

Dec 11th, 11:40 AM - 12:40 PM

Quantifying the fine-scale behaviour of spawning run river lamprey (*Lampetra fluviatilis*) approaching a low-head weir retrofitted with studded tiles

James Kerr
University of Southampton

Jeroen S. Tummers
Durham University

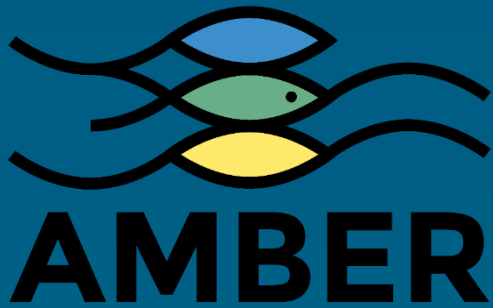
Martyn C. Lucas
Durham University

Paul S. Kemp
University of Southampton

Follow this and additional works at: https://scholarworks.umass.edu/fishpassage_conference

Kerr, James; Tummers, Jeroen S.; Lucas, Martyn C.; and Kemp, Paul S., "Quantifying the fine-scale behaviour of spawning run river lamprey (*Lampetra fluviatilis*) approaching a low-head weir retrofitted with studded tiles" (2018). *International Conference on Engineering and Ecohydrology for Fish Passage*. 10.
https://scholarworks.umass.edu/fishpassage_conference/2018/December11/10

This Event is brought to you for free and open access by the Fish Passage Community at UMass Amherst at ScholarWorks@UMass Amherst. It has been accepted for inclusion in International Conference on Engineering and Ecohydrology for Fish Passage by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.



UNIVERSITY OF
Southampton



Quantifying the fine-scale behaviour of spawning run river lamprey (*Lampetra fluviatilis*) approaching a low-head weir

James Kerr^a, Jeroen Tummers^b, Tom Benson^c, Martyn Lucas^b, Paul Kemp^a

a: International Centre for Ecohydraulics Research, Faculty of Engineering and Physical Sciences, University of Southampton, Highfield, Southampton, SO17 1BJ, UK.

b: Department of Biosciences, University of Durham, South Road, Durham, DH1 3LE, UK.

c: HR Wallingford, Howbery Park, Wallingford, Oxfordshire, OX10 8BA, UK.

ICER

International Centre for Ecohydraulics Research

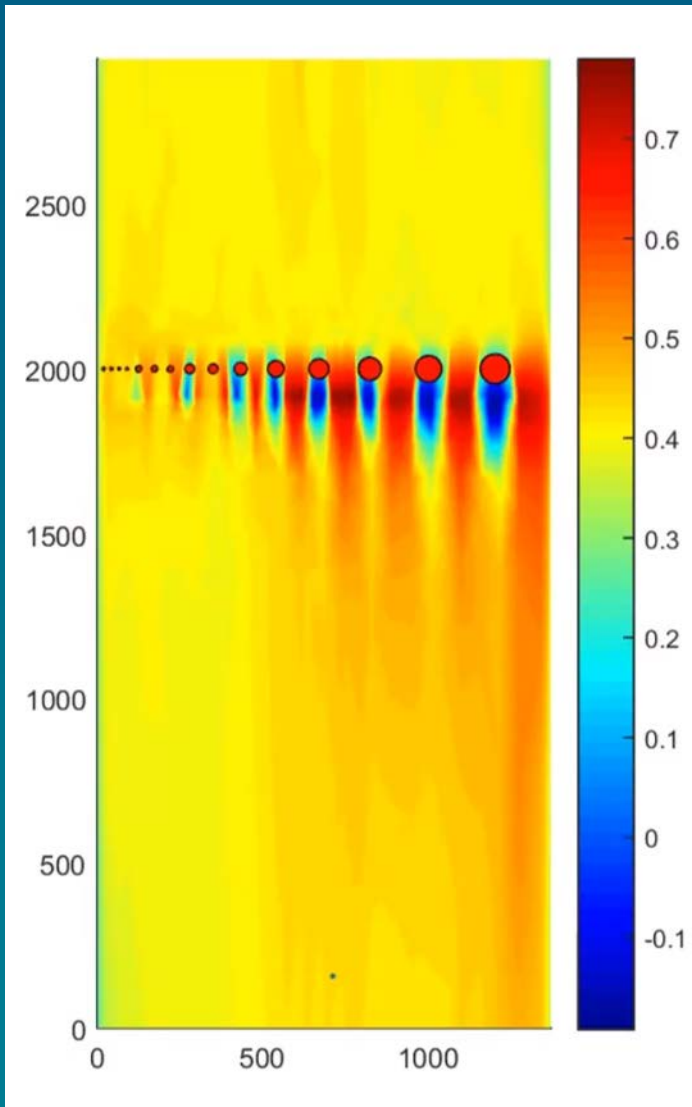


Aims and objectives

- **Aim:** Create a model to predict the upstream movement of river lamprey (*Lampetra fluviatilis*) as they approach a riverine barrier
- **Objectives:**
 - Quantify lamprey upstream movement parameters (e.g. speed/tortuosity)
 - Link movement to environmental factors (e.g. depth/velocity)
 - Develop behavioural rules
 - Integrate behavioural rules into an ABM



