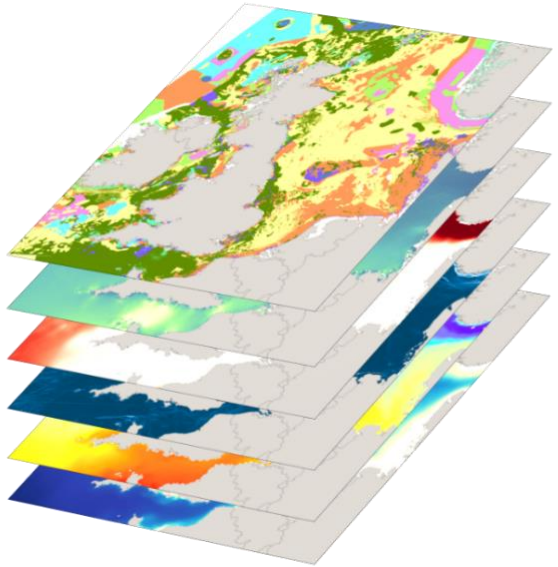
Similarity assessment of OWFs within UK marine habitats

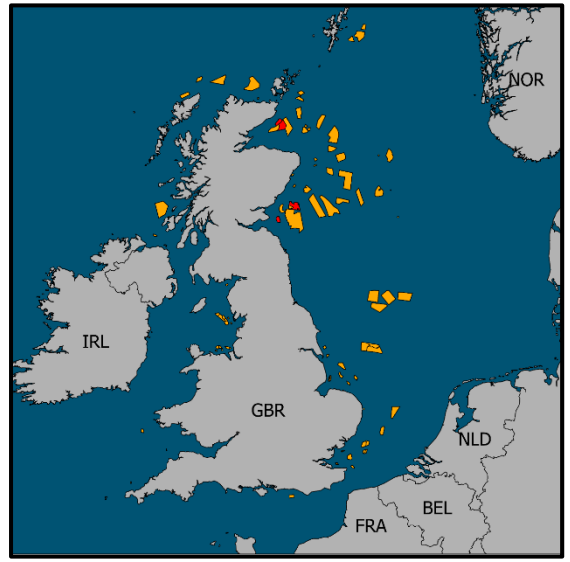
University of Exeter

Sam Gierhart, Anthony Bicknell & Matthew Witt

PrePARED

Predators + Prey Around Renewable Energy Developments





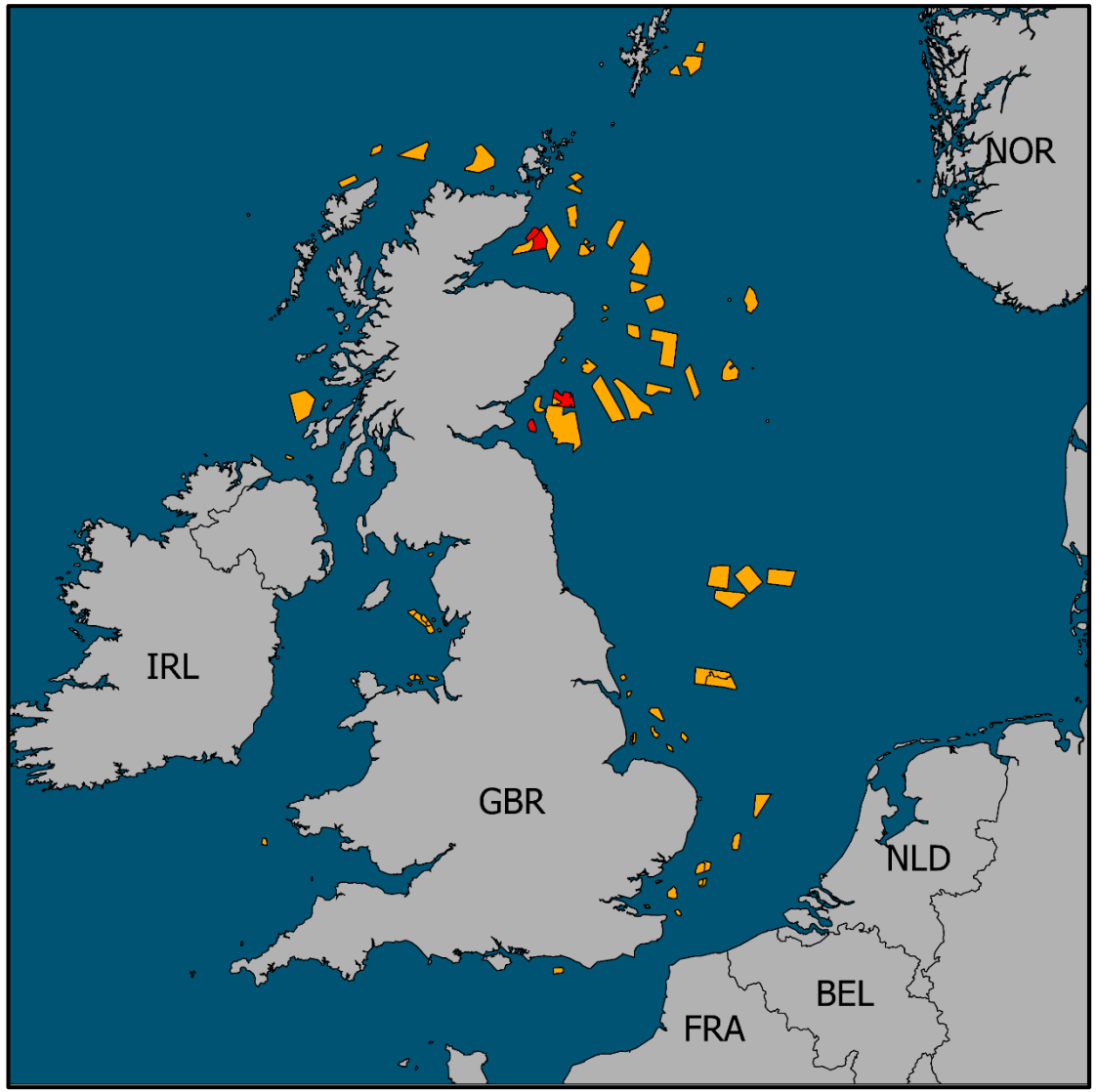
Scottish Government Riaghaltas na h-Alba · SMRU Consulting understand • assess • mitigate · Sea Mammal Research Unit · University of Aberdeen · University of Exeter · Aarhus University · UK Centre for Ecology & Hydrology · BioSS · Natural England · NatureScot · Crown Estate Scotland · Offshore Wind Evidence + Change Programme

Background

- PrePARED focuses on two highly monitored OWF sites: Moray Firth and Firth of Forth

