Investigations into the Life History of Naturally Produced Spring Chinook Salmon and Summer Steelhead in the Grande Ronde River Subbasin

Annual Report 2013

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Brian C. Jonasson
Alan B. Garner
Edwin R. Sedell
Christopher Horn
Jeff M. Whitty
Marissa P. Ticus
Scott D. Favrot
Nicole A. McConnell
Bradley C. Power
Justin M. Hay
Joel P. Ophoff
Joshua W. Dowdy
Richard W. Carmichael

Oregon Department of Fish and Wildlife
La Grande, OR, 97850

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Executive Project Summary

Abundance and Migration of Juvenile Salmonids in Study Streams during Migration Year 2013, and
Survival and Relative Success of Juvenile Salmonids from the Grande Ronde and Imnaha Subbasins

We determined migration timing, abundance, and survival of juvenile spring Chinook salmon *Oncorhynchus tshawytscha* and steelhead *Oncorhynchus mykiss* using rotary screw traps at five locations in the Grande Ronde River Subbasin. In Catherine Creek, we estimated 32,175 juvenile spring Chinook salmon and 38,823 steelhead migrated from upper rearing areas, and 82% of the Chinook salmon and 21% of the steelhead migrated in fall. In Lostine River, we estimated 78,437 juvenile spring Chinook salmon and 30,326 steelhead migrated from upper rearing areas, and 77% of the Chinook salmon and 52% of the steelhead migrated in fall. In Minam River, we estimated 61,106 juvenile spring Chinook salmon and 28,582 steelhead migrated from upper rearing areas, and 72% of the Chinook salmon and 21% of the steelhead migrated in fall. In upper Grande Ronde River, we estimated 21,609 juvenile spring Chinook salmon and 18,726 steelhead migrated from upper rearing areas, and 41% of the Chinook salmon and 12% of the steelhead migrated in fall. In middle Grande Ronde River, we estimated 31,160 juvenile spring Chinook salmon and 81,713 juvenile steelhead migrated from the Upper Grande Ronde Watershed.

Combining abundance estimates and survival estimates with estimates of spawners, obtained from Lower Snake River Compensation Plan - Oregon Evaluation Project, we estimate smolts per spawner, which is an indicator for the Viable Salmonid Population (VSP) parameter, productivity. We estimated that in Catherine Creek the number of spring Chinook salmon smolt equivalents leaving Catherine Creek was 17,899 for the 2013 migratory year (2011 brood year), for productivity of 15 smolts per spawner. We estimated that in Lostine River the number of spring Chinook salmon smolt equivalents leaving Lostine River was 42,527 for the 2011 brood year, for productivity of 14 smolts per spawner. We estimated that in Minam River the number of spring Chinook salmon smolt equivalents leaving Minam River was 30,016 for the 2011 brood year, for productivity of 41 smolts per spawner. We estimated that in upper Grande Ronde River the number of spring Chinook salmon smolt equivalents leaving upper Grande Ronde River was 17,701 for the 2011 brood year, for productivity of 22 smolts per spawner.

In 2013, we saw high numbers of juvenile spring Chinook salmon from all of our study streams, resulting from the high number of spawners in 2011, continuing the increasing trend in juvenile migrants. However, these high numbers of juvenile spring Chinook salmon resulted in smaller out-migrants and lower survival to Lower Granite Dam. The lower survival of the out-migrants resulted in low estimates of smolts/spawner, one indicator of the VSP parameter productivity. The higher number of spawners, whether of hatchery or natural origin, produced more total migrants but produced lower numbers of smolts per spawner, due to reduced survival rates of smolts. Habitat restoration projects funded by BPA and Bureau of Reclamation in the Upper Grande Ronde River watershed are addressing habitat capacity which should, in turn, result in an increase in productivity, such as smolts/spawner.

Steelhead emigrant abundance was above the trend line in three of the four streams we have been monitoring since 2000. In the future, this project will combine the out-migrant estimates, age structure, and survival rates to quantify the number of smolts by age and relate to the appropriate number of spawners to estimate smolts/spawner, a VSP indicator of productivity.

Steelhead Spawner Surveys

We conducted 157 spawning ground surveys in the Upper Grande Ronde River (UGRR) watershed and 100 surveys in the Joseph Creek watershed from 13 March through 18 June 2013 to determine summer steelhead redd abundance and adult escapement for these two populations. We sampled 29 random, spatially-balanced sites throughout the UGRR basin encompassing 56.1 km (6.3%) of an estimated 892 km of available steelhead spawning habitat. In Joseph Creek, we surveyed 26 sites encompassing 51.5 km (13.4%) of the 384 km of available spawning habitat. During these surveys we observed 52 steelhead redds and nine live steelhead in the UGRR watershed and 153 redds and 27 live steelhead in the Joseph Creek watershed. We observed five carcasses in the Joseph Creek watershed and one carcass in the UGRR watershed.

On 18.7 km of Deer Creek, 33 redds, 10 live steelhead, and two carcasses were observed during five survey visits. A total of 63 wild-origin adult steelhead were passed above a permanent weir on Deer Creek, resulting in a 1.91 fish:redd ratio for the 2013 spawning season.

Abundance of Steelhead Spawners at the Population Level

Using the fish:redd ratio extrapolated from Deer Creek surveys, adult steelhead escapement estimates for the UGRR and Joseph Creek basins were 1,561 (95% C.I.: 800 – 2,323) and 2,197 (95% C.I.: 1,263 – 3,130) respectively. Escapement estimates in the UGRR sub-basin had been relatively stable from 2008-2012, but showed a substantial decrease in 2013. The UGRR estimate was roughly half of it’s running average over that period of time. This was the second GRTS-based steelhead spawning ground survey in Joseph Creek, and estimates were substantially higher than the previous year’s estimate of 1,357 (95% C.I. 977-1,736) adults.

Steelhead and Chinook Salmon Parr Surveys and
Steelhead and Chinook Salmon Parr Density and Distribution.

Salmonids were observed at 51 of the 56 surveyed CHaMP sites in 2014. Steelhead were found at 50 of the 56 sites, Chinook salmon at 30, and bull trout *Salvelinus confluentus* at only eight sites.

Juvenile Chinook were most concentrated in the mainstem UGRR, Lookingglass Creek and Catherine Creek, though they were found in several tributaries to these streams. Bull trout were observed in Lookingglass Creek and the upstream portions of Catherine Creek and UGRR.

Juvenile Chinook salmon and steelhead density estimates, were significantly higher (Kruskal-Wallis with Dunn’s Test, $p<0.05$) in pools than fastwater units or runs. There was no statistically significant difference between densities in fastwater units compared to runs. UGRR and Lookingglass Creek sites had the highest densities of Chinook, followed by Catherine Creek sites. Steelhead densities were highest in Fly, Lookingglass and Meadow Creeks.

Repeat snorkel surveys were completed at a subset of sites. These showed the highest steelhead counts in August and highest Chinook salmon counts in September. However, there was no significant statistical difference between months. Based on this, we estimate the most productive sampling period for small streams (steelhead domain) will be August, and September for larger streams (Chinook domain).

Introduction

The goal of this project is to investigate the critical habitat, abundance, migration patterns, survival, and alternate life history strategies exhibited by spring Chinook salmon and summer steelhead juveniles from distinct populations in the Grande Ronde River and Imnaha River subbasins (Figures 1 and 2). This project will provide information on abundance of spring Chinook salmon and steelhead parr , estimates for egg-to-migrant survival for spring Chinook salmon and migrant survival for steelhead, estimate the Viable Salmonid Population (VSP) Indicator smolts per spawner for four populations of spring Chinook salmon, and assess stream conditions in selected study streams. This study provides a means for long term monitoring of juvenile salmonid production in the Grande Ronde and Imnaha River subbasins that is essential for assessing the success of restoration and enhancement efforts including hatchery supplementation and habitat improvement. As hatchery supplementation of spring Chinook salmon continues in the Grande Ronde Subbasin, we will monitor abundance of migrants, life history characteristics, and survival to various life stages to provide data to the Lower Snake River Compensation Plan - Oregon Evaluation project to determine the effectiveness of this management action.

This project coordinates and collaborates with many projects, including Columbia River Intertribal Fish Commission (CRITFC) and their project 2009-004-00 Monitoring Recovery Trends in Key Spring Chinook Habitat Variables and Validation of Population Viability Indicators, the Columbia Habitat and Monitoring Program (CHaMP) project 2011-006-00, and Lower Snake River Compensation Plan - Oregon Evaluation project. This project provides data for the Interior Columbia Technical Recovery Team (ICTRT) spring Chinook salmon life cycle model.

Objectives for FY13:

1. Document the in-basin migration patterns and estimate abundance of spring Chinook salmon juveniles in Catherine Creek and the upper Grande Ronde, Minam, and Lostine rivers.

2. Determine overwinter mortality and the relative success of fall (early) migrant and spring (late) migrant life history strategies for spring Chinook salmon from tributary populations in Catherine Creek and the upper Grande Ronde, and Lostine rivers, and the relative success of fall (early) migrant and spring (late) migrant life history strategies for spring Chinook salmon from the Minam River.

3. Estimate and compare smolt survival probabilities at main stem Columbia and Snake River dams for migrants from five local, natural populations of spring Chinook salmon in the Grande Ronde River and Imnaha River subbasins.

4. Document the annual migration patterns for spring Chinook salmon juveniles from five local, natural populations in the Grande Ronde River and Imnaha River subbasins: Catherine Creek, Upper Grande Ronde, Lostine, Minam, and Imnaha rivers.

5. Document patterns of movement and estimate abundance of juvenile steelhead from tributary populations in Catherine Creek, the upper Grande Ronde, Lostine and the Minam rivers including migration timing, and duration.

6. Estimate and compare survival probabilities to main stem Columbia and Snake River dams for summer steelhead from four tributary populations: Catherine Creek and the upper Grande Ronde, Lostine, and Minam rivers.

7. Describe aquatic habitat conditions, using water temperature and discharge, in Catherine Creek and the upper Grande Ronde, Lostine, and Minam rivers.

8. Estimate reach survival through the Grande Ronde Valley of Chinook salmon migrants from Catherine Creek.

9. Estimate adult steelhead escapement to the Upper Grande Ronde and Joseph Creek populations.

10. Estimate density and distribution of steelhead parr from the Upper Grande Ronde population and Chinook salmon parr from the Upper Grande Ronde and Catherine Creek populations.

The project addresses the following strategy questions associated with Fish Population Status Monitoring:

- Assess the status and trend of juvenile abundance and productivity of natural origin fish populations.
  What are the status and trend of juvenile abundance and productivity of fish populations?

- Assess the status and trend of spatial distribution of fish populations.
  What are the status and trend of spatial distribution of fish populations?

- Assess the status and trend of diversity of natural and hatchery origin fish populations.
  What are the status and trend of diversity of natural and hatchery origin fish populations?

The focal species are Snake River Spring/Summer Chinook salmon and Snake River steelhead.

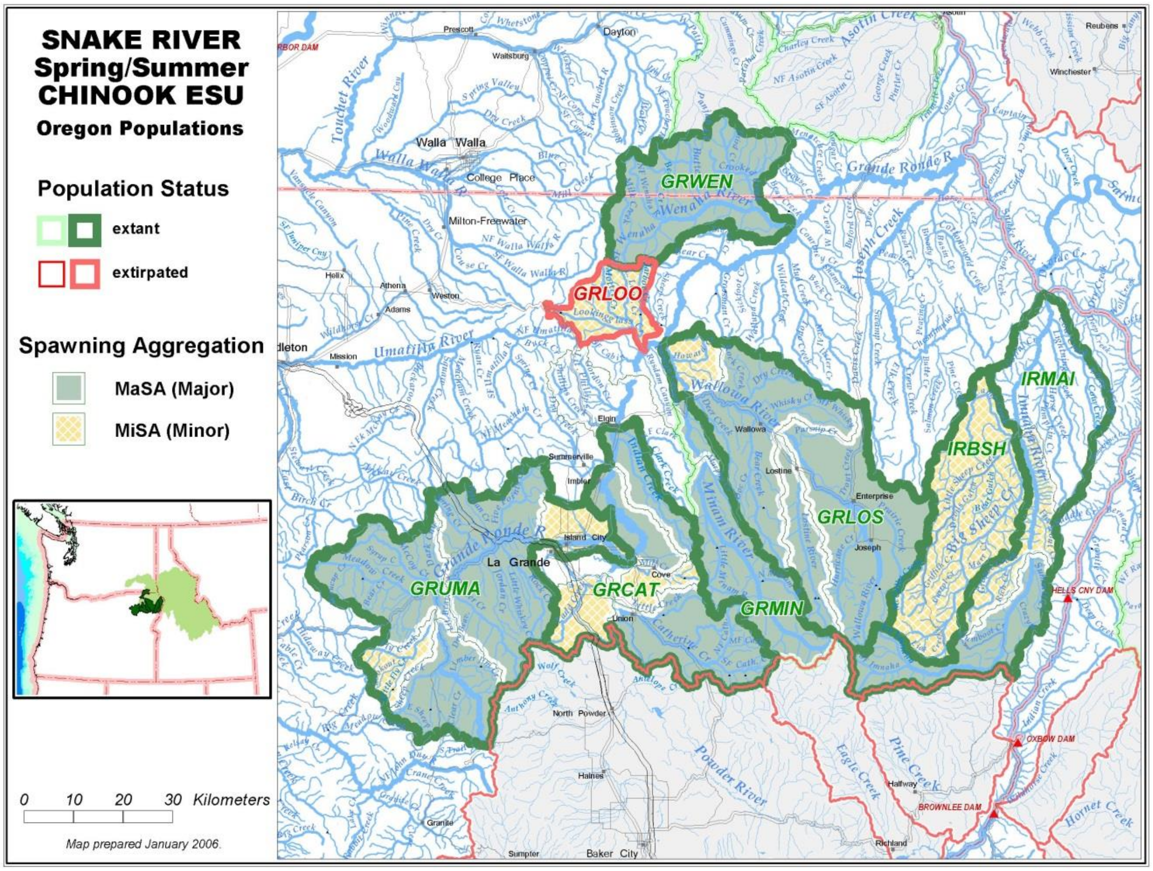

Figure 1. Map of the Grande Ronde-Imnaha spring Chinook salmon MPG with individual Chinook salmon populations identified. This project monitors these populations within this MPG: Upper Grande Ronde River (GRUMA), Catherine Creek (GRCAT), Minam River (GRMIN), Lostine River (GRLOS), and Imnaha River (IRMAI).

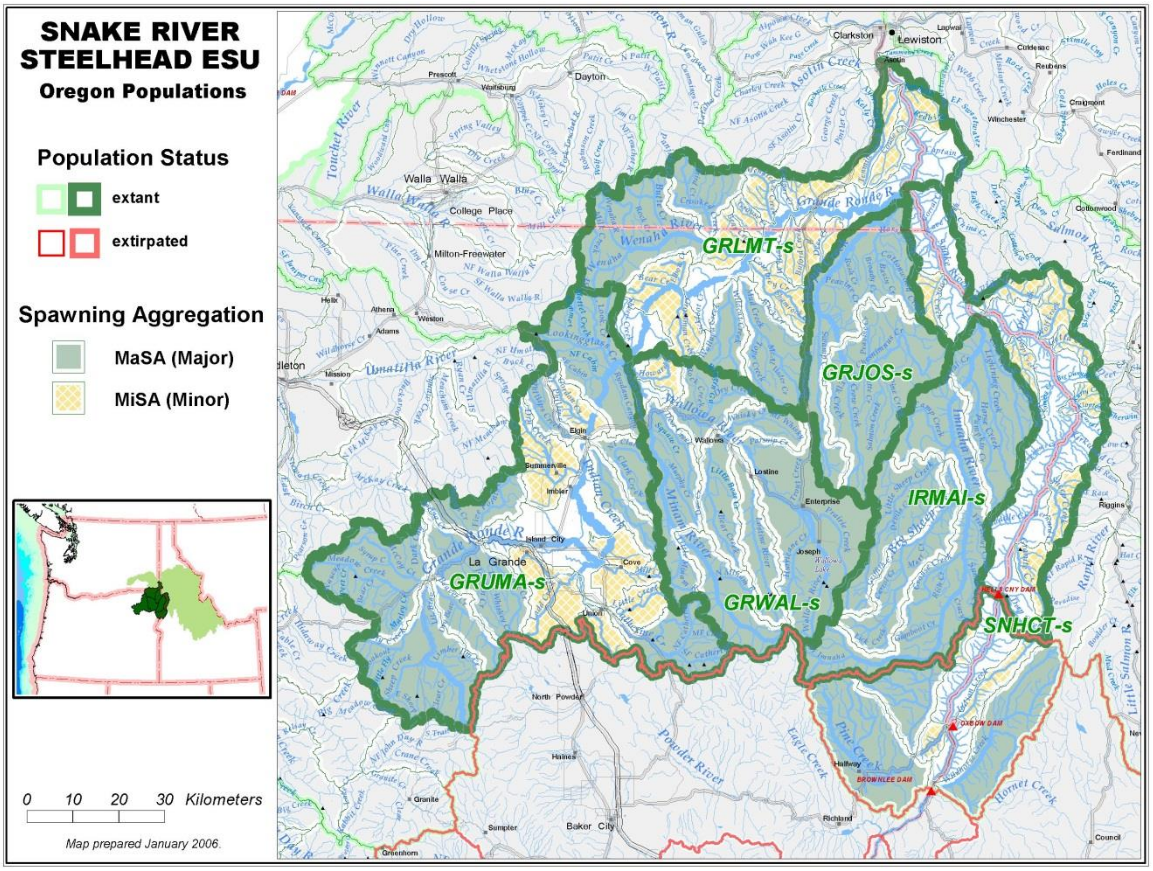

Figure 2. Map of the Grande Ronde-Imnaha steelhead MPG with individual steelhead populations identified. This project monitors these populations within this MPG: Upper Grande Ronde River (GRUMA-s), Wallowa River (GRWAL-s), and Joseph Creek (GRJOS-s).

Work Elements

WE H: Abundance and Migration of Juvenile Salmonids in Study Streams During Migration Year 2013, and

WE I: Survival and Relative Success of Juvenile Salmonids from the Grande Ronde and Imnaha Subbasins

Introduction

Numerous enhancement activities, including hatchery supplementation and habitat restoration, have been undertaken to recover spring Chinook salmon populations in Grande Ronde River Subbasin. Supplementation programs have been initiated by Oregon Department of Fish and Wildlife, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe using endemic broodstock from Catherine Creek and Lostine and upper Grande Ronde rivers. This study provides a means for long term monitoring of juvenile salmonid production in the Grande Ronde and Imnaha River subbasins that is essential for assessing the success of restoration and enhancement efforts including hatchery supplementation and habitat improvement. As hatchery supplementation of spring Chinook salmon continues in the Grande Ronde Subbasin, we will monitor abundance of migrants, life history characteristics, and survival to various life stages to determine the effectiveness of this management action.

Methods

Life history of spring Chinook salmon and summer steelhead (1992-026-04):
http://www.monitoringmethods.org/Protocol/Details/217

The locations of the rotary screw traps are shown in Figure 3.

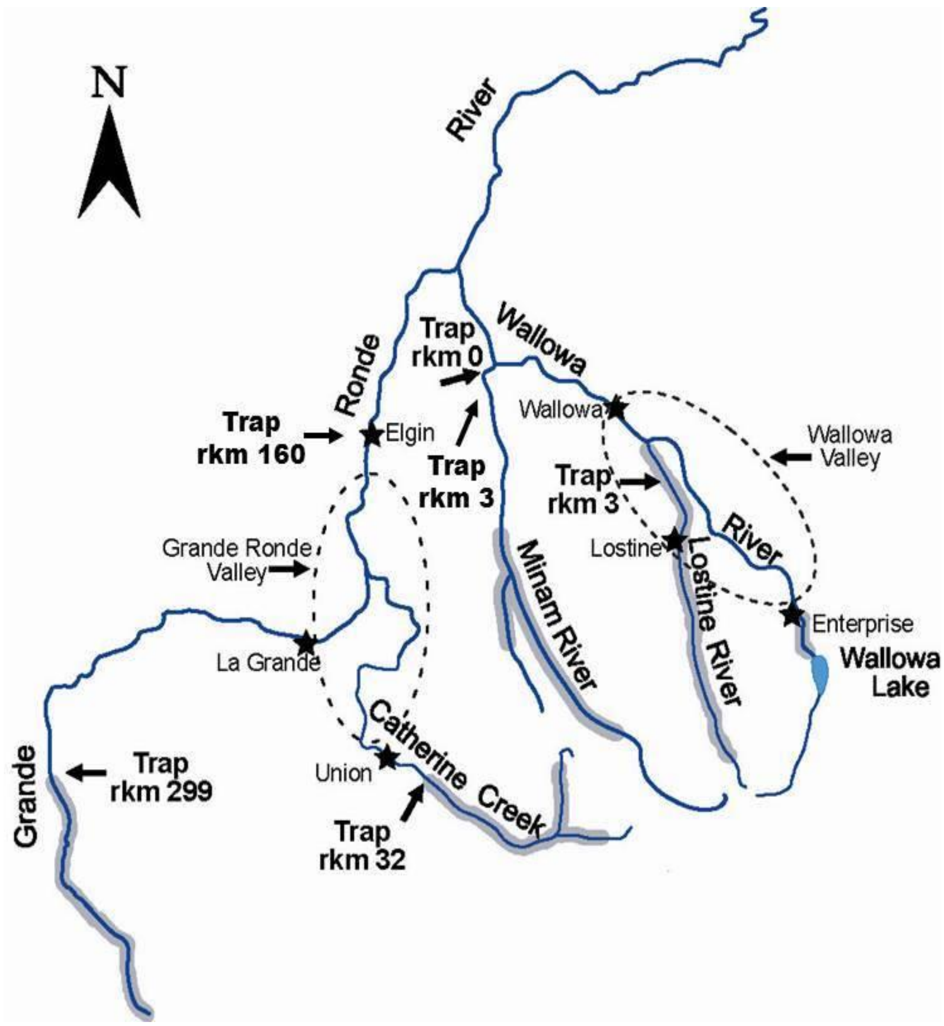

Figure 3. Locations of fish traps in Grande Ronde River Subbasin during the study period. Shaded areas delineate spring Chinook salmon spawning and upper rearing areas. Dashed lines indicate Grande Ronde and Wallowa river valleys.

Results
Spring Chinook Salmon

We estimated a minimum of 32,175 ± 2,626 juvenile spring Chinook salmon emigrated from Catherine Creek upper rearing areas during MY 2013. This migrant estimate was within ranges previously reported during this study (Figure 4). Based on total minimum estimate, 82% (26,393 ± 2,519) migrated early and 18% (5,782 ± 741) migrated late. Typically, emigration from Catherine Creek upper rearing areas occurs during the early migration period.

We estimated a minimum of 78,437 ± 9,454 juvenile spring Chinook salmon emigrated from Lostine River during MY 2013 (Figure 5). Based on the minimum estimate, 77% (60,619 ± 8,894) of juvenile spring Chinook salmon migrated early, while 23% (17,818 ± 3,208) migrated late. The Lostine River population appears to be similar to that of Catherine Creek in that the largest emigration has been typically observed during the early migration period.

We estimated a minimum of 61,106 ± 6,016 juvenile spring Chinook salmon emigrated from Minam River during MY 2013 (Figure 6). Based on the minimum estimate, 72% (43,900 ± 4,917) of juvenile spring Chinook salmon migrated early and 28% (17,206 ± 3,466) migrated late.

We estimated a minimum of 21,609 ± 1,234 juvenile spring Chinook salmon emigrated from upper Grande Ronde River during MY 2013 (Figure 7). Based on the minimum estimate, 41% (8,958 ± 801) of juvenile spring Chinook salmon migrated early and 59% (12,651 ± 939) migrated late.

The middle Grande Ronde River trap at Elgin fished for 71 d between 13 March 2013 and 7 June 2013. We estimated a minimum of 31,160 ± 6,751 juvenile spring Chinook salmon emigrated from upper rearing areas.

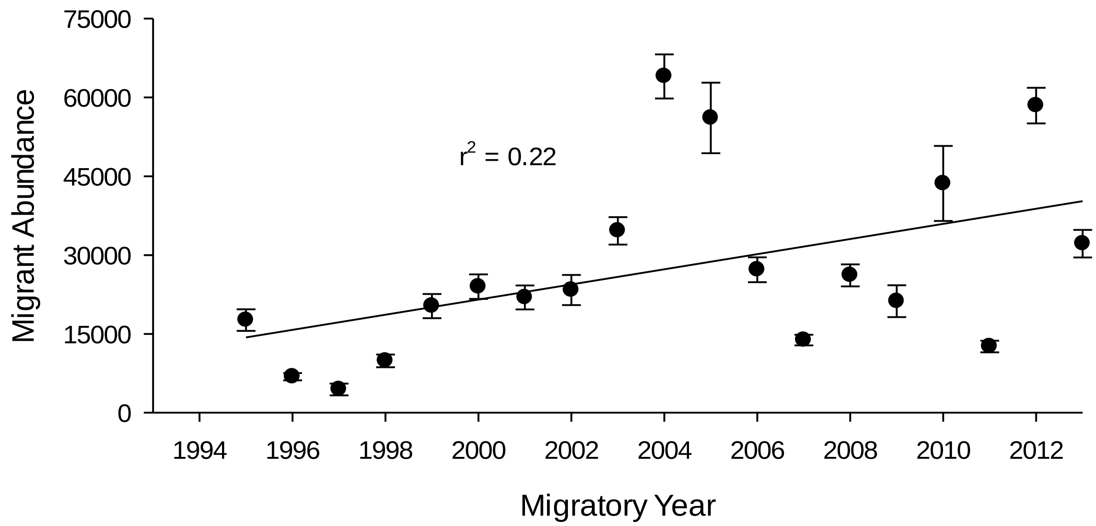

Figure 4. Spring Chinook salmon migrant abundance estimates at the Catherine Creek trap site by migratory year. Error bars are 95% confidence intervals.

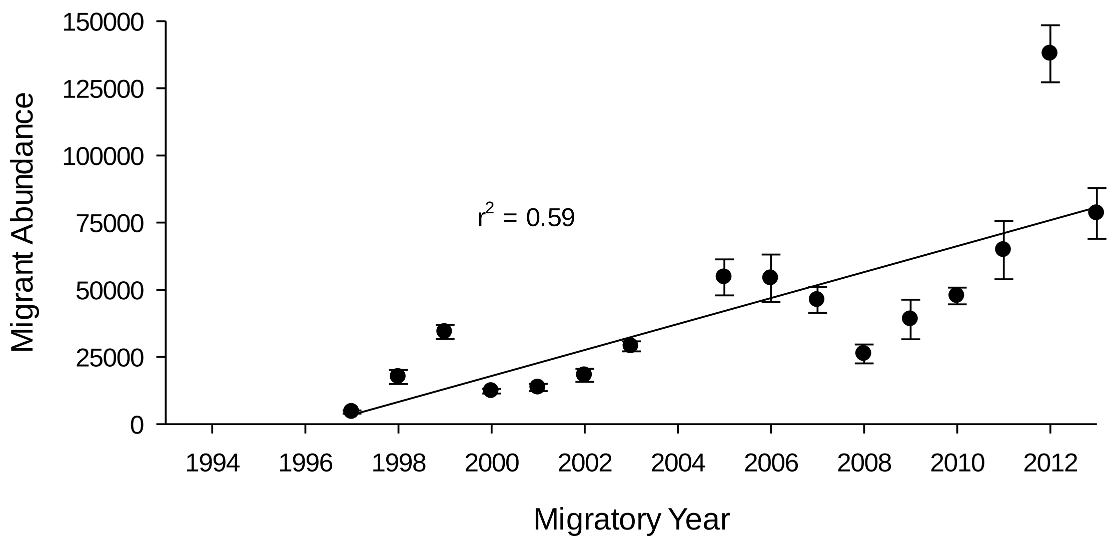

Figure 5. Spring Chinook salmon migrant abundance estimates at the Lostine River trap site by migratory year. Error bars are 95% confidence intervals.

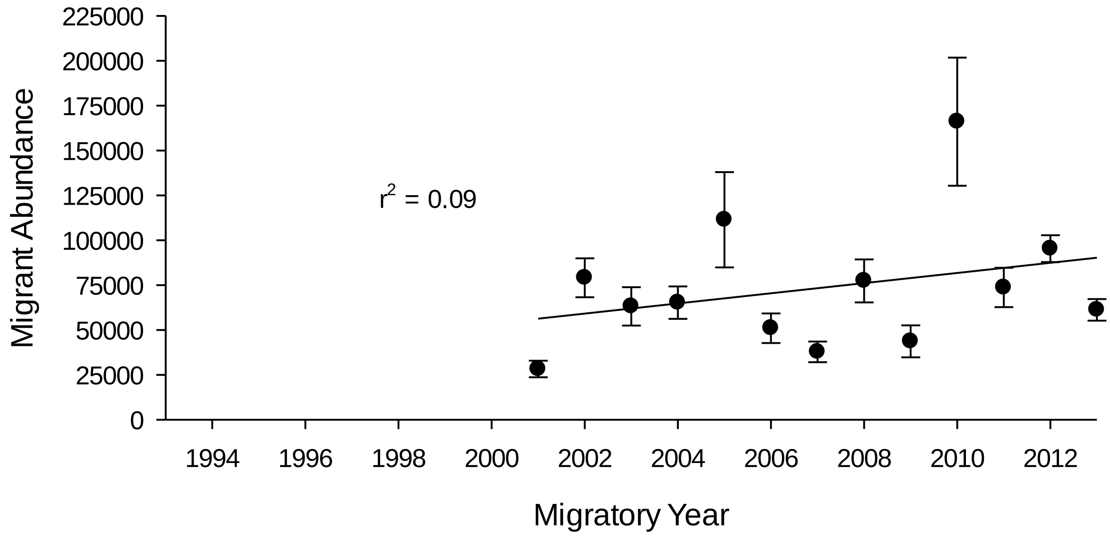

Figure 6. Spring Chinook salmon migrant abundance estimates at the Minam River trap site by migratory year. Error bars are 95% confidence intervals.

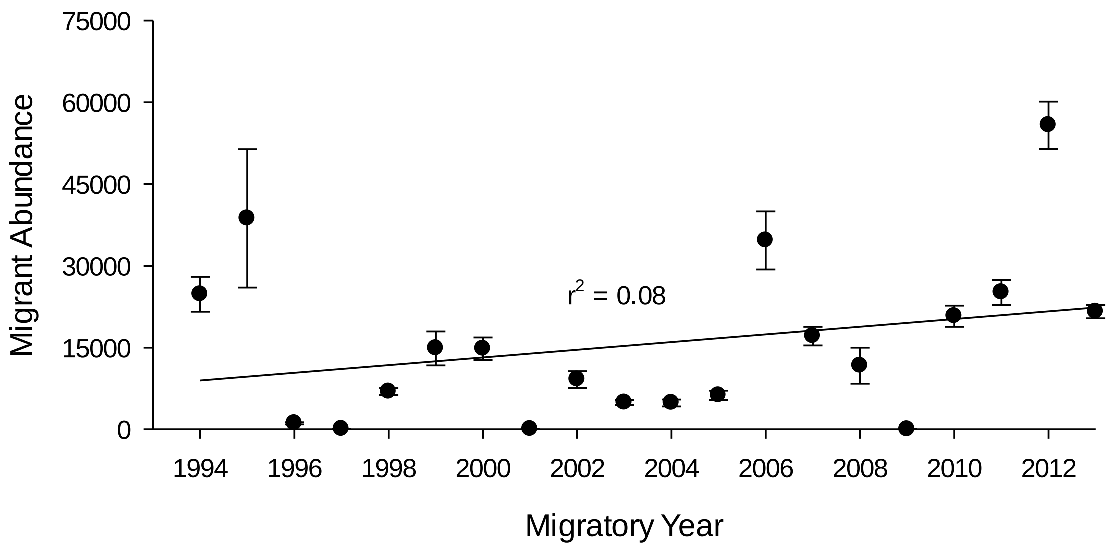

Figure 7. Spring Chinook salmon migrant abundance estimates at the upper Grande Ronde River trap site by migratory year. Error bars are 95% confidence intervals.

Fork lengths of juvenile spring Chinook salmon migrants at each of our rotary screw traps are shown in Figures 8 – 11. Mean fork lengths of migrants at the Catherine Creek, Minam, Lostine, and upper Grande Ronde River traps during the 2013 migratory year were within the range of fork lengths seen at these traps in previous years. We have observed that the length of fall migrants is negatively correlated with the abundance of parr in late summer (ODFW unpublished data).

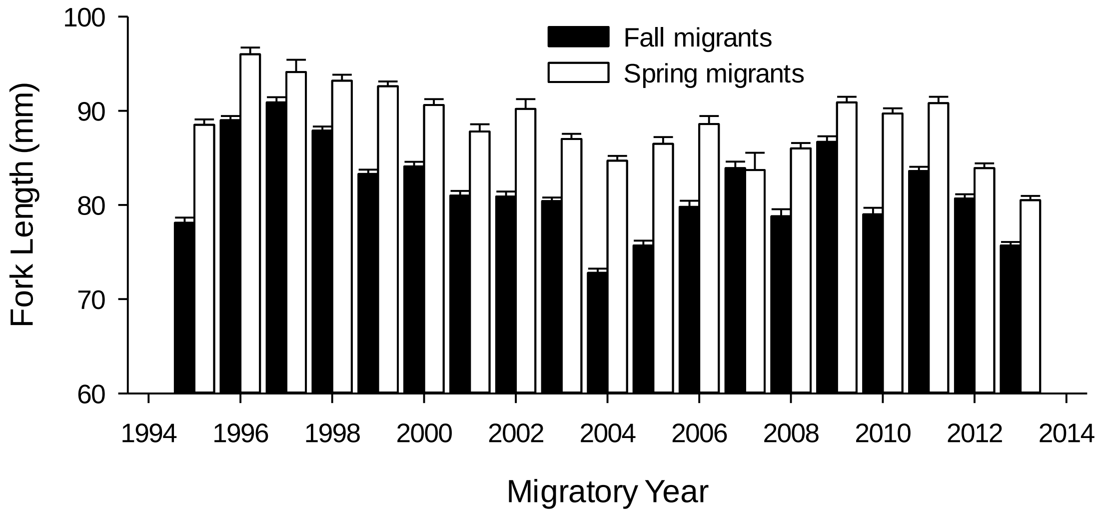

Figure 8. Fork length of spring Chinook salmon migrants captured at the Catherine Creek rotary screw trap by migratory year. Error bars are 95% confidence intervals.

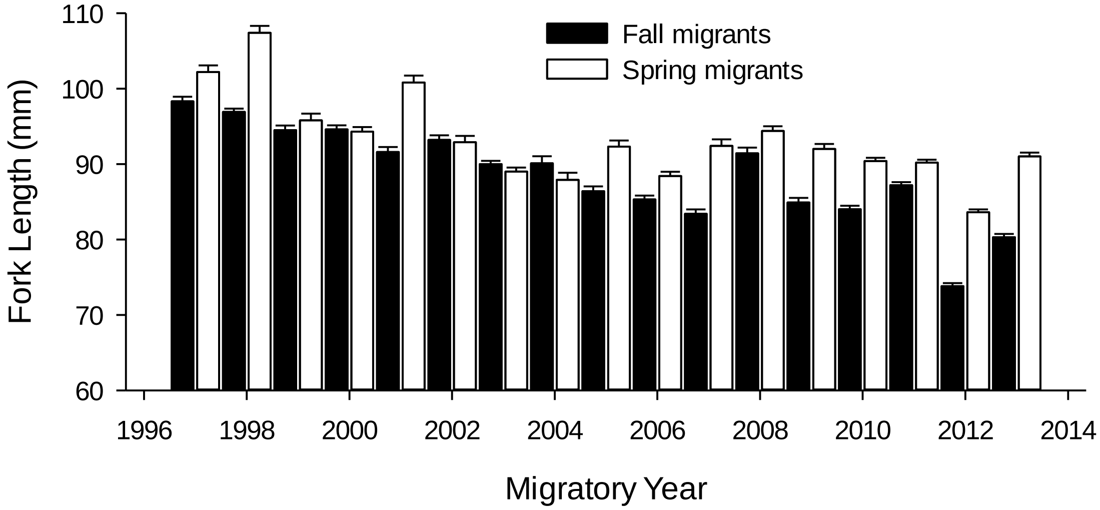

Figure 9. Fork length of spring Chinook salmon migrants captured at the Lostine River rotary screw trap by migratory year. Error bars are 95% confidence intervals.

