PELAgIO
Physics-to-Ecosystem Level Assessment of Impacts of Offshore Wind Farms (OWF)

ECOWind

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The PELAgIO Team

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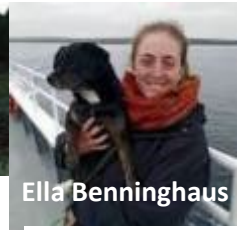
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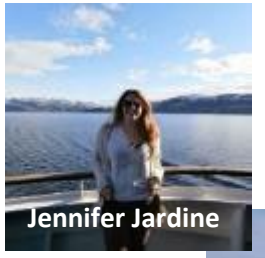
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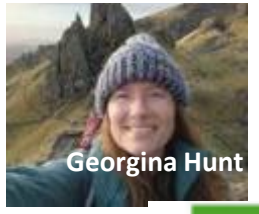
marine scotland science

PML Plymouth Marine Laboratory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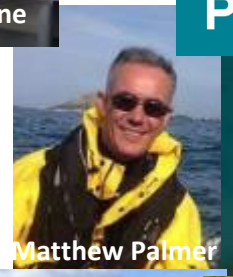
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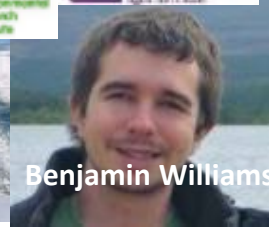
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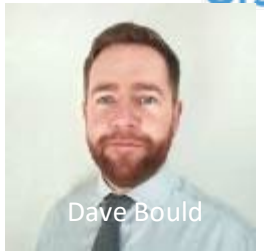
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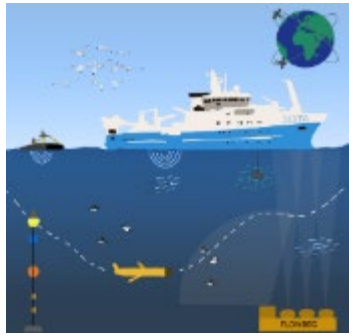
ECOWind

AREA 1 observing inter-species interactions, population dynamics and viability



AREA 2 enhancing marine observations

AREA 3 informing marine policy and management solutions.

PELAgIO

WP1 Physical effects from OWFs on primary production and ocean health, **locally, regionally, shelf-wide**, and in response to climate change

WP2 Prey-to-predator understanding of fish availability providing foraging opportunities

WP3 Ecosystem-level cumulative effects on populations and tools for assessing trade-offs to inform policy

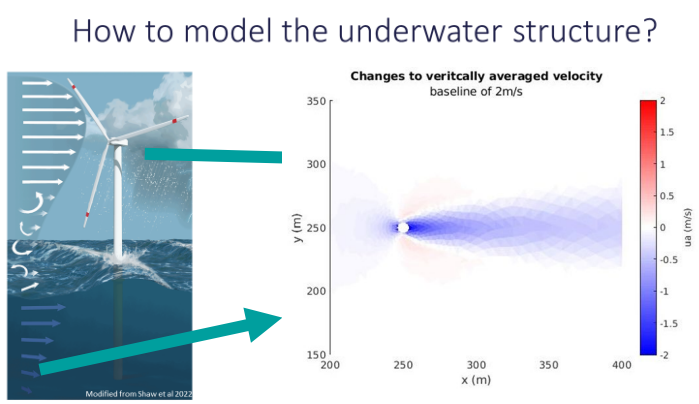
*all artwork by Ella Benninghaus

WP1: BioPhysical effects from OWFs and climate change

Field Data and Model Predictions at 3 spatial Scales: Physics and Biology

Local: idealized channel

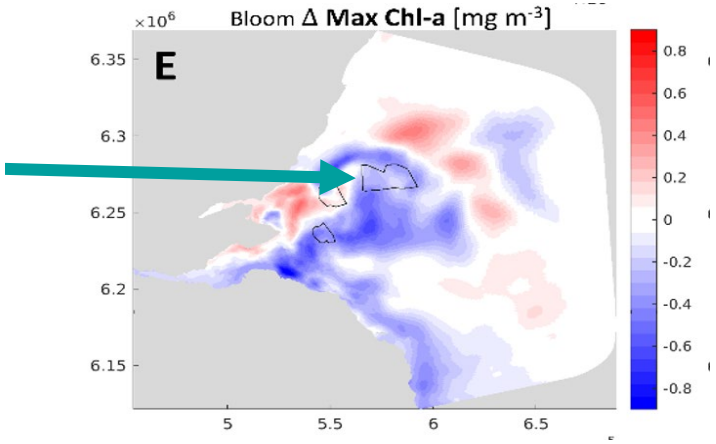
(10 m-1 km)



