

**2014 & 2015 Rotating steelhead creel surveys for Lower Columbia River watersheds**  
Washington Department of Fish and Wildlife, February 2016

**Project Description**

The Washington Department of Fish and Wildlife (WDFW) manages multiple steelhead fisheries in lower Columbia River (LCR) tributaries. Many of these fisheries occur in areas where wild steelhead populations are listed as threatened under the Endangered Species Act (ESA). The majority of these fisheries provide opportunity to harvest hatchery steelhead, but some also offer specific opportunities for catch and release of wild fish. Although all wild steelhead caught in these fisheries must be released, wild steelhead are still susceptible to post-release mortality and sub-lethal impacts resulting from recreational angling-related injuries. The monitoring of impacts of non-retention fisheries on wild stocks of fish is a critical component of fishery management and a requirement for conducting fisheries under the ESA, as described in WDFW's LCR Fisheries Management and Evaluation Plan (FMEP; WDFW 2003) and Hatchery and Genetic Management Plans (HGMP). With increasing levels of selective fisheries, it is imperative that the reported fishing impacts on wild fish in FMEP's and HGMP's be accurate and within acceptable levels. By achieving this, the rebuilding of wild stocks can progress and fishing opportunity can be maximized.

**Project Objectives**

The goal of the rotating steelhead creel surveys is to estimate the impacts (i.e., induced mortality) of recreational fisheries on wild populations by:

- (1) Collecting angler effort and angler success (i.e., catch per unit effort) information, which is needed to estimate total catch of wild steelhead.
- (2) Estimating the non-retention (catch and release) mortality of wild steelhead associated with sport fishing through the on-going summer steelhead hooking mortality study being conducted on the Wind River.

**Methods**

*Creel Surveys*

In 2014 and 2015, WDFW implemented steelhead creel surveys on the Coweeman River, Kalama River, East Fork (EF) Lewis River, Washougal River, Rock Creek, Wind River, White Salmon River, and Drano Lake. The specific survey dates varied between each river system depending on the focal steelhead race of interest (i.e., summer- vs. winter-runs) and the fishing regulations that determined seasonal closures (Table 1). The creel survey methods used in 2014 and 2015 followed those that were used previously on Columbia River Salmon and Steelhead Endorsement (CRSSE) funded surveys for the Washougal and South Fork Toutle rivers from 2011-2014, which were summarized in Bentley et al. (2015). These creel surveys were designed to collect spatially

and temporally representative (i.e., unbiased) angler data. These data (i.e., samples) will be used to make expanded estimates of angler effort and angler success, which ultimately allow for the calculation of total catch and the associated mortality and impact rates on wild steelhead.

To collect temporally representative data, a stratified random survey design was used to conduct on-site creel surveys following the methods outlined in Malvestuto et al. (1978), Pollock et al. (1994) and Hahn et al. (2000). First, the survey was stratified by day-type (weekday or weekend) and four to five sample days were randomly selected consisting of two to three weekdays and two weekend days per week. Second, the survey was stratified within each sample date by shift (AM or PM) and a random survey start time was selected within that shift. During each shift, the creel technician conducted two general types of surveys: (1) angler effort counts and (2) angler interviews. During each effort count, the technician recorded the number of bank and boat anglers in select index reaches along the river by vehicle and foot. Typically, two randomized effort counts were conducted each shift. In between effort counts, bank and boat anglers were interviewed to obtain a range of information, including: trip length, fishing method and gear-use, fishing location, number of fish harvested and/or released by species, origin (hatchery, wild), and race (summer, winter), and the corresponding hooking location for each fish.

To collect spatially representative data, we conducted “tie-in” angler effort surveys beginning in 2015. The purpose of the tie-in surveys was to develop a relationship between angler effort that occurs in the index reaches relative to the entire river that is open to steelhead fishing. By developing this relationship, twice-daily angler effort counts can be conducted in (smaller) index reaches and then expanded to estimate effort across the entire spatial extent of the river’s steelhead fishery. Therefore, on a sub-set of creel survey days each month (n = 2-3), an angler effort count and a tie-in survey were simultaneously conducted on each river. The majority of reaches included in each tie-in count were surveyed using a pontoon raft. Floating allowed almost all reaches along the river, including private land, to be surveyed for angler effort.

Table 1. Summary of steelhead creel surveys conducted during the 2014-15 and 2015-16 study periods. Year-groups were grouped from Apr-Year1 to March-Year2. Note: This table was constructed on January 5th, 2016, and the 2015-16 surveys are still on-going.

