LOWER SNAKE RIVER COMPENSATION PLAN
Oregon Spring Chinook Salmon Harvest Monitoring
2013 Annual Progress Report

Oregon Department of Fish and Wildlife
Grande Ronde Watershed, Northeast Region

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Front cover photo of Koy Aschenbrenner with his Imnaha River catch. Photo courtesy of Chad Aschenbrenner, June 2011.

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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 2013 run year of spring/summer Chinook salmon to Oregon Snake basin tributaries provided recreational (sport) harvest opportunity on Lookingglass Creek and the Imnaha River. The sport fishery on Lookingglass Creek opened 1 June and closed on 21 June (21 days). The area open to anglers extended from the mouth at the Moses Creek Lane Bridge upstream to the confluence of Jarboe Creek (2 miles). The sport fishery on the Imnaha River opened 5 July and closed 19 July (15 days). The area open to anglers extended from the mouth to Summit Creek Bridge (river mile 45) on the Imnaha River.

Daily bag limits for the Lookingglass Creek fishery was limited to five adipose fin-clipped jacks. Anglers were required to cease angling if they had retained a daily limit of jacks, or two daily limits in possession. Angling was restricted to the use of artificial flies and lures only to minimize impact on bull trout. The Imnaha River offered a brief season for adult salmon retention from 5-7 July. During these three days, daily bag limits were 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. From 8-19 July the fishery was limited to daily bag limit of five fin-clipped jacks per day.

Creel surveys were conducted on 12 days of the Lookingglass fishery, and 8 days of the Imnaha fishery. On Lookingglass Creek, 110 anglers were contacted who had fished a total of 380.7 hours. Anglers reported an average catch of one adult Chinook for every 23.5 hours of fishing and one jack for every 9.4 hours of fishing. During Imnaha River surveys, 142 anglers were contacted who had fished a total of 629.5 hours. During the adult retention season (5-7 July), anglers reported an average catch of one adult Chinook caught for every 47.6 hours of fishing, and one jack salmon caught for every 37.1 hours of fishing. During the jack-only season no Chinook were reported caught. Angler effort was estimated at 1312.0 angler hours for the Lookingglass fishery, and 1192.0 angler hours for the Imnaha fishery.

Based on these creel surveys, both Lookingglass and Imnaha fisheries were managed within predetermined ESA impact limits. Incidental mortality of adult, natural-origin salmon in the Lookingglass Creek fishery was estimated at 1.0, well under the allowable limit of 3.5. Incidental mortality of adult, natural-origin salmon in the Imnaha River fishery was 1.0, under the allowable limit of 3.0. In addition, the jack fishery on Lookingglass Creek required the handle and release of all adipose-clipped adult salmon. At a handling mortality rate of 7.5%, creel surveys estimated an incidental mortality of 3.0 hatchery adult salmon.

Both Lookingglass and Imnaha fisheries in 2013 provided modest recreational benefits within harvest-sharing agreements with co-managers. Total recreational fishery harvest in Lookingglass Creek was estimated at 132 hatchery-origin jacks. For the Imnaha fishery, total recreational fishery harvest was estimated at 30 hatchery-origin adults and 31 hatchery-origin jacks. Estimated recreational fishery harvest for adults was 34% of the predetermined harvest limit.

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 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 initiated the Imnaha and Grande Ronde spring Chinook hatchery program in 1982 under the LSRCP. Subsequent program management has been coordinated between ODFW, Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and 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 originating from the Catherine Creek population. 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 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 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 more 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 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 2013. 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 post-season preliminary 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 point of entry/exit to the fishery. One creel clerk staffed the check station four days per week during the fishery. 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. Shift duration depended on actual length of the angling day. AM shifts began 30 minutes before sunrise 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, 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 with the number of hours spent fishing.

Catch information was also determined from interviews and/or visual inspection of harvested fish. Catch of jack and adult salmon was determined by length. Jacks are considered salmon equal to or less than 61 cm (24 inches), adults were all salmon exceeding 61 cm (24 inches). Interviews determined the number of unmarked jack and adult salmon, and marked adult salmon, handled and released during the survey day. Marked 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.

Imnaha River – The Imnaha River fishery was surveyed using a roving survey design that was stratified into two sections. The lower section of the fishery survey 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 at 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. 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 mouth (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.

One creel clerk surveyed each reach four days per week during the fishery. 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 10 hour shift was applied each day (including drive time). Shifts were stratified info 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.

