How the Greater Thames Estuary Fish Migration Roadmap was built

THAMES ESTUARY PARTNERSHIP

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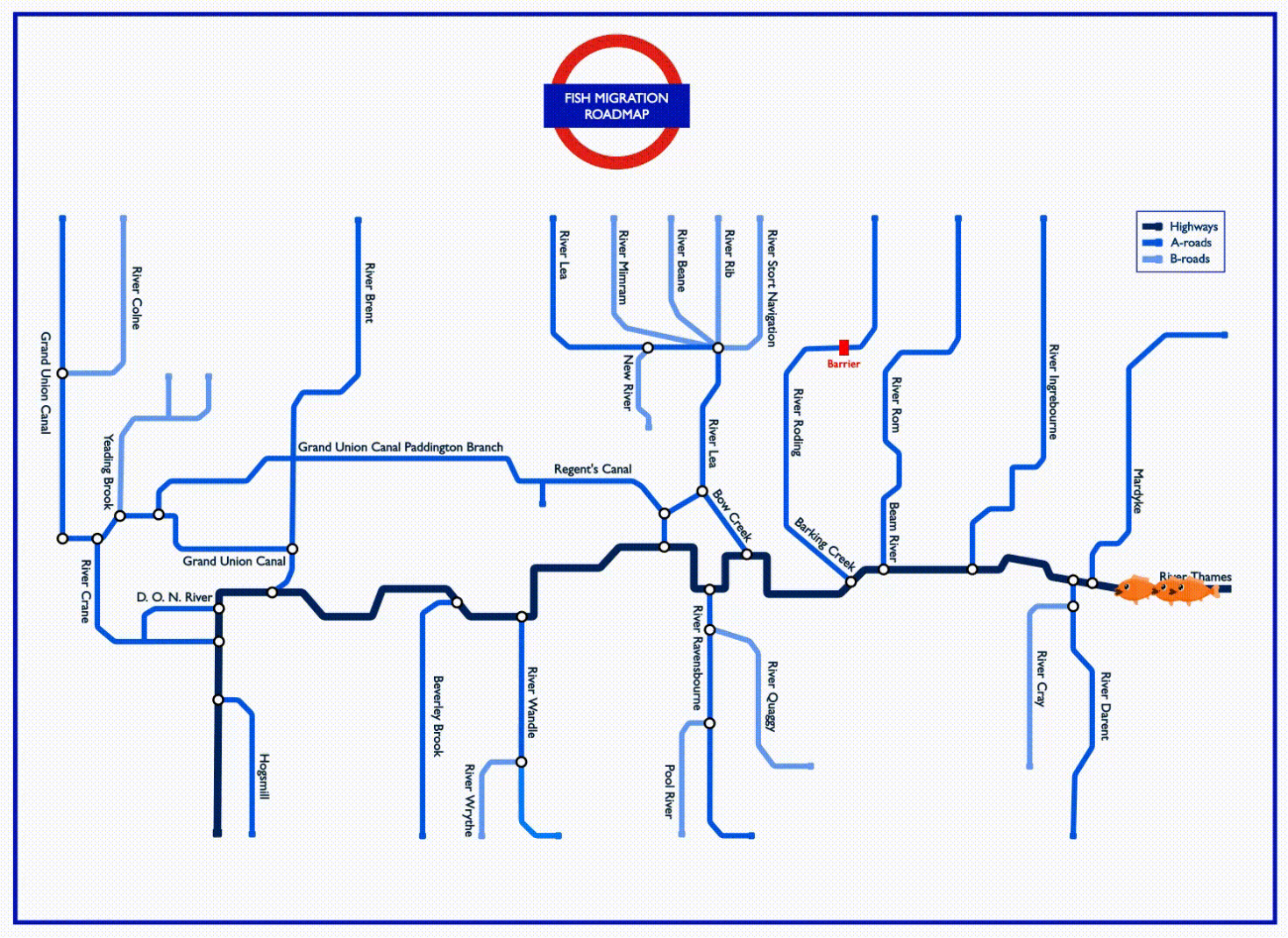
Thames Estuary Partnership
11th Nov 2021

Environment Agency · Port of London Authority · Thames Water · City of London · UCL · Natural England · Essex County Council · rspb giving nature a home

Introduction



Introduction

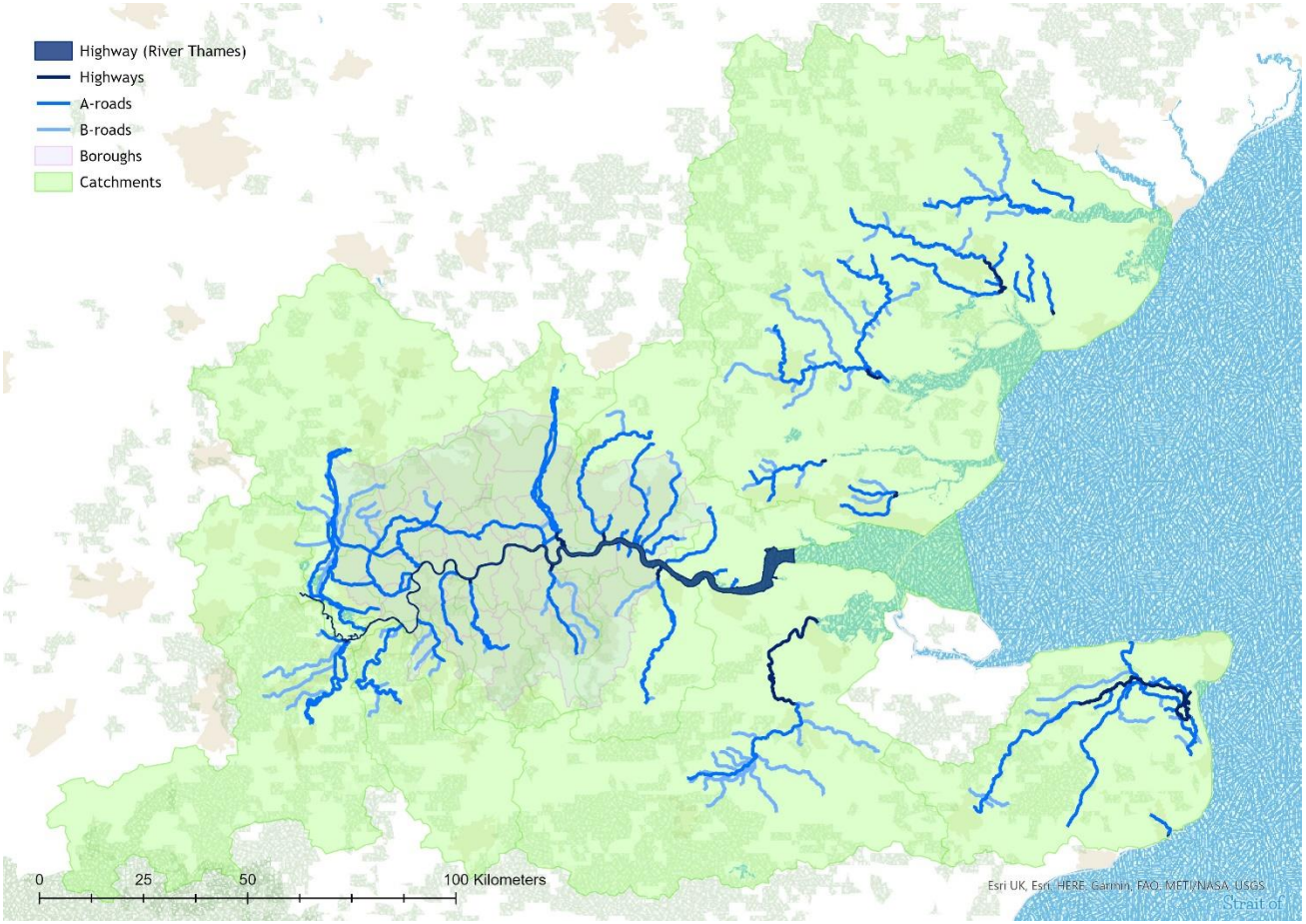
- Objectives:
  - To gather information on fish migratory barriers and river connectivity within the Thames River Basin and adjacent catchments
  - To develop an online, easy-to-access and easy-to-use web-based GIS tool to visualise all relevant data
  - To develop a replicable, strategic method that can be used in other catchments

Introduction

- Data science
  - Designation of project area
  - Data collection
  - Data pre-processing and merging
  - Data analysis
  - Data visualisation