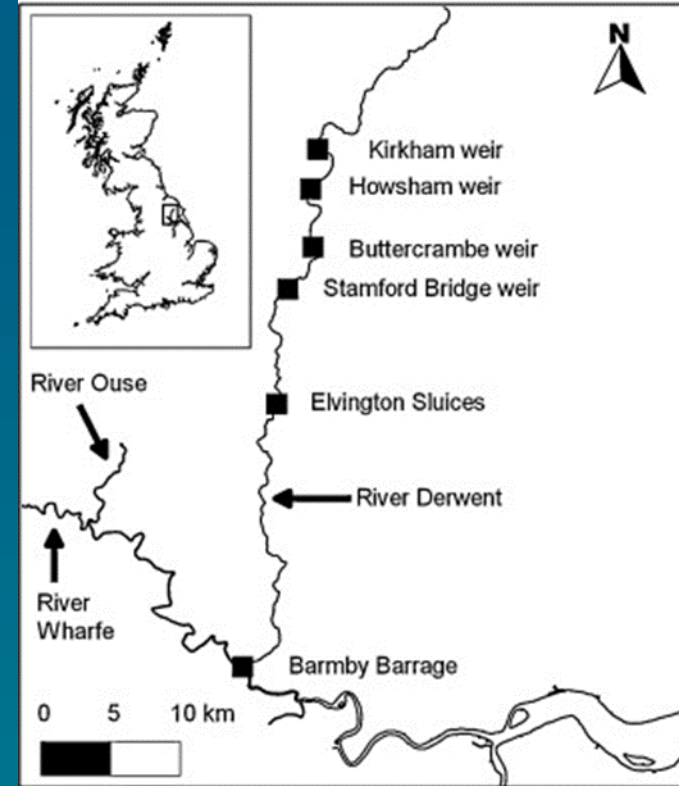
Upstream migrating river lamprey movement model



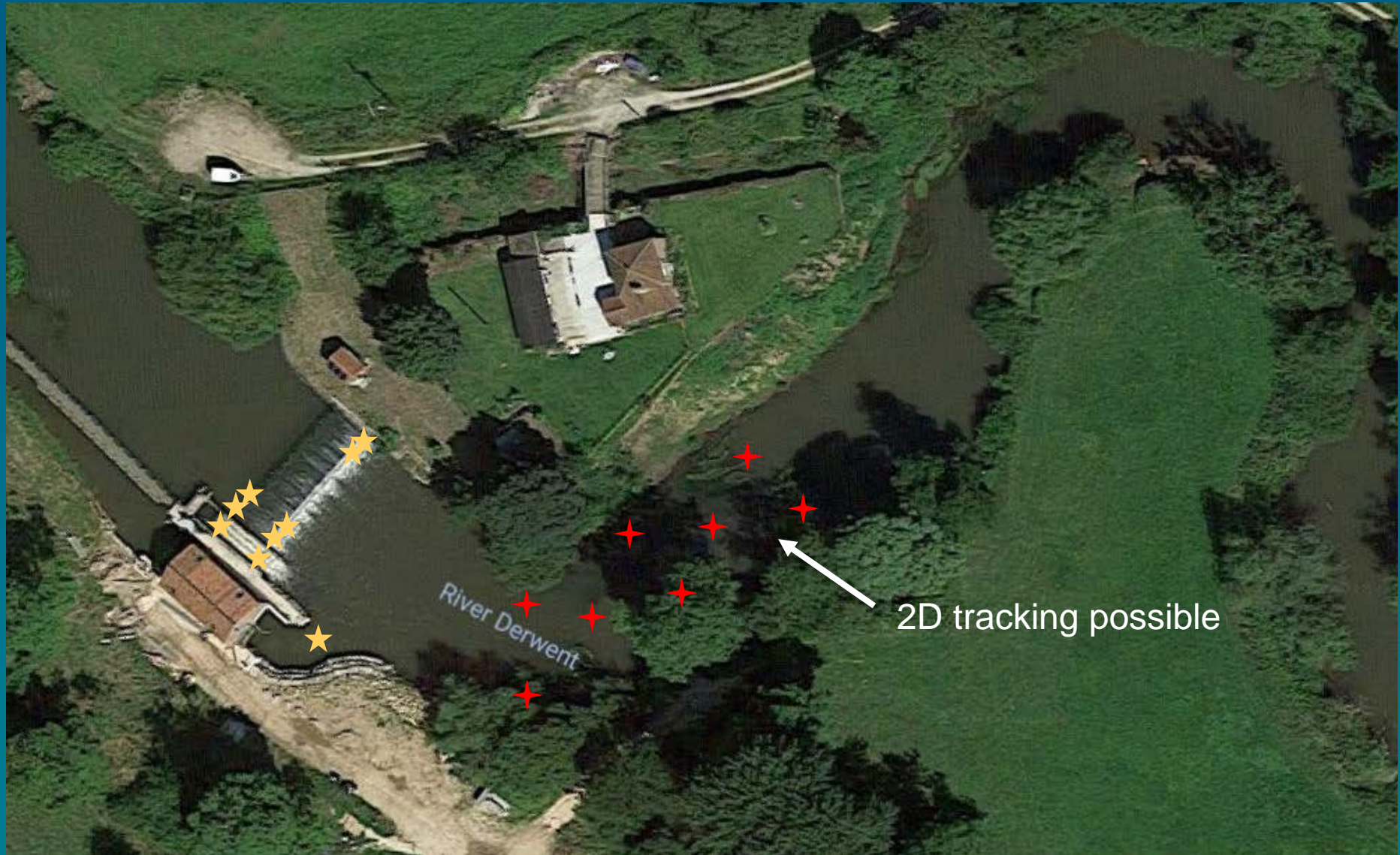
- 2D Model includes:
 - Advection
 - Swimming
 - Reflection
 - Tortuosity/persistence
- Aim to incorporate:
 - Behavioural preferences to certain hydrodynamic conditions
 - Rules learnt from telemetry study