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 each reach) 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 also determined from interviews and/or visual inspection of harvested fish. Catch of jack and adult salmon was determined by length. Jacks are considered salmon equal to or less than 61 cm (24 inches), adults were all salmon exceeding 61 cm (24 inches). Interviews determined the number of unmarked salmon landed and marked salmon harvested (and in some cases landed and released) during the survey day. Marked 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.

Lookingglass Fishery Data Analysis – Total effort (E), angler hours (e_i), catch (fish landed; C), and harvest (fish kept; 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 (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 ($v(\theta_i)$) were derived using methods described by Pollock et al. (1994):

$$v\ \theta_i\ = \frac{N^2}{n}\frac{{}_{j=1}^{n}(\theta_j - \theta)^2}{n-1}$$

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

$$\theta \pm\ 1.96\ \times\quad \overline{v(\theta)}.$$

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

Imnaha Fishery Data Analysis – Total angler effort (E), catch and harvest (fish landed or kept, respectively, 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. To adjust pressure counts for anglers fishing in this reach, vehicles were counted at the trailhead that accesses this portion of the river as a surrogate. Information collected during past year's creel interviews suggested that each vehicle represented two anglers in this section. Therefore, adjusted angler counts in the lower survey section were calculated as:

$$m_i = m_i + 2v_i$$

where: m_i = estimated number of anglers in the lower survey reach 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. Total angler effort (in hours) was estimated for each stratum as:

$$E = m \times d \times h$$

where: m = the mean angler count during the stratum (as a function of m_i for the upper reach, and m_i for the lower reach 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 (m) was calculated as:

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

where: m_i= number of anglers counted during the ith sample day (or $m_i$for the lower section, as described above), and p_i = total of all counts made on the ith sample day. Variance of total strata angling hours was estimated as (Cochran 1977):

$$v\ C_i\ = (d_i \times h_i)^2\ \ \frac{s^2{}_i}{p}$$

where: $s^2{}_i$ is the strata sample variance which was estimated as (Cochran 1977):

$$s^2{}_i = \frac{1}{p-1} \sum_{i=1}^{m} (m - m_i)^2$$

Total catch or harvest (C) for each stratum was estimated as:

$$C = E \times r$$

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

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

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.

Variance of mean strata catch rate was estimated as (Thompson 1992; Bernard et al. 1998):

$$v(r_i) = \frac{\sum_{j=1}^{n}(x_j - w_j r_i)^2}{w_j{}^2 n(n-1)}$$

Variance of total strata catch or harvest was estimated as (Goodman 1960):

$$v(C_i) = r_i^2 v(E_i) + E_i^2 v(r_i) - v(E_i)\, v(r)$$

Harvest and effort for the season (θ) was estimated as the sum of the strata harvest estimates and season variance ($v(\theta)$) was estimated as the sum of the strata variance estimates. Ninety-five percent confidence intervals were estimated as (Cochran 1977):

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

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

RESULTS AND DISCUSSION

Lookingglass Creek – In-season return estimates based on PIT tag recoveries at Bonneville Dam indicated a relatively small return of adult Chinook to Lookingglass Creek in 2013. However; a large return of jacks were expected. State and Tribal co-managers agreed to manage fisheries in Lookingglass Creek based on a total estimated return of 106 natural-origin (N-O) and 320 hatchery-origin (H-O) adults. In addition, 1,147 H-O jacks were estimated to return to Lookingglass Creek (Table 4).

Using these run estimates, FMEP guidelines allowed for a sport fishery impact of two (2) natural fish (1.89 % of the run) and an allowable harvest of 49 adult H-O salmon (15.3% of the run). While technically allowable under FMEP guidelines, managing a fishery within those small margins would have been difficult. Therefore, provided the relatively large expected return of jack salmon, we chose to implement a sport fishery targeting the harvest of jacks only.

The 2013 Lookingglass sport fishery was managed within three constraints: 1) the allowable number of N-O adults handled in the fishery, 2) the allowable number of H-O adults handled in the fishery, and 2) the number of H-O jacks harvested in the fishery. Given the run estimates, FMEP guidance, and an applied handling mortality of 7.5%; sport anglers could not handle more than 27 N-O or 653 H-O adult salmon. In addition, we planned to harvest no more than 573 jacks (50% of the estimated return) in Lookingglass Creek during the 2013 fishery.