Data science

- Designation of project area

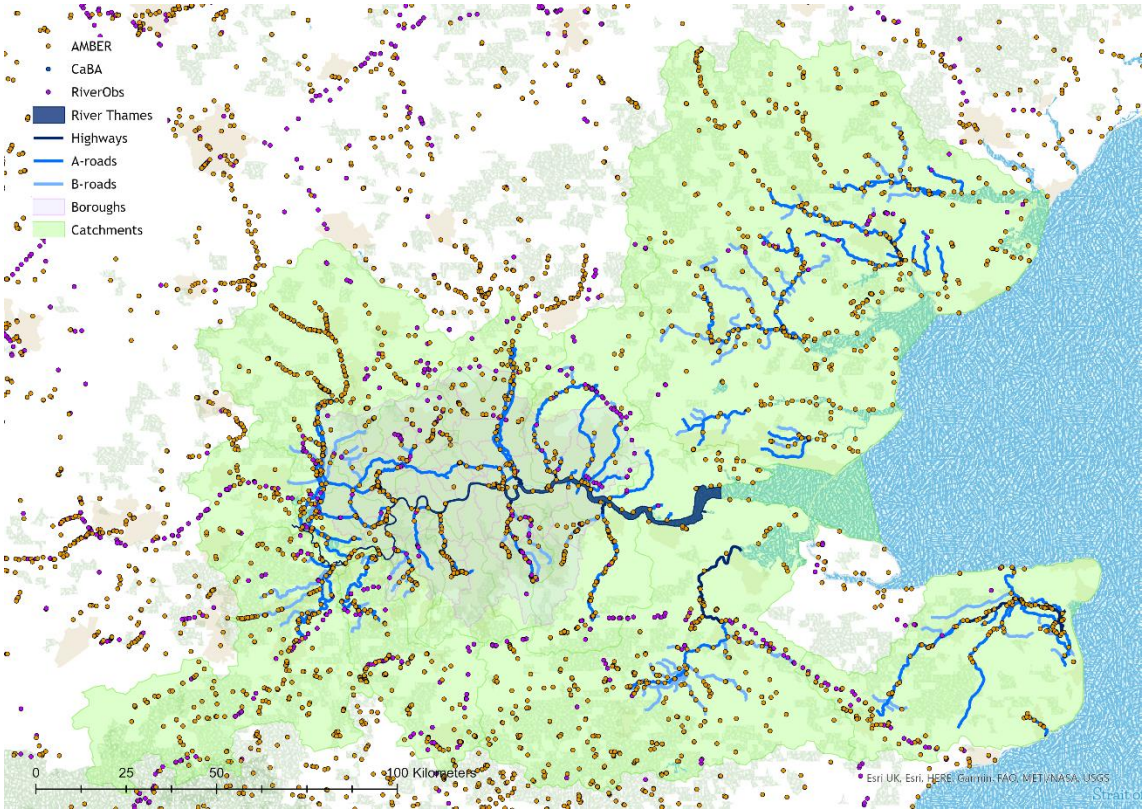


Data science

- Data collection
  - Barriers
    - Adaptive Management of Barriers in European Rivers (AMBER)
    - Catchment Based Approach (CaBA)
    - Canal and River Trust (CRT)
    - Combined Essex Catchment
    - Environment Agency (EA) (separate file on barriers and passes)
    - River Obstacles app (existing data)
    - Stakeholders (London Wildlife Trust, SERT, ZSL)

Data science

- Data pre-processing and merging
  - All barrier datasets were clipped in ArcMap (*Clip tool*) to focus on the project area only

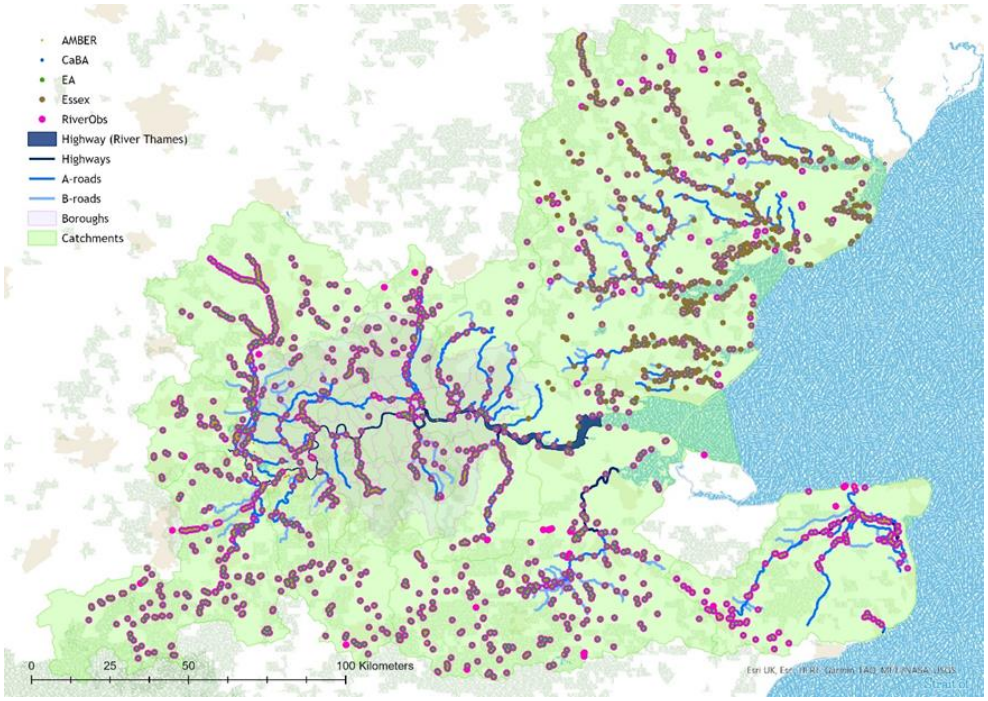


Data science

- Data pre-processing and merging
  - The separately received ‘Fish and eel passes’ (135 locations) data and the ‘Thames obstruction’ (1,333 locations) data from the EA were spatially joined in ArcMap (*Spatial join tool*)
  - AMBER, CaBA, EA, Essex and River Obstacles app barrier datasets were spatially joined in ArcMap (*Spatial join tool*) and standardised

Data science

- Data pre-processing and merging
  - Finalised barrier dataset
    - Cut down in ArcMap (*Buffer tool*) using a 100-metre buffer zone to concentrate on those barriers that occurred on the migratory routes only



Data science

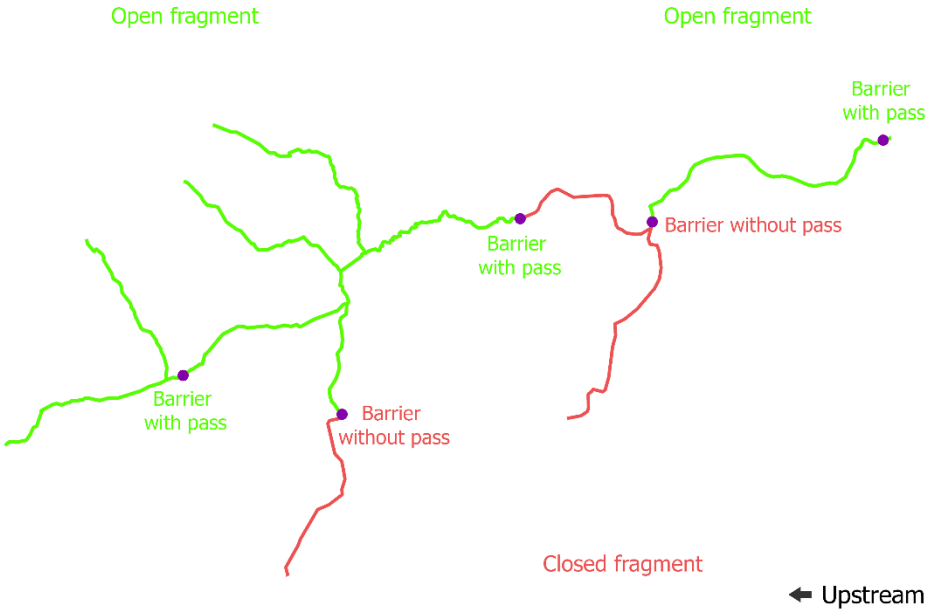
- Data pre-processing and merging
  - Data from CRT, SERT, London Wildlife Trust and ZSL were manually integrated
  - Checking through each barrier location using Google Earth 3D satellite imagery

Data science

- Data analysis
  - The finalised barrier dataset was overlayed on top of the river shapefile
  - The river shapefile was split into fragments using the Split tool (manually)
    - *In GIS: snapping points to lines and then split line at point*
  - The length of each river fragment (km) was calculated (*Calculate geometry tool*)

