

# Acoustic tracking of Atlantic salmon smolt migration in the Lomond system

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A project supported by the European Union's INTERREG IVA Programme managed by the Special EU Programmes Body

# Talk outline

1. Background
2. Methods
3. Results
  - Smolts tagged in the Endrick
  - Smolts tagged in the Leven
4. Changes for this year's study



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Background

# Acoustic telemetry

- Acoustic tags transmit an underwater sound signal which is picked up by hydrophone receivers
- Each tag has an individual code, allowing identification of individual fish
- Has the benefit of working in sea as well, unlike radio tags (radio frequencies are blocked by dissolved salts)

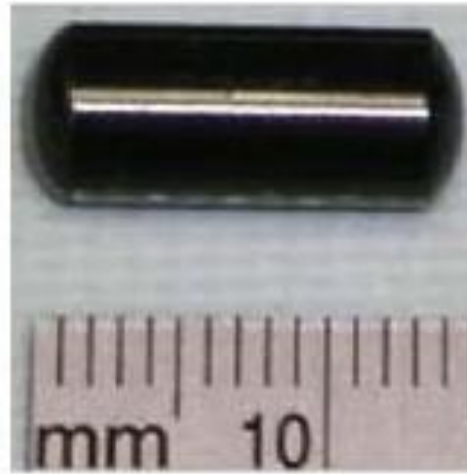
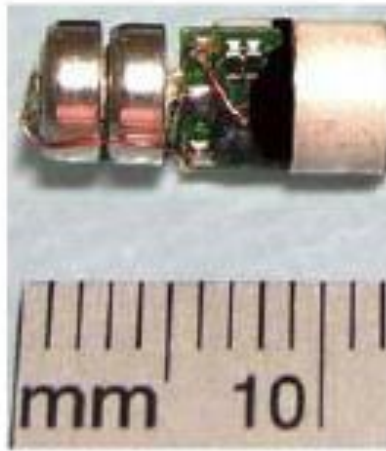


# Acoustic telemetry

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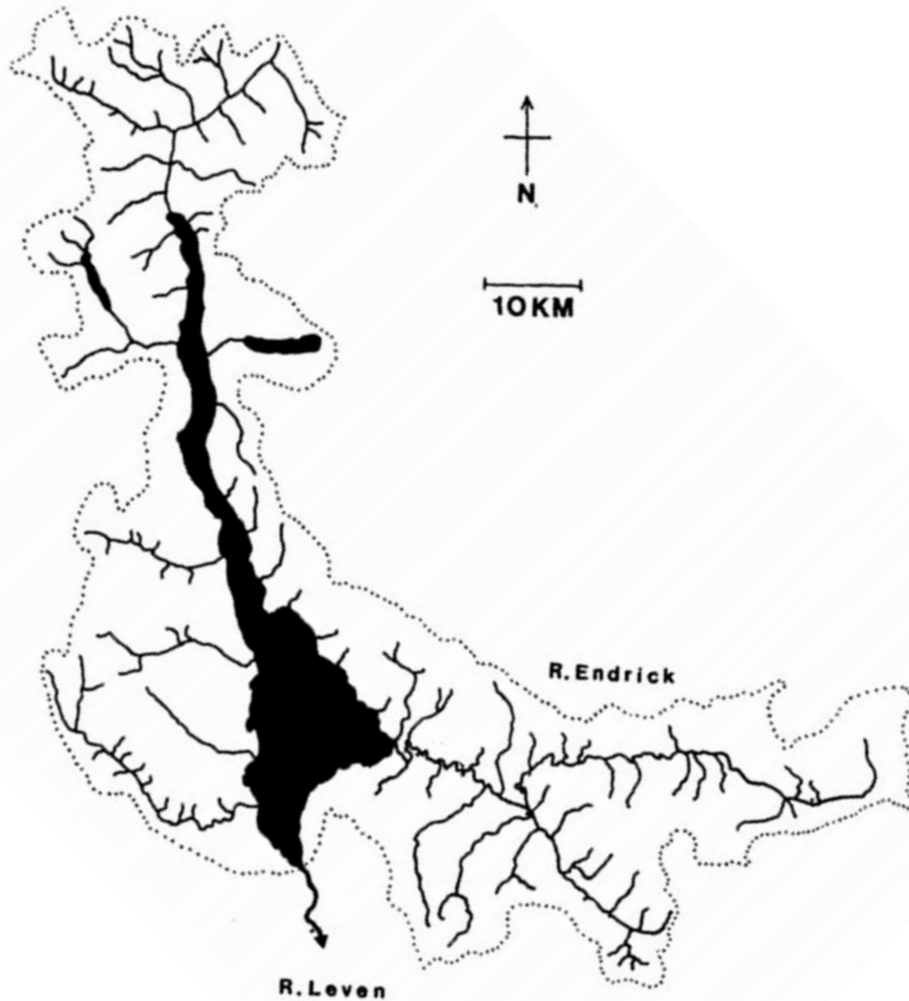
# Smolting – critical life stage