The sport fishery on Lookingglass Creek opened 1 June and closed on 21 June (21 days). The area open to anglers extended from the mouth at the Moses Creek Lane Bridge upstream to the confluence of Jarboe Creek (2 miles). Daily bag limits for the Lookingglass Creek fishery was limited to five fin-clipped jacks. Anglers were required to cease angling if they had retained a daily limit of marked jacks, or two daily limits in possession. Angling was restricted to the use of artificial flies and lures only to minimize impact on bull trout.

Creel surveys were conducted on 12 days of the Lookingglass fishery. During the surveys, 110 anglers were contacted who had fished a total of 380.7 hours. Anglers reported an average catch of one adult Chinook (N-O and H-O combined) for every 23.5 hours of fishing and one jack for every 9.4 hours of fishing. Total angler effort was estimated at 1312.0 with a 95% confidence limit (95% CI) between 944 and 1860 angler hours for the Lookingglass fishery (Table 5). We estimated sixteen (16, 95% CI = 6-35) unmarked N-O adults and 40 (95% CI = 18-63) marked H-O adults were caught and released in the Lookingglass fishery in 2013 (Table 5). Applying a handling mortality rate of 7.5%, we estimated an incidental mortality of 1.0 and 3.0 N-O and H-O adult salmon, respectively. We estimated that sport anglers harvested 132 (95% CI = 47-217) H-O jacks in the 2013 Lookingglass fishery (Table 5). Finally, we estimated that anglers handled 32 (95% CI = 8-67) bull trout during the fishery.

Based on these creel surveys, the 2013 Lookingglass fishery was managed within predetermined ESA impact limits and harvest sharing agreements. The sport fishery selected for the harvest of jack salmon only; therefore, anglers were constrained by the amount of both N-O and H-O adult salmon. Estimates provided from the creel survey indicated that 59.2% (16 of 27) of the allowable N-O impacts and 6.0% of the allowable H-O harvest quota were used in the fishery. We estimated that anglers harvested 23.1% (132 of 573) of the allowable quota on jack salmon during the fishery.

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 2013. However; a relatively large return of jacks were expected. State and Tribal co-managers agreed to manage fisheries in Lookingglass Creek based on a total estimated return of 390 natural-origin (N-O) adults and 1,143 hatchery-origin (H-O) adults. In addition, 1,391 H-O jacks were estimated to return to the Imnaha River (Table 4).

Using these run estimates, FMEP guidelines allowed for a sport fishery impact of three (3) N-O adults (0.77 % of the run) and an allowable harvest of 88 adult H-O salmon (7.7% of the run). While technically allowable under FMEP guidelines, these margins were considered quite small to successfully manage an open-ended (i.e., no predetermined closure date) fishery in the Imnaha River. Therefore, we chose to open the Imnaha sport fishery for a limited-duration adult harvest followed by an open-ended fishery targeting jack salmon only.

The 2013 Imnaha sport fishery was managed within three constraints: 1) the allowable number of N-O adults handled in the fishery, 2) the combined number of H-O adult harvest (during 5-7 July) and incidental mortality in the fishery (during the following jack-only season), and 3) the number of H-O jacks harvested in the fishery. Given the run estimates, FMEP guidance, and an applied handling mortality of 10.0%; sport anglers could not handle more than 30 N-O adult salmon. Combined H-O adult harvest and/or incidental mortality could not exceed 88 fish. In addition, we planned to harvest no more than 696 jacks (50% of the estimated return) in the Imnaha River during the 2013 fishery.

The sport fishery on the Imnaha River opened 5 July and closed 19 July (15 days). The area open to anglers extended from the mouth to Summit Creek Bridge (river mile 45) on the Imnaha River. The Imnaha River was opened for adult salmon retention from 5-7 July. During these three days, daily bag limits were 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. From 8-19 July the fishery was limited to daily bag limit of five fin-clipped jacks per day.

Creel surveys were conducted on eight (8) days of the Imnaha River fishery. During the surveys, 142 anglers were contacted who had fished a total of 629.5 hours. Anglers reported an average catch of one adult Chinook (N-O and H-O combined) for every 47.6 hours of fishing and one jack for every 37.1 hours of fishing. Total angler effort was estimated at 1192.0 (95% CI = 454-1941) angler hours for the Imnaha fishery (Table 5). We estimated eleven (11, 95% CI = 3-26) N-O adults were caught and released in the fishery (Table 5). From 5-7 July, we estimated 30 (95% CI = 10-64) H-O adults were harvested and none were reported caught during the jack-only fishery. We estimated that anglers harvested 31 (95% CI = 11-66) H-O jacks, and released 21 (95% CI = 6-50) unmarked, N-O jacks in the Imnaha fishery (Table 5). Applying a handling mortality rate of 10.0%, we estimated an incidental mortality of 3.0 and no H-O adult salmon, respectively. Finally, we estimated that anglers handled six (6, 95% CI = 4-12) bull trout during the fishery.