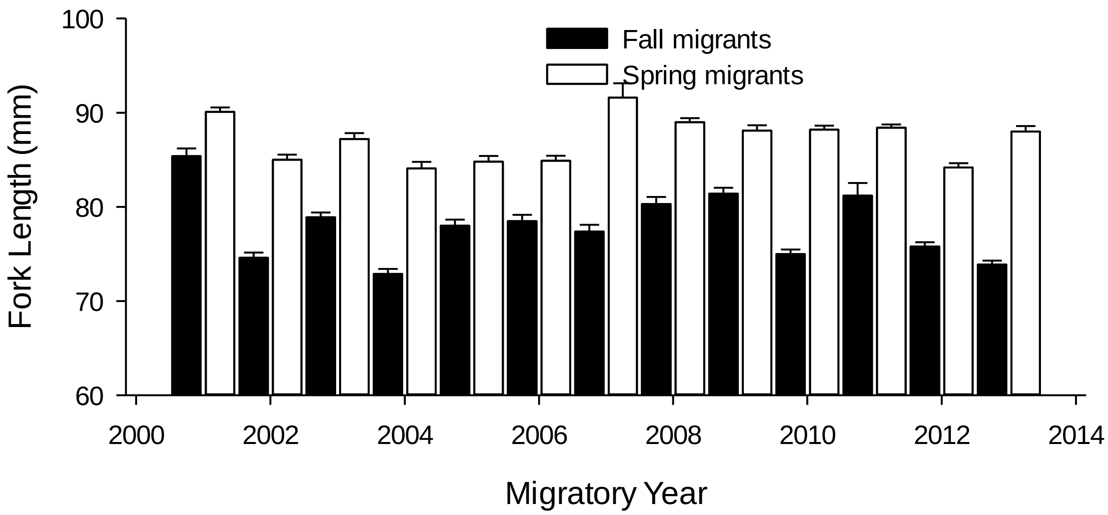

Figure 10. Fork length of spring Chinook salmon migrants captured at the Minam River rotary screw trap by migratory year. Error bars are 95% confidence intervals.

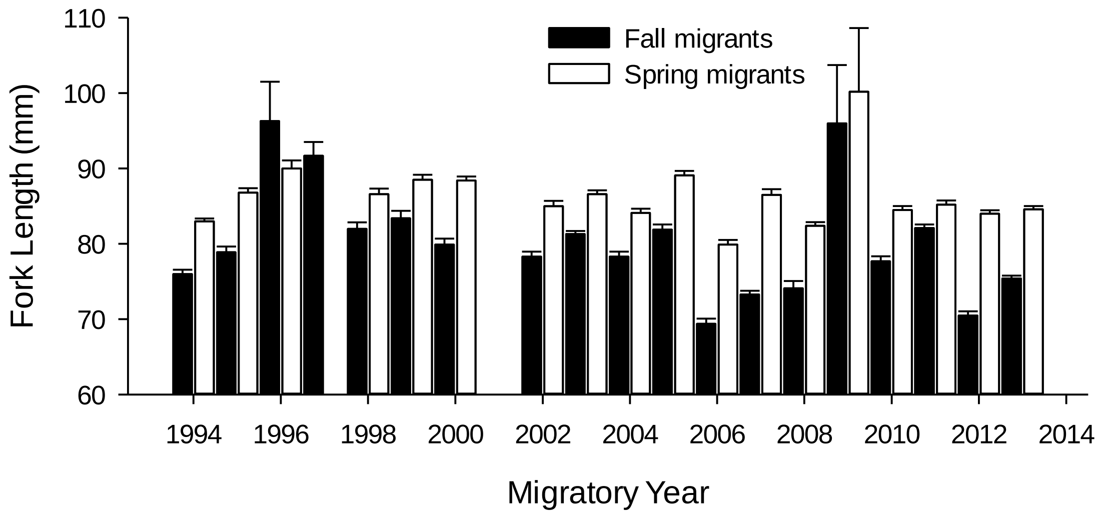

Figure 11. Fork length of spring Chinook salmon migrants captured at the upper Grande Ronde River rotary screw trap by migratory year. Error bars are 95% confidence intervals.

Survival probabilities to Lower Granite Dam for parr tagged during summer 2012 were 0.031 for Catherine Creek, 0.125 for Imnaha, 0.098 for Lostine, 0.106 for Minam, and 0.098 for upper Grande Ronde river populations (Figure 12). Generally, survival probabilities during MY 2013 fell within ranges previously reported; however, Catherine Creek survival probability estimate (0.031) is the lowest reported survival estimate previously reported.

Catherine Creek fall, winter, and spring tag group survival probabilities to Lower Granite Dam were 0.101, 0.108, and 0.220, respectively. Survival probabilities for Lostine River fall, winter, and spring tag groups were 0.225, 0.191, and 0.552, respectively. Probability of survival for the middle Grande Ronde River spring tag group was 0.685. Survival probabilities for Minam River fall and spring tag groups were 0.185 and 0.634, respectively. Upper Grande Ronde River fall, winter, and spring tag group survival probabilities to Lower Granite Dam were 0.177, 0.057, and 0.314, respectively. Survival probabilities, similar to past years, were generally higher for spring tag groups, likely because these fish were not subject to overwinter mortality that summer, fall, and winter tag groups experienced (Figure 12).

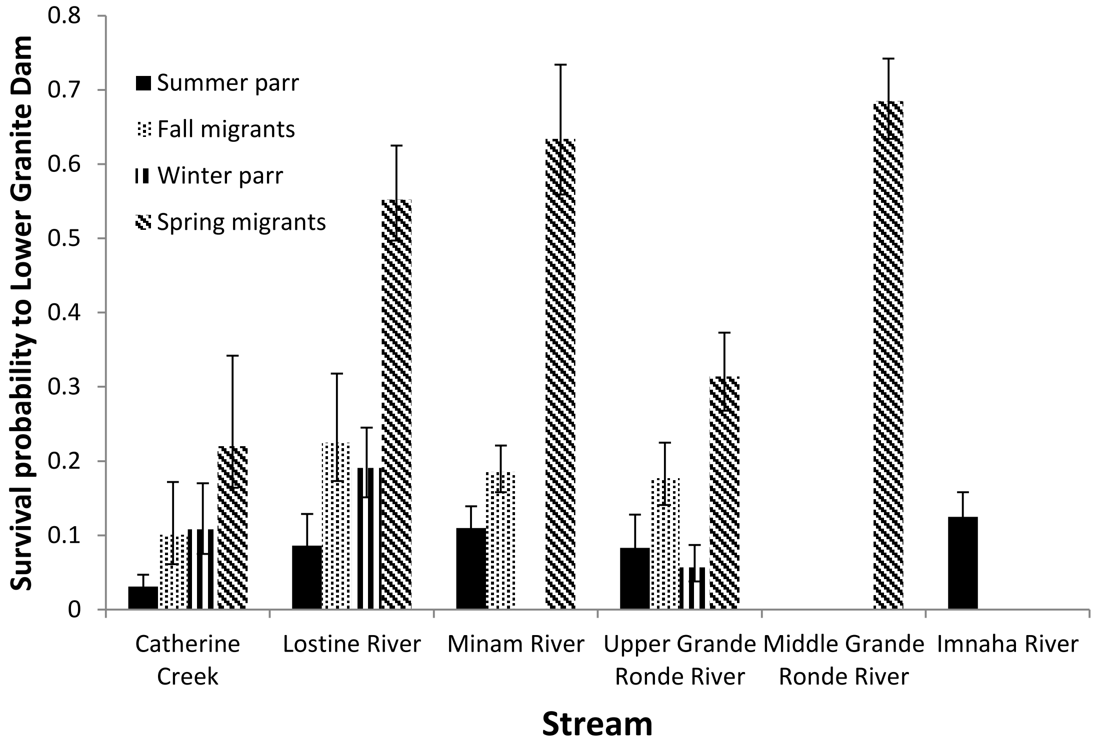

Figure 12. Survival probability to Lower Granite Dam of juvenile spring Chinook salmon PIT tagged at various life stages for the 2013 migratory year. Error bars are 95% confidence intervals.

Smolt equivalents are defined as the estimated number of smolts from a population that successfully emigrate from a specified area (Hesse et al. 2006). Combining the survival probability data with our migrant abundance estimates, we estimated the number of smolt equivalents produced in our study streams upstream of our rotary screw traps. In migratory year 2013 we estimated 17,899 smolt equivalents from Catherine Creek, 42,527 smolt equivalents from Lostine River, 30,016 smolt equivalents from Minam River, and 17,701 smolt equivalents from upper Grande Ronde River (Figure 13).

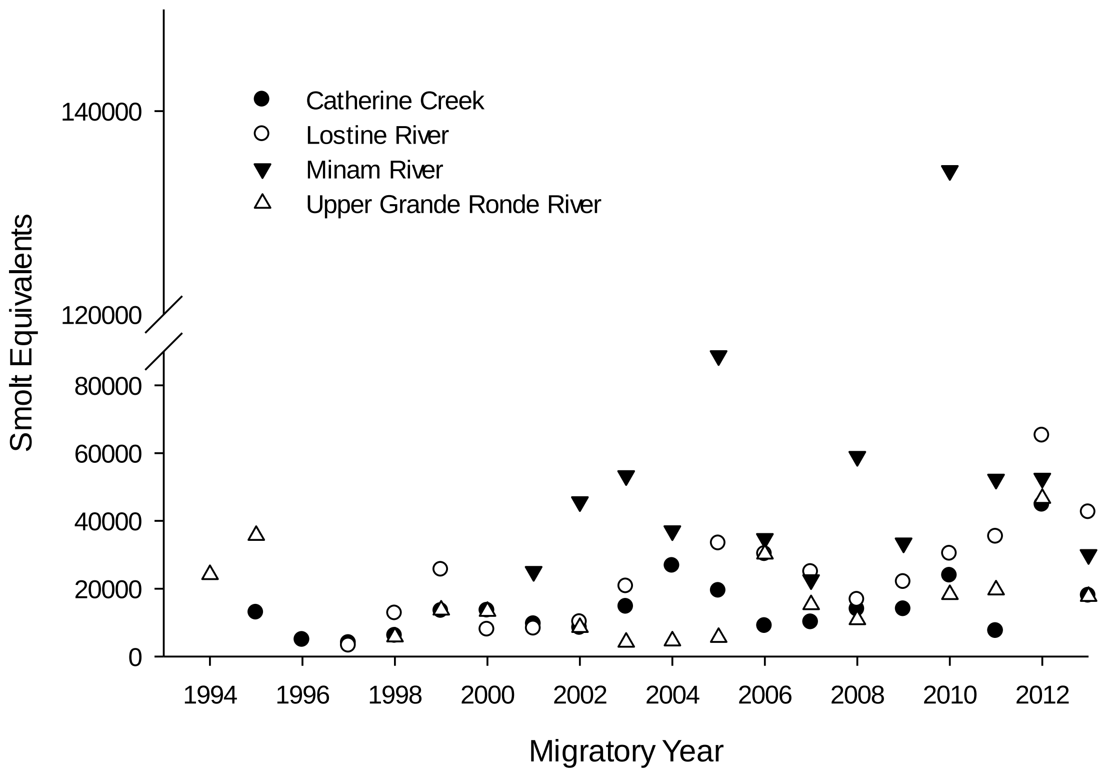

Figure 13. Spring Chinook salmon smolt equivalents produced from redds upstream of rotary screw traps in four study streams by migratory year.

Estimated productivity of spring Chinook salmon in Catherine Creek was 15 smolts per spawner for the 2011 brood year (2013 migratory year). This value is in the lowest value we have observed in Catherine Creek since we began calculating this VSP indicator with the 1993 brood year and coincides with the highest number of spawners (Figure 14). Estimated productivity of spring Chinook salmon in Lostine River was 14 smolts per spawner for the 2011 brood year (2013 migratory year). This value is the lowest we have observed in Lostine River since we began calculating this VSP indicator with the 1995 brood year and coincides with the second highest number of spawners (Figure 15). Estimated productivity of spring Chinook salmon in Minam River was 41 smolts per spawner for the 2011 brood year (2013 migratory year). This value is the lowest we have observed in Minam River since we began calculating this VSP indicator with the 1999 brood year and coincides with the second highest number of spawners (Figure 16). Estimated productivity of spring Chinook salmon in upper Grande Ronde River was 22 smolts per spawner for the 2011 brood year (2013 migratory year). This value is the lowest we have observed in the upper Grande Ronde River since we began calculating this VSP indicator with the 1992 brood year, and with more than 20 spawners, and coincides with the second highest number of spawners (Figure 17).

Plots of smolts per spawner versus spawners for each of the study streams show that productivity, as measured as smolts per spawner, decreases at higher spawner densities (Figures 18 – 21).

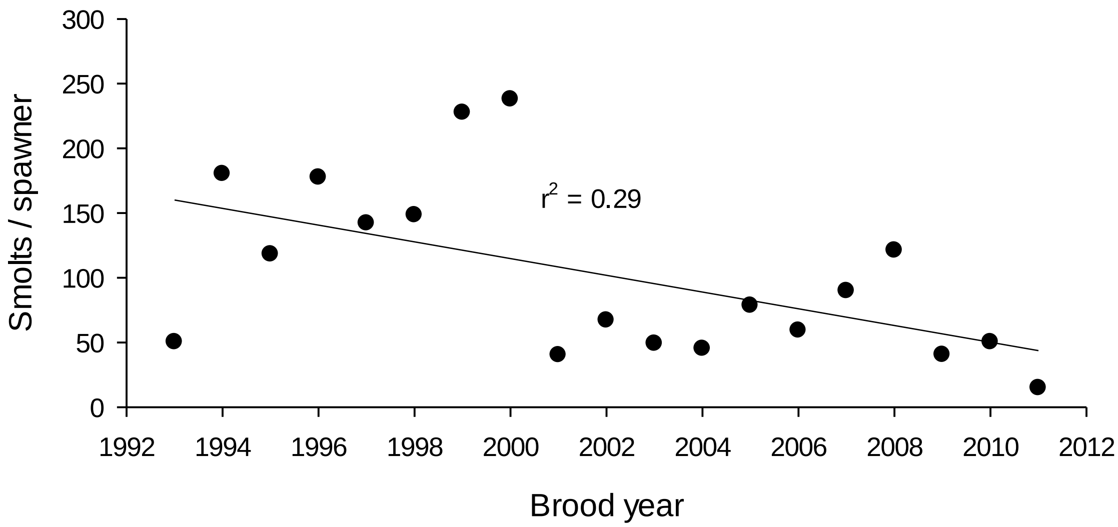

Figure 14. Spring Chinook salmon smolt equivalents produced per spawner in Catherine Creek by brood year.

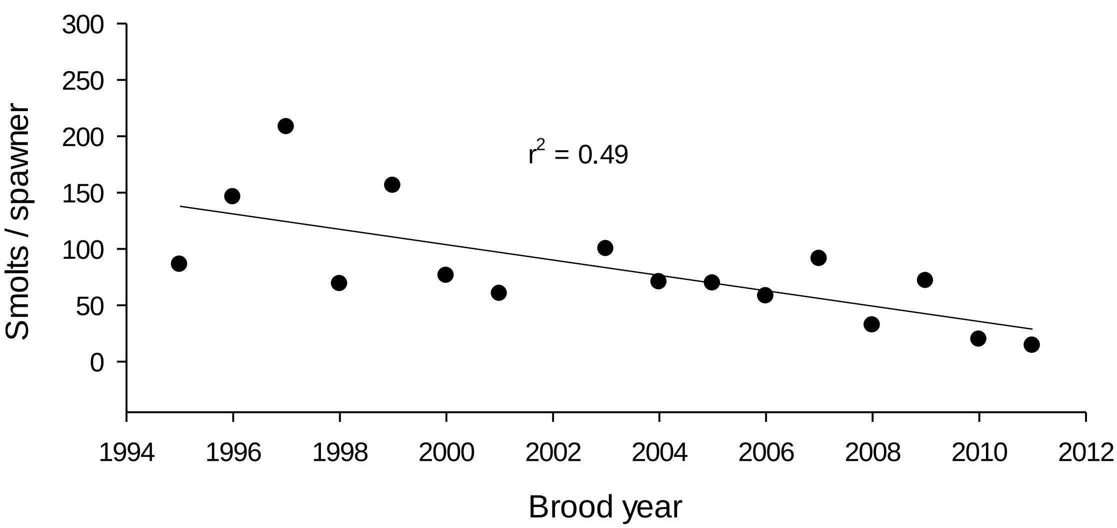

Figure 15. Spring Chinook salmon smolt equivalents produced per spawner in Lostine River by brood year.

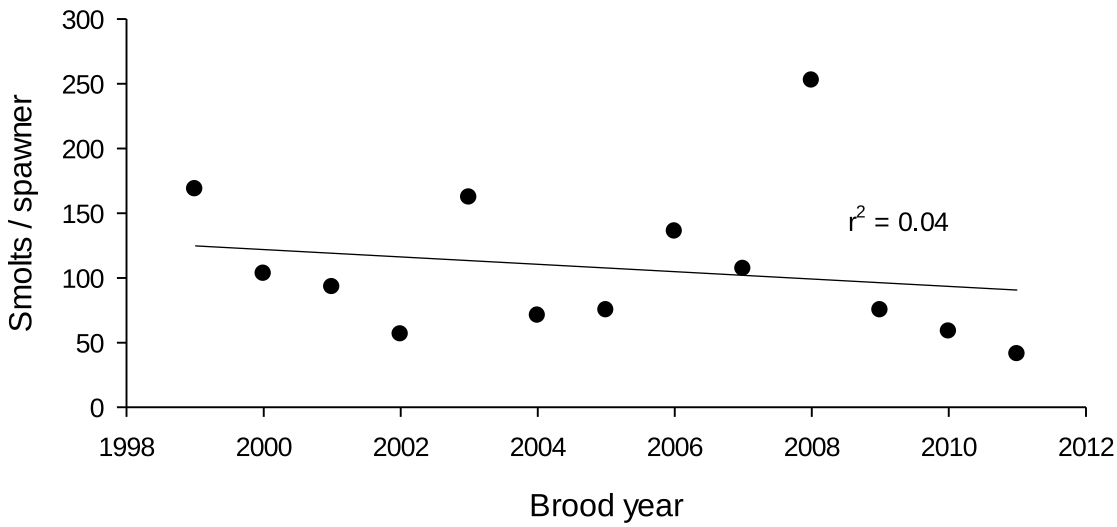

Figure 16. Spring Chinook salmon smolt equivalents produced per spawner in Minam River by brood year.

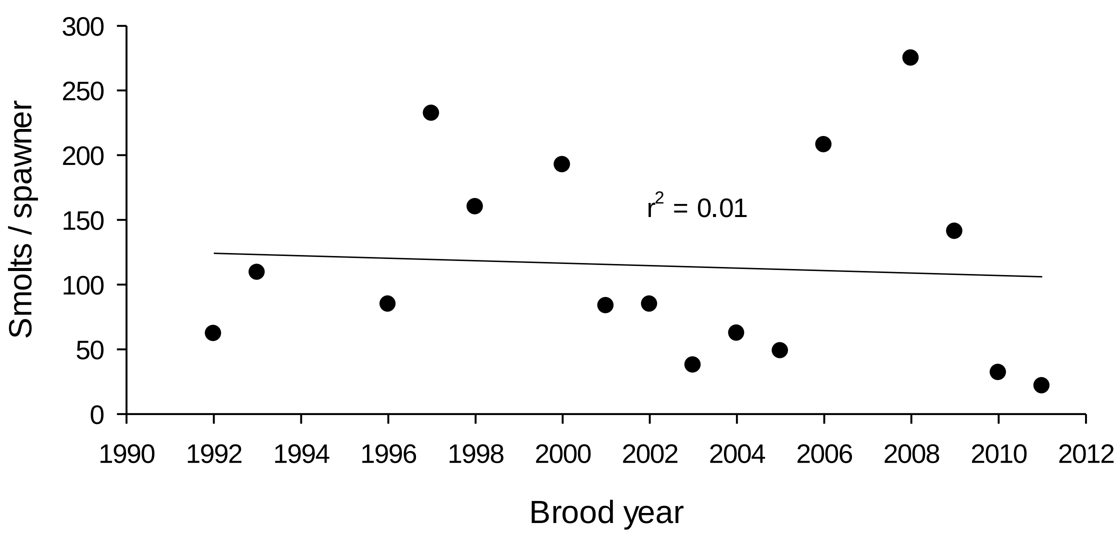

Figure 17. Spring Chinook salmon smolt equivalents produced per spawner in upper Grande Ronde River by brood year.

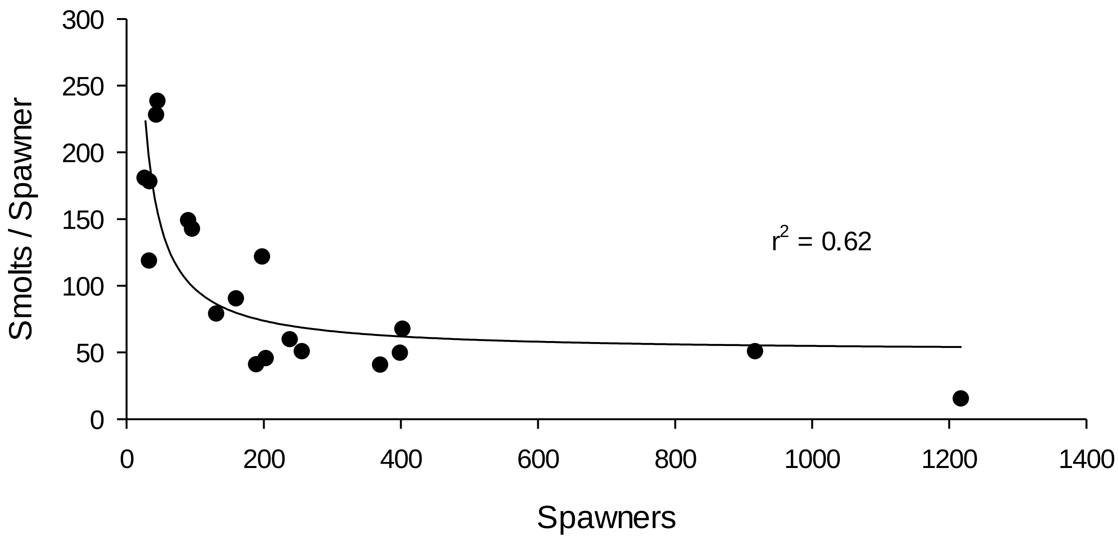

Figure 18. Spring Chinook salmon smolt equivalents produced per spawner in Catherine Creek by number of spawners.

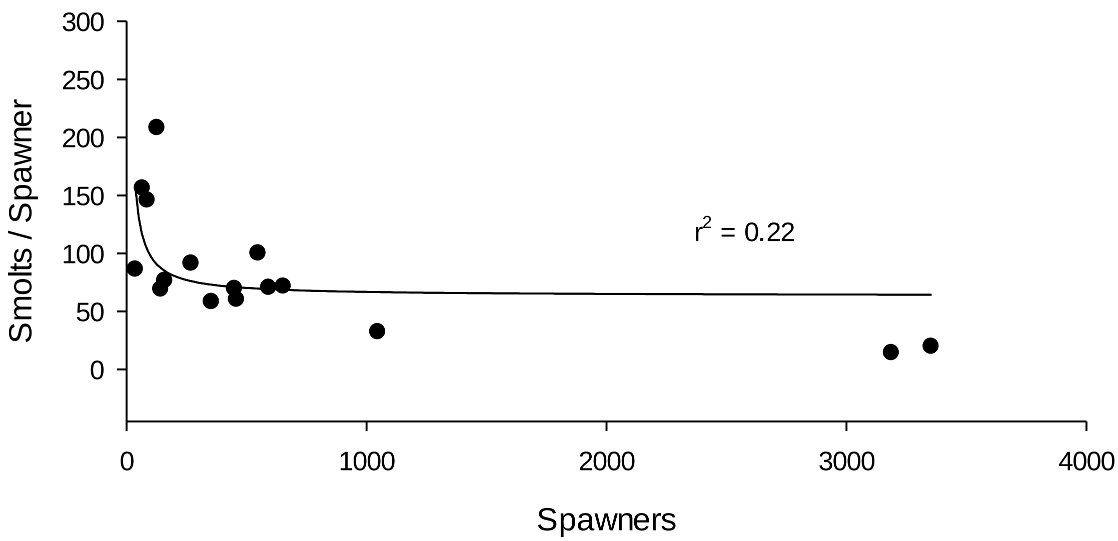

Figure 19. Spring Chinook salmon smolt equivalents produced per spawner in Lostine River by number of spawners.

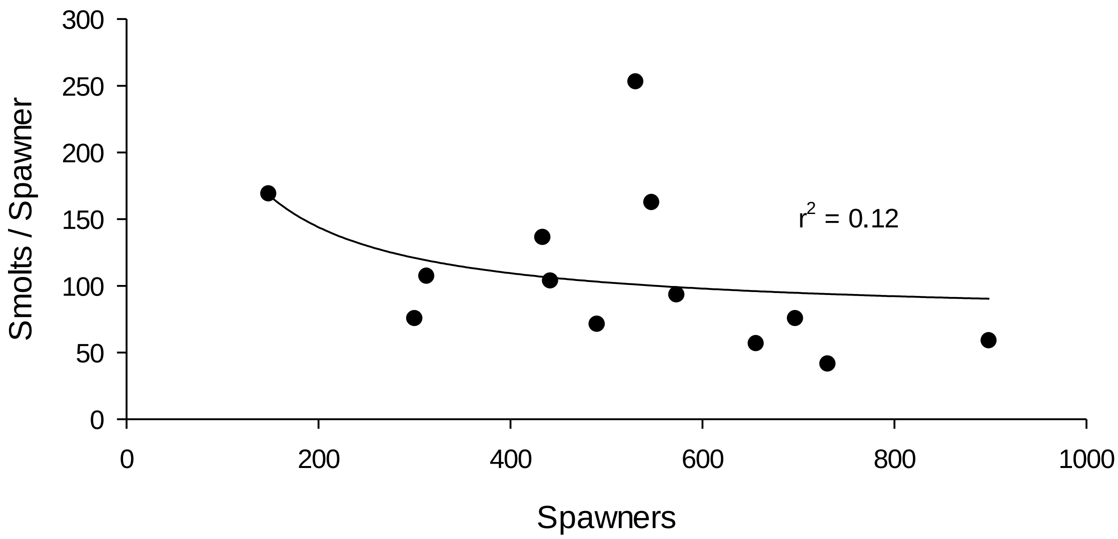

Figure 20. Spring Chinook salmon smolt equivalents produced per spawner in Minam River by number of spawners.

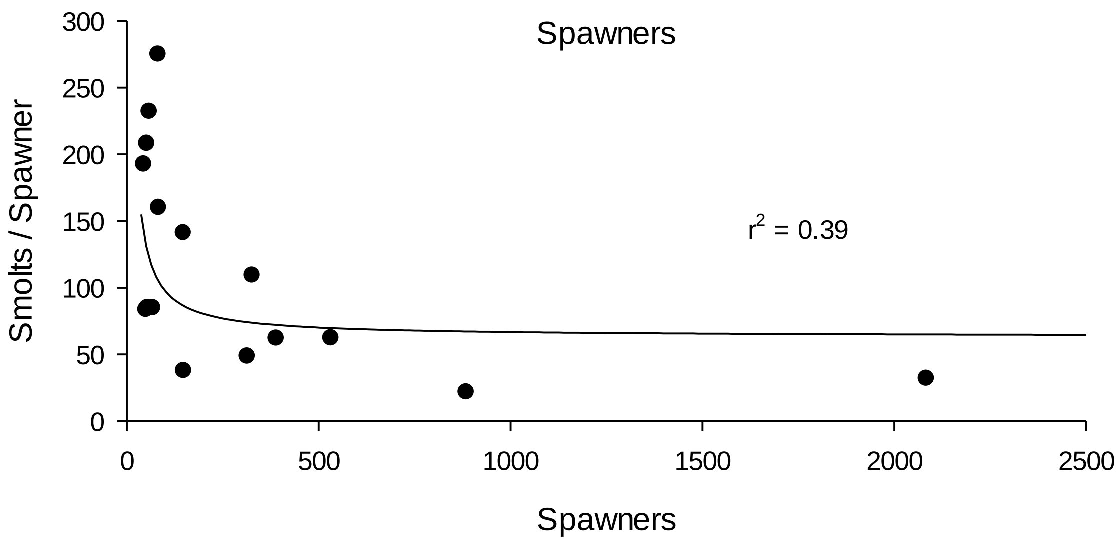

Figure 21. Spring Chinook salmon smolt equivalents produced per spawner in upper Grande Ronde River by number of spawners.

Radio-telemetry studies in 2013 consisted of determination of reach-specific survival rates of late migrating juvenile spring Chinook salmon through lower Catherine Creek and the Grande Ronde River between our rotary screw trap and Elgin, OR. We found that juvenile spring Chinook salmon migrate slowly (10 – 20 km/d) through lower Catherine Creek and then significantly faster (60 – 70 km/d) in the Grande Ronde River. Mortality through lower Catherine Creek averaged about 1% per river kilometer and then decreased in the Grande Ronde River. Our results in 2013 are similar to those of our previous two years of this reach-specific survival study.

Steelhead

We estimated a minimum of 38,823 ±, 6,704 (±95% CI) juvenile steelhead migrated from Catherine Creek upper rearing areas during MY 2013 (Figure 22). Based on total minimum abundance estimate, 21% (8,149 ± 2,492) migrated early and 79% (30,674 ± 6,224) migrated late. MY 2013 proportion of juvenile steelhead emigrating from upper rearing areas as late migrants (79%) is within those proportions previously reported during 1997-2013.

We estimated a minimum of 30,326 ± 4,304 juvenile steelhead migrated from Lostine River upper rearing areas MY 2013 (Figure 23). Based on total minimum abundance estimate, 52% (15,636 ± 2,301) of juvenile steelhead migrated early and 48% (14,690 ± 3,638) migrated late. MY 2013 proportion of juvenile steelhead emigrating from upper rearing areas as late migrants (48%) is within those proportions previously reported during 1997-2013.

We estimated a minimum of 28,582 ± 14,161 juvenile steelhead migrated from Minam River rearing areas during MY 2013 (Figure 24). Based on total minimum abundance estimate, 21% (5,989 ± 1,509) migrated early and 79% (22,593 ± 14,081) migrated late. Proportion of juvenile steelhead emigrating as late migrants, during MY 2013, is consistent with proportions from previous migration years.

We estimated a minimum of 18,726 ± 2,349 juvenile steelhead emigrated from upper Grande Ronde River rearing areas during MY 2013, which is within estimates from previous migration years (Figure 25). Based on total minimum abundance estimate, 12% (2,252 ± 310) were early migrants and 88% (16,474 ± 2,328) were late migrants. Predominant late migration of juvenile steelhead in upper Grande Ronde River is consistent for all migration years studied to date.

The middle Grande Ronde River trap fished for 71 d between 13 March 2013 and 7 June 2013. We estimated a minimum of 81,713 ± 16,523 juvenile steelhead emigrated from upper rearing areas.

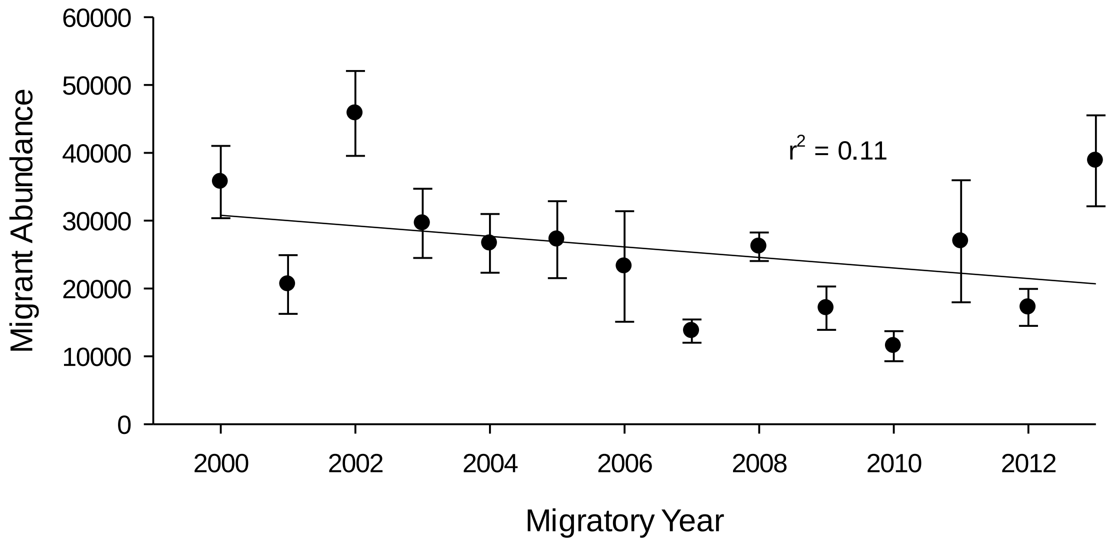

Figure 22. Steelhead migrant abundance estimates at the Catherine Creek trap site by migratory year. Error bars are 95% confidence intervals.

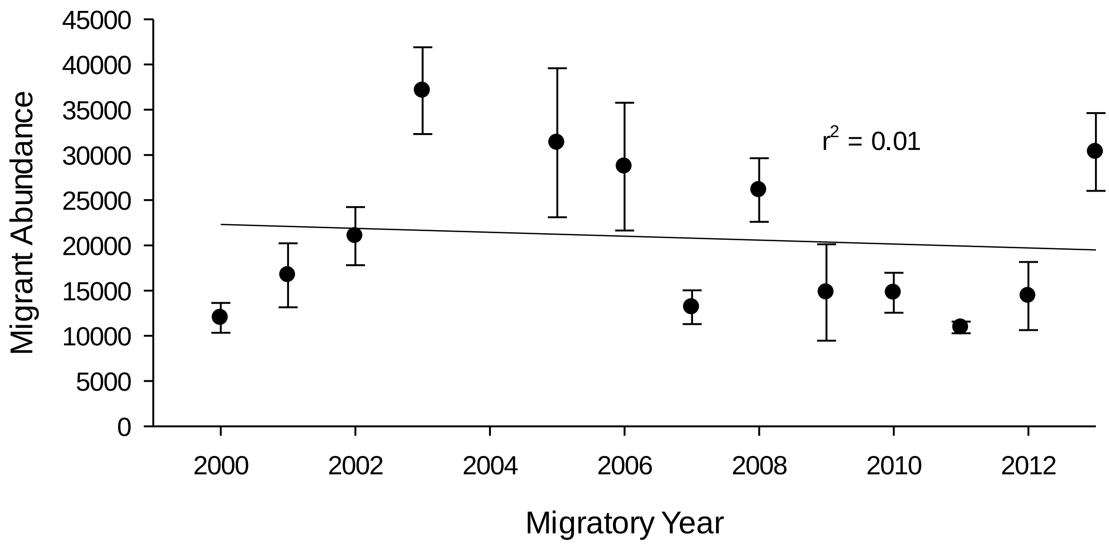

Figure 23. Steelhead migrant abundance estimates at the Lostine River trap site by migratory year. Error bars are 95% confidence intervals.

