



How changing tidal limits can impact tidal freshwater ecosystems

Charlie Roddis, Nottingham Trent University

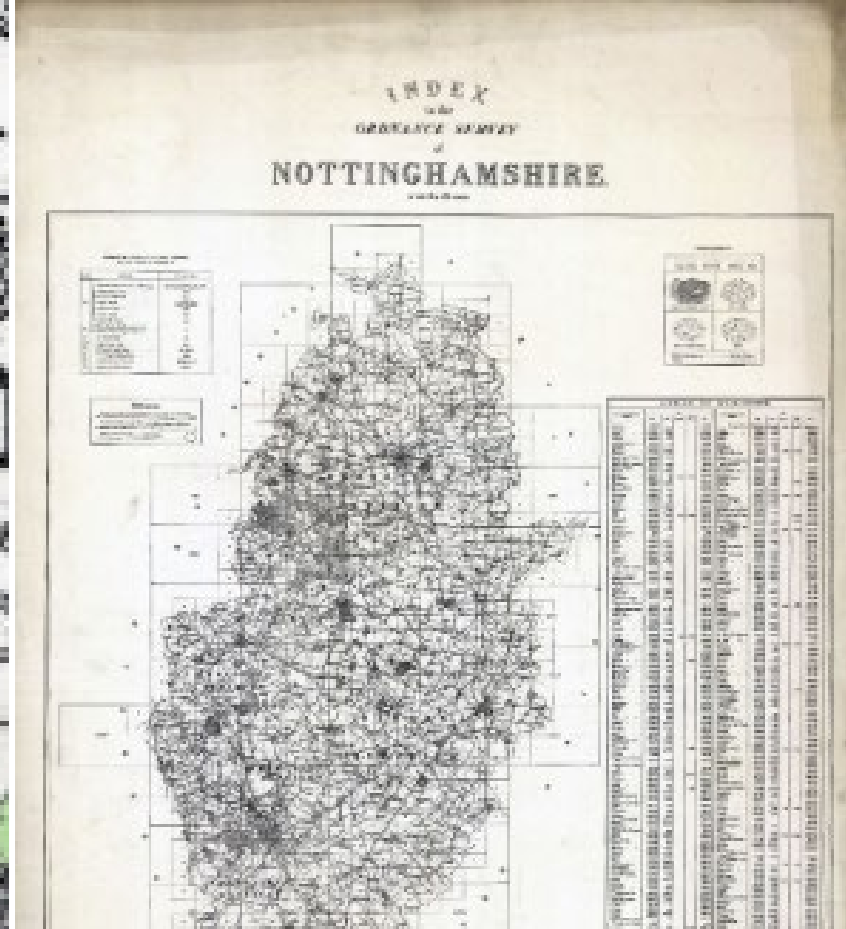
Tidal Freshwater Ecosystems

- Unique estuarine environments that link terrestrial and estuarine habitats.
- Found in upper estuaries where the rivers discharge their freshwater flow. River water dilutes saltwater to near-zero levels (less than 0.5ppt).
- Habitats include tidal freshwater marshland and tidal freshwater wetlands. Home to a diverse range of flora and fauna – provide wintering grounds for migratory birds such as the Berwick Swan ([Wetlands and Wildlife Trust 2016](#)).
- Provide important ecosystem services – flood control, water filtration, etc.



Threats to Tidal Freshwater Ecosystems

- Their total global extent is not fully known but there's a general decline ([Foster et.al. 2013](#)).
- Main risk is estuarine squeeze – loss of tidal freshwater (salt content less than 0.5ppt) in the upper estuary .
- Restriction of the extent of tidal freshwater largely due to artificial in-stream barriers such as weirs and dams.
- Additional threats to tidal freshwater include sea-level rise, industrial pollution and urban expansion.
- Water quality is also a major issue in these tidal freshwater stretches of river.