Based on these creel surveys, the 2013 Imnaha fishery was managed within predetermined ESA impact limits and harvest sharing agreements. Estimates provided from the creel survey indicated that 36.7% (11 of 30) of the allowable N-O impacts and 35.2% (31 of 88) of the allowable H-O harvest quota were used in the fishery. We estimated that anglers harvested 4.5% (31 of 696) of the allowable quota on jack salmon during the fishery.

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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 2013.

Population	Projected Run Size		
	Adult (age 4 & 5)		Jack (age 3) [a]
	Natural	Hatchery	Hatchery
Imnaha Basin			
Imnaha River [c]	390	1,143	1,391
Grande Ronde Basin			
Catherine Creek [b]	142	259	–
Lookingglass Creek [b]	106	320	1,147
Upper Grande Ronde River [b]	178	749	–
Wallowa-Lostine River [c,d,e]	677	93	–
Minam River [b,f]	451	–	–
Wenaha River [f]	–[g]	–	–

[a] Natural and/or hatchery jack estimates are not utilized for fishery management decisions, but are only used to structure additional harvest opportunity. We show hatchery jack estimates only for populations that offered fisheries in 2013.

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

[c] Estimates based on in-season projections utilizing PIT tag detections at mainstem dams in mid-June 2013

[d] 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 1.5X estimated returns to the Lostine River.

[e] Natural-origin returns exceeded triggers required under the FMEP to implement fisheries; however, low returns of hatchery fish precluded harvest opportunity.

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

[g] No reliable method currently exist to predict returns to the Wenaha River.

Table 5. Estimates of effort, catch, and harvest during the 2013 Lookingglass Creek (1-21 June) and Imnaha River (5-19 July) fisheries. Ninety-five percent (95%) confidence limits are indicated in parentheses. The Lookingglass Creek fishery was limited to the retention of marked jacks only. The Imnaha River fishery allowed for marked adult retention from 5-7 July, only marked jack retention was allowed 8-19 July.

Fishery Parameter	Lookingglass Creek (95% CI)		Imnaha River (95% CI)	
Fishery Days	15		21	
Total Estimated Angler Hours	1312	(944-1680)	1192	(454-1941)
Marked Adults Harvested	–		30	(10-64)
Marked Jacks Harvested	132	(47-217)	31	(11-66)
Unmarked Adults Released	16	(6-35)	11	(3-26)
Unmarked Jacks Released	7	(1-18)	21	(6-50)
Marked Adults Released	40	(18-63)	–	
Bull Trout Released	32	(8-67)	6	(4-12)