Quantifying movement parameters:

- Field work site:
 - River Derwent, Yorkshire, UK
 - SAC
 - Multiple anthropogenic barriers
 - Buttercrambe weir
 - Gauging weir (1973)
 - Ineffective fish passage options (2013)
 - Microhydropower (2017)



Monitoring equipment downstream of the weir



★ Acoustic hydrophone

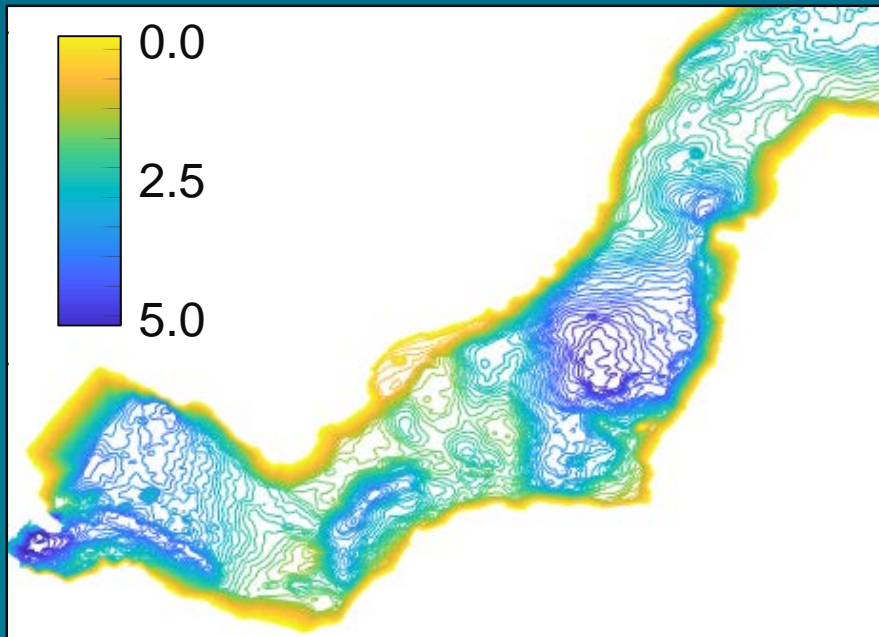
★ PIT Antenna

Bathymetry and hydraulics:

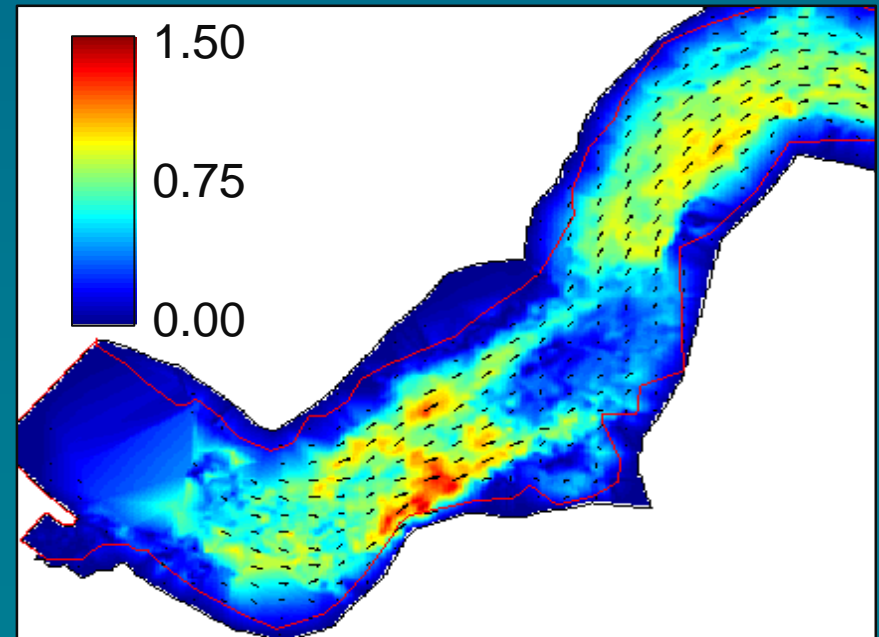


- ArcBoat
- GPS
- ADCP

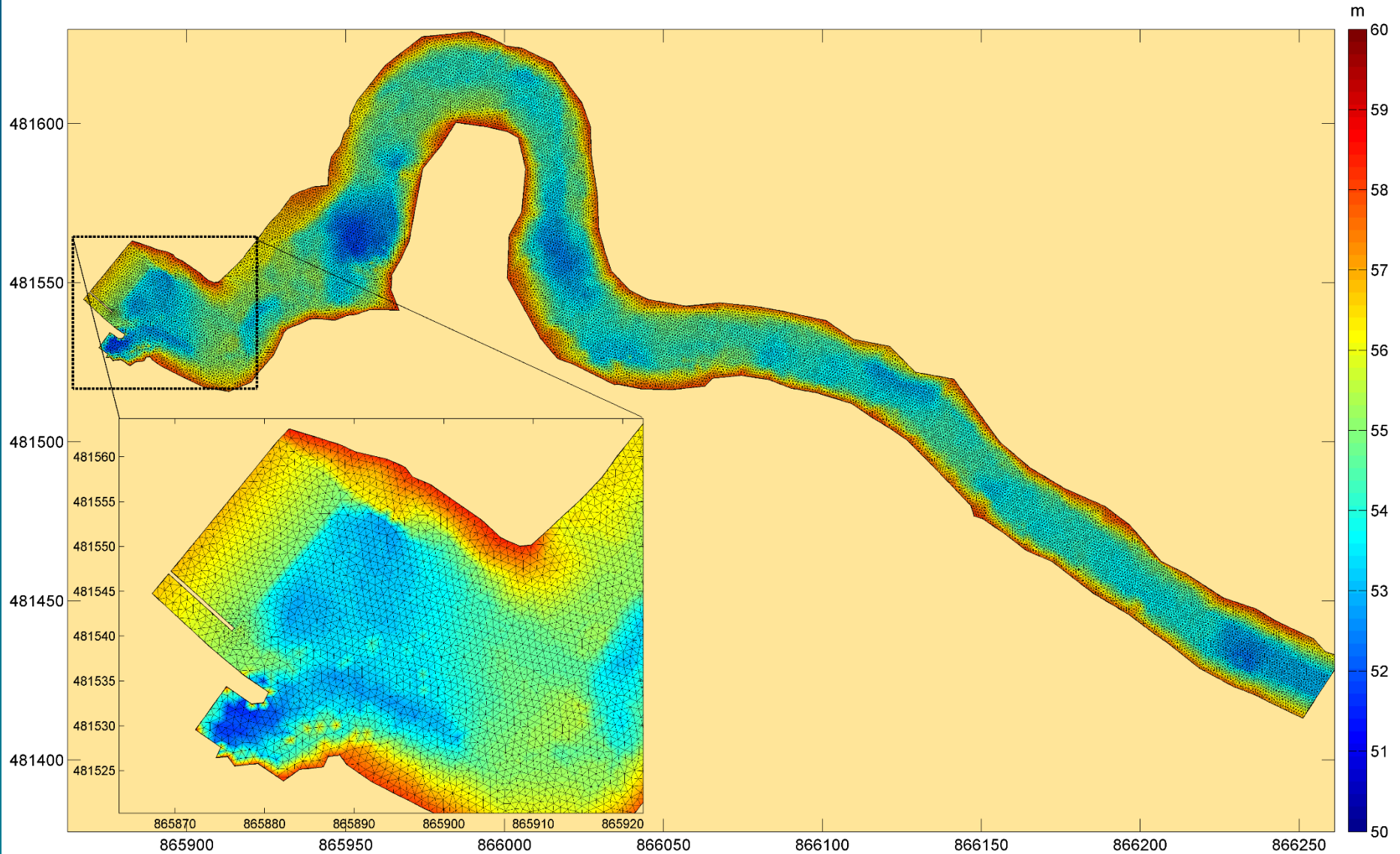
Depth (m)



Depth averaged velocity (m s^{-1})



Hydraulic model mesh:



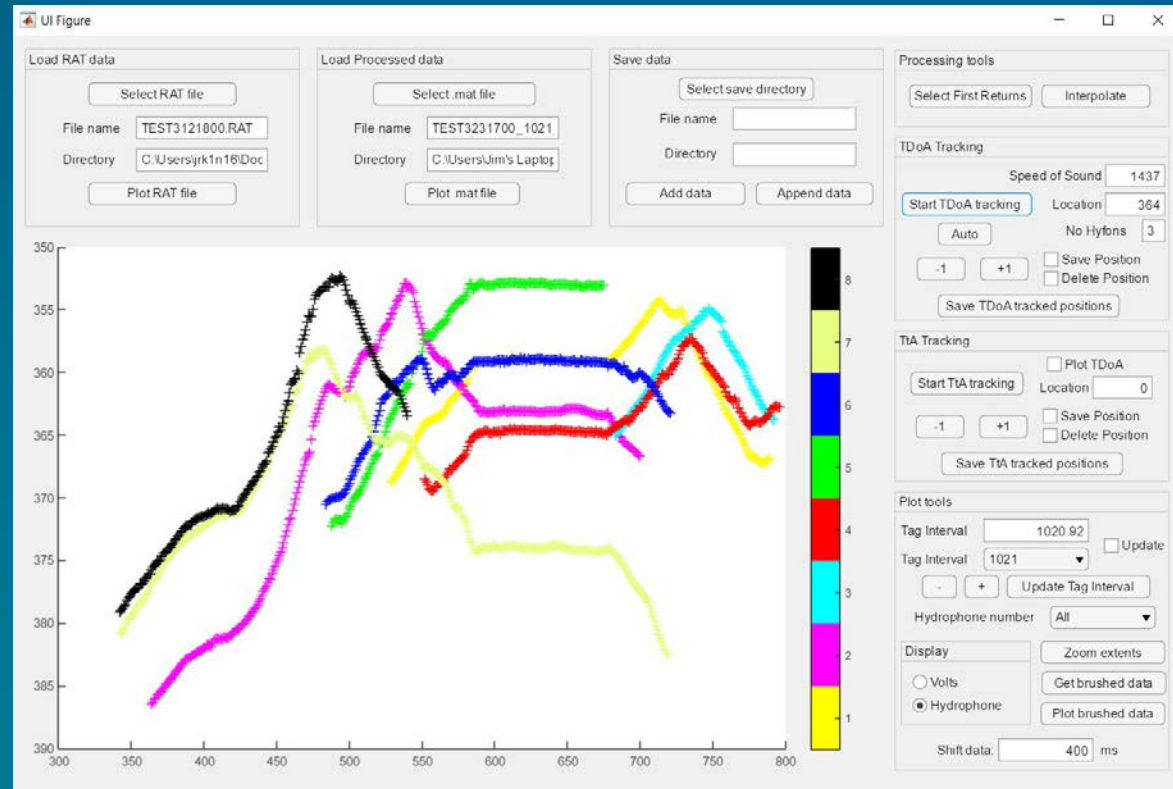
- 395 lamprey captured and released over 10 release events November/December 2017.

- All lamprey PIT tagged
- 34 lamprey double tagged with acoustic and PIT tags



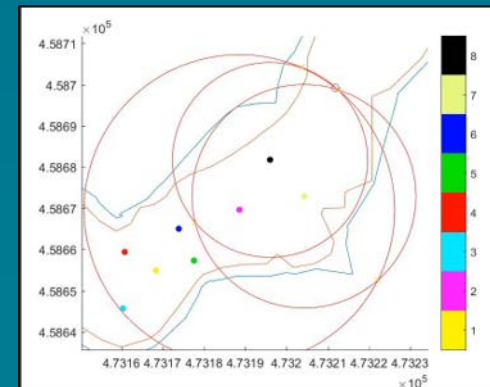
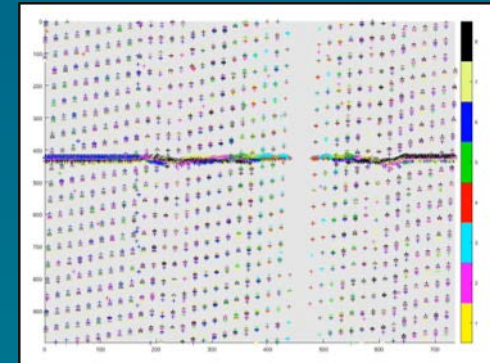
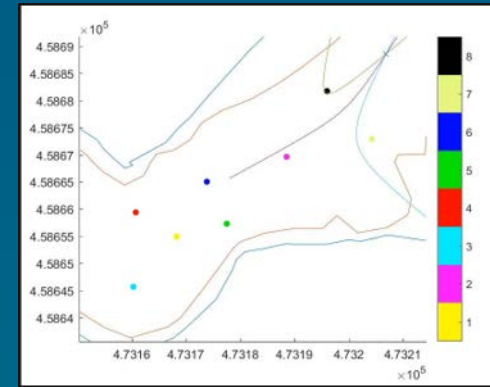
Acoustic 2D tracking

- Multiple issues with acoustic telemetry at the site
 - Air entrainment
 - Depth
 - Bed structure
 - Solid surfaces
- Conventional tracking software wasn't effective:
 - Failed
 - Errors
 - No transparency