Effect of drag (structure) and changes to mixing throughout the water column

Regional: FVCOM+ERSEM

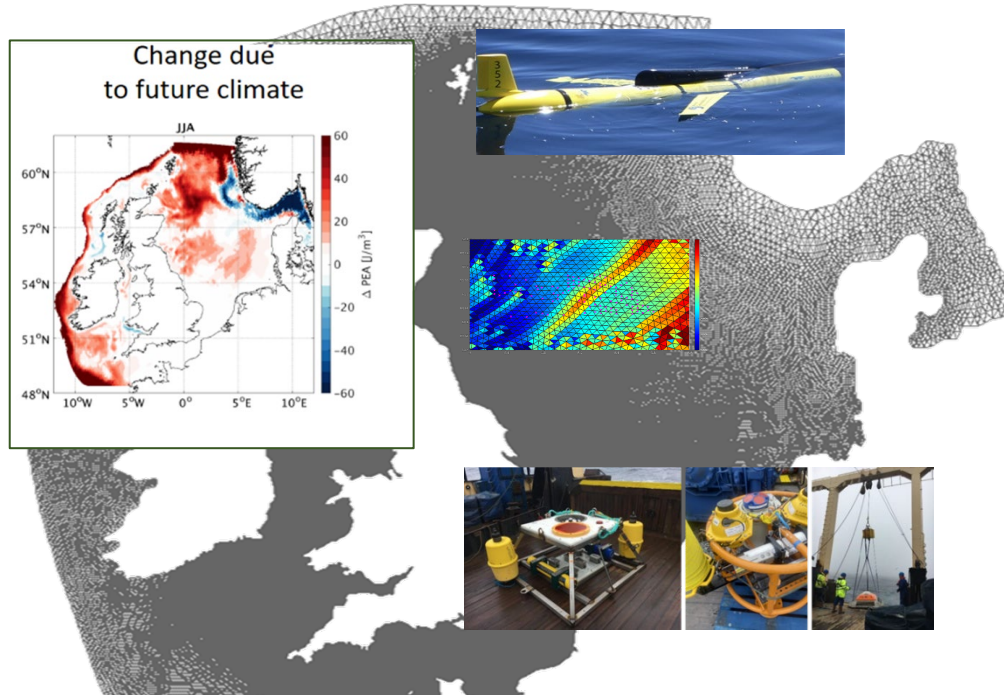
(1-100 km)



Effect of energy extraction (less force from the wind) – effect called wind-wake.

