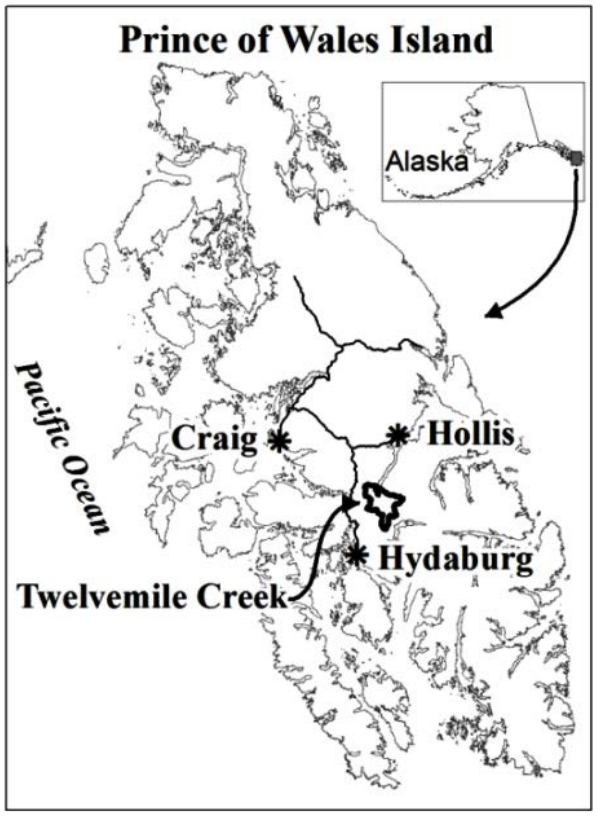
Appendix C. Twelvemile Creek Juvenile Salmonid Smolt Investigation Summary Report, FY2014

The work captured in this summary report is a component of the overall Tongass Watershed Restoration Effectiveness Monitoring (WREM) program, and while it stands alone as a contribution to the management of anadromous salmonids and their habitat, it also plays a key role within the WREM program.

Enumerating the number of smolts or downstream migrants emigrating from a watershed or a stream reach is a critical parameter for habitat restoration projects for anadromous fishes. Solazzi et al. (2000), Cederholm et al. (1997), Reeves et al. (1997) used downstream migrant traps to estimate the number of smolts produced from stream reaches and watershed restoration efforts. Smolt traps can be an effective tool for assessing watershed-scale success of habitat restoration actions on anadromous fish production and survival. On small streams including tributaries, a weir with downstream migrant trap can be constructed to estimate the number of migrating fish moving out of a particular sub-watershed. Rotary screw traps are used on larger rivers. A five foot rotary screw trap and downstream weirs with box traps were used in the Twelvemile Creek watershed to capture smolt to estimate growth, survival, and a suite of other life history characteristics.