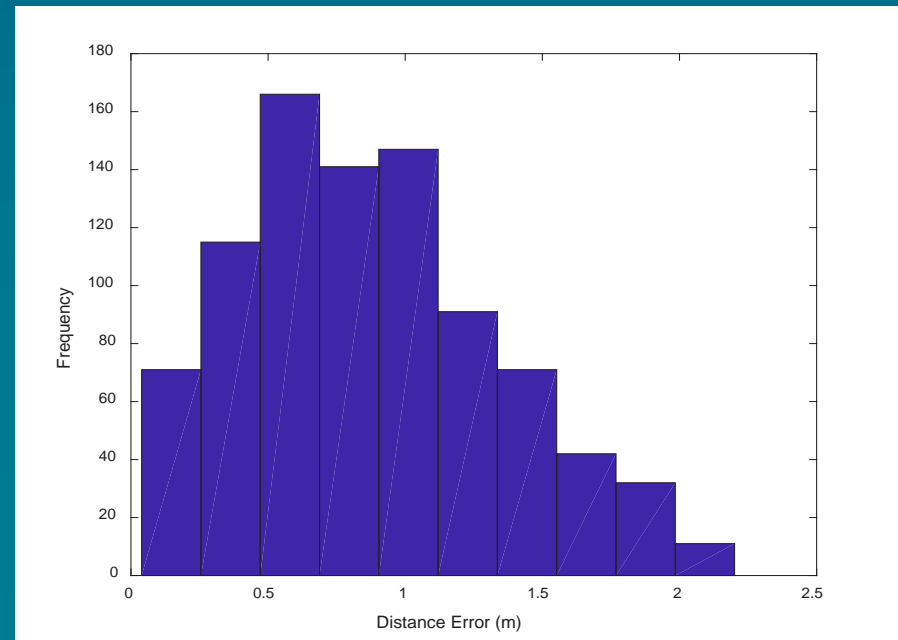
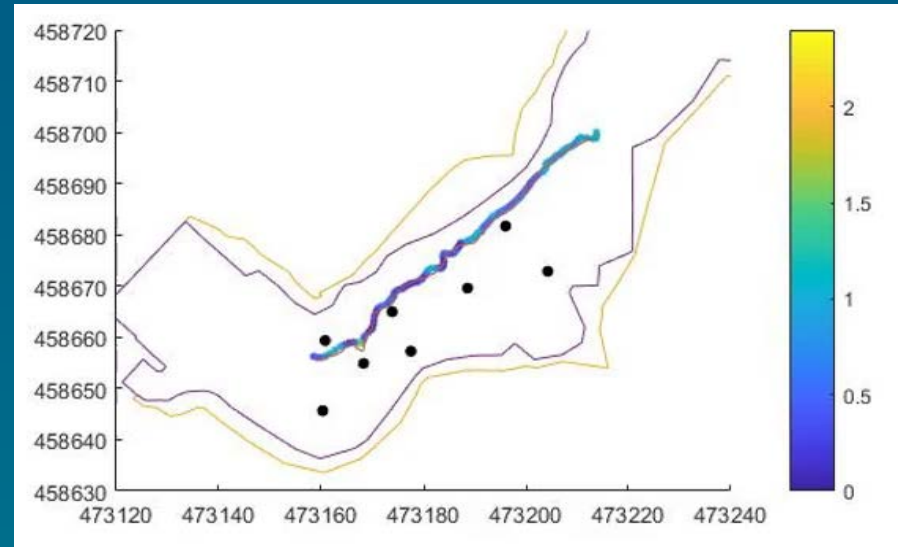
Acoustic 2D tracking

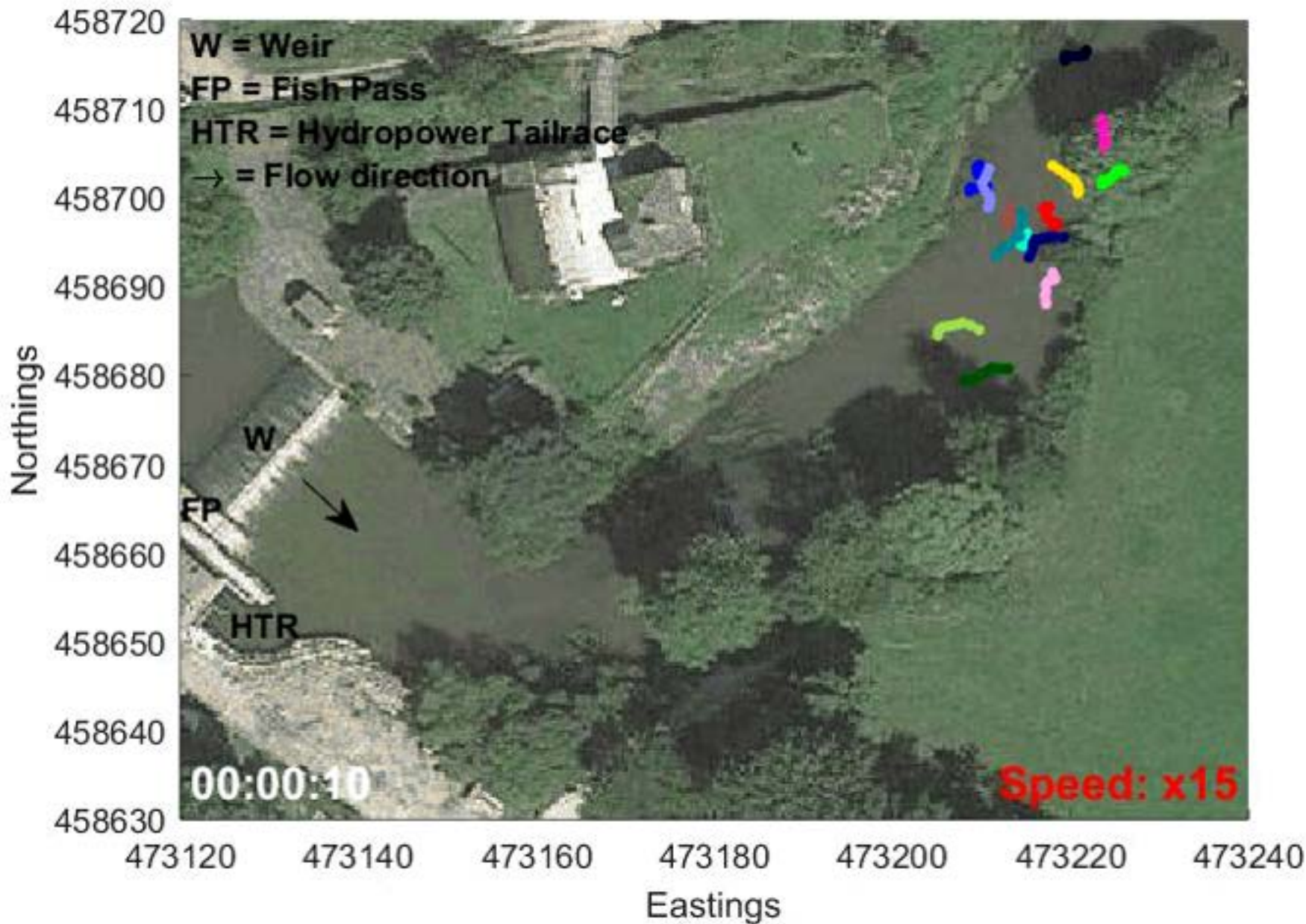
- 1) Select and clean the required data
- 2) Track fish position based on 'time difference of arrival' calculations
- 3) Calculate exact ping time of the tag
- 4) Track fish position based on 'time till arrival' calculations