- Changes in physiology, morphology and behaviour prepare the fish for marine life
- Timing of smolting is triggered by environmental cues with increased daylight believed to have the greatest influence
  - timing important for marine survival
- **Smolt migration is associated with high mortality and is thus considered a critical life stage in the Atlantic salmon life history**

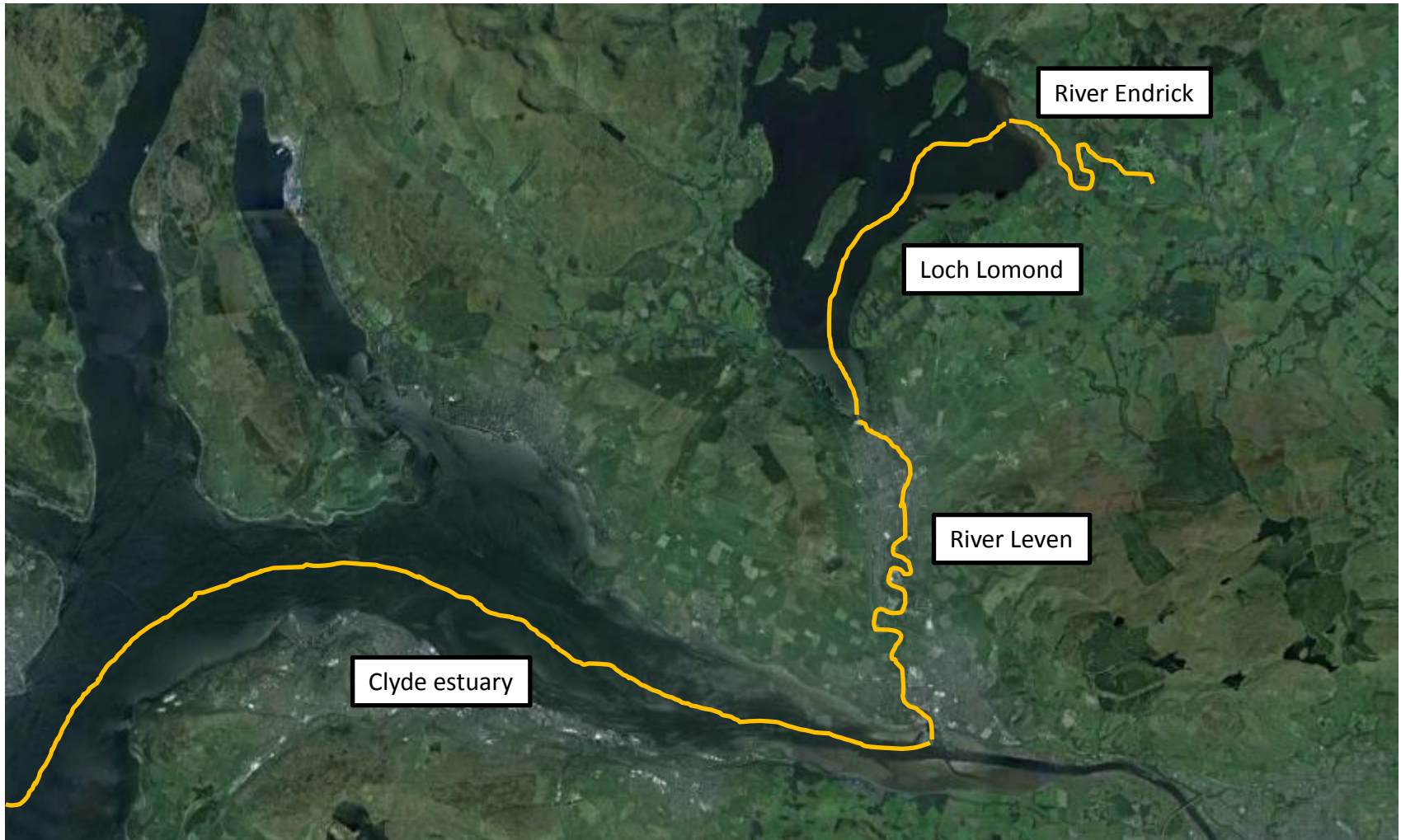


# Lake migration

- In rivers, smolt migration is believed to be mostly passive
- In lakes with no clear water flow or mixed flows the smolts will most likely have to swim actively to navigate and to locate the outflow
- Previous studies suggesting surface currents play a role in guiding lake migration
- Loch Lomond is a very interesting study system for this question



# The migration route of the Endrick salmon smolts





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Aims



## We were hoping to get more information on...

- Behaviour during migration through Loch Lomond
- Mortality – overall and between different sections
- Speed of migration – overall and between different sections