Investigation Area

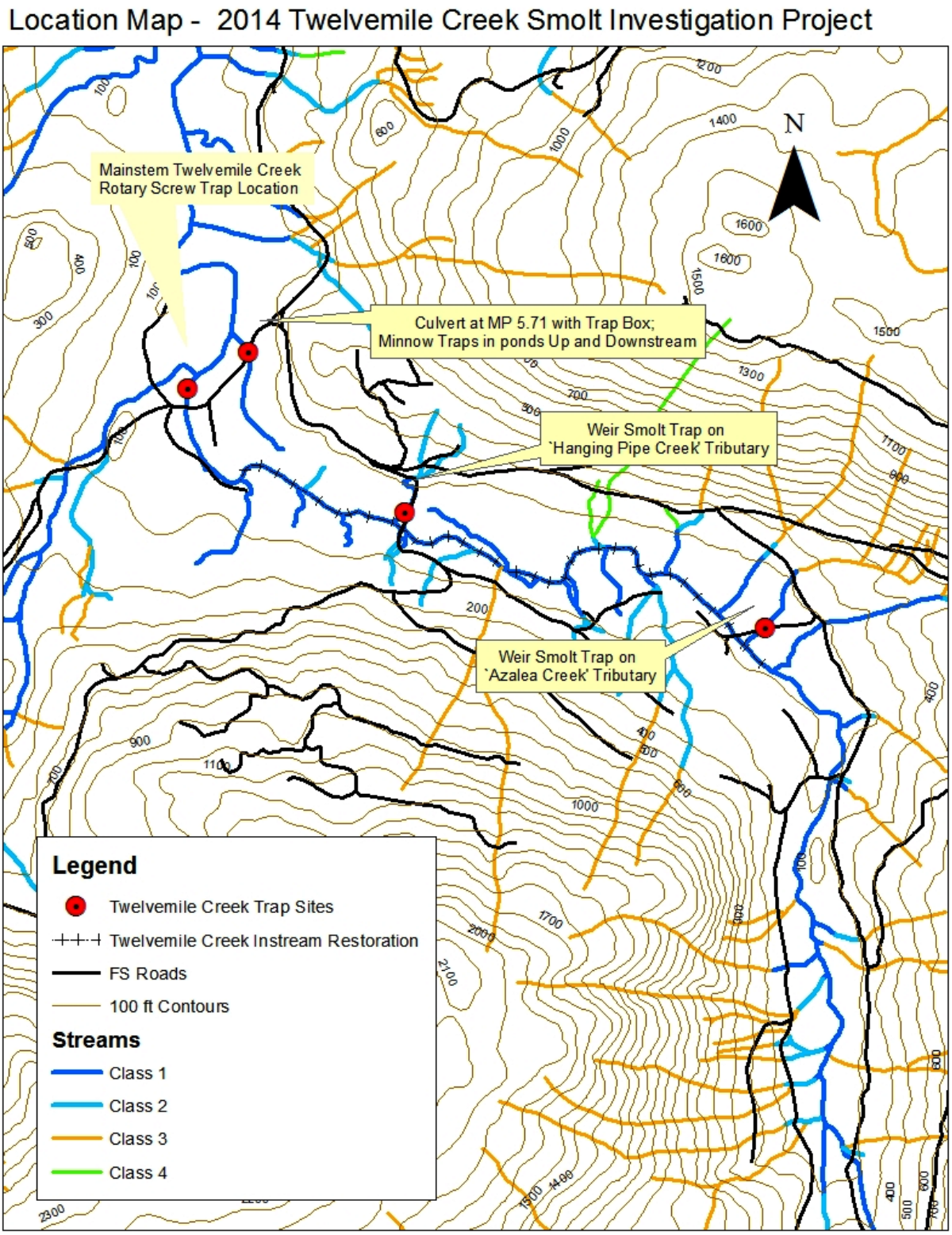
Twelvemile Creek (Figure 1) is located on Prince of Wales Island, southeast of the community of Craig and north of the community of Hydaburg. Twelvemile Creek, (ADF&G Catalog Number 102-60-10720) is listed as a producer of coho, pink, and chum salmon and steelhead trout in the ADF&G Catalog of Waters Important for Spawning, Rearing, and Migration of Anadromous Fishes. A network of forest roads are present, the result of previous timber harvest. Tributary instream log placement projects and riparian thinning were initiated in 2007 and 2012 and mainstem log placement and off-channel reconnections were implemented in 2012-2013.



Twelvemile Creek Table 1. Location of Prince of Wales Island and Twelvemile Creek in Southeast Alaska

The mainstem location of the rotary screw trap allows for nearly complete watershed population estimates such as the majority of coho salmon and steelhead smolt emigrating from Twelvemile Creek, with the exception of the contribution from Cave Creek (tributary of Twelvemile Creek) and a palustrine channel that enters the river opposite from Cave Creek confluence. In addition to the rotary screw trap operation, traps with live boxes were positioned within two small tributary streams in Twelvemile Creek, Azalea Creek and Hanging Creek to capture all outmigrating fish (Figure 2). An additional two traps were placed in lower Twelvemile drainage at outlets of beaver pond complexes which drain into the estuary.