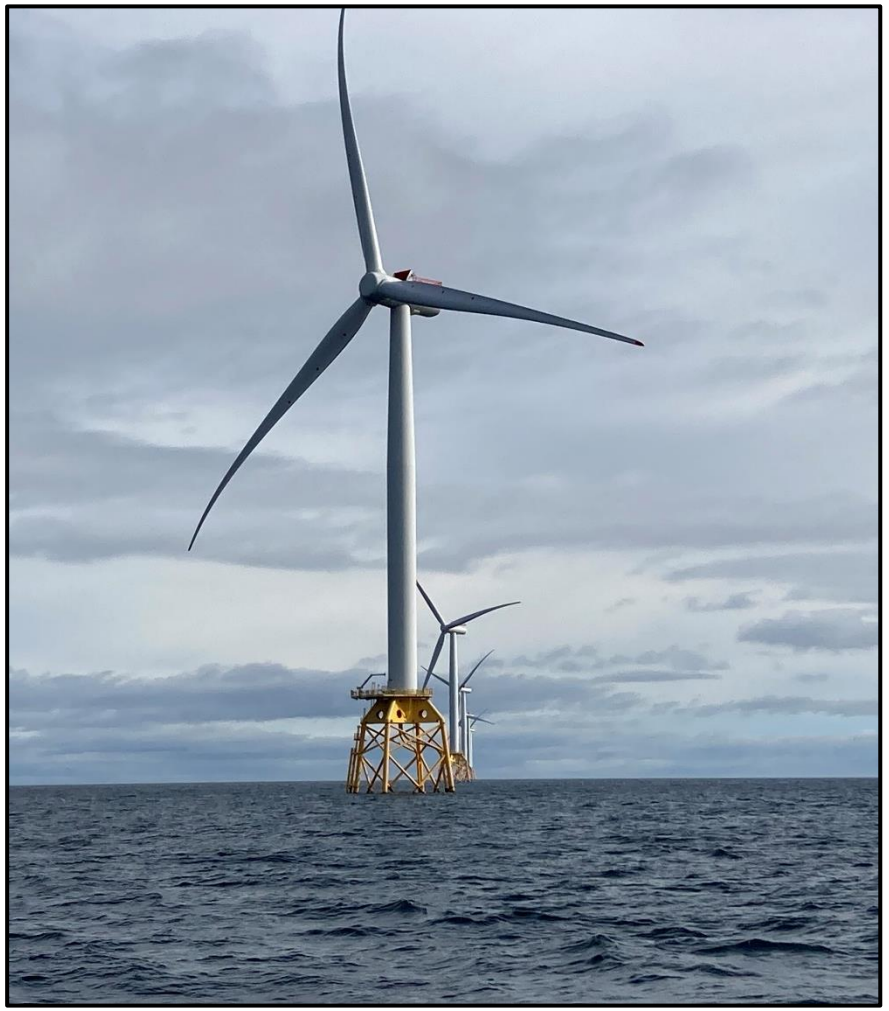
- Site comparison requires evidence-based decision making

- Utilising a broad bio-geographical approach that considers the base environment to investigate similarity and site comparison

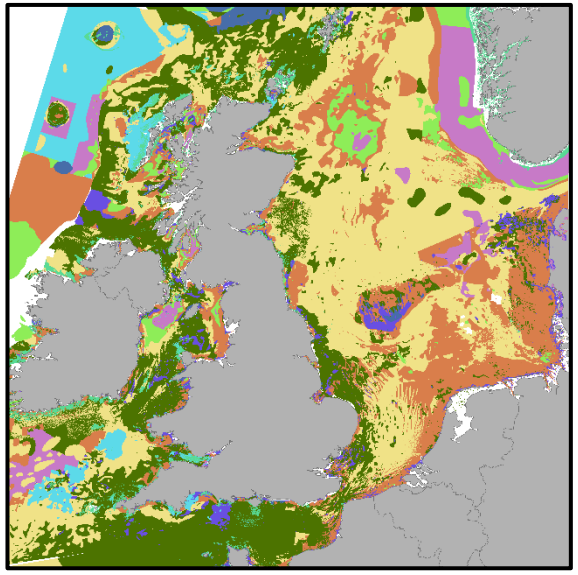


Objective

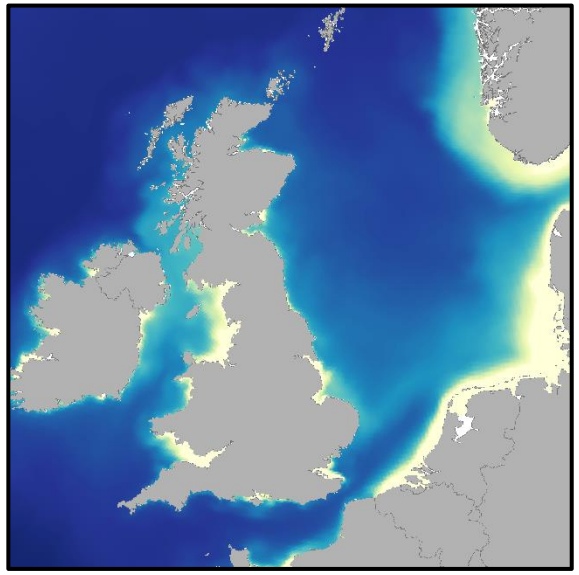
- Identify environmental similarities between PrePARED sites and other offshore wind farms, to:
    - **Seek sites where findings might be transferable**
    - **Find opportunities for collaborative / structured science to improve understanding**
    - **Identify potential reference or comparison sites**
- This analysis has been conducted on both the PrePARED sites; this presentation will mostly focus on Moray Firth



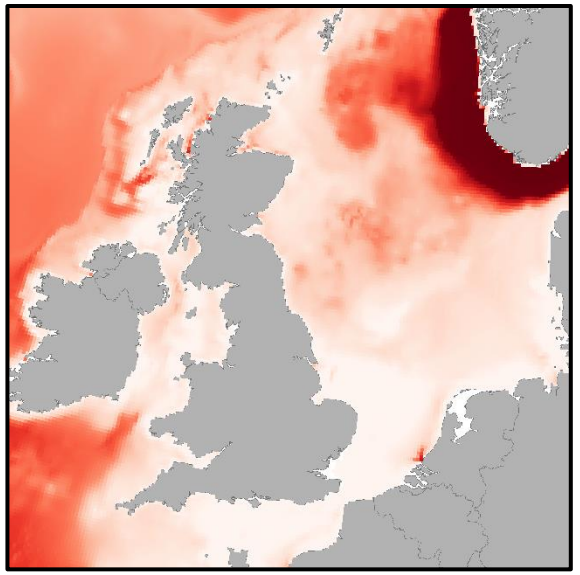
Seabed substrate



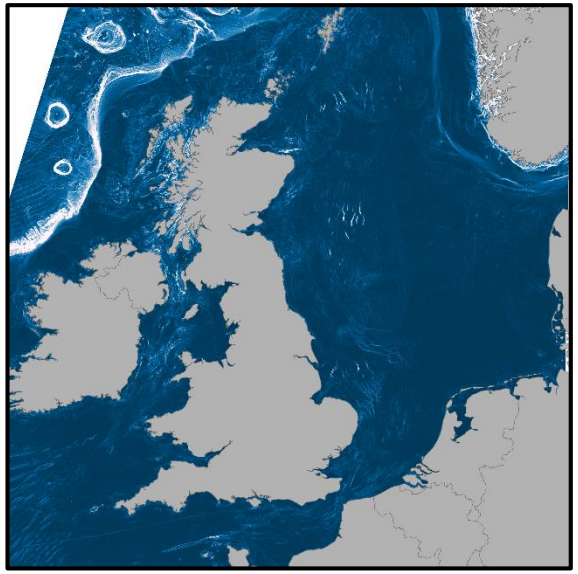
Salinity (ppt)



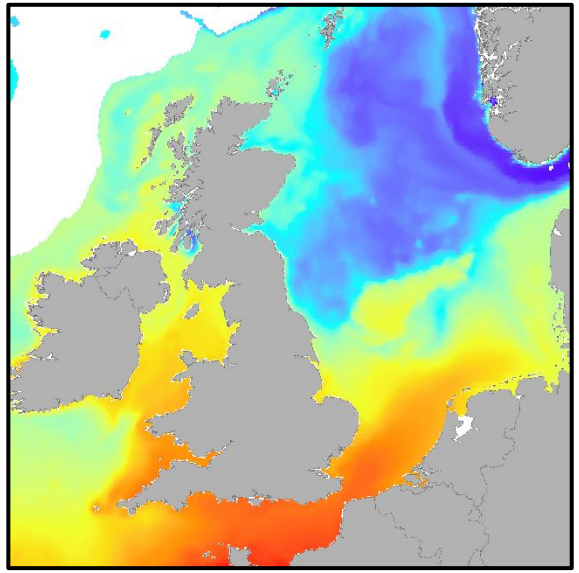
Vertical stratification (J m^{-3})