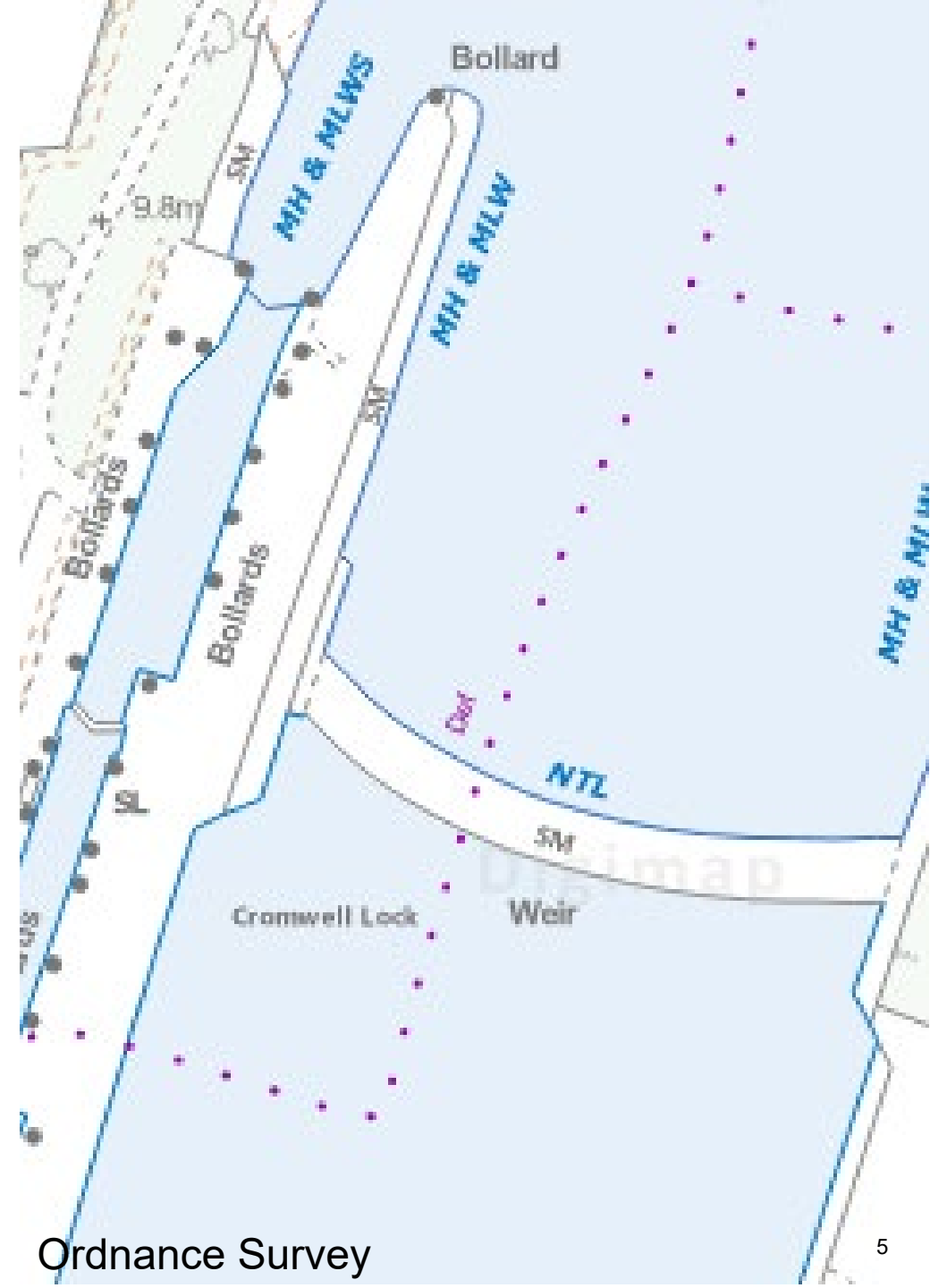


Historic Maps

Ordnance Survey

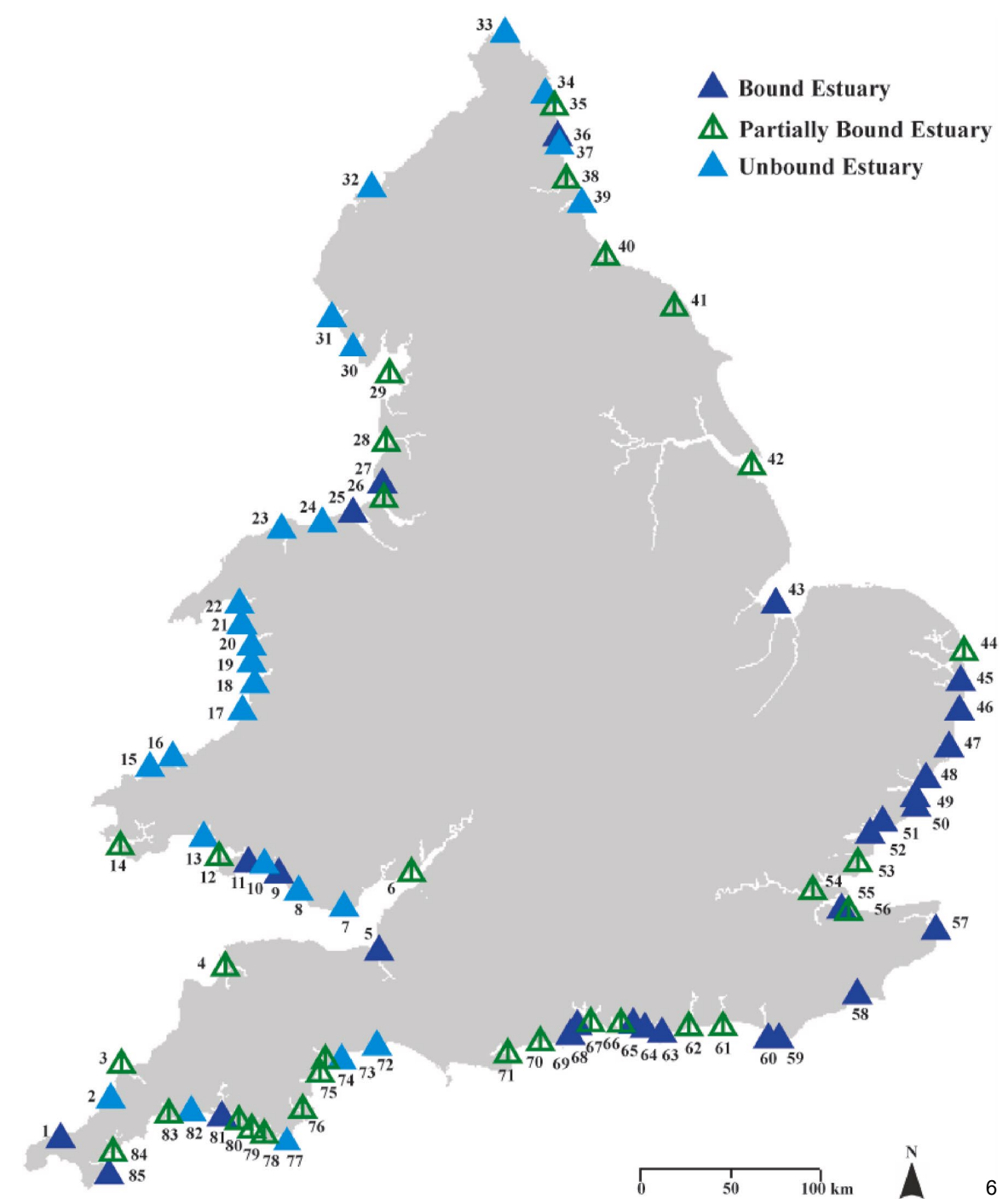
Tidal Limits

- Upstream limit of tidal activity within an estuary (or lateral limit e.g. mean high water mark).
- On ordnance survey maps they're marked as (and measured as) the Normal tidal limit.
- This limit can be influenced by climate change, sea level rise and the introduction of in-stream barriers – which can lead to estuarine squeeze (impacting tidal freshwater ecosystems).



