Executive Summary for the Evaluation of Fish Passage Improvement Projects in the South Coast and Rogue River Basins 2009

Submitted to the
Oregon Watershed Enhancement Board
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Executive Summary

This is a companion executive summary to the full document entitled, *Evaluation of Fish Passage Improvement Projects in the South Coast and Rogue River Basins 2009.* This executive summary covers the man points found in the companion document.

Introduction

In the summer of 2009, Duck Creek Associates was contracted by the Oregon Watershed Enhancement Board (OWEB) to evaluate various fish passage enhancement projects carried out from 1992 to 2001 in the Southwest Region of Oregon. Duck Creek conducted field assessments at 64 of theses project sites. The two primary objectives of this study were to determine if fish passage improvement projects provide adequate passage for salmonids and if juvenile salmonids utilize the habitat above the passage improvement projects.

Study Area

All of the survey sites were located in western Oregon within the Southwest Region of Oregon. The majority of the sites fell within the Coos and Coquille sub-basins.

Methods

Field Survey

In order to evaluate the various fish passage projects, we needed to deploy basic stream channel survey methods that have been adapted for the various circumstances we encountered at culverts, bridges, dams, and fish ladders/screens.

We snorkeled pools upstream of the stream crossings to determine if juvenile fish were present. Typically, we searched for juvenile salmonids in pools within the first 135 meters upstream of a crossing. If no fish were found in the first pool upstream of a crossing, we extended the snorkel survey to all pools within 330 meters upstream of the crossing. We followed standard operating procedures when snorkeling. We counted juvenile salmonids (< 5 cm long) by species. We had to group juvenile steelhead and cutthroats into the same category due to our inability to tell these species apart when they were this size.

We also took digital photographs at each site we visited. Photographs are presented in a separate photo log. We tried to capture the essence of a particular site. We photographed culvert inlets, outlets, tail waters and the stream channel both upstream and downstream.

Office Data Processing and Reporting

We modeled fish passage potential at culverts with FishXings. FishXings is a free interactive software package used to design and assess culverts for fish passage. It predicts if a certain size and species of fish can pass through a culvert at a range of stream flow rates.

Results

We surveyed and analyzed 42 culverts and 14 bridge stream crossings and 8 other restoration type projects. Many of these sites were also surveyed by snorkeling to determine if juvenile salmonids were present upstream of the projects. We found juvenile salmonids present upstream of the grand majority of these restoration project sites

Juvenile salmonids were absent on a relatively small percentage of surveyed reaches. At each crossing where we did not observe juvenile salmonids, we also noted a general lack of in-stream habitat in terms of sustained gradients less than 10%, available pools (wet or dry), and flowing water. Essentially, if juveniles were not observed, suitable rearing habitat was lacking.

FishXings

When using FishXings to determine if culverts were passable by juvenile salmonids, we found that none of the culverts were predicted to be 100% passable using the modeled flow rates. FishXings returned results that indicated 16 culverts were 100% impassable by juveniles. Of the 16 rated as impassable, all were velocity barriers, 3 were combined velocity/outlet drop barriers, and 3 were rated as velocity/depth barriers. The remaining 26 culverts were considered to be passable through varying percentages of modeled flows.

Fish Passage at Bridges

There were 14 bridge crossings surveyed for this study. We predict that all of the bridge stream crossings will be passable by juvenile salmonids. We determined this by conducting longitudinal profiles to determine channel slope and bed form. We typically found that channel slope at the bridge site was less than the overall channel gradient. Often, there was pool-like slow-water through the bridge site that creates potential refuge for migrating fish. In addition, we observed juveniles above all the bridge sites that we snorkeled.
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Discussion

Our field study showed that juvenile salmonids utilize the habitat upstream of the grand majority of the restoration projects (culverts, bridges) surveyed in this study. Our modeling exercise predicted that juvenile passage at culverts would be limited to a small percentage of flow rates.

Even though only small percentages of total modeled flows are considered passable on many of these culverts, those predicted flows are in a range that would probably occur from early to late spring through the summer to early to late fall. These flows would coincide with the migration times of many juvenile salmonids.

Many of the culverts in our study are rated as partial barriers. That means that some percentages of the flows we modeled are passable by juveniles. Since we have found juvenile salmonids upstream of those culverts, we assume that juveniles are passing through these culverts.

Table 1 list the 16 culverts predicted to be 100% barriers to juvenile passage. These culverts are reviewed below.

Table 1. A list of 16 culverts predicted to be 100% barriers to juvenile passage and qualitative notes explaining the culvert condition. 3 of these barrier culverts are on non-fish bearing streams. 8 of these culverts are most likely barriers (italicized). 5 of these culverts do not appear to be barriers (Sites 18, 20, 50, 74 and 21).The 8 italicized culverts are a priority for re-inspection and consideration for repairing or replacing.