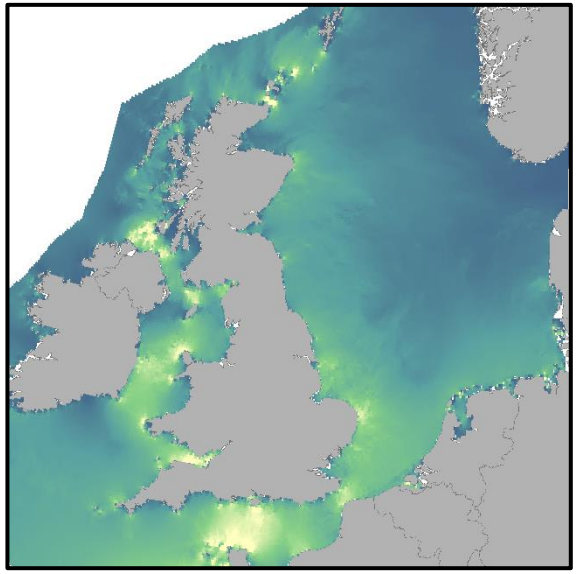
Seabed slope (degrees)



Sea bottom temperature (°C)



Spring tide current (m/s)



Wind farm database

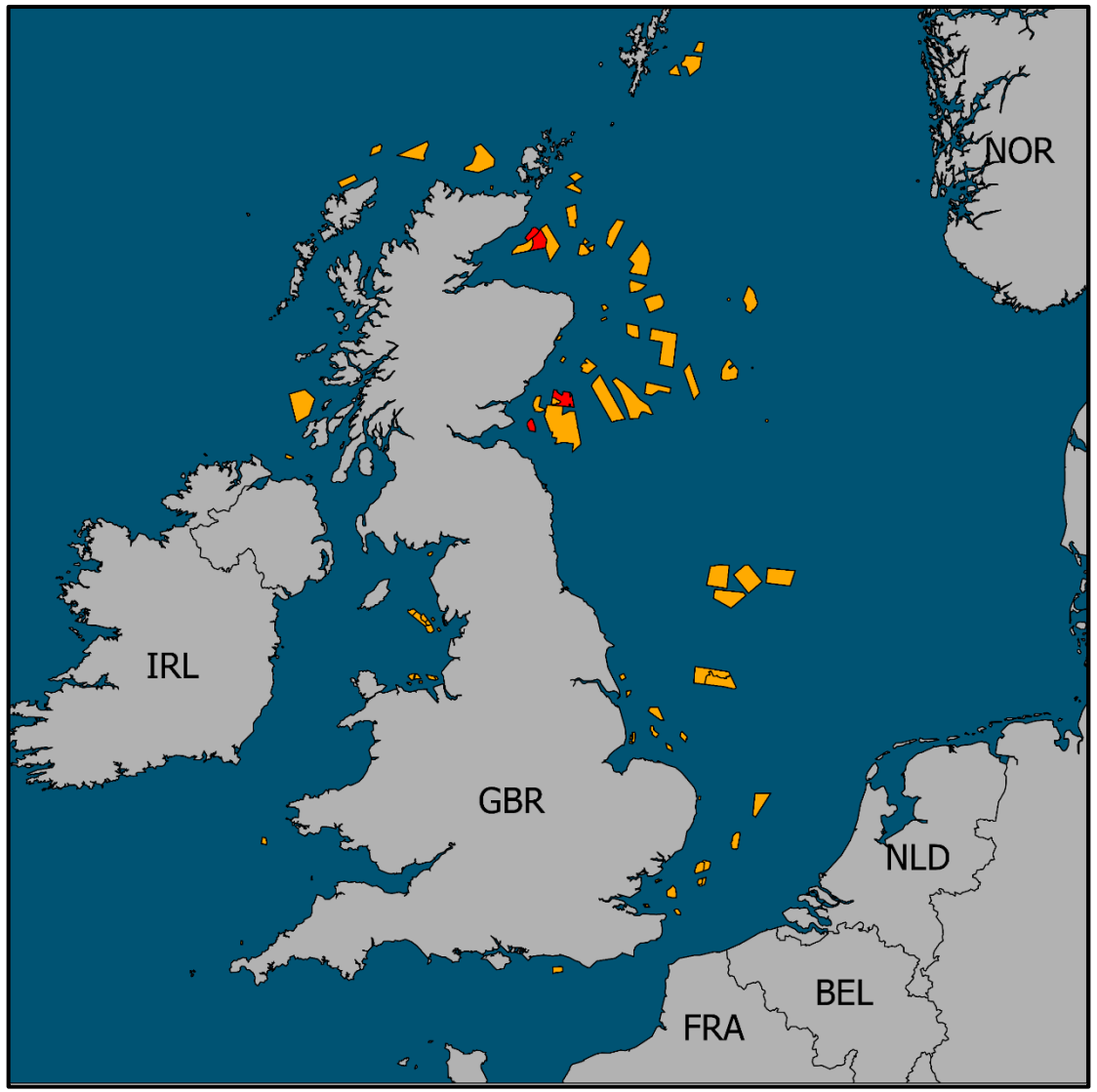
- Database was gathered from various sources

Included:

- Only UK windfarms
- All operational windfarms
- ScotWind and INTOG sites

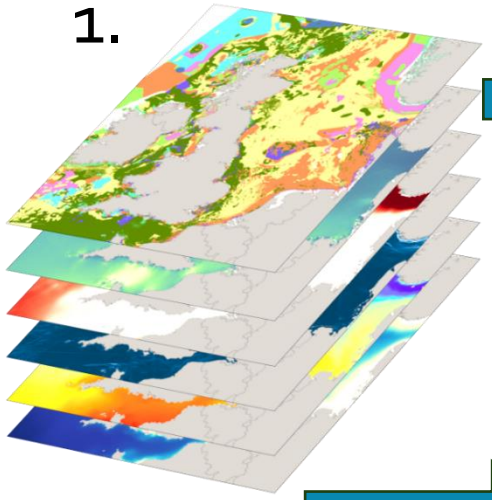
Excluded:

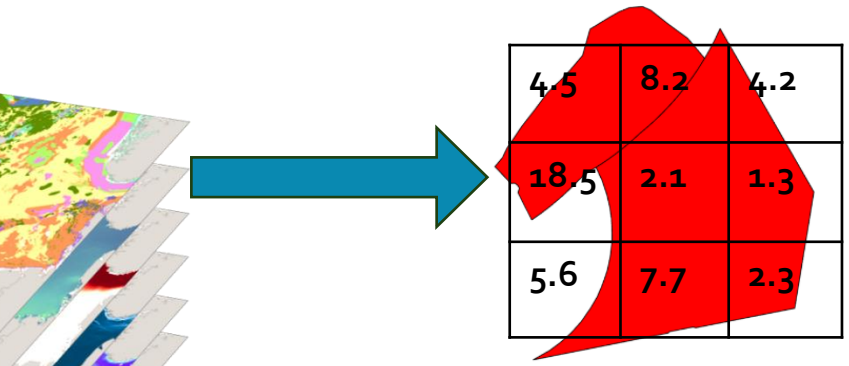
- European windfarms
- Leasing round 4 and 5



Similarity Search Methods

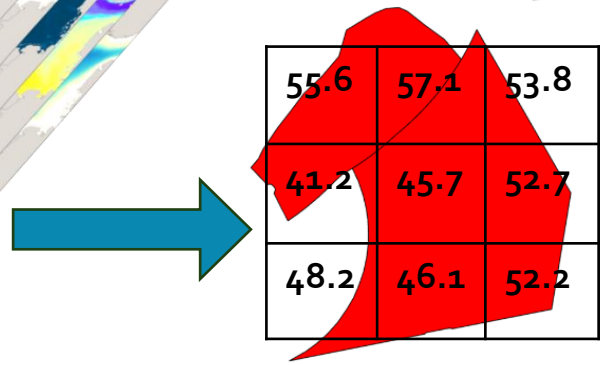
1.





