

Jun 24th, 2:45 PM - 3:00 PM

Session E8: Not Just for Adults! Evaluating the Efficacy of Multiple Fish Passage Designs at Low-Head Barriers for the Upstream Movement of Juvenile and Adult Trout *Salmo Trutta*

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Not just for adults! Evaluating the efficacy of multiple fish passage designs at low-head barriers for the upstream movement of juvenile and adult trout *Salmo trutta*

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Introduction

In-stream structures (e.g. weirs/culverts) can impact free movement of fish

Longitudinal connectivity is vital for both juvenile and adult fish

- Most studies focus on larger adults

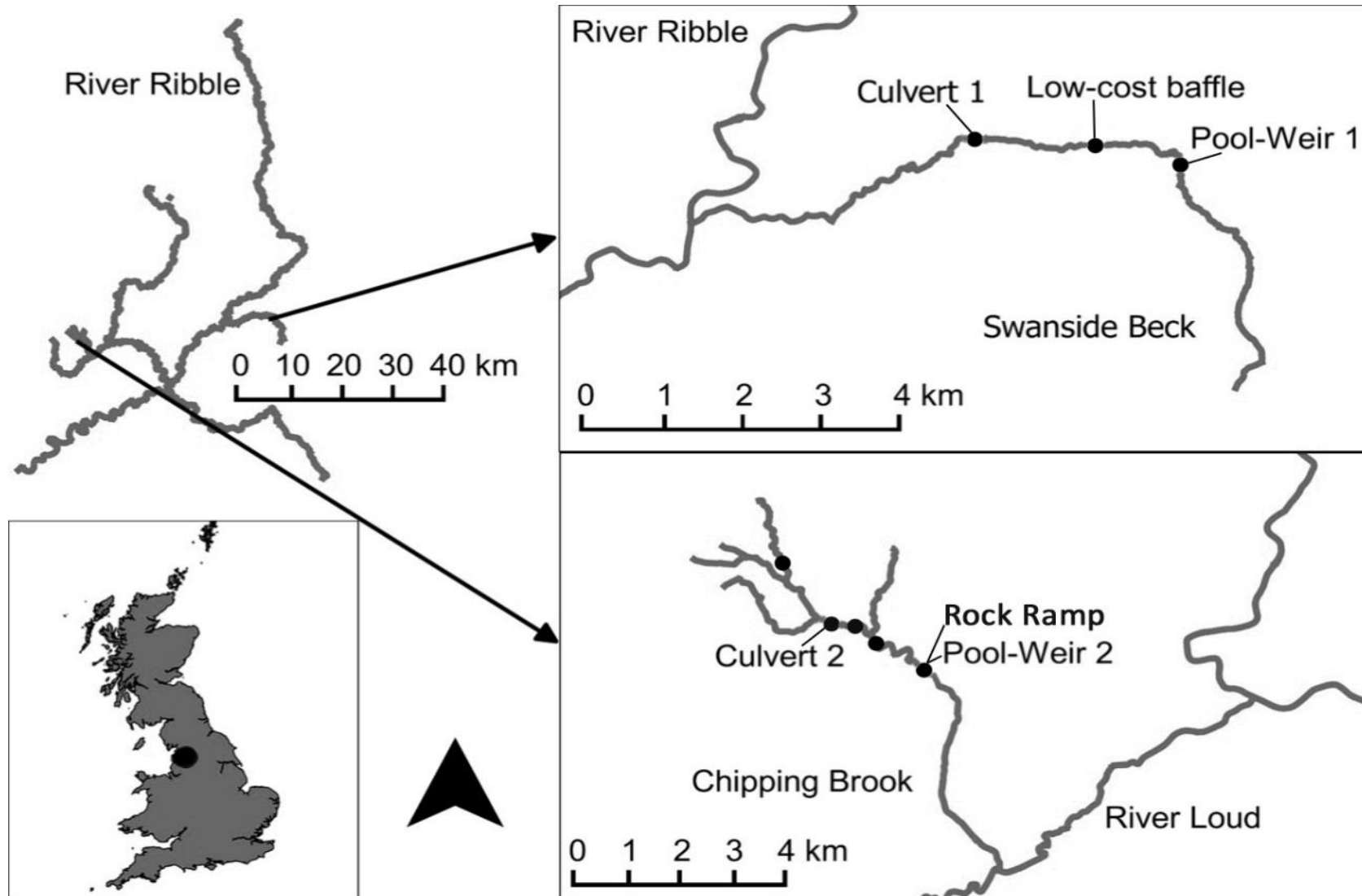
Paucity of knowledge on:

- low-head (< 3m) structures in small tributaries
- Efficacy of, including delays incurred at, different fish passage designs

25,000 known structures in the UK (Gough et al., 2012)



Site location: River Ribble, Lancashire



Study structures



Culvert 1 (Control; 2013 and 2014)
Length = 20 m, Slope = 4%, Mean $V = 0.46 \text{ ms}^{-1}$



Culvert 2 (2013)
Length = 70 m, Slope = 5.2%, Mean $V = 2.32 \text{ ms}^{-1}$

Study structures



Low-cost baffle (Servais, 2006; 2013 and 2014)
Length = 6.70 m, Slope = 24%, Mean $V = 1.42 \text{ ms}^{-1}$

Study structures



Pool-Weir 1 (2013)

Length = 8.43 m, Slope = 14%,
Mean V at notches = 0.53 ms^{-1}



Pool-Weir 2 (2013 and 2014)

Length = 7.20 m, Slope = 12%, Mean V at notches = 1.85 ms^{-1}
2014: Corrected head drop at entrance from 0.49 to 0.25 m

Study structures



Embedded Rock Ramp (2014)

Length = 4.57 m, Slope = 12%, Mean V in channel = 1.13 ms^{-1}

Methods

Passive Integrated Transponder (PIT) telemetry:

Downstream and upstream antennae to determine

- Attempts, success, and delay before passage.

Displaced and naturally migrating fish

Fish displaced from 100 m above to below utilising natural homing instinct to instigate attempts – monitored for 15 days.

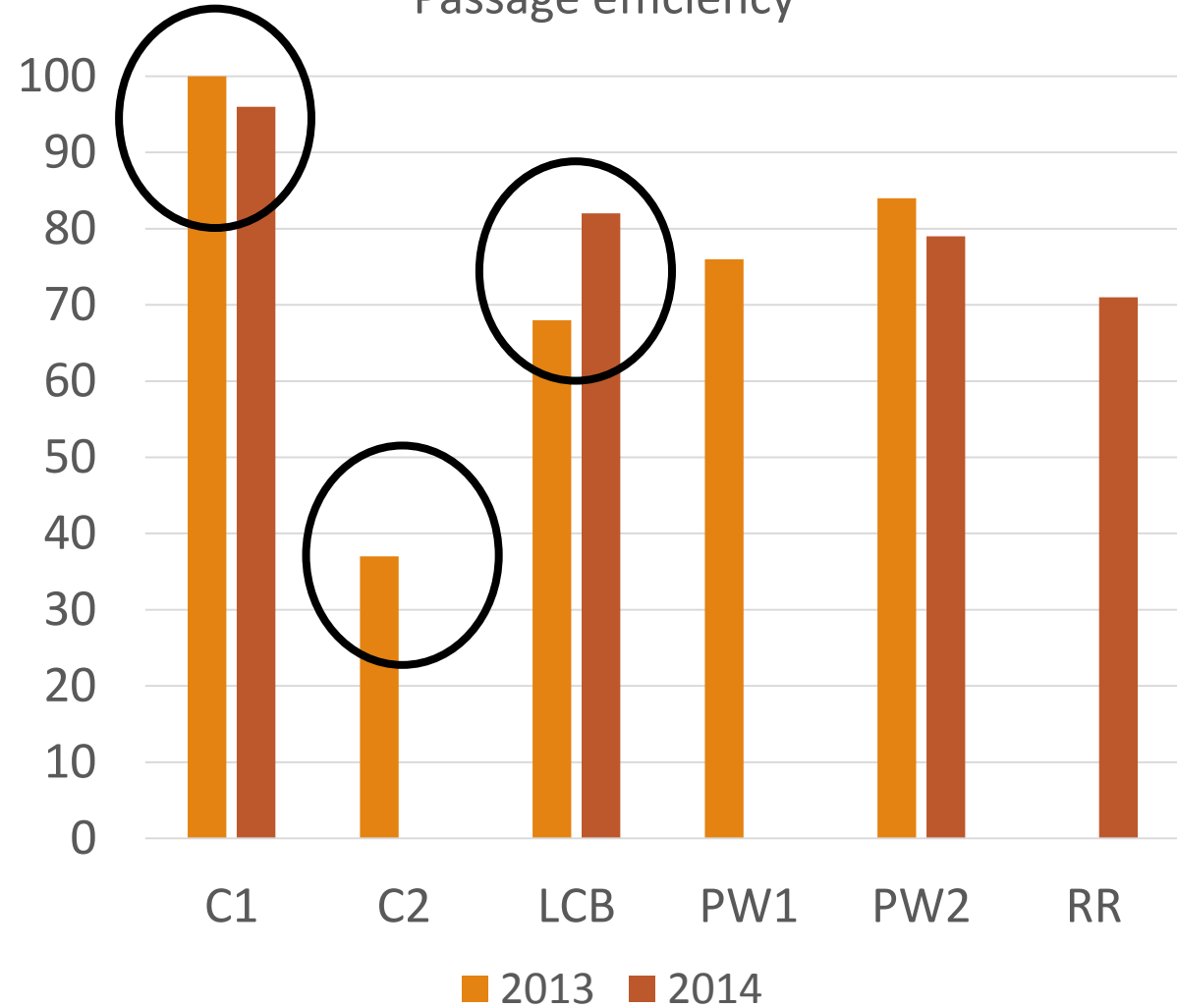
Fish were caught using electric fishing.