Unique _ID	OWEB grant #	Predicted % Passable of Modeled Flows	Juvenile Salmonids Observed Above Culvert	Qualitative Notes
4	SC-009	0.00%	UNK	Concrete culvert on marginal stream, probably not fish bearing stream
10	***097-240***	***0.00%***	***Yes***	***> 0.1 meter outlet drop***
131	***SC-009***	***0.00%***	***Yes***	***> 0.1 meter outlet drop***
132	***SC-009***	***0.00%***	***Yes***	***> 0.1 meter outlet drop***
18	096-164/099-113	0.00%	Yes	Baffled, 4.8% slope
20	099-113	0.00%	Yes	2% slope Sediment filled
21	098-137	0.00%	Yes	Stream simulated design
27	098-055	0.00%	NOHAB	Ephemeral and steep, probably not fish bearing stream
28	098-055	0.00%	NOHAB	Ephemeral and steep, probably not fish bearing stream
50	099-113	0.00%	Yes	3% Channel, 7.8% culvert slope, Stream simulated design
72	***099-461***	***0.00%***	***Yes***	***5% culvert with little velocity reduction, but some stream simulation***
73	***098-137/099-461***	***0.00%***	***Yes***	***Clear with no obstruction, velocity unimpeded***
74	098-137/099-461	0.00%	Yes	Stream simulated design
75	***200-056***	***0.00%***	***Yes***	***Clear with no obstruction, velocity unimpeded***
80	***SC-017***	***0.00%***	***Yes***	***Very steep with baffles***
82	***SC-017***	***0.00%***	***Yes***	***Clear with no obstruction, velocity unimpeded***

Recommendations

The recommendations presented here are based solely on observations made during this study.

- Revisit the 8 sites highlighted above and in that appear to be juvenile barriers and evaluate if repairing the culverts is possible. If not, consider the cost benefit of replacing the culverts.

- Expand this study to look at the time of year that the expected passable flow range predicted by FishXings would occur at each site. This could be carried out using the regional regression equations in conjunction with ArcHydro. Then link those results to when juvenile species are expected to be migrating. This would help determine if the percentage of passable flows coincides with juvenile migration patterns.

- Consider further monitoring of juvenile passage using a sophisticated study design similar to the study ODFW conducted at Crowfoot Falls (Appendix A).

We recognize that upgrading stream crossings requires engineering and must be considered in terms of channel dynamics, safety, and cost; however, this study leads us to suggest that when upgrading a stream crossing, the first consideration should be removing the crossing completely. This was done at Site 12 (McNight Creek). Next consider replacing the crossing with a bridge. If removing the crossing or installing a bridge is impossible, consider installing a stream simulated bottomless arch. When possible, strive for reducing the overall gradient at the stream crossing. Countersinking a culvert seems to work best.

Conclusion

This study used both field analysis and software modeling to make predictions about whether juvenile salmonids are able to pass through stream crossings that have been upgraded within the last ~ 20 years. Field analysis included channel and culvert measurements and snorkel surveys. Software modeling consisted of modeling low flow rates at specific locations using regional regression equations and FishXings software.

We found several different types of upgrades present on the landscape:

- 42 Culverts
- 14 Bridges
- 1 Ford (removed crossing, decommissioned road)
- 1 Push-up dam
- 1 log placement survey
- 2 fish ladders
- 3 fish screens

The channel morphology in terms of slope and bed form at bridges does not impair juvenile fish passage. Juvenile salmonids were found above all of the bridge crossings.

In terms of culverts, we found juvenile fish upstream during the snorkel surveys of the grand majority of stream crossings. FishXings predicted that none of the structures would allow juvenile salmonids to pass 100% of the time. However, there are limitations to the FishXings model predictions. We estimate, that of the 42 culverts surveyed, 8 are probable barriers to juvenile passage, 3 were not on fish bearing streams, and the remainder are passable by juveniles at certain flow conditions. We are not certain that the flow conditions suitable for passage coincide with juvenile migration patterns, but we suspect that that there is a positive relationship between predicted passable flows and the seasons when juveniles migrate.

The ford and push-up dam we surveyed had a gradient and channel form that would easily allow juvenile passage. One fish ladder was completely fenced off, so we were not able to determine if it allowed passage. The other fish ladder, was at a steep waterfall. ODFW had conducted intense fish surveys at this location and have deemed the falls to be a partial barrier to migration. The fish screens were difficult to assess; however, we detemined they were in good repair and mechanically sound. The log placement survey showed that logs were acting to accumulate sediment, provide habitat cover, and force pool formation.

The snorkel survey used ODFW protocol to determine juvenile salmonid (5 cm or less) presence upstream of the various projects. We found fish upstream of the grand majority of upgraded crossings. However, we cannot say whether those fish migrated through the various crossings, or if we observed them in their natal habitat.