Euchre Creek Large Wood Placement Effectiveness Monitoring - Juvenile Snorkel Survey: 2005, 07, 09, 11, 13

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Prepared by
South Coast Watershed Council &
Swanson Ecological Services, LLC
Gold Beach, OR 97444

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Introduction

In 2004 the South Coast Watershed Council submitted a grant application to the Siskiyou National Forest Resource Advisory Committee (RAC), requesting Title II funding for a large wood project on the mainstem of Euchre Creek; located upstream of the Boulder Creek confluence. Implementation was planned for 2005, but postponed until 2006 because of administrative delays. The project proposal called for the placement of 50 whole trees within a 2-mile reach of Euchre Creek, extending from Boulder Creek upstream to the confluence with Crew Canyon Creek. Within this reach the channel is low gradient (<0.5%), and moderately unconfined with alternating floodplain terraces; the active channel width averages 61 feet. Willow and 20-year-old red alder dominate the riparian area, though some segments are forested with mature myrtle and big leaf maple, and a scattering of second growth conifers.

Approximately 20 whole trees averaging 80 feet in length were pulled over from upslope of the riparian area, on the west side of the channel, using a ground-based "tree puller" stationed on the east side of the stream. The trees were yarded into the channel with rootwads and branches intact, and pinned into the riparian vegetation to create 5 large wood structures. These structures were concentrated in the upstream mile of the proposed project area, where suitable trees were available and equipment could be staged; the farthest upstream structure was built just upstream of the confluence with Crew Canyon Creek. The reduction in placements from 50 trees to 20 trees was due to fiscal constraints, which resulted from difficult site conditions and a failure to secure matching funds.

In 2010 seventeen additional wood structures were built within the 2006 project reach, using approximately 75 "key" pieces of wood; funding was provided through an OWEB restoration grant and an ODFW Landowner Incentive Program grant. Trees were harvested from 3 upland sites using ground based equipment, transported to the project area on log trucks, and placed with an excavator. Most "key" pieces had rootwads attached, and measured 20-24 inches in diameter and 40-50 feet in length. The structures were built (wedged) into the existing riparian vegetation to provide stability – no cable, boulders, or pins were used. The project area was planted following implementation.

Juvenile salmonid snorkel surveys have been used to monitor project effectiveness, on the premise that improved habitat conditions would specifically benefit summer rearing. Pre-implementation conditions were captured in 2005, both within the project area and within two adjacent control reaches; these reaches were resurveyed in 2007, 09, 2011 and again in 2013. Data from these surveys have been analyzed; the results are the subject of this report.

Methodology

In July 2005 Monte Verde Diving Research was contracted to conduct a Rapid Bio-Assessment snorkel survey on approximately 3 miles of Euchre Creek, to document pre-

project juvenile salmonid presence and abundance. The survey was designed with 2 control reaches: 1 mile downstream and 1 mile upstream of the proposed project area. Within the control reaches every 5th pool was snorkeled; within the project segment the protocol was modified to include every pool, so that total fish production would not be skewed by the redistribution of fish into pools with wood. Throughout the survey habitat units were broken into pools, glides, and riffles; unit lengths were estimated; and at each snorkeled pool unit width and length were estimated and measured (meters). Each snorkeled pool was also given a *Cover Rating* between 1-5, where 1 represented a simple pool and 5 represented a highly complex pool. Complexity was based on a number of factors, including: pool depth, undercut banks, overhanging vegetation, large wood, and varied flow patterns. *Visibility* was also noted for every snorkeled pool.

In late July/early August 2007 the project area and the 2 control reaches were resurveyed, to document post-implementation conditions. The survey was conducted by a 2-person crew consisting of a Watershed Council employee with 4 years of snorkel experience with the Oregon Department of Fish and Wildlife (ODFW), and a contractor with Swanson Ecological Services, LLC. The protocol regarding unit lengths and widths was modified; in the control reach snorkeled pool unit lengths and widths were measured while other unit lengths and widths were estimated. Within the project reach pool units were measured and other unit metrics were estimated, lengths were estimated by pacing.

The survey was repeated again in early August 2009 to capture both post-implementation (2006 placements) and pre-implementation (2010 placements) conditions. Two Curry Soil and Water Conservation District (SWCD) employees were trained by the Council's employee who conducted the 2007 survey, and the protocol was amended to improve its function as a monitoring tool – all pools were snorkeled in both the project and control reaches; pool lengths and widths were measured, and other unit lengths were paced and widths estimated; and future wood placement sites were noted during the survey. Additionally, 0+ trout were counted as steelhead.