River	Survey Focus	Survey Dates	
		2014-15	2015-16
Coweeman	Winters	Nov - Mar	Nov - Mar
Kalama	Summers & Winters	Jun - Mar	Apr - Mar
EF Lewis	Summers & Winters	Apr - Mar	Apr - Mar
Washougal	Summers	Jun - Oct	Jun - Oct
Rock Ck.	Winters	Nov - Jan	Nov - Mar
Upper Wind	Summers	Sep - Nov	Sep - Nov
Lower Wind	Winters	Dec	Dec - Mar
White Salmon	Summers	Jun - Oct	Jun - Oct
Drano Lake	Summers	Jul - Sep	Jul - Sep

### *Hooking Mortality*

Adult steelhead were sampled in the Wind River in 2014-15 and 2015-16 as part of an on-going CRSSE funded hooking mortality study and the BPA funded steelhead lifecycle monitoring program. The purpose of this study was to compare the survival between angled (i.e., impact group) and non-angled (i.e., control group) fish. Control fish were captured in the adult trap facility located at Shipherd Falls and marked with an internal Passive Integrated Transponder (PIT) tag and external brightly colored Floy T-bar anchor tags. Impact fish were captured with hook and line gear (i.e., angled) using a variety of popular methods including drifting bait and artificial lures, bait or jigs under a float, traditional hardware (spinners and spoons), and fly fishing gear. If the captured fish was not previously tagged, the individual was marked using the same methods as the control fish at Shipherd Falls. PIT tag detectors located downstream of the Wind River in the mainstem Columbia River at Bonneville Dam and in the estuary trawl record PIT tagged steelhead kelts (fish that go back to the ocean after spawning and return to spawn again) and non-ocean going repeat spawners, which enables us to calculate the post-spawn survival of individual fish.

### **Budget**

During the 2014-15 study period, actual budget expenditures were \$8,999 less than proposed. In 2015-16, actual budget expenditures are projected to be approximately \$42,340 more than the proposed amount (Table 2). This projected over-expenditure is directly attributed to a salary and benefit increase received by WDFW employees effective on July 1, 2015. This increase was not anticipated at the time of initial proposal development.

Table 2. Proposed and actual budget for the 2014-15 and 2015-16 study periods.

Period	Expense	Proposed	Actual <sup>1</sup>
2014-15	Salaries & Benefits	\$248,402	\$241,844
	Goods & Services	\$42,267	\$41,400
	Indirect	\$49,413	\$47,839
	<b>Total</b>	<b>\$340,082</b>	<b>\$331,083</b>
2015-16	Salaries & Benefits	\$224,170	\$262,728
	Goods & Services	\$36,725	\$34,951
	Indirect	\$41,743	\$47,299
	<b>Total</b>	<b>\$302,638</b>	<b>\$344,978</b>

<sup>1</sup> For 2015-16, the project period is on-going through April 15, 2016. At the time of this report actual expenditures were available through December 2015. "Actual" values for 2015-16 include projections for Jan-April 2016.

## Results

### *Creel surveys*

During the 2014-15 study period, creel surveys were conducted on the seven different river and Drano Lake, for a total of 715 individual survey days where 6,352 individual recreational anglers were interviewed across all nine of our survey sites (Table 3). Among all interviewed anglers, we sampled a total of 469 hatchery harvested steelhead and 479 wild released steelhead. The 2015-16 study period is still on-going, but through November 2015, we have conducted 472 creel surveys, interviewed 3,284 anglers, and sampled 472 hatchery harvested steelhead and 672 wild released steelhead (Table 3). Additionally, in 2015-16, we have and are continuing to conduct tie-in surveys, which will be used to estimate angler effort throughout the entire reach of each river. We have proposed to continue the creel surveys for a third and final survey period (2016-17) on the current suite of rivers. After that time, expanded estimates of catch, catch rates, angler effort, steelhead mortality, and overall impact rates (i.e., mortalities divided by run-size) will be calculated for each of the nine sites following a similar format to Bentley et al. (2015).

### *Hooking mortality*

During 2014-15 and 2015-16, we continued the Wind River hooking mortality study by tagging steelhead that returned to Shipherd Falls and opportunistically angling fish upstream of Shipherd Falls. Some steelhead jump the falls and therefore not all fish are able to be tagged, so some untagged fish are also caught upstream. In 2014-15, a total of 223 steelhead were tagged at Shipherd Falls and 76 were angled upstream, of which, 25 were previously tagged at Shipherd Falls. In 2015-16, a total of 396 steelhead were tagged at Shipherd Falls and 64 were angled, of which 21 were previously tagged at Shipherd Falls. Preliminary data analysis from the first three years of the study has generated an estimate of hooking mortality. To continue to improve estimates and their level of uncertainty (confidence interval), we have proposed continuing this study for a final study period (2016-17) by incorporating this work into the duties of staff also conducting the White Salmon, Wind River and Rock Creek creels surveys. Due to the nature of our study design, we will continue to collect survival data via PIT tag detection of returning kelts until at least the Fall/Winter of 2018-19. In the meantime, we plan on transitioning into our final analysis by the summer of 2017 and continuing to incorporate data as it becomes available.