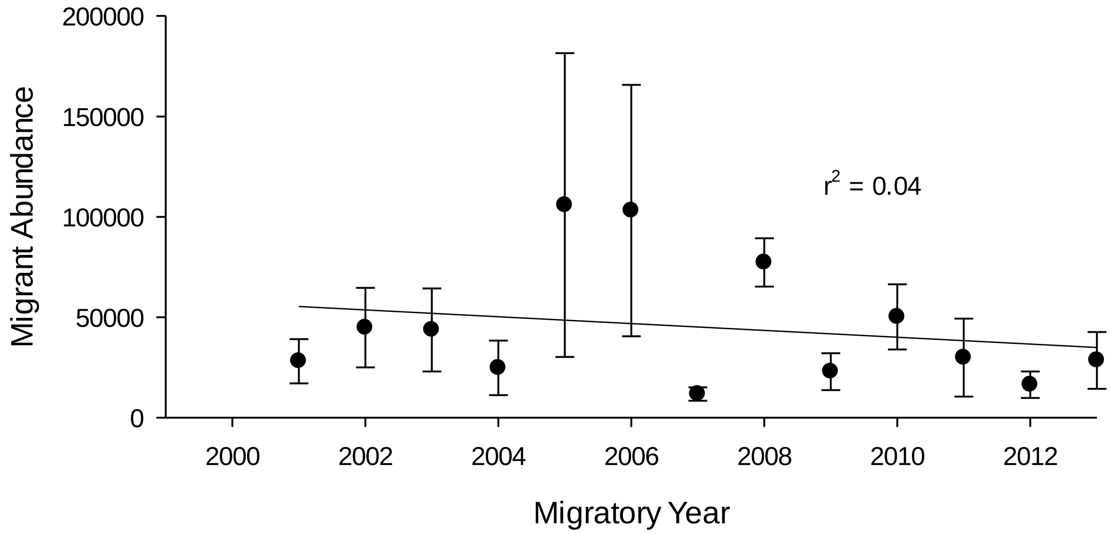

Figure 24. Steelhead migrant abundance estimates at the Minam River trap site by migratory year. Error bars are 95% confidence intervals.

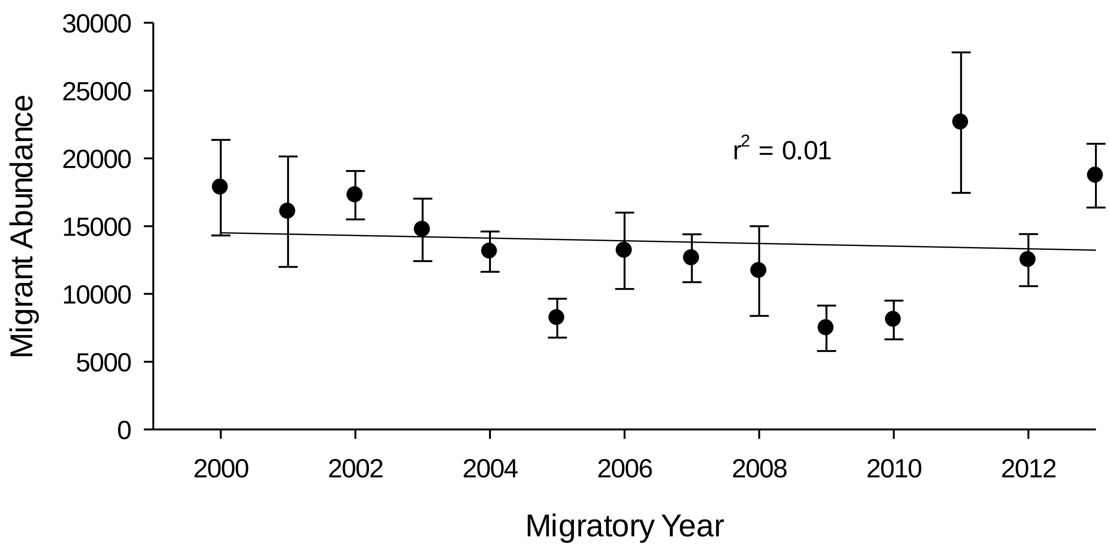

Figure 25. Steelhead migrant abundance estimates at the upper Grande Ronde River trap site by migratory year. Error bars are 95% confidence intervals.

Summer steelhead collected at trap sites during MY 2013 comprised five age-groups. Early migrants ranged from 0 to 4 years of age, while late migrants ranged from 1 to 4 years of age (Table 1). Majority of upper Grande Ronde river (53.8%) early migrants were age 1, while majority of Catherine Creek (58.5%), Lostine River (59.5%), and Minam River (70.4%) early migrants were age 0. Majority of Catherine Creek (78.8%), Lostine River (74.6%), and upper

Grande Ronde River (48.8%) late migrants were age 1, while majority of middle Grande Ronde River (63.0%) and Minam River (55.3%) late migrants were age 2 (Table 1).

Table 1. Age structure of early and late steelhead migrants collected at trap sites during MY 2013. The same four cohorts were represented in each migration period, but ages increased by one year from early migrants to late migrants (e.g., age-0 early migrants were same cohort as age-1 late migrants). Age structure was based on frequency distribution of sampled lengths and allocated using an age–length key. Means were weighted by migrant abundance at trap sites.

	Percent				
Emigrant type and trap site	Age-0	Age-1	Age-2	Age-3	Age-4
Early					
Catherine Creek	58.5	36.2	5.3	0.0	0.0
Lostine River	59.5	30.5	9.8	0.2	0.0
Minam River	70.4	7.6	20.4	1.6	0.0
Upper Grande Ronde River	34.2	53.8	11.7	0.3	0.0
Late					
Catherine Creek	0.0	78.8	16.7	4.4	0.1
Lostine River	0.0	74.6	20.6	4.7	0.0
Minam River	0.0	33.1	55.3	11.6	0.0
Upper Grande Ronde River	0.0	48.8	33.5	17.6	0.0
Early and Late[a]					
Middle Grande Ronde River	0.0	17.4	63.0	19.6	0.1

[a] Middle Grande Ronde River trap was located downstream from Catherine Creek and upper Grande Ronde River overwinter rearing reaches resulting in early and late emigrants being sampled simultaneously during spring emigration.

Probability of surviving and migrating, during migration year of tagging, to Lower Granite Dam for steelhead tagged in fall 2012 ranged from 0.059 to 0.104 for all four spawning tributaries (Figure 26). Probabilities of migration and survival, for larger steelhead (FL ≥ 115 mm) tagged during spring 2013, ranged from 0.364 to 0.813 for all five populations studied (Figure 26). Generally, probabilities of migration and survival, during spring 2013, were moderate to relatively low for all five populations studied compared to previous years.

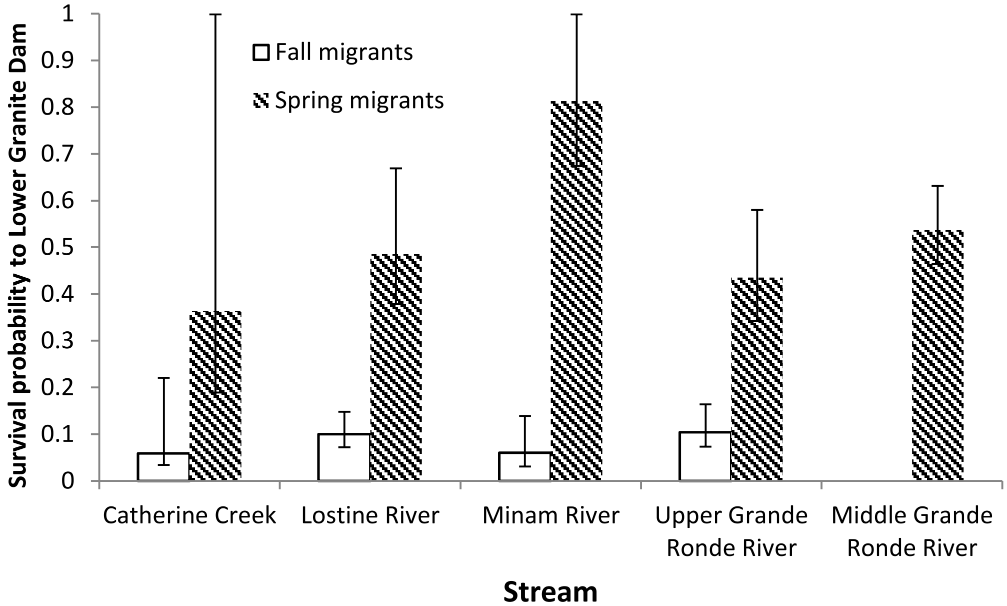

Figure 26. Probability of surviving and migrating, in the first year to Lower Granite Dam, for steelhead PIT-tagged at screw traps on Catherine Creek and Lostine, middle Grande Ronde, Minam, and upper Grande Ronde rivers during fall 2012 and spring 2013 (MY 2013). Catherine Creek and upper Grande Ronde River early migrants overwinter upstream of middle Grande Ronde River trap site, so no fall tag group was available for that site.

Conclusions
In 2013, we saw high numbers of juvenile spring Chinook salmon from all of our study streams, resulting from the high number of spawners in 2011, continuing the increasing trend in juvenile migrants. However, these high numbers of juvenile spring Chinook salmon resulted in smaller out-migrants and lower survival to Lower Granite Dam. The lower survival of the out-migrants resulted in low estimates of smolts/spawner, one indicator of the VSP parameter productivity. The higher number of spawners, whether of hatchery or natural origin, produced more total migrants but produced lower numbers of smolts per spawner, due to reduced survival rates of smolts. Habitat restoration projects funded by BPA and Bureau of Reclamation in the Upper Grande Ronde River watershed are addressing habitat capacity which should, in turn, result in an increase in productivity, such as smolts/spawner.

Steelhead emigrant abundance was above the trend line in three of the four streams we have been monitoring since 2000. In the future, this project will combine the out-migrant estimates, age structure, and survival rates to quantify the number of smolts by age and relate to the appropriate number of spawners to estimate smolts/spawner, a VSP indicator of productivity.

WE L: Steelhead Spawner Surveys

Introduction

Summer steelhead in the Grande Ronde River subbasin fall within the Snake River Distinct Population Segment (DPS) and are listed as threatened under the Endangered Species Act (62 FR 43937; August 18, 1997). The Upper Grande Ronde River (UGRR) and Joseph Creek watersheds (Figure 27) support two of the four Major Population Groups (MPG) in the Grande Ronde River subbasin. These populations are segregated based on topographic, genetic, and behavioral evidence of interactions. Historically, the Grande Ronde River was one of the more significant anadromous fish producing rivers in the Columbia River basin. Despite recovery efforts, these populations remain depressed relative to historic levels.

The goal of this project is to annually evaluate summer steelhead population abundance for the UGRR, and recently Joseph Creek, by conducting surveys of redds and spawning activity. These surveys provide those data needed to estimate adult steelhead escapement, improve our understanding of habitat utilization, and contribute to productivity and survival estimates for these populations.

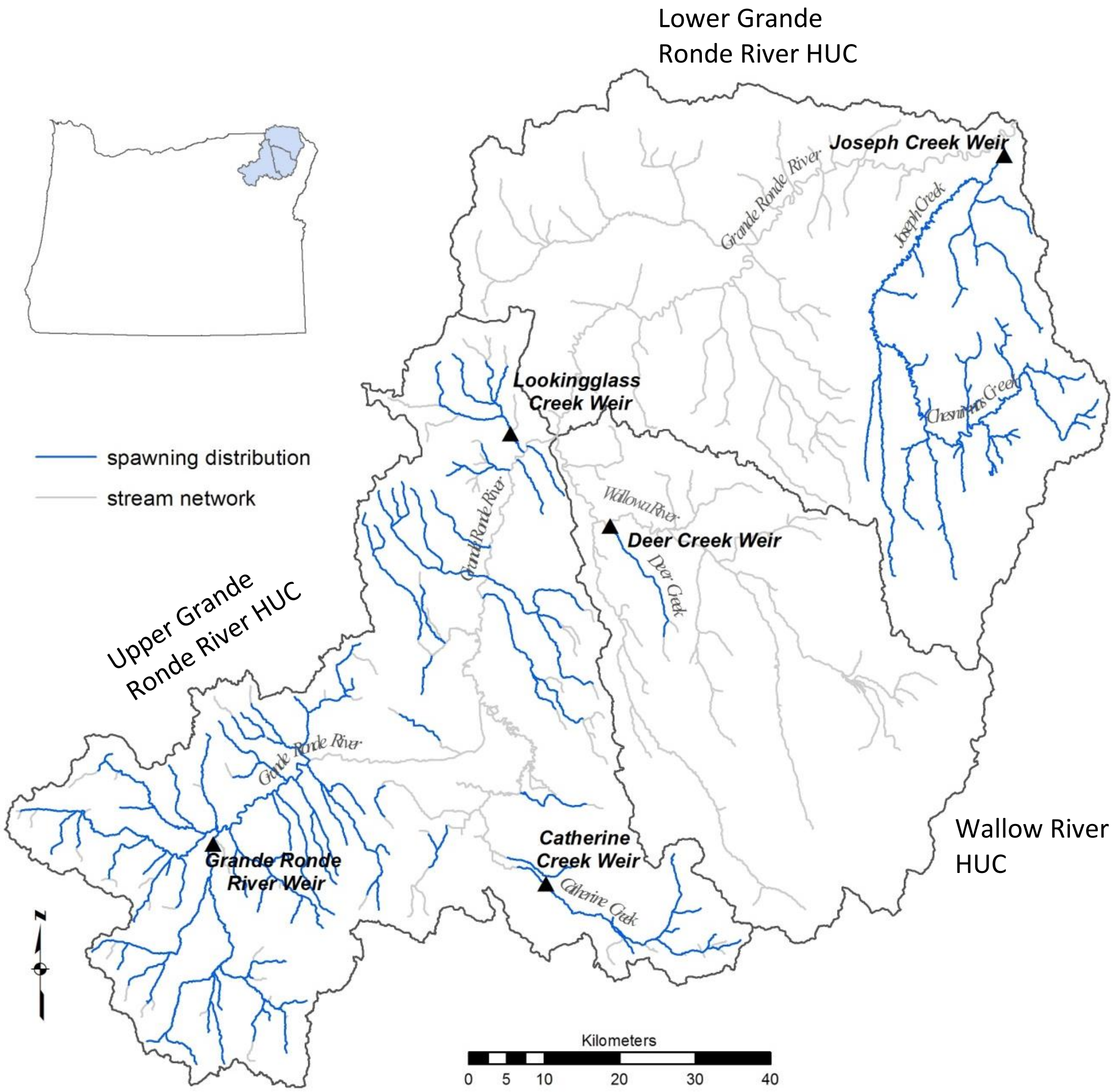

Figure 27. Grande Ronde River basin, divided by 4th order HUC. Steelhead distribution highlighted in blue for Joseph and UGRR subbasins.

Methods

Estimating Adult Summer Steelhead Escapement in North East Oregon
https://www.monitoringmethods.org/Protocol/Details/757

Results

We surveyed 29 sites in the UGRR (Figure 28) encompassing 56.1 km of an estimated 892 km (6.3 %) available steelhead spawning habitat. One additional site was never surveyed due to persistent high discharge and was not included in our calculations. Stream classification (T. Beechie, 2011) for the 29 sites was distributed as evenly as possible while retaining previously-surveyed sites: eight sites in source classification, nine in transport, and 12 in depositional. Four sites were located above the Grande Ronde River weir, three above the Catherine Creek weir, and one above the Lookingglass Creek weir. Available spawning habitat was estimated at 897 km at the beginning of 2013 season, but we removed 5.2 km from Wright Slough, Orodell Ditch, and Conley Creek after determining this section of stream was ditched, had extremely low gradient, and little to no gravel available for spawning.

We conducted 157 surveys in the UGRR basin in 2013, with a mean interval of 14.1 d between surveys. A total of 52 steelhead redds were observed at 15 of the 29 sites (Appendix Table B-14). Redds were not evenly distributed among stream classifications: only two redds (4%) were found in source areas, 19 (37%) in transport, and 31 (59%) in depositional reaches. A total of nine, live adult steelhead were observed at four sites (Appendix Table B-16) while one steelhead carcass was found in Meadow Creek. No adipose-clipped hatchery fish were observed during our surveys.

Twenty-six sites were surveyed in Joseph Creek and tributaries (Figure 29), encompassing 51.5 km of an estimated 384 km (13.4 %) available spawning habitat (Appendix Table B-13), all of which were above the weir. Stream classification for the 26 sites was random with eleven sites in source classification, eight in transport, and seven in depositional.

A total of 100 surveys were completed in the Joseph Creek watershed. We found 153 steelhead redds at 16 of the 26 sites (Appendix Table B-15). The major concentration of redds were in Chesnimnus Creek, below Devil's Run Confluence. More redds were found in the depositional stream classification (n=74, 48%), than source or transport reaches (n=53 (35%) and 26 (17%) respectively). Water clarity was more challenging in Joseph Creek than UGRR, and surveys had a mean interval of 20.4 d once conditions allowed for access. Twenty-seven live, adult steelhead were seen at eight of the sites (Appendix Table B-17), while five steelhead carcasses were recovered at four sites (Appendix Table B-18). No adipose-clipped hatchery fish were observed during our surveys.

We conducted five surveys on Deer Creek encompassing 18.7 km of what is believed to be all available spawning habitat from the weir to the USFS road 8270 bridge. In previous years, additional surveys were conducted upstream of these 18.7 km, and no redds or adult steelhead were observed.

We observed 33 redds on our visits to Deer Creek, 21 (63.6 %) of which were discovered in the lower 9.6 km. Two steelhead carcasses were also observed. No adipose-clipped hatchery fish were observed during our surveys.

Based on our redd observations, onset of spawn timing was similar between the surveyed watersheds. We observed the first redds on 26 March in the UGRR and Joseph Creek basins (Appendix Figure B-21) and 28 March in Deer Creek (Appendix Figure B-22). The last redds were observed on 13 June in the UGRR, 30 May in Deer Creek, and 13 June in Joseph Creek. By the third survey on 15 April, 33% of the total redds were observed on Deer Creek. By 6 May, 56% of the total redds in the UGRR basin were observed. By 15 May, 50% of the total redds in the Joseph Creek basin were observed. Although onset of redd building was similar among basins, peak redd observations occurred slightly later in Joseph Creek than UGRR, which is similar to the pattern observed in 2012 (Dobos et al. 2012). Most redds in the UGRR basin were first observed during the descending hydrographs of early May to late June. The five visits to Deer Creek coincided with low discharge periods.

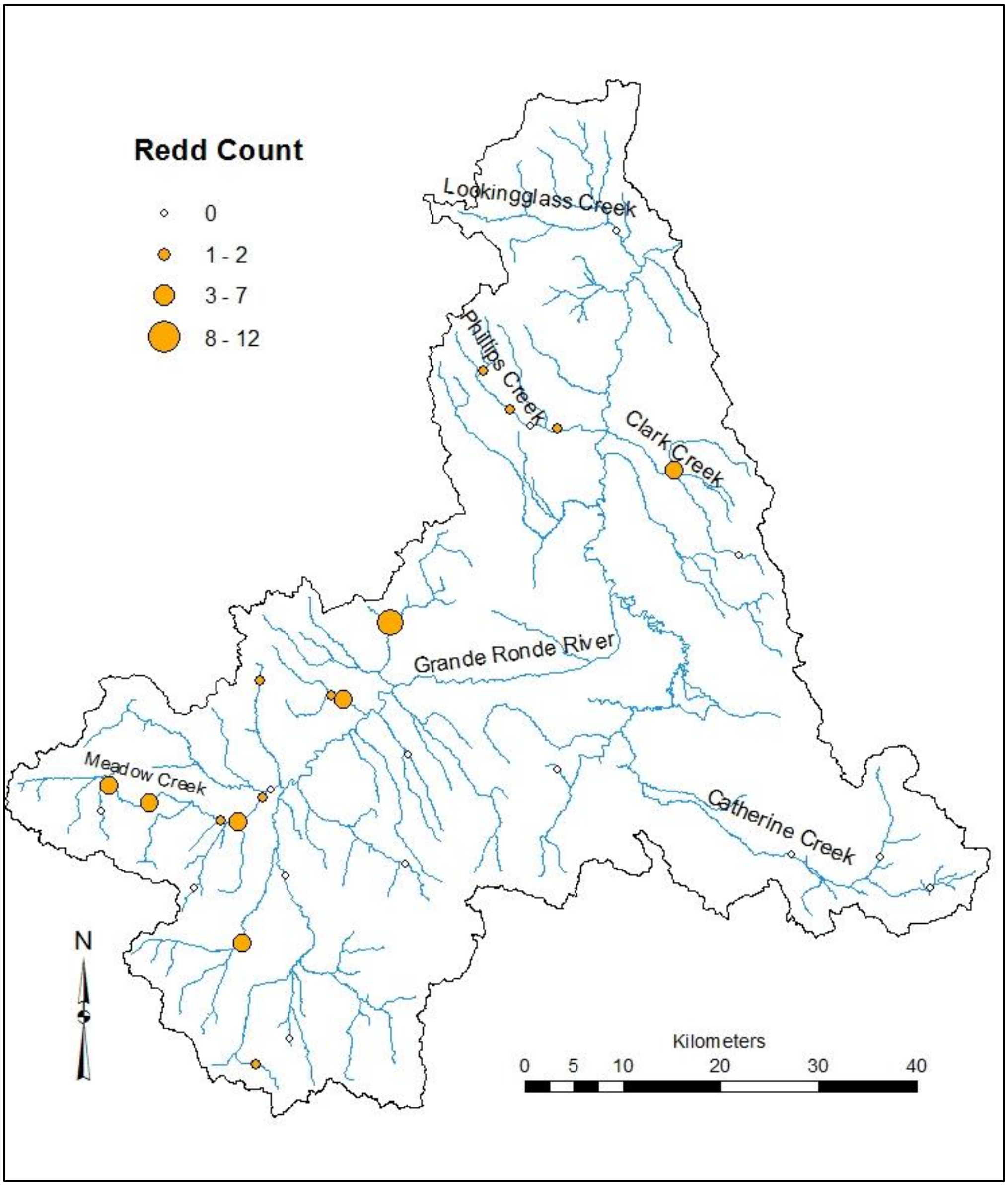

Figure 28. Map of the Upper Grande Ronde River watershed showing count of redds observed at each site in 2013.

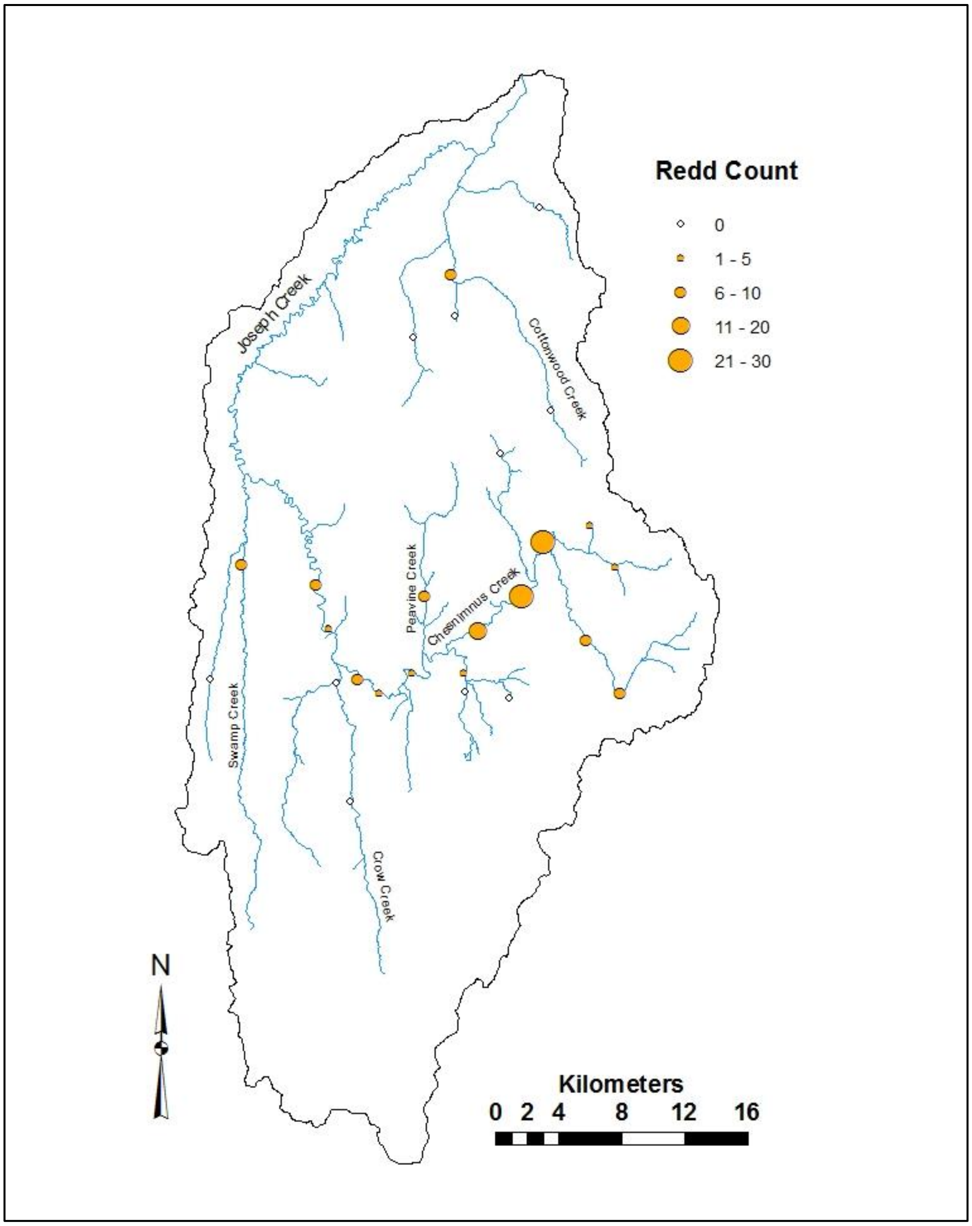

Figure 29. Map of the Joseph Creek watershed showing count of redds observed at each site in 2013.

Conclusions

Water clarity during surveys was marginal to good in both the UGRR and Joseph Creek watersheds throughout most of the season. Water clarity and our ability to observe redds generally improved as the season progressed, especially after April. Restriction of snow to higher elevations, relatively low precipitation, and moderate to low flows in May resulted in early access to most sites and good visibility. Flows were generally higher, and persisted longer in Lookingglass, Deer, Catherine creeks, and other tributaries flowing from the Wallowa Mountains due to their high elevation headwaters. Our protocol indicates that surveys be conducted at two week intervals and we achieved this in the UGRR. Joseph Creek was more challenging as turbidity is generally higher than in the UGGR, and our interval was closer to three weeks than two.

The efficiency of our surveys on larger tributaries (i.e., Lookingglass and Catherine creeks) was poor. Even when able to survey the stream, we were often unable to cross the creek or even walk in the water for significant stretches. This may explain why zero redds were found in all of Lookingglass or Catherine Creek sites, despite hundreds of steelhead being captured at their respective fish weirs (Appendix Table B-20).

Seasonal stream discharge appears to play a significant role in our ability to observe steelhead redds. The fish:redd ratio from Deer Creek correlated strongly with the total water volume from UGRR (Appendix FigureB-24). This suggests that the use of fish:redd is an appropriate method to compensate for our ability to successfully observe redds throughout the basin based on water conditions.

Most redds were first observed during descending limbs of the hydrograph. However, this tells us little about the relationship of spawning to stream flow. Our ability to observe redds is strongly influenced by water clarity, which is generally better on the descending limb of hydrographs than on rising limbs. Even though our observations of redds were during these descending periods, they do not indicate exactly when the redd was made. Deer Creek surveys illustrate this point. We were only able to survey during the low water periods between peaks in the hydrograph. However, redds were likely built during the high water periods between surveys. Our surveys cannot determine or estimate when redds were built, limiting our ability to infer a relationship between flow and spawning activities.

Timing of initial redd observations was similar across both basins and in Deer Creek. However, the progression of redd building appeared to be slower in Joseph Creek. This seems counterintuitive, as Joseph Creek is lower in elevation, and generally warmer than UGRR or Deer Creek. We observed a two week lag (early April) between redd building in UGRR and Joseph Creek. This was also observed in 2012 (Dobos et al. 2012), the first year of Joseph Creek surveys. We were unable to determine if this is a real discrepancy in spawn timing, or an inability to effectively survey Joseph Creek tributaries during early April. Surveyors recorded water clarity (scale 1-3) at each survey event, and water clarity did improve substantially in Joseph Creek around April 10th. However, if water clarity/redd visibility was limiting our counts, one would expect a rapid increase in redd counts once water clarity improved. This was not the case, as redd observations climbed steadily after mid-April, but not faster than UGRR or Deer Creek.

WE M: Abundance of Steelhead Spawners at the Population Level

Introduction

Summer steelhead in the Grande Ronde River basin fall within the Snake River Distinct Population Segment (DPS) and are listed as threatened under the Endangered Species Act (62 FR 43937; August 18,1997). The Upper Grande Ronde River (UGRR) and Joseph Creek watersheds support two of the four Major Population Groups (MPG) in the Grande Ronde River basin. These populations are segregated based on topographic, genetic, and behavioral evidence of interactions. Historically, the Grande Ronde River was one of the more significant anadromous fish producing rivers in the Columbia River Basin. Despite recovery efforts, these populations remain depressed relative to historic levels.

The goal of this project is to annually evaluate summer steelhead population abundance for the UGRR, and recently Joseph Creek, by conducting surveys of redds and spawning activity. These surveys provide the data needed to estimate adult steelhead escapement, improve our understanding of habitat utilization, and contribute to productivity and survival estimates for these populations.

Methods

Estimating Adult Summer Steelhead Escapement in North East Oregon
https://www.monitoringmethods.org/Protocol/Details/757

Results

A fish:redd ratio of 1.91 (63/33) was generated using the number of fish passed above the weir at Deer Creek and the number of redds observed there in 2013. Using this ratio and a single weight value for all stream classifications (30.8), 1,553 adult steelhead (95% C.I.: 796 – 2,310) escaped into the UGRR watershed and naturally spawned (Figure 30). No adipose-clipped hatchery fish were observed during surveys on the UGRR. Using this same method with a weight value of 14.9, 2,197 adult steelhead (95% C.I.: 1,263 – 3,130) escaped into the Joseph Creek watershed. No adipose-clipped hatchery fish were observed during surveys on Joseph Creek.

Stratifying surveys by stream classification reduced the escapement estimate for UGRR by about 29%. Using the weight values for each strata, source (56.6), transport (27.0), and depositional (16.4), we estimated that 1,101 (95% CI, 616 – 1,585) adult steelhead for the UGRR population (Figure 30). For Joseph Creek estimates changed little: using the weight values for each strata, source (14.5), transport (14.3), and depositional (15.8), we estimated that 2,241 (95% CI, 1,306 – 3,175) adult steelhead returned to spawn.

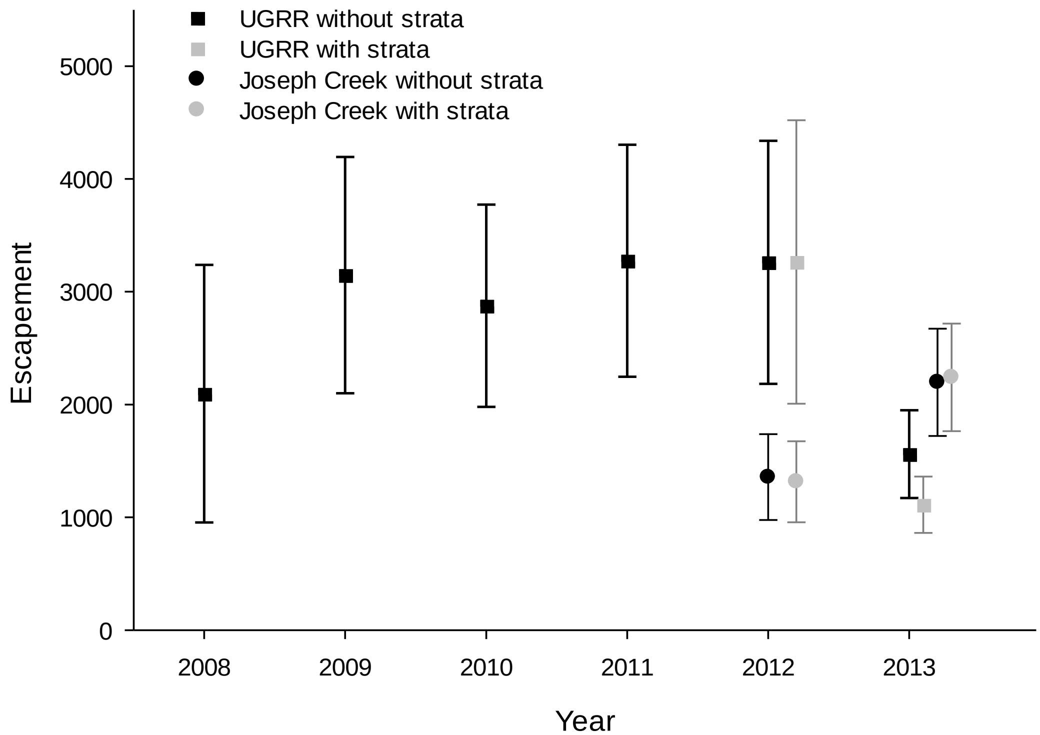

Figure 30. Escapement estimates with 95% confidence intervals for steelhead in the Upper Grande Ronde River watershed using a single weight value, 2008−2013 and using strata weights for the three classifications of stream type for UGRR and Joseph Creek, 2012−2013.

Conclusions

Population-scale escapement estimates had relatively poor precision for both Joseph Creek and UGRR (95% CI ~45% of the estimate). This is worse than previous years' precision. Confidence intervals have consistently been 30 – 35% of the UGRR escapement estimate since 2009 (Appendix Table B-19). This is despite our refinement of known steelhead spawning distribution, which has been reduced in length by 31% since 2008. It appears that the variable distribution of redds throughout the spawning distribution inflates the confidence intervals. In particular, observations of zero redds substantially increase the confidence interval, and certain streams are not likely to produce redds regardless of the number of adults returning. In 2013 we observed zero redds at 48% of our UGRR basin sites, and 38% of those in Joseph Creek. With continued observations of zero redds at some survey sites, it seems unlikely that precision will improve unless some other method of identifying appropriate spawning habitat can be found.

This is our second year of attempting to correlate redd locations with stream classifications. Redd observations were highest in depositional reaches for both Joseph Creek (48% of redds) and UGRR (60% of redds) basins. This distribution is similar to Joseph Creek observations in 2012, but far different for UGRR streams (Dobos et al. 2012). There seems to be only minor utility in attempting to relate stream classification generated from landscape level variables to redd locations. Steelhead are likely not choosing appropriate spawning sites at the landscape scale. With the overlap of CHaMP sites and steelhead spawning ground surveys, we are exploring other potential relationships between redd building and small-scale habitat characteristics.

We will continue to define the extent of these identified stream reaches deemed unsuitable for spawning and locate similar reaches when they are selected in our sample draw. As the spawning distribution is refined, precision in our escapement estimates should increase. We will also continue to monitor trends of both methods and relate redd locations to immediate habitat to gain better understanding of how spawning habitat is utilized.

WE N: Steelhead and Chinook Salmon Parr Surveys, and
WE O: Steelhead and Chinook Salmon Parr Density and Distribution

Introduction
Human impacts on fish populations are apparent in the Grande Ronde River basin, a tributary to the Lower Snake River. Historically, the Grande Ronde River supported several anadromous salmonid runs, including spring, summer and fall Chinook salmon, sockeye salmon, coho salmon and summer steelhead (ODFW 1990). During the past century numerous factors, including those mentioned above, have led to a reduction in salmonid stocks. Today, the only viable populations remaining are spring Chinook salmon and summer steelhead. Snake River spring/summer Chinook salmon, including Grande Ronde River spring Chinook salmon, were listed as threatened under the Endangered Species Act (ESA) in 1992; summer steelhead in 1997.

Numerous habitat restoration and protection projects have occurred within the Grande Ronde River basin, and other Columbia River sub-basins, over the past decades in attempt to improve native salmonid populations. The effectiveness of these projects at increasing native salmonid production and/or use has not been systematically evaluated. The CHaMP program systematically characterizes stream habitats in a spatially balanced manner and allows both status and trend monitoring (Bouwes et al. 2011). Coupling these habitat characterizations with salmonid presence and abundance will improve our understanding of the most important habitats for salmonid production, and allow appropriate targeting for restoration and protection actions.

Methods
Fifty-six habitat and fish monitoring locations were chosen within the UGRR subbasin for 2013. Habitat monitoring locations were generated with the generalized random tessellation stratification (GRTS) design for the third year of the CHaMP (Bouwes et al. 2011). Only streams within the known (or assumed) anadromous fish spawning distribution were eligible for selection. Two crews completed these surveys, one from Oregon Department of Fish and Wildlife (ODFW) and the other from CRITFC. Site length varied based on stream size and was approximately 20 times the bankfull width (minimum 120 m, maximum 600 m).