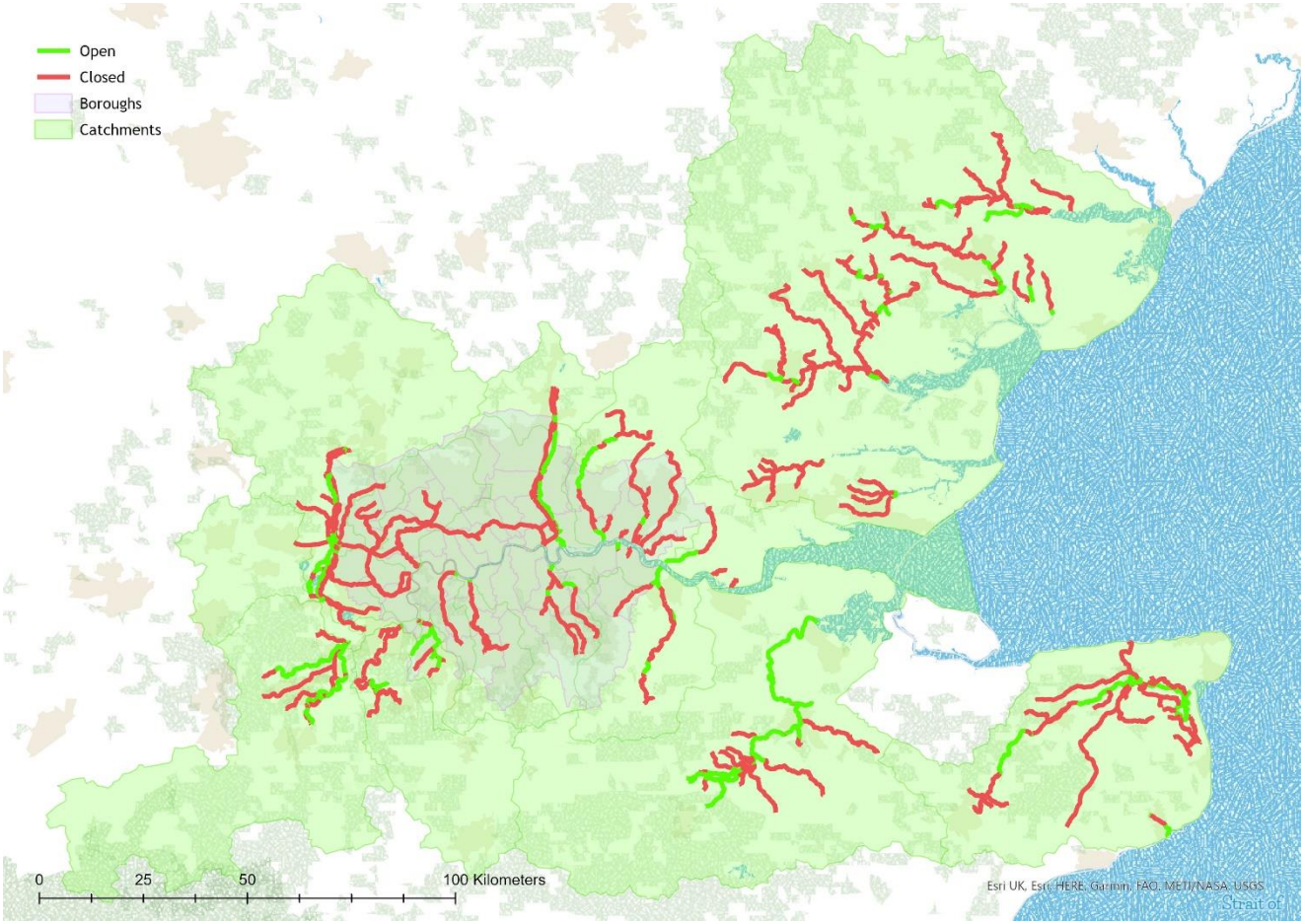
Data science

- Data analysis
  - Open: river fragments where the nearest barrier downstream had fish, eel or multi-species pass, installed, were removed, or did not need mitigation
  - Closed: the rest of the river fragments
  - Separate shapefiles:
    - Upstream fish connectivity
    - Upstream eel connectivity