600-700 fish per stream IP tagged (12 mm (FL < 120 mm) or 23 mm (FL > 120 mm) HDX tags).

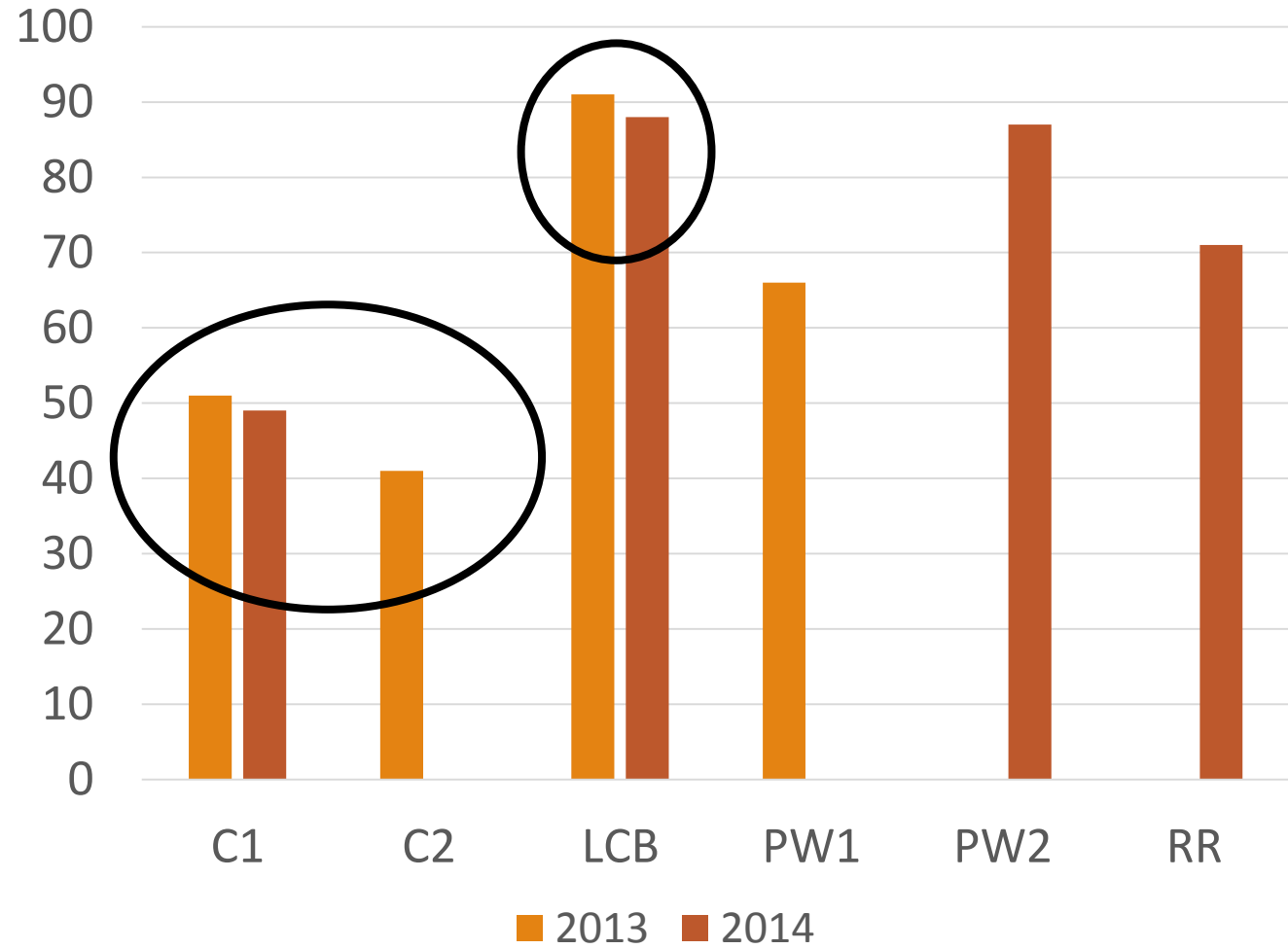


