

Fish Passage and Culverts: Why did the Fish Cross the Road?



Background

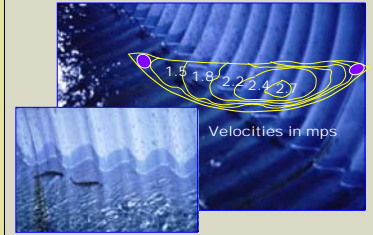
Richard Thompson and Craig Mount

Fish Passage associated with closed bottom structures (e.g., corrugated metal pipes) is an identified problem throughout British Columbia and the US Pacific Northwest. Assessments completed in the last five years by MoE, DFO and MoFR have raised concerns regarding the number of problem culverts and the amount of habitat isolated upstream of these structures. Assessments completed in two high value fisheries watersheds (Prince George Forest District) found that ~ 90% of the culverts assessed failed to meet one or more of the fish passage criteria. Assessments in other areas of the province on both forestry and non forestry roads have revealed similar problems. BC's Coastal Cutthroat Recovery team has recently indicated that fish passage is one of the greatest concerns related to recovery of coastal cutthroat stocks. Fish passage at road crossings is also a concern for the management of other fish stocks in B.C.



Fish Swimming Ability

Culverts with gradients as little as 0.5% can be barriers to juvenile fish passage. Studies on fish movement in culverts have shown juvenile fish use velocity shadows provided by culvert corrugations.



Assessment Method

Multiple methods exist to assess fish passage including:

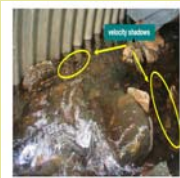
1. Direct observation of fish movement (Mark-recapture experiments, fish surveys)
2. Velocity measurements
3. Hydraulic analysis
4. Measurement of surrogates indicative of hydraulic condition.

The standard assessment method being adopted in BC uses hydraulic surrogates. Measurements are made of stream channel and structure attributes and then thresholds are used to decide if fish can pass. These thresholds are based on our current knowledge of fish swimming ability. Advantages of this method include:

- a. Easy to train people to take measurements in an accurate and repeatable way.
- b. Measurements can be taken quickly allowing more culverts to be assessed in a single day.
- c. The measures are independent of stream stage (unlike velocity, which is stage-dependant)
- d. The measurements can be useful in hydraulic design

Measurements taken include:

1. Outlet drop
2. Culvert slope, width and length
3. Amount and depth of material in culvert (embedment)
4. Stream channel characteristics (width, outlet pool depth, habitat quality upstream)



The statement below is the Fish Passage Standards from the 1970's. Today our understanding of fish swimming ability and the need to allow juvenile fish passage has advanced. Even with those advances there have been few changes to the velocity standards and gradient requirements over the last 30 years.

Present Fish and Wildlife Branch and Fisheries and Marine Service standards in this Province suggest velocities less than 6fps (12cm/sec)(0.12 m/s) in culverts of 80ft (24.4m) or less, and less than 3fps (90cm/sec)(0.09 m/s) where culvert length exceeds 80ft (24.4m). Gradient should not be greater than 2%.

The Good



The Bad



The Ugly



Results

During the 2006 field season MoE, MoFR, DFO and Industry staff looked at 178 culverts (CMP) in the Carp and McGregor Watersheds. The adjacent charts show the number of culvert failures (potential barriers = failed to meet one or more criteria for fish passage). Eight structures in the McGregor and 2 in the Carp were classified as borderline. Borderline structures require more detailed data collection and analysis than was done as part of this study.

Location of barrier culverts were mapped using a GIS. An estimate of the total amount of fish habitat upstream of culvert barriers was made. In the Carp and McGregor approximately 1600 km of fish habitat has been isolated. For each structure the amount of habitat that will be restored can be calculated. When the study team asked the question "how much habitat will be restored if the top 10% of the problem structures are repaired?", the calculated estimate is ~ 1080 km or 68% of the isolated habitat will be accessible to fish again. Therefore, setting priorities for which structures to repair first will be a critical step in ensuring we get the greatest "bang for our restoration buck".

Actions

Why should we care? Healthy fish populations rely on access to functioning habitat. Removal of culvert barriers can restore access to thousands of kilometers of valuable fish habitat. In addition to fish, many other organisms require unimpeded access in aquatic ecosystems. Healthy unfragmented aquatic ecosystems will help protect BC's biodiversity and ensure we have healthy fish populations in the future.

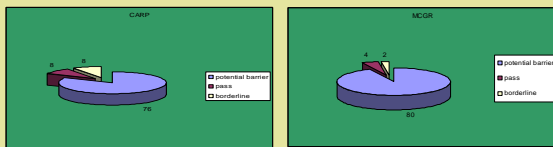
Goals

MoE, MoFR and DFO would like road designers and builders to help eliminate historic fish passage problems and ensure no new problems are created.

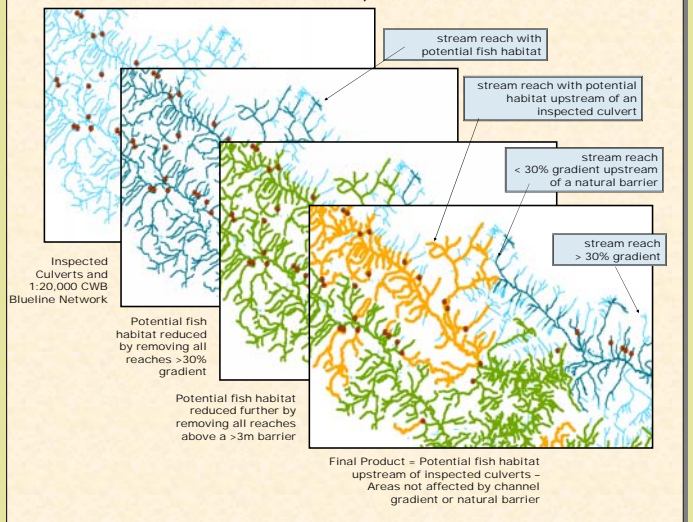
- Measures of success
1. No new fish passage barriers as a result of culverts
 2. A reduction in the number of historic culvert barriers
 3. Kilometers of habitat with restored access.

Dealing with fish passage problems at culverts on resource roads will help BC achieve one of governments great goals of the "best fisheries management bar none" (BC Government Strategic Plan, 2005)

Culverts Assessed



GIS Method for Calculating the Amount of Potential Fish Habitat Upstream of a Culvert



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