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Session B5: Efficiency of a Nature-Like Bypass Channel at Rodley Weir, River Aire

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Efficiency of a nature-like bypass channel at Rodley Weir, River Aire, England

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Rodley Weir

River Aire

1.8m in height

Nature-like bypass built in 2011/2012

Fish pass design

Aim

The aim of this investigation was to assess the performance of Rodley Weir nature-like bypass on the River Aire in West Yorkshire using passive integrated transponder (PIT) telemetry.

Objective

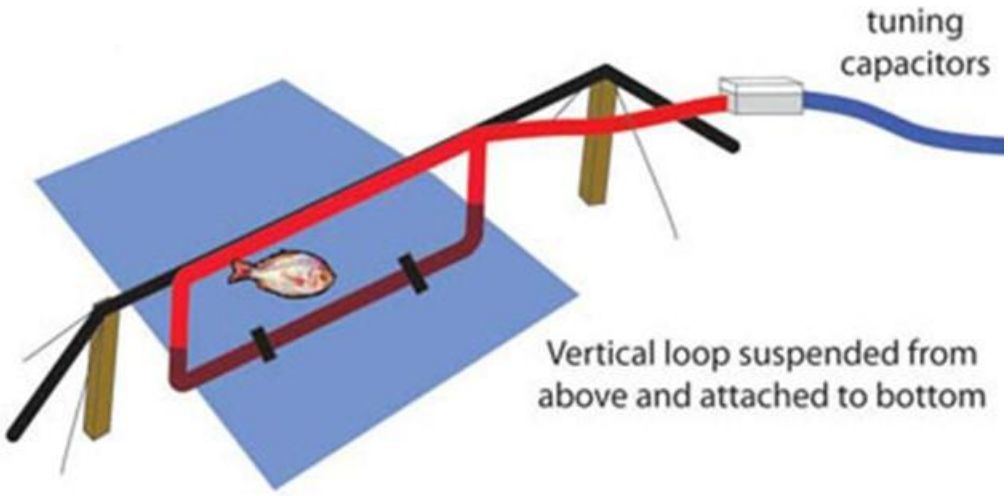
1) Quantify attraction, entrance, exit and passage efficiency of brown trout.

2) Establish the influence of fish size on approaches and movements into and through the fish pass.

3) Evaluate the timing of movements in relation to time after release and environmental conditions (river flow and water temperature).

How PIT telemetry works

- Electromagnetic induction coil in tag
- Energized from an external source
- Tag detection range is influenced by tag size and antenna dimensions

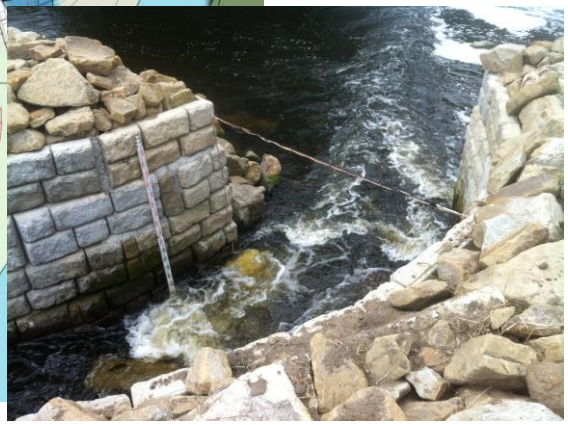


Brown trout capture and tagging

- Half-duplex PIT tag (23.0-mm long x 3.4-mm diameter, 0.6 g weight in air)
- Anaesthetised with buffered tricaine methanesulphonate (MS-222)
- Inserted into body cavity through a 5-mm long ventro-lateral incision
- Released ~350 m downstream of Rodley Weir.
- Fish treated in compliance with the UK Animals (Scientific Procedures) Act 1986 (PPL 60/4400)

Date of Capture	Capture site	n	Length (mean ± SD (range), mm)
10/10/2013	Esholt Hall	16	357.1 ± 93.4 (224-510)
10/10/2013	Crossflats	8	311.3 ± 71.7 (245-438)
11/10/2013	Hirstwood	31	273.5 ± 61.6 (212-441)
11/10/2013	Silsden bridge	33	257.3 ± 64.2 (167-429)
30/06/2014	Rodley weir	23	184.6 ± 24.7 (151-239)

Study design



Fish pass efficiency

Attraction efficiency: The number of fish detected on A1 as a proportion of the total number tagged.