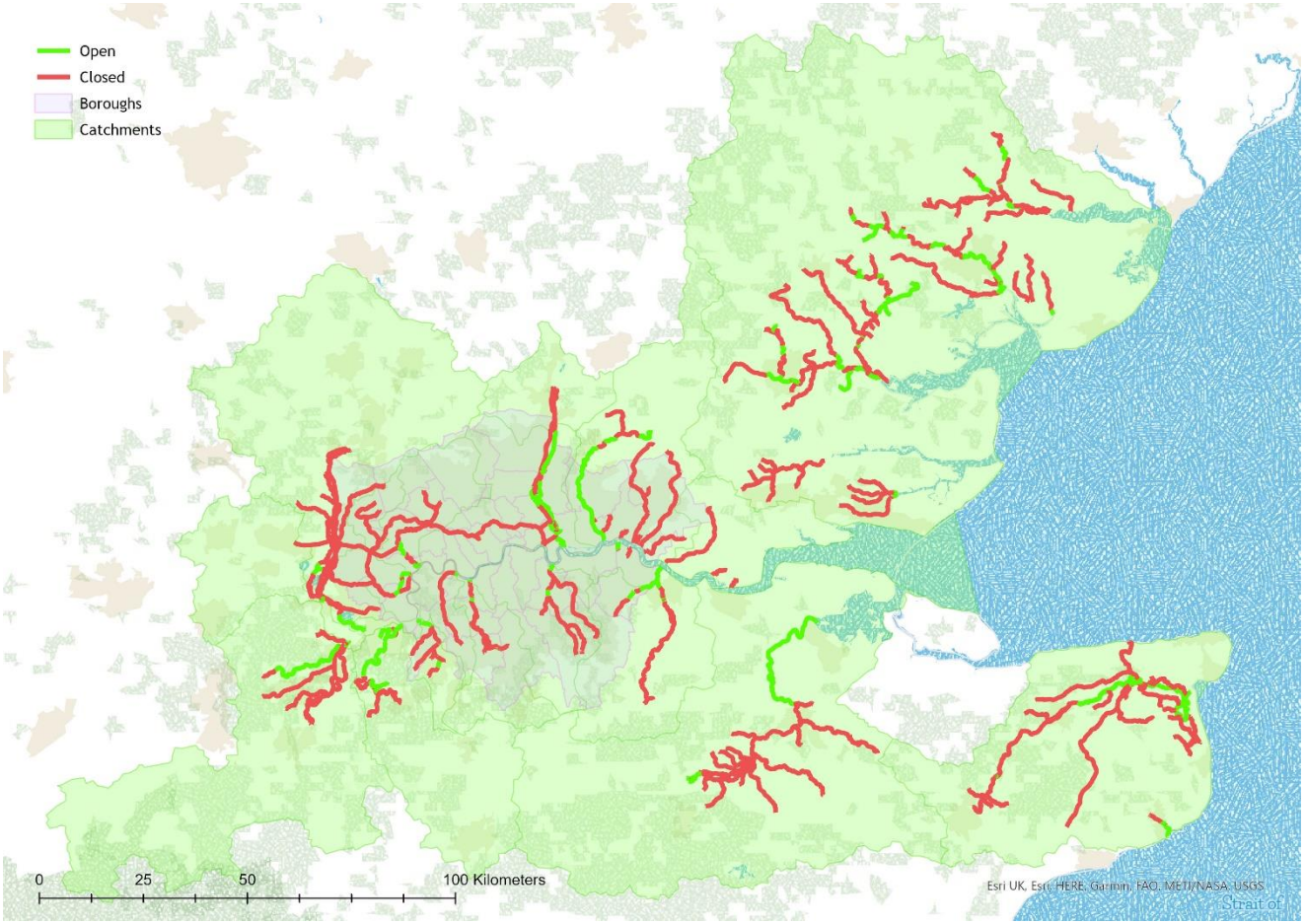
Data science

- Data analysis



Data science

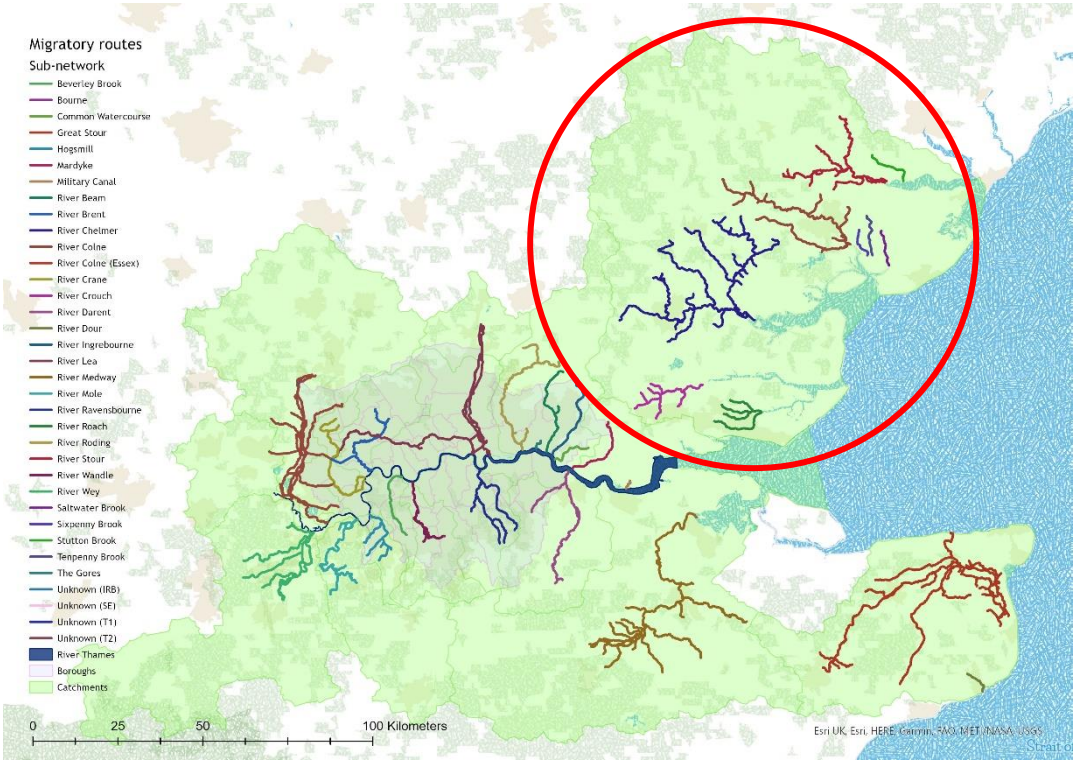
- Data analysis



Data science

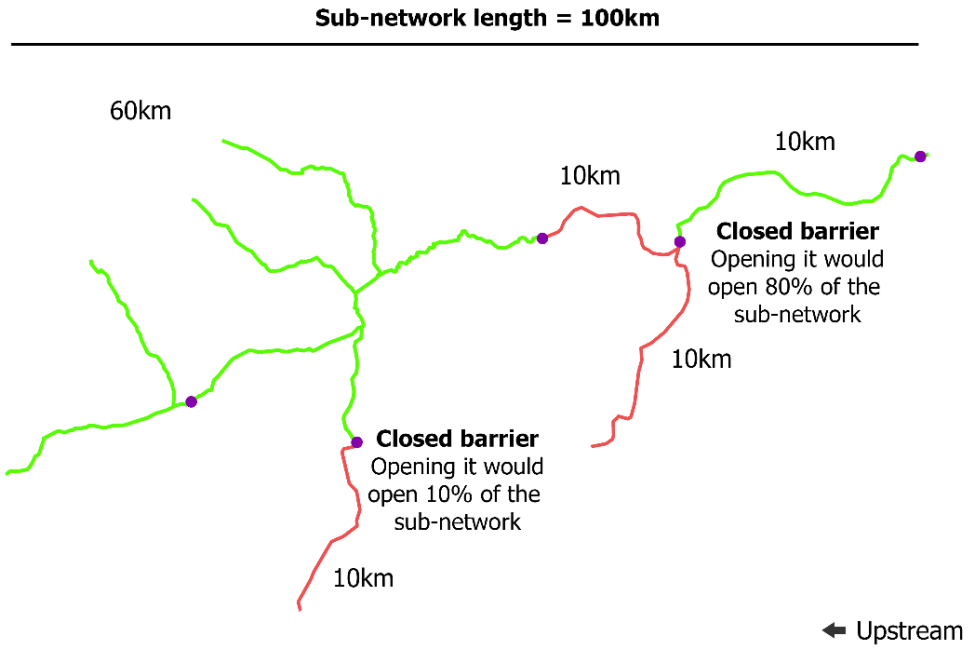
- Data analysis
  - The upstream fish and eel connectivity shapefiles were further arranged into sub-networks

  (Each sub-network was made up of interconnected migratory routes)



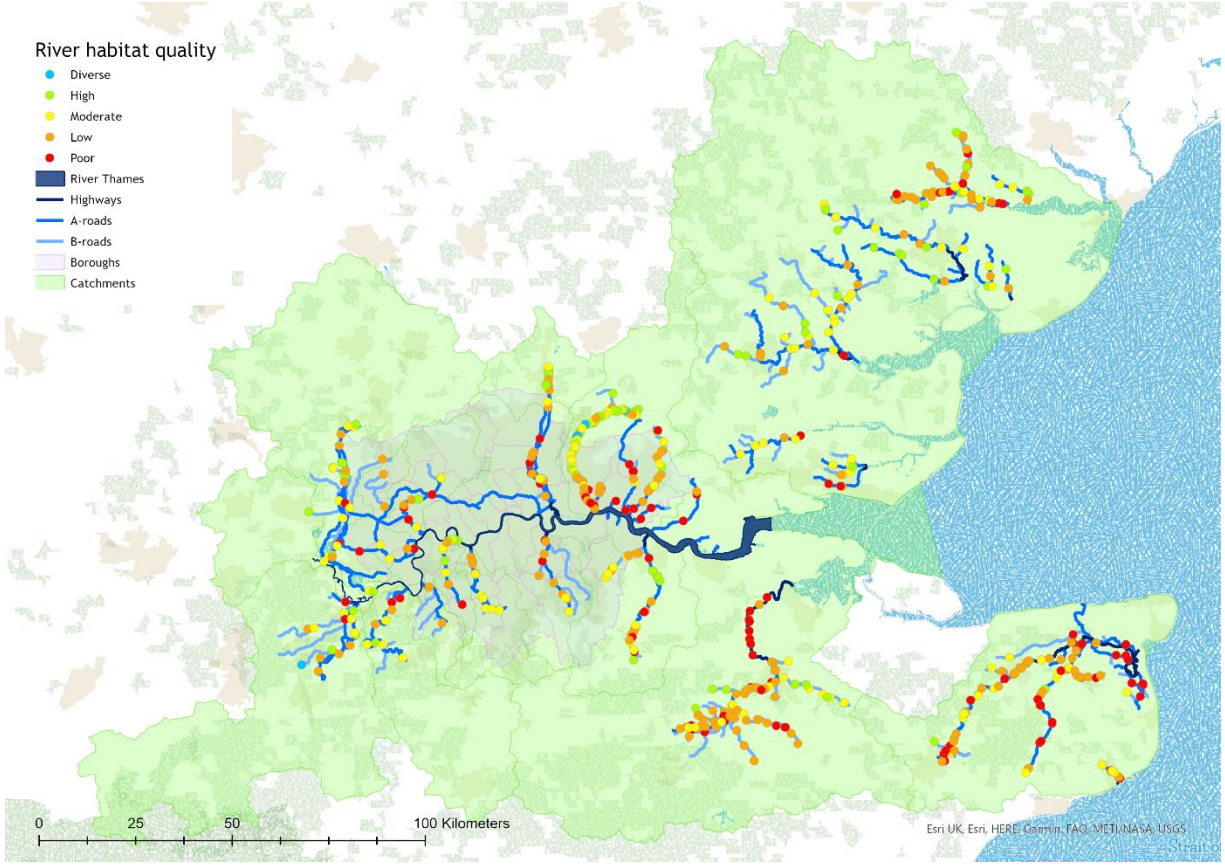
Data science

- Data analysis