Mean values

= 5.9



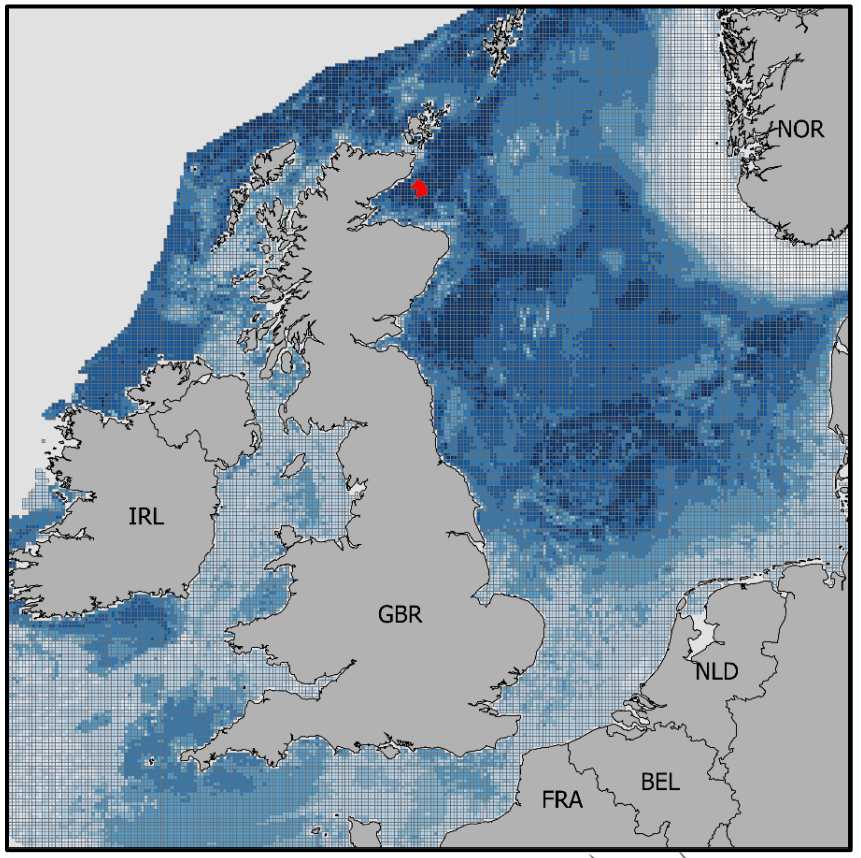
Mean values

= 50.3

2. Similarity search

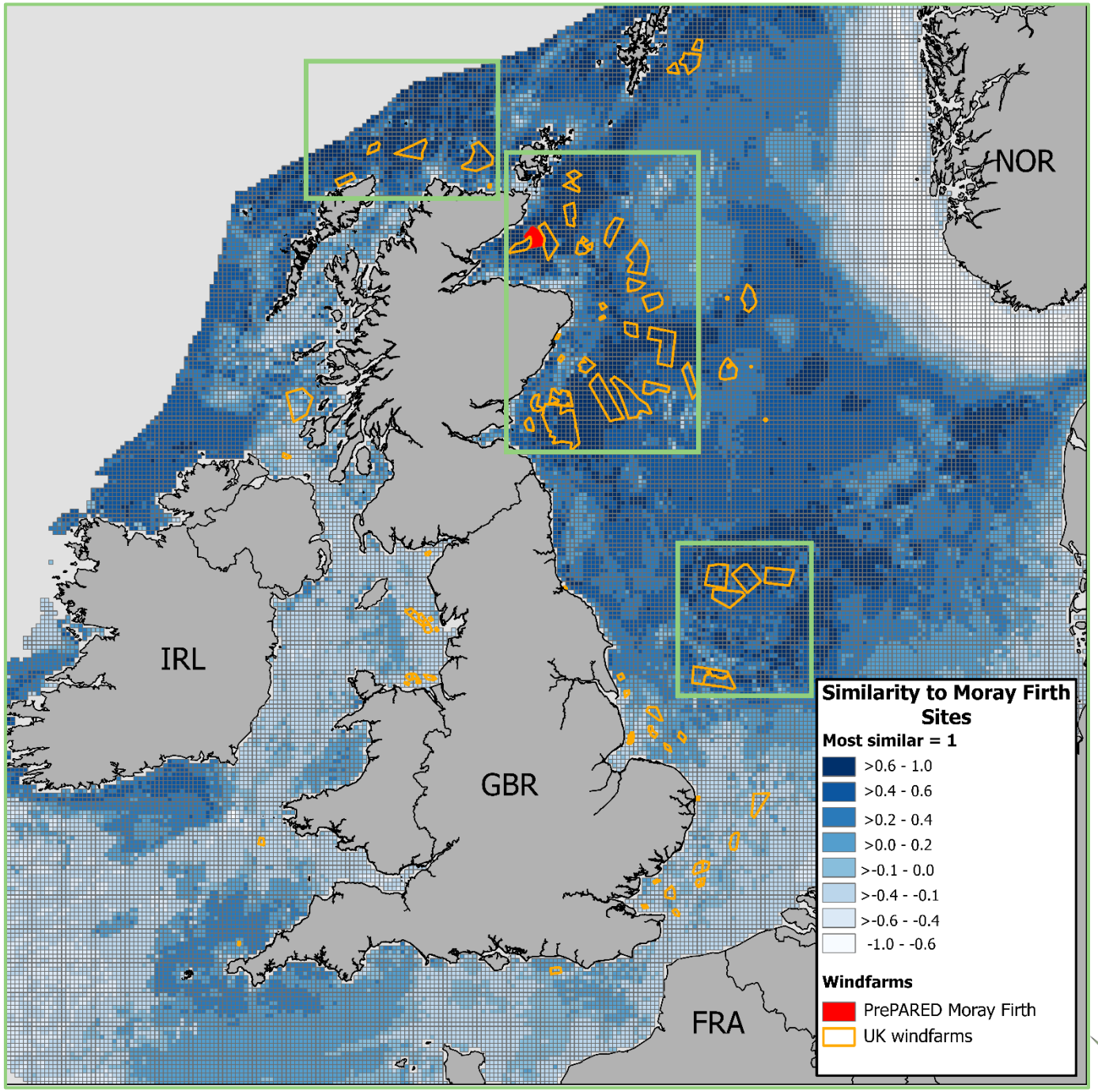
The similarity scores range from 1 (perfect similarity), to -1 (perfect dissimilarity).