In August 2011 the SWCD employees resurveyed Euchre Creek to document conditions following the 2010 placements. The 2009 protocol was followed, except 0+ trout were not counted, and a Trimble GeoXT 2005 series GPS was used to record the start (downstream end) of each pool, glide or riffle; the GeoXT was also used to record the survey data, which was exported to a spreadsheet for analysis. Notes were taken regarding the location of the 2010 wood placements.

The 2013 survey was similar to the 2009 and 2011 surveys with a few exceptions. The 2009 protocol was followed and 0+ trout were again not counted. The pool and riffle locations were captured using the Trimble GeoXT GPS with notes taken regarding the wood placements. Additionally, the downstream control reach had to be shortened on the downstream end by approximately 300 meters due to an inability to gain landowner permission on that stretch of channel. It is likely that this lack of access will continue given the current ownership.

Survey data for all years was analyzed in an attempt to discern the effectiveness of placing large wood structures to create summer rearing habitat in the Euchre Creek mainstem. In regards to fish, data were analyzed for species composition, fish density in pool habitats (both by individual species and all salmonid species combined); and percent occupancy of salmonid species. Physical habitat data were analyzed for distribution of pool habitat; area of pool habitat; and the proportion of complex pool area.

Monitoring Results

Fish

Species Composition

In 2005 and 2007 all four species of salmonid native to Euchre Creek – Chinook, coho, steelhead, and cutthroat – were present within the project area and within both control reaches. In 2009, 2011, and 2013 Chinook, steelhead, and cutthroat were still present across all three reaches, but coho were entirely absent with the exception of one observed in the downstream control in 2009 and two observed in the project reach in 2013.

Percent Occupancy

Across all years and all reaches steelhead were present in nearly 100% of the surveyed pools, and cutthroat were present over 95% of the time. Chinook occupancy was also very high, with only two readings below 90% (Table 1); coho were less common though still well distributed in 2005 and 2007, but were virtually absent from all pools in 2009, 2011, and 2013.

Table 1: Salmon percent occupancy by reach and year.

Occupancy (% of pools per site with fish)							
		2005	2007	2009	2011	2013	Mean
DOWNSTREAM PROJECT CONTROL	Coho	75%	67%	3%	0%	**0%**	**29%**
	Chinook	100%	100%	87%	100%	**100%**	**97%**
PROJECT AREA	Coho	62%	93%	0%	0%	**3%**	**31%**
	Chinook	100%	95%	96%	98%	**100%**	**98%**
UPSTREAM PROJECT CONTROL	Coho	57%	80%	0%	0%	**0%**	**27%**
	Chinook	100%	80%	97%	99%	**100%**	**95%**

Fish Density

Fish density was calculated for each species and all salmonid species combined in each reach. Table 2 summarizes these densities for the five survey years.

Table 2: Density calculated per species per reach. Note: * In 2009 0-trout counts were lumped with steelhead counts. In 2011 and 2013 0-trout were not counted.

Reach	Species	Fish/m² 2005	Fish/m² 2007	Fish/m² 2009	Fish/m² 2011	Fish/m² 2013
DOWNSTREAM PROJECT CONTROL	Chinook	0.061	0.020	0.074	0.082	0.092
	Coho	0.004	0.006	0.000	0.000	0.000
	Steelhead	0.021	0.062	0.229	0.138	0.193*
	Cutthroat	0.037	0.009	0.041	0.033	0.044
	0-Trout	0.038	0.040	0.000	NA*	NA*
	Totals:	**0.161**	**0.137**	**0.345**	**0.253**	**0.329**
PROJECT AREA	Chinook	0.073	0.040	0.069	0.063	0.133
	Coho	0.004	0.039	0.000	0.000	0.000
	Steelhead	0.020	0.108	0.228	0.162	0.324*
	Cutthroat	0.064	0.038	0.028	0.020	0.026
	0-Trout	0.092	0.153	0.000	NA*	NA*
	Totals:	**0.253**	**0.378**	**0.326**	**0.246**	**0.483**
UPSTREAM PROJECT CONTROL	Chinook	0.086	0.029	0.072	0.098	0.093
	Coho	0.008	0.029	0.000	0.000	0.000
	Steelhead	0.019	0.101	0.268	0.190	0.210*
	Cutthroat	0.054	0.025	0.040	0.019	0.011
	0-Trout	0.158	0.150	0.000	NA*	NA*
	Totals:	**0.325**	**0.333**	**0.380**	**0.308**	**0.314**