Entrance efficiency: The number of fish detected on A2 as a proportion of fish detected on A1.

Exit efficiency: The number of fish that ascended the fish pass as a proportion of fish detected on A4.

Passage efficiency: The number of fish that ascended the fish pass as a proportion of fish detected on A2.

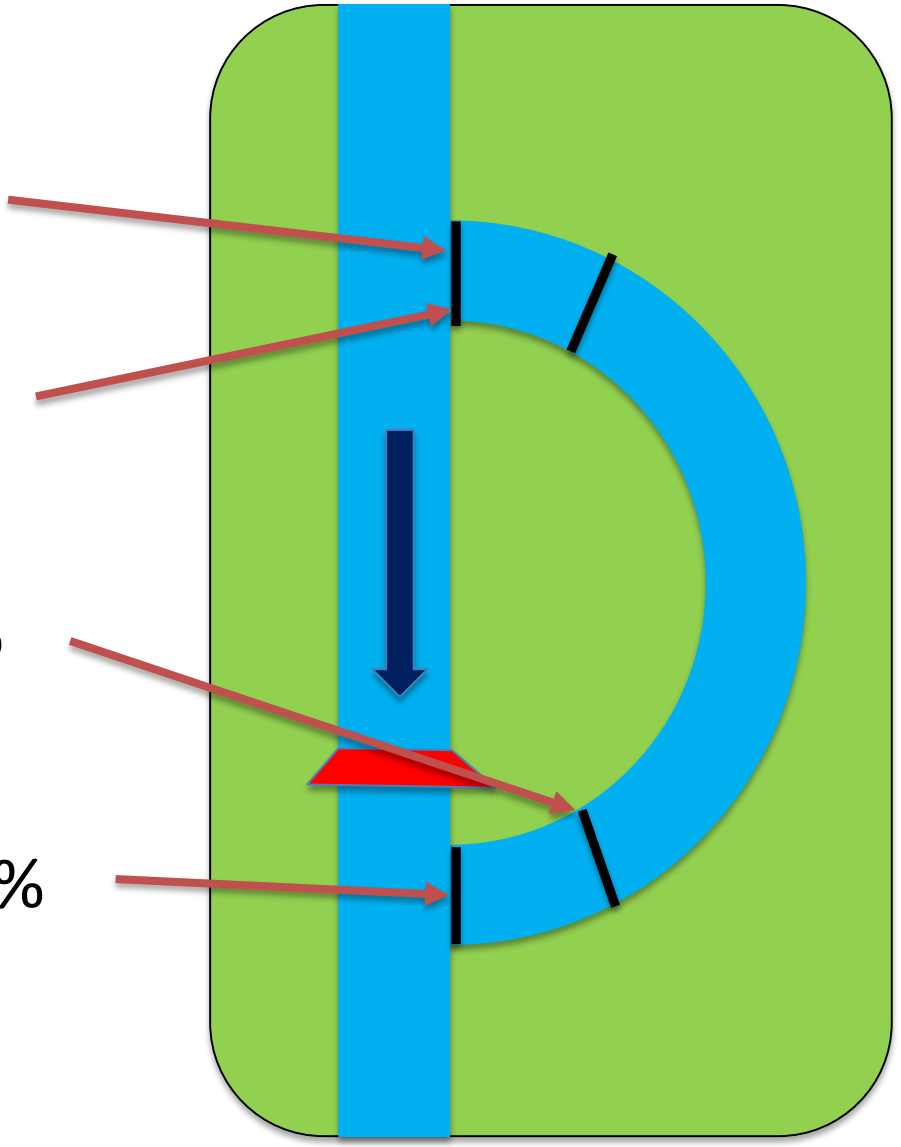
Efficiency results

Passage efficiency= 78%
38/49

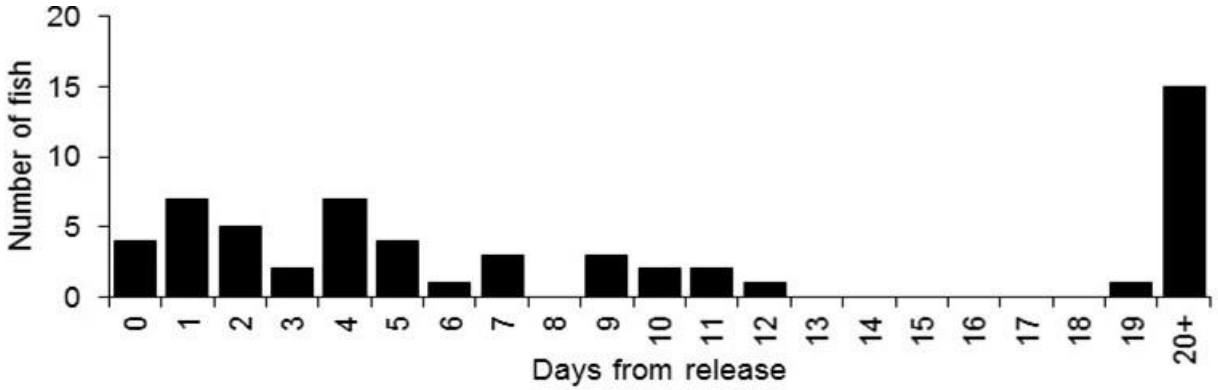
Exit efficiency= 97%
38/39

Entrance efficiency= 86%
49/57

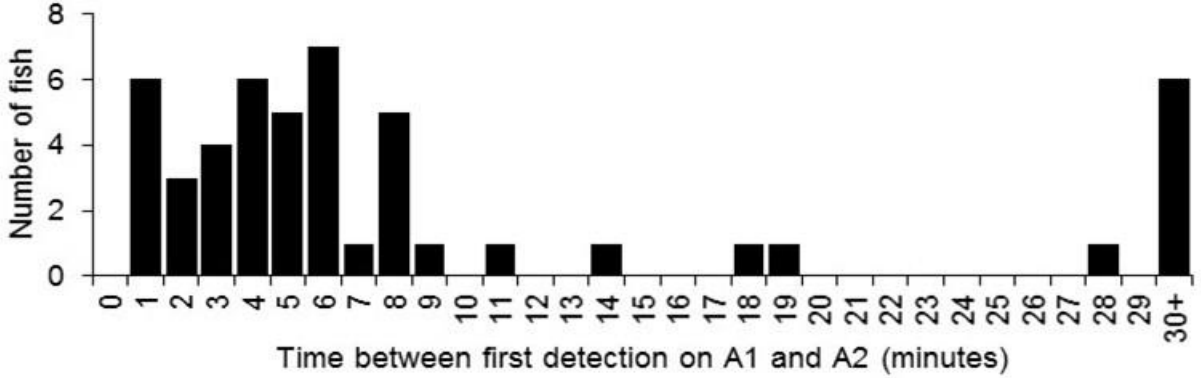
Attraction efficiency= 51%
57/111



Passage timings and duration (1)

