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

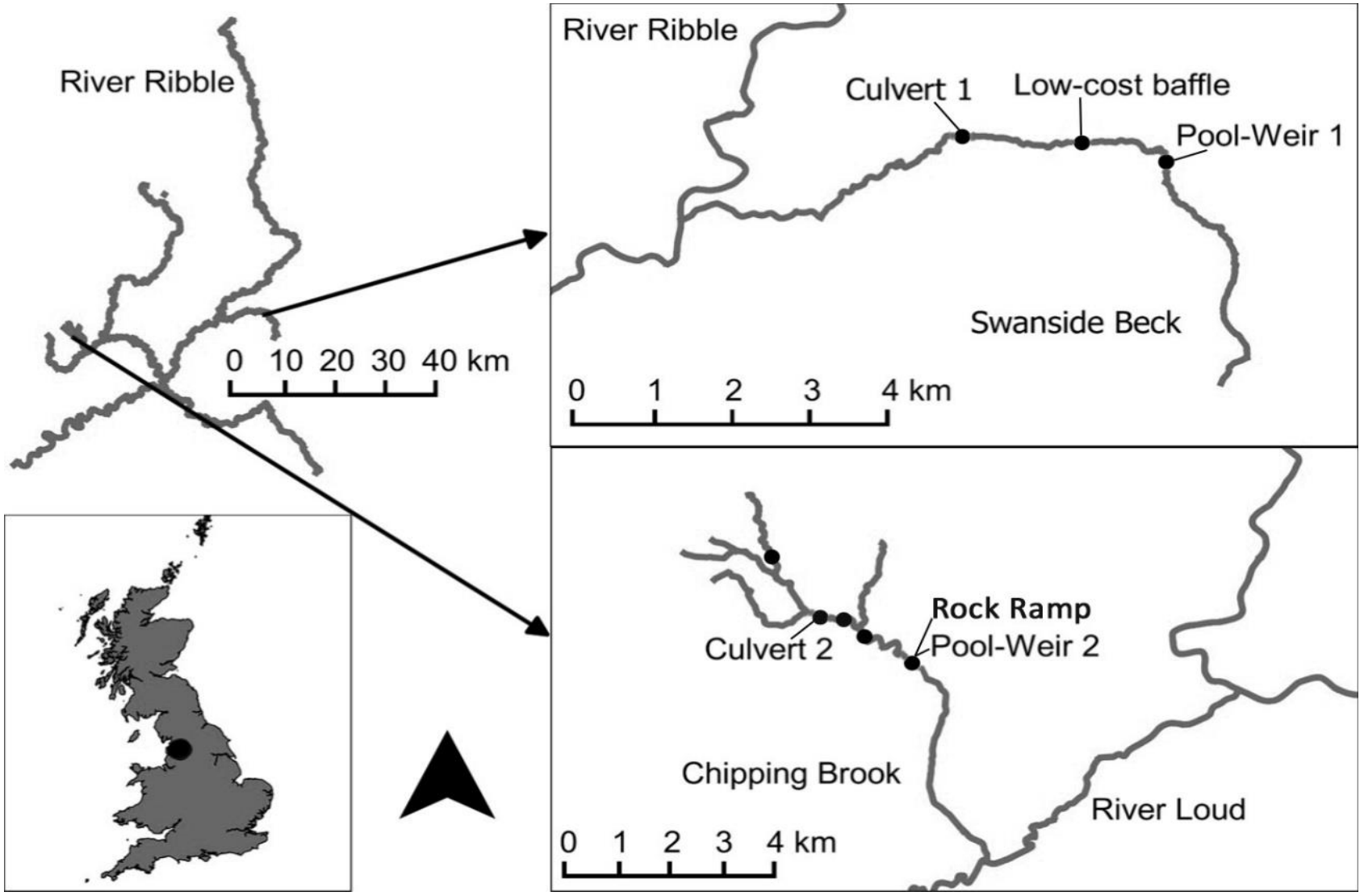
- Most studies focus on larger adults

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 $ms^{-1}$

Culvert 2 (2013)

