

Retrofitting Culverts for Fish

Culverts are a well established method to pass a roadway over a waterway. Standard design criteria exist for meeting the hydraulic requirements for moving the water through the culverts. However, the hydraulic conditions resulting from many culvert designs create conditions that impede the passage of fish. This is especially true for juvenile fish because their swimming abilities are not equal to those of adult fish.



Upstream end of the culvert on Big Noise Creek, Oregon where the short-term controlled release study was performed. The wire cage is the upstream fish trap for fish that swim out of the culvert.

The transportation connectivity created by Oregon's system of roads allows freedom of movement and facilitates economic activity to the benefit of the citizens. The culverts under our roads can have the opposite effect for the fish living in our streams. Culverts can fragment fish habitat and compromise the ability of a stream to support the normal life cycle of native fish species. A natural stream bed under a bridge is the ideal solution for the fish. Simulated stream beds in specially designed culverts are equivalent,

but the cost of replacing an existing culvert with one of these solutions is high.

A lower cost option has been devised that consists of merely placing baffles in an existing culvert. The recently completed study *Fish Passage Through Retrofitted Culverts* explored the effectiveness of this baffle solution. Two observations of fish movement were used. The first was a long term mark and recapture experiment and the second was a short-term controlled release experiment.



One of the authors of the research report holds a section of baffle material such as was used to retrofit the culverts to aid fish passage

The long term mark and recapture experiment looked at seven stream reaches with ODOT culverts that had been previously retrofitted with baffles. Each study reach was divided into two segments below the culvert and two segments above the culvert. Fish in each segment were captured and marked three different times over an 18 month period. Results showed that the rate of recapture was low but consistent with other similar studies. Most of the fish that were

recaptured typically had not moved out of the segment in which they were previously captured. Given this, it was not surprising that very few fish moved through the culverts. Some fish did move upstream through five of the seven culverts clearly demonstrating that those five were not complete barriers to upstream passage. The small numbers of recaptured fish moving between segments limits the degree to which firm conclusions can be drawn but the data does not seem to indicate that the retrofitted culverts are a major impediment to movement.

The controlled release experiment consisted of releasing juvenile fish from a trap in the middle of a culvert and observing their movements. It was done in a single culvert both without baffles and with various configurations of baffles installed. This was repeated for both summer and winter flow conditions.



Electrofishing as part of the long-term capture, mark and recapture experiment.

The results showed that the baffles enabled the juvenile fish to move upstream through the culvert. Two configurations which appeared to be most effective at facilitating upstream movement in the culvert - 90° baffles and 45° baffles angled upstream.

Measurements were also made of the water depths and velocities in the culvert with the different baffle configurations. The baffles performed as expected by slowing and deepening the water in portions of the culvert. This change in the water flow in the culvert is the mechanism by which the baffles are intended to ease fish movement.

The results of this study will be used in consultation with fishery resource agencies to guide the process of improving fish passage where it is currently impeded by culverts under roadways.

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To request a copy of the report "*Fish Passage Through Retrofitting Culverts*" contact the ODOT Research Unit by phone, or view the report on the Research Unit web page listed below



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