  - Using the upstream fish and eel connectivity shapefiles, the proportion of river fragmentation was calculated
  - The percentage value (%) of a river fragment was then assigned to the nearest barrier downstream and was integrated into the finalised barrier dataset



Data science

- Data analysis
  - River habitat survey data (EA)



Data science

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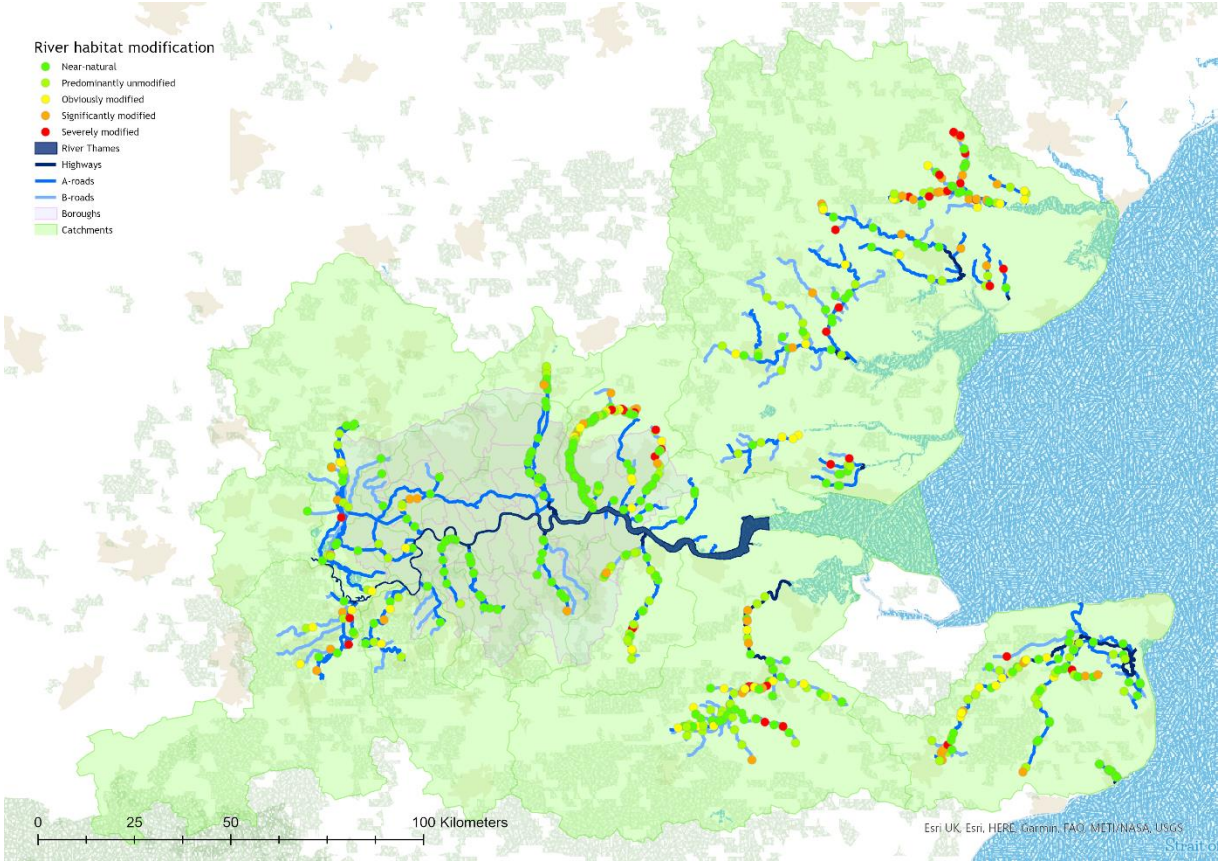