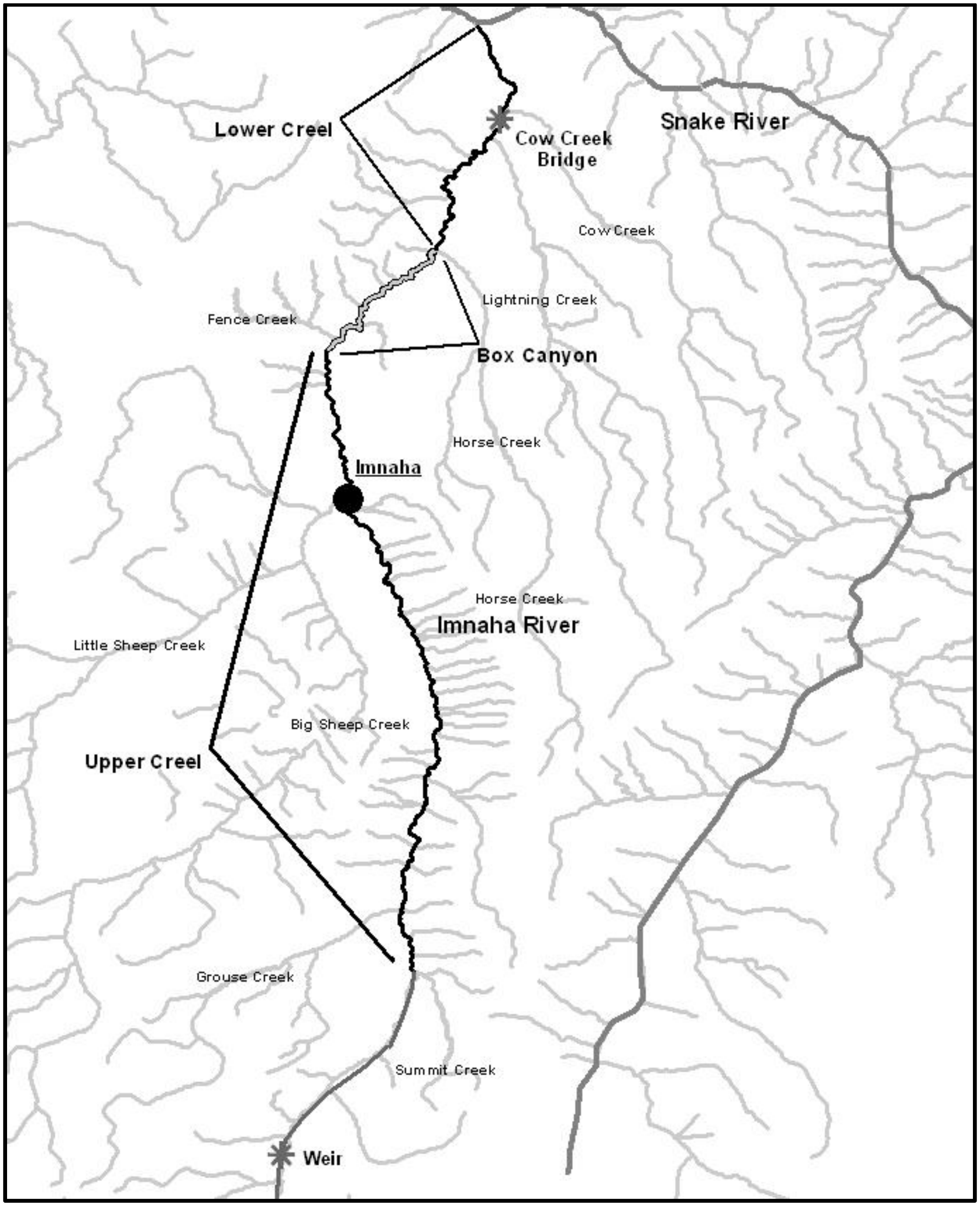

Figure 1. The Imnaha River fishery management area (RM 0 to 48) showing descriptions of surveyed reaches (lower RM 5-13, upper RM 20-48), the unsurveyed Box Canyon reach (RM 13-20), major tributaries, and the location of the adult weir and juvenile release facility upstream of the fishery area.