All 56 CHaMP sites (Appendix Table B-23) were surveyed for juvenile salmonids via either a single-pass snorkel protocol (Juvenile Salmonid Density & Distribution in Northeast Oregon Watersheds, http://www.monitoringmethods.org/Protocol/Details/370) or single pass electrofishing. Forty-eight of the sites were surveyed snorkeling and most of those were only snorkeled once. However, a subset of sites (n=9) were snorkeled monthly to investigate temporal changes in fish abundance throughout the summer.

The remaining eight sites, small headwater streams, were sampled via electrofishing. These sites were electrofished with a single backpack electrofishing unit (Smith-Root model 12) during low flow periods (late June and July 2013). Direct current was used at all sites, with frequency and voltage adjusted to permit efficient capture of fish. Block nets were placed at the bottom and top of sites if the stream was flowing continuously. Some sites had only intermittent flow, and block nets were not used if fish were trapped within the sample reach by stretches of dry stream channel. A single electrofishing pass was completed in an upstream direction. Only salmonids were netted, while a visual estimate of non-salmonid relative abundance (abundant, common, or rare) was made throughout the survey. Netted fish were kept in a bucket until the entire channel unit had been sampled. All salmonids captured were identified to species, measured (fork length, mm), and released in the unit they were collected. No marks or tags were placed on/in any fish. Metrics calculated from electrofishing surveys included: catch per unit effort (CPUE, no. fish/hour), mean length and relative density (fish per $100m^2$). Abundance estimates were calculated with a correction factor relating electrofishing catch to mark/recapture population estimates (Horn and Sedell 2012).

Electrofishing Abundance Est. (all unit types): $NHat = 1.7507 * Efish\ Count$

Results

Salmonids were observed at 51 of the 56 surveyed CHaMP sites. Steelhead were found at 50 of the 56 sites, Chinook salmon at 30, and bull trout *Salvelinus confluentus* at only eight sites.

In the UGRR subbasin, Chinook were usually the dominant salmonid in mainstem snorkel surveys (Figure 31), with counts in the hundreds, while counts were in the dozens for tributaries (Appendix Table B-25). A total of 5,686 juvenile Chinook were observed during snorkel surveys, and 97.5% were in the 50 – 80 mm size category (age 0). However, a handful of fish in the >100 mm size category were also observed, corresponding to age 1 fish (Appendix Table B-25). Chinook were most abundant in mainstem UGRR, Lookingglass and Catherine creeks (Figure 32), with fewer observed in the larger tributaries like Sheep, Meadow, and the fork of Catherine creeks. They were usually not seen in small tributaries (<8 m bankfull width), except for a few observations in Meadow, Milk, Clark, Fly and Spring creeks.

Overall steelhead counts were lower than Chinook counts, with 3,856 individuals observed. Steelhead counts only exceeded 100 individuals at a few sites. However, they were more widely distributed than Chinook (Figure 33). Steelhead size classes were more variable than Chinook. Most steelhead, 94%, were <200 mm in length, corresponding with age 0 – age 2. Age 0 steelhead were smaller than 70 mm, and were lumped into the young-of-year (YOY) salmonid category for snorkel surveys. These YOY were observed through electrofishing, and were generally 40 – 60 mm fork length. Steelhead >250 mm were observed with some regularity. We made no differentiation between resident and anadromous individuals, and it is possible that many individuals observed in the smaller streams were resident rainbow trout, not steelhead. No adult steelhead were observed due to the timing of surveys.

Juvenile Chinook salmon and steelhead density estimates, were significantly higher (Kruskal-Wallis with Dunn's Test, $p<0.05$) in pools than fastwater units or runs (Appendix Table B-26). There was no statistically significant difference between densities in fastwater units compared to runs. UGRR and Lookingglass Creek sites had the highest densities of Chinook, followed by Catherine Creek sites. Steelhead densities were highest in Fly, Lookingglass and Meadow creeks.

Other fish taxa observed during snorkeling were bull trout, mountain whitefish (*Prosopium williamsoni*), northern pikeminnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), longnose dace (*Rhinichthys cataractae*), sculpin (*Cottus spp.),* bridgelip and unidentified suckers (*Catostomus spp.*), unidentified catfish (*Ictalurus spp.*) and sunfish (*Lepomis spp.)* (Appendix Table B-24). Bull trout were only observed in Catherine Creek (mainstem, north and south forks) and the upper reaches of UGRR (Appendix Table B-24). Mountain whitefish, northern pikeminnow and suckers were generally seen in the mainstem Catherine Creek and UGRR sites, while dace, redside shiners and sculpins were observed in mainstem and lower gradient tributary sites, like Meadow Creek. In many cases, dace and shiners outnumbered salmonids in the same reaches (Appendix Table B-24). The smallest, high gradient sites generally produced only steelhead and sculpin. Catfish and sunfish were rarely observed in Meadow Creek and the UGRR mainstem.

Steelhead dominated the electrofishing catch at small stream sites. Juvenile steelhead were captured at six of the eight sampled sites. Steelhead CPUE ranged from 0.0 – 182.3 fish/hour, and relative densities were 0 – 21.63 fish/100m^2 (Appendix Table B-27). Chinook salmon were captured at two electrofishing sites, Milk and Spring creeks, with only three individuals were caught total. No fish were captured in Little Whiskey or West Fork Ladd creeks despite electrofishing attempts.

Steelhead captured during electrofishing did not show the same variation in size structure as those observed during snorkeling. Only smaller individuals were captured, with the largest individuals in the 130 - 200 mm size class (Appendix Table B-28). This size class corresponds with age-2 steelhead, but it is possible that small-stream, resident rainbow trout were captured, and could be older than estimated. Length-frequency histograms were generated for the electrofishing sites to try and determine age class breaks, but there were no clear breaks after the age 0 – age 1 break (which was between 70 and 80 mm).

Nine sites in the UGRR and tributaries were sampled monthly in 2013: July, August, September and October. Only three of these sites were sampled in October. Water temperatures and fish counts at these three were very low, and we determined the data at the remaining sites would be of little value in meeting our objective. One site, dsgn4-000009, on the Grande Ronde River had fish counts several times higher than other repeat sites, and was dropped from trend analysis as an outlier.

Generally, mean steelhead density estimates were highest during August surveys, slightly lower in July and September, and very much lower in October. Confidence intervals overlap for July, August and September (Figure 34). This pattern is similar between large sites (mainstem UGRR) and small sites (tributaries). Chinook densities showed an opposite pattern, with lowest densities in August, and higher densities estimated in July and September. Again, confidence intervals overlapped for Chinook densities.

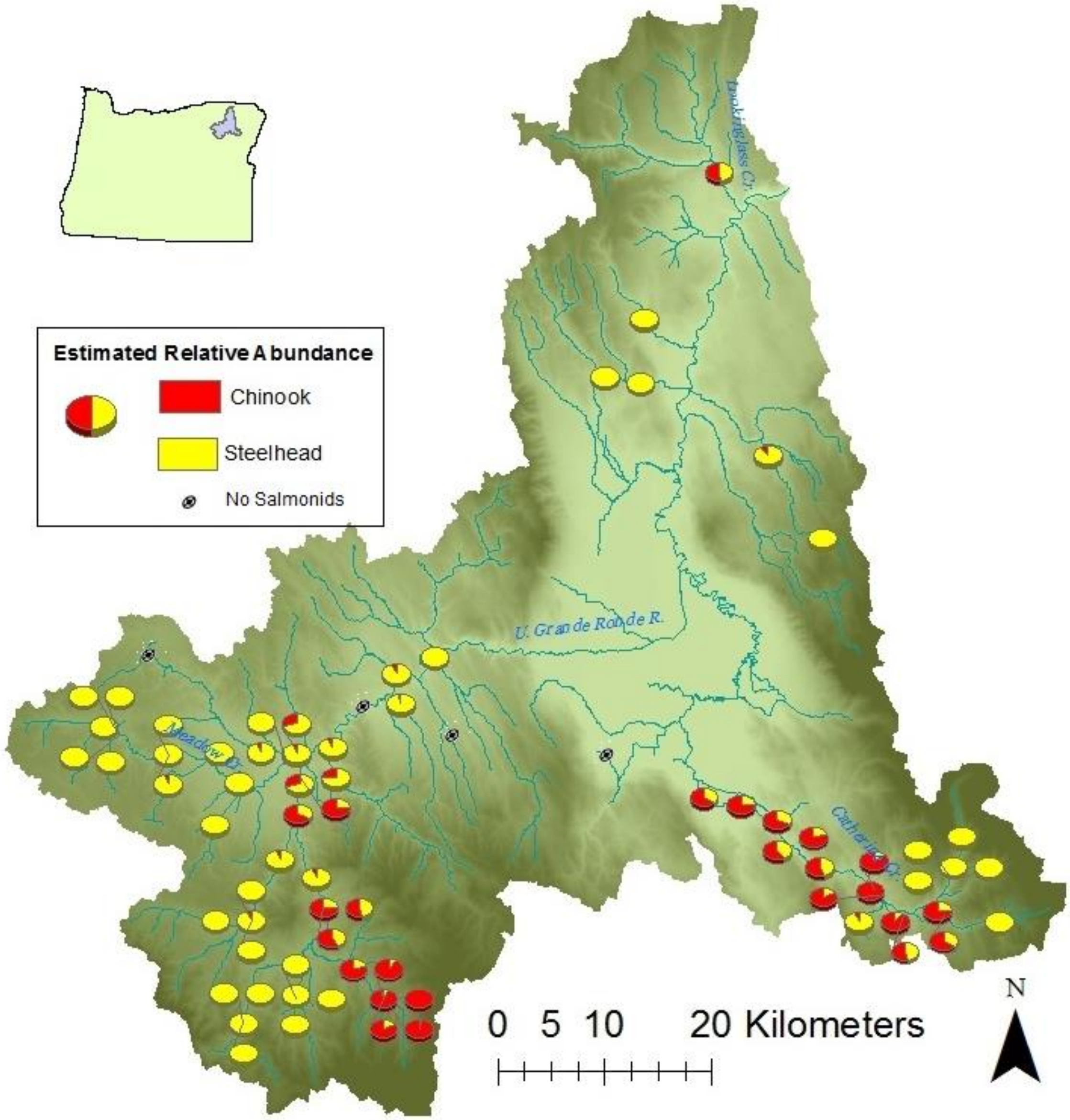

Figure 31. Proportional distribution of juvenile steelhead and Chinook salmon observed via snorkel surveys, 2013.

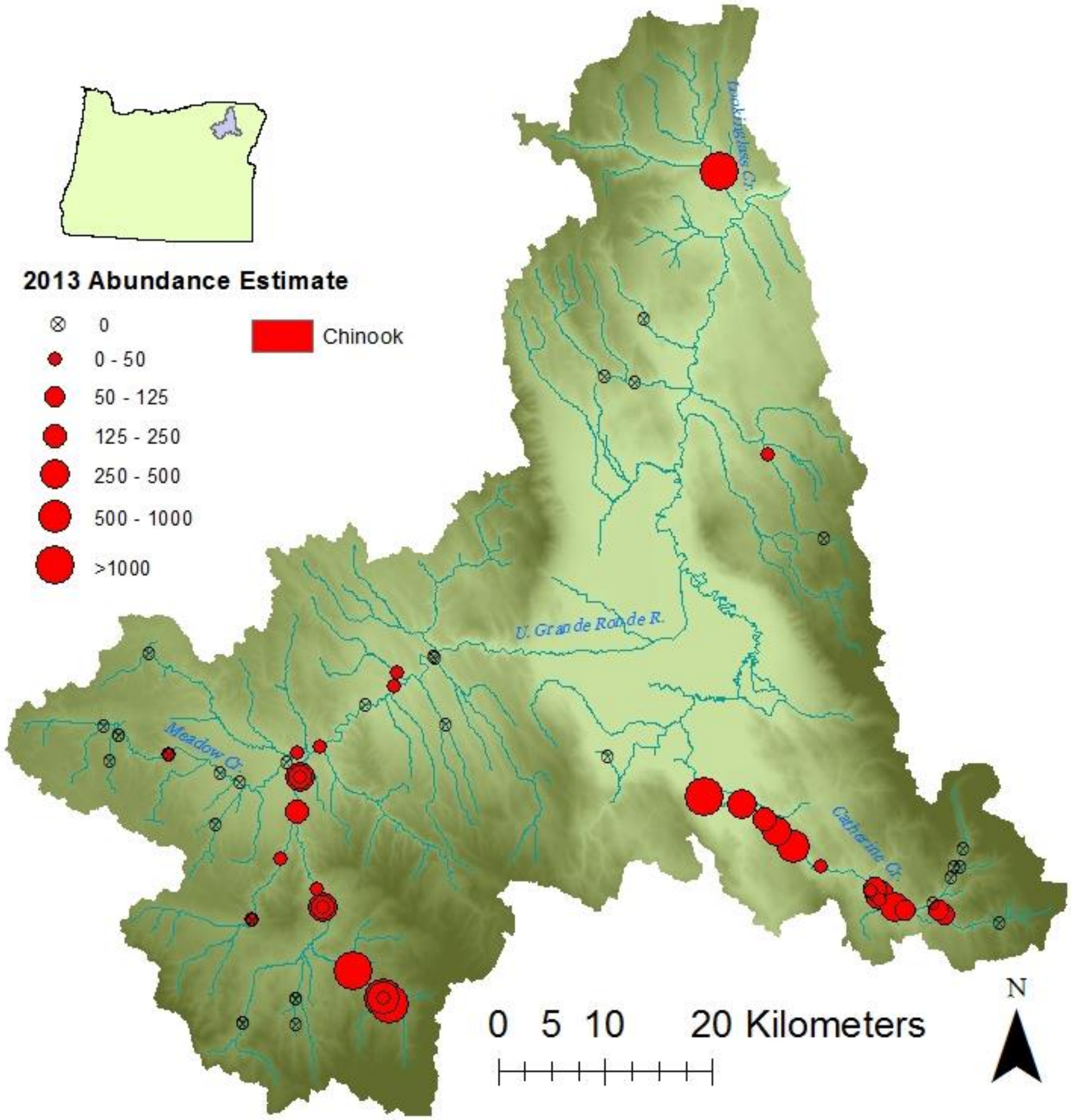

Figure 32. Spatial distribution and site level abundance estimates of Chinook salmon observed during snorkel surveys of the UGRR basin, 2013. Concentric circles indicate repeat snorkel surveys.

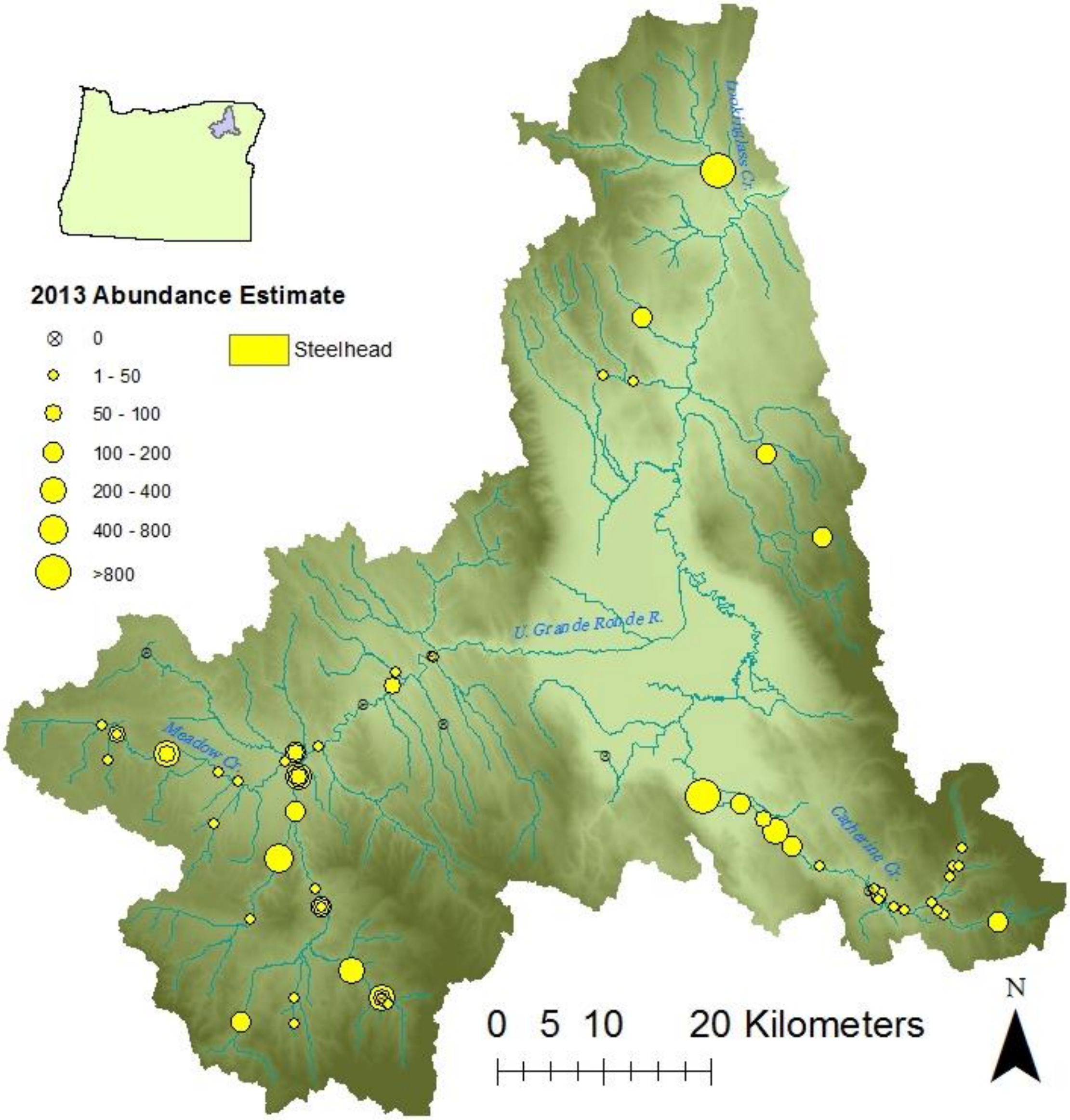

Figure 33. Spatial distribution and site level abundance estimates of steelhead observed during snorkel surveys of the UGRR basin, 2013. Concentric circles indicate repeat snorkel surveys.

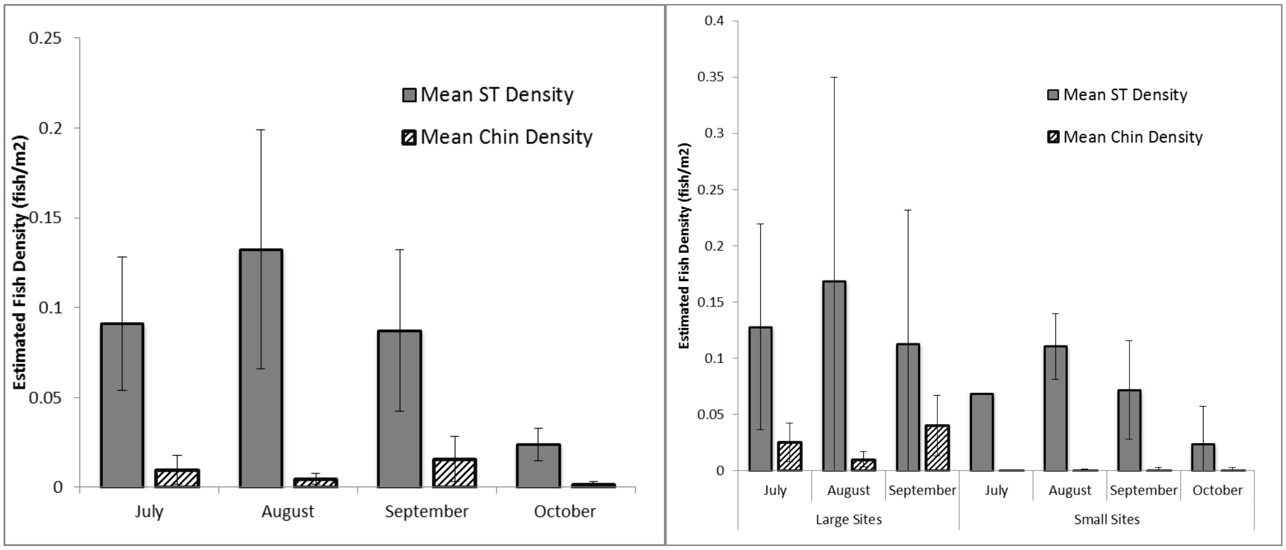

Figure 34. Mean salmonid densities (+/- 80% C.I.) from repeat surveys, 2013. Left, all sites combined, right, large and small sites separated. Site dsgn4-000009 (large site) omitted as an outlier.

Conclusions

The observed distribution of juvenile Chinook salmon was generally consistent with previous surveys and local, professional estimation of the Chinook rearing habitat. The majority of fish were using the mainstem Catherine, Lookingglass creeks and Upper Grande Ronde River during their first summer. These areas are also the primary spawning grounds for UGRR Chinook salmon (Feldhaus et al. 2012). We did observe small numbers of juveniles in several small tributaries. These are likely individuals that migrated from their natal areas in Catherine Creek and UGRR in search of food, thermal refuge, etc. The exception to this was the juvenile Chinook salmon in Clark Creek, which were apparently produced by spawning in that stream.

As part of this project, we observed both juvenile and spawning adult Chinook salmon in upper portions of Clark Creek during 2012 surveys (last year). The 2013 surveys indicated that these spawning adults successfully produced offspring, as 11 juvenile Chinook were observed at site cbw05583-142490. This site was within two kilometers of where we observed Chinook redd building in 2012.

There are several potential explanations for the presence of Chinook in Clark Creek. First, in the summer of 2013, 114 adult Chinook of hatchery origin, captured at the Catherine Creek weir, were moved to Indian Creek (M. McLean, CTUIR, personal comm.). Indian Creek neighbors Clark Creek. It seems likely that some of these adults would leave Indian Creek and enter Clark Creek prior to spawning. Secondly, the mouth of Clark Creek is geographically close to the mouth of Lookingglass Creek, which has a Chinook-producing fish hatchery. Chinook adults observed in Clark Creek may have strayed from Lookingglass. Thirdly, Clark Creek Chinook could have been strays from throughout the Grande Ronde basin. Fourthly, Clark Creek has been producing Chinook salmon naturally, and the adults observed in 2012 were returning to their natal stream.

In all likelihood, the presence of spawning Chinook in Clark Creek was likely the result of some combination of the above four scenarios. Unfortunately, no genetic or tag data was obtained from the adults, and their origin remains unknown. This program will attempt to obtain adult Chinook salmon data in unique locations in future years.

One of our goals is to constantly refine the known spawning and rearing distribution for steelhead in UGRR subbasin. This information is used by other ODFW research projects to define their sample space. A handful of sites contained no salmonids this season, and are candidates for removal from the spawning and rearing distribution. Particularly, WF Ladd Creek had no juvenile fish, no adult spawning (this project, work elements L & M), and no observations of juvenile fish while doing habitat surveys. Additionally, it is extremely small, low gradient, and has much fine sediment. It also is in a wetland area. None of these characteristics are typical of steelhead or salmon spawning and rearing areas.

We believe that all remaining sites lacking salmonids during snorkel surveys are not candidates for removal from the known distribution. Two of these sites were in the UGRR mainstem. The lack of salmonid observations was most likely due to high temperatures during summer surveys, and movement of salmonids to thermal refuges. The annual site in McCoy Creek has had high abundance of juvenile steelhead in past years. Their absence in 2013 is surprising, but the reach should remain in the distribution area for steelhead. The site in Little Whiskey Creek also had no salmonids, but many juveniles were anecdotally observed a short distance upstream from the site. That reach may be avoided due to seasonal dryness, poor habitat, or some other condition we are unaware of. Nevertheless, juvenile salmonids likely use that reach periodically and it should remain within the steelhead distribution.

Steelhead <70mm were generally identifiable around the 45mm size when snorkeling. The current snorkel protocol restricts enumeration of steelhead to >70 mm FL. However, steelhead could be visually differentiated from Chinook except for the smallest of individuals. These should be counted in future years, and we are working with TetraTech, CRITFC and NOAA Fisheries to standardize our snorkeling methodologies throughout the interior Columbia River basin. These changes will include counting steelhead down to 50 mm in length. It will also include addition of size classes.

In previous years' surveys we anecdotally noted changes to fish abundance at sites that we visited multiple times for various reasons. However, these were never quantified. In 2013, we attempted to catalog those changes with repeat snorkel surveys. Our data suggest substantial changes to both steelhead and Chinook abundance as the season progressed. However, these changes were highly variable among sites. From a statistical standpoint, there is no significant difference in our mean snorkel counts from July – September. October saw a sharp decline, and fish counts were statistically lower than the rest of the season. The October decline was likely due to onset of winter concealment behavior when temperatures fall below 4°C (VanDyke et al. 2010). From this standpoint there appears no statistically clear reason to change survey timing. However, from a practical standpoint, it seems most prudent to attempt the majority of snorkeling in August for steelhead domain sites, and September for mainstem Chinook domain sites (mainly Catherine Creek and UGRR). This would leave time in July to sample the small sites with electrofishing. This is only a slight deviation from past years' sample timing, and should be instituted with little change to personnel or interference with habitat surveys.

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Appendix A: Use of Data and Products

Viable Salmonid Population (VSP) indicator and metric data that support and feed ODFW's Recovery Planning and BiOP reporting needs are summarized and compiled into a standard format (Coordinated Assessments Data Exchange Standard; DES) at the population level and stored in a central server location. VSP data in DES format is quality checked, reviewed and approved for sharing by a data steward and the primary VSP data contact for each population(s). Upon reviewer approval, data in DES format is made available to the public and interested parties through upload on ODFW's Salmon and Steelhead Recovery Tracker (http://odfwrecoverytracker.org/), NOAA's Salmon Population Summary (SPS; https://www.webapps.nwfsc.noaa.gov/apex/f?p=261:home:0) database and StreamNet (http://www.streamnet.org/).

Appendix B: Detailed Results

WE H: Abundance and Migration of Juvenile Salmonids in Study Streams During Migration Year 2013, and
WE I: Survival and Relative Success of Juvenile Salmonids from the Grande Ronde and Imnaha Subbasins

Appendix Table B-1. Dates of tagging and number of spring Chinook salmon parr PIT-tagged in various northeast Oregon streams during summer 2012 and 2013.

Migration year and stream	Tagging Dates	Number PIT-tagged	Distance to Lower Granite Dam (km)
2013 (*Summer 2012)*			
Catherine Creek	31 Jul–3 Aug, 5 Sep	975	363–383
Imnaha River	13 Aug–15 Aug, 5 Sep	995	221–233
Lostine River	6 Aug–9 Aug	999	271–308
Minam River	20 Aug–23 Aug	997	276–290
Upper Grande Ronde	27 Aug–29 Aug	996	418–428
2014 (*Summer 2013)*			
Upper Catherine Creek	29 Jul–31 Jul	1,035	371–383
Lower Catherine Creek	22 Jul–26 Jul	963	356–359
Imnaha River	12 Aug–15 Aug	1,000	221–233
Lostine River	1 Aug, 4 Aug–6 Aug	1,000	271–308
Minam River	19 Aug–22 Aug	999	276–290

Appendix Table B-2. Juvenile spring Chinook salmon catch at five general trap locations in Grande Ronde River Subbasin during MY 2013. Early migration period starts 1 July 2012 and ends 28 January 2013. Late migration period starts 29 January and ends 30 June 2013. The period a trap operated was used to identify total number of days fished, with percentage in parentheses, during each migration period.

Trap site	Migration period	Sampling period	Days fished	Trap catch
Catherine Creek	Early	20 Sep 12 – 17 Dec 12	80 (90)	10,620
	Late	15 Feb 13 – 20 Jun 13	111 (88)[a]	1,449[a]
			7 (6)[b]	41[b]
Lostine River	Early	19 Sep 12 – 1 Jan 13	90 (86)	12,236
	Late	6 Feb 13 – 7 Jun 13	100 (82)[a]	1,900[a]
			7 (6)[b]	285[b]
Middle Grande Ronde River	Late	13 Mar 13 – 3 Jun 13	71 (86)	1,178
Minam River	Early	18 Sep 12 – 7 Dec 12	78 (96)	12,694
	Late	28 Feb 13 – 7 Jun 13	81 (81)	1,190
Upper Grande Ronde River	Early	26 Sep 12 – 24 Nov 12	42 (70)	7,056
	Late	16 Mar 13 – 24 Jun 13	87 (86)[a]	3,189[a]
			14 (14)[b]	536[b]
Catherine Creek	Early	20 Sep 12 – 17 Dec 12	80 (90)	10,620
	Late	15 Feb 13 – 20 Jun 13	111 (88)[a]	1,449[a]

[a] Continuous 24 h trapping
[b] Sub-sampling with 1 to 4 h trapping.

Appendix Table B- 3. Fork lengths of juvenile spring Chinook salmon collected from study streams during MY 2013. Early and late migrants were captured with a rotary screw trap on each study stream. Summer and winter tag group fish were captured using netting techniques upstream from rotary screw traps. Min = minimum, Max = maximum.

	Lengths (mm) of fish collected					Lengths (mm) of fish tagged and released				
Stream and tag group	*n*	Mean	SE	Min	Max	*n*	Mean	SE	Min	Max
Catherine Creek										
Summer	1,198	63.3	0.27	39	95	973	66.1	0.24	55	95
Early migrants	1,865	75.4	0.19	47	95	1,151	75.1	0.23	55	95
Winter	618	77.4	0.35	50	99	587	77.4	0.34	55	99
Late migrants	989	80.5	0.23	54	99	829	80.4	0.25	55	99
Lostine River										
Summer	1,711	58.1	0.23	32	99	999	63.4	0.27	51	99
Early migrants	2,295	80.3	0.22	45	148	1,167	79.4	0.30	55	121
Winter	618	73.7	0.30	46	93	595	73.8	0.29	55	93
Late migrants	1,555	91.0	0.26	56	143	1,238	91.5	0.29	56	143
Middle Grande Ronde River										
Spring emigrants	1,080	100.5	0.30	73	128	819	98.1	0.32	73	125
Minam River										
Summer	1,081	65.0	0.23	42	90	995	66.1	0.21	52	90
Early migrants	2,283	73.9	0.21	43	125	1,205	75.1	0.27	55	118
Late migrants	880	88.0	0.30	60	134	761	88.0	0.33	60	134
Upper Grande Ronde River										
Summer	1,639	57.8	0.19	39	90	996	62.4	0.20	54	89
Early migrants	1,362	75.4	0.20	53	102	645	75.6	0.28	56	102
Winter	581	71.2	0.41	51	110	576	71.3	0.41	55	110
Late migrants	1,728	84.6	0.22	55	150	787	84.9	0.29	57	106

Appendix Table B- 4. Weights of juvenile spring Chinook salmon collected from study streams during MY 2013. Early and late migrants were captured with a rotary screw trap on each study stream. Summer and winter tag group fish were captured using netting techniques upstream from rotary screw traps. Min = minimum, Max = maximum.

	Weights (g) of fish collected					Weights (g) of fish tagged and released				
Stream and group	*n*	Mean	SE	Min	Max	*n*	Mean	SE	Min	Max
Catherine Creek										
Summer	975	3.5	0.04	1.6	10.5	974	3.5	0.04	1.6	10.5
Early migrants	1,863	4.8	0.03	1.1	9.1	1,150	4.8	0.04	1.8	9.1
Winter	617	4.9	0.06	1.4	10.1	598	4.9	0.06	1.6	10.1
Late migrants	989	5.5	0.04	1.7	11.1	829	5.5	0.05	1.9	11.1
Lostine River										
Summer	998	3.2	0.06	1.2	13.0	997	3.2	0.06	1.2	13.0
Early migrants	2,247	5.9	0.06	0.9	37.7	1,151	5.7	0.07	1.7	22.4
Winter	603	4.2	0.05	1.4	8.8	590	4.2	0.05	1.4	8.8
Late migrants	1,549	8.5	0.08	1.9	31.6	1,232	8.6	0.09	1.9	31.6
Middle Grande Ronde River										
Spring emigrants	1,076	10.9	0.11	3.7	23.0	819	10.0	0.10	3.7	21.3
Minam River										
Summer	996	3.4	0.04	1.3	8.7	996	3.4	0.04	1.3	8.7
Early migrants	2,268	4.5	0.04	0.8	23.0	1,197	4.6	0.05	1.7	18.5
Late migrants	879	7.4	0.08	2.4	29.1	760	7.4	0.09	2.4	29.1
Upper Grande Ronde River										
Summer	998	2.9	0.03	1.0	8.2	995	2.9	0.03	1.0	8.2
Early migrants	1,362	4.5	0.04	1.4	11.4	645	4.6	0.05	1.7	11.4
Winter	577	3.8	0.07	1.3	13.1	576	3.8	0.07	1.3	13.1
Late migrants	1,728	6.2	0.06	1.6	40.2	787	6.3	0.07	1.7	13.6

Appendix Table B- 5. Survival probability to Lower Granite Dam of juvenile spring Chinook salmon tagged during summer 2012 and detected at Columbia and Snake river dams during 2013.

Stream	Number PIT-tagged and released	Survival probability (95% CI)
Catherine Creek	975	0.031 (0.021–0.047)
Imnaha River	995	0.125 (0.100–0.158)
Lostine River	999	0.098 (0.072–0.141)
Minam River	997	0.106 (0.084–0.135)
Upper Grande Ronde River	996	0.098 (0.071–0.143)

Appendix Table B- 6. Juvenile spring Chinook salmon survival probability by location and tag group from time of tagging to Lower Granite Dam. Spring Chinook salmon were tagged from fall 2012 to spring 2013 and detected at dams during 2013.

Stream and tag group	Number PIT-tagged and released	Survival probability (95% CI)
Catherine Creek		
Fall (trap)	1,151	0.101 (0.071–0.172)
Winter (above trap)	598	0.108 (0.075–0.170)
Spring (trap)	829	0.220 (0.164–0.342)
Lostine River		
Fall (trap)	1,167	0.225 (0.173–0.318)
Winter (above trap)	595	0.191 (0.151–0.245)
Spring (trap)	1,237	0.552 (0.495–0.625)
Middle Grande Ronde River		
Spring (trap)	819	0.685 (0.634–0.742)
Minam River		
Fall (trap)	1,205	0.185 (0.158–0.221)
Spring (trap)	761	0.634 (0.559–0.734)
Upper Grande Ronde River		
Fall (trap)	645	0.177 (0.141–0.225)
Winter (above trap)	576	0.057 (0.038–0.087)
Spring (trap)	787	0.314 (0.268–0.373)

Appendix Table B- 7. Juvenile steelhead catch at five general trap locations in Grande Ronde River Subbasin during MY 2013. Early migration period starts 1 July 2012 and ends 28 January 2013. Late migration period starts 29 January and ends 30 June 2013. The period a trap operated was used to identify total number of days fished, with percentage in parentheses, during each migration period.

Trap site	Migration period	Sampling period	Days fished / days operated	Trap catch
Catherine Creek	Early	20 Sep 12 – 17 Dec 12	80 (90)	1,530
	Late	15 Feb 13 – 20 Jun 13	111 (88)[a]	1,992[a]
			7 (6)[b]	19[b]
Lostine River	Early	19 Sep 12 – 1 Jan 13	90 (86)	2,158
	Late	6 Feb 13 – 7 Jun 13	100 (82)[a]	799[a]
			7 (6)[b]	48[b]
Middle Grande Ronde River	Late	13 Mar 13 – 3 Jun 13	71 (86)	1,681
Minam River	Early	18 Sep 12 – 7 Dec 12	78 (96)	424
	Late	28 Feb 13 – 7 Jun 13	81 (81)	402
Upper Grande Ronde River	Early	26 Sep 12 – 24 Nov 12	42 (70)	1,092
	Late	16 Mar 13 – 24 Jun 13	87 (86)[a]	2,515[a]
			14 (14)[b]	377[b]

[a] Continuous 24 h trapping
[b] Sub-sampling with 1 to 4 h trapping.

Appendix Table B- 8. Age structure of early and late steelhead migrants collected at trap sites during MY 2013. The same four cohorts were represented in each migration period, but ages increased by one year from early migrants to late migrants (e.g., age-0 early migrants were same cohort as age-1 late migrants). Age structure was based on frequency distribution of sampled lengths and allocated using an age–length key. Means were weighted by migrant abundance at trap sites.