Length = 70 m, Slope = 5.2%, Mean V = 2.32 $ms^{-1}$

# Study structures

Low-cost baffle (Servais, 2006; 2013 and 2014)

Length = 6.70 m, Slope = 24%, Mean V = 1.42 $ms^{-1}$

# 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.

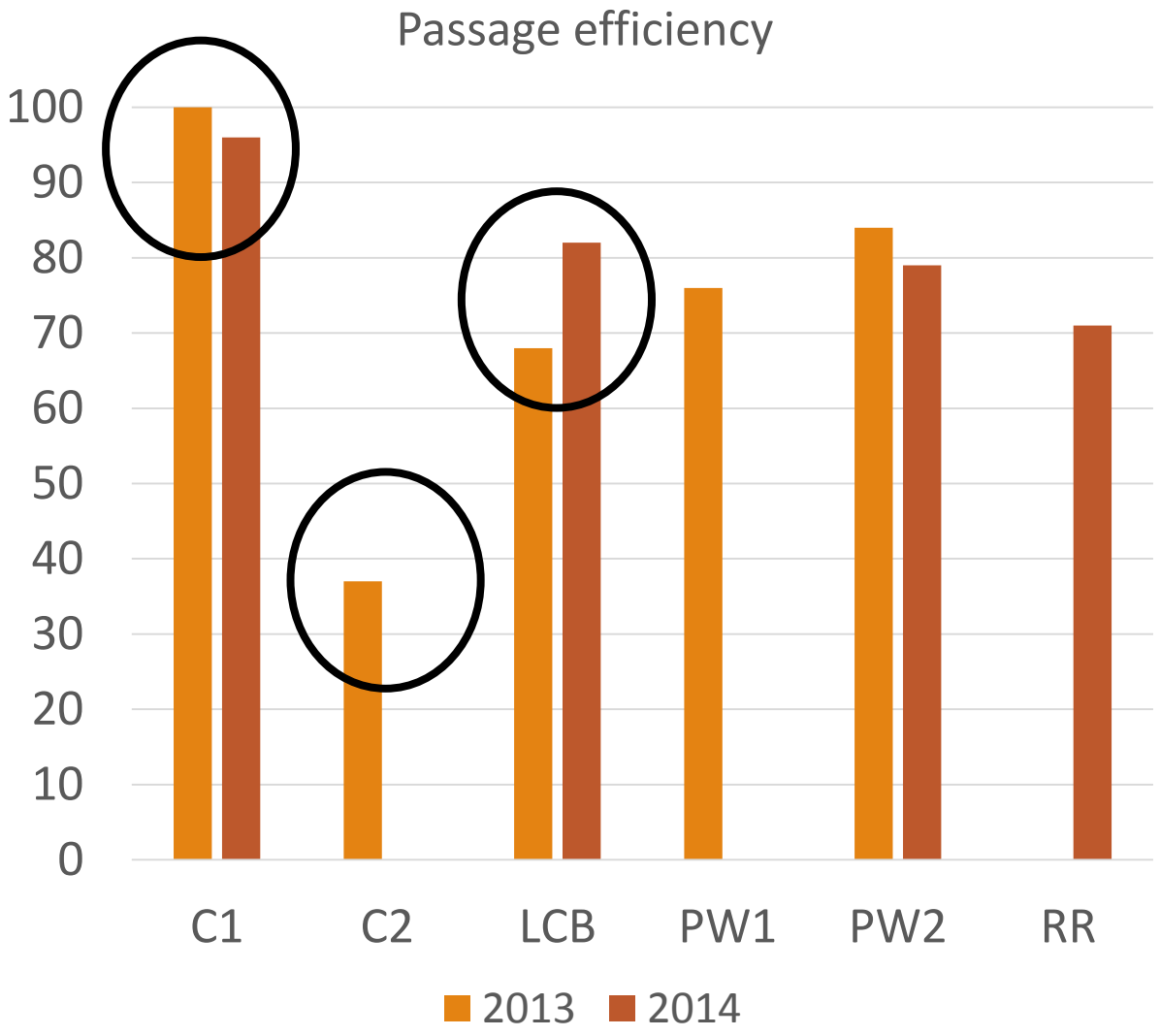
***Displaced and naturally migrating fish***