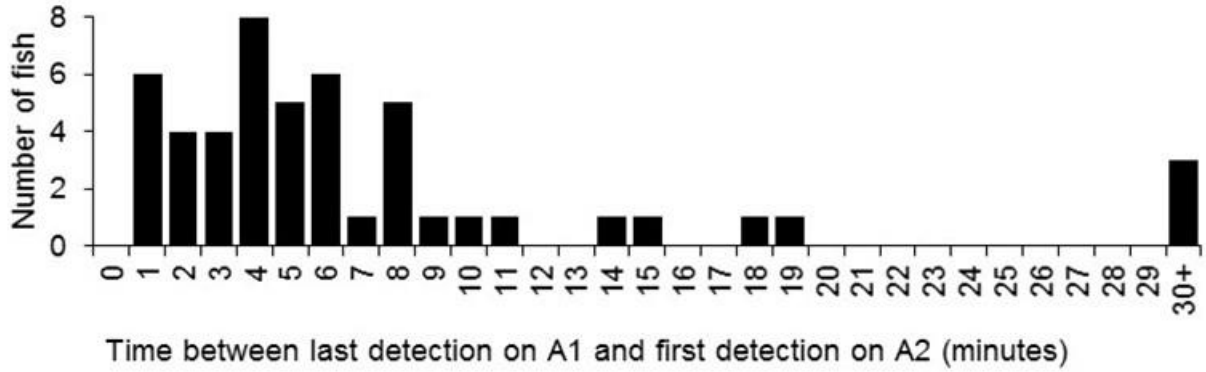


Time from release to first detection at fish pass entrance

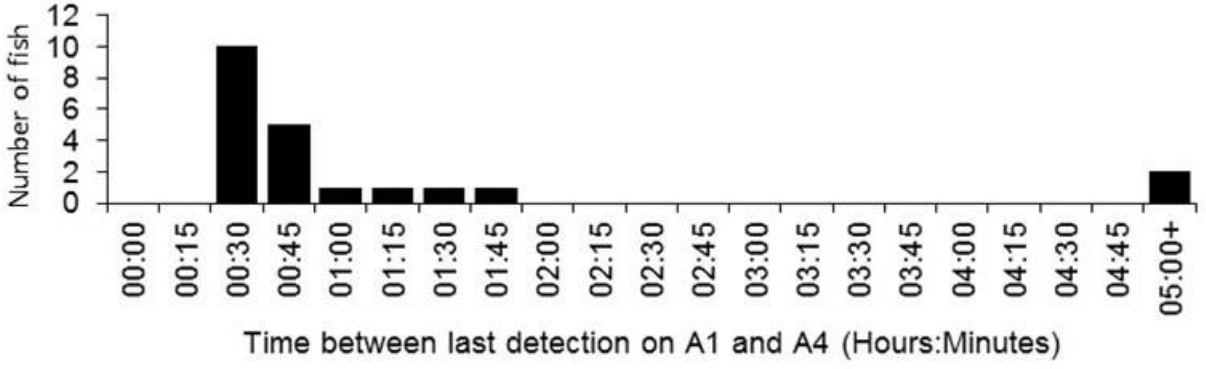


Time taken to enter the fish pass once detected at the entrance

Passage timings and duration (2)