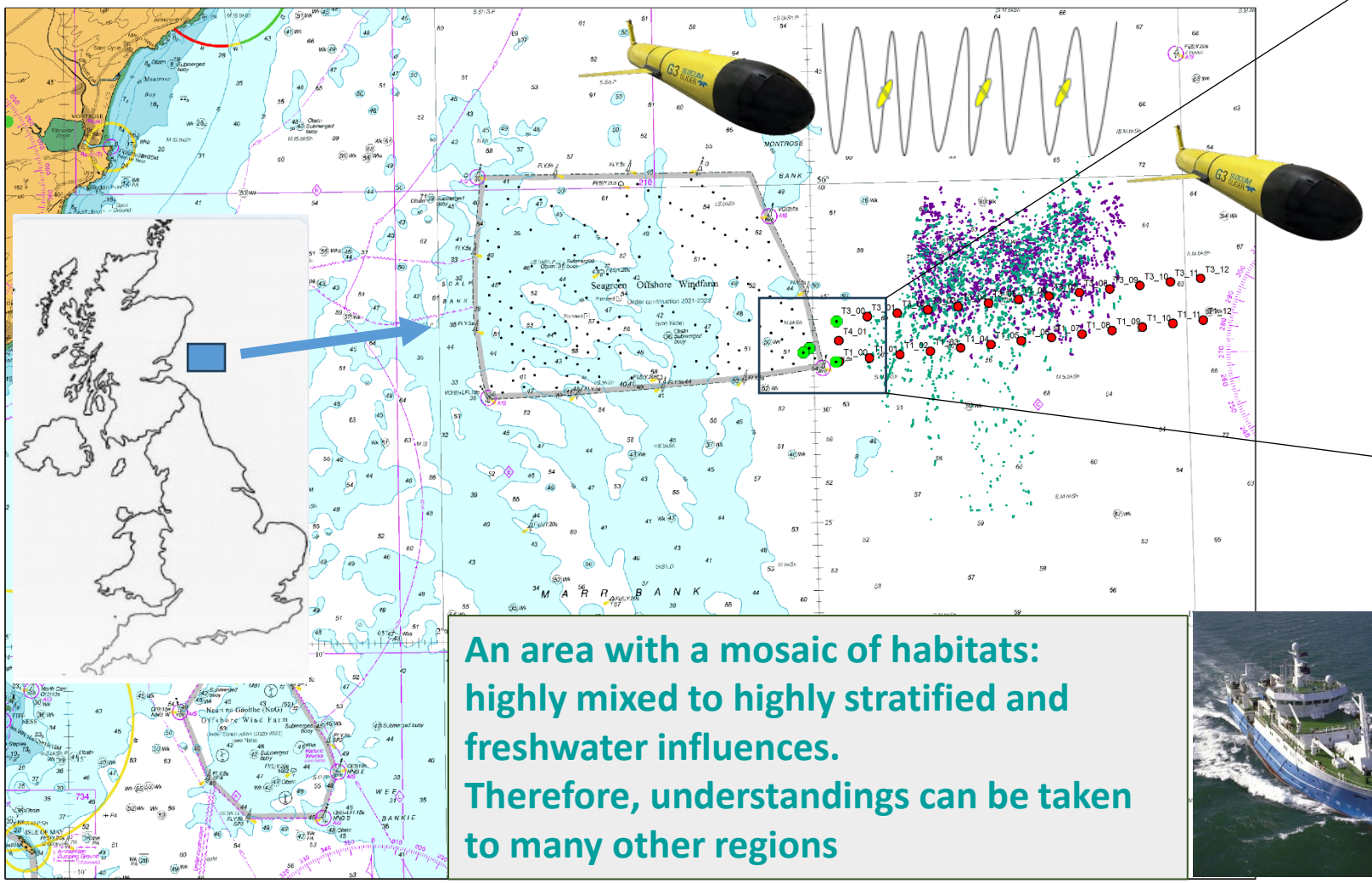
Shelf Wide: FVCOM+ERSEM + Climate

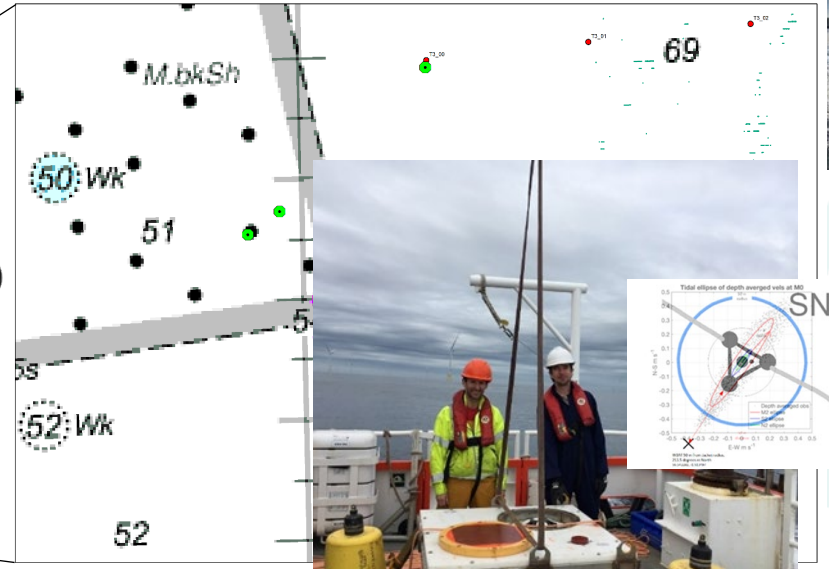
(>1000 km)