# Methods

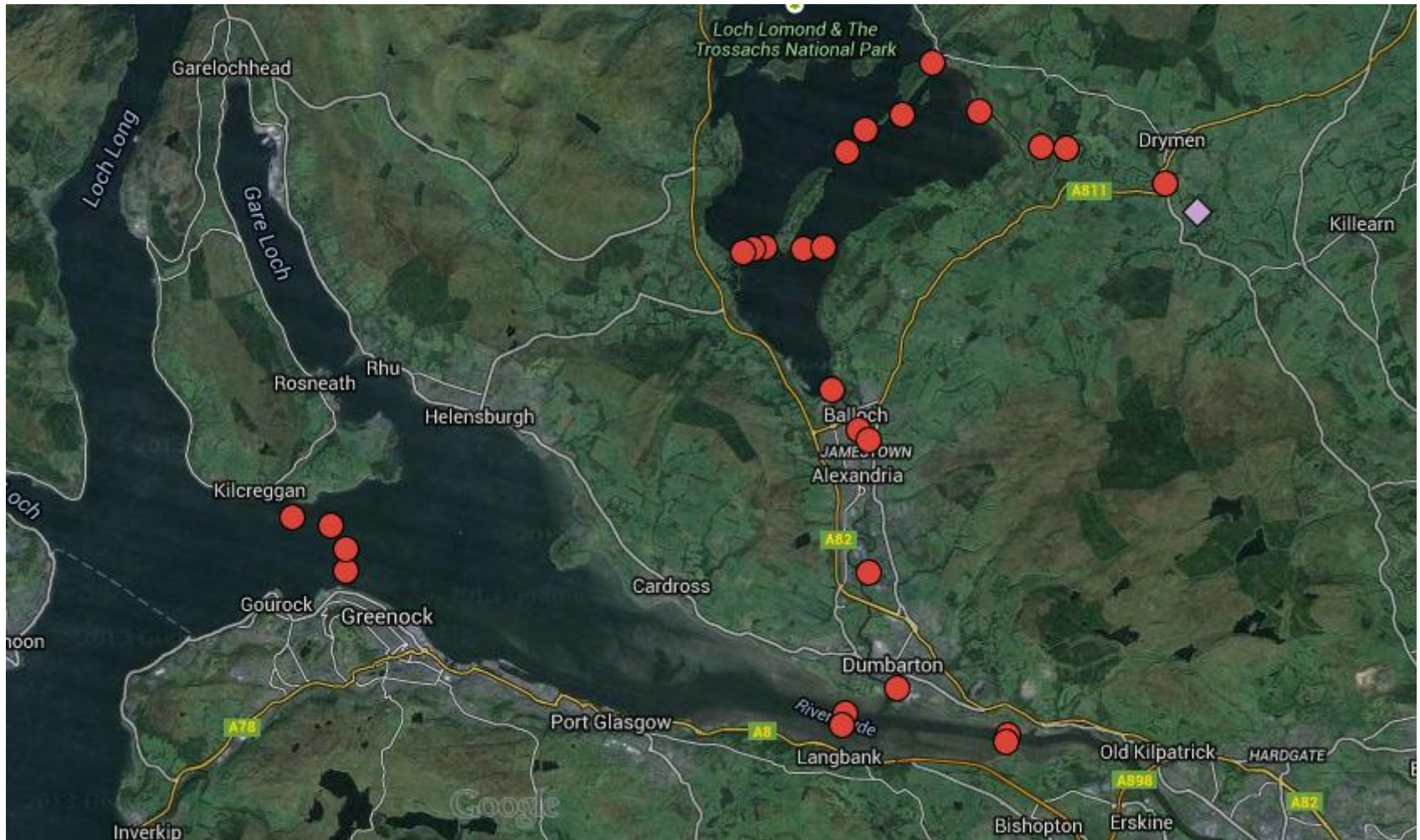
# Methods - tagging



- Smolts were captured by the smolt trap (checked daily)
- Smolts that were big enough ( $>12$  cm) were anaesthetised and tag inserted into body cavity
- After tagging, smolts were first allowed to recover in buckets (~30 mins) and then in a holding cage in the river