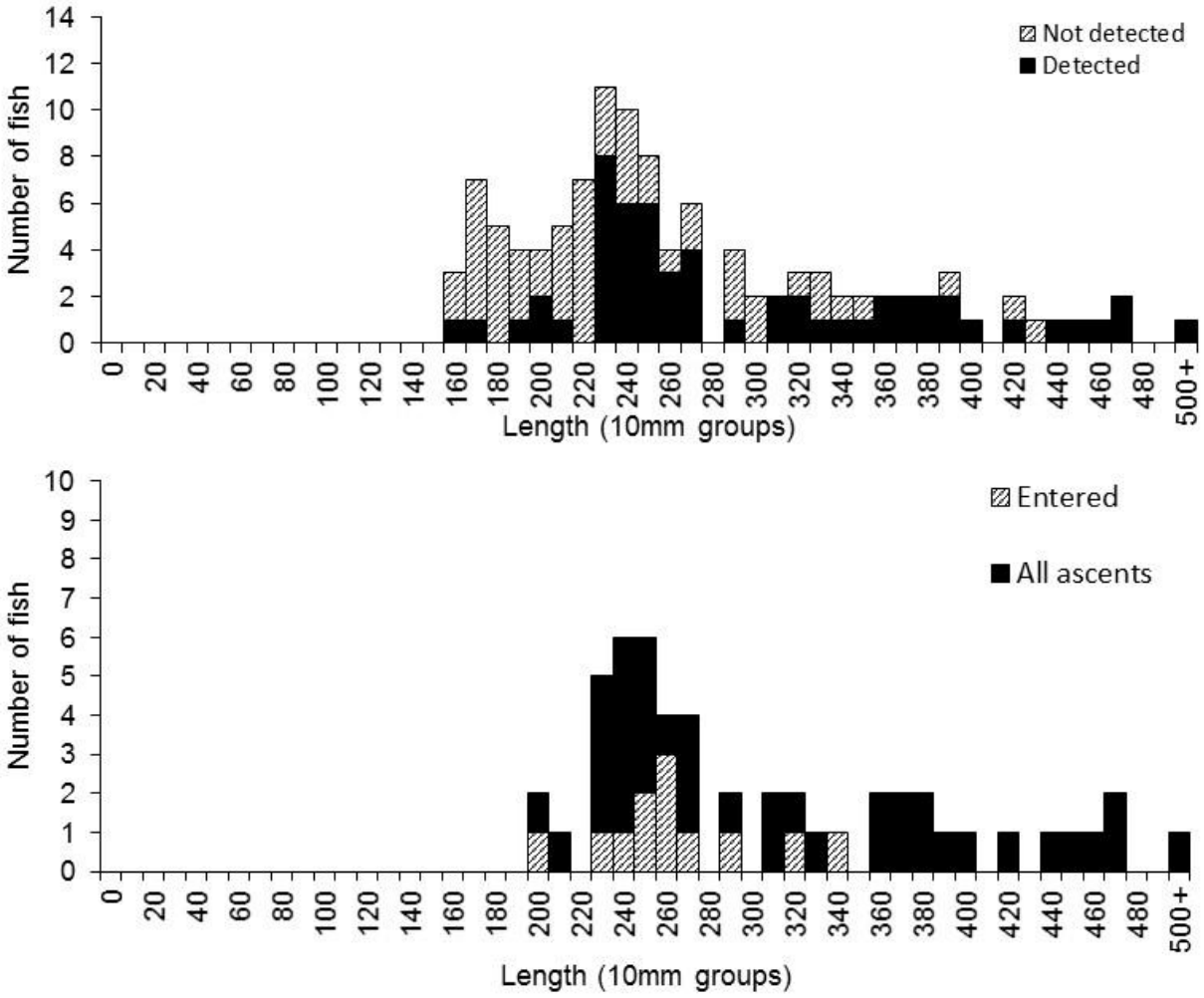


Time taken to move through the most downstream section of the fish pass



Time taken to ascend the fish pass

Results

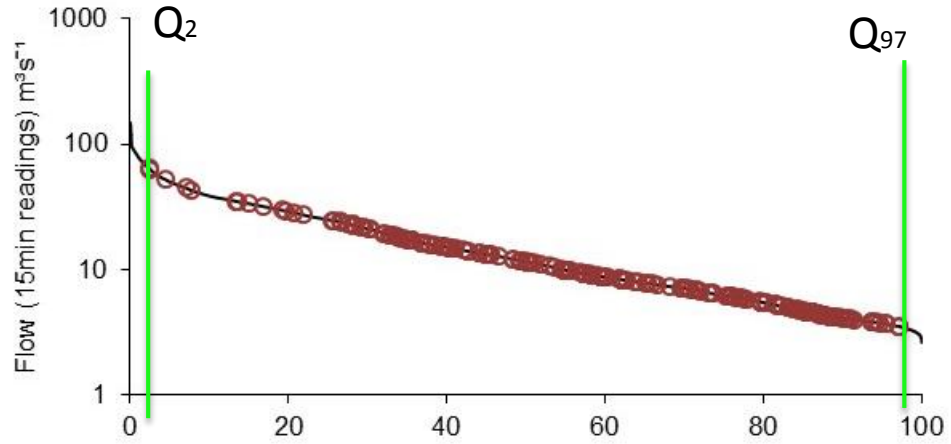


Fish detected in the pass were significantly larger than fish not detected (Mann-Whitney *U* test: $Z = 2{,}237.00$, $n = 111$, $P = 0.000$).

Fish that ascended the pass were comparable in size to fish detected in the pass but did not ascend (Mann-Whitney *U* test: $Z = 261.5$, $n = 49$, $P = 0.208$).

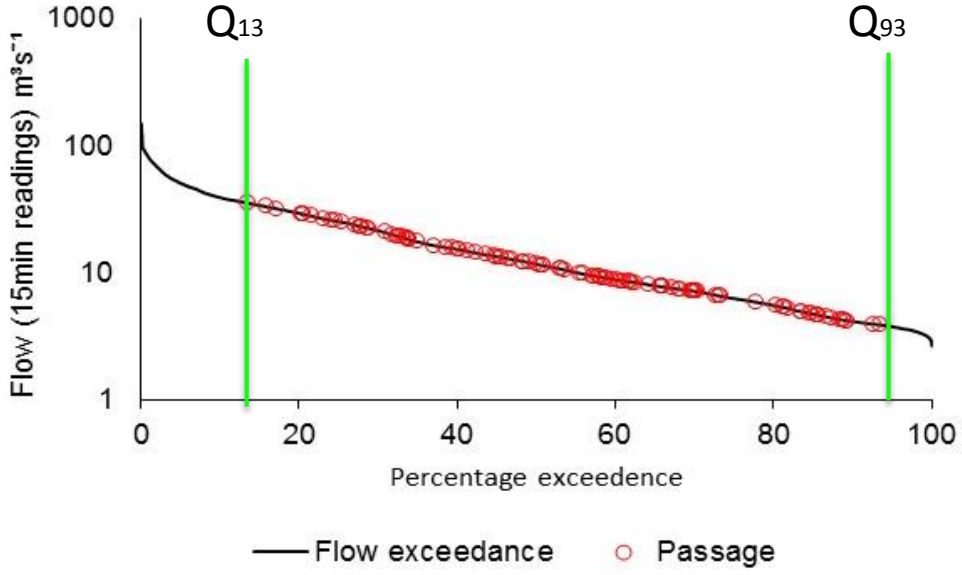
Timing of entrance and passage in relation to flow