Passage and attraction efficiency

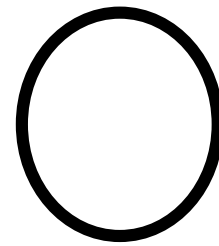
Passage efficiency



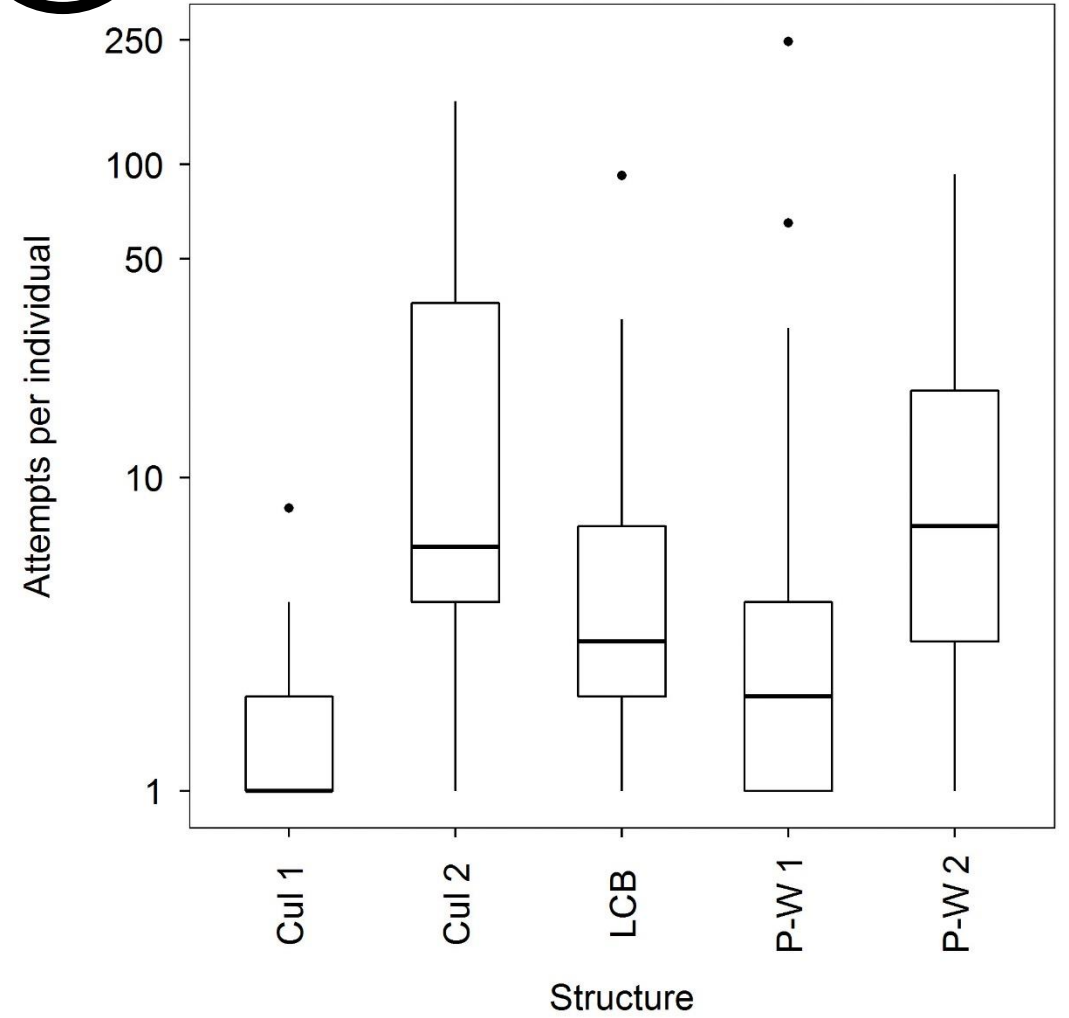
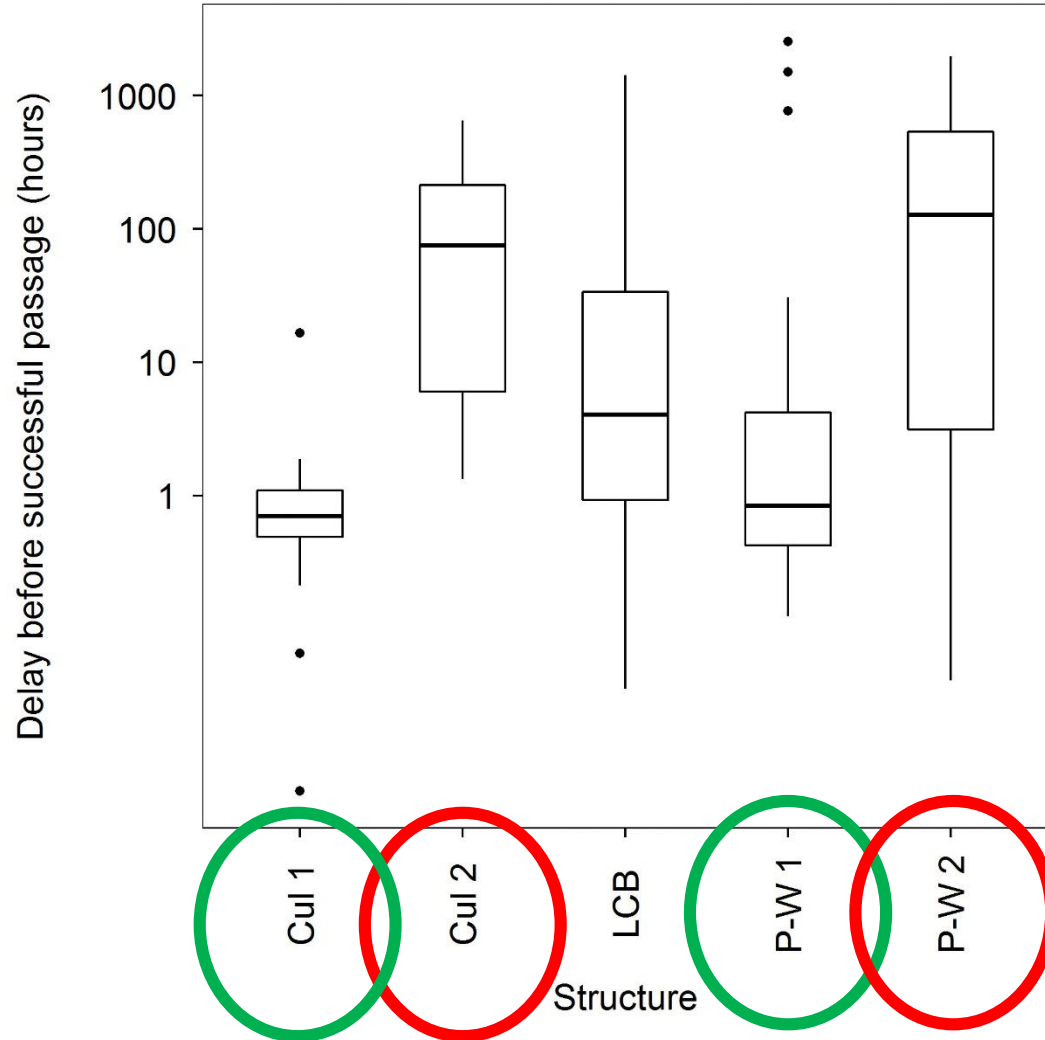
Displaced attraction efficiency