# Methods - receiver array





# Receivers in the rivers and the loch



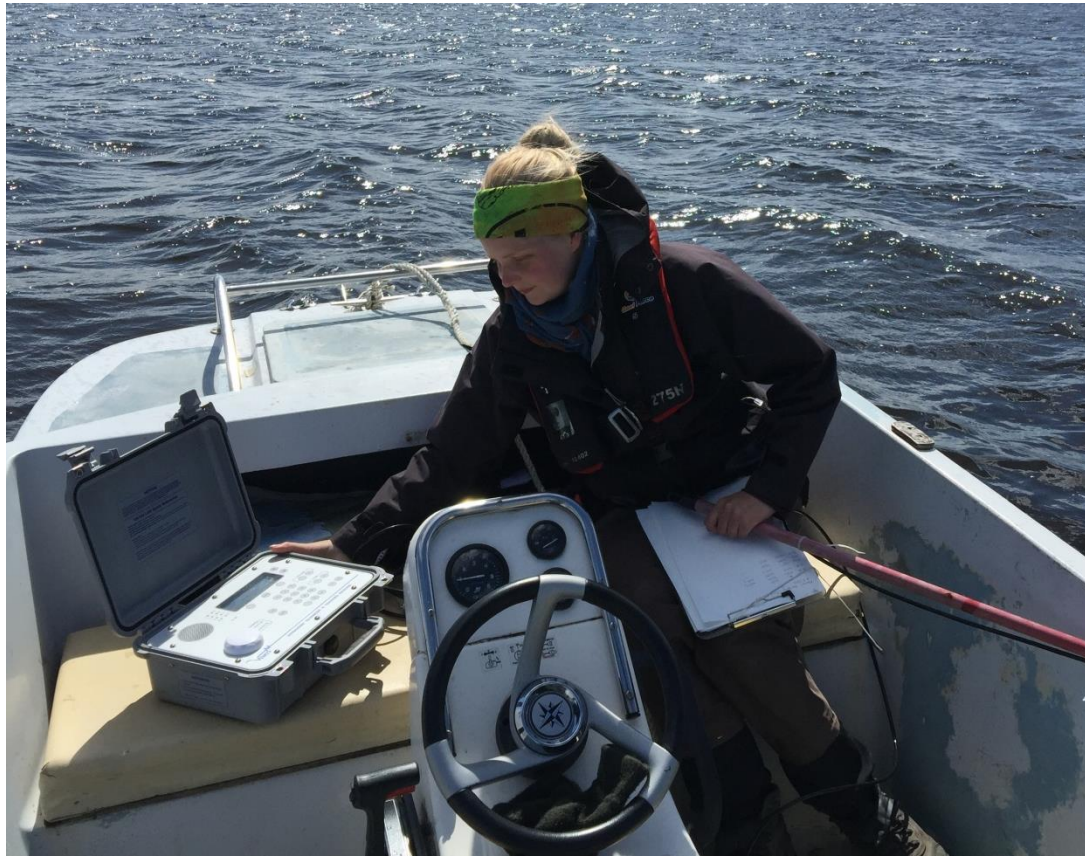


# Receivers in the estuary





# Manual tracking





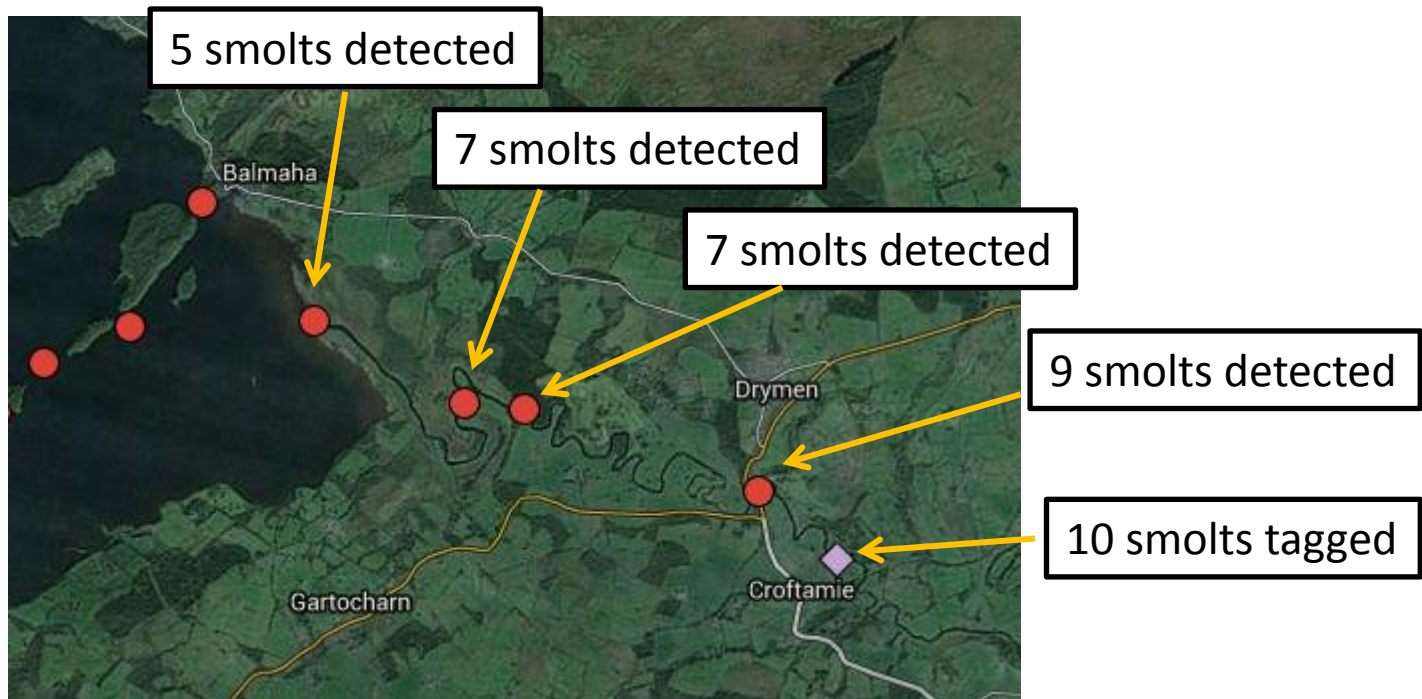


# Results



## Results – Endrick smolts

- Total of 10 smolts tagged over five days (24 April - 2 May 2015), the average length was 13.5 cm and average weight 25.7 g
- Average migration time from first to last receiver was 24 hrs 51 min