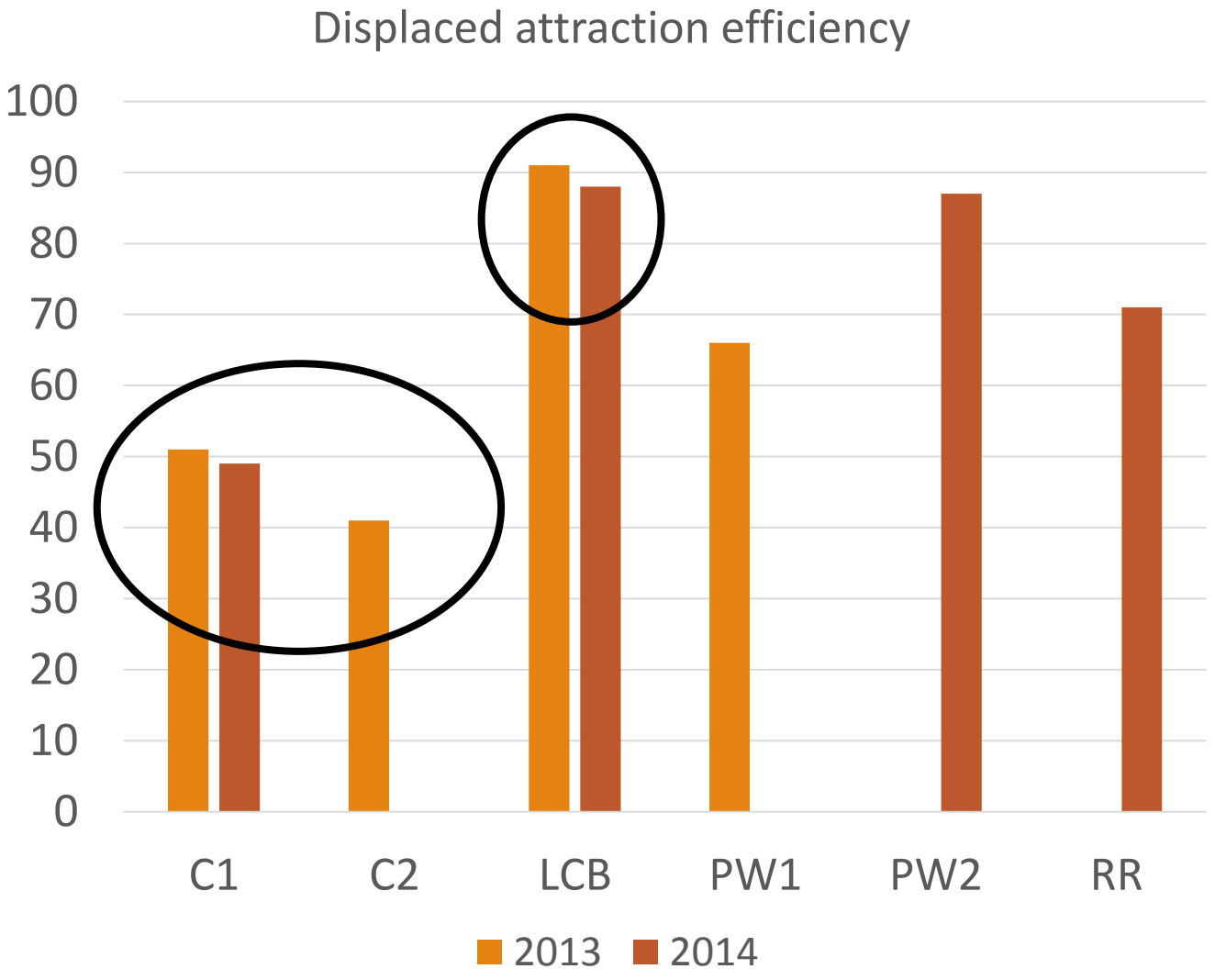
Fish displaced from 100 m above to below utilising natural homing instinct to instigate attempts – monitored for 15 days.