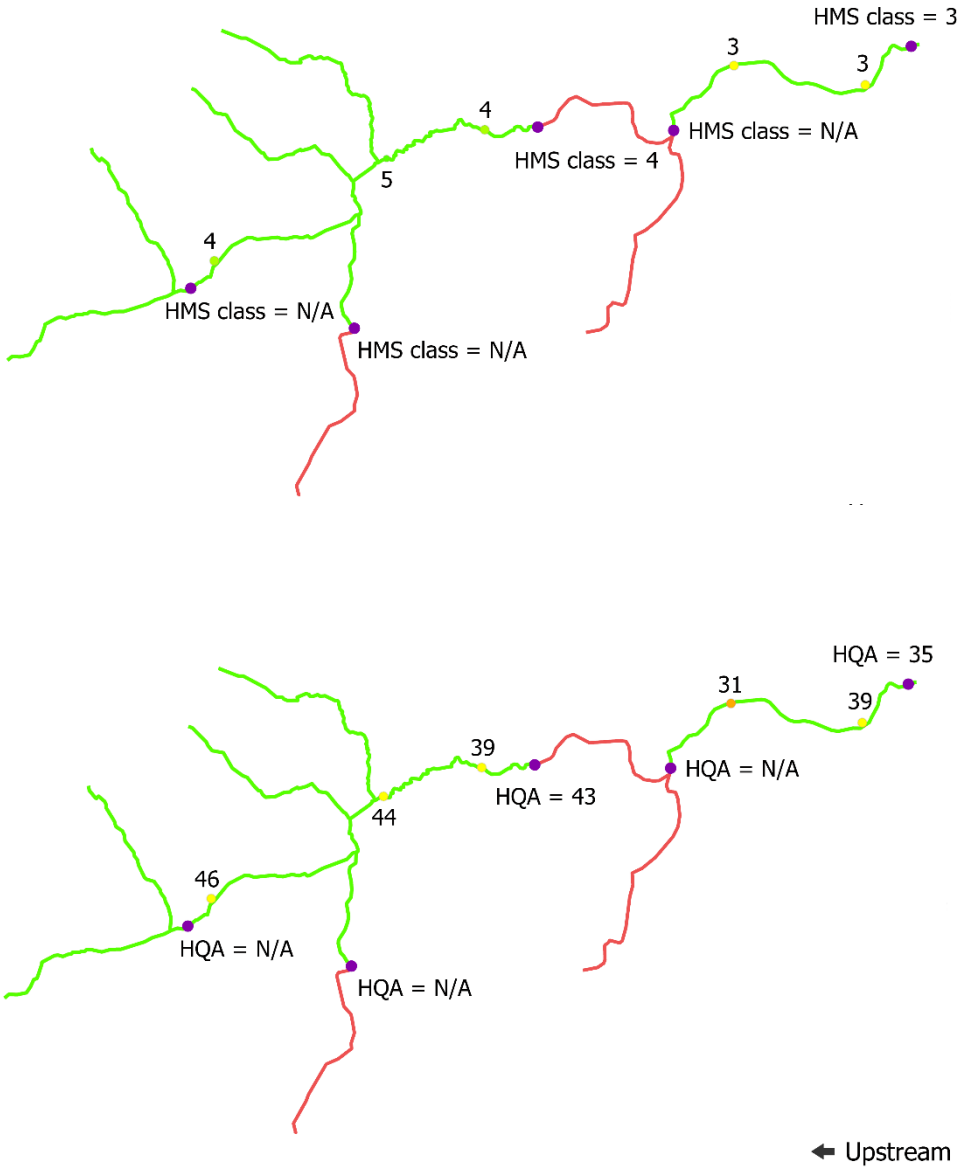
Data science

- Data analysis
  - River habitat survey data (EA)

River Habitat Survey			
Habitat quality assessment		Habitat modification score (class)	
Diverse	61 to 100	Near-natural	5
High	49 to 60	Predominantly unmodified	4
Moderate	38 to 48	Obviously modified	3
Low	37 to 37	Significantly modied	2
Poor	1 to 25	Severely modified	1

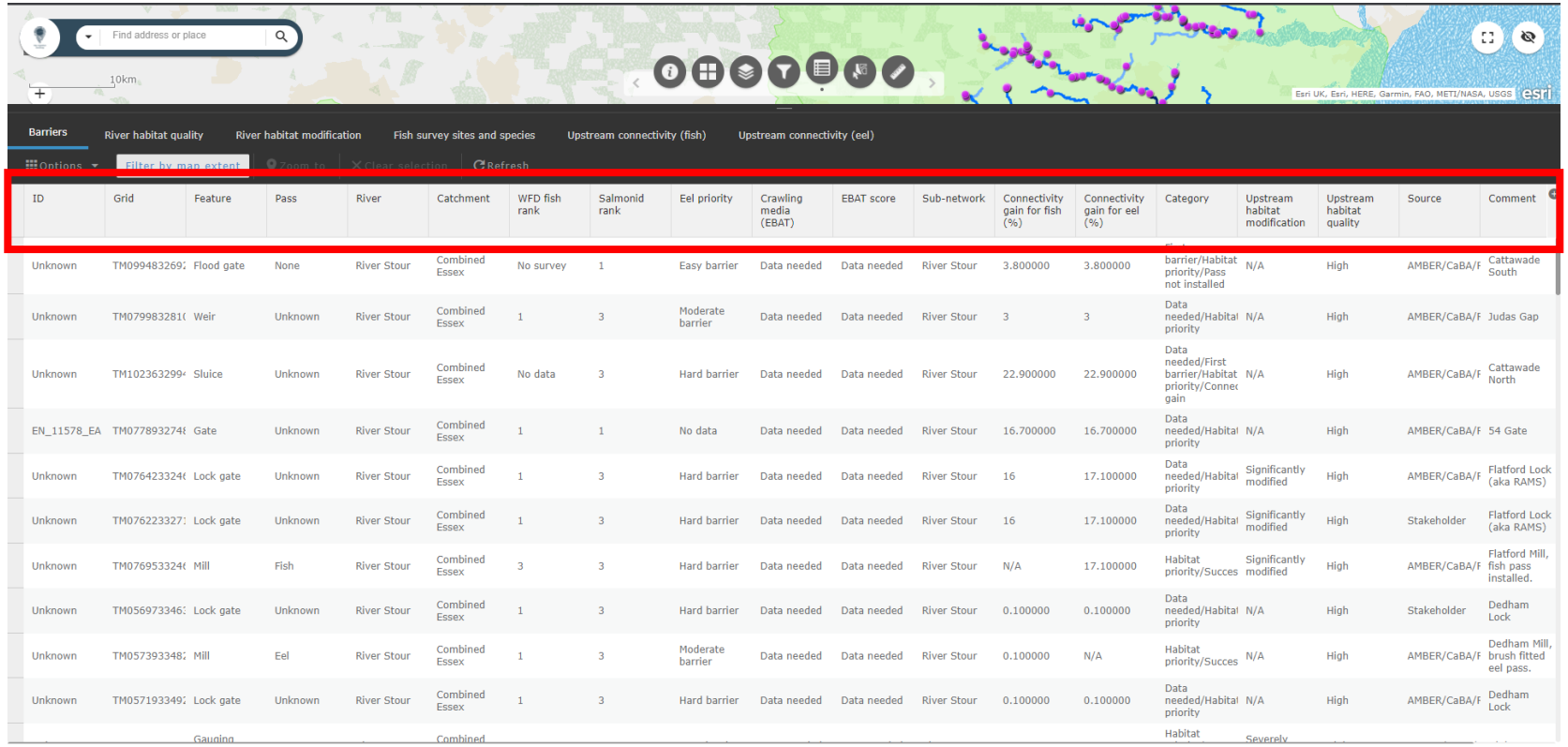
Data science

- Data analysis
  - River habitat survey data (EA)
    - Within each river fragment, the mean average was calculated for all HQA and HMS class habitats, and the value of the mean average was then assigned to nearest barrier downstream