The Twelvemile Creek watershed supports coho, pink, and chum salmon, as well as steelhead and cutthroat trout, and Dolly Varden char. Other fish species include sculpin *Cottus* spp., stickleback and eulachon in the lowest estuary-floodplain transitional mainstem reach.



Twelvemile Creek Figure 2. Locations of outmigration traps on Twelvemile Creek during 2014

Project Objectives

1. Estimate emigrating juvenile coho salmon and steelhead in the Twelvemile watershed (mid-April through the end of May).
2. Document the timing, size, and age distribution of migrating coho salmon, Dolly Varden, and steelhead trout.
3. Coded wire tag (CWT) a portion of the emigrating coho smolts to enable the determination of marine survival and harvest rates for Twelvemile Creek.

Additional tasks for the 2013 field season:

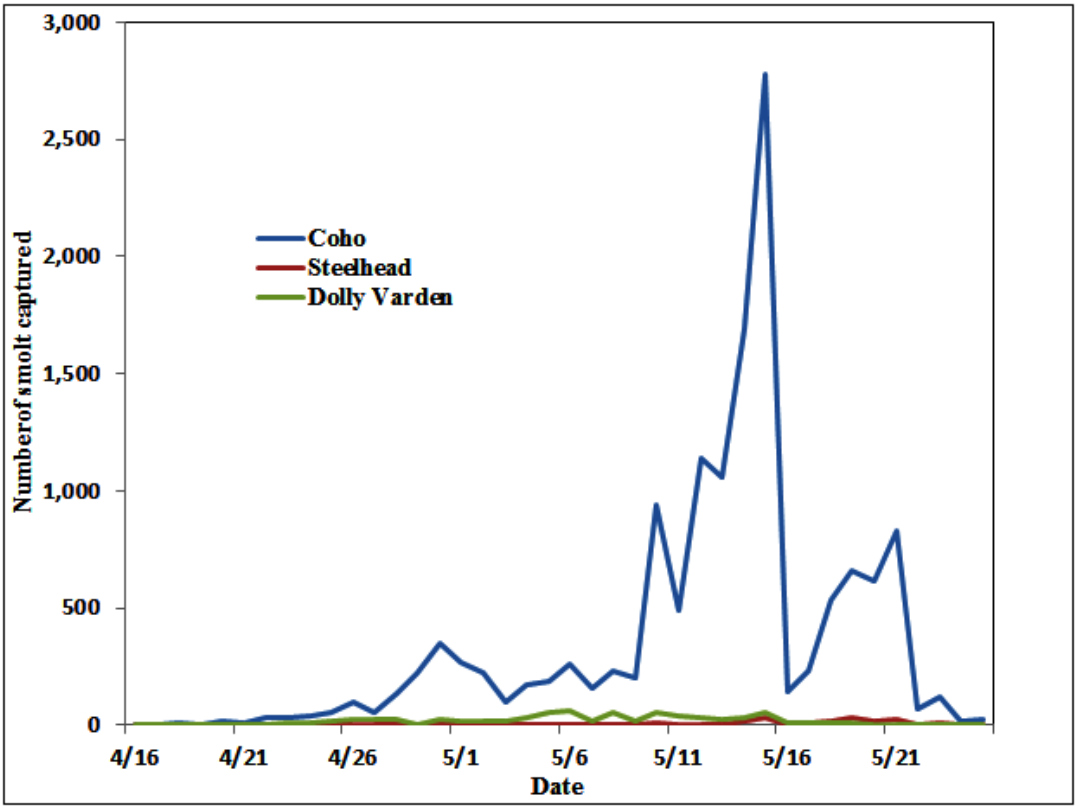
1. Count all salmonids (other than coho and steelhead) encountered at the smolt weirs and screw trap.
2. Count all non-salmonids (i.e., sculpin) encountered at the smolt weirs and screw trap.
3. Weigh and measure any previously PIT tagged fish captured.
4. Determine the condition factor using the fish length and weight data.

In fall 2014, adult coho escapement will be monitored and sampled for marked CWT coho to determine ocean exploitation and survival rates.