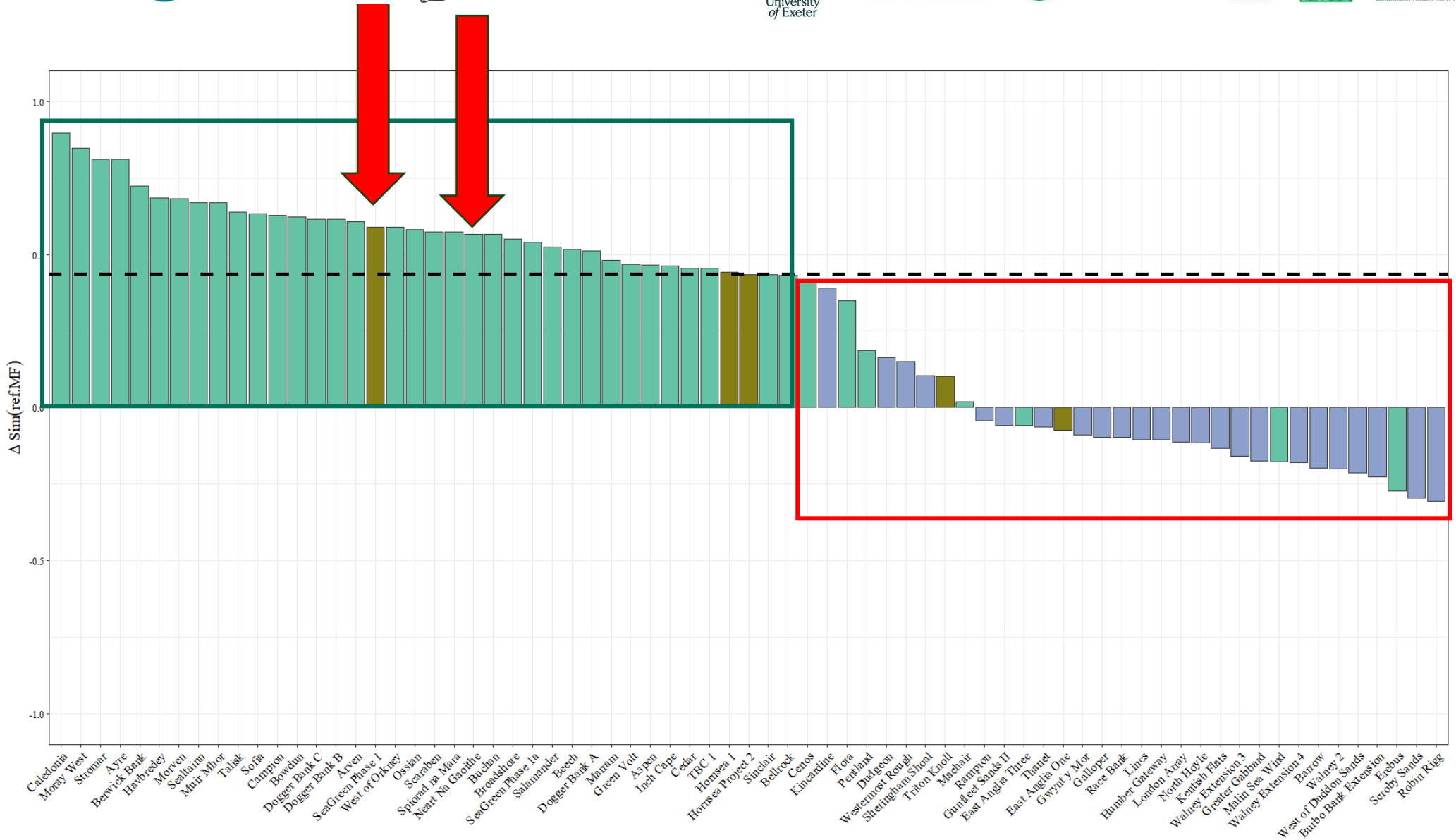
3. Output map

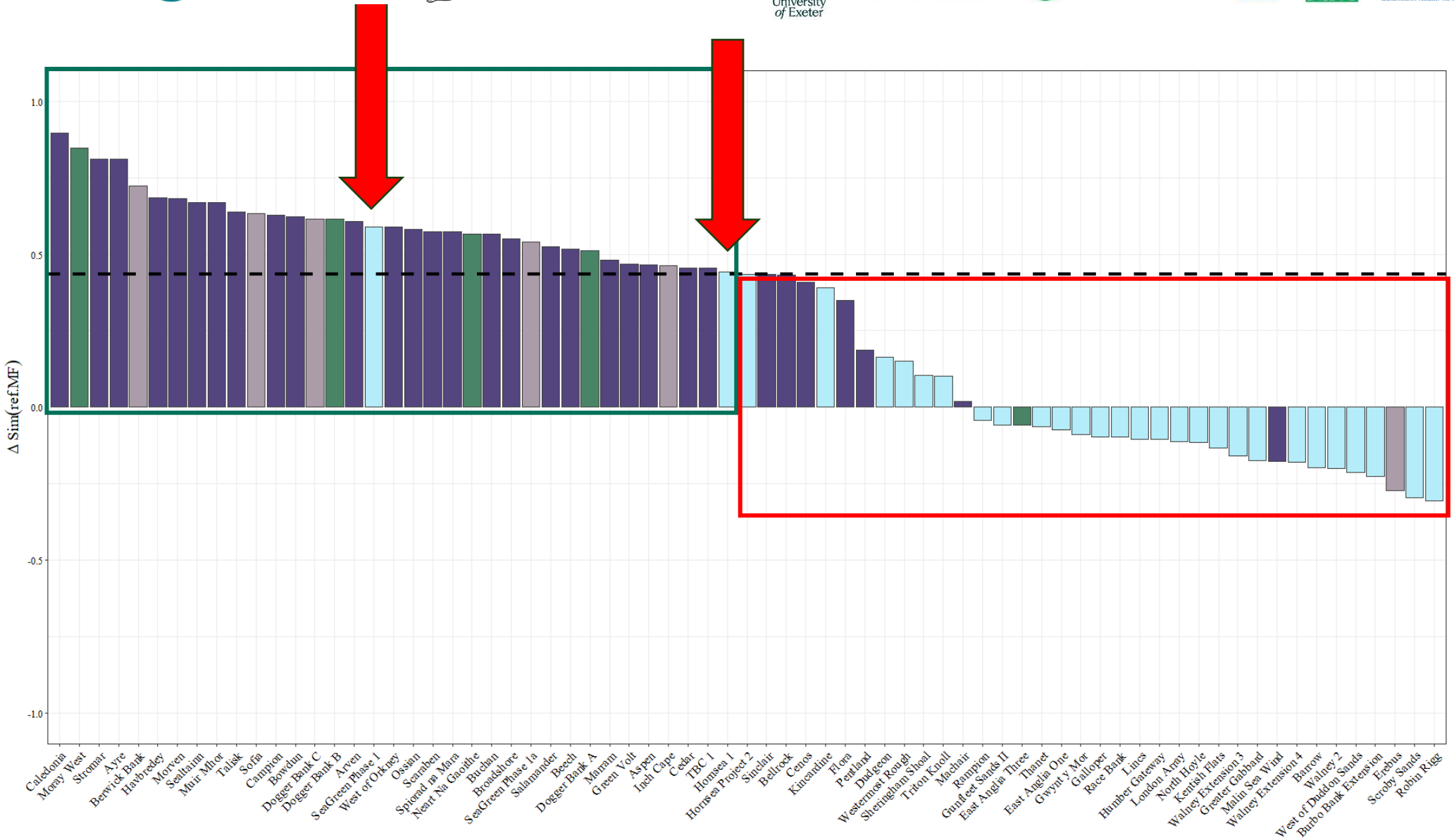


Moray Firth

- Higher similarity regions: East of Scotland; North of Scotland; Central North Sea.
- Lower similarity regions: Southern North Sea; English Channel; Irish and Celtic Sea




1.0
0.5
0.0
-0.5
-1.0
Δ Sim(ref.MF)
Caledonia
Moray West
Stromar
Ayre
Berwick Bank
Havbredey
Morven
Seaitaim
Muir Mhor
Talisk
Sofia
Campion
Bowdun
Dogger Bank C
Dogger Bank B
Arven
SeaGreen Phase 1
West of Orkney
Ossian
Scaraben
Spiorad na Mara
Neart Na Gaoithe
Buchan
Broadshore
SeaGreen Phase 1a
Salamander
Beech
Dogger Bank A
Marram
Green Volt
Aspen
Inch Cape
Cedar
TBC 1
Hornsea 1
Hornsea Project 2
Sinclair
Bellrock
Cenos
Kincardine
Flora
Pentland
Dudgeon
Westermost Rough
Sheringham Shoal
Triton Knoll
Machair
Rampion
Gunfleet Sands II
East Anglia Three
Thanet
East Anglia One
Gwynt y Mor
Galloper
Race Bank
Lincs
Humber Gateway
London Array
North Hoyle
Kentish Flats
Walney Extension 3
Greater Gabbard
Walney Extension 4
Barrow
Walney 2
West of Duddon Sands
Burbo Bank Extension
Erebus
Scroby Sands
Robin Rigg
Windfarm age
2024+
2019 - 2024
Pre 2019