Fish were caught using electric fishing.

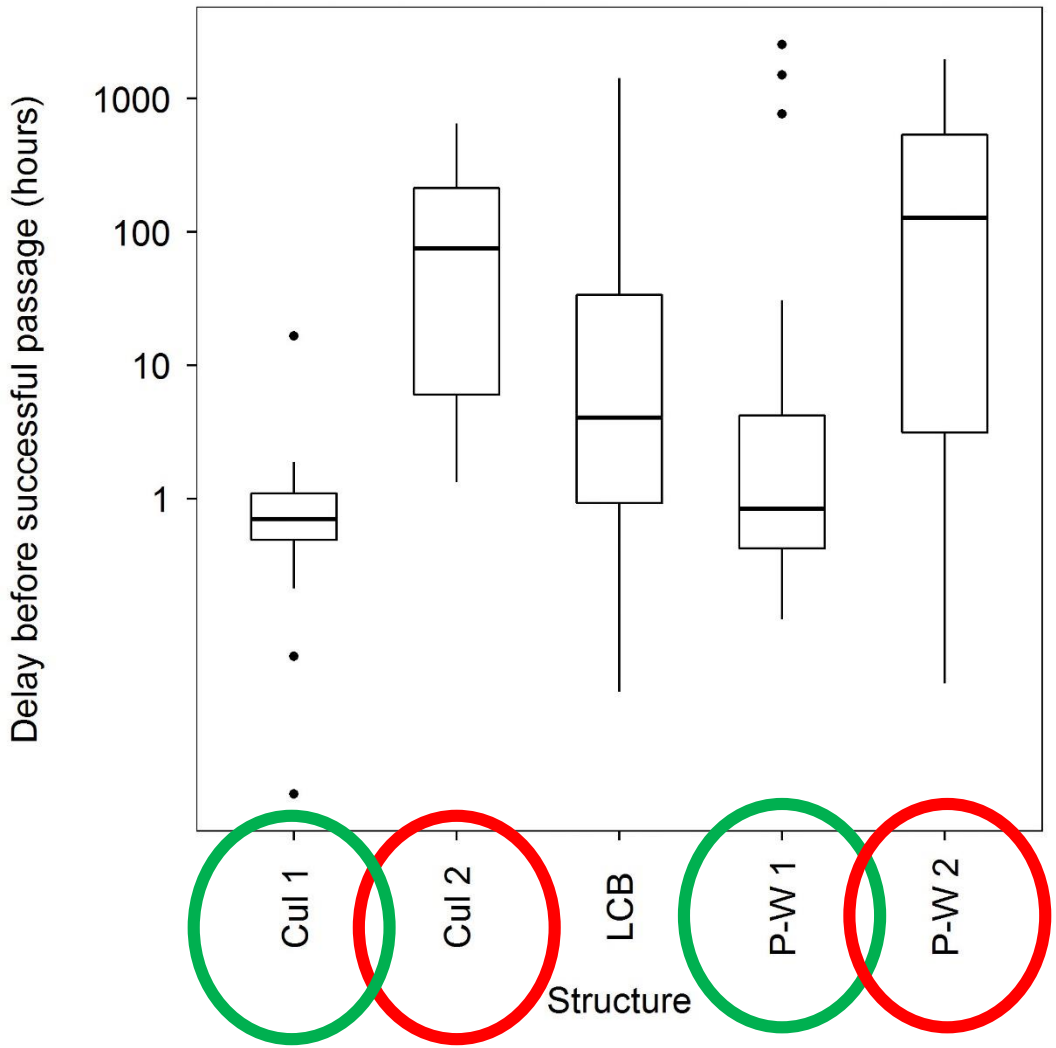
600-700 fish per stream IP tagged (12 mm (FL < 120 mm) or 23 mm (FL > 120 mm) HDX tags).