Entrances



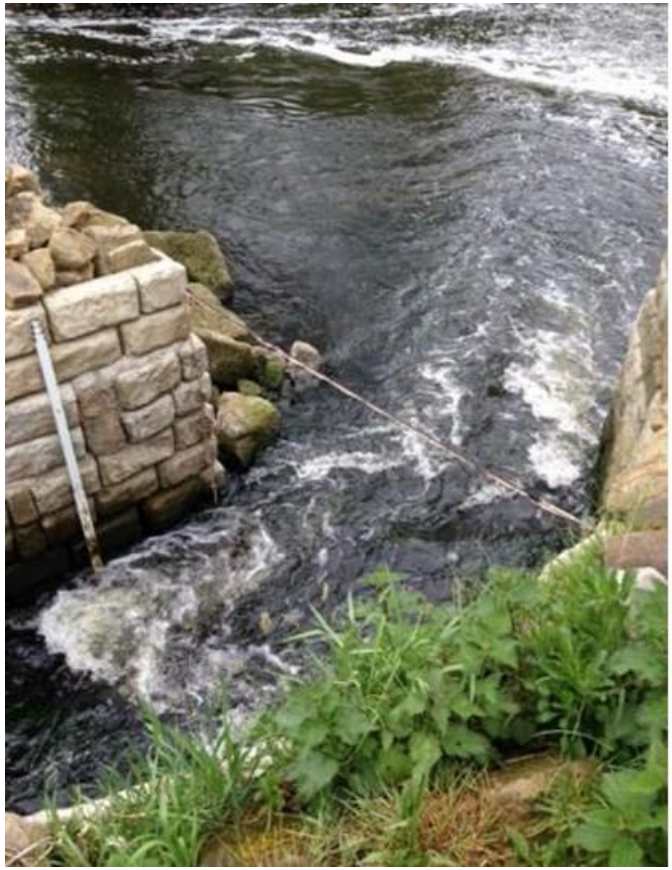
Fish entered the fish pass between Q_{97} and Q_2