In order to detect differences in trends in fish density among reaches, data were plotted with respect to each reach (Figure 1). This analysis was complicated by two factors: 1) only every fifth pool was snorkeled in the control reaches in 2005 and 2007 and 2) 0+ trout were lumped with steelhead in 2009 and not counted at all in 2011 and 2013. To handle the first complication, 2005 and 2007 data were limited to every fifth pool for all reaches. Unfortunately, no correction could be made to the inconsistencies regarding 0+

trout; however, it can be assumed that fish density values for 2011 and 2013 were higher than reported here. Figure 1 shows that the project reach has seen the largest gains in total fish density.

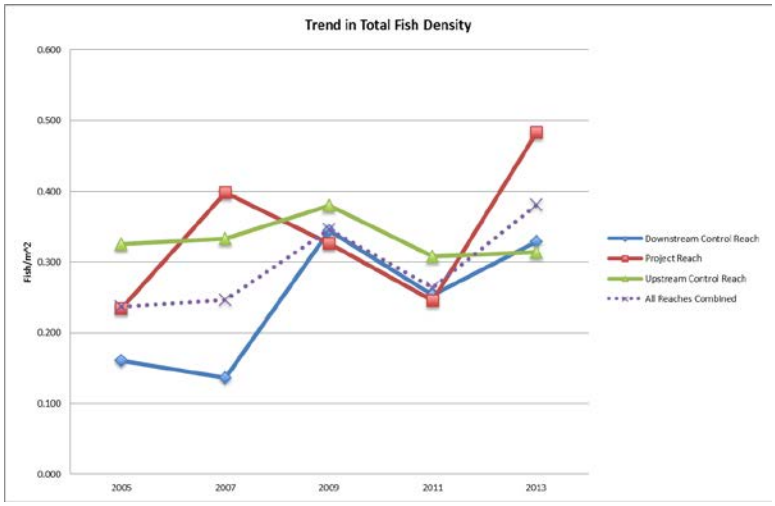

Figure 1. Trends in total fish (salmonids) density. Data set was limited to every fifth pool for all reaches for 2005 and 2007.

Pool Habitat

Number of Pools

The number of pools identified during snorkel surveys in 2005, 2007, 2009, 2011, and 2013 were 72, 96, 114, 96, and 81, respectively. Figure 2 shows the trend in number of pools within each reach. Over the course of project implementation and subsequent monitoring of the three reaches, the project reach has gone from having the fewest pools to the most.

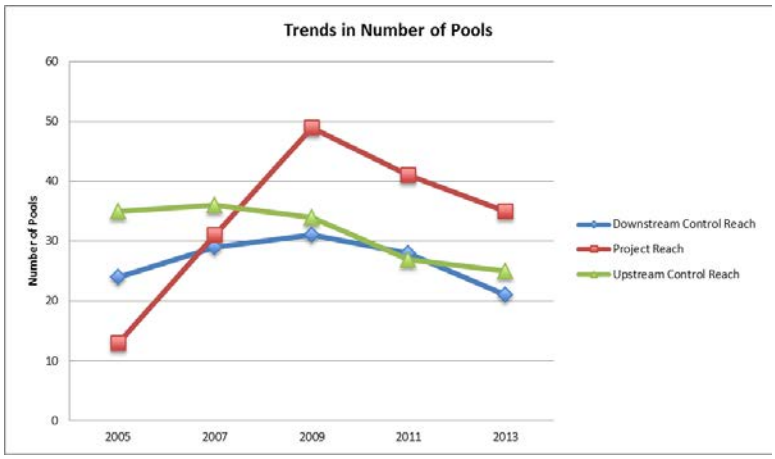

Figure 2. Trends in number of pools per reach.

Pool Area

Total pool area was analyzed by reach as the total pool area in square meters of snorkeled pool habitat. Since only every fifth pool was snorkeled within the control reaches in 2005 and 2007, pool area analysis of the 2009, 2011, and 2013 data was also limited to every fifth pool for the control reaches. Hence, this analysis shows only within-reach changes. When plotted, the data show that only the project reach has sustained gains in pool area over the course of the monitoring period (Figure 3). In fact, the lowest value for the project reach after the 2006 wood placements was nearly double the pre-project (2005) value (Figure 3).