# Passage and attraction efficiency

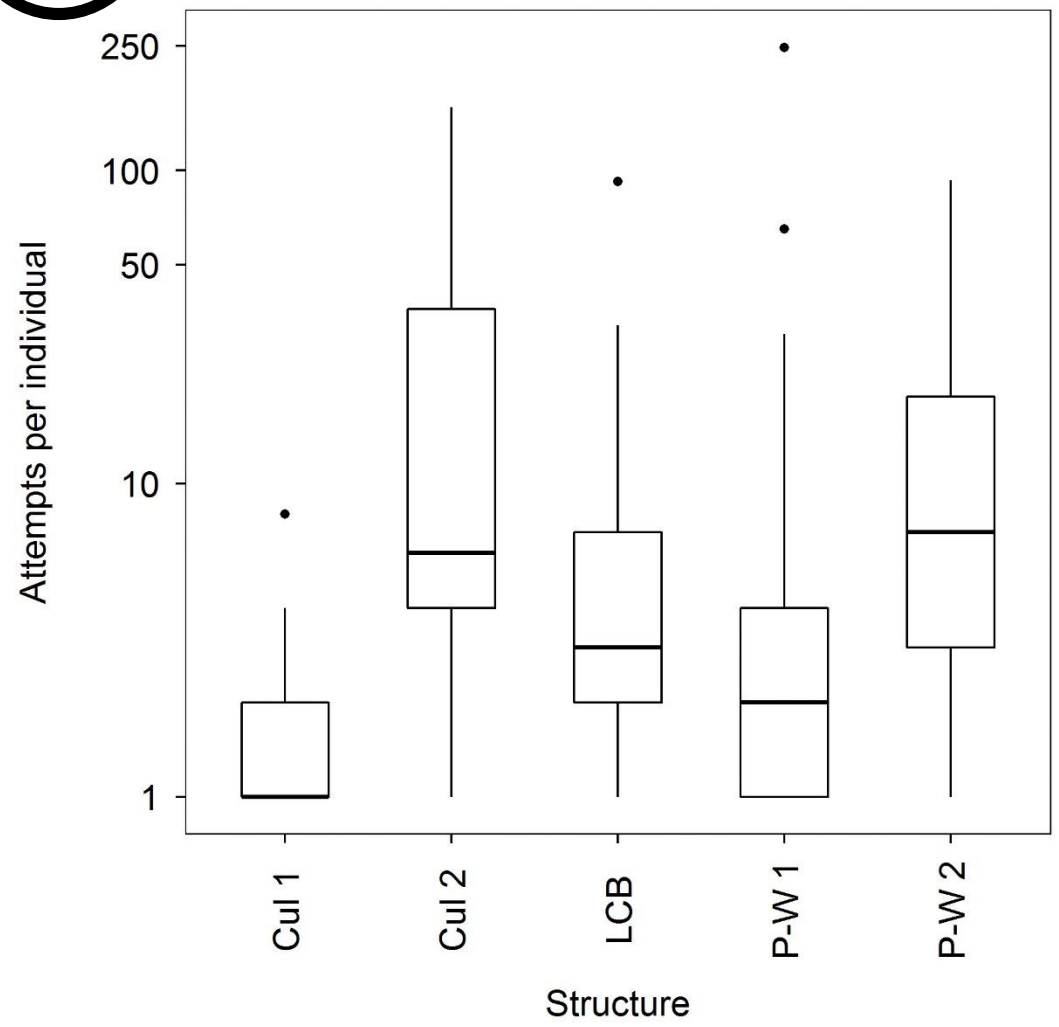


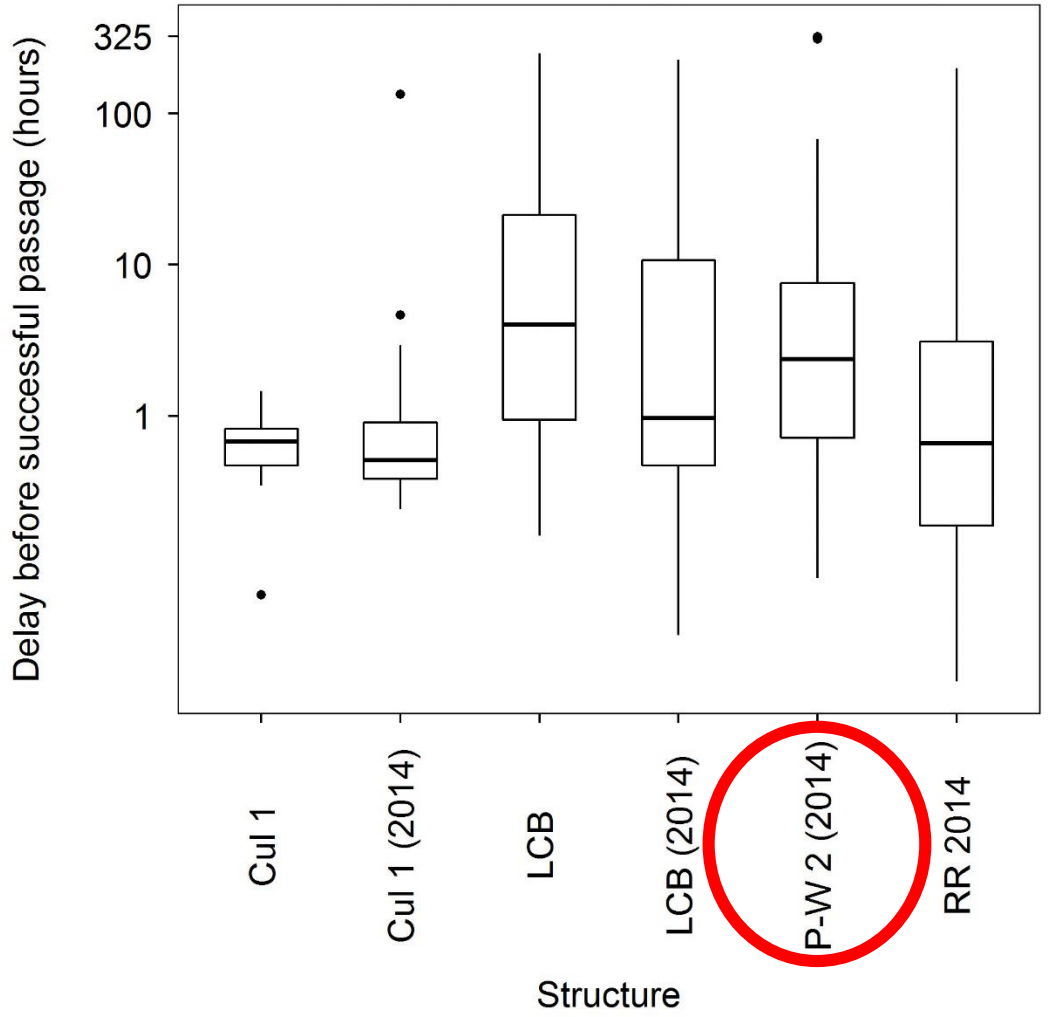
# Delays

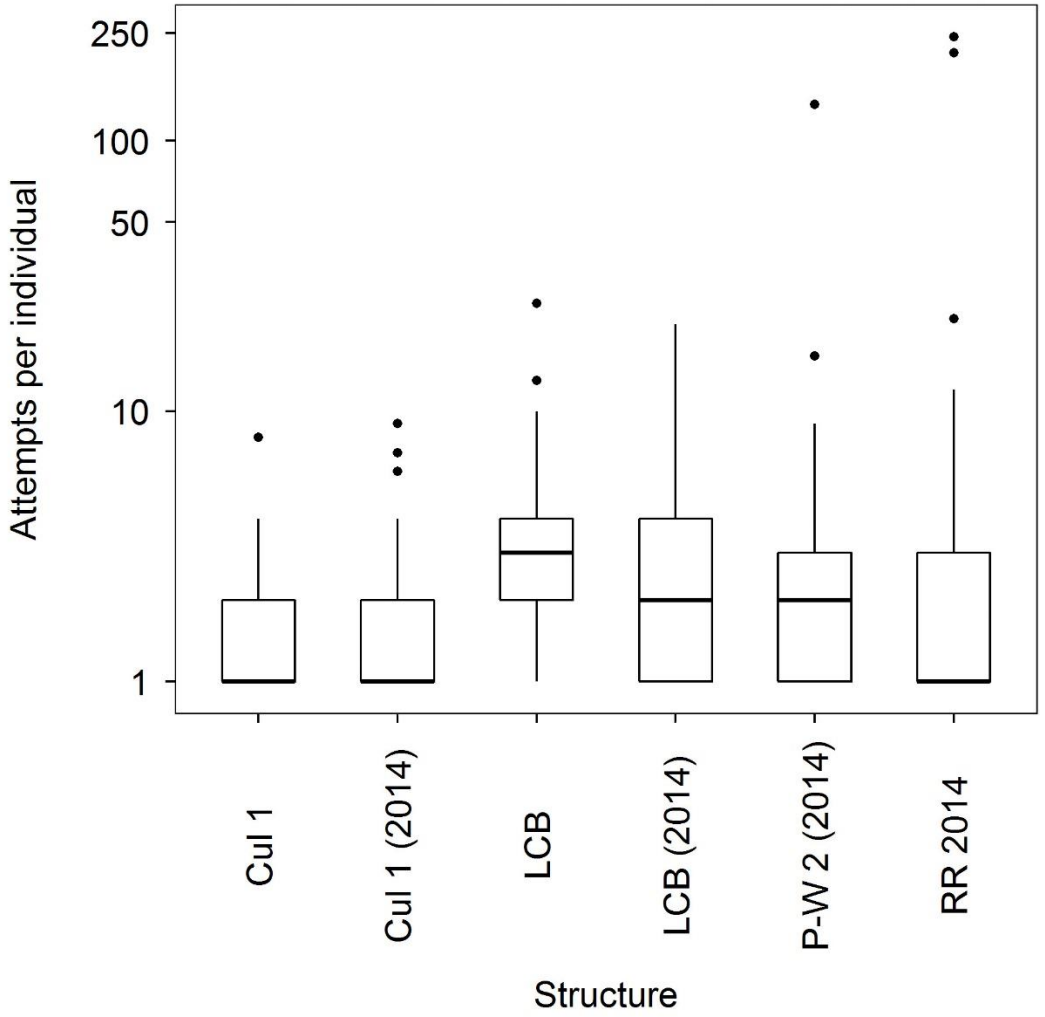