Passages

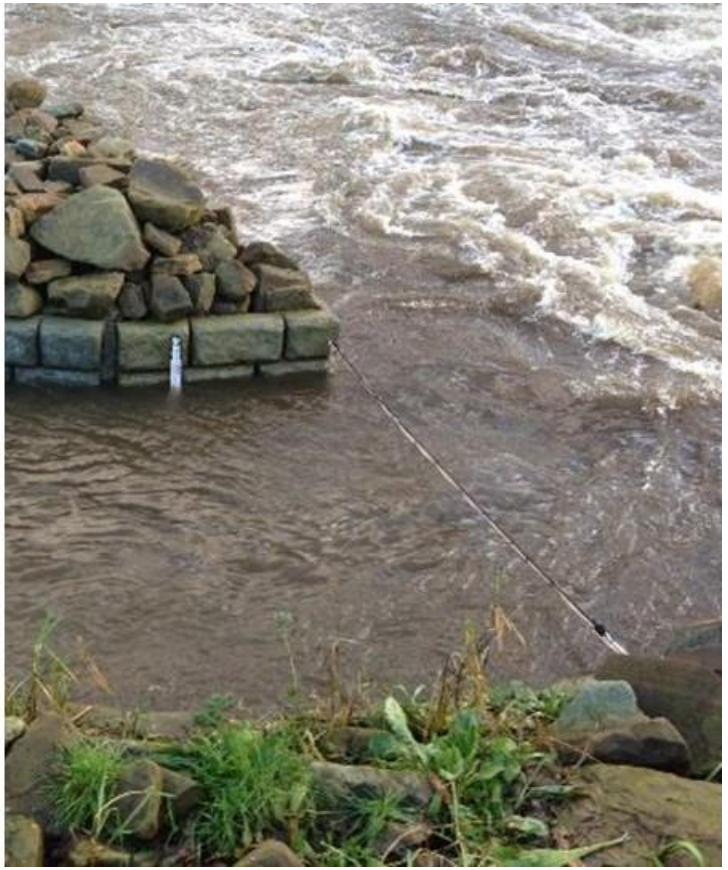


Fish ascended the fish pass between Q_{93} and Q_{13}

Fish pass entrance

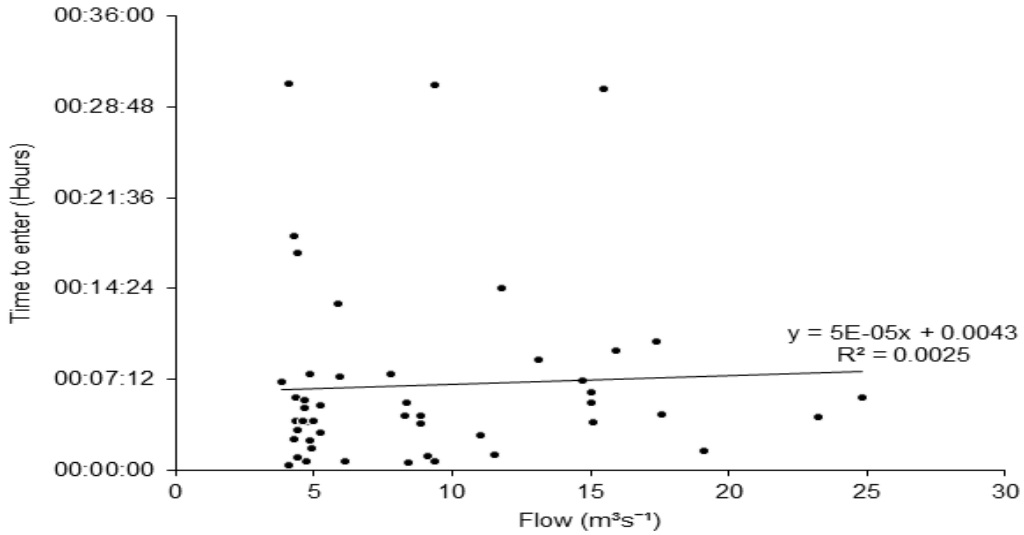


5.74 m^3s^{-1}. (Q78)

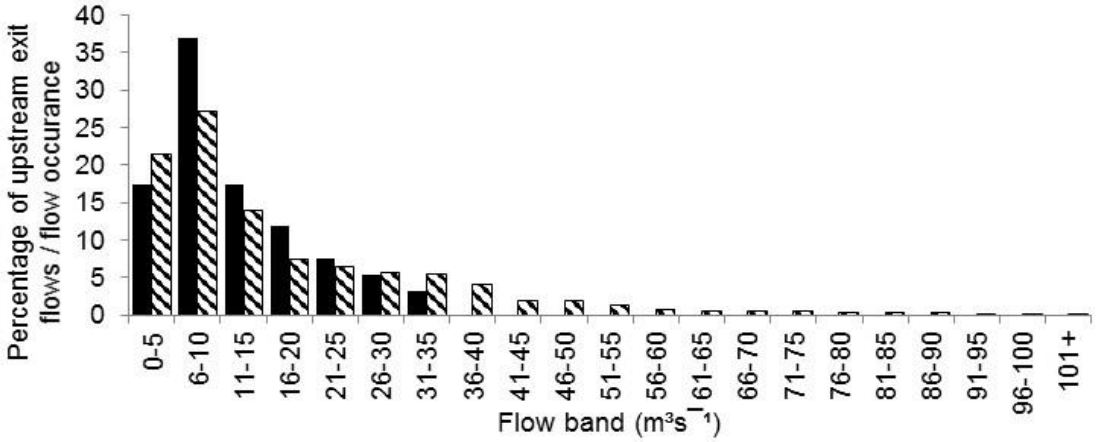


90 $m^3 s^{-1}$. (Q0.4)

Flow at entrance and exit



The time to enter the fish pass was not correlated with prevailing flow



36% of upstream exits occurred between flows of 6-10 $m^3 s^{-1}$ (Q_{54} - Q_{76})

Discussion

	Rodley	River Emån (Calles & Greenberg, 2005)	Tirsæk brook (Aarestrup et al. 2003) Sea trout
Attraction	51%	14-53%	60%
Entrance	86%	-	-
Passage	78%	91-100%	91%

Passage efficiency has not reached similar levels to those found in similar studies.

Results indicate that fish are able to find and ascend the bypass.

One of very few studies involving efficiency results with non-obligatory migrating brown trout through a nature-like bypasses.

Thank You for listening

Any Questions?

Many thanks must go to HIFI staff and students, the Environment Agency, Arup, Yorkshire Water, Rodley Nature Reserve and Ian Wellby (BlueRoof)

Please contact me at:

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