Movement of brown trout in and between headwater tributaries and reservoirs

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Reservoirs in Yorkshire

- Over 120 reservoirs in Yorkshire
- Constructed since late 19th Century
- Water supply to over 5 million people
- Recreational value
- Compensation release to maintain river flow
Aim

The aim of this investigation was to assess the spatial ecology and behaviour of brown trout in reservoirs and their tributaries, including those with barriers to movement.

Objectives

• Investigate the spatial ecology of brown trout in a tributary upstream of a reservoir using radio telemetry.

• Investigate the timing and influence of flow, temperature and fish size on the upstream and downstream movements of brown trout between tributaries and reservoirs using fixed-location PIT telemetry.

• Investigate the behaviour and habitat use of brown trout in a reservoir, especially during the spawning period, using fine-scale acoustic telemetry.
Langsett Reservoir (impact)
## Adult fish movements in a tributary

<table>
<thead>
<tr>
<th>Fish length (mean ± SD (range), mm)</th>
<th>Fish mass (mean ± SD (range), g)</th>
<th>Tag / body wt ratio (mean (range), %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>186.4 ± 22.2 (164 – 227)</td>
<td>82.8 ± 28.5 (55 – 134)</td>
<td>1.3 (0.7 – 1.7)</td>
</tr>
</tbody>
</table>

![Graphs showing fish movements and data distribution](image-url)
Influence of flow and temperature

Mean weekly distance moved (m) vs. Temperature (°C) and depth (cm)

16/10/14, 23/10/14, 30/10/14, 06/11/14, 13/11/14, 20/11/14, 27/11/14, 04/12/14, 11/12/14, 18/12/14, 25/12/14, 01/01/15, 08/01/15, 15/01/15, 22/01/15

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Grimwith Reservoir

Detected, 107.9 ± 27.7 mm
Not detected, 98.1 ± 30.0 mm

Mann-Whitney U test:
Z = -2.311, n = 150,
P = 0.021

Langsett Reservoir

Detected, 102.2 ± 32.7 mm
Not detected, 139.9 ± 32.3 mm

Mann-Whitney U test:
Z = -2.173, n = 50,
P = 0.03

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Fish length (10-mm classes)

Number of fish

Detected, 301.5 ± 65.7 mm
Not detected, 243.7 ± 74.8 mm

Detected, 222.0 ± 45.0 mm
Not detected, 197.2 ± 35.5 mm

Mann-Whitney U test:
Z = -1.225, n = 50, P = 0.221

Mann-Whitney U test:
Z = -2.244, n = 50, P = 0.025
Daily movements between Grimwith Reservoir and tributaries

Number of fish

River
Reservoir
Temperature (°C) and depth (cm)

Depth (cm)

Temperature (°C)
Daily approaches to weir on Little Don, Langsett Reservoir

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Daily approaches to weir on Thickwoods Brook, Langsett Reservoir

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Number of different days fish approached the weirs upstream of Langsett
Habitat use and movements of fish in the reservoir (VPS)

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All positions from all fish
>5 positions per cell

- Fish almost exclusively occupied littoral zone
- Only positions in middle of reservoir when crossing
- Very little time near tributaries
Conclusions

- Radio tagged adult fish in a headwater tributary occupied small home ranges and moved very little, including during spates.

- 6-26% of PIT tagged fish moved from the tributaries into the reservoir, predominantly in autumn and spring.

- A large weir prevented 66% of downstream moving PIT tagged fish entering the reservoir.

- Fish in the reservoirs moved / attempted to move into tributaries, from October-January, probably to spawn.

- Large barriers prevented 100% of upstream moving fish entering tributaries.

- Fish in reservoirs almost exclusively occupied littoral zone, generally not near tributaries, though variability been fish was observed.