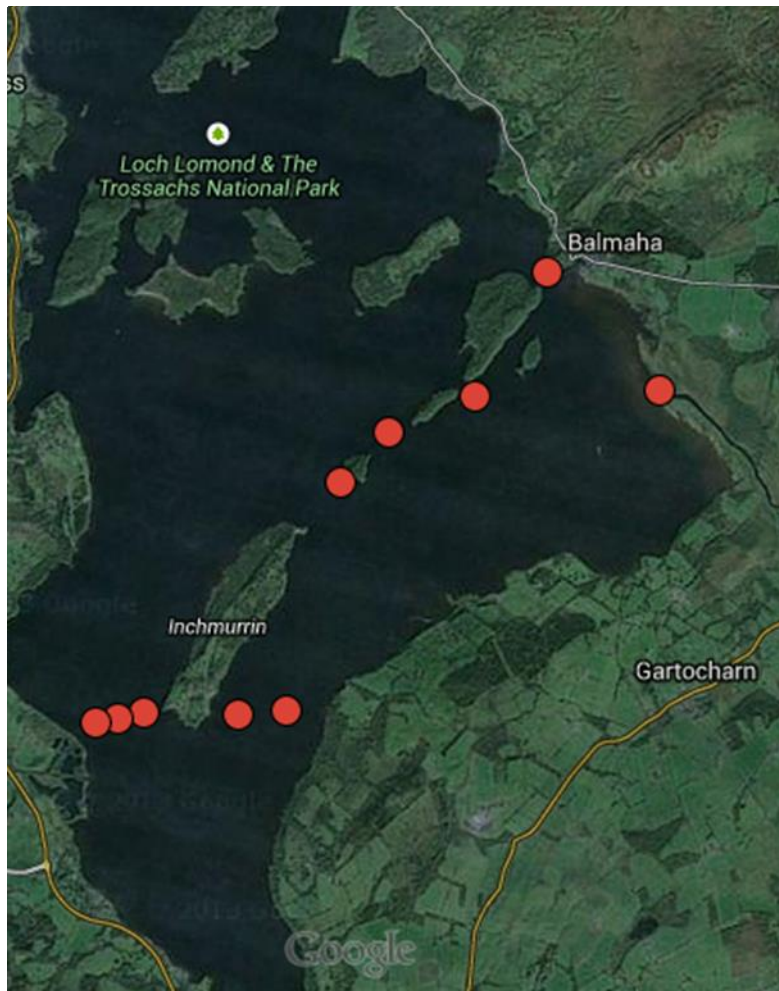


# Results – Endrick smolts





# Results – Endrick smolts



- 4 smolts entered the loch
- 2 out of the 4 smolts migrated successfully through the loch
  - one smolt took 6 days, the other 11 days
- One smolt was detected by a receiver near Balmaha
- Both of the smolts that entered Leven passed Inchmurrin by the east side
- Unfortunately the manual tracking was unsuccessful so we do not have detailed information on the movements

# Results – Endrick smolts



- Both smolts that entered River Leven migrated through it successfully
- Moved straight past the barrage in Balloch
- Moved through the river very quickly - the migration times from the barrage to the mouth of Leven were 146 and 158 mins

# Results – Endrick smolts

- Two smolts entered the Clyde estuary and were detected by the pair of receivers downstream of Leven
- One of the smolts was also detected by the downstream pair, meaning it turned back or more likely was “pulled” back due to the tidal influence





# Results – Endrick smolts

- Neither of them were detected by the final line of receivers
- **Therefore it seems none of the 10 smolts tagged in River Endrick reached the open ocean**





## Results – River Leven smolts

- Since we did not get enough smolts from the Endrick, it was decided to try to capture some from River Leven
- 9 salmon smolts were caught and tagged in the Leven
- Smolts were caught by fly fishing
- After tagging, they were transported to about a mile upstream, past the barrage in Balloch



# Results – Leven smolts

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# Conclusions




# Conclusions

- Unfortunately low sample size limits the conclusions we can make but...
- 50% mortality during migration through Endrick
- Loch migration took relatively long, 6 and 11 days
  - unfortunately no detailed data on movements due to manual tracking not working
- No mortality during migration through Leven for either group of smolts (despite large variation in time spent in Leven)
- High estuary mortality; 100% for Endrick smolts and 75% for Leven smolts



Changes for 2016 study



## Changes for 2016 study

- Location of smolt trap
- More advanced tags with a depth sensor
- Different methodology for active tracking in the loch



# Acknowledgements

**Loch Lomond Angling Improvement Association:** Keith Adams, Malcolm MacCormick, Jim Freeman, Jim Muir, Gordon, Andy, Wulfie, Chic, Ian + many others!


**Loch Lomond Fisheries Trust:** Carolyn Bryce, Eddie Edmonstone

**SCENE:** Jess Fordyce, Christina Campbell, Dan Erben, Travis van Leeuwen, Jennifer Dodd, Stuart Wilson, Davy Fettes, James Barry, Rob Brackley, Matt Newton, Josua Gavinet, Colin Adams

Rufus Redman (Peelports Glasgow), David Tollan + other rangers (Loch Lomond & Trossachs National Park), Alastair Stephens (SSE)

**Funding:** SSE, SEPA, LLAIA, Glasgow Natural History Society





Thank you for listening,  
happy to answer any questions!

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