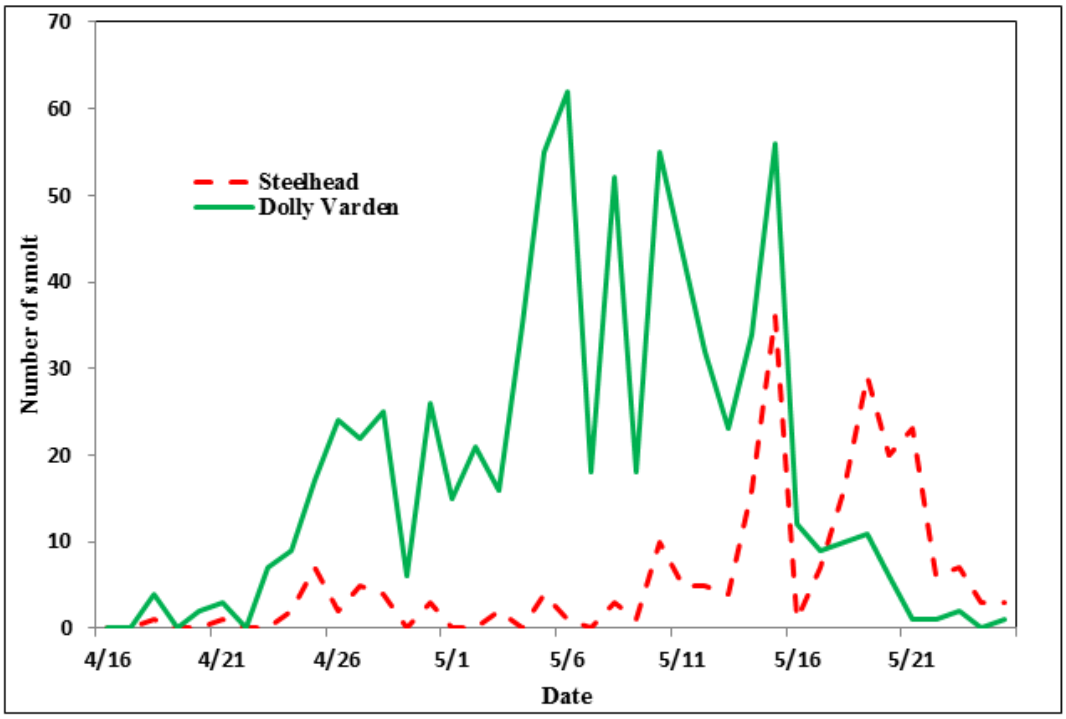
Draft Results

Main Stem Trapping

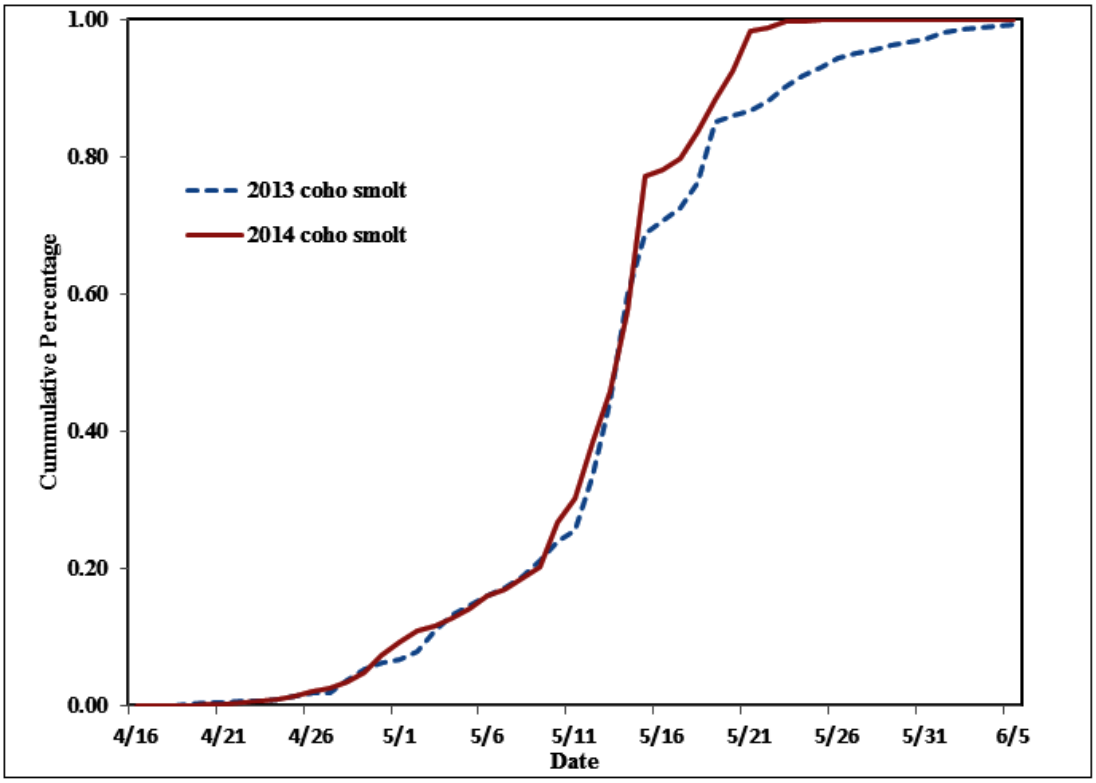
A 5-foot rotary screw trap was operated in mainstem Twelvemile Creek from April 15 through May 25, 2013 during the peak of the coho salmon smolt out-migrant season. Along with the screw trap, juvenile emigrants were also captured at remote locations in the lower Twelvemile drainage. Emigration timing appeared very similar to 2013, assuming the number of smolt captured is somewhat indicative of run timing. A total of 14,199 coho salmon smolt, 205 steelhead smolt, and 733 Dolly Varden smolt were captured in the screw trap (Figures 3 and 4). The total number of smolt captured by the screw trap was higher in 2014 than in 2013 for all three species of smolt; 14,199 vs 8,467 for coho, 205 vs 100 for steelhead, and 733 vs 595 for Dolly Varden (Figure 5). It is unclear at this point if this is due to increased abundance in 2014 or capturing a larger proportion of the emigration, or a combination of the two. A total of 18,309 coho salmon smolt were coded wire tagged in 2014 with 18 post-tagging mortalities for a total of 18,291 tagged coho released.



Twelvemile Creek Figure 3. Daily number of coho, steelhead and Dolly Varden smolt captured in the screw trap on Twelvemile Creek, 2014



Twelvemile Creek Figure 4. Daily number of steelhead and Dolly Varden smolt captured in the Twelvemile Creek screw trap, 2014.



Twelvemile Creek Figure 5. The cumulative portion of the 2013 and 2014 Twelvemile Creek coho smolt emigrations captured in the screw trap.

Because the screw trap fails to sample 100 percent of the water column, only a portion of the total number of downstream migrants are captured. A variety of factors, including changing streamflow, changing fish size, behavior, and species composition can influence the proportion of the total migrant population captured by the trap (trap efficiency). To address this, mark-recapture experimentation utilizing catch and an estimate of trap efficiency on a daily basis were used to estimate species smolt abundance. Recapture rates for coho and Dolly Varden used in efficiency tests were both higher in 2014 than in 2013: 18.3 percent vs 14.3 percent for coho and 5.1 percent vs 1.7 percent for Dolly Varden; but lower for steelhead, 11.0 percent vs 13.0 percent. Catches were expanded based on seasonal trap efficiency estimates and resulted in estimates of 80,677 (SE 2,995) coho salmon smolt; 1,983 (SE 361) steelhead smolt; and 14,794 (SE 2,249) Dolly Varden smolt for the 2014 season. Potential bias lies in some aspects of the trap efficiency assumptions; thus these are considered very general estimates. Overall, the smolt monitoring provided valuable information on species diversity, fish size and condition.