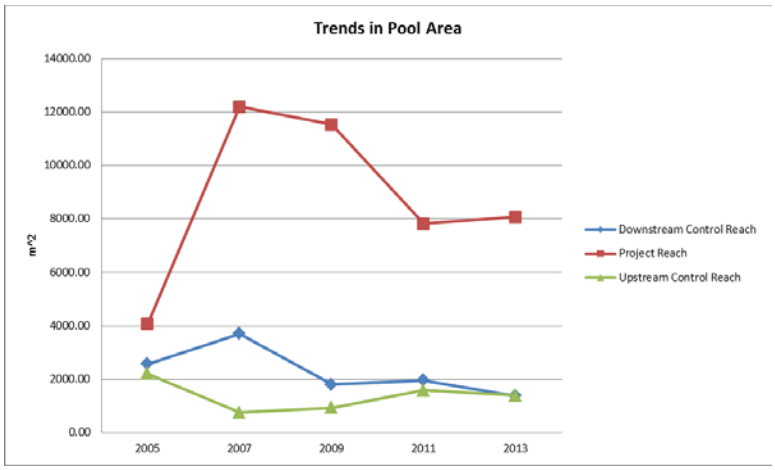

Figure 3. Trends in Pool Area within reaches.

Pool Complexity

Pool cover data was analyzed in an attempt to detect trends in pool complexity by calculating the relative proportion of complex pool area to total pool area (Figure 4). Pools with a cover rating of 4 or 5 were considered complex pools for this analysis. The nature of this analysis was to determine whether the placement of wood structures in the project reach affected pool complexity in comparison to the control reaches; therefore, the data set for the project reach was limited to every fifth pool for 2005 and 2007 (the only data available for the control reaches for those years).

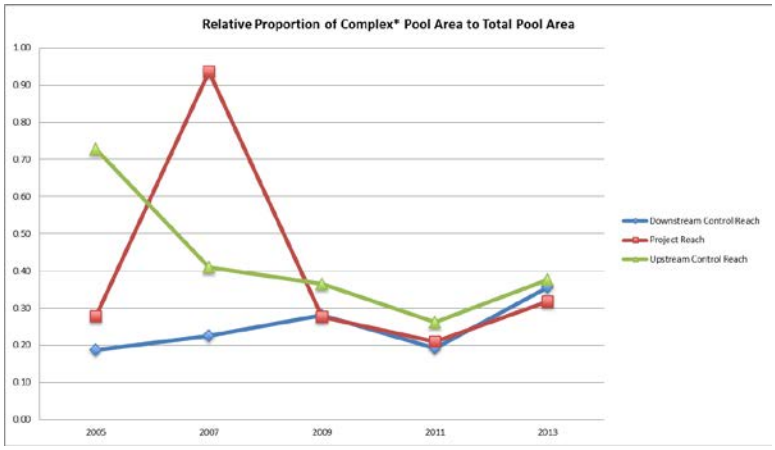

Figure 4. Changes in Pool Complexity among reaches. *Pools with a Cover Rating of 4 or 5 were considered Complex Pools.

Discussion

Two separate efforts to improve summer rearing habitat in the Euchre Creek mainstem were undertaken, the first in 2006 and the second in 2010. A Rapid Bio-Assessment snorkel protocol was used to monitor juvenile salmonid populations over a 3-mile reach in an attempt to document project effectiveness. The monitored reach was divided into three reaches, with a project (treatment) reach bound by upstream and downstream control reaches. The snorkel surveys were conducted every second year from 2005 – 2013. The 2005 survey represents pre-project conditions. After the 2013 survey, all five years of survey data was analyzed to determine the effectiveness of placing habitat structures in the Euchre Creek mainstem.

Although complicated by changes to protocol and inconsistent methodologies, careful analysis of the dataset has yielded interesting results:

Species Composition and Percent Occupancy
Steelhead, cutthroat, and Chinook were each present in nearly all pools in all years, regardless of reach. Coho, however, while present in the majority of pools in 2005 and 2007, were virtually absent in subsequent years. A myriad of reasons could account for the drop in coho numbers, including lack of winter habitat, but it is not overly surprising given the Euchre Creek population is classified as Ephemeral by the National Marine Fisheries Service (NMFS 2012).

Fish Density
Fish density values have increased overall since the pre-project survey in 2005 (Figure 1). This is especially true given that 0+ trout were counted in 2005 – 2009 surveys, but not in 2011 and 2013. In terms of project effectiveness, the project reach has shown the largest increase in fish density from 2005 – 2013; however, it has also shown the greatest variance over the post-project years (2007 – 2013).