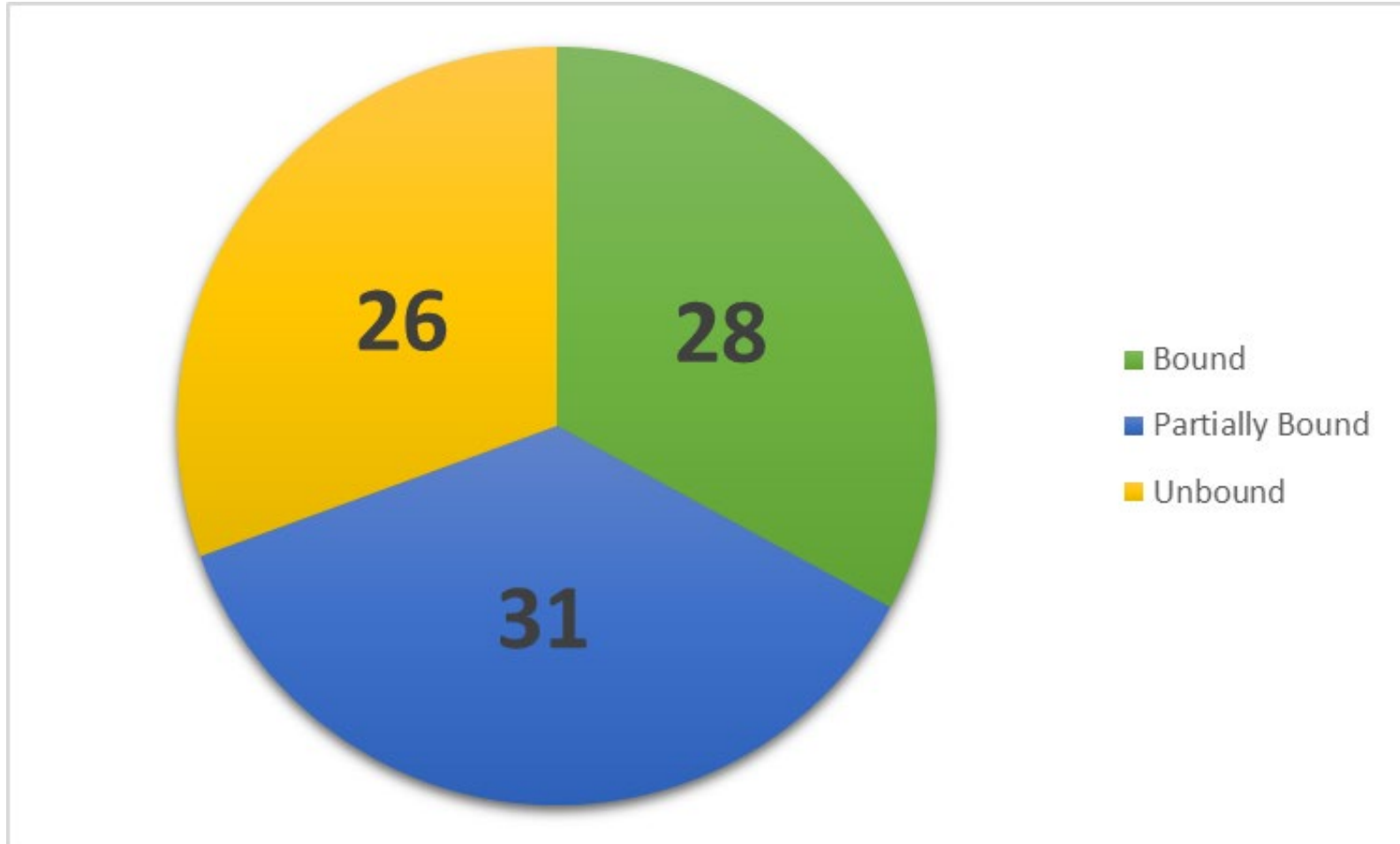
Artificial Barriers

- Most common in-stream barriers are dams, weirs (for flow regulation) and locks (for navigation).
- Oldest dam still in use is the Castle Pond Dam, built 1199.
- Can cause extreme estuarine squeeze – River Tees (21km loss of tidal freshwater).