	Percent				
Emigrant type and trap site	Age-0	Age-1	Age-2	Age-3	Age-4
Early					
Catherine Creek	58.5	36.2	5.3	0.0	0.0
Lostine River	59.5	30.5	9.8	0.2	0.0
Minam River	70.4	7.6	20.4	1.6	0.0
Upper Grande Ronde River	34.2	53.8	11.7	0.3	0.0
Mean	54.3	35.3	10.1	0.3	0.0
CV (%)	12.1	42.8	76.6	280.5	0.0
Late					
Catherine Creek	0.0	78.8	16.7	4.4	0.1
Lostine River	0.0	74.6	20.6	4.7	0.0
Minam River	0.0	33.1	55.3	11.6	0.0
Upper Grande Ronde River	0.0	48.8	33.5	17.6	0.0
Mean	0.0	63.3	27.5	9.1	0.0
CV (%)	0.0	34.2	63.1	69.2	0.0
Early and Late[a]					
Middle Grande Ronde River	0.0	17.4	63.0	19.6	0.1

[a] Middle Grande Ronde River trap was located downstream from Catherine Creek and upper Grande Ronde River overwinter rearing reaches resulting in early and late emigrants being sampled simultaneously during spring emigration.

Appendix Table B- 9. Travel time to Lower Granite Dam of wild steelhead PIT-tagged at screw traps during spring 2013 and subsequently arriving at Lower Granite Dam (LGD) during spring 2013.

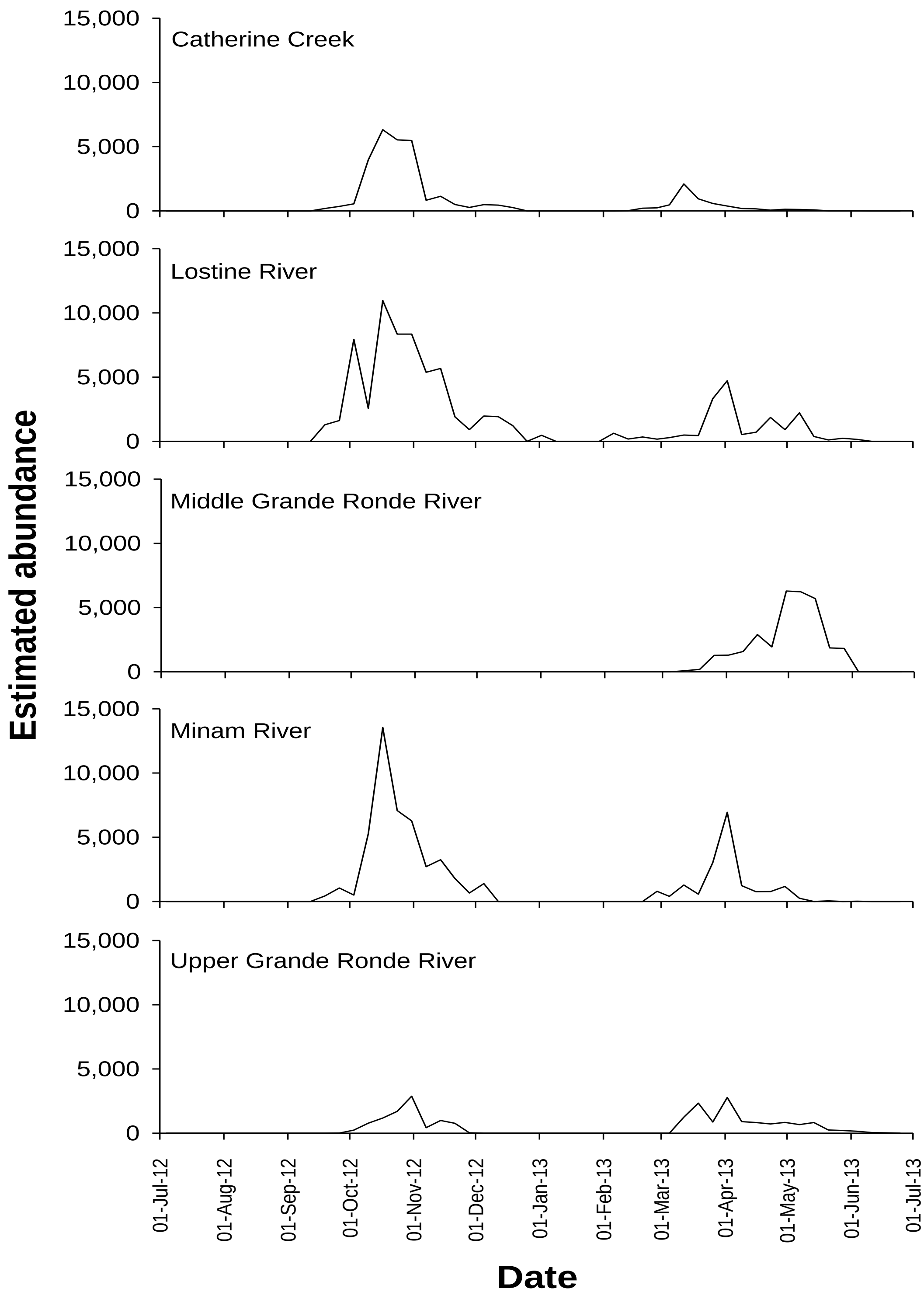
Stream	Distance to LGD (km)	Number detected	Travel time (d) Median	Min	Max
Catherine Creek	362	13	37.7	10	83
Lostine River	274	27	8.1	6	83
Middle Grande Ronde River	258	156	10.1	3	75
Minam River	245	60	10.3	4	46
Upper Grande Ronde River	397	45	18.9	7	54

Appendix Table B- 10. Probability of surviving and migrating, in the first year to Lower Granite Dam, for steelhead PIT-tagged at screw traps on Catherine Creek and Lostine, middle Grande Ronde, Minam, and upper Grande Ronde rivers during fall 2012 and spring 2013 (MY 2013). Catherine Creek and upper Grande Ronde River early migrants overwinter upstream of middle Grande Ronde River trap site, so no fall tag group was available for that site.

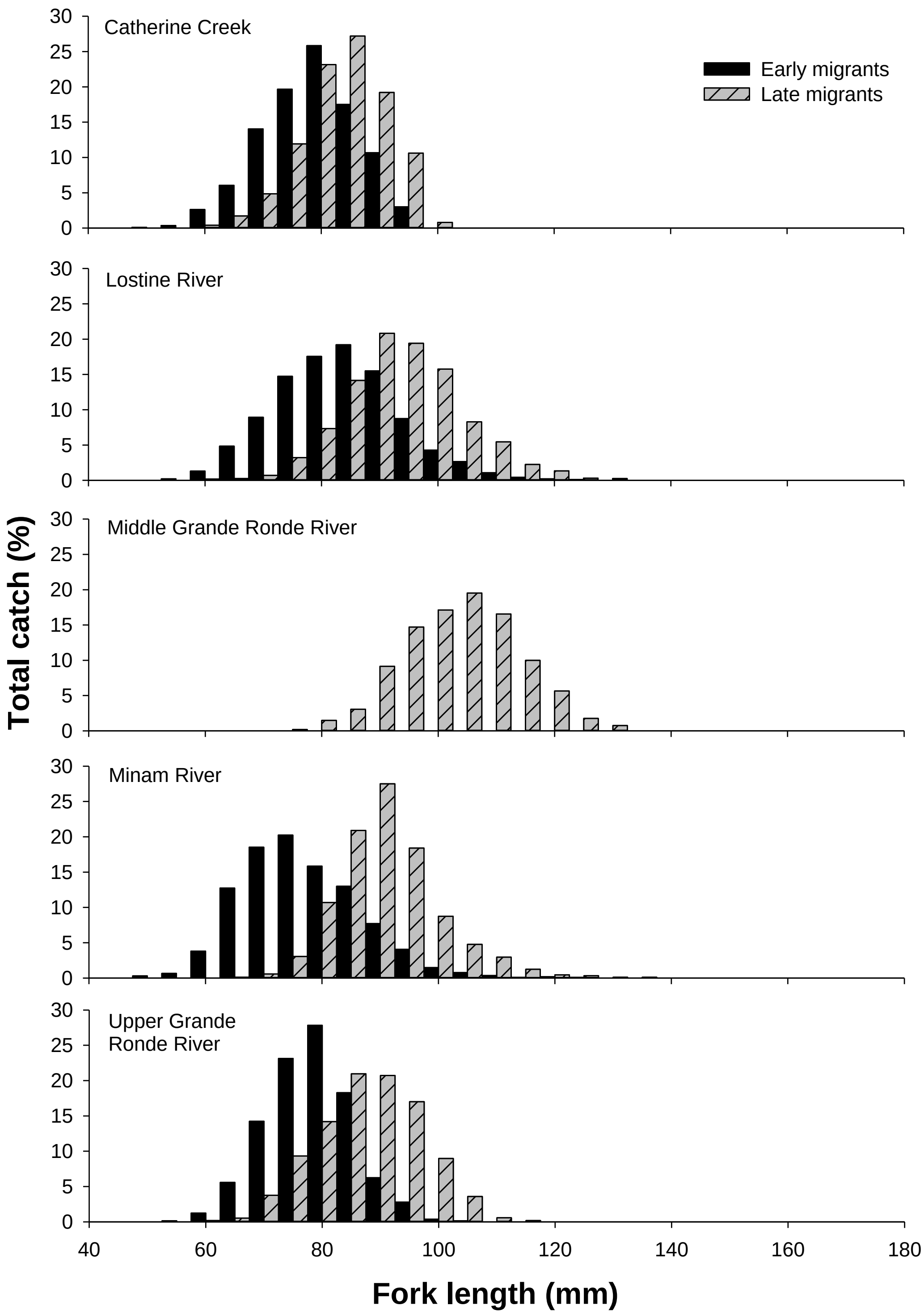
Season and location tagged	Number tagged	Number detected	Probability of surviving and migrating in the first year (95% CI)
Fall			
Catherine Creek	648	28	0.059 (0.034–0.221)
Lostine River	605	51	0.100 (0.072–0.148)
Minam River	232	12	0.060 (0.031–0.139)
Upper Grande Ronde River	613	48	0.104 (0.073–0.164)
Spring (FL ≥ 115 mm)			
Catherine Creek	214	39	0.364 (0.189–1.609)
Lostine River	174	70	0.485 (0.379–0.669)
Middle Grande Ronde River	1,164	381	0.537 (0.464–0.631)
Minam River	274	165	0.813 (0.674–1.053)
Upper Grande Ronde River	432	123	0.435 (0.343–0.580)

Appendix Table B- 11. PIT tagged early migrating steelhead sampled by screw trap in the Grande Ronde Basin, and subset subsequently detected at Snake and Columbia River dams during spring 2012. Italicized headings represent smolt age at time detections were recorded at a dam. Means are weighted by sample size (*n*).

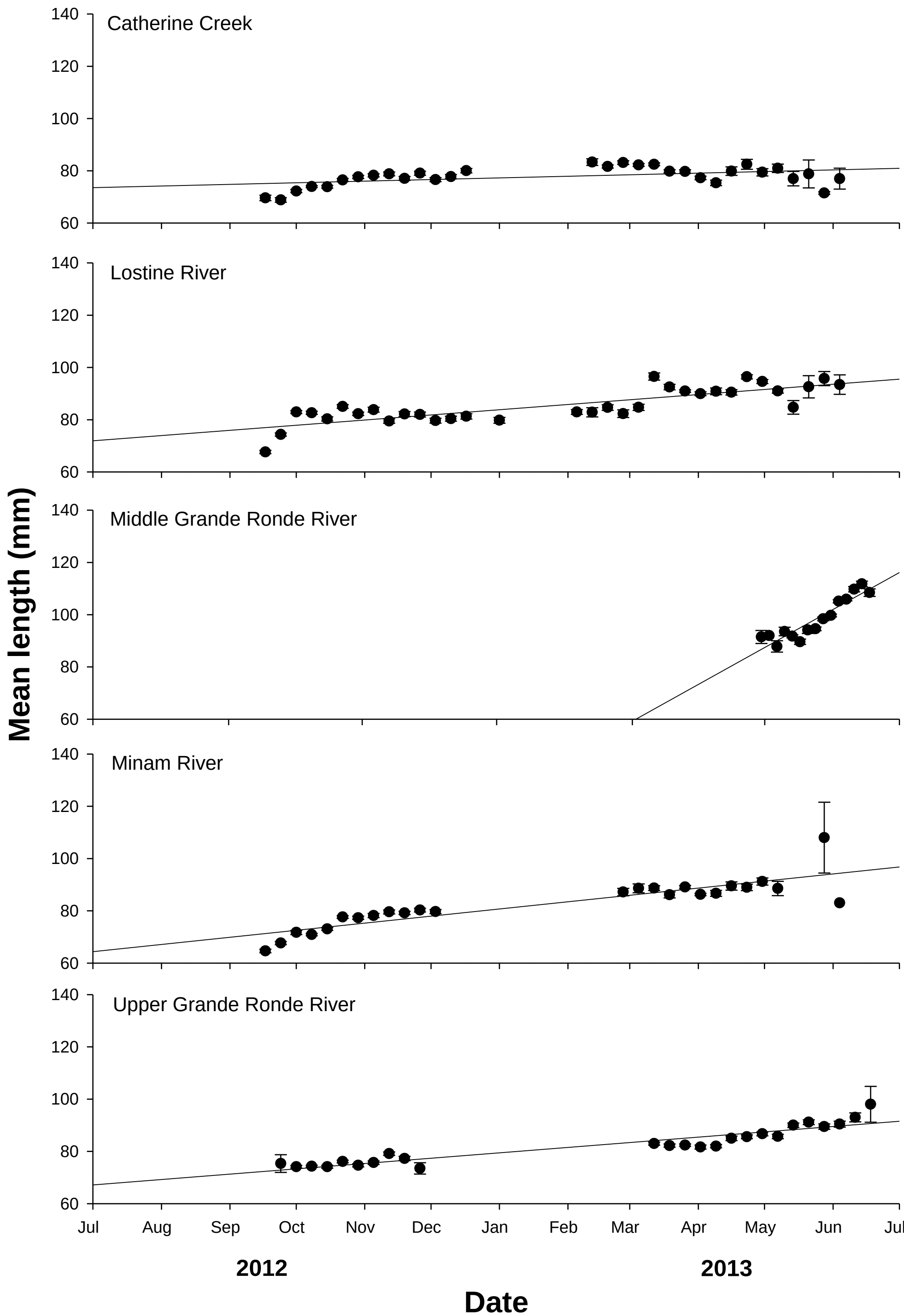
Trap site	*n*	Age-0 *Age-1 smolt*	Age-1 *Age-2 smolt*	Age-2 *Age-3 smolt*	Age-3 *Age-4 smolt*
	PIT tagged fish with known age (%)				
Catherine Creek	190	34	49	16	0
Lostine River	164	29	46	24	1
Minam River	91	41	18	38	3
Upper Grande Ronde River	142	21	56	21	1
Mean		31.3	42.3	24.9	1.5
CV (%)		26.3	40.3	38.3	91.9
	PIT tagged fish detected at dams (%)				
Catherine Creek	12	0	67	33	0
Lostine River	0	0	0	0	0
Minam River	0	0	0	0	0
Upper Grande Ronde River	23	0	39	61	0
Mean		0.0	26.4	23.6	0.0
CV (%)		0.0	123.0	124.9	0.0



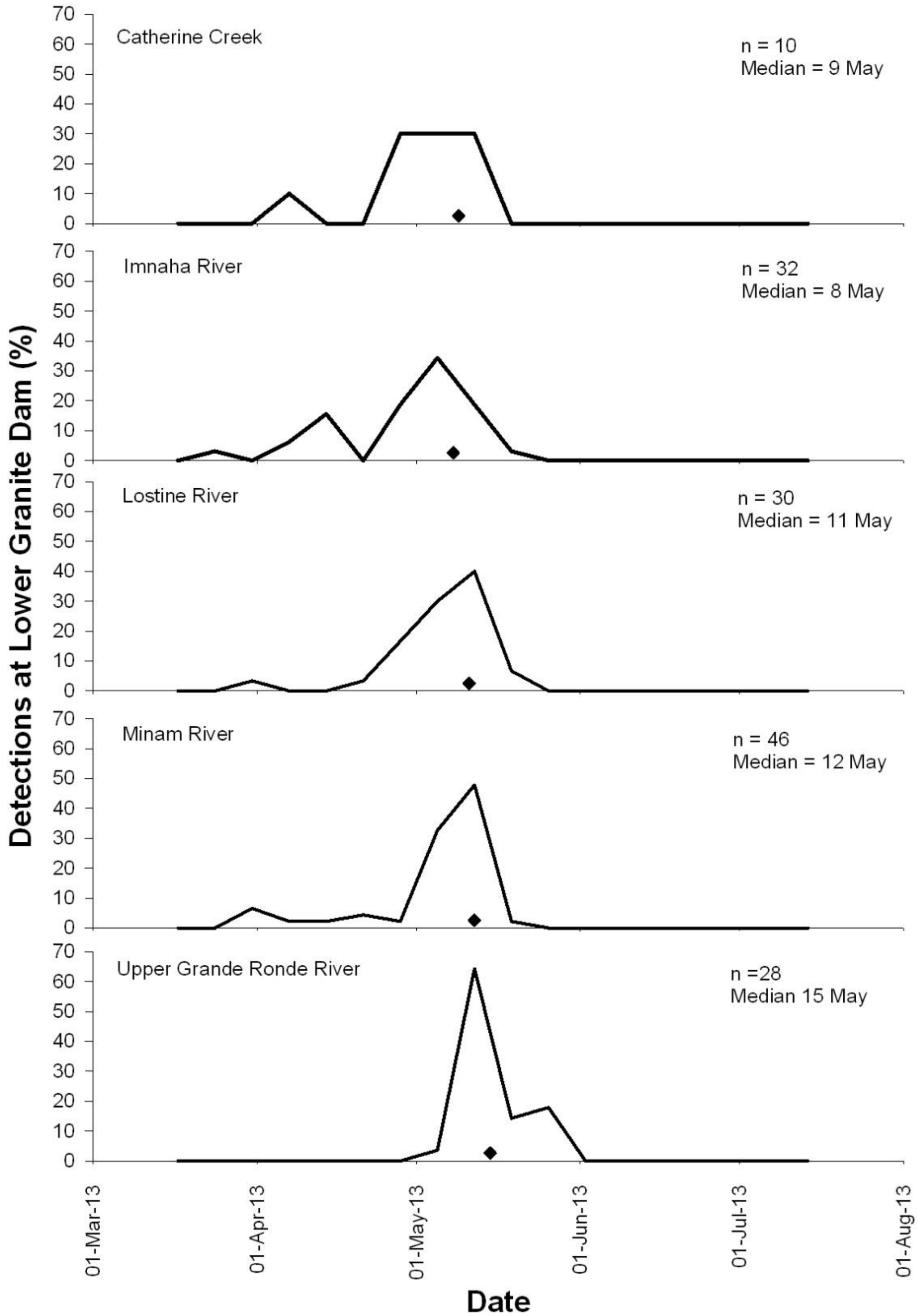
Appendix Figure B-1. Estimated migration timing and abundance for juvenile spring Chinook salmon migrants sampled by rotary screw traps during MY 2013. Traps were located at rkm 32 on Catherine Creek, rkm 3 on Lostine River, rkm 0 on Minam River, and rkm 299 on upper Grande Ronde River.



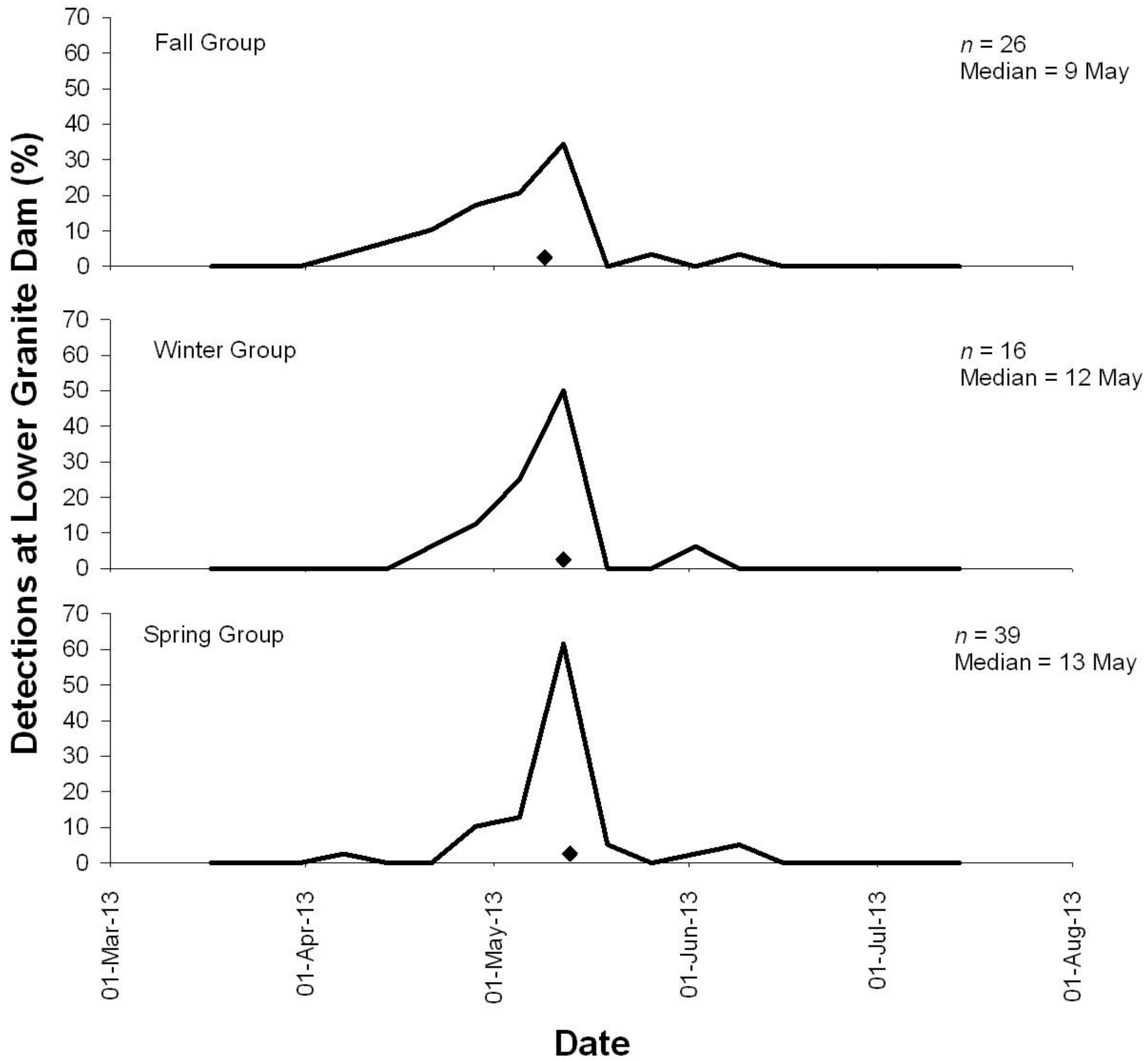
Appendix Figure B-2. Length frequency distribution (fork length) of early and late migrating juvenile spring Chinook salmon captured at Catherine Creek (rkm 32), Lostine (rkm 3), middle Grande Ronde (rkm 160), Minam (rkm 0), and upper Grande Ronde (rkm 299) river traps during MY 2013.



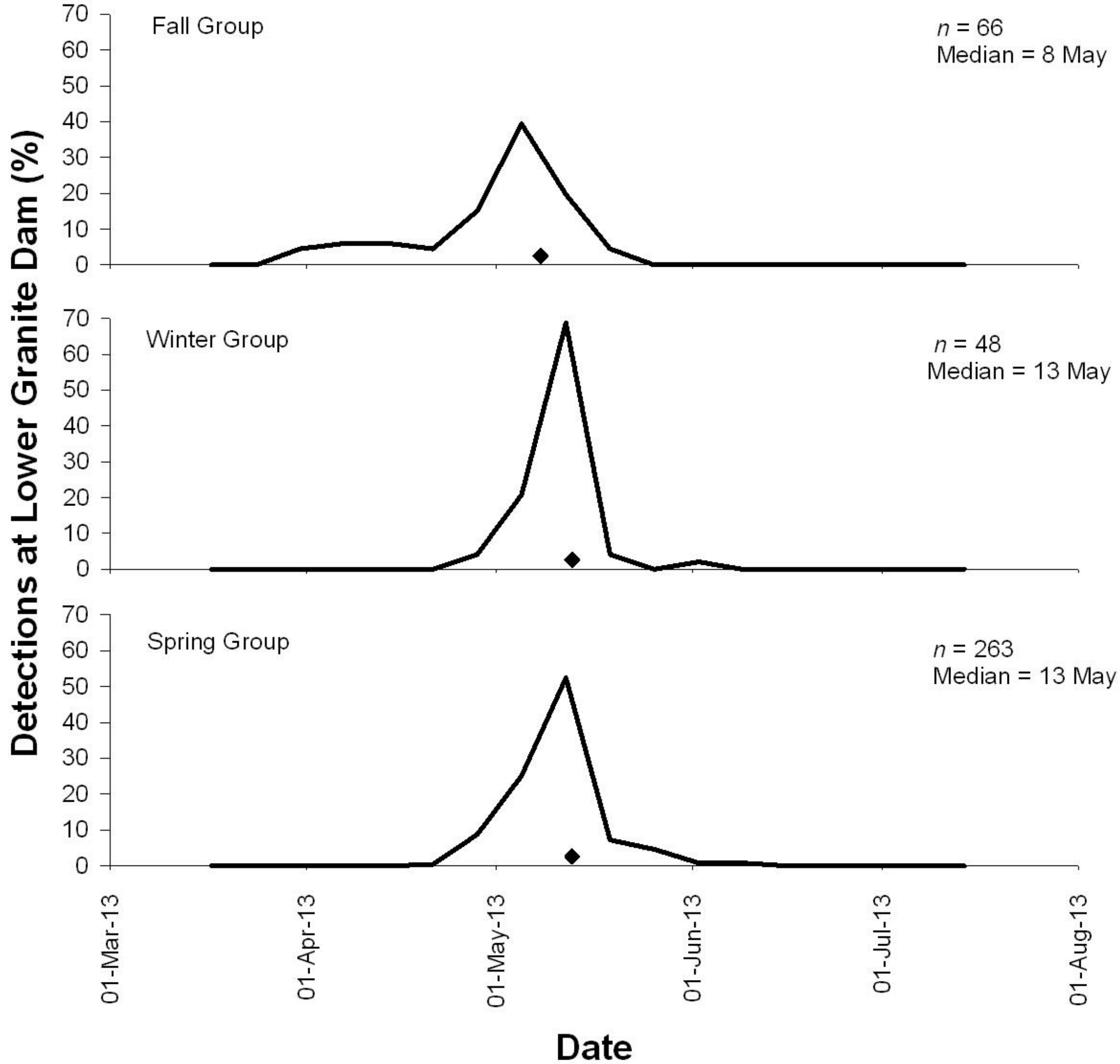
Appendix Figure B-3. Weekly mean fork lengths and associated standard error for spring Chinook salmon captured by rotary screw traps in Grande Ronde River Subbasin during MY 2013.



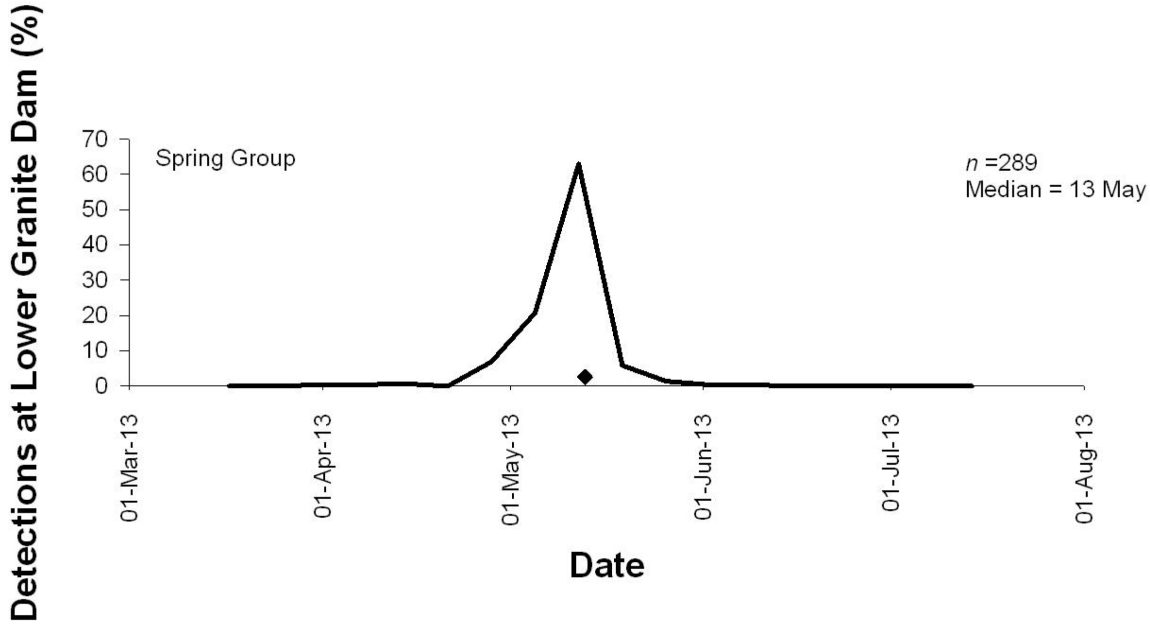
Appendix Figure B-4. Dates of arrival, during 2013 at Lower Granite Dam, of spring Chinook salmon PIT-tagged as parr in Catherine Creek and Imnaha, Lostine, Minam, and upper Grande Ronde rivers during summer 2012. Data was summarized by week and expressed as percentage of total detected. Detections were expanded for spillway flow. ♦ = median arrival date.



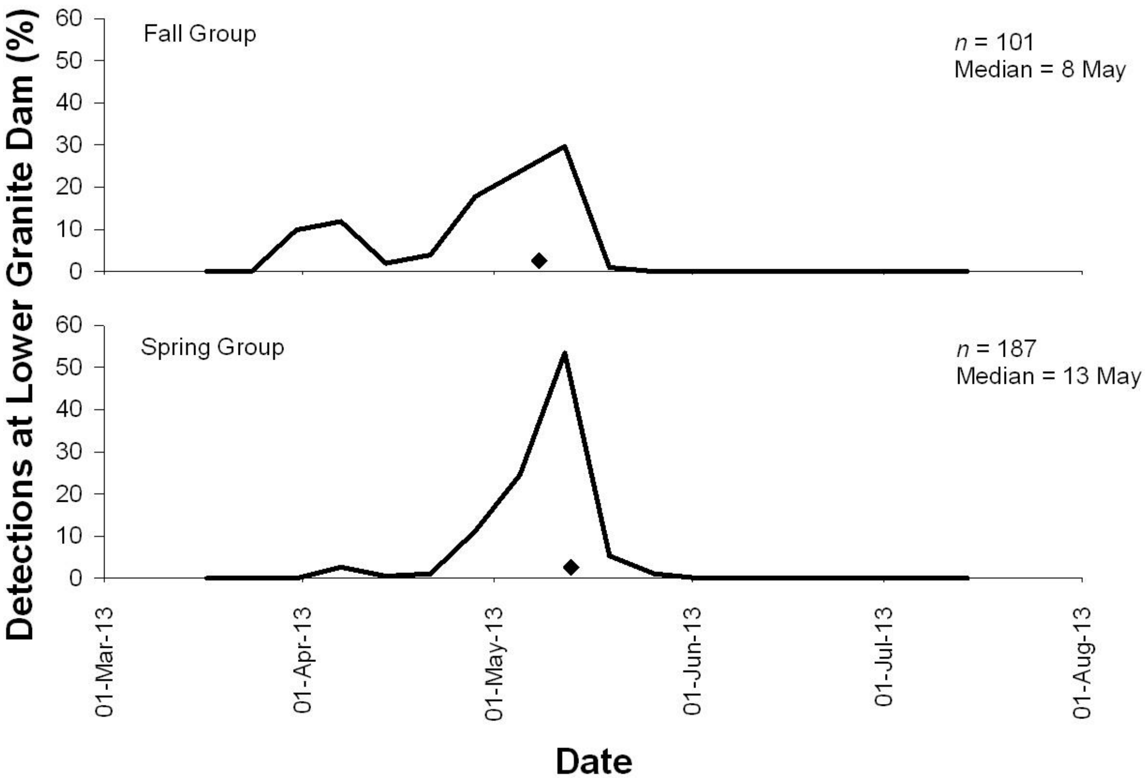
Appendix Figure B-5. Dates of arrival, during 2013 at Lower Granite dam, for fall, winter, and spring tag groups of juvenile spring Chinook salmon PIT-tagged from Catherine Creek. Data was summarized by week and expressed as percentage of total detected. Detections were expanded for spillway flow. ◆ = median arrival date.



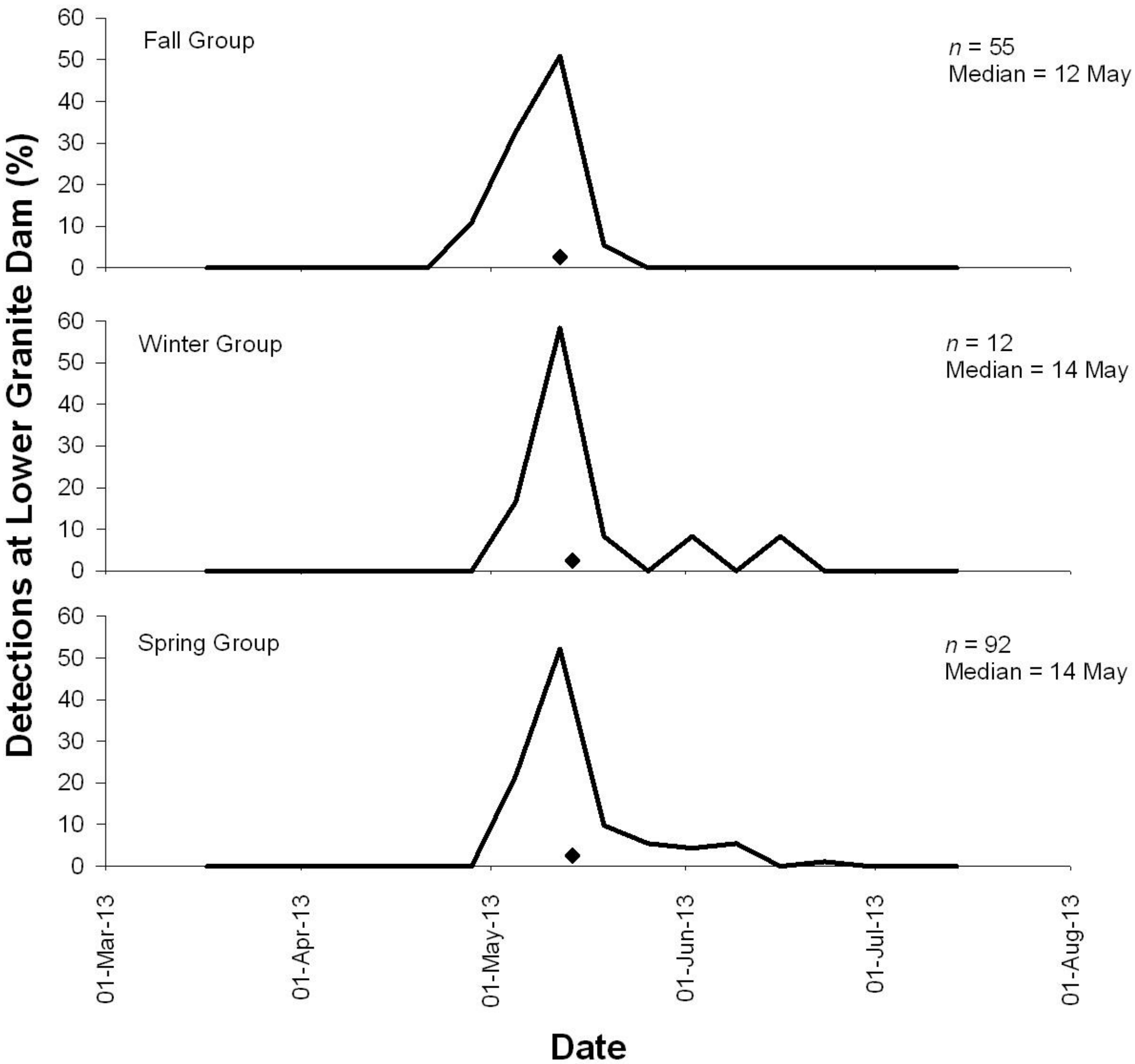
Appendix Figure B-6. Dates of arrival, during 2013 at Lower Granite dam, for fall, winter, and spring tag groups of juvenile spring Chinook salmon PIT-tagged from Lostine River. Data was summarized by week and expressed as percentage of total detected. Detections were expanded for spillway flow. ◆ = median arrival date.