Data science

- Data analysis
  - Final barrier dataset



ID	Grid	Feature	Pass	River	Catchment	WFD fish rank	Salmonid rank	Eel priority	Crawling media (EBAT)	EBAT score	Sub-network	Connectivity gain for fish (%)	Connectivity gain for eel (%)	Category	Upstream habitat modification	Upstream habitat quality	Source	Comment
Unknown	TM099483269:	Flood gate	None	River Stour	Combined Essex	No survey	1	Easy barrier	Data needed	Data needed	River Stour	3.800000	3.800000	barrier/Habitat priority/Pass not installed	N/A	High	AMBER/CaBA/F	Cattawade South
Unknown	TM079983281(	Weir	Unknown	River Stour	Combined Essex	1	3	Moderate barrier	Data needed	Data needed	River Stour	3	3	Data needed/Habitat priority	N/A	High	AMBER/CaBA/F	Judas Gap
Unknown	TM102363299<	Sluice	Unknown	River Stour	Combined Essex	No data	3	Hard barrier	Data needed	Data needed	River Stour	22.900000	22.900000	Data needed/First barrier/Habitat priority/Connec gain	N/A	High	AMBER/CaBA/F	Cattawade North
EN_11578_EA	TM077893274(	Gate	Unknown	River Stour	Combined Essex	1	1	No data	Data needed	Data needed	River Stour	16.700000	16.700000	Data needed/Habitat priority	N/A	High	AMBER/CaBA/F	54 Gate
Unknown	TM076423324(	Lock gate	Unknown	River Stour	Combined Essex	1	3	Hard barrier	Data needed	Data needed	River Stour	16	17.100000	Data needed/Habitat priority	Significantly modified	High	AMBER/CaBA/F	Flatford Lock (aka RAMS)
Unknown	TM076223327:	Lock gate	Unknown	River Stour	Combined Essex	1	3	Hard barrier	Data needed	Data needed	River Stour	16	17.100000	Data needed/Habitat priority	Significantly modified	High	Stakeholder	Flatford Lock (aka RAMS)
Unknown	TM076953324(	Mill	Fish	River Stour	Combined Essex	3	3	Hard barrier	Data needed	Data needed	River Stour	N/A	17.100000	Habitat priority/Succes	Significantly modified	High	AMBER/CaBA/F	Flatford Mill, fish pass installed.
Unknown	TM056973346:	Lock gate	Unknown	River Stour	Combined Essex	1	3	Hard barrier	Data needed	Data needed	River Stour	0.100000	0.100000	Data needed/Habitat priority	N/A	High	Stakeholder	Dedham Lock
Unknown	TM057393348:	Mill	Eel	River Stour	Combined Essex	1	3	Moderate barrier	Data needed	Data needed	River Stour	0.100000	N/A	Habitat priority/Succes	N/A	High	AMBER/CaBA/F	Dedham Mill, brush fitted eel pass.
Unknown	TM057193492:	Lock gate	Unknown	River Stour	Combined Essex	1	3	Hard barrier	Data needed	Data needed	River Stour	0.100000	0.100000	Data needed/Habitat priority	N/A	High	AMBER/CaBA/F	Dedham Lock
		Gauging			Combined									Habitat		Severely		

82 features 0 selected

Data science

- Data analysis
  - Reprioritisation (Category field in the data)
    - Barriers with the highest % connectivity gain within the given sub-network were marked as ‘Connectivity gain’
    - Barriers that had information missing were marked as ‘Data needed’
    - Impassable barriers (barriers without fish/eel pass) on the Highways and at the confluence of the Highways and A-roads were marked as ‘First barrier’
    - Barriers without fish, eel or multi-species pass from where the upstream river sections had habitat scores HQA ≥ 49 and/or HMS class ≥ 4 were marked as ‘Habitat priority’
    - Locations where it is known that passes are not present were marked as ‘Pass not installed’
    - Barriers that had fish/eel pass installed or were removed were marked as ‘Success’
    - Barriers that need to be addressed urgently for eel passage were marked as ‘Super critical’

Data science

Reprioritisation

Barrier data	Integrating additional data	Expert knowledge
• Barriers locations where data is missing (not surveyed) • Barriers with no pass installed • Barriers with low EBAT score	• Barriers with high connectivity gain • Barriers with good quality habitat upstream • Barriers in the vicinity of developments • Barriers with river section prone to pollution	• Barriers with a quick ‘win’ • Barriers with easy access • Barrier where major fish or eel project is needed • Barrier where the fish/eel pass is now missing • Redundant barriers • Barrier where connectivity is not possible • Barriers passable at HT

Data science

Reprioritisation

Barrier data

- Barriers locations where data is missing (not surveyed)
- Barriers with no pass installed
- Barriers with low EBAT score

Integrating additional data

- Barriers with high connectivity gain
- Barriers with good quality habitat upstream
- Barriers in the vicinity of developments
- Barriers with river section prone to pollution

Expert knowledge

- Barriers with a quick ‘win’
- Barriers with easy access
- Barrier where major fish or eel project is needed
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Data science

Reprioritisation

Barrier data

- Barriers locations where data is missing (not surveyed)
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Integrating additional data

- Barriers with high connectivity gain
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Expert knowledge

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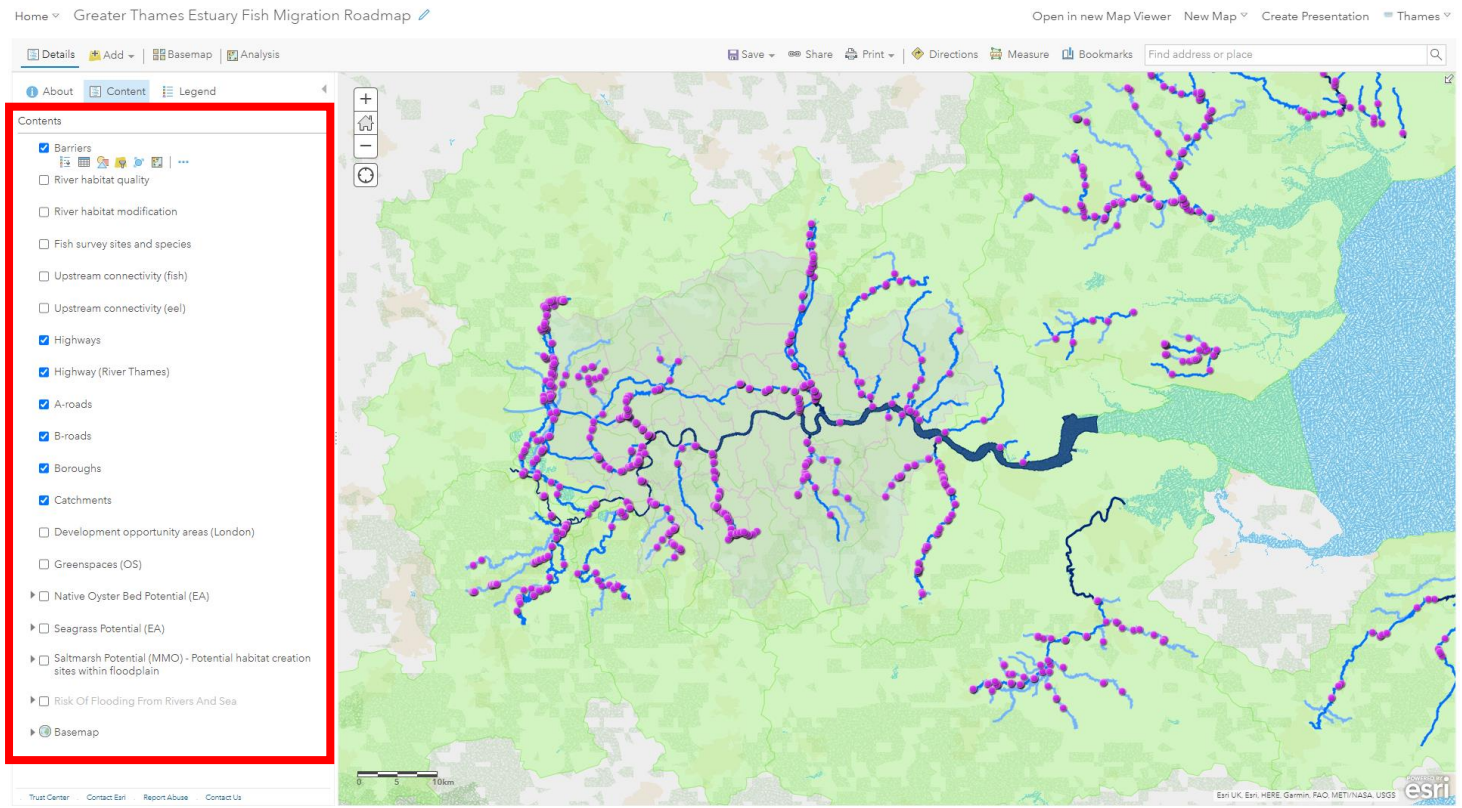
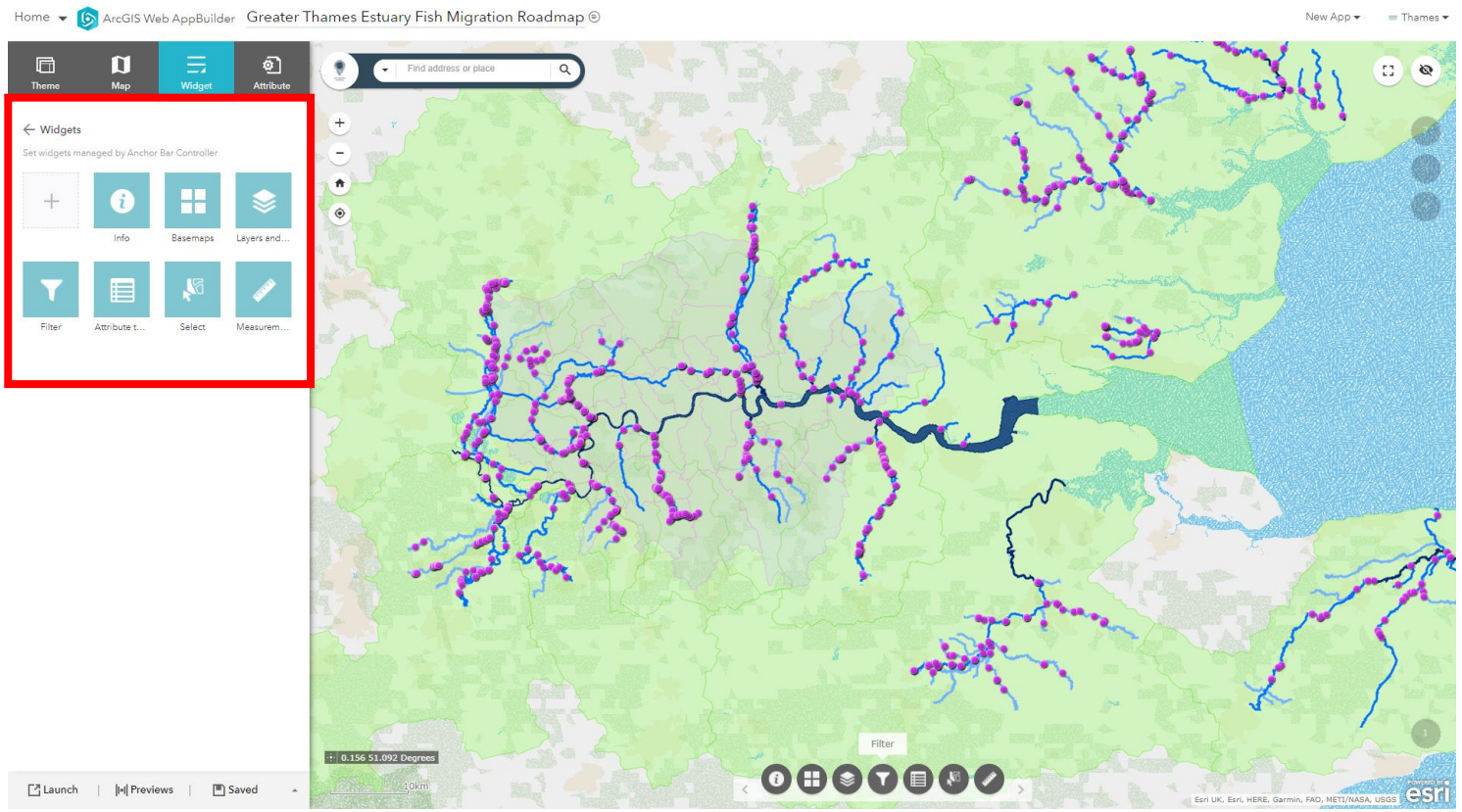
Data science