1.0
0.5
0.0
-0.5
-1.0
Δ Sim(ref.MF)
Caledonia
Moray West
Stronsar
Ayre
Berwick Bank
Havbredey
Morven
Sealtaim
Muir Mhor
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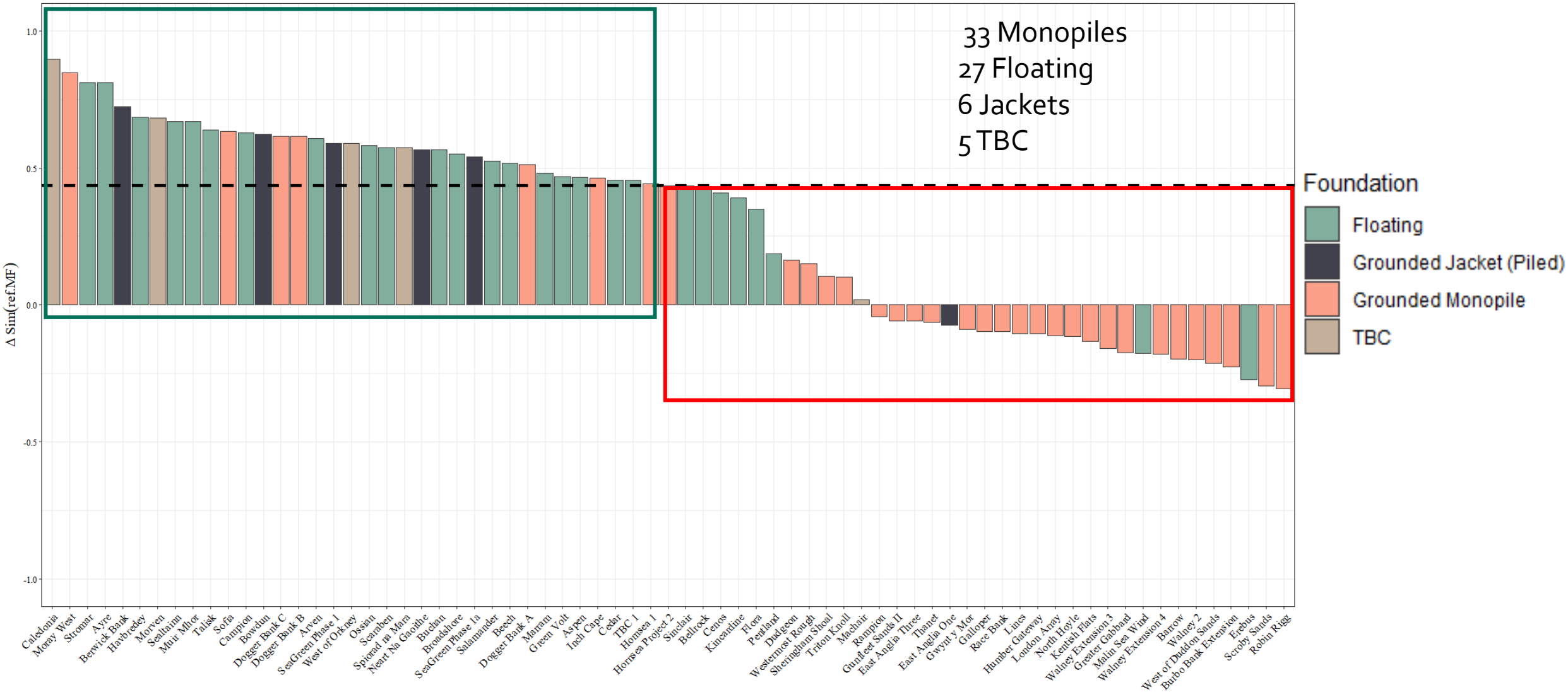
Rampion
Gunfleet Sands II
East Anglia Three
Thanet
East Anglia One
Gwynt y Mor
Galloper
Race Bank
Lincs
Humber Gateway
London Array
North Hoyle
Kentish Flats
Walney Extension 3
Greater Gabbard
Malin Sea Wind
Walney Extension 4
Barrow
Walney 2
West of Duddon Sands
Burbo Bank Extension
Erebus
Scroby Sands
Robin Rigg
Status
Approved
Construction
Operational
Planned