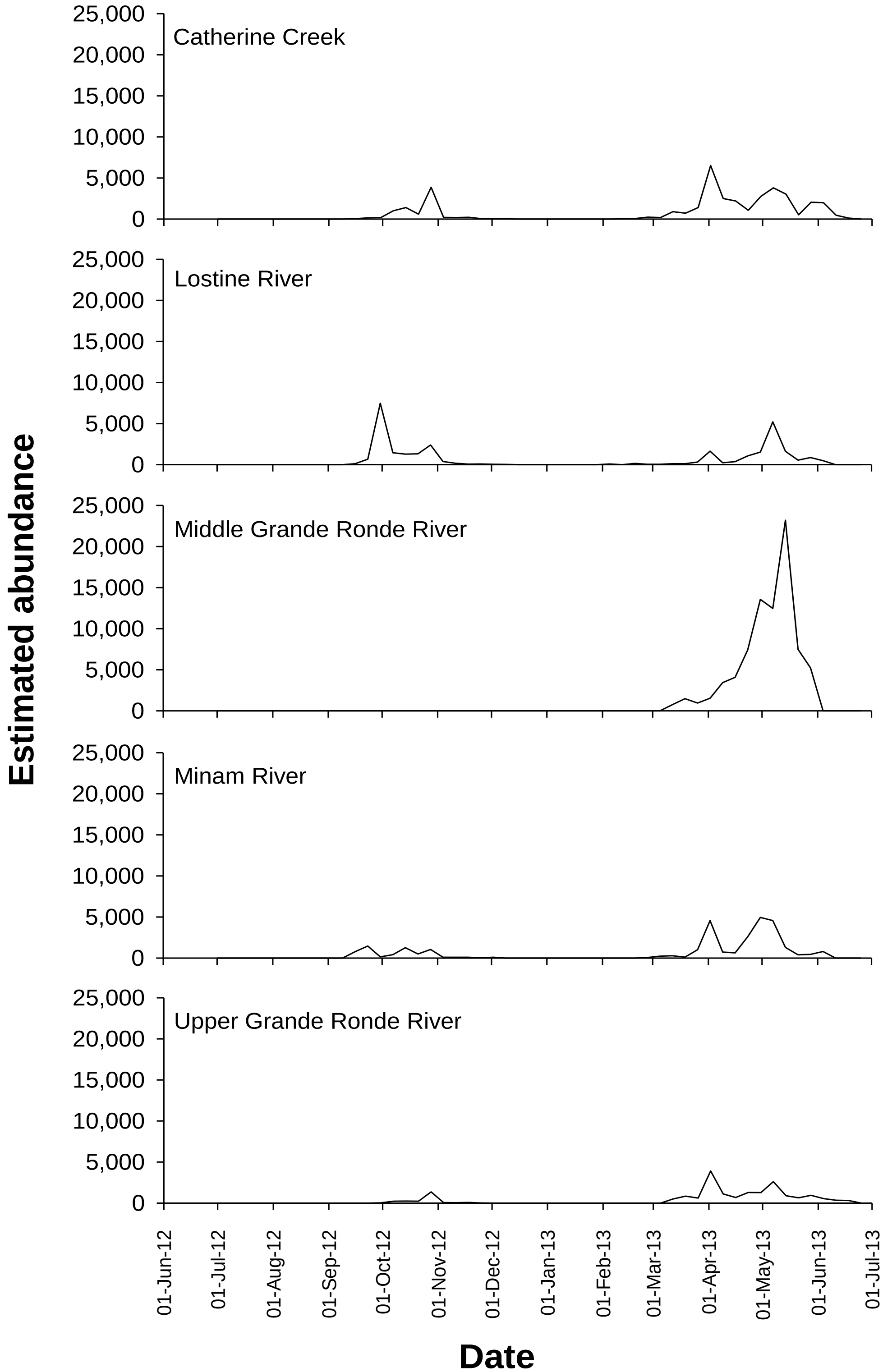
Appendix Figure B-7. Dates of arrival, during 2013 at Lower Granite dam, for the spring tag group of juvenile spring Chinook salmon PIT-tagged from middle Grande Ronde River. Data was summarized by week and expressed as percentage of total detected. Detections were expanded for spillway flow. ◆ = median arrival date.



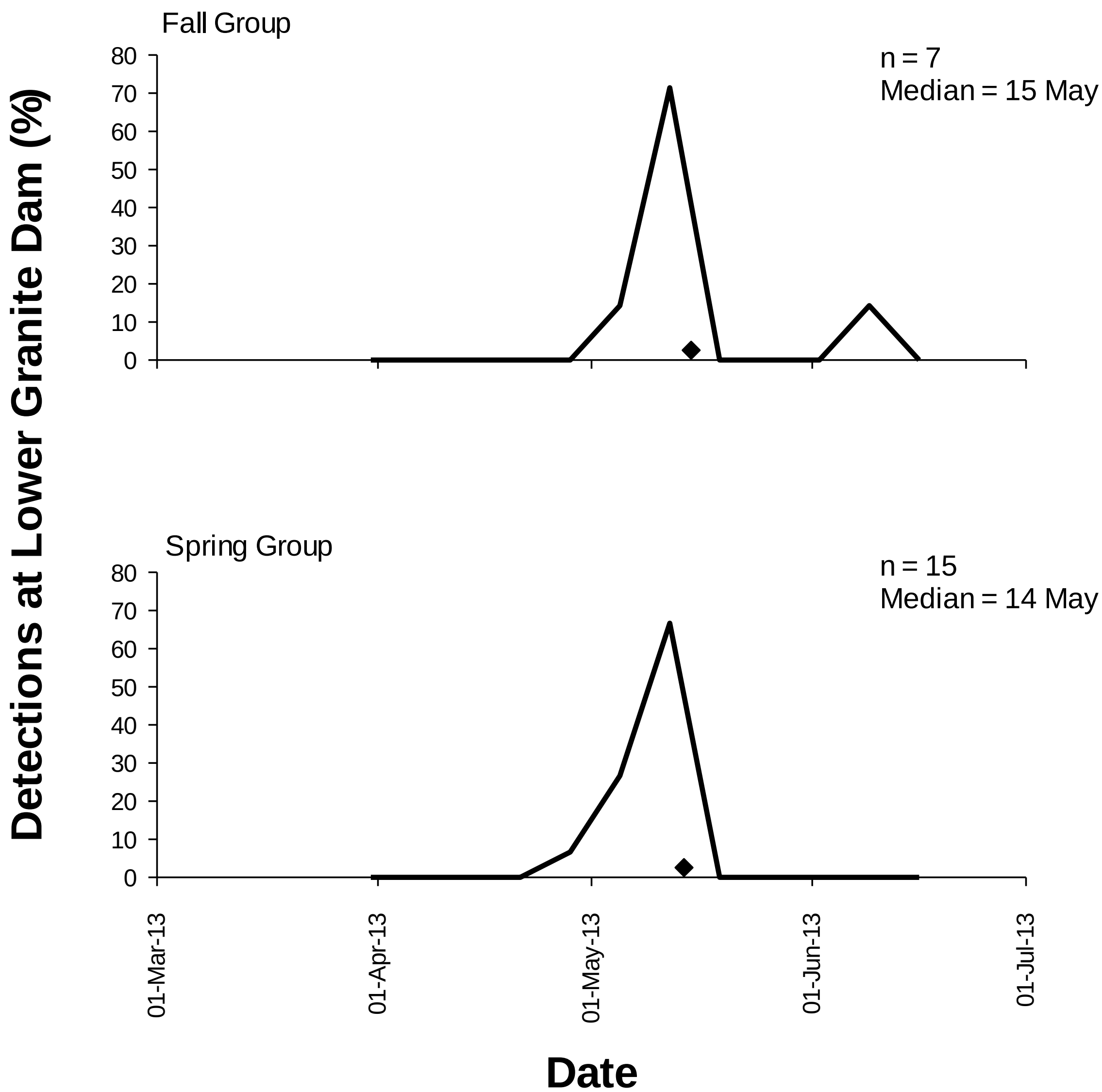
Appendix Figure B-8. Dates of arrival, during 2013 at Lower Granite dam, for fall and spring tag groups of juvenile spring Chinook salmon PIT-tagged from Minam River. Data was summarized by week and expressed as percentage of total detected. Detections were expanded for spillway flow. ♦ = median arrival date.



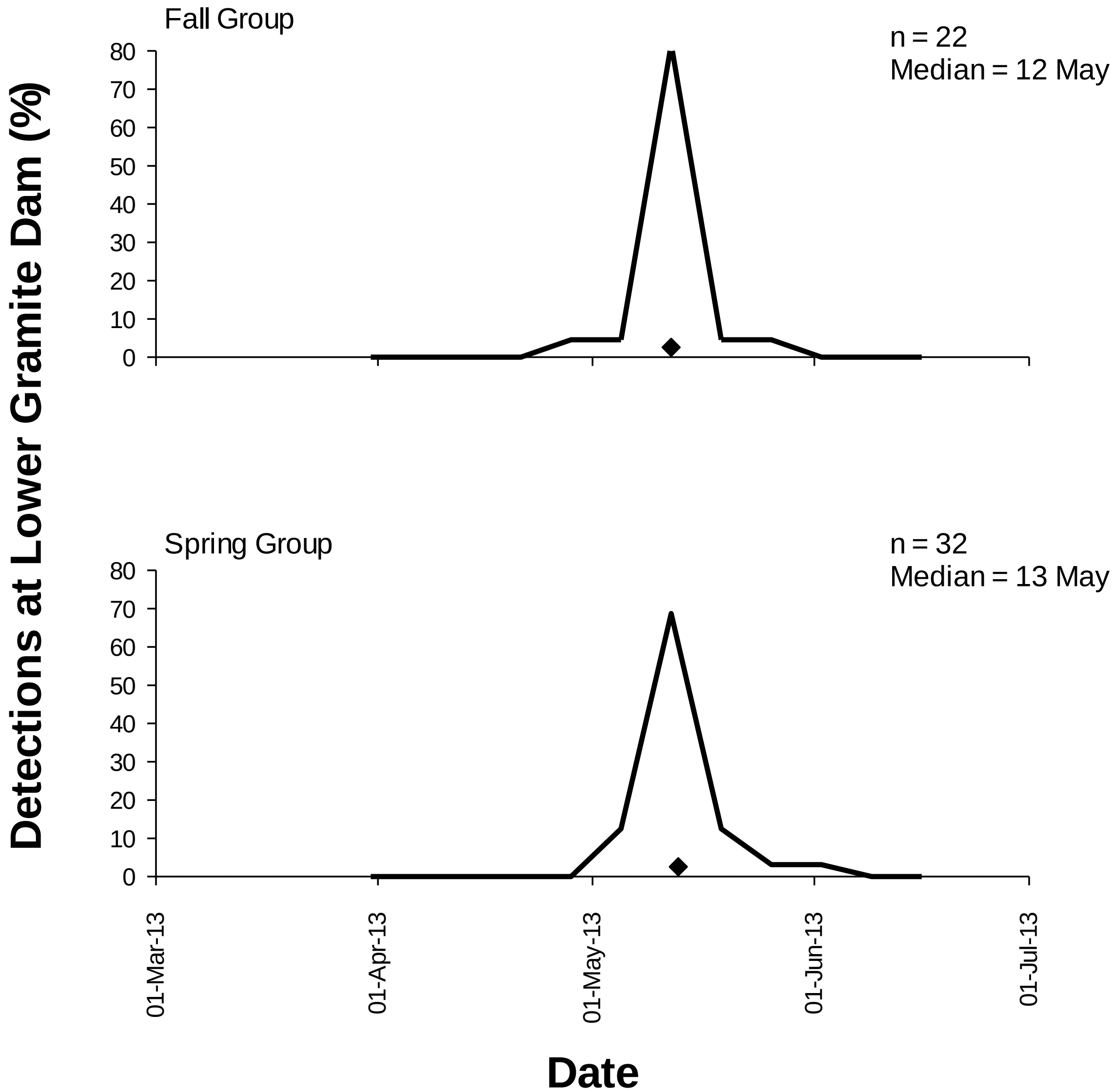
Appendix Figure B-9. Dates of arrival, during 2013 at Lower Granite dam, for fall, winter, and spring tag groups of juvenile spring Chinook salmon PIT-tagged from upper Grande Ronde River. Data was summarized by week and expressed as percentage of total detected. Detections were expanded for spillway flow. ◆ = median arrival date.



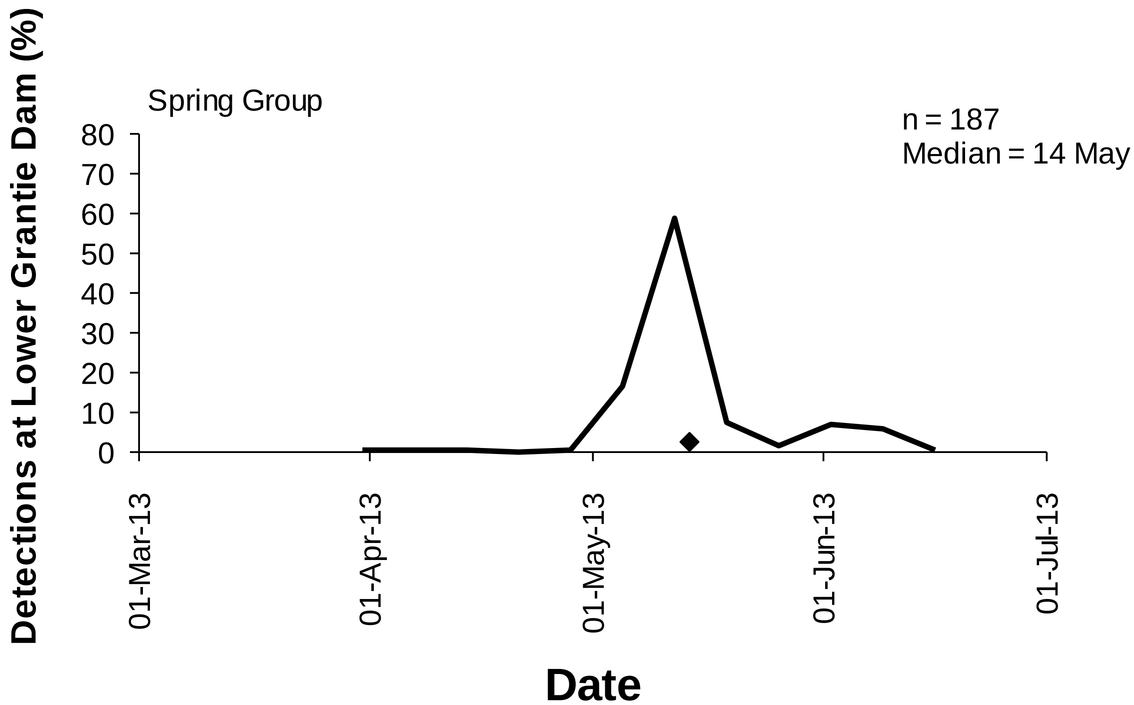
Appendix Figure B-10. Estimated migration timing and abundance of juvenile summer steelhead migrants captured by rotary screw trap during MY 2013. Traps were operated at rkm 32 on Catherine Creek, rkm 3 on Lostine River, rkm 0 on Minam River, and rkm 299 on upper Grande Ronde River.



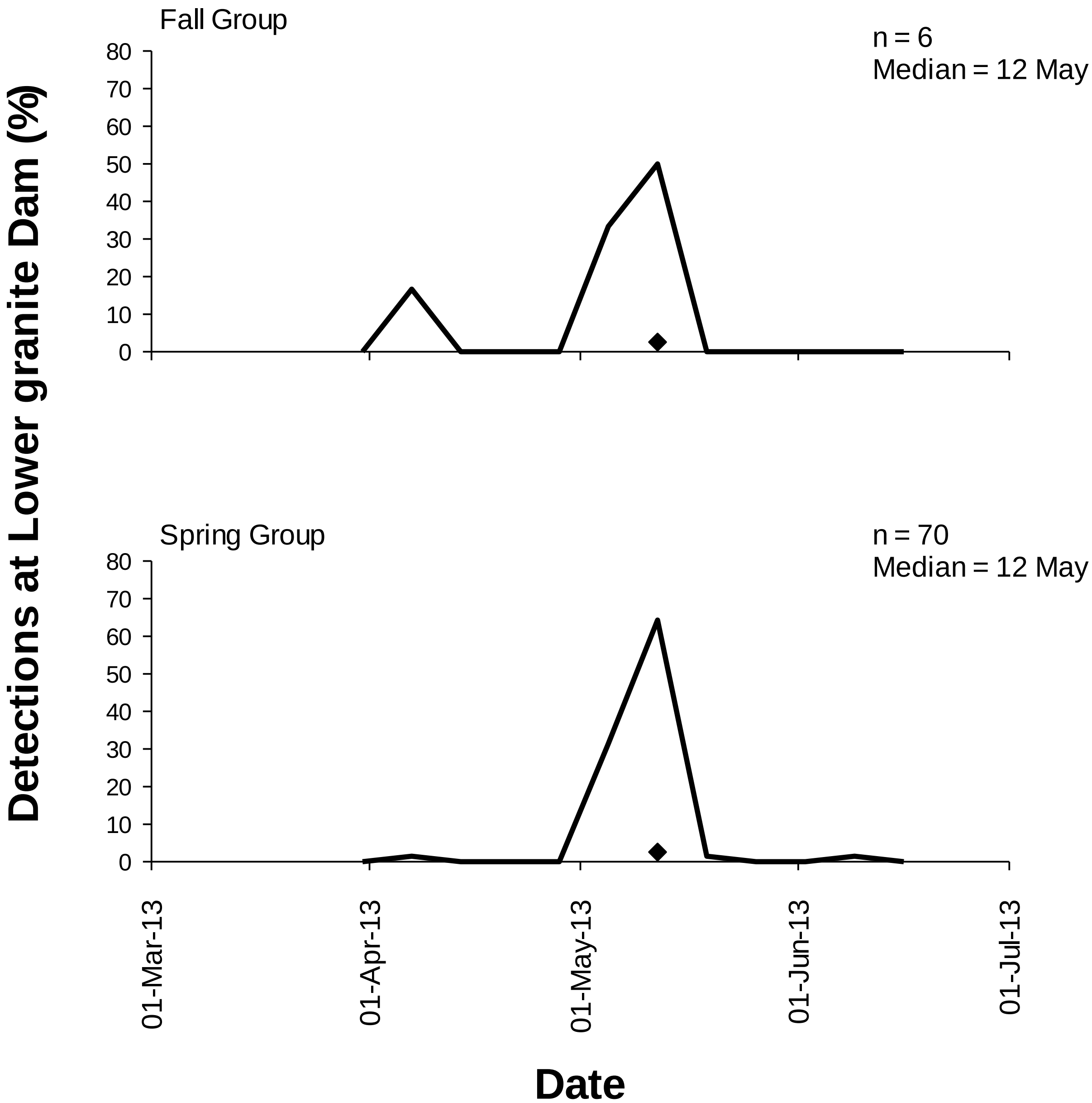
Appendix Figure B-11. Dates of arrival, in 2013, at Lower Granite Dam for fall and spring tag groups of steelhead PIT-tagged from Catherine Creek, and expressed as a percentage of total detected for each group. Detections were expanded for spillway flow. ♦ = median arrival date.



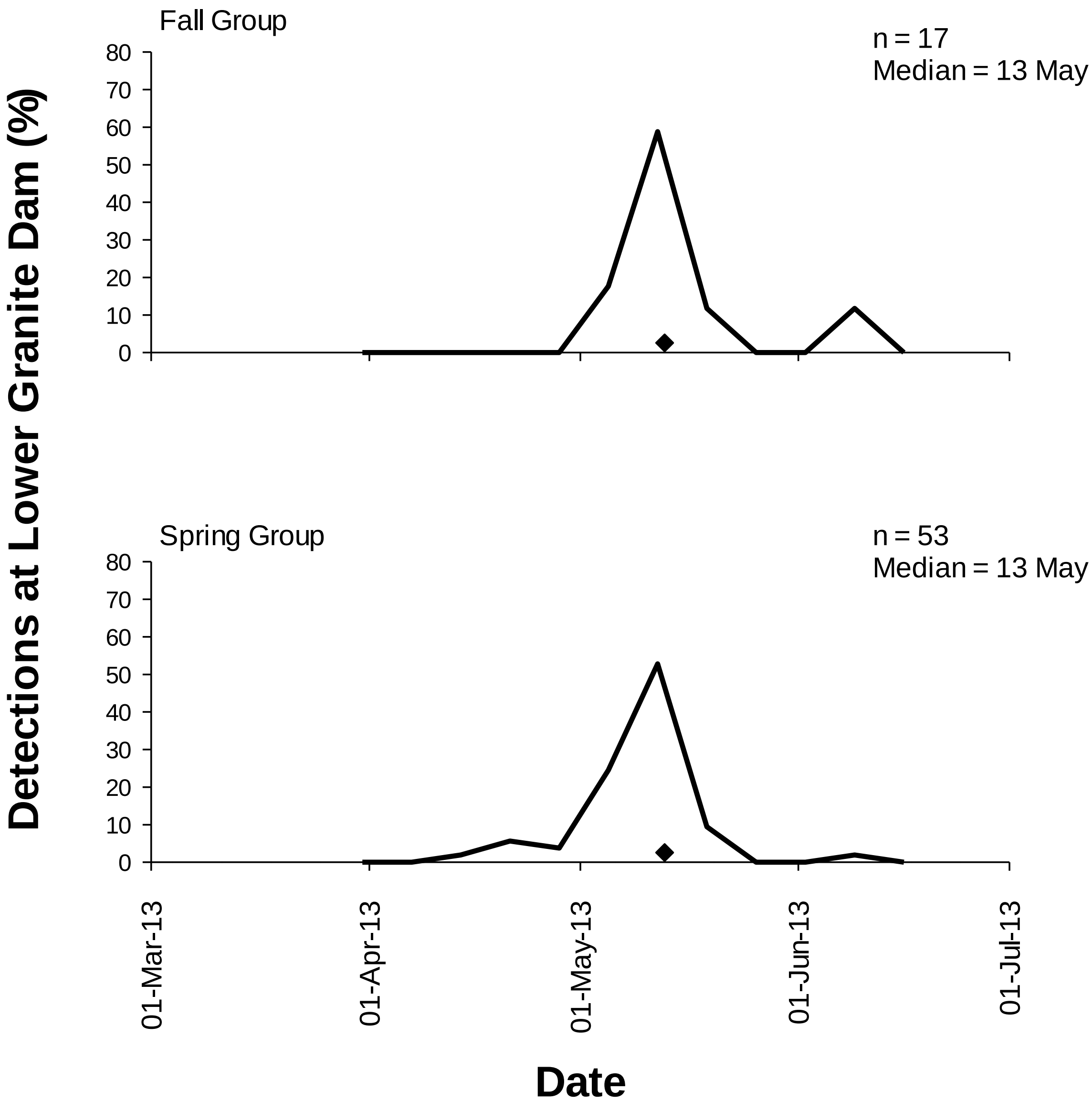
Appendix Figure B-12. Dates of arrival, in 2013, at Lower Granite Dam for fall and spring tag groups of steelhead PIT-tagged from Lostine River, and expressed as a percentage of total detected for each group. Detections were expanded for spillway flow. ♦ = median arrival date.



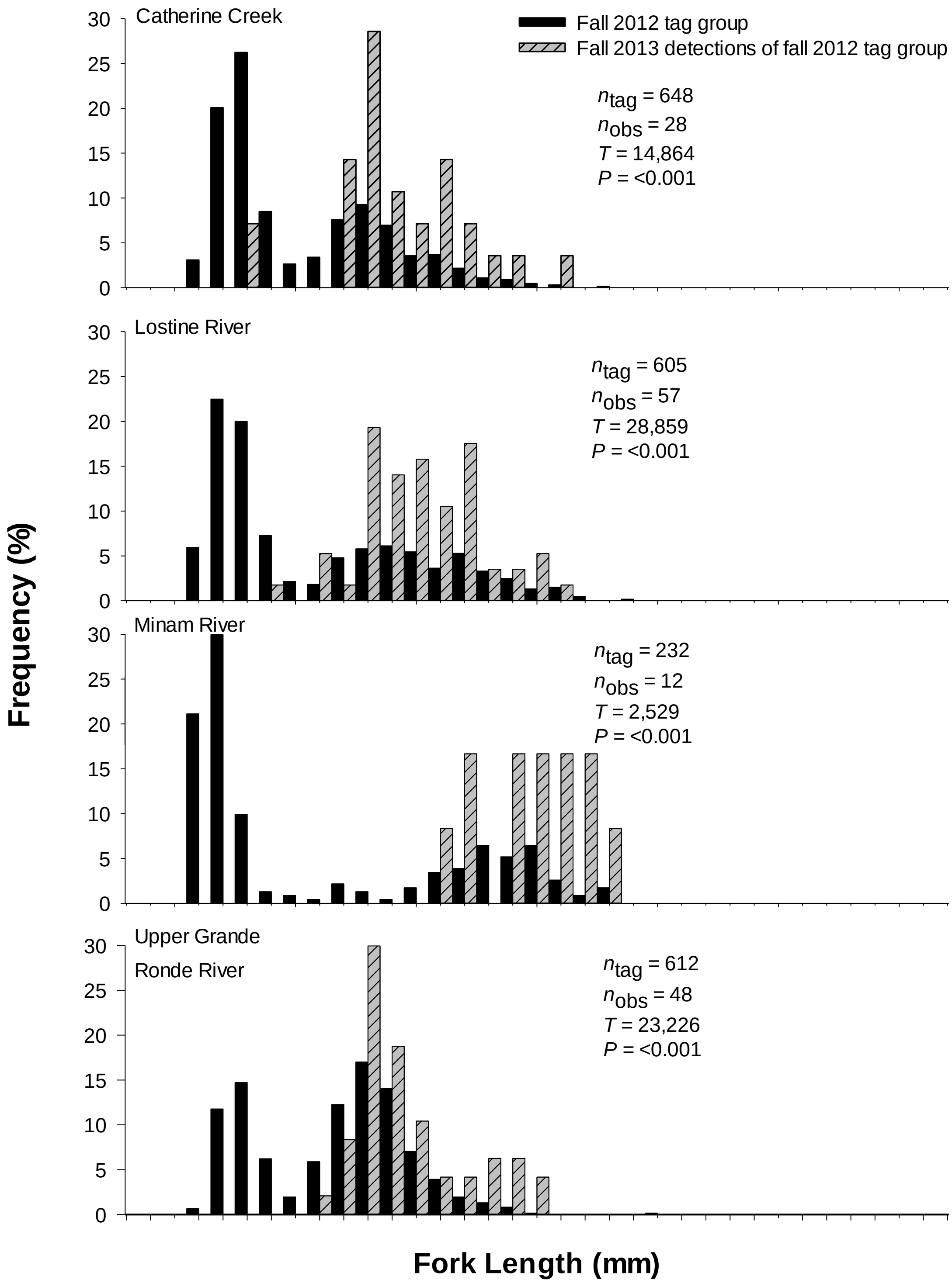
Appendix Figure B-13. Dates of arrival, in 2013, at Lower Granite Dam for fall and spring tag groups of steelhead PIT-tagged from middle Grande Ronde River, and expressed as a percentage of total detected for each group. Detections were expanded for spillway flow. ♦ = median arrival date.



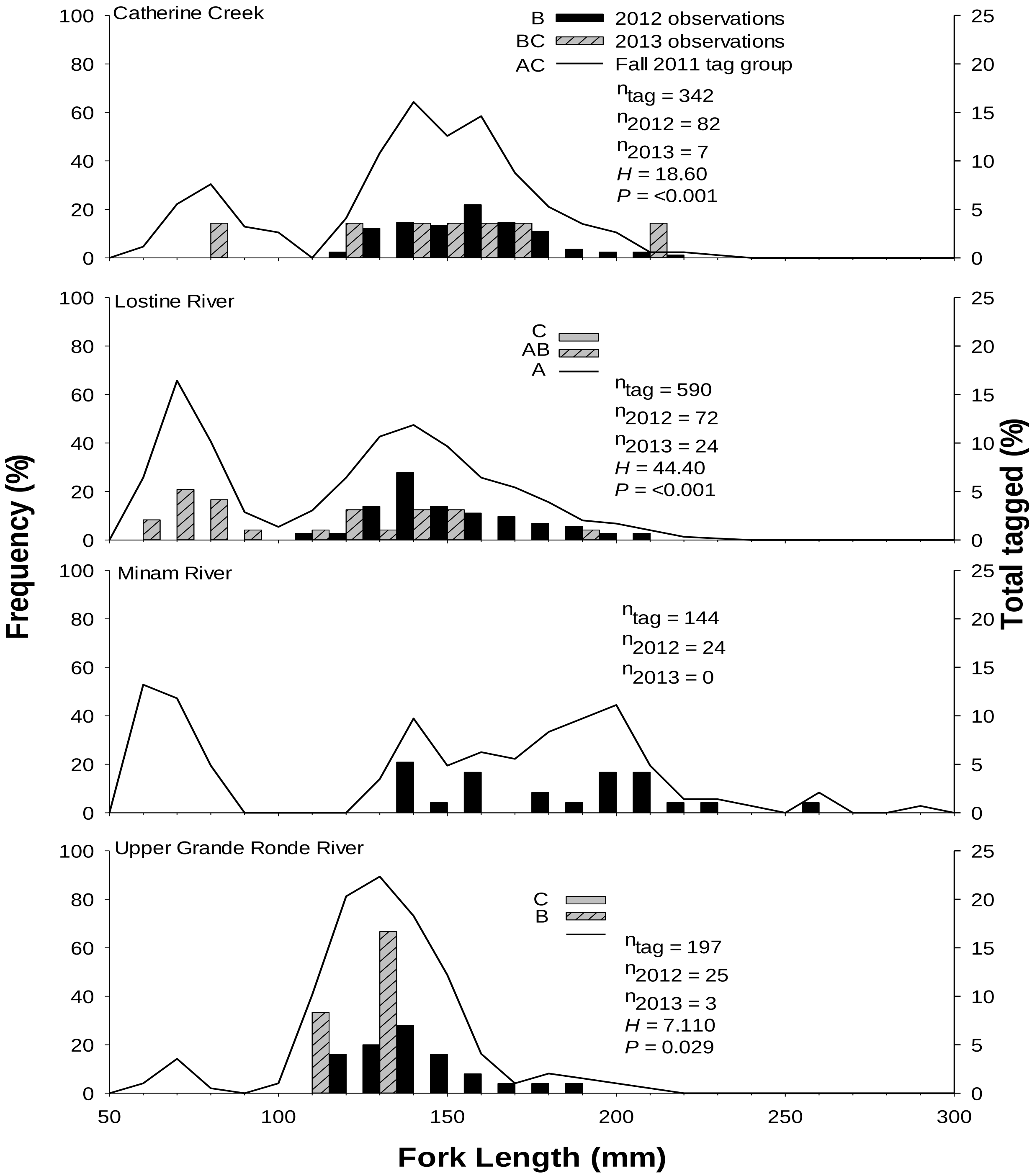
Appendix Figure B-14. Dates of arrival, in 2013, at Lower Granite Dam for fall and spring tag groups of steelhead PIT-tagged from Minam River, and expressed as a percentage of total detected for each group. Detections were expanded for spillway flow. ♦ = median arrival date.



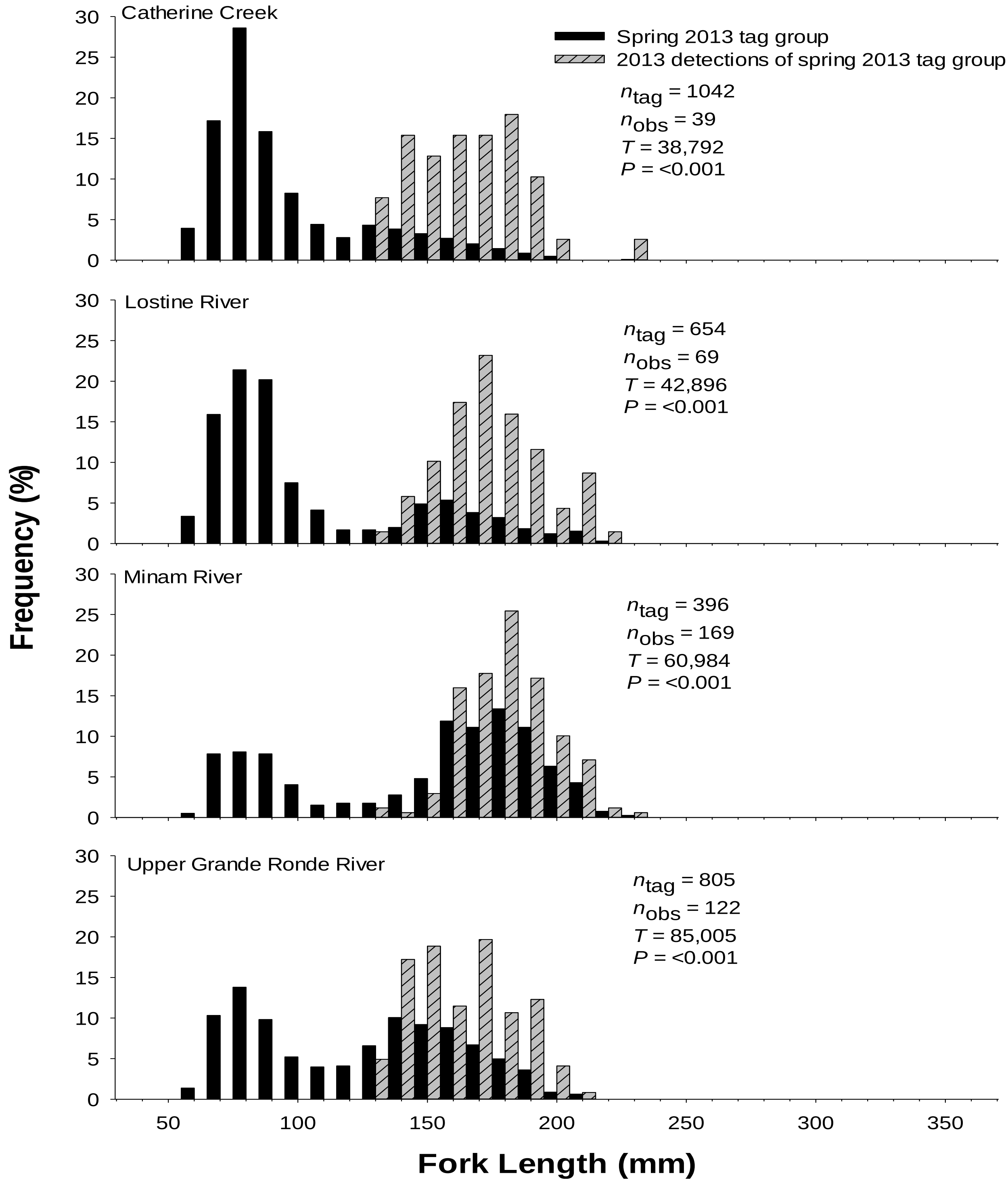
Appendix Figure B-15. Dates of arrival, in 2013, at Lower Granite Dam for fall and spring tag groups of steelhead PIT-tagged from upper Grande Ronde River, and expressed as a percentage of total detected for each group. Detections were expanded for spillway flow. ♦ = median arrival date.