Table 3. Summary of steelhead creel survey data collected during the 2014-15 and 2015-16 study periods. Year-groups were grouped from Apr-Year1 to March-Year2. Note: This table was constructed on January 12th, 2016, thus, 2015-16 surveys that are still on-going have been denoted.

River	2014 - 15							
	No. Survey Dates	No. Anglers Surveyed	Harvested			Released		
			Hatchery	Wild	Unk	Hatchery	Wild	Unk
Coweeman	65	110	2	0	0	4	15	0
Kalama	212	3870	242	0	1	33	86	6
EF Lewis	223	1368	50	0	0	37	97	2
Washougal	52	291	6	0	0	0	7	2
Rock Ck.	33	45	7	0	0	1	3	0
Upper Wind <sup>1</sup>	39	37	0	0	0	1	23	0
Lower Wind	0	0	0	0	0	0	0	0
White Salmon <sup>1</sup>	78	224	5	0	0	1	5	0
Drano Lake	13	407	157	0	0	1	243	1
River	2015 - 16							
	No. Survey Dates	No. Anglers Surveyed	Harvested			Released		
			Hatchery	Wild	Unk	Hatchery	Wild	Unk
Coweeman <sup>2</sup>	16	5	0	0	0	0	2	0
Kalama <sup>2</sup>	155	1927	178	1	0	12	75	1
EF Lewis <sup>2</sup>	102	173	1	0	0	0	8	0
Washougal	86	462	8	0	0	0	6	0
Rock Ck. <sup>2</sup>	17	24	6	0	0	0	2	0
Upper Wind <sup>3</sup>	31	47	0	1	0	1	23	0
Lower Wind <sup>2</sup>	3	4	0	0	0	0	1	0
White Salmon <sup>3</sup>	44	218	18	0	0	1	31	0
Drano Lake	18	424	261	0	0	1	524	2

<sup>1</sup> During 2014-15, Wind and White Salmon creel surveys were half days split between the two rivers.

<sup>2</sup> Data updated through November 2015, but surveys are still on-going for 2015-16 period

<sup>3</sup> During 2015-16, Wind and White Salmon creel surveys were full days.

Unk = Unknown

## Benefits

Our CRSSE funded steelhead creel surveys maintains WDFW’s ability to provide LCR steelhead recreational fisheries consistent with wild fish recovery and the ESA, while providing a substantial economic benefit to the LCR region (Table 4).

Table 4. Average catch of hatchery steelhead by river and the corresponding estimated economic value<sup>1</sup>. Catch was calculated by averaging Catch Record Card estimates from 2012-13, 2013-14, and 2014-15. Given that CRC estimates do not include wild catch, the associated estimates of catch and economic value are likely underestimated for most rivers.

River	Avg. Catch	\$Value <sup>1</sup>
Coweeman	75	\$43,307
Kalama	2965	\$1,719,893
EF Lewis	316	\$183,473
Rock Creek <sup>2</sup>	12	\$6,960
Wind	946	\$548,487
Little White and Drano Lake	4649	\$2,696,227
White Salmon	207	\$120,060

<sup>1</sup> Total Value = Avg. CRC catch totals multiplied by 10 angler days/fish multiplied by \$58/angler day (TCW 2008).

<sup>2</sup> Only one year of catch data (2014-15). First year of plants began in spring 2013.

## Summary

### *Status Update*

We have completed two years of steelhead creel surveys at nine study locations (Table 1). Over these two years, we have interviewed >9,000 anglers and sampled >2,000 steelhead across more than 1000 individual creel survey days (Table 3). Additionally, we have continued the Wind River hooking mortality study to increase sample size and thus precision of estimates. These data sets will ultimately be used to estimate catch of steelhead and the associated impacts (i.e., mortality) from recreational fisheries.

### *Outstanding Issues and Future Work*

We are relying on a third year of funding from CRSSE Recreational Advisory Board to complete our three-year creel rotation for the current suite of rivers. During this final proposed year for these rivers, we are planning on adding additional personal to increase the number of tie-in surveys, which are needed to provide unbiased estimates of steelhead catch, and extending our project period to June 2, 2017, to insure completion of winter/spring period fisheries to correctly calculate impact rates. After the final study year (2016-17) on these rivers, we will be completing our comprehensive creel report, which will include: estimates of steelhead catch by origin, estimates of mortality and the associated impact rates to wild steelhead, and a continuation of the evaluation of the feasibility of using Catch Record Card (CRC) estimates of hatchery catch to estimate wild catch based on relative handle rates. This final report will follow

a similar format as our previous comprehensive creel analysis (Bentley et al. 2015). During 2016-17, we will also be planning for our new rotation of creel surveys, which we will be proposing to conduct on the Grays River, Elochoman River, Mill/Abernathy/Germany rivers, Green River, and Salmon Creek, which would begin in the spring of 2017.

## References

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