In addition to the screw trap, two box and weir traps were installed within the lower portion of the watershed to capture coho smolt from two beaver pond complexes downstream of the screw trap site. The primary purpose of capturing and tagging these additional coho smolt was to increase the precision and accuracy of a smolt abundance estimate, as well as marine survival and marine harvest estimates, of coho smolt from the Twelvemile Creek watershed. Using a two-event mark-recapture experiment, where marking the smolt with an adipose fin clip is event one, and event two is sampling returning mature fish for marks, abundance of smolt can be estimated using Chapman's modification of the Petersen estimator for a closed population. A total of 18,309 coho salmon smolt were coded wire tagged in 2014 with 18 post-tagging mortalities for a total of 18,291 tagged coho released.

A systematic sample of every 35th coho smolt was measured for length and weight and had a scale sample

taken to estimate age. This resulted in an unbiased sample of 405 smolt from the screw trap, 82 smolt from the estuary beaver ponds, and 38 from the culvert beaver ponds. Tables 1 and 2 provide a summary of the length, weight and age data for sampled coho smolt. Scale-derived age data is considered estimated age. Based on circuli patterns and the size of the fish, it was assumed that the specialist who read the scales correctly estimated the age on the vast majority of the samples. Having aged scales in the past with the aid of being able to compare scale samples to 'known age sample', the specialist understood that ages are often over-estimated due to the appearance of a 'false annulus'. It was suspected that the majority of the Twelvemile samples had a false annulus as most of the fish had a small section of tight circuli at about the third circuli.

Twelvemile Creek Table 1. Estimated age composition, and mean length- and weight-at-age of emigrating coho smolt captured in the screw trap at Twelvemile Creek in 2014.

	Age 1	Age 2	All smolt[1]
Sample size	342	58	405
Estimated composition (percent)	85.5	14.5	100
SE composition (percent)	1.7	1.7	
Mean length (mm)	85.3	101.0	87.7
SE mean length	0.5	1.4	0.5
Mean weight (g)	6.2	10.0	6.7
SE mean weight	0.1	0.5	0.1

[1] Includes 5 smolt that were not successfully aged due to regenerated scales.

Twelvemile Creek Table 2. Estimated age composition, and mean length- and weight-at-age of emigrating coho smolt captured from the beaver ponds (estuary and culvert traps combined) at Twelvemile Creek in 2014.

	Age 1	Age 2	All smolt[1]
Sample size	97	20	117
Estimated composition (percent)	82.9	17.1	100
SE composition (percent)	3.4	3.4	
Mean length (mm)	84.9	102.2	88.0
SE Mean length	0.9	2.6	0.6
Mean weight (g)	5.5	9.7	6.2
SE mean weight	1.0	1.5	0.0

[1] Includes 2 smolt that were not successfully aged due to regenerated scales.

Tributary Traps

A weir and box trap were installed in Hanging Pipe Creek on April 15 in about the same location as in 2013. The trap was fished continuously until it was dismantled on May 22. The trap appeared fish tight for the entire season. A total of 16 fish were captured during the season at Hanging Pipe, including 2 steelhead smolt with PIT tags. On most days no fish were captured and the channel was often dry near the trap.

A weir and box trap were also installed at Azalea Creek on April 15. The trap was fished continuously until it was dismantled on May 24. The trap appeared fish tight for the entire season. A total of 686 fish were captured at Azalea Creek for the season, predominantly steelhead parr (44 percent of all fish), followed by coho smolt (22 percent), and Dolly Varden parr (19 percent). Overall, 3 times as many fish were captured in 2014 as the previous year in Azalea Creek.

Discussion

Project objectives were met during the 2014 field season. Recommendations for 2015 include improve the current study plan, install hobo temperature probes in various locations within the system, consider how best to analyze efficiency data for smolt estimates and compare to mark-recapture event using CWT coho and adult fish captured in the river.

Citations

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Reeves, G.H., D.B. Hohler, B.E. Hansen, F.H. Everest, J.R. Sedell, T.L. Hickman and D. Shively. 1997. Fish habitat restoration in the Pacific Northwest: Fish Creek of Oregon. In: J.E. Williams, C.A. Wood, and M.P. Dombeck, editors. Watershed restoration: principles and practices. American Fisheries Society. Bethesda, Maryland: 335-359.

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