33 Monopiles
27 Floating
6 Jackets
5 TBC
Foundation
Floating
Grounded Jacket (Piled)
Grounded Monopile
TBC
Δ Sim(ref.MF)
1.0
0.5
0.0
-0.5
-1.0
Caledonia
Moray West
Stromar
Ayre
Berwick Bank
Havbreedey
Morven
Sealtainn
Muir Mhor
Talisk
Sofia
Campion
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Marram
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Inch Cape
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Sinclair
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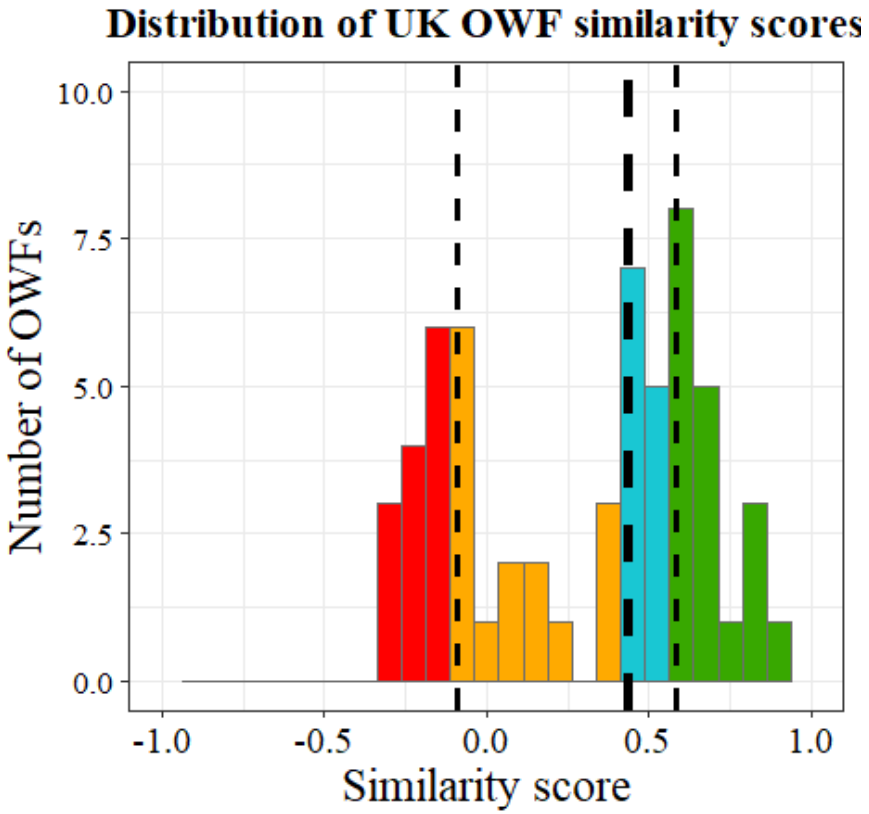
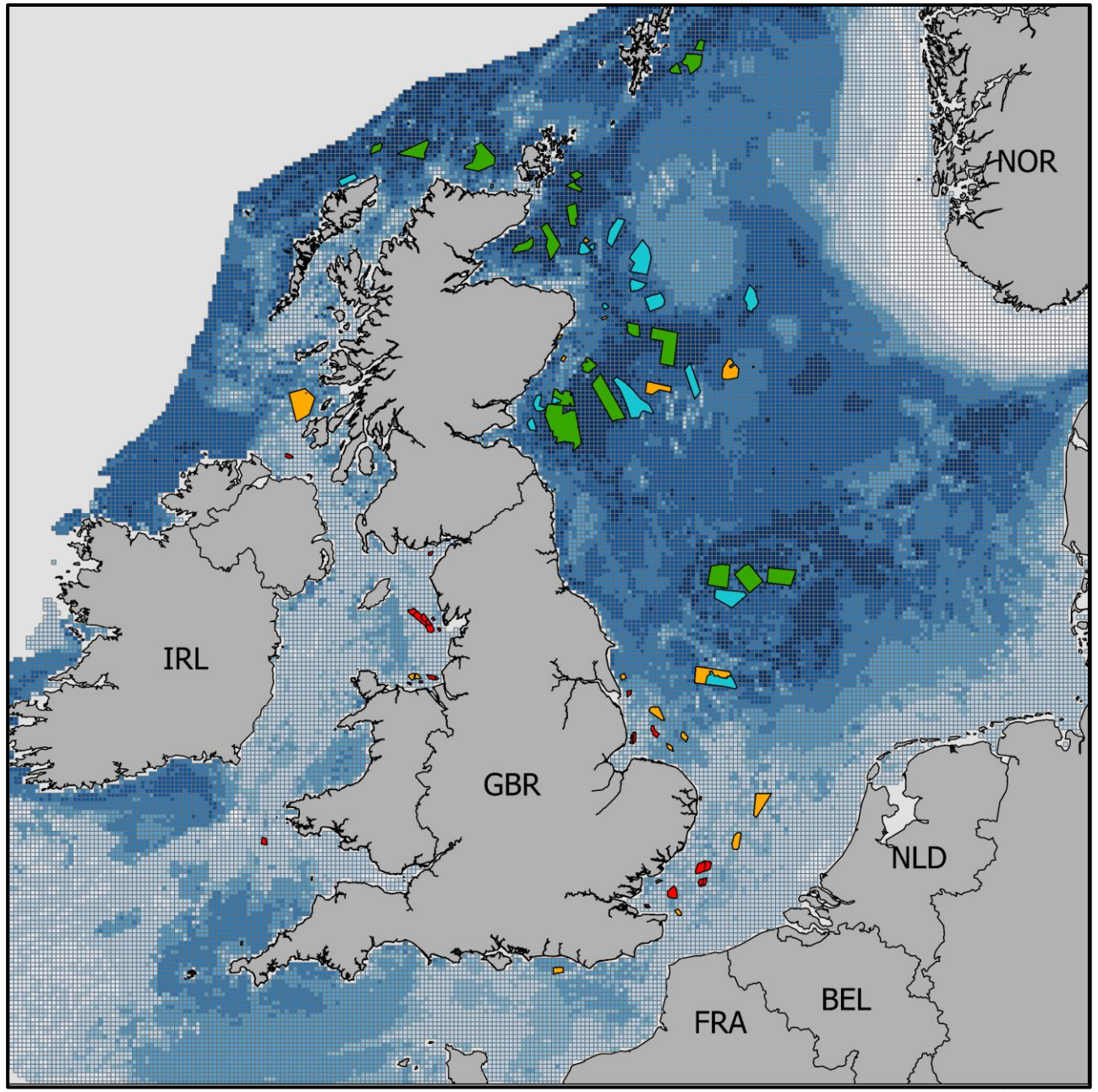
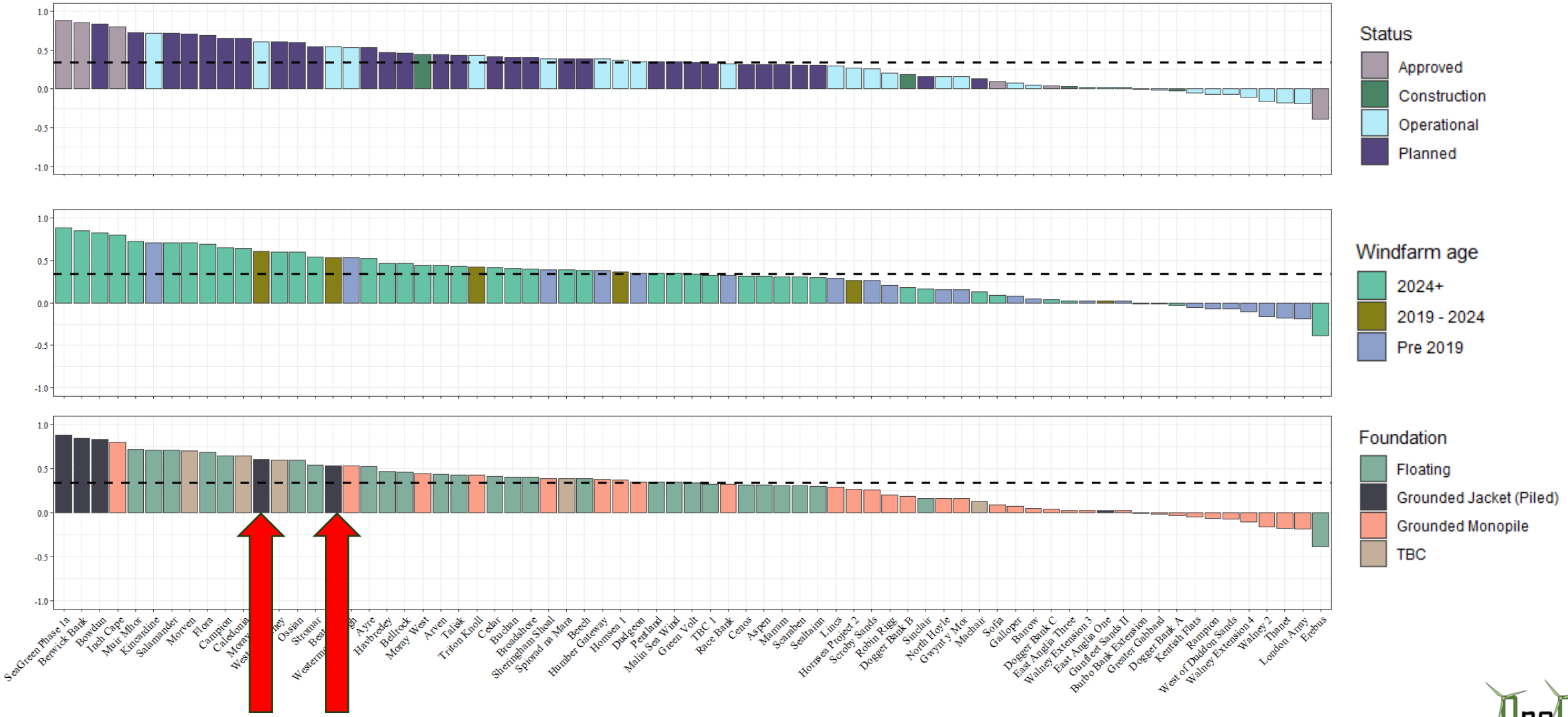
Moray Firth


Distribution of UK OWF similarity scores
Number of OWFs
10.0
7.5
5.0
2.5
0.0
-1.0
-0.5
0.0
0.5
1.0
Similarity score