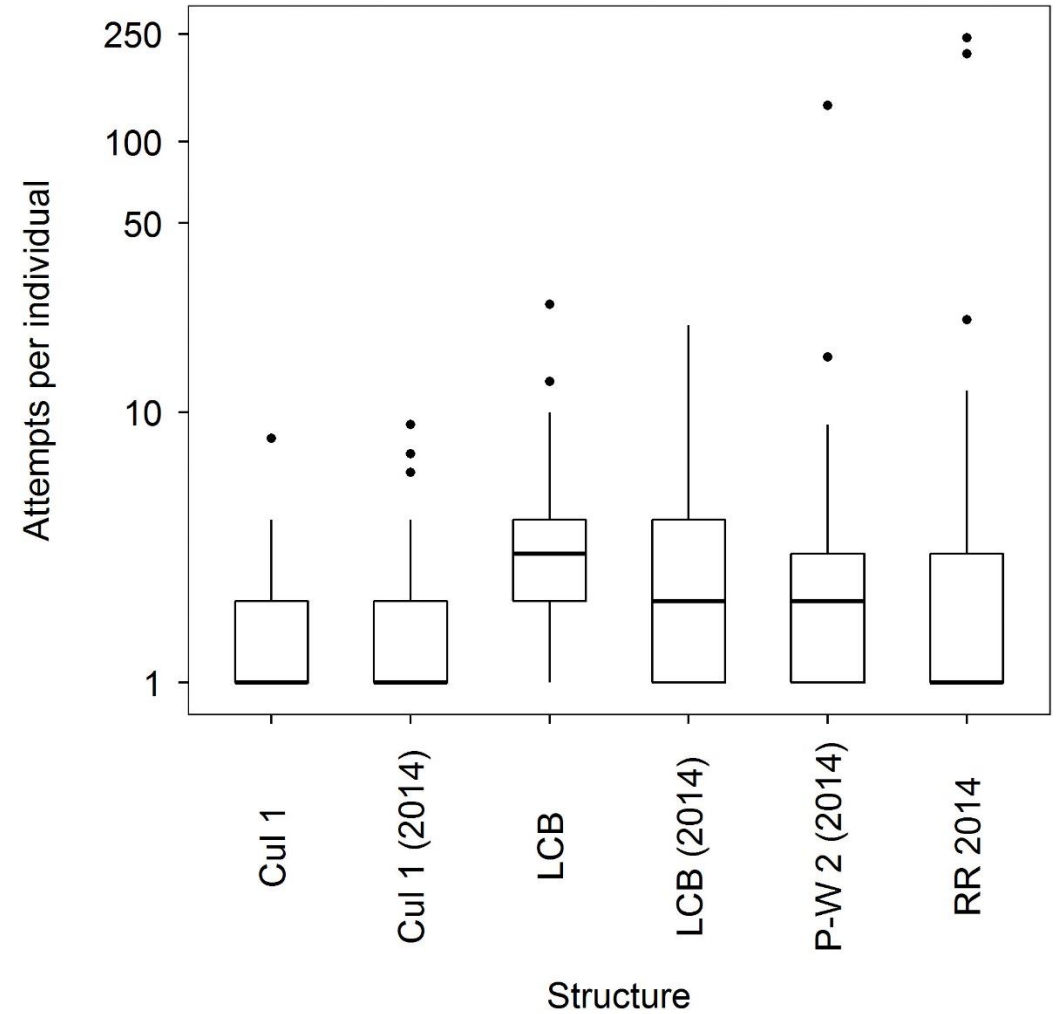