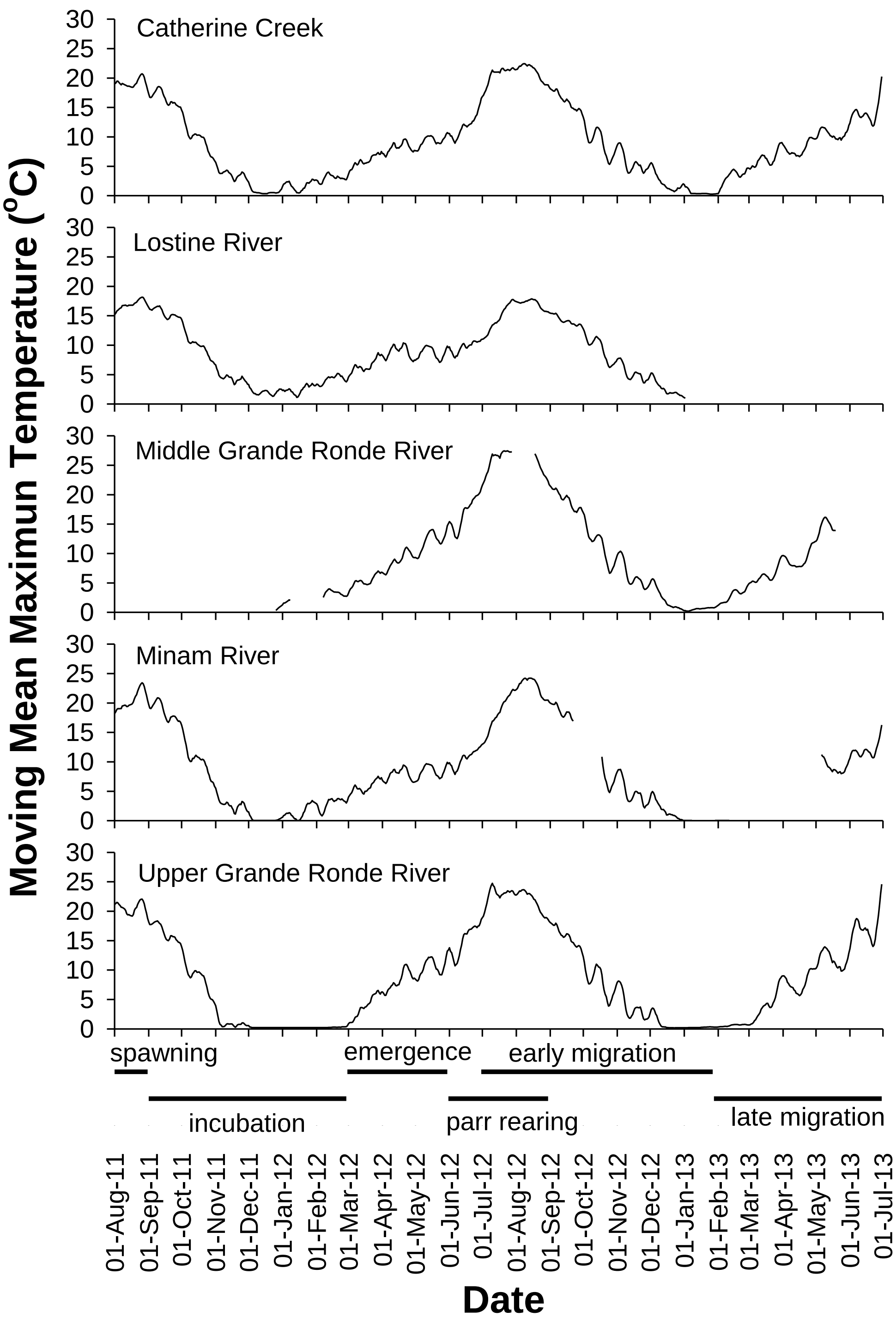
Appendix Figure B-16. Length frequency distributions for all steelhead PIT-tagged at screw traps during fall 2012 and those subsequently observed at Snake or Columbia river dams during spring 2013. Fork lengths are based on measurements taken at time of tagging. Frequency is expressed as percent of total number tagged (n_{tag}). 'n_{obs}' is number detected.



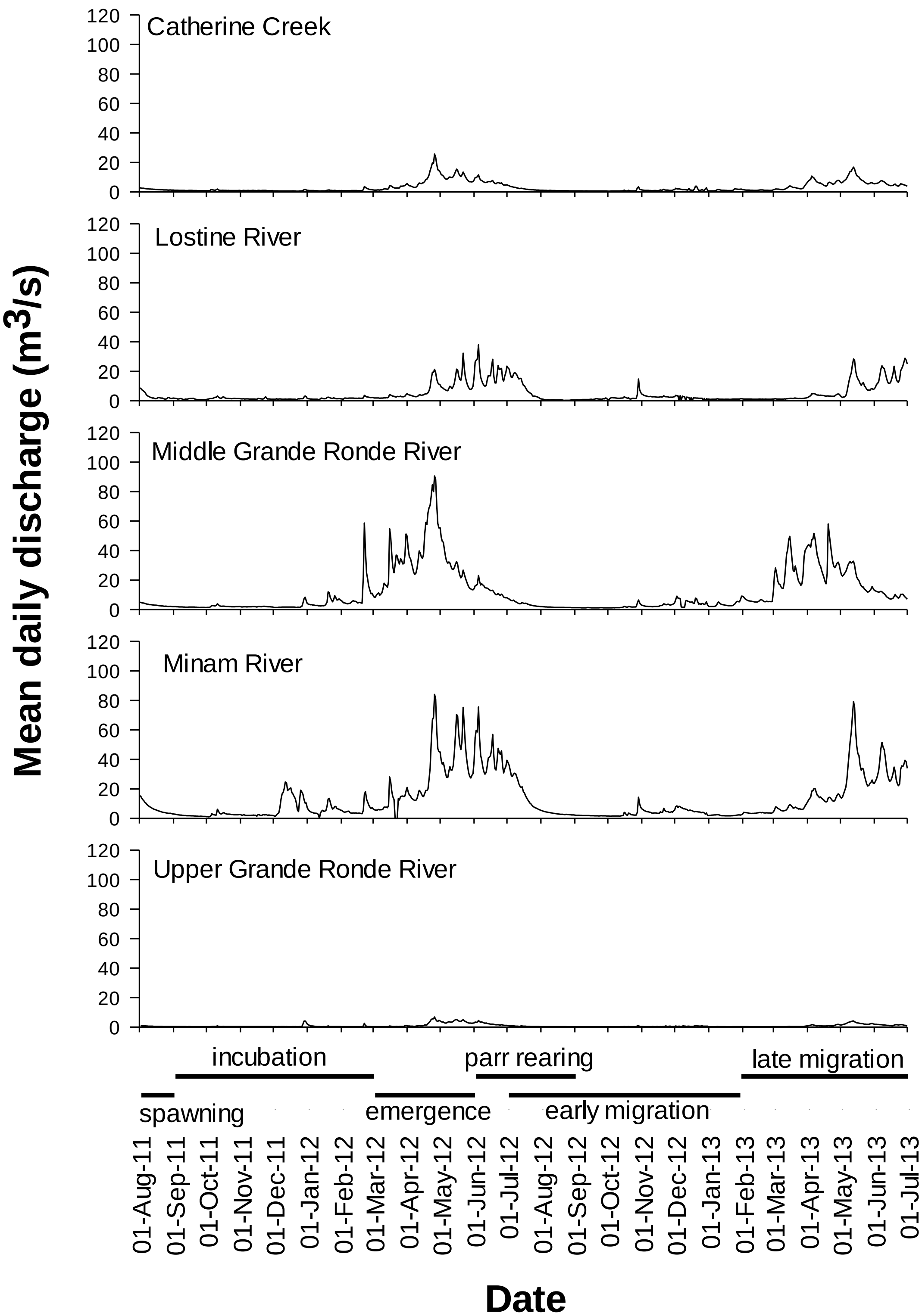
Appendix Figure B-17. Length frequency distributions for steelhead PIT-tagged at screw traps during fall 2011, and those subsequently observed at Snake or Columbia river dams during 2012 and 2013. Frequency is expressed as percent of total number tagged. 'H' is the test statistic for the Kruskal–Wallis one-way ANOVA on ranks of lengths. Dunn's all pair-wise multiple comparison procedure was employed to compare groups among Catherine Creek, Lostine, and Minam rivers (α = 0.05).



Appendix Figure B-18. Length frequency distributions for steelhead PIT-tagged at screw traps during spring 2013, and those subsequently observed at Snake or Columbia river dams during spring 2013. Data were compared using the Mann-Whitney rank-sum test. Fork lengths are based on measurements taken at time of tagging. Frequency is expressed as percent of total number tagged (n_{tag}), and 'n_{obs}' represents number detected.



Appendix Figure B-19. Moving mean of maximum water temperature from four study streams in Grande Ronde River Subbasin during MY 2013. Data corresponds with juvenile spring Chinook salmon in-basin egg-to-emigrant life stages. Missing portions of a trend line represent periods where data were not available.



Appendix Figure B-20. Average daily discharge from four study streams in the Grande Ronde River Subbasin during MY 2013. Data corresponds with juvenile spring Chinook salmon in-basin egg-to-emigrant life stages.

WE L: Steelhead Spawner Survey, and

WE M: Abundance of Steelhead Spawners at the Population Level

Appendix Table B-12. Steelhead spawning ground survey characteristics, location and stream classification for sites in the UGRR basin, 2013.

Site ID	Stream	Survey Frequency	Stream Classification	Survey Distance (km)	GRTS point		Downstream point of survey		Upstream point of survey	
					Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
018904	Spring Creek	Annual	Transport	2.06	45.3393	-118.2893	45.3381	-118.2861	45.3472	-118.3073
059352	Clark Creek	Annual	Depositional	1.86	45.5155	-117.8297	45.5150	-117.8289	45.5002	-117.8199
079752	Grande Ronde River	Annual	Depositional	1.95	45.1834	-118.3883	45.1933	-118.3952	45.1793	-118.3894
101102	Phillips Creek	Annual	Depositional	1.95	45.5671	-117.9746	45.5669	-117.9732	45.5697	-117.9937
101560	Meadow Creek	Annual	Transport	1.87	45.2832	-118.6023	45.2832	-118.6022	45.2924	-118.6122
118408	West Chicken Creek	Annual	Source	2.07	45.0318	-118.4057	45.0445	-118.4039	45.0268	-118.4036
120904	Burnt Corral Creek	Annual	Source	1.91	45.1807	-118.5073	45.1843	-118.4997	45.1740	-118.5165
125832	Meadow Creek	Annual	Depositional	1.89	45.2637	-118.5514	45.2714	-118.5333	45.2636	-118.5515
147928	Five Points Creek	Annual	Depositional	1.98	45.4047	-118.2170	45.4034	-118.2228	45.4107	-118.2018
177134	East Phillips Creek	Annual	Source	1.97	45.6280	-118.0615	45.6230	-118.0722	45.6345	-118.0557
075502	Phillips Creek	Once	Transport	2.00	45.5891	-118.0336	45.5816	-118.0244	45.5942	-118.0413
094088	Meadow Creek	Once	Depositional	2.09	45.2369	-118.4400	45.2449	-118.4234	45.2370	-118.4405
117208	South Fork Spring Creek	Once	Transport	2.04	45.3451	-118.3046	45.3456	-118.3021	45.3346	-118.3195
141832	North Fork Catherine Creek	Once	Depositional	1.97	45.1380	-117.6235	45.1303	-117.6316	45.1447	-117.6208
010424	Dark Canyon Creek	Panel 3	Transport	2.10	45.3652	-118.3936	45.3576	-118.3960	45.3753	-118.3902
025816	West Fork Ladd Creek	Panel 3	Transport	1.07	45.2536	-118.0238	45.2540	-118.0245	45.2457	-118.0186
051964	Catherine Creek	Panel 3	Depositional	2.17	45.1507	-117.7365	45.1521	-117.7444	45.1429	-117.7234
084462	Lookingglass Creek	Panel 3	Depositional	1.56	45.7416	-117.8687	45.7362	-117.8631	45.7474	-117.8712
095704	Beaver Creek	Panel 3	Transport	1.96	45.1825	-118.2324	45.1826	-118.2331	45.1714	-118.2179
102024	East Sheep Creek	Panel 3	Source	1.95	45.0127	-118.4511	45.0165	-118.4724	45.0128	-118.4508
130904	Little Whiskey Creek	Panel 3	Source	1.78	45.2821	-118.2135	45.2891	-118.2191	45.2751	-118.2091
131128	Clark Creek	Panel 3	Source	1.94	45.4310	-117.7590	45.4372	-117.7748	45.4278	-117.7549
139144	Meadow Creek	Panel 3	Depositional	1.92	45.2405	-118.4626	45.2404	-118.4623	45.2472	-118.4797
157422	Phillips Creek	Panel 3	Transport	1.98	45.5721	-118.0093	45.5727	-118.0060	45.5814	-118.0244
000094	Fly Creek	Panel 3*	Transport	2.01	45.1248	-118.4520	45.1367	-118.4477	45.1208	-118.4540
000161	South Fork Catherine Creek	Panel 3*	Source	1.97	45.1043	-117.5648	45.1051	-117.5830	45.1068	-117.5608
000213	Meadow Creek	Panel 3*	Depositional	1.97	45.2641	-118.3952	45.2659	-118.3902	45.2567	-118.4060
013882	Peet Creek	Panel 3*	Source	2.12	45.2610	-118.6152	45.2776	-118.6160	45.2601	-118.6146
252730	Meadow Creek	Panel 3*	Depositional	1.98	45.2566	-118.4061	45.2566	-118.4061	45.2451	-118.4232

*CHaMP annual sites integrated into the steelhead spawning survey draw.

Appendix Table B-13. Steelhead spawning ground survey characteristics, location and stream classification for sites in the Joseph Creek basin, 2013.

Site ID	Stream	Survey Frequency	Stream Classification	Survey Distance (km)	GRTS Point		Downstream point of survey		Upstream point of survey	
					Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
002175	Crow Creek	Annual	Transport	2.04	45.7033	-117.1550	45.7056	-117.1516	45.6902	-117.1503
051026	Unnamed trib to Alder Creek	Annual	Source	1.60	45.6945	-117.0136	45.7044	-117.0217	45.6939	-117.0126
112130	Devils Run Creek	Annual	Source	2.02	45.7842	-116.9856	45.7801	-116.9842	45.7826	-116.9690
141826	Basin Creek	Annual	Source	2.26	45.9138	-117.0579	45.9323	-117.0575	45.9128	-117.0573
167426	Chesnimnus Creek	Annual	Depositional	2.05	45.7536	-117.0031	45.7507	-117.0188	45.7550	-116.9973
169810	Chesnimnus Creek	Annual	Transport	2.03	45.6978	-116.9229	45.6975	-116.9228	45.7128	-116.9101
301570	Cottonwood Creek	Annual	Source	1.65	45.9375	-117.0616	45.9430	-117.0590	45.9325	-117.0534
389247	Chesnimnus Creek	Annual	Depositional	1.70	45.7053	-117.1373	45.7051	-117.1361	45.6984	-117.1210
493394	Salmon Creek	Annual	Transport	1.90	45.7092	-117.0513	45.7188	-117.0522	45.7048	-117.0492
515586	Chesnimnus Creek	Annual	Depositional	2.06	45.7331	-117.0400	45.7318	-117.0496	45.7370	-117.0317
007682	Joseph Creek	Panel 2	Depositional	1.93	45.7595	-117.1718	45.7688	-117.1757	45.7583	-117.1738
022018	Cottonwood Creek	Panel 2	Source	1.95	45.8593	-116.9798	45.8594	-116.9788	45.8448	-116.9681
061375	Swamp Creek	Panel 2	Transport	2.00	45.7711	-117.2332	45.7840	-117.2290	45.7682	-117.2331
062978	Chesnimnus Creek	Panel 2	Transport	1.75	45.7278	-116.9510	45.7394	-116.9622	45.7275	-116.9497
103938	Unnamed trib to Billy Creek	Panel 2	Source	1.91	45.8349	-117.0215	45.8316	-117.0190	45.8464	-117.0294
120658	Crow Creek	Panel 2	Transport	2.06	45.6350	-117.1435	45.6420	-117.1427	45.6265	-117.1381
155138	Joseph Creek	Panel 2	Depositional	2.07	45.7341	-117.1615	45.7424	-117.1653	45.7333	-117.1598
157522	Chesnimnus Creek	Panel 2	Depositional	2.28	45.6977	-117.1200	45.6980	-117.1196	45.7026	-117.1017
187906	Peavine Creek	Panel 2	Source	2.17	45.7534	-117.0831	45.7363	-117.0836	45.7551	-117.0832
227263	Davis Creek	Panel 2	Transport	2.15	45.7051	-117.2581	45.7067	-117.2570	45.6883	-117.2606
231250	Salmon Creek	Panel 2	Transport	2.02	45.6981	-117.0499	45.7039	-117.0485	45.6870	-117.0533
265730	TNT Gulch	Panel 2	Source	2.09	45.7698	-116.9270	45.7706	-116.9267	45.7538	-116.9190
310786	Chesnimnus Creek	Panel 2	Depositional	1.90	45.7095	-117.0932	45.7031	-117.1010	45.7093	-117.0912
408066	Summit Creek	Panel 2	Source	1.83	45.7939	-116.9475	45.7779	-116.9491	45.7937	-116.9468
510466	Broady Creek	Panel 2	Source	2.15	45.9013	-117.0930	45.9184	-117.0935	45.9005	-117.0919
527618	Horse Creek	Panel 2	Source	1.92	45.9758	-116.9886	45.9842	-117.0057	45.9760	-116.9869

Appendix Table B-14. Completion dates and general results for surveys in the Upper Grande Ronde River watershed and Deer Creek, 2013.

Site ID	Stream	No. of surveys completed	Mean no. of days between surveys	Redd count	1st Survey Date	2nd Survey Date	3rd Survey Date	4th Survey Date	5th Survey Date	6th Survey Date	7th Survey Date
000094	Fly Creek	6	12.6	4	4/9/2013	4/22/2013	5/6/2013	5/14/2013	5/29/2013	6/11/2013	
000161	South Fork Catherine Creek	2	16.0	0	5/21/2013	6/6/2013					
000213	Meadow Creek	6	15.4	0	3/25/2013	4/16/2013	4/29/2013	5/14/2013	5/28/2013	6/10/2013	
010424	Dark Canyon	4	12.0	1	4/22/2013	5/7/2013	5/16/2013	5/28/2013			
013882	Peet Creek	5	14.0	0	4/2/2013	4/18/2013	4/30/2013	5/15/2013	5/28/2013		
018904	Spring Creek	7	13.0	3	3/26/2013	4/5/2013	4/22/2013	5/7/2013	5/20/2013	6/3/2013	6/12/2013
025816	West Fork Ladd Creek	6	13.6	0	3/13/2013	3/26/2013	4/9/2013	4/23/2013	5/8/2013	5/20/2013	
051964	Catherine Creek	5	17.8	0	3/27/2013	4/17/2013	5/1/2013	5/21/2013	6/6/2013		
059352	Clark Creek	7	14.0	4	3/26/2013	4/8/2013	4/23/2013	5/8/2013	5/21/2013	6/3/2013	6/18/2013
075502	Phillips Creek	7	12.8	2	4/1/2013	4/12/2013	4/24/2013	5/7/2013	5/20/2013	6/3/2013	6/17/2013
079752	Grande Ronde River	5	19.3	0	3/27/2013	4/18/2013	4/30/2013	5/30/2013	6/12/2013		
084462	Lookingglass Creek	5	19.3	0	3/27/2013	4/15/2013	5/1/2013	5/31/2013	6/12/2013		
094088	Meadow Creek	6	15.4	6	3/25/2013	4/16/2013	4/29/2013	5/14/2013	5/28/2013	6/10/2013	
095704	Beaver Creek	2	10.0	0	5/30/2013	6/9/2013					
101102	Phillips Creek	7	13.8	1	3/26/2013	4/9/2013	4/23/2013	5/7/2013	5/20/2013	6/3/2013	6/17/2013
101560	Meadow Creek	6	12.4	7	4/9/2013	4/25/2013	5/6/2013	5/15/2013	5/28/2013	6/10/2013	
102024	East Sheep Creek	5	12.5	1	4/22/2013	5/2/2013	5/13/2013	5/29/2013	6/11/2013		
117208	South Fork Spring Creek	5	13.8	2	3/26/2013	4/5/2013	4/22/2013	5/7/2013	5/20/2013		
118408	West Chicken Creek	6	14.2	0	4/1/2013	4/22/2013	5/2/2013	5/13/2013	5/29/2013	6/11/2013	
120904	Burnt Corral Creek	5	10.8	0	4/1/2013	4/11/2013	4/25/2013	5/6/2013	5/14/2013		
125832	Meadow Creek	7	12.5	5	3/27/2013	4/18/2013	4/30/2013	5/6/2013	5/15/2013	5/28/2013	6/10/2013
130904	Little Whiskey Creek	6	14.0	0	3/25/2013	4/8/2013	4/22/2013	5/7/2013	5/20/2013	6/3/2013	
131128	Clark Creek	3	15.0	0	5/8/2013	5/21/2013	6/7/2013				
139144	Meadow Creek	7	12.8	1	3/25/2013	4/12/2013	4/25/2013	5/6/2013	5/14/2013	5/28/2013	6/10/2013
141832	North Fork Catherine Creek	4	16.7	0	4/17/2013	5/1/2013	5/21/2013	6/6/2013			
147928	Five Points Creek	5	14.5	12	4/16/2013	4/29/2013	5/13/2013	5/29/2013	6/13/2013		
157422	Phillips Creek	7	12.8	0	4/1/2013	4/12/2013	4/24/2013	5/7/2013	5/20/2013	6/3/2013	6/17/2013
177134	East Phillips Creek	5	13.8	1	4/23/2013	5/7/2013	5/20/2013	6/3/2013	6/17/2013		
252730	Meadow Creek	6	15.4	2	3/25/2013	4/16/2013	4/29/2013	5/14/2013	5/28/2013	6/10/2013	
N/A	Deer Creek	5	15.8	33	3/28/2013	4/15/2013	4/29/2013	5/22/2013	5/30/2013		

Appendix Table B-15. Completion dates and general results for surveys in the Joseph Creek watershed, 2013.

Site ID	Stream	No. of surveys completed	Mean no. of days between surveys	Redd count	1st Survey Date	2nd Survey Date	3rd Survey Date	4th Survey Date	5th Survey Date
002175	Crow Creek	4	16.3	0	4/3/2013	4/24/2013	5/7/2013	5/22/2013	
007682	Joseph Creek	5	21.0	10	4/18/2013	5/9/2013	5/20/2013	5/30/2013	6/11/2013
022018	Cottonwood Creek	2	63.0	0	4/10/2013	6/12/2013			
051026	Unnamed trib to Alder Creek	4	14.0	0	4/2/2013	4/12/2013	5/1/2013	5/14/2013	
061375	Swamp Creek	2	40.0	8	4/25/2013	6/4/2013			
062978	Chesnimnus Creek	4	15.7	7	4/17/2013	5/2/2013	5/15/2013	6/3/2013	
103938	Unnamed trib to Billy Creek	4	13.7	0	4/23/2013	5/8/2013	5/16/2013	6/3/2013	
112130	Devils Run Creek	3	34.5	30	4/5/2013	4/24/2013	6/13/2013		
120658	Crow Creek	4	14.0	0	4/4/2013	4/24/2013	5/7/2013	5/16/2013	
141826	Basin Creek	4	16.0	0	3/26/2013	4/9/2013	4/29/2013	5/13/2013	
155138	Joseph Creek	5	13.5	4	4/18/2013	5/7/2013	5/20/2013	5/30/2013	6/11/2013
157522	Chesnimnus Creek	4	16.0	4	4/16/2013	5/6/2013	5/20/2013	6/3/2013	
167426	Chesnimnus Creek	4	16.3	25	4/17/2013	5/2/2013	5/22/2013	6/5/2013	
169810	Chesnimnus Creek	4	27.0	8	4/5/2013	5/2/2013	5/15/2013	5/30/2013	
187906	Peavine Creek	5	15.5	9	3/28/2013	4/12/2013	4/24/2013	5/10/2013	5/29/2013
227263	Davis Creek	3	18.5	0	4/3/2013	4/23/2013	5/10/2013		
231250	Salmon Creek	4	15.3	0	3/29/2013	4/8/2013	5/1/2013	5/14/2013	
265730	TNT Gulch	3	17.0	3	4/24/2013	5/8/2013	5/28/2013		
301570	Cottonwood Creek	5	19.0	10	3/26/2013	4/9/2013	4/29/2013	5/13/2013	6/10/2013
310786	Chesnimnus Creek	4	16.7	3	4/16/2013	5/6/2013	5/20/2013	6/5/2013	
389247	Chesnimnus Creek	4	16.0	10	4/16/2013	5/6/2013	5/16/2013	6/3/2013	
408066	Summit Creek	4	18.0	1	4/4/2013	4/24/2013	5/9/2013	5/28/2013	
493394	Salmon Creek	5	16.5	3	3/29/2013	4/8/2013	5/1/2013	5/14/2013	5/29/2013
510466	Broady Creek	2	21.0	0	4/30/2013	5/21/2013			
515586	Chesnimnus Creek	4	19.0	18	4/17/2013	5/2/2013	5/28/2013	6/13/2013	
527618	Horse Creek	4	16.0	0	3/27/2013	4/9/2013	4/29/2013	5/14/2013	

Appendix Table B-16. Locations, dates, and characteristics of live steelhead observations in the UGRR watershed, 2013.

Site ID	Stream	Date observed	Fin clip	Origin	Near redd
000213	Meadow Creek	4/16/2013	Unknown	Unknown	No
000213	Meadow Creek	4/16/2013	Unknown	Unknown	No
000213	Meadow Creek	4/16/2013	No	Wild	No
059352	Clark Creek	3/26/2013	No	Wild	No
059352	Clark Creek	3/26/2013	No	Wild	Yes
059352	Clark Creek	3/26/2013	No	Wild	Yes
094088	Meadow Creek	4/29/2013	Unknown	Unknown	No
094088	Meadow Creek	4/29/2013	Unknown	Unknown	No
147928	Five Points Creek	4/16/2013	No	Wild	Yes

Appendix Table B-17. Locations, dates, and characteristics of live steelhead observations in the Joseph Creek watershed, 2013.

Site ID	Stream	Date observed	Fin clip	Origin	Near redd
112130	Devils Run Creek	4/24/2013	No	Wild	No
155138	Joseph Creek	5/7/2013	Unknown	Unknown	Yes
167426	Chesnimnus Creek	4/17/2013	Unknown	Unknown	No
167426	Chesnimnus Creek	5/2/2013	No	Wild	Yes
187906	Peavine Creek	3/28/2013	Unknown	Unknown	Yes
187906	Peavine Creek	3/28/2013	No	Wild	Yes
187906	Peavine Creek	3/28/2013	No	Wild	No
187906	Peavine Creek	3/28/2013	No	Wild	No
187906	Peavine Creek	3/28/2013	No	Wild	No
265730	TNT Gulch	4/24/2013	Unknown	Unknown	Yes
265730	TNT Gulch	4/24/2013	Unknown	Unknown	Yes
301570	Cottonwood Creek	3/26/2013	Unknown	Unknown	Yes
301570	Cottonwood Creek	3/26/2013	Unknown	Unknown	Yes
301570	Cottonwood Creek	3/26/2013	No	Wild	Yes
301570	Cottonwood Creek	4/9/2013	Unknown	Unknown	Yes
301570	Cottonwood Creek	4/9/2013	Unknown	Unknown	Yes
301570	Cottonwood Creek	4/9/2013	Unknown	Unknown	Yes
301570	Cottonwood Creek	4/9/2013	Unknown	Unknown	No
301570	Cottonwood Creek	4/29/2013	Unknown	Unknown	No
301570	Cottonwood Creek	4/29/2013	Unknown	Unknown	No
301570	Cottonwood Creek	4/29/2013	Unknown	Unknown	No
301570	Cottonwood Creek	5/13/2013	No	Wild	No
389247	Chesnimnus Creek	4/16/2013	Unknown	Unknown	No
515586	Chesnimnus Creek	4/17/2013	No	Wild	No
515586	Chesnimnus Creek	5/2/2013	Unknown	Unknown	Yes
515586	Chesnimnus Creek	5/2/2013	Unknown	Unknown	No
515586	Chesnimnus Creek	5/2/2013	No	Wild	Yes

Appendix Table B-18. Locations, dates, and characteristics of dead steelhead observations in the UGRR, Joseph Creek and Deer Creek watersheds, 2013.

Site ID	Stream	Date observed	Sex	Fork length	Age Fresh:Salt, Total	Fin Clip	Origin
094088	Meadow Creek	4/16/2013	Unknown	730	NA	Unknown	Unknown
062978	Chesnimnus Creek	5/2/2013	Unknown	672	2:1, 4	No	Wild
112130	Devils Run Creek	6/13/2013	Unknown	NA	NA	Unknown	Unknown
389247	Chesnimnus Creek	5/6/2013	Male	703	NA	No	Wild
389247	Chesnimnus Creek	5/6/2013	Female	608	NA	No	Wild
515586	Chesnimnus Creek	4/17/2013	Female	NA	2:2, 5	No	Wild
NA	Deer Creek	4/29/2013	Male	768	Unk:2, Unk	No	Wild
NA	Deer Creek	5/22/2013	Male	725	3:2, 6	No	Wild

Appendix Table B-19. Annual results of steelhead spawning ground surveys, 2008−2013. Available spawning habitat was refined yearly based on previous surveys.

Year	No. of sites	Spawning habitat (km)	Weight value	Redds observed	Distance surveyed (km)	Fish:redd ratio	Spawner escapement	SE	95% CI	CI as % of escapement
UGRR basin										
2008	29	1,301	44.9	24	64.2	4.07	2,096	583	±1,142	54.5%
2009	30	1,178	39.3	42	59.9	3.81	3,148	534	±1,047	33.2%
2010	29	934	32.2	109	56.4	1.60	2,876	457	±897	31.2%
2011	28	929	33.2	44	59.5	4.75	3,275	524	±1,028	31.4%
2012	30	897	29.9	70	60.7	3.14	3,261	549	±1,077	33.0%
2013	29	892	30.8	52	56.1	1.91	1,553	386	±757	48.7%
Joseph Creek basin										
2012	30	384	12.8	67	58.4	3.14	1,357	193	±380	28.0%
2013	26	384	14.8	153	51.5	1.91	2,197	476	±934	42.5%

Appendix Table B-20. Origin and count of adult steelhead encountered and passed at weirs within our sample area, spring 2013.

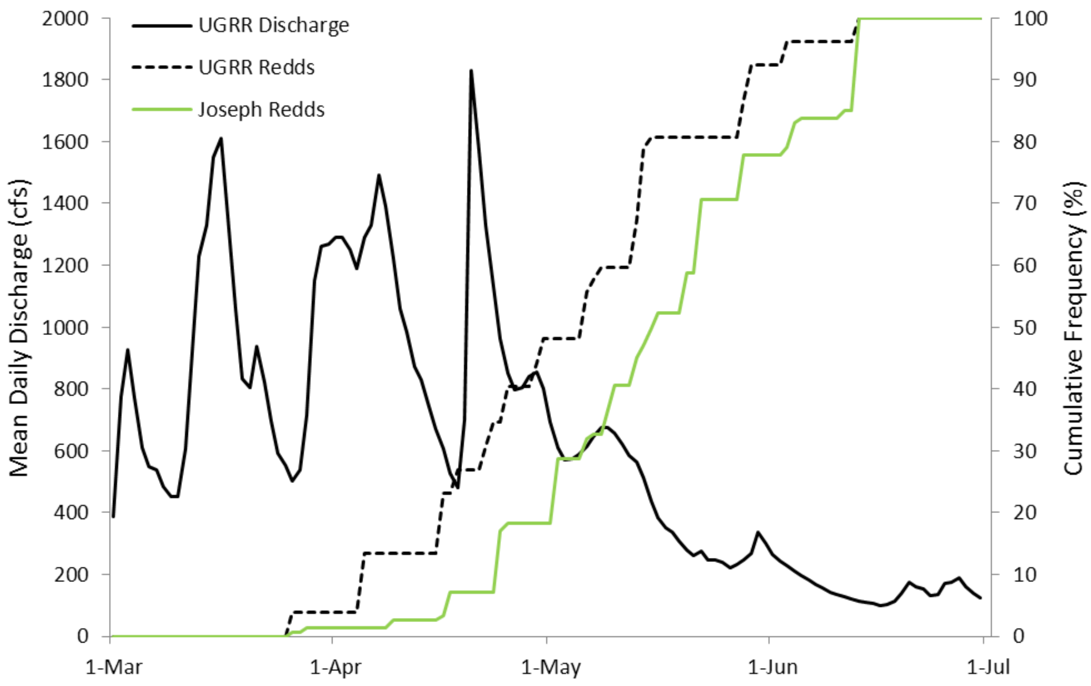
	Natural Origin	Hatchery Origin	Proportion Hatchery (%)	Total Steelhead
Joseph Creek	1,640	34	2.1	1,674
UGRR	28	0	0.0	28
Catherine Creek	171	0	0.0	171
Lookingglass Creek	157	2	1.3	159
Deer Creek	63	0	0.0	63

Appendix Table B-21. Survey characteristics and results, grouped by stream classification type for UGRR basin, 2013.

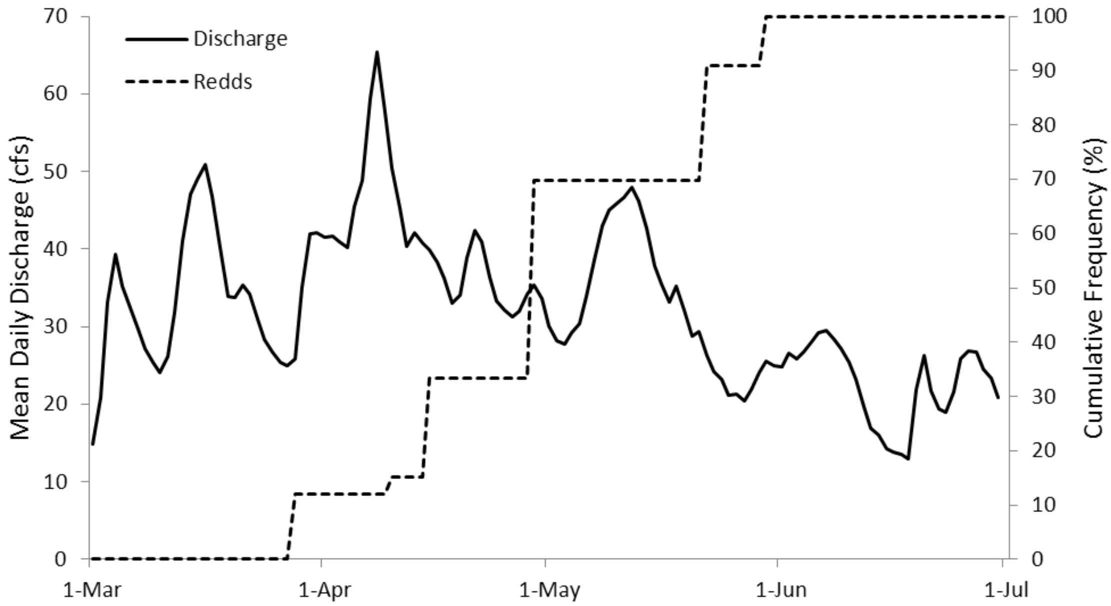
Stream Classification	No. of sites	Spawning habitat (km)	Weight value	Distance surveyed (km)	Total redds observed	Redds per km	Spawner escapement	Standard error	Lower 95%CI	Upper 95% CI
Source	8	453	56.6	15.7	2	0.1	110	64	-15	235
Transport	9	243	27.0	17.1	19	1.1	497	151	201	792
Depositional	12	197	16.4	23.3	31	1.3	494	185	131	857
Total	**29**	**892**	**30.8**	**56.1**	**52**	**0.9**	**1,101**	**247**	**616**	**1,585**

Appendix Table B-22. Survey characteristics and results, grouped by stream classification type for Joseph Creek basin, 2012.