Pool Habitat
The number of pools has increased dramatically in the project reach, whereas the number of pools decreased in both control reaches. Perhaps not surprisingly, trends in pool area are similar. In regards to pool complexity, the project reach performed well in comparison to the control reaches in 2007 (following the 2006 wood placements), but then fell in line with the control reaches in subsequent years.

In terms of project effectiveness, the increase in quantity of pool habitat may be the most telling data. That is to say, the placement of large wood in the project reach was intended to improve the amount of quality rearing habitat available for juvenile salmonids; according to the metrics described here, that has been accomplished. The observed increase in juvenile density coupled with the increase in pool habitat strengthens the notion that the habitat improvement project has been successful.

Summary

The 2013 juvenile salmonid snorkel survey marked the fifth time since 2005 that Council/SWCD staff and contractors have utilized the Rapid Bio-Assessment protocol to monitor the effectiveness of large wood placements in the Euchre Creek mainstem channel. The decision to use juvenile surveys over other assessment methodologies, such as ODFW's Aquatic Inventory Protocol (AIP), was a two-fold: (1) past attempts to use AIP surveys to monitor the effectiveness of large wood placements resulted in findings that were difficult to interpret because of variability inherent to the AIP methodology and because of variability within the natural environment; and (2) generating data about salmonid usage has other benefits besides project effectiveness, such as documenting juvenile rearing habits.

As it turns out, juvenile snorkel surveys have had their own suite of idiosyncrasies that also make it difficult to quantify change resulting from large wood placements, including: surveyor bias, visibility, stream flow, mobility of the wood, and natural fluctuations in fish populations. When we embarked on this project we anticipated that fish would gravitate to pools with wood, on the reach scale, so we decided to snorkel every pool within the project reach to account for this bias; eventually we extended this decision to include the control reaches as well. We also realized over time that in order to accurately compare fish density between reaches pools should be measured rather than estimated, to further reduce human bias. In the end we've concluded that the Rapid Bio-Assessment protocol is, like the AIP, better at assessing conditions than monitoring changes tied to a specific restoration activity. With that said, the data collected over the last eight years is

serving multiple purposes: we have documented coho in the middle mainstem, which multiple years of Council and ODFW spawning surveys failed to do; we better understand the role the middle, and presumably lower mainstem, channels play in the life cycle of Chinook; and we have observed increases in total fish production and pool habitat creation within the treated reach.

One interesting result of these surveys has been the intermittent presence of coho within the middle mainstem. Following the first two surveys (2005 and 2007), it appeared that coho were consistently using this habitat in moderately good numbers. This was particularly promising because coho had not been observed on any spawning surveys within this portion of the watershed for many years, even though survey efforts had increased substantially over the last decade. The virtual absence of juvenile coho in 2009, 2011, and 2013 was definitely a disappointment, and reaffirmed the belief that Euchre Creek has good spawning and summer rearing habitat, but is severely limited in over-wintering habitat; thus a few spawners can produce a sizeable juvenile population, but few if any of those off-spring are surviving the winter and outmigrating as smolts.

In regard to the effectiveness of the 2010 wood placements, the data from 2011 generally suggested that both the habitat and the juvenile fish numbers retreated slightly from the gains they had made as of 2009. At the time, it was thought that perhaps the 2010 wood placements had not been as effective as those of 2006, either due to a lack of scouring flows in the winter of 2010/2011 or substantially higher summer flows in 2011 leading to fewer pools (less segmenting and fragmentation) with larger areas. The 2013 data do not appear to refute the idea that the 2010 placements did not perform well; although fish density improved in 2013, the pool habitat metrics continued to slip. It is possible that the lack of obvious habitat improvement from the 2010 placements is a result of using smaller material than the 2006 project (see description in Introduction section of this report).

When we undertook this project we anticipated the channel's response time would be relatively quick given the mobility of the bedload and the scale of yearly discharge, but that it would take years if not decades for the habitat to fully develop and the fisheries to make significant improvements. For this reason we have treated this project as a long-term monitoring effort that will produce a dataset that can be used to evaluate the effectiveness of these wood placements as well as assess trends in the health of the middle mainstem fisheries.

For more information please contact:

Drew Harper, Erin Minster, or Matt Swanson
South Coast Watershed Council
(541) 247-2755

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