$P > 0.05$, Mann-Whitney U

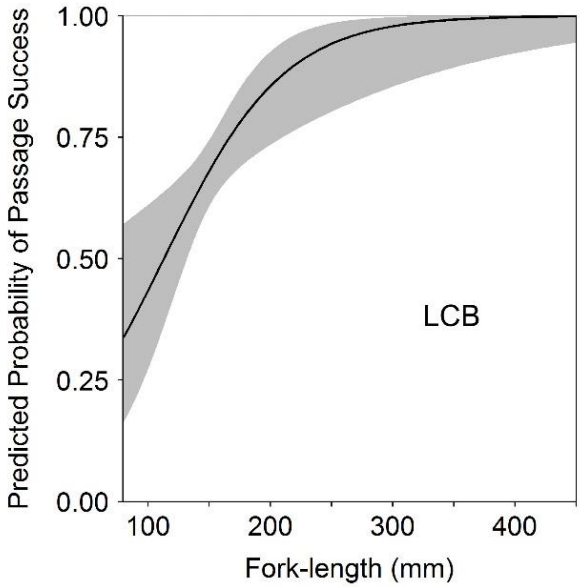


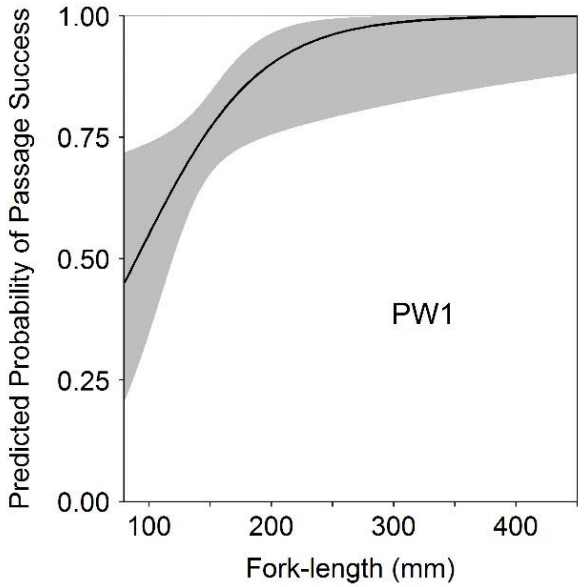
# Delays – Displacements

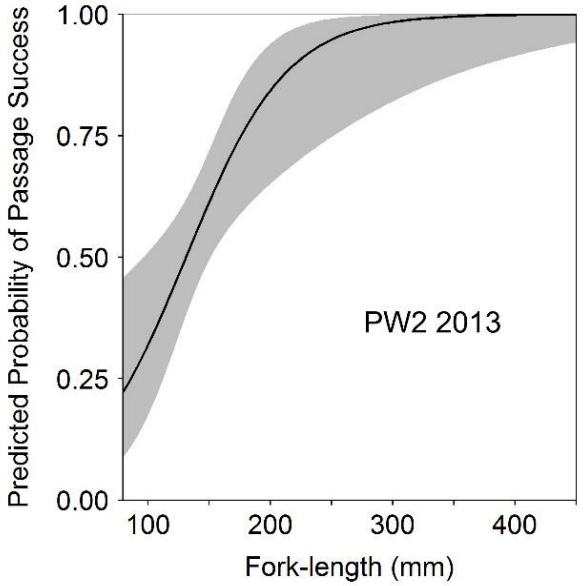


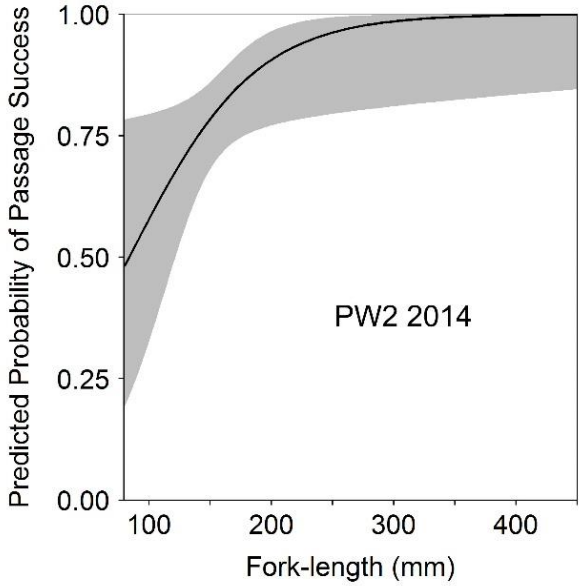



# Length and probability of passage




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?

# Acknowledgements

Ribble Rivers trust volunteers and staff

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River Ribble, Lancashire

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