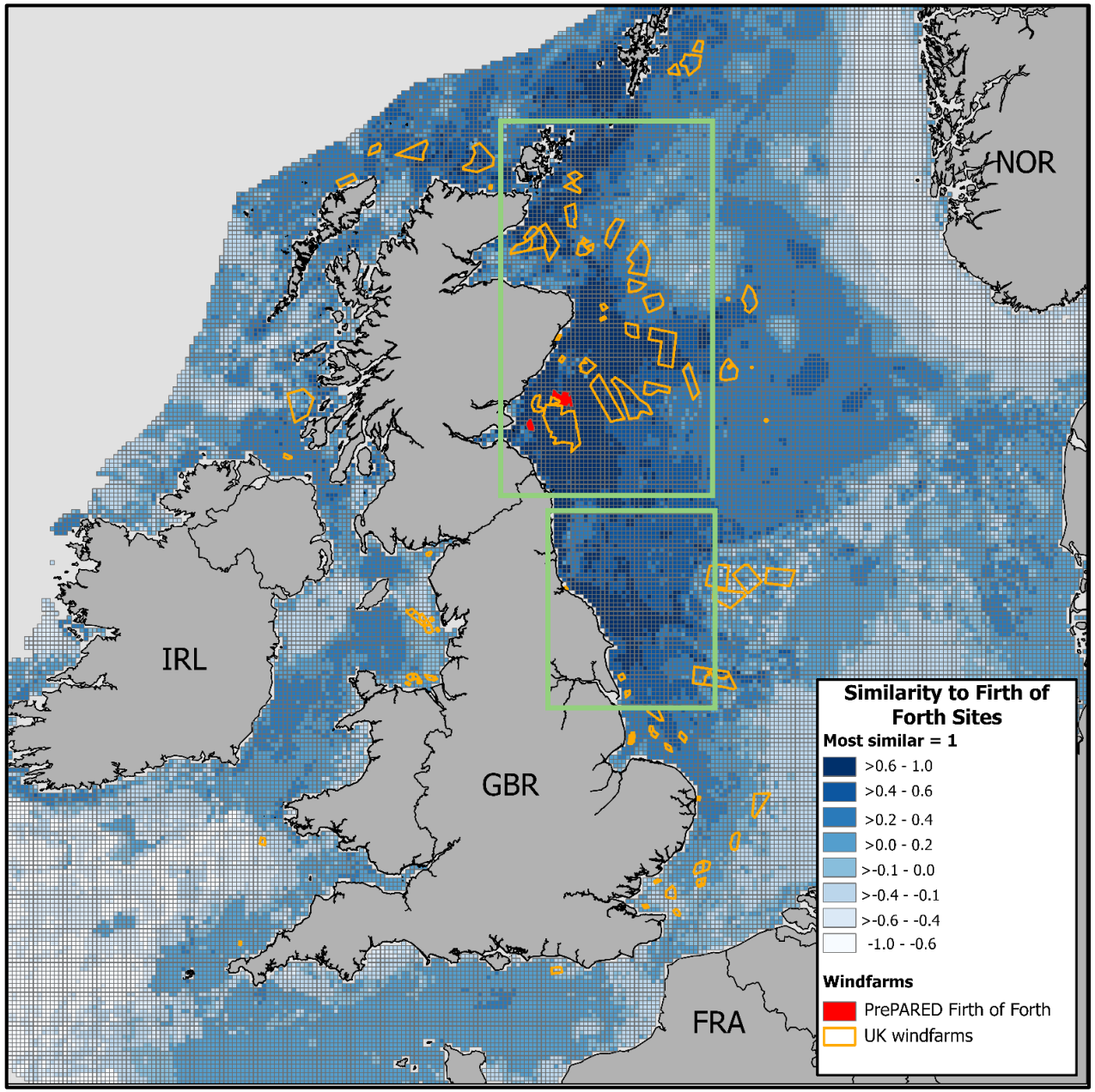

NOR
IRL
GBR
NLD
BEL
FRA

Firth of Forth



Firth of Forth

- Higher similarity regions: East of Scotland; Northeast of England
- Lower similarity regions: Southern North Sea; English Channel; Irish and Celtic Sea



Considerations & Applications

Considerations

- Uncertainty exists regarding how the foundation type might influence prey-predator assemblages
- We don't fully understand how the interactions of biogeographical variables drive ecology

Key Take-home messages

- Evidence that PrePARED findings can be broadly comparable to future areas of offshore wind
- Guide selection of future fixed and floating wind study sites

Future

- Cross reference similarity assessment with other studies of predators & prey to improve inferences
- Expand windfarm database
- Could include biological variables

Thank you!

Any questions?

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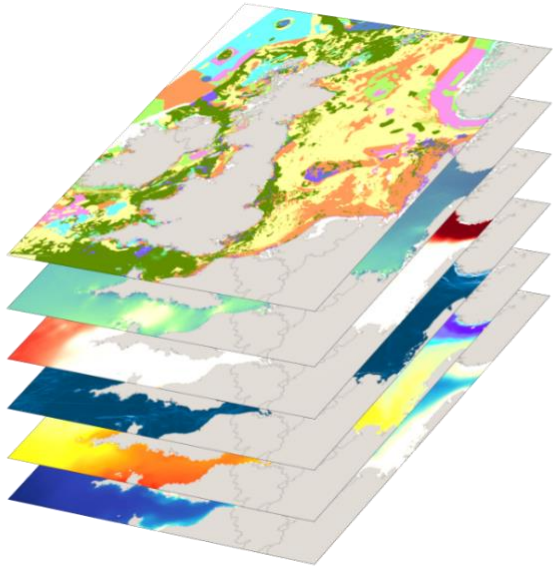
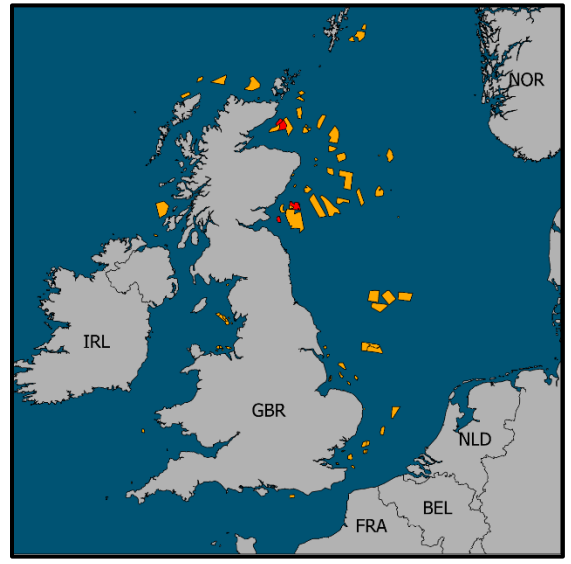
Predators + Prey Around Renewable Energy Developments





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Sea Mammal Research Unit

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University of Exeter

AARHUS UNIVERSITY

UK Centre for Ecology & Hydrology

BioSS

NATURAL ENGLAND

NatureScot Scotland's Nature Agency Buidheann Nàdair na h-Alba

Crown Estate Scotland Oighreachd a' Chrùin Alba

Offshore Wind Evidence + Change Programme

	N	Depth (m) (median; range)		Slope (degrees) (median; range)		Seabed (median; range)		Spring tide (m/s) (median; range)		Potential sea bottom temperature (°C) (median; range)		Salinity (PSU) (median; range)
Moray Firth	**2**	**49 (37 – 64)**		**0.14 (0.08 – 0.39)**		**5.9 (4.2 – 8.0)**		**0.41 (0.26 – 0.51)**		**10.4 (10.3 – 10.4)**		**34.6 (34.61 - 34.62)**
Selected farms (those above the median)	26	63 (18 – 135)		0.19 (0 – 1.37)		5.7 (1 – 9.7)		0.44 (0.2 – 1.8)		10.3 (9.1 – 12.4)		34.5 (32.9 - 34.8)
Variance		14		0.05		0.2		0.0300		0.1		

Bias in dataset