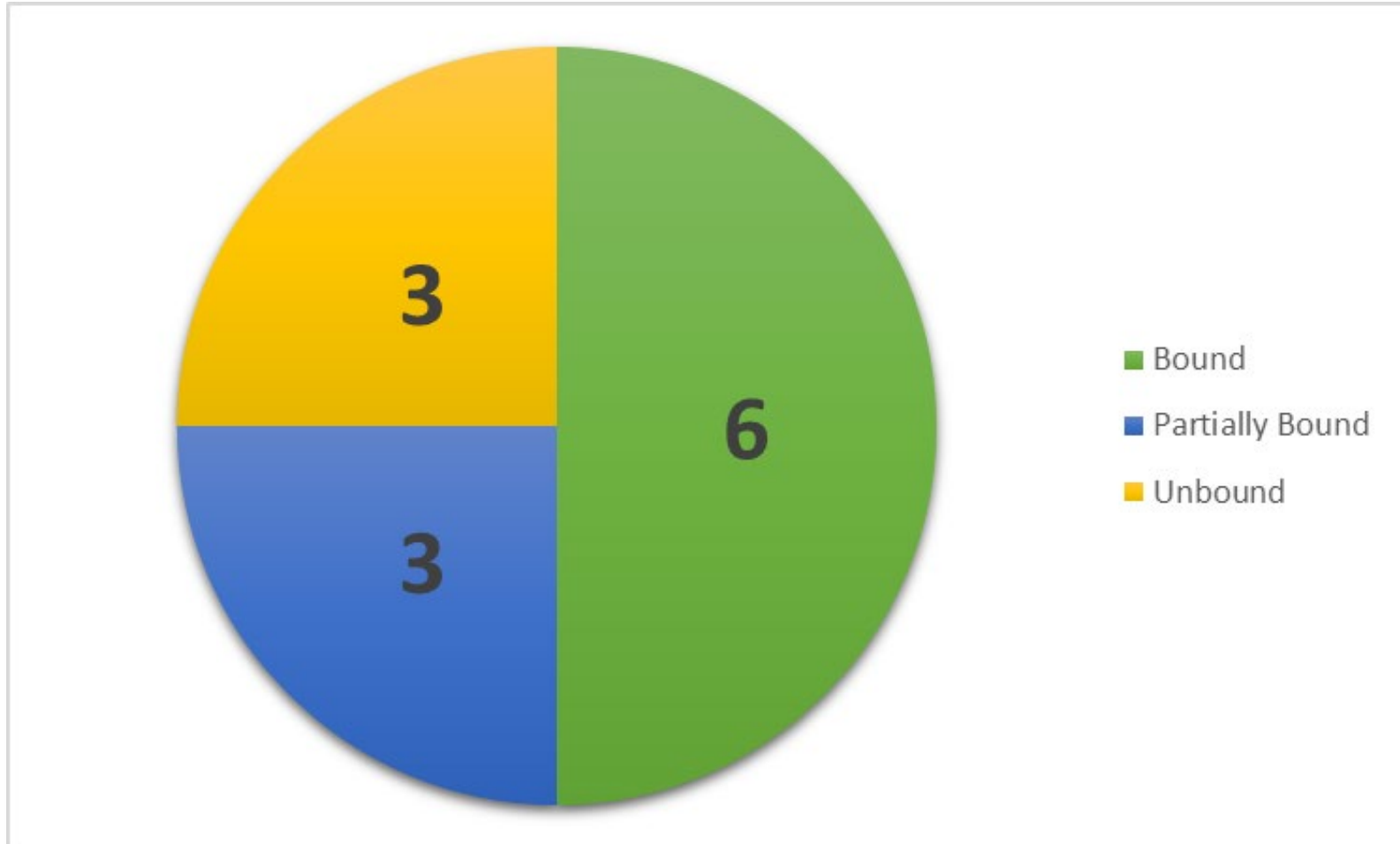




How many barriers?