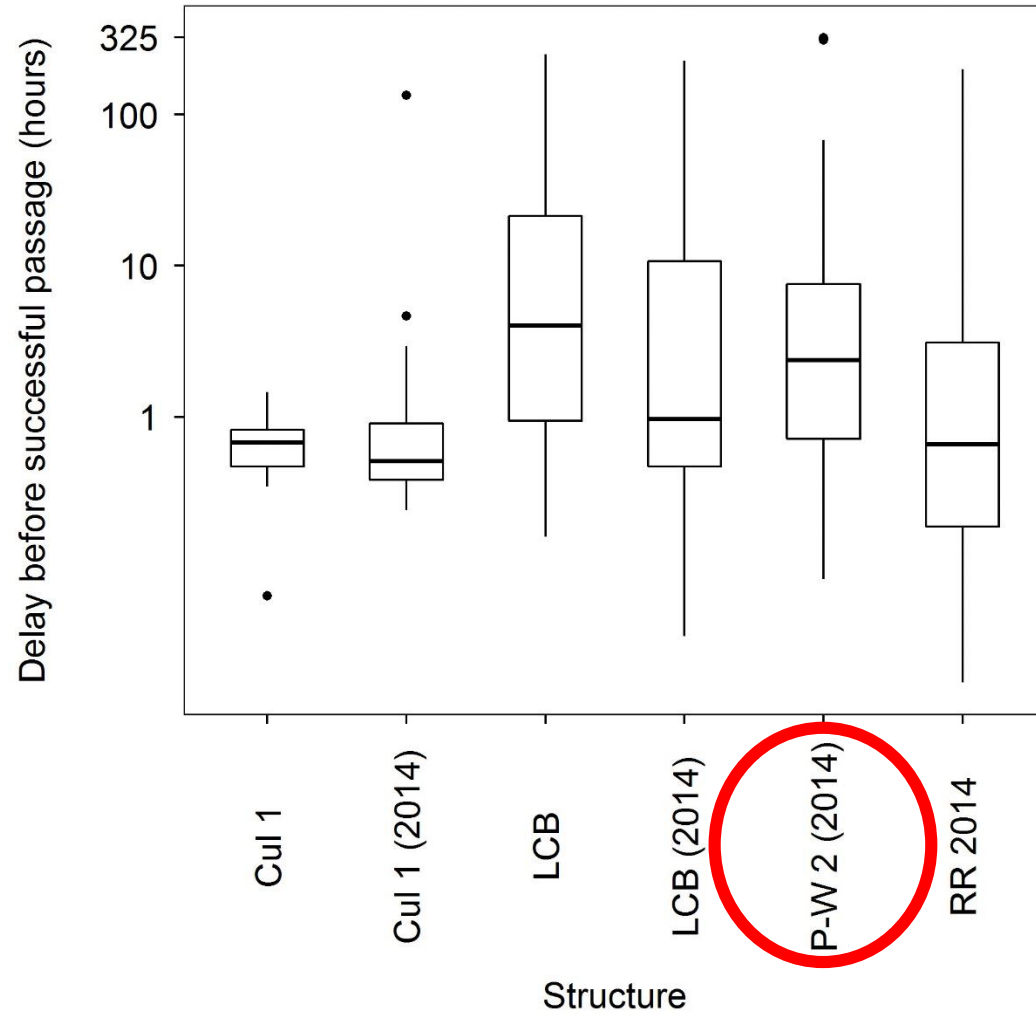
Delays