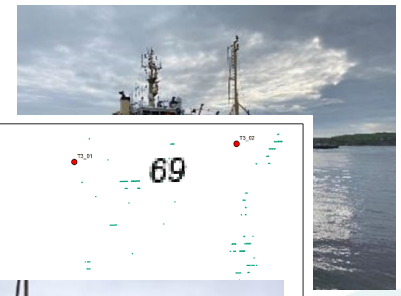


Real data from field studies to make models more accurate

WP1: fieldwork 2023/24 to validate models





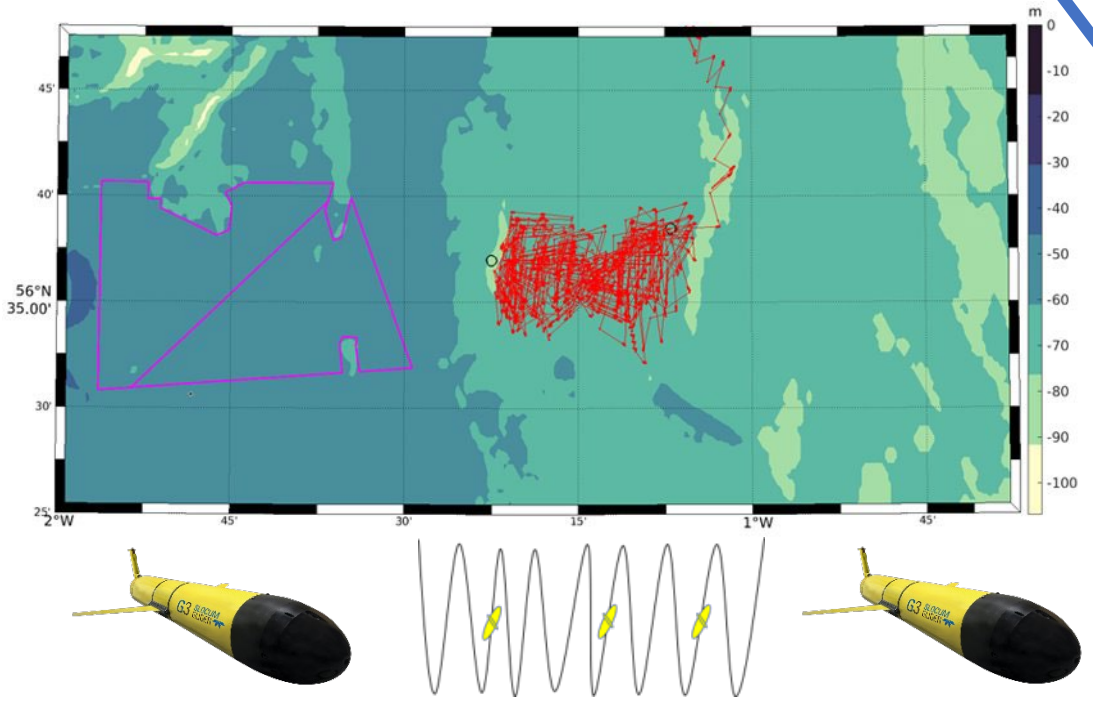


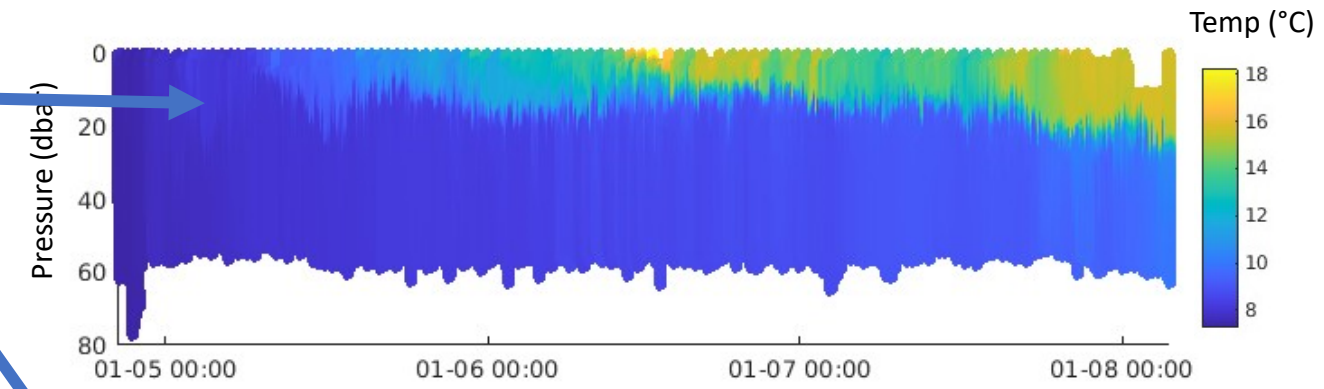
An area with a mosaic of habitats:
highly mixed to highly stratified and freshwater influences.
Therefore, understandings can be taken to many other regions

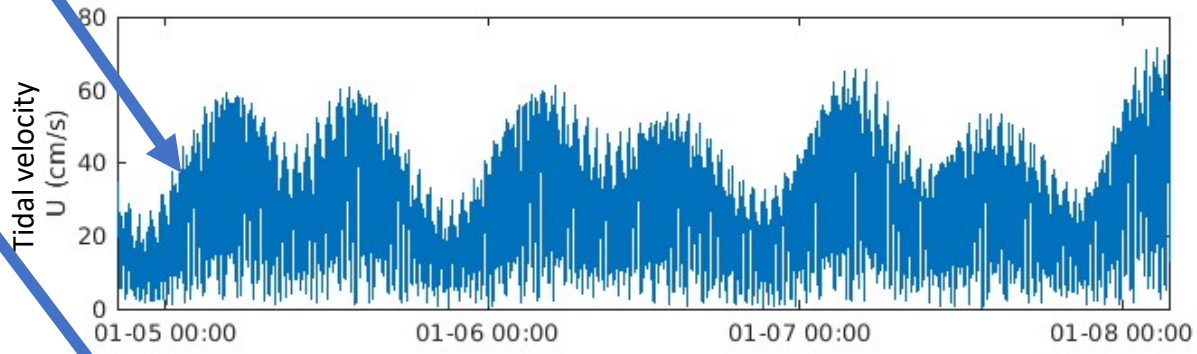
WP1: Glider observations - Data to validate models