- Data visualisation
  - ArcGIS Online

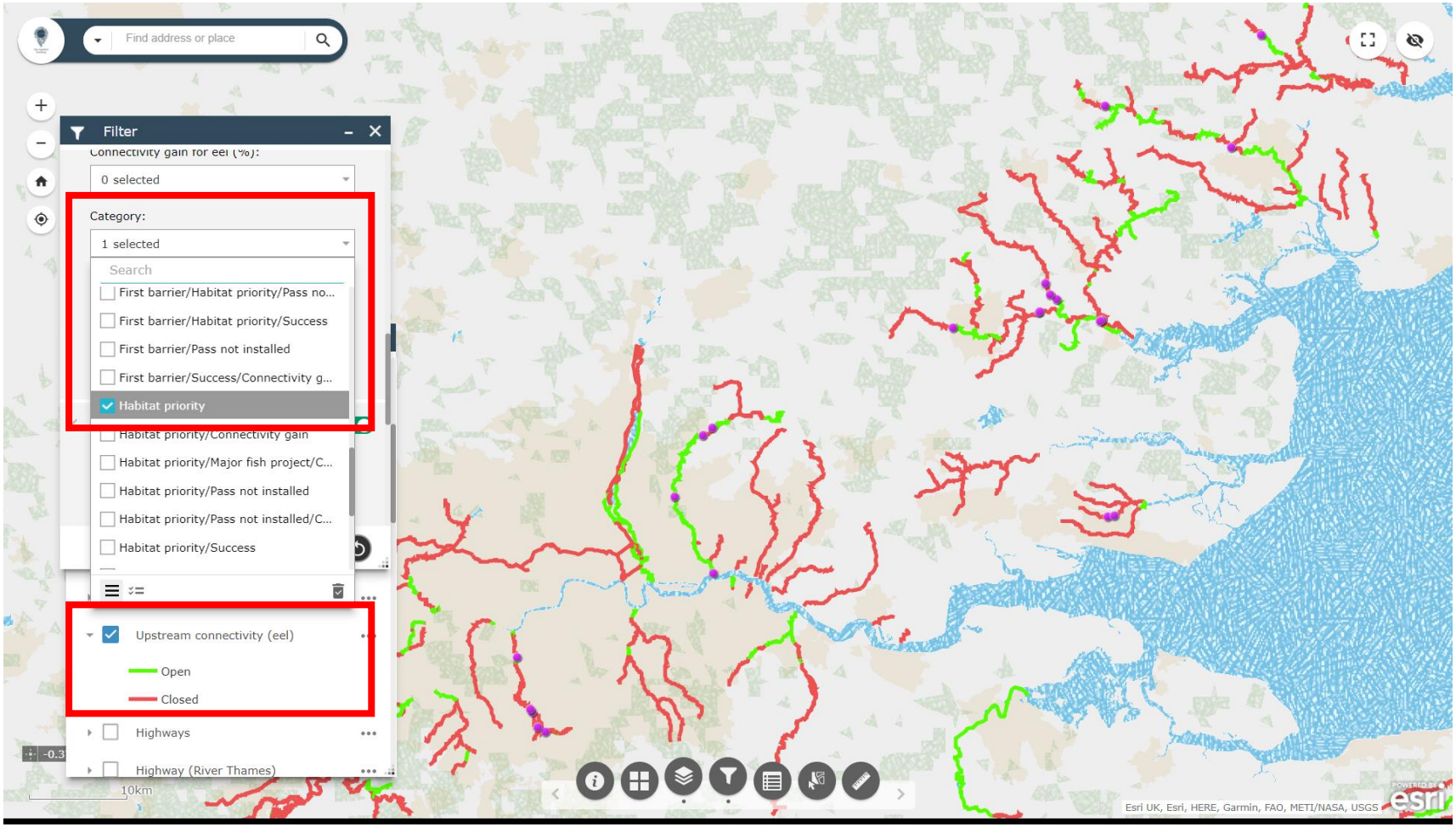


Data science

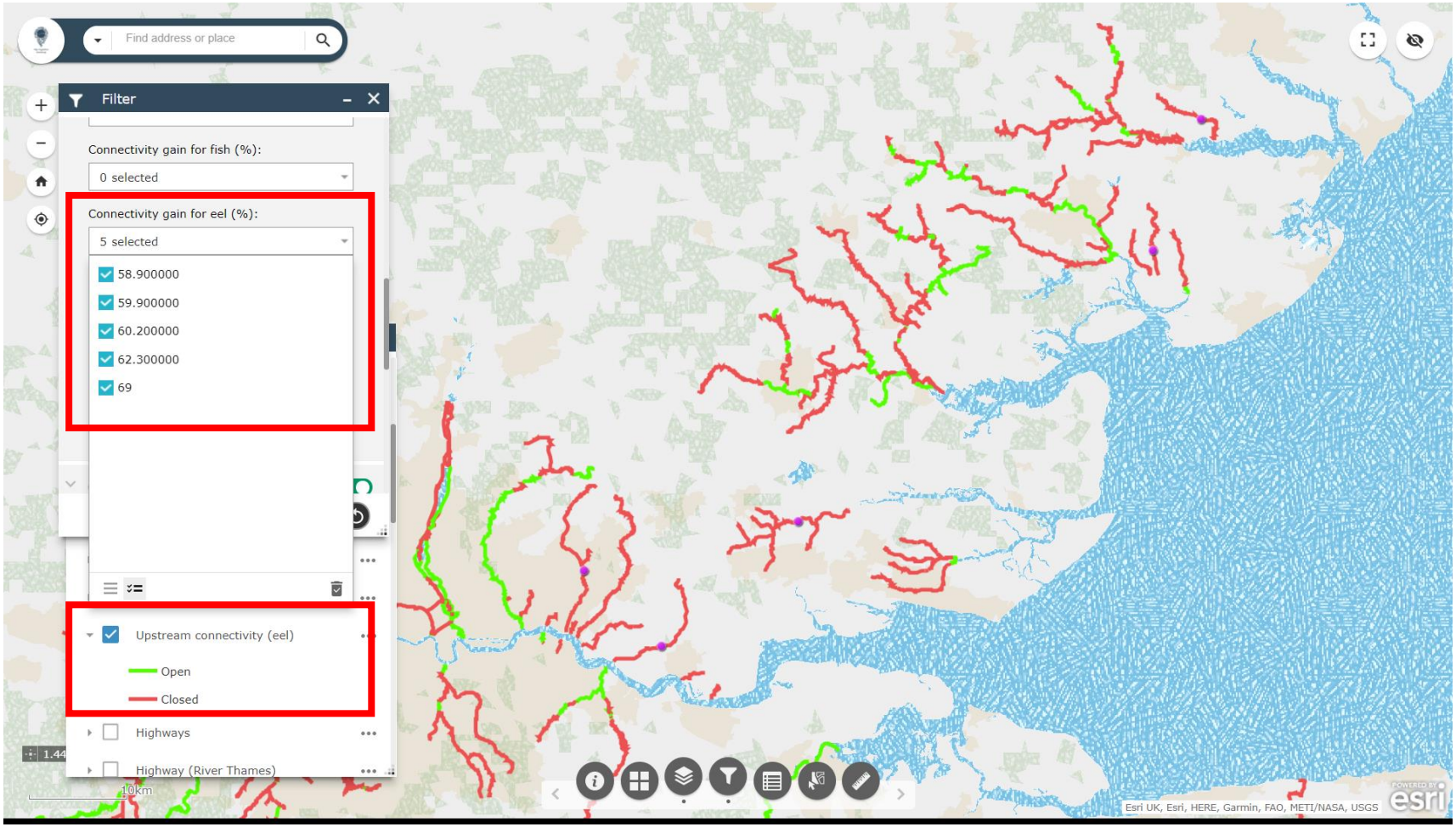
- Data visualisation
  - ArcGIS Web Mapping Application



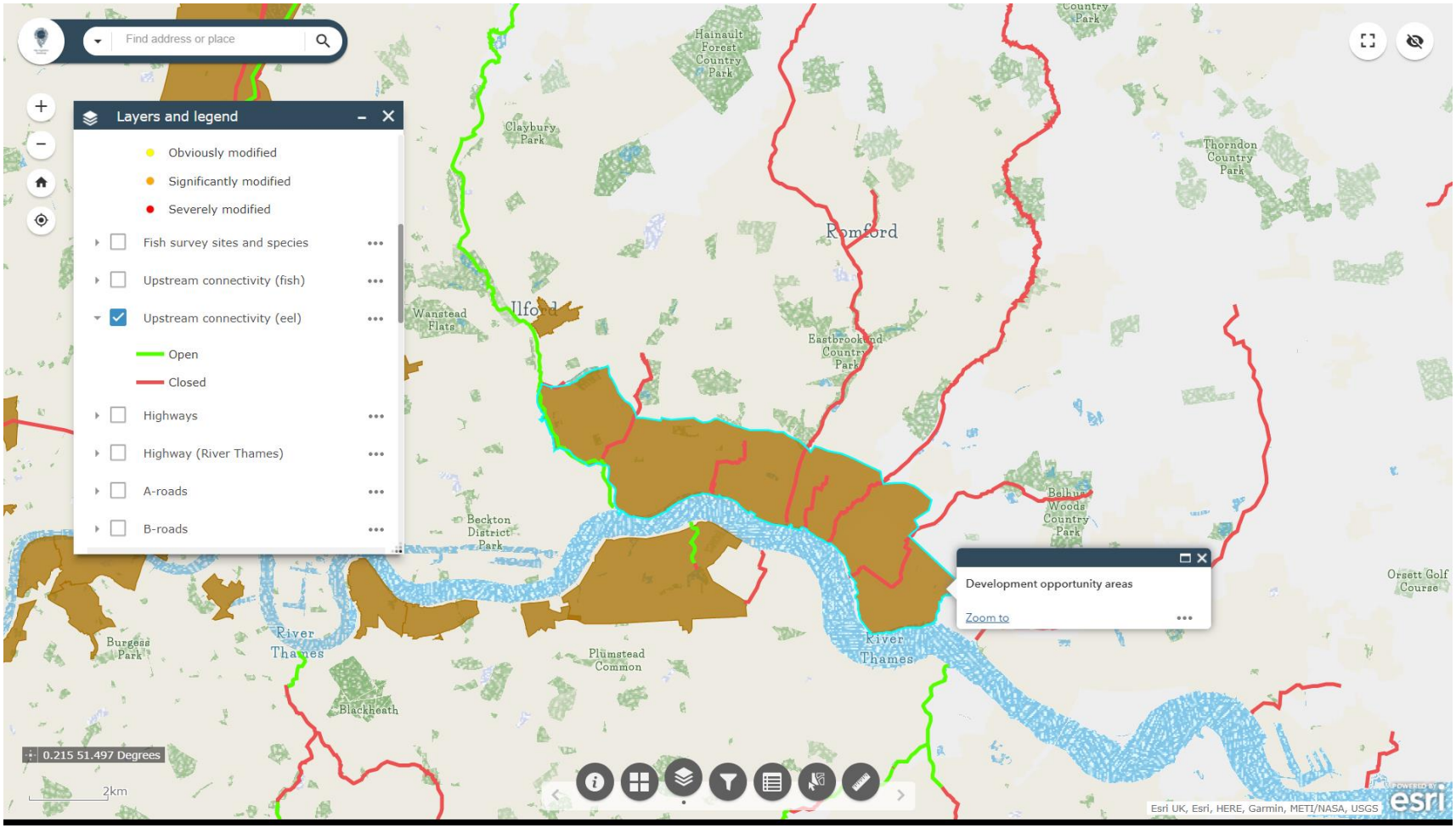
Map usage


Find address or place
Filter
Connectivity gain for eel (%):
0 selected
Category:
1 selected
Search
First barrier/Habitat priority/Pass no...
First barrier/Habitat priority/Success
First barrier/Pass not installed
First barrier/Success/Connectivity g...
Habitat priority
Habitat priority/Connectivity gain
Habitat priority/Major fish project/C...
Habitat priority/Pass not installed
Habitat priority/Pass not installed/C...
Habitat priority/Success
Upstream connectivity (eel)
Open
Closed
Highways
Highway (River Thames)
10km
Esri UK, Esri, HERE, Garmin, FAO, METI/NASA, USGS

Map usage


Find address or place
Filter
Connectivity gain for fish (%):
0 selected
Connectivity gain for eel (%):
5 selected
58.900000
59.900000
60.200000
62.300000
69
Upstream connectivity (eel)
Open
Closed
Highways
Highway (River Thames)
10km
Esri UK, Esri, HERE, Garmin, FAO, METI/NASA, USGS

Map usage


Find address or place
Layers and legend
Obviously modified
Significantly modified
Severely modified
Fish survey sites and species
Upstream connectivity (fish)
Upstream connectivity (eel)
Open
Closed
Highways
Highway (River Thames)
A-roads
B-roads
Development opportunity areas
Zoom to
Hainault Forest Country Park
Claybury Park
Romford
Thorndon Country Park
Wanstead Flats
Ilford
Eastbrookend Country Park
Beckton District Park
Belhus Woods Country Park
Orsett Golf Course
River Thames
Burgess Park
Plumstead Common
Blackheath
0.215 51.497 Degrees
2km
Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
esri

Next steps

- Thames Eels project barrier data
  - Data collection – DONE
  - Data pre-processing and merging – DONE
  - Data analysis
    - Open and closed river fragments – Project partners
    - Calculation of connectivity gain – Project partners
    - River habitat data integration – Wanda
    - Reprioritisation – Project partners
    - Integration of additional data – Project partners
  - Data visualisation
    - Online and/or hardcopy map -> Fish Migration Vision and legacy projects – Project partners

Next steps

- Thames Eels project barrier data
  - Data visualisation
    - Online and/or hardcopy map -> Fish Migration Vision and legacy projects
      - Highlighting which barriers are already passable
      - Marking where the ‘new’ barriers are
      - Identifying how the ‘new’ barriers scored with EBAT and ‘passability’
      - ‘New’ barriers in between eel passes

Next steps

- Thames Eels project
  - Updated data to be sent tomorrow (12th Nov)
  - 26th Nov Fish Migration Vision follow-up meeting
    - Draft maps for each catchment with prioritised barriers for discussion
  - 29th Nov Co-design workshop
    - Discussion of possible legacy projects with the wider audience

Next steps

- Update of the Greater Thames Estuary Fish Migration Roadmap with extra catchments and updated barrier data
- Final report by March 2021 -> inform the Thames Eels project report

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Questions & Discussion