$P > 0.05$, Mann-Whitney U



Delays – Displacements



Length and probability of passage

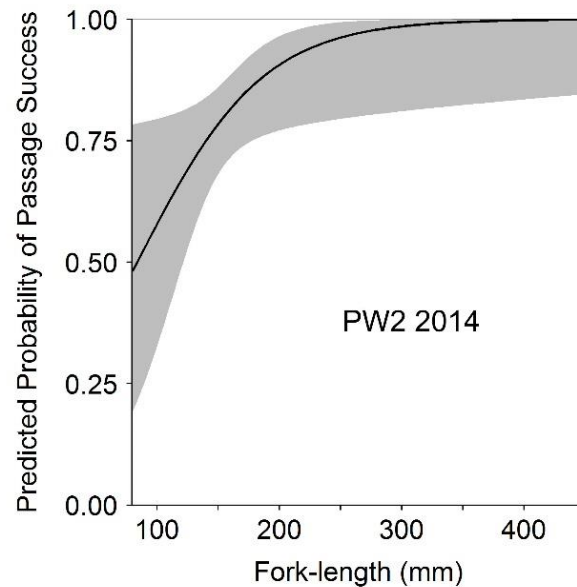
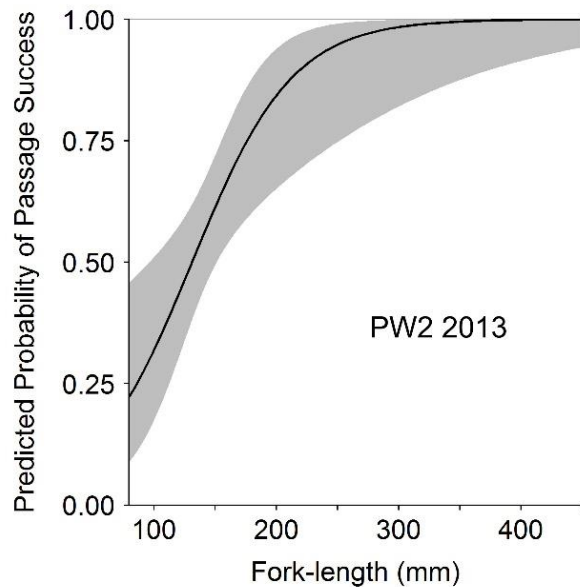
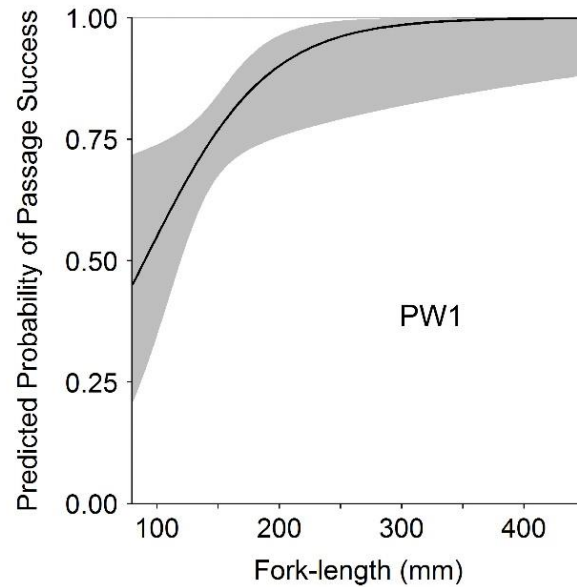
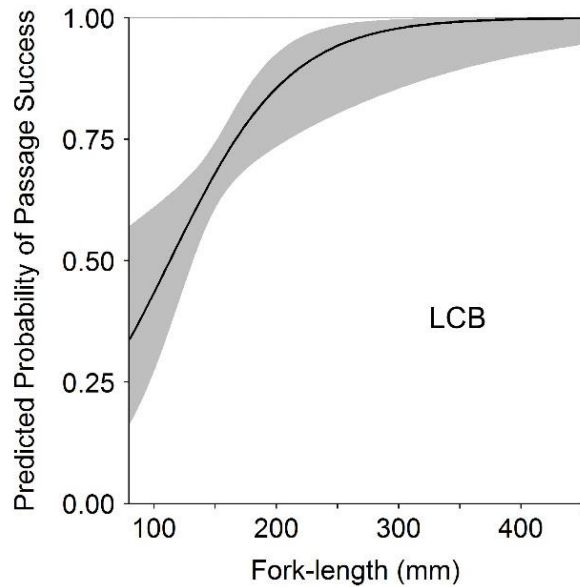
Models based on ultimate passage success of *Salmo trutta*. All $P < 0.05$ against null model.

LCB (2013) – $P_{50} = 113$ mm $P_{90} = 222$ mm

PW1 (2013) – $P_{50} = 91$ mm $P_{90} = 199$ mm

PW2 (2013) – $P_{50} = 132$ mm $P_{90} = 222$ mm

PW2 (2014) – $P_{50} = 82$ mm $P_{90} = 192$ mm



Summary

- Evidence to support use of low-cost baffle fish passes for *S. trutta* on ~20% slope flat faced weirs.
- Length effect observed – probability of passage lower to smaller fish
- Variability in delay incurred even between similar designs
- Displacement method successful – potential for useful rapid assessment tool?

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River Ribble,
Lancashire

River Wear,
Durham