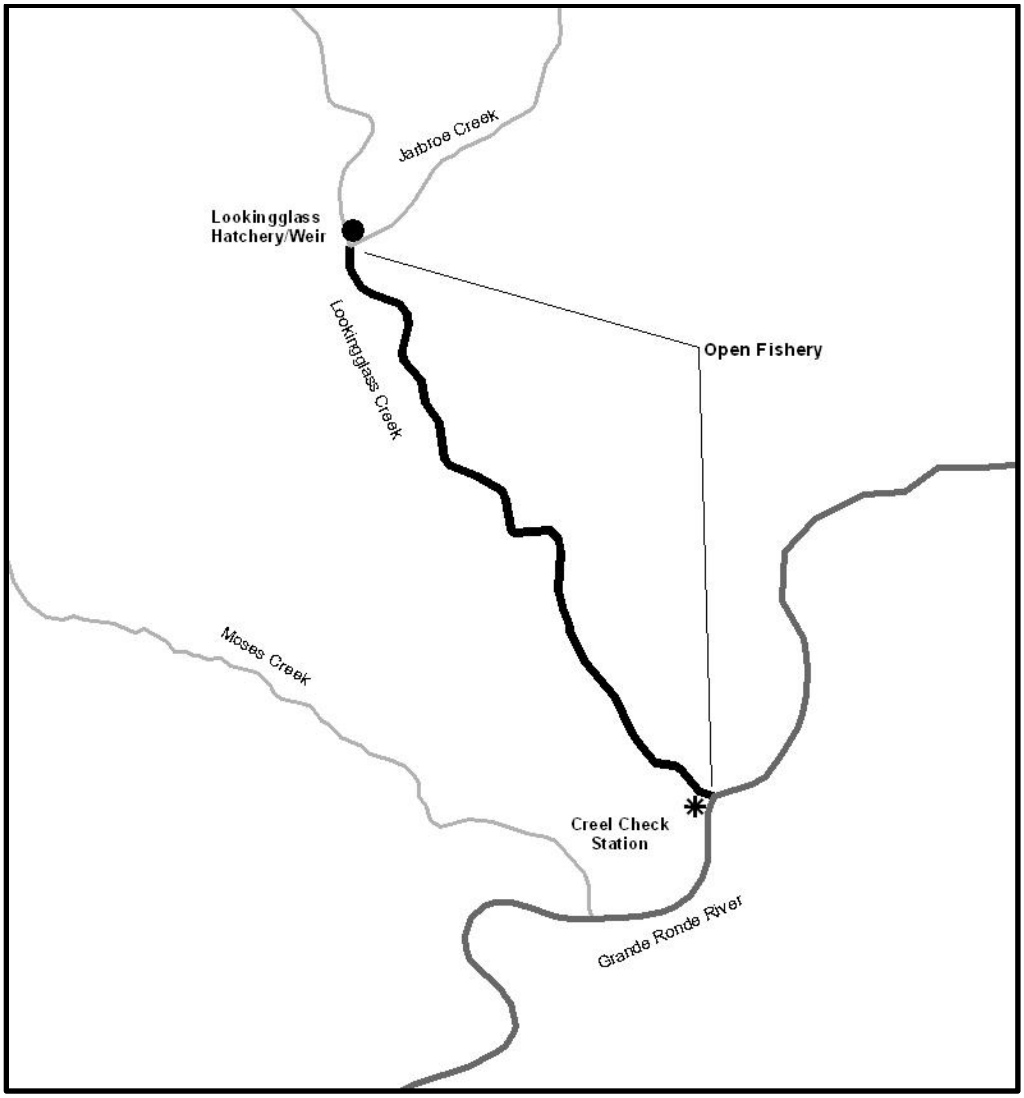

Figure 2. The Lookingglass Creek fishery management area (RM 0 to 2) showing area open to fishing and the location of the access point survey (creel check station) near the confluence with the Grande Ronde River at Palmer Junction, OR.

APPENDIX TABLES

Appendix Table 1. Imnaha River spring Chinook sport fisheries adult (age-4 and 5 only) impact for years 2001 through 2013. Adult abundance did not support sport harvest in 2006 and 2007.

Year	Sport Season	Escapement to River[1] (H/N)[2]	Est. Harvest	Est. Released		Impact[3]	
						n	%
			(H)	(H)	(N)	(N)	(N/W)
2001	6/2-6/21	2,580 / 2,421	302	21	433	43	11.7 / 1.8
2002	6/1-6/30	2,859 / 1,405	152	9	15	2	5.3 / 0.1
2003	6/7-7/1	1,838 / 1,594	125	22	83	8	6.8 / 0.5
2004	6/19-7/5	1,471 / 557	192	21	29	3	13.1 / 0.5
2005	6/25-7/4	1,093 / 331	22	54	22	2	2.0 / 0.6
2008	7/4-7/15	2,741 / 274	64	0	17	2	2.3 / 0.7
2009	6/13-7/12	1,886 / 471	197	0	50	5	10.4 / 1.1
2010	5/22-7/25	3,660 / 785	336	48	108	11	9.2 / 1.4
2011	5/28-7/23	2,438 / 972	519	0	153	15	21.3 / 1.5
2012	6/9-6/27	2,565 / 874	203	0	62	6	7.9 / 0.7
2013	7/5-7/19	1,217 / 350	30	0	11	1	2.5 / 0.3

[1] J. Feldhaus (ODFW), personal communication
[2] (H) = Hatchery-origin fish, (N) = Natural-origin fish
[3] Impact includes an 10% fishery mortality for both hatchery and wild fish caught and released

Appendix Table 2. Lookingglass Creek spring Chinook sport fisheries adult (age-4 and 5 only) impact for years 2011 through 2013. The 2013 fishery was limited to retention of jacks only.

Year	Sport Season	Escapement to River[1] (H/N)[2]	Harvest (H)	Released (H)	Released (N)	Impact[3] N (N)	Impact[3] % (H/N)
2011	5/28-7/15	1,014 / 80	141	4	38	3	13.9 / 3.8
2012	5/26-6/12 6/22-6/25	1,529 / 155	464	20	26	4	30.3 / 3.5
2013	6/1-6/21	840 / 92	0	40	16	1	0.0 / 6.3

[1] ODFW unpublished data
[2] (H) = Hatchery-Origin fish, (N) = Natural-Origin fish
[3] Impact includes an 7.5% fishery mortality for both hatchery and wild fish caught and released