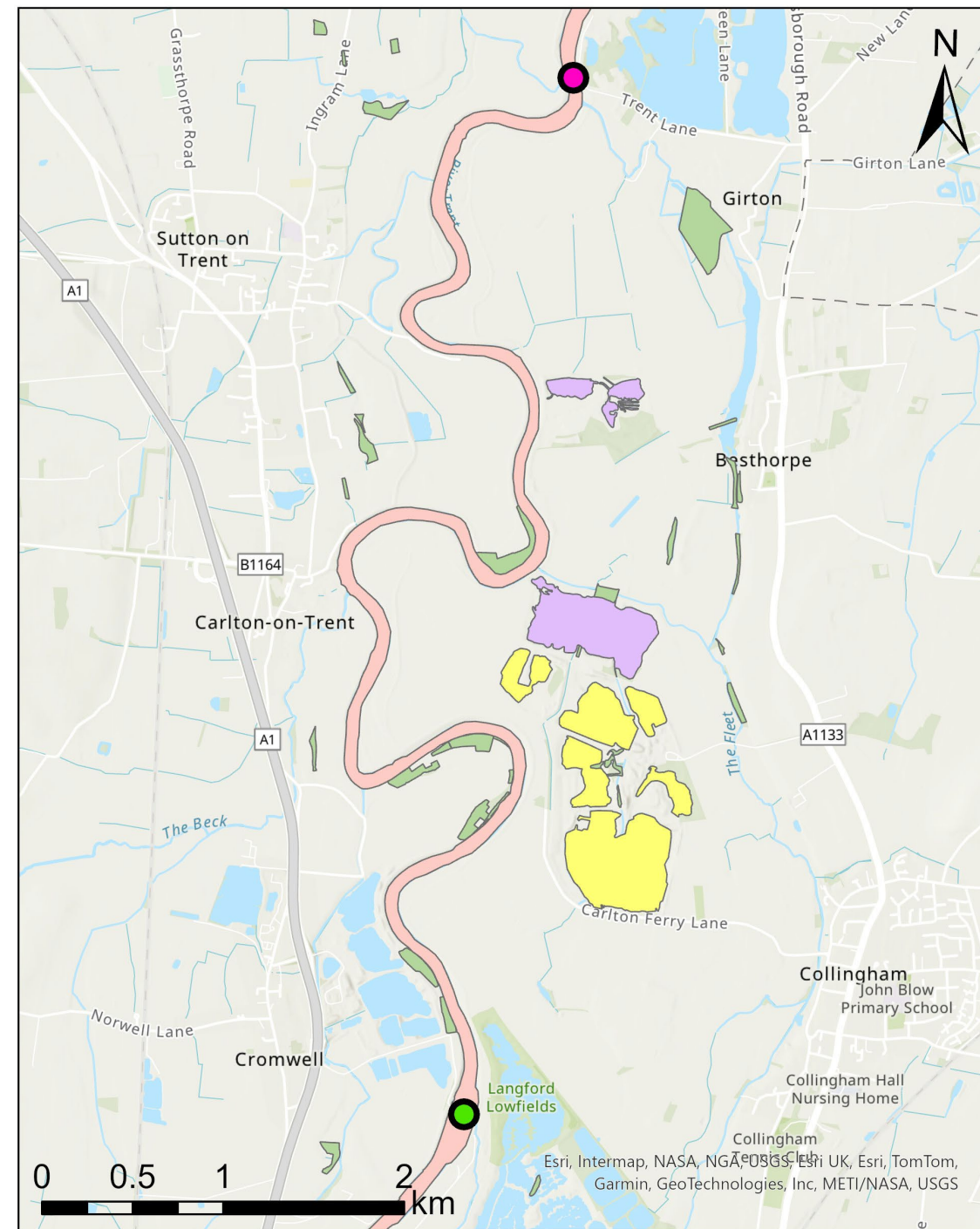
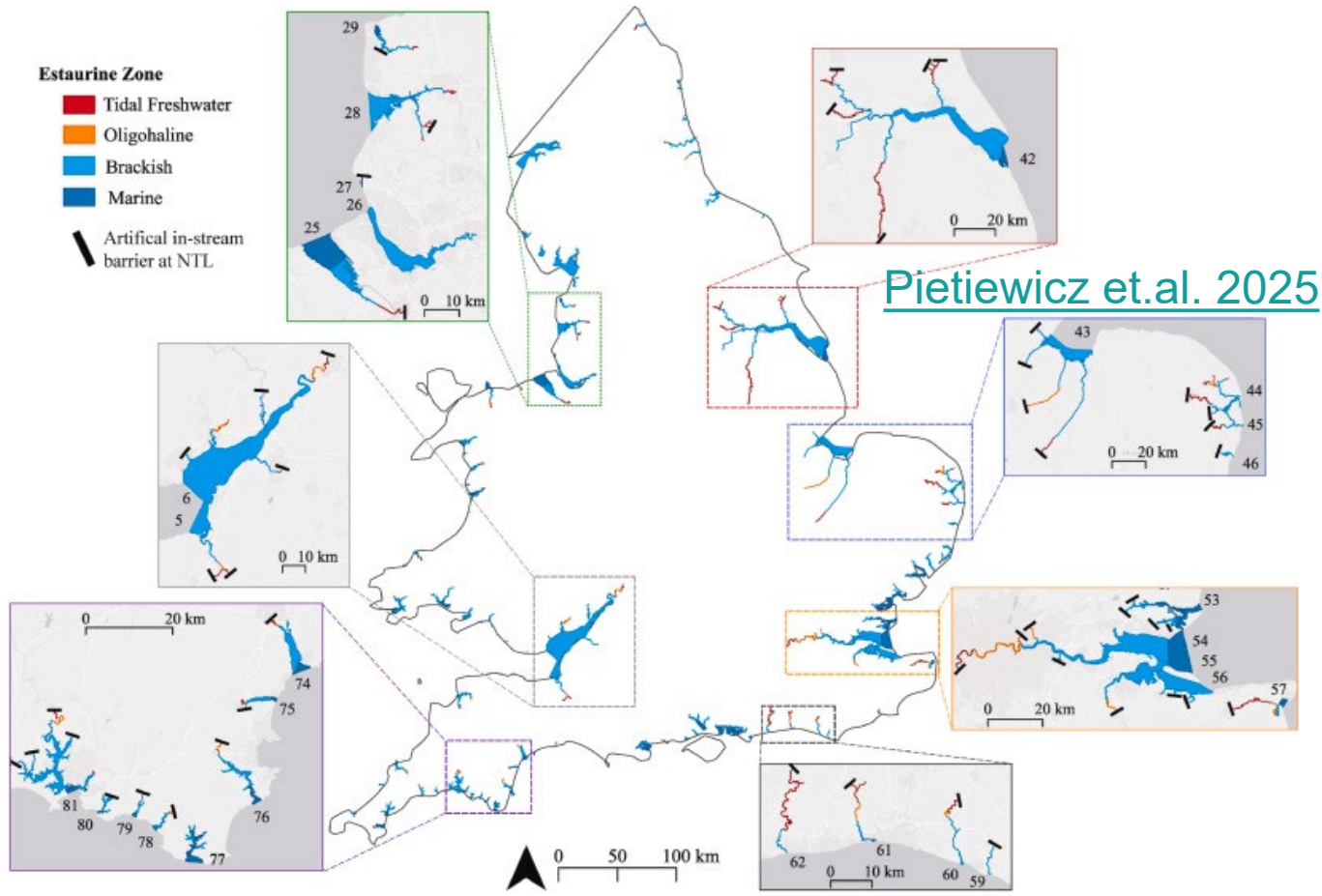


How many barriers?



Marshland Extent

- Historic maps were compared to contemporary maps (2024) to analyse the extent of change of freshwater marshland.



Restoration Examples

- Managed realignment.
- Revegetation.
- Control of invasive species.
- Removing barriers and species reintroduction (now 400 beavers). Follows the UK's 25-year environmental strategy to utilise Nature Based Solutions
- Beesthorpe nature reserve – the success of which is being monitored via environmental DNA strategies (looking at the reintroduction of eels).