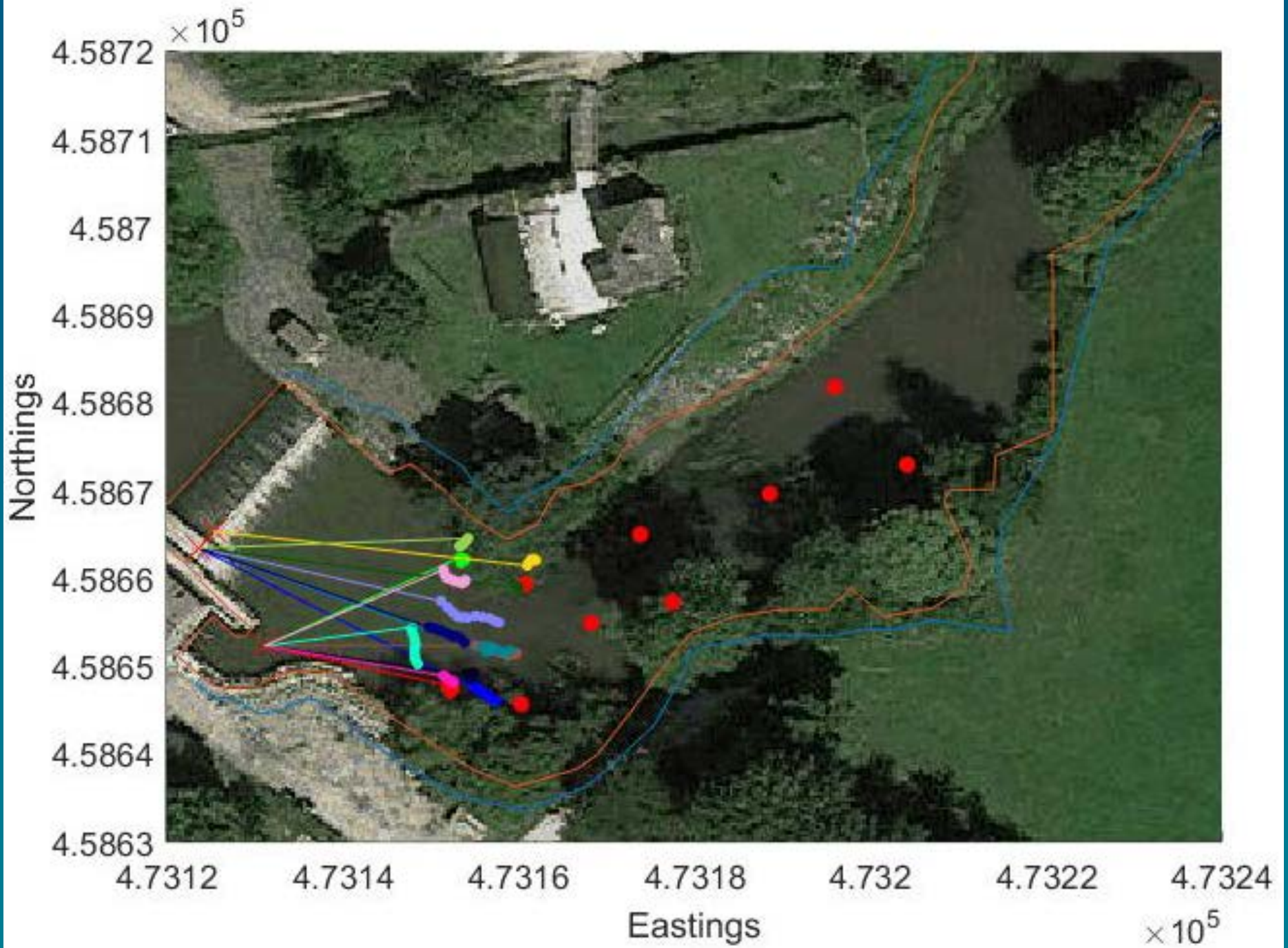


Tracking accuracy

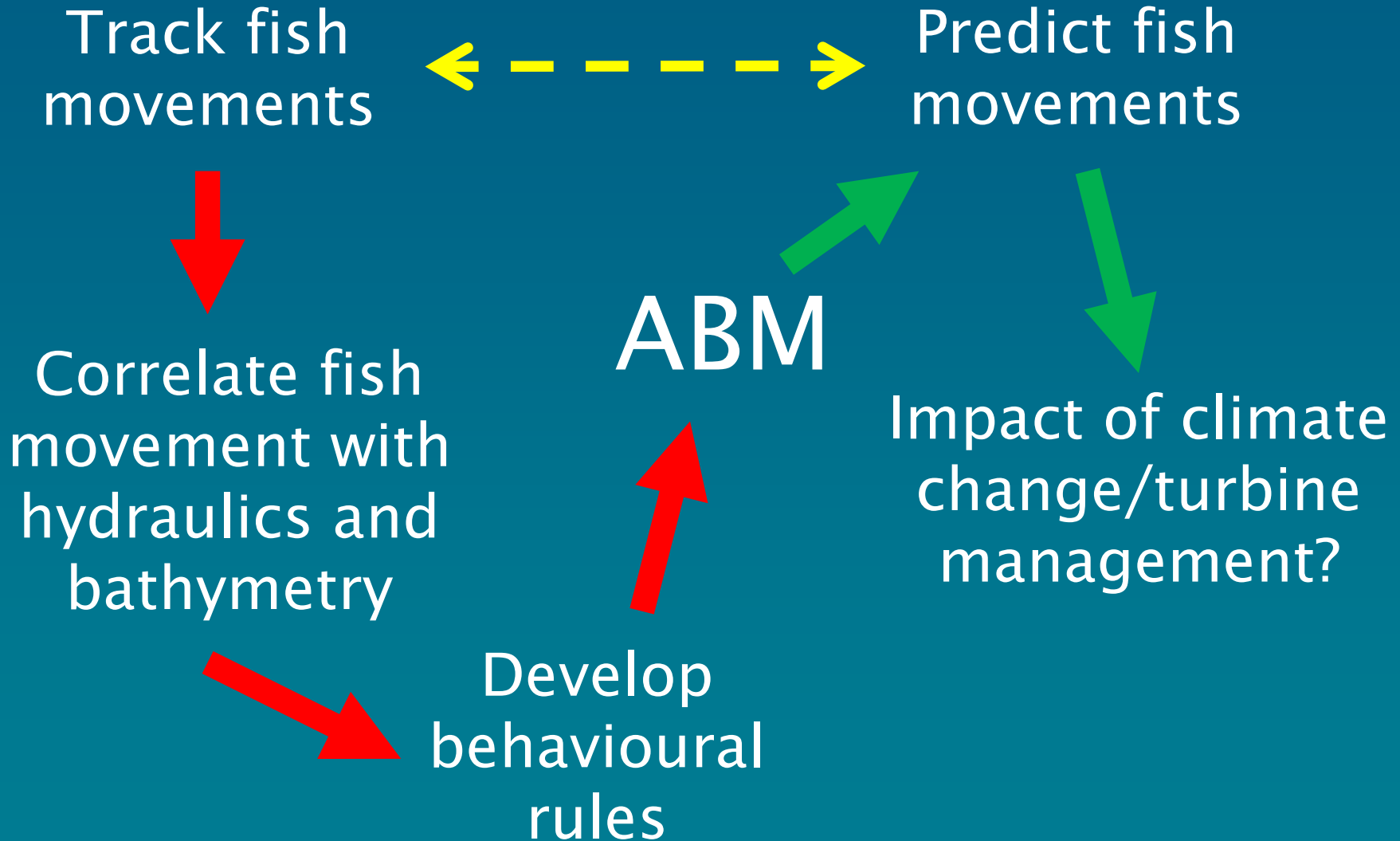
- Five ArcBoat transits through the array blind tracked.
- Median error:
 - 0.83 m
- Maximum error:
 - 2.20 m



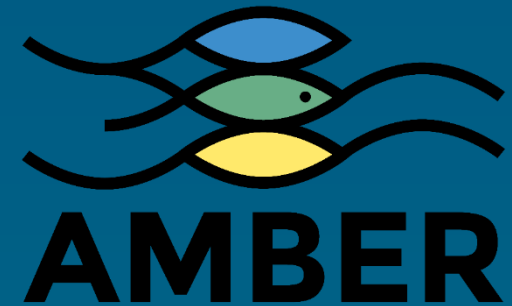




Predicting lamprey movement



Acknowledgements



- University of Southampton:
 - James Miles, Jasper de Bie, Daniella Montali-Ashworth, Toru Tsuzaki.
- Environment Agency:
 - Jon Hateley, Jim Lyons, Pat O'Brien, David Lindsay.
- MicroHydropower
 - Greg McCormick
- Albury Park Estate:
 - George Winn Darley, Shane Collier



Thank you. Any questions?

Contact: Dr Jim Kerr j.kerr@soton.ac.uk