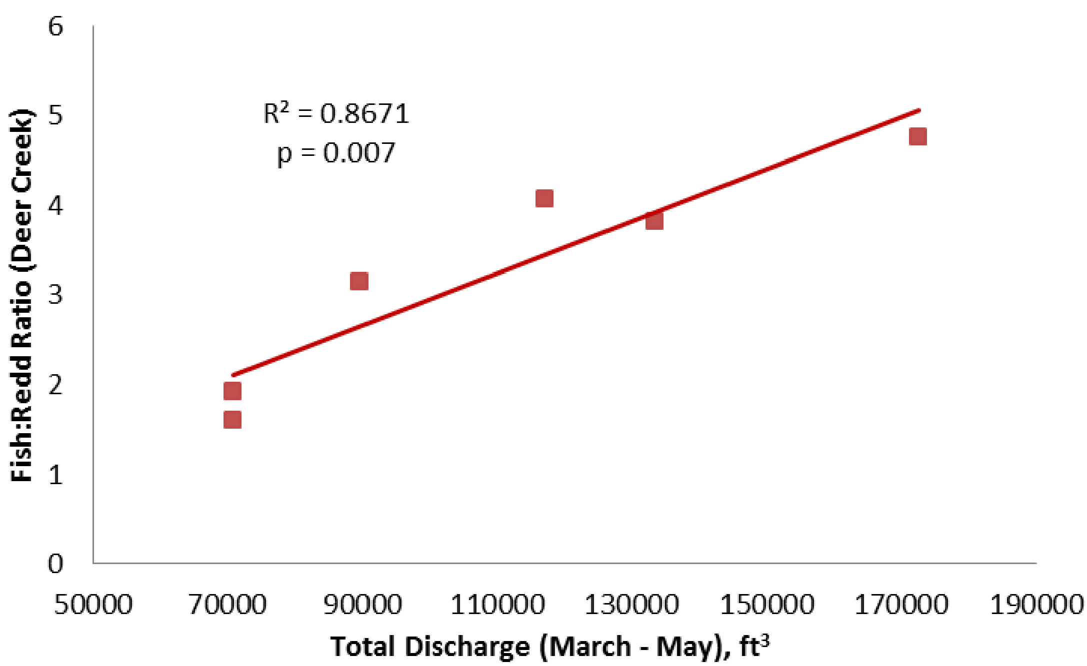
Stream Classification	No. of sites	Spawning habitat (km)	Weight value	Distance surveyed (km)	Total redds observed	Redds per km	Spawner escapement	Standard error	Lower 95%CI	Upper 95% CI
Source	11	159	14.5	21.6	53	2.5	747	386	-11	1,504
Transport	8	115	14.3	16.0	26	1.6	370	121	134	607
Depositional	7	111	15.8	14.0	74	5.3	1,124	252	631	1,617
Total	**26**	**384**	**14.8**	**51.5**	**153**	**3.0**	**2,241**	**477**	**1,306**	**3,175**



Appendix Figure B-21. Cumulative frequency of observed redds and mean daily discharge during the spawning period for the UGRR (USGS station #13318960) in 2013. The Joseph Creek gauge (WA DOE station ID 35G060) ceased operation in 2012.



Appendix Figure B-22. Cumulative frequency of observed redds and mean daily discharge during the spawning period for Deer Creek in 2013.



Appendix Figure B-23. Relationship between total discharge in UGRR (Perry Station) and the fish:redd ratio derived from Deer Creek surveys, 2008–2013.

WE N: Steelhead and Chinook Salmon Parr Surveys, and
WE O: Steelhead and Chinook Salmon Parr Density and Distribution

Appendix Table B-23. Basic descriptors and location of CHaMP survey sites sampled via snorkeling 2013.

Site ID	Stream	Easting	Northing	Mean BF Width(m)	Site Length(m)	Sample Method	Agency
cbw05583-013882	Peet Creek	373283	5013232	3.9	100	E-Fishing	ODFW
cbw05583-020282	Meadow Creek	383425	5011663	11.4	240	Snorkel	ODFW
CBW05583-031546	Grande Ronde River	390576	5007683	16.6	360	Snorkel	CRITFC
CBW05583-036266	Catherine Creek	446791	4996091	13.6	280	Snorkel	CRITFC
cbw05583-062890	Milk Creek	444485	4997219	3.8	120	E-Fishing	ODFW
CBW05583-071770	Grande Ronde River	397266	5017497	24.6	520	Snorkel	CRITFC
cbw05583-086186	Catherine Creek	428505	5007537	13	380	Snorkel	ODFW
cbw05583-095642	McCoy Creek	377392	5023146	6.5	160	E-Fishing	ODFW
CBW05583-099818	Grande Ronde River	398350	4989411	7.3	160	Snorkel	CRITFC
CBW05583-109658	Grande Ronde River	403826	5021688	34.3	600	Snorkel	CRITFC
cbw05583-135615	Gordon Creek	424807	5052336	5	120	Snorkel	ODFW
cbw05583-142490	Clark Creek	435844	5039110	7	151	Snorkel	ODFW
cbw05583-147626	Catherine Creek	436695	5002449	22.5	480	Snorkel	ODFW
CBW05583-204202	S.F. Catherine Creek	450416	4995568	8.6	200	Snorkel	CRITFC
cbw05583-228666	Sheep Creek	384623	4988280	5.1	126	Snorkel	ODFW
cbw05583-240730	Rock Creek	403993	5021641	5.7	114	Snorkel	ODFW
cbw05583-252730	Meadow Creek	389670	5012415	19.4	400	Snorkel	ODFW
CBW05583-253354	N.F. Catherine Creek	451111	4999024	14	280	Snorkel	CRITFC
cbw05583-269738	S.F. Catherine Creek	449897	4996010	8.1	200	Snorkel	ODFW
cbw05583-278698	Catherine Creek	435188	5003951	14.6	320	Snorkel	ODFW
CBW05583-294202	West Chicken Creek	389474	4989197	2.3	120	Snorkel	CRITFC
CBW05583-311466	Catherine Creek	439053	5000514	12.6	286	Snorkel	CRITFC
CBW05583-325034	Catherine Creek	444476	4997642	19.3	400	Snorkel	CRITFC
CBW05583-370490	Grande Ronde River	391992	5000498	16.5	360	Snorkel	CRITFC
cbw05583-382778	Burnt Corral Creek	382837	5006898	4.6	120	E-Fishing	ODFW
CBW05583-405674	Catherine Creek	434103	5005125	16	323	Snorkel	CRITFC
CBW05583-442266	Rock Creek	406178	5018511	9.6	200	Snorkel	CRITFC
CBW05583-449962	M.F. Catherine Creek	452002	4999939	5.2	120	Snorkel	CRITFC
CBW05583-468458	Grande Ronde River	395107	4992651	11.3	240	Snorkel	CRITFC
cbw05583-480666	Waucup Creek	372803	5016479	2	120	Snorkel	ODFW
CBW05583-502586	Fly Creek	388807	5003357	9.3	200	Snorkel	CRITFC
CBW05583-515498	N.F. Catherine Creek	452375	5001652	9.1	200	Snorkel	CRITFC
cbw05583-527786	Catherine Creek	445901	4996416	13.5	228	Snorkel	ODFW
dsgn4-000001	N.F. Catherine Creek	449378	4996719	11	255	Snorkel	ODFW
dsgn4-000006	West Chicken Creek	389645	4990436	6	113	Snorkel	ODFW
dsgn4-000009	Grande Ronde River	397787	4989997	6.7	160	Snorkel	CRITFC
dsgn4-000010	Catherine Creek	444089	4998107	13.4	298	Snorkel	CRITFC
dsgn4-000092	Spring Creek	400306	5020308	6	117	E-Fishing	ODFW
dsgn4-000094	Fly Creek	385822	4997835	8	157	Snorkel	ODFW
dsgn4-000161	S.F. Catherine Creek	455515	4994703	8.5	201	Snorkel	ODFW
dsgn4-000168	N.F. Catherine Creek	451458	5000050	9.9	208	Snorkel	ODFW
dsgn4-000202	Grande Ronde River	390902	5010925	20.3	452	Snorkel	CRITFC
dsgn4-000204	Catherine Creek	432089	5006604	11.8	255	Snorkel	CRITFC

Site ID	Stream	Easting	Northing	Mean BF Width(m)	Site Length(m)	Sample Method	Agency
dsgn4-000205	Grande Ronde River	400037	5018984	31.8	600	Snorkel	ODFW
dsgn4-000213	Meadow Creek	390655	5013164	14.6	320	Snorkel	ODFW
dsgn4-000245	Grande Ronde River	392832	5013601	30	620	Snorkel	CRITFC
dsgn4-000277	Grande Ronde River	392554	4998782	17.3	370	Snorkel	CRITFC
orw03446-025816	West Fork Ladd Creek	419661	5011643	2	120	E-Fishing	ODFW
ORW03446-071176	Milk Creek	443651	4998115	3.7	120	Snorkel	CRITFC
orw03446-084462	Lookingglass creek	432404	5065690	18	345	Snorkel	ODFW
orw03446-101102	Phillips Creek	423719	5046366	9.4	200	Snorkel	ODFW
ORW03446-101560	Meadow Creek	374245	5015653	8	160	Snorkel	ODFW
orw03446-118408	West Chicken Creek	389452	4987950	2.9	120	E-Fishing	ODFW
ORW03446-125832	Meadow Creek	378635	5013674	11	240	Snorkel	ODFW
orw03446-130904	Little Whiskey Creek	404707	5015302	2.7	120	E-Fishing	ODFW
orw03446-131128	Clark Creek	440652	5031108	5.4	120	Snorkel	ODFW
orw03446-139144	Meadow Creek	385211	5010725	11.3	240	Snorkel	ODFW
orw03446-157422	Phillips Creek	420877	5047063	6.8	160	Snorkel	ODFW

Appendix Table B- 24. Fish species observed during snorkel surveys, 2013. Species codes at bottom.

Site Id	**Stream**	**Date**	**Dominant Spp.**	**Spp. Present**
CBW05583-013882	Peet Creek	7/11	CT	ST, CT
CBW05583-020282	Meadow Creek	8/21	SD	ST, RS, NP, LD
CBW05583-031546	Grande Ronde River	8/20	SD	ST, CH, RS, NP, MW , LD, CN
CBW05583-036266	Catherine Creek	9/24	CH	ST, CH
CBW05583-062890	Milk Creek	7/18	CT	ST, CH, CT
CBW05583-071770	Grande Ronde River	8/22	SD	RS, NP LD , CT SU
CBW05583-086186	Catherine Creek	9/16	RS	ST, CH, RS, NP, MW, CT, SU
CBW05583-095642	McCoy Creek	7/22	SD	ST
CBW05583-099818	Grande Ronde River	8/21	CH	ST, CH, BT
CBW05583-109658	Grande Ronde River	9/27	RS	RS, CT
CBW05583-135615	Gordon Creek	7/16	ST	ST, CT
CBW05583-142490	Clark Creek	7/17	ST	ST, CH , NP, LD, CT
CBW05583-147626	Catherine Creek	9/9	CH	ST, CH, MW, LD, CT
CBW05583-204202	South Fork Catherine Creek	9/24	CH	ST, CH
CBW05583-228666	Sheep Creek	7/31	ST	ST
CBW05583-228666	Sheep Creek	8/21	ST	ST, RS, MW, LD, CT
CBW05583-228666	Sheep Creek	9/23	ST	ST, LD, CT
CBW05583-240730	Rock Creek	7/15	SD	ST , RS, NP, LD, SU
CBW05583-252730	Meadow Creek	8/1	SD	ST, RS, NP, LD, CT, SU
CBW05583-253354	North Fork Catherine Creek	9/25	ST	ST
CBW05583-269738	South Fork Catherine Creek	9/9	ST	ST, CT
CBW05583-278698	Catherine Creek	9/16	CH	ST, CH, MW, LD
CBW05583-311466	Catherine Creek	9/25	MW	ST, CH, MW
CBW05583-325034	Catherine Creek	9/23	CH	ST, CH, BT, MW
CBW05583-370490	Grande Ronde River	9/27	ST	ST, CH, CT
CBW05583-382778	Burnt Corral Creek	7/9	ST	ST, CT
CBW05583-405674	Catherine Creek	9/26	CH	ST, CH, MW
CBW05583-449962	Middle Fk Catherine Creek	9/26	BT	ST, BT
CBW05583-468458	Grande Ronde River	8/21	CH	ST, CH

Site Id	Stream	Date	Dominant Spp.	Spp. Present
CBW05583-480666	Waucup Creek	7/18	LD	ST, RS, LD, CT
CBW05583-502586	Fly Creek	8/22	ST	ST, CH, LD
CBW05583-515498	North Fork Catherine Creek	9/26	BT	ST, BT
CBW05583-527786	Catherine Creek	8/27	CH	ST, CH, MW
dsgn4-000001	North Fork Catherine Creek	8/27	ST	ST
dsgn4-000006	West Chicken Creek	7/15	CT	ST, CT
dsgn4-000006	West Chicken Creek	8/12	ST	ST, CT
dsgn4-000006	West Chicken Creek	9/4	ST	ST, LD, CT
dsgn4-000006	West Chicken Creek	10/10	ST	ST
dsgn4-000009	Grande Ronde River	7/30	CH	ST, CH, BT, CT
dsgn4-000009	Grande Ronde River	8/21	CH	ST, CH, MW
dsgn4-000009	Grande Ronde River	9/23	CH	ST, CH, MW
dsgn4-000009	Grande Ronde River	10/21	CH	CH, BT
dsgn4-000010	Catherine Creek	8/23	CH	ST, CH, LD
dsgn4-000092	Spring Creek	7/15	CT	ST, CH , NP, LD, CT
dsgn4-000094	Fly Creek	7/11	LD	ST, RS, LD, CT, SU
dsgn4-000094	Fly Creek	8/12	SU	ST, LD, CT, SU
dsgn4-000094	Fly Creek	9/4	SD	ST, LD, CT, SU
dsgn4-000094	Fly Creek	10/10	ST	ST, CH, SU
dsgn4-000161	South Fork Catherine Creek	8/28	ST	ST, BT
dsgn4-000168	North Fork Catherine Creek	9/24	ST	ST, BT
dsgn4-000202	Grande Ronde River	7/29	SD	ST, CH, RS, NP, LD, CT, SU
dsgn4-000202	Grande Ronde River	8/19	RS	ST, CH, RS, NP, CN, DACE, SU
dsgn4-000202	Grande Ronde River	9/24	RS	ST, CH, RS, NP, LD, CT, SU
dsgn4-000204	Catherine Creek	9/25	CH	ST, CH, MW
dsgn4-000205	Grande Ronde River	8/8	RS	ST, CH, RS, NP, CT, SU
dsgn4-000213	Meadow Creek	7/31	RS	ST, CH, RS, NP, LD, IC, CN, SU
dsgn4-000213	Meadow Creek	8/26	RS	ST, CH, RS, NP, LD, CM, CT, IC, CN, SU
dsgn4-000213	Meadow Creek	9/19	RS	ST, CH, RS, NP, CM, CT, CN, SU
dsgn4-000245	Grande Ronde River	8/20	SU	ST, CH, RS, NP, MW, LD, CT, CN, SU
dsgn4-000277	Grande Ronde River	7/30	CH	ST, CH, RS, MW, LD, CT, SU
dsgn4-000277	Grande Ronde River	8/20	CH	ST, CH, RS
dsgn4-000277	Grande Ronde River	9/24	CH	ST, CH, MW, LD, CT, SU
ORW03446-025816	West Fork Ladd Creek	7/8		No Fish
ORW03446-071176	Milk Creek	9/24	CH	ST, CH
ORW03446-084462	Lookingglass Creek	8/19	CH	ST, CH, BT, CT
ORW03446-101102	Phillips Creek	7/16	ST	ST
ORW03446-101560	Meadow Creek	7/22	SD	ST, RS, LD, CT, SU
ORW03446-101560	Meadow Creek	8/14	SD	ST, RS, NP, LD, CT, SU
ORW03446-101560	Meadow Creek	9/12	SD	ST, RS, NP, LD, CT, SU
ORW03446-118408	West Chicken Creek	7/9	ST	ST
ORW03446-125832	Meadow Creek	7/23	SD	ST, RS, NP, LD, CT
ORW03446-125832	Meadow Creek	8/13	SD	ST, RS, NP, LD, CT, SU
ORW03446-125832	Meadow Creek	9/17	SD	ST, CH, RS, LD, CT
ORW03446-130904	Little Whiskey Creek	7/8		No Fish
ORW03446-131128	Clark Creek	7/17	ST	ST
ORW03446-139144	Meadow Creek	8/21	RS	ST, RS, NP, LD, CT, SU
ORW03446-157422	Phillips Creek	7/16	ST	ST

Site Id	Stream	Date	Dominant Spp.	Spp. Present

Species Codes:

ST	steelhead/rainbow trout	LD	longnose dace
CH	Chinook salmon	SD	speckeled dace
BT	bull trout	CM	chiselmouth
RS	redside shiner	CT	Sculpin (cottidae)
NP	northern pikeminnow	IC	Catfish (ichthuluridae)
MW	mountain whitefish	CN	Sunfish (centrarchidae)
BS	bridgelip sucker	DACE	unknown dace
MS	mountain sucker	SU	unknown sucker
LS	largescale sucker		

Appendix Table B-25. Counts of steelhead and Chinook size and age classes (see methods) for CHaMP sites snorkeled in 2013.

			Steelhead Count					Chinook Count			
		FL (mm)→	70-130	130-200	200-250	>250		50-80	>100		
Site ID	Waterbody	Date	Age 1	Age 2	Age 3	Age 4+	Total	Age 0	Age 1+	Adult	Juv-Total
CBW05583-013882	Peet Creek	7/11	8	12	1	0	21	0	0	0	0
CBW05583-020282	Meadow Creek	8/21	4	0	0	0	4	0	0	0	0
CBW05583-031546	Grande Ronde River	8/20	18	19	3	0	40	82	0	0	82
CBW05583-036266	Catherine Creek	9/24	3	1	0	0	4	9	0	0	9
CBW05583-062890	Milk Creek	7/18	10	0	0	0	10	1	0	0	1
CBW05583-071770	Grande Ronde River	8/22	0	0	0	0	0	0	0	0	0
CBW05583-086186	Catherine Creek	9/16	454	53	0	0	507	1009	38	0	1047
CBW05583-095642	McCoy Creek	7/22	0	0	0	0	0	0	0	0	0
CBW05583-099818	Grande Ronde River	8/21	14	1	1	0	16	439	0	9	439
CBW05583-109658	Grande Ronde River	9/27	0	0	0	0	0	0	0	0	0
CBW05583-135615	Gordon Creek	7/16	48	18	3	0	69	0	0	0	0
CBW05583-142490	Clark Creek	7/17	77	10	1	0	88	11	0	0	11
CBW05583-147626	Catherine Creek	9/9	62	2	0	0	64	231	3	2	234
CBW05583-204202	South Fork Catherine Creek	9/24	4	3	2	0	9	28	1	0	29
CBW05583-228666	Sheep Creek	7/31	46	4	1	0	51	0	0	0	0
		8/21	49	9	0	1	59	0	0	0	0
		9/23	44	9	2	1	56	0	0	0	0
CBW05583-240730	Rock Creek	7/15	3	1	0	0	4	0	0	0	0
CBW05583-252730	Meadow Creek	8/1	2	2	1	0	5	0	0	0	0
CBW05583-253354	North Fork Catherine Creek	9/25	1	1	0	0	2	0	0	0	0
CBW05583-269738	South Fork Catherine Creek	9/9	6	4	2	0	12	32	1	0	33
CBW05583-278698	Catherine Creek	9/16	73	14	0	1	88	133	10	0	143
CBW05583-311466	Catherine Creek	9/25	2	1	0	0	3	4	0	0	4
CBW05583-325034	Catherine Creek	9/23	17	7	4	1	29	158	8	0	166
CBW05583-370490	Grande Ronde River	9/27	3	0	1	0	4	1	0	0	1
CBW05583-382778	Burnt Corral Creek	7/9	6	4	0	0	10	0	0	0	0
CBW05583-405674	Catherine Creek	9/26	12	17	2	1	32	96	0	0	96
CBW05583-449962	Middle Fork Catherine Creek	9/26	2	1	2	1	6	0	0	0	0
CBW05583-468458	Grande Ronde River	8/21	46	8	2	0	56	198	1	1	199
CBW05583-480666	Waucup Creek	7/18	8	5	1	0	14	0	0	0	0
CBW05583-502586	Fly Creek	8/22	106	11	0	0	117	15	0	0	15

			Steelhead Count					Chinook Count			
		FL (mm)→	70-130	130-200	200-250	>250		50-80	>100		
Site ID	Waterbody	Date	Age 1	Age 2	Age 3	Age 4+	Total	Age 0	Age 1+	Adult	Juv-Total
CBW05583-515498	North Fork Catherine Creek	9/26	1	0	1	1	3	0	0	0	0
CBW05583-527786	Catherine Creek	8/27	9	3	6	0	18	129	4	5	133
dsgn4-000001	North Fork Catherine Creek	8/27	1	0	0	0	1	0	0	0	0
dsgn4-000006	West Chicken Creek	7/15	12	2	0	0	14	0	0	0	0
		8/12	14	5	0	0	19	0	0	0	0
		9/4	13	3	1	0	17	0	0	0	0
		10/10	1	0	0	0	1	0	0	0	0
dsgn4-000009	Grande Ronde River	7/30	92	21	4	0	117	554	12	10	566
		8/21	25	7	3	0	35	345	1	1	346
		9/23	15	6	2	0	23	293	0	0	293
		10/21	0	0	0	0	0	4	0	0	4
dsgn4-000010	Catherine Creek	8/23	10	3	0	0	13	105	1	10	106
dsgn4-000092	Spring Creek	7/15	23	4	0	0	27	2	0	0	2
dsgn4-000094	Fly Creek	7/11	15	4	0	0	19	0	0	0	0
		8/12	16	2	1	0	19	0	0	0	0
		9/4	7	3	0	0	10	0	0	0	0
		10/10	8	2	1	0	11	1	0	0	1
dsgn4-000161	South Fork Catherine Creek	8/28	36	20	10	2	68	0	0	0	0
dsgn4-000168	North Fork Catherine Creek	9/24	4	1	3	1	9	0	0	0	0
dsgn4-000202	Grande Ronde River	7/29	107	29	1	0	137	49	10	0	59
		8/19	40	24	2	0	66	20	0	0	20
	Grande Ronde River	9/24	37	8	0	0	45	127	0	0	127
dsgn4-000204	Catherine Creek	9/25	9	10	2	0	21	88	0	0	88
dsgn4-000205	Upper Grande Ronde River	8/8	22	6	1	0	29	1	0	0	1
dsgn4-000213	Meadow Creek	7/31	30	16	1	1	48	4	0	0	4
		8/26	20	9	1	2	32	12	0	0	12
		9/19	41	7	3	2	53	4	0	0	4
dsgn4-000245	Grande Ronde River	8/20	13	1	1	1	16	2	0	0	2
dsgn4-000277	Grande Ronde River	7/30	70	3	0	0	73	84	3	3	87
		8/20	6	1	0	0	7	10	0	2	10
dsgn4-000277	Grande Ronde River	9/24	19	8	6	1	34	94	1	0	95
ORW03446-025816	West Fork Ladd Creek	7/8	0	0	0	0	0	0	0	0	0

			Steelhead Count					Chinook Count			
		FL (mm)→	70-130	130-200	200-250	>250		50-80	>100		
Site ID	Waterbody	Date	Age 1	Age 2	Age 3	Age 4+	Total	Age 0	Age 1+	Adult	Juv-Total
ORW03446-071176	Milk Creek	9/24	0	0	0	0	0	2	0	0	2
ORW03446-084462	Lookingglass Creek	8/19	700	295	91	14	1100	1168	43	0	1212
ORW03446-101102	Phillips Creek	7/16	11	5	0	0	16	0	0	0	0
ORW03446-101560	Meadow Creek	7/22	10	6	0	0	16	0	0	0	0
		8/14	28	8	0	0	36	0	0	0	0
		9/12	15	4	1	0	20	0	0	0	0
ORW03446-118408	West Chicken Creek	7/9	17	5	0	0	22	0	0	0	0
ORW03446-125832	Meadow Creek	7/23	27	6	0	1	34	0	0	0	0
		8/13	72	22	7	2	103	0	0	0	0
		9/17	31	11	1	1	44	3	0	0	3
ORW03446-130904	Little Whiskey Creek	7/8	0	0	0	0	0	0	0	0	0
ORW03446-131128	Clark Creek	7/17	53	9	0	0	62	0	0	0	0
ORW03446-139144	Meadow Creek	8/21	12	2	1	0	15	0	0	0	0
ORW03446-157422	Phillips Creek	7/16	13	10	0	0	23	0	0	0	0
	GRAND TOTAL		2833	808	180	35	3856	5548	137	43	5686

Appendix Table B-26. Density of juvenile Chinook salmon (CH) and steelhead (ST) observed during snorkel surveys, 2013. Fastwater units include riffles, cascades and rapids.

			Density (fish/100m2) – Snorkel/Efish correction factor used					
			Pool Units		Run Units		Fastwater Units	
Site ID	Stream Name	Date	ST	CH	ST	CH	ST	CH
CBW05583-013882	Peet Creek	7/11	41.48	0.00	21.53	0.00	0.00	0.00
CBW05583-020282	Meadow Creek	8/21	NA	NA	0.67	0.00	0.74	0.00
CBW05583-031546	Grande Ronde River	8/20	5.35	8.23	3.46	20.68	2.46	4.26
CBW05583-036266	Catherine Creek	9/24	3.49	12.76	NA	NA	1.35	1.35
CBW05583-062890	Milk Creek	7/18	12.95	0.00	0.00	4.06	1.51	0.00
CBW05583-071770	Grande Ronde River	8/22	0.00	0.00	0.00	0.00	0.00	0.00
CBW05583-086186	Catherine Creek	9/16	32.30	83.82	96.34	319.98	54.85	22.74
CBW05583-095642	McCoy Creek	7/22	0.00	0.00	0.00	0.00	0.00	0.00
CBW05583-099818	Grande Ronde River	8/21	4.53	152.59	NA	NA	4.19	73.27
CBW05583-109658	Grande Ronde River	9/27	0.00	0.00	0.00	0.00	0.00	0.00
CBW05583-135615	Gordon Creek	7/16	160.61	0.00	12.85	0.00	2.57	0.00
CBW05583-142490	Clark Creek	7/17	101.22	7.26	45.74	14.87	7.31	1.17
CBW05583-147626	Catherine Creek	9/9	1.95	8.47	NA	NA	3.00	10.31
CBW05583-204202	South Fork Catherine Creek	9/24	6.37	23.00	NA	NA	3.19	3.19
CBW05583-228666	Sheep Creek	9/23	57.29	0.00	17.72	0.00	8.86	0.00
CBW05583-228666	Sheep Creek	8/21	67.94	0.00	17.72	0.00	5.16	0.00
CBW05583-228666	Sheep Creek	7/31	56.43	0.00	0.00	0.00	6.09	0.00
CBW05583-240730	Rock Creek	7/15	5.81	0.00	0.00	0.00	0.64	0.00
CBW05583-252730	Meadow Creek	8/1	2.02	0.00	0.19	0.00	0.00	0.00
CBW05583-253354	North Fork Catherine Creek	9/25	0.84	0.00	NA	NA	0.43	0.00
CBW05583-269738	South Fork Catherine Creek	9/9	4.60	7.33	0.00	0.00	1.33	6.31
CBW05583-278698	Catherine Creek	9/16	11.92	31.09	3.36	20.24	4.60	2.74
CBW05583-311466	Catherine Creek	9/25	0.81	1.23	0.35	0.35	0.00	0.00
CBW05583-325034	Catherine Creek	9/23	3.26	26.82	0.49	0.51	0.98	1.02
CBW05583-370490	Grande Ronde River	9/27	0.16	0.16	0.00	0.00	0.76	0.00
CBW05583-382778	Burnt Corral Creek	7/9	5.40	0.00	15.03	0.00	5.27	0.00
CBW05583-405674	Catherine Creek	9/26	6.33	35.90	1.15	6.16	1.68	0.00
CBW05583-449962	Middle Fork Catherine Creek	9/26	4.59	0.00	NA	NA	0.00	0.00
CBW05583-468458	Grande Ronde River	8/21	58.22	207.42	35.57	189.77	16.61	51.70
CBW05583-480666	Waucup Creek	7/18	31.20	0.00	10.86	0.00	0.00	0.00
CBW05583-502586	Fly Creek	8/22	48.69	7.39	84.07	34.14	53.18	0.00
CBW05583-515498	North Fork Catherine Creek	9/26	2.84	0.00	NA	NA	0.00	0.00
CBW05583-527786	Catherine Creek	8/27	2.23	10.26	1.82	22.44	0.60	10.67
dsgn4-000001	North Fork Catherine Creek	8/27	0.00	0.00	NA	NA	0.13	0.00
dsgn4-000006	West Chicken Creek	10/10	2.49	0.00	0.00	0.00	0.00	0.00
dsgn4-000006	West Chicken Creek	9/4	33.25	0.00	10.49	0.00	0.00	0.00
dsgn4-000006	West Chicken Creek	8/12	20.28	0.00	30.33	0.00	0.00	0.00
dsgn4-000006	West Chicken Creek	7/15	17.82	0.00	19.46	0.00	0.00	0.00
dsgn4-000009	Grande Ronde River	10/21	0.00	1.72	0.00	0.00	0.00	0.40
dsgn4-000009	Grande Ronde River	9/23	8.60	108.43	11.36	84.30	2.06	40.28

			Density (fish/100m2) – Snorkel/Efish correction factor used					
			Pool Units		Run Units		Fastwater Units	
Site ID	Stream Name	Date	ST	CH	ST	CH	ST	CH
dsgn4-000009	Grande Ronde River	8/21	11.46	154.77	7.41	223.74	9.84	23.74
dsgn4-000009	Grande Ronde River	7/30	23.79	229.18	31.42	215.52	30.34	57.57
dsgn4-000010	Catherine Creek	8/23	0.77	13.28	4.70	15.57	1.36	0.00
dsgn4-000092	Spring Creek	7/15	14.98	4.99	15.57	0.00	4.95	0.38
dsgn4-000094	Fly Creek	10/10	6.91	0.00	2.79	0.00	3.35	0.66
dsgn4-000094	Fly Creek	9/4	10.33	0.00	1.40	0.00	2.04	0.00
dsgn4-000094	Fly Creek	8/12	19.21	0.00	4.19	0.00	3.52	0.00
dsgn4-000094	Fly Creek	7/11	6.91	0.00	4.33	0.00	8.50	0.00
dsgn4-000161	South Fork Catherine Creek	8/28	18.15	0.00	NA	NA	12.68	0.00
dsgn4-000168	North Fork Catherine Creek	9/24	0.00	0.00	NA	NA	1.81	0.00
dsgn4-000202	Grande Ronde River	9/24	5.00	7.68	0.60	8.66	1.35	1.98
dsgn4-000202	Grande Ronde River	8/19	1.27	0.28	0.21	0.00	1.79	3.83
dsgn4-000202	Grande Ronde River	7/29	6.75	1.01	5.48	0.00	7.86	1.98
dsgn4-000204	Catherine Creek	9/25	5.78	24.77	0.00	2.49	8.59	21.50
dsgn4-000205	Grande Ronde River	8/8	0.41	0.20	0.40	0.00	0.83	0.00
dsgn4-000213	Meadow Creek	9/19	3.19	0.28	0.88	0.00	7.32	0.59
dsgn4-000213	Meadow Creek	8/26	1.71	0.43	1.39	0.80	2.66	0.87
dsgn4-000213	Meadow Creek	7/31	3.19	0.59	2.64	0.00	1.77	0.00
dsgn4-000245	Grande Ronde River	8/20	0.32	0.00	0.13	0.00	0.86	0.00
dsgn4-000277	Grande Ronde River	9/24	NA	NA	1.37	7.56	1.81	4.37
dsgn4-000277	Grande Ronde River	8/20	NA	NA	1.20	2.21	1.07	0.51
dsgn4-000277	Grande Ronde River	7/30	NA	NA	4.72	7.26	3.60	3.88
ORW03446-025816	West Fork Ladd Creek	7/8	0.00	0.00	0.00	0.00	0.00	0.00
ORW03446-071176	Milk Creek	9/24	0.00	4.81	0.00	0.00	0.00	0.00
ORW03446-084462	Lookingglass Creek	8/19	118.41	192.31	NA	NA	41.59	36.07
ORW03446-101102	Phillips Creek	7/16	12.58	0.00	0.00	0.00	0.00	0.00
ORW03446-101560	Meadow Creek	9/12	8.80	0.00	4.75	0.00	0.00	0.00
ORW03446-101560	Meadow Creek	8/14	17.15	0.00	5.99	0.00	0.00	0.00
ORW03446-101560	Meadow Creek	7/22	7.62	0.00	2.18	0.00	0.00	0.00
ORW03446-118408	West Chicken Creek	7/9	27.16	0.00	13.48	0.00	7.73	0.00
ORW03446-125832	Meadow Creek	9/17	13.76	1.32	4.35	0.00	2.76	0.00
ORW03446-125832	Meadow Creek	8/13	35.91	0.00	12.37	0.00	1.79	0.00
ORW03446-125832	Meadow Creek	7/23	14.26	0.00	1.23	0.00	0.00	0.00
ORW03446-130904	Little Whiskey Creek	7/8	0.00	0.00	0.00	0.00	0.00	0.00
ORW03446-131128	Clark Creek	7/17	35.99	0.00	34.63	0.00	30.41	0.00
ORW03446-139144	Meadow Creek	8/21	3.62	0.00	1.36	0.00	2.98	0.00
ORW03446-157422	Phillips Creek	7/16	16.90	0.00	3.54	0.00	0.52	0.00

Appendix Table B-27. Density and site level abundance estimates for Steelhead (ST) and Chinook salmon (CH) captured with electrofishing methods, 2013.

SiteID	Stream	Date	ST Density (fish/100m2)	ST Est. (fish/site)	CH Density (fish/100m2)	CH Est. (fish/site)
CBW05583-013882	Peet Creek	6/18	21.63	36.75	0	0.00
CBW05583-062890	Milk Creek	7/1	4.57	17.50	0.46	1.75
CBW05583-095642	McCoy Creek	7/12	0	0.00	0	0.00
CBW05583-382778	Burnt Corral Creek	6/24	6.12	17.50	0	0.00
dsgn4-000092	Spring Creek	6/20	7.65	47.25	0.57	3.50
ORW03446-025816	West Fork Ladd Cr.	6/17	0	0.00	0	0.00
ORW03446-118408	West Chicken Creek	6/26	14.52	38.50	0	0.00
ORW03446-130904	Little Whiskey Creek	6/24	0	0.00	0	0.00

Appendix Table B-28. Capture statistics for sites where electrofishing was used instead of snorkeling, 2013.

Site ID	Creek Name	Date	Species	CPUE (fish/hr)	Non-salmonids
CBW05583-013882	Peet	7/11	ST	88.4	CT (ab)
CBW05583-062890	Milk	7/18	CH	2.8	CT (ab)
			ST	47.0	
CBW05583-095642	McCoy	7/22	ST	15.0	SD (ab)
CBW05583-382778	Burnt Corral	7/9	ST	35.9	CT (ra)
dsgn4-000092	Spring	7/15	CH	4.3	CT (ab), SD (ra),
			ST	182.3	LD (ra), NP (ra)
			YOY	2.1	
ORW03446-025816	W.F. Ladd	7/8	No Fish		None
ORW03446-118408	West Chicken	7/9	ST	113.9	None
ORW03446-130904	Little Whiskey	7/8	No Fish		

ab = abundant, cmn = common, ra = rare

Appendix C: List of Metrics and Indicators

Metrics collected by this project include:

- Abundance of juvenile spring Chinook salmon migrants
- Length of spring Chinook salmon migrants
- Survival of spring Chinook salmon migrants to Lower Granite Dam from several life stages
- Abundance of juvenile steelhead migrants
- Probability of surviving and migrating to Lower Granite Dam of juvenile steelhead migrants
- Age of juvenile steelhead migrants
- Length of juvenile steelhead migrants by age
- Steelhead redd abundance in the Upper Grande Ronde River Watershed and in the Joseph Creek Watershed
- Density and distribution of steelhead and Chinook salmon parr in the upper Grande Ronde River Watershed

Indicators calculated by this project include:

- Number of spring Chinook salmon smolt equivalents produced by population
- Number of spring Chinook salmon smolt equivalents produced per spawner by population
- Adult steelhead escapement in the Upper Grande Ronde River Watershed and in the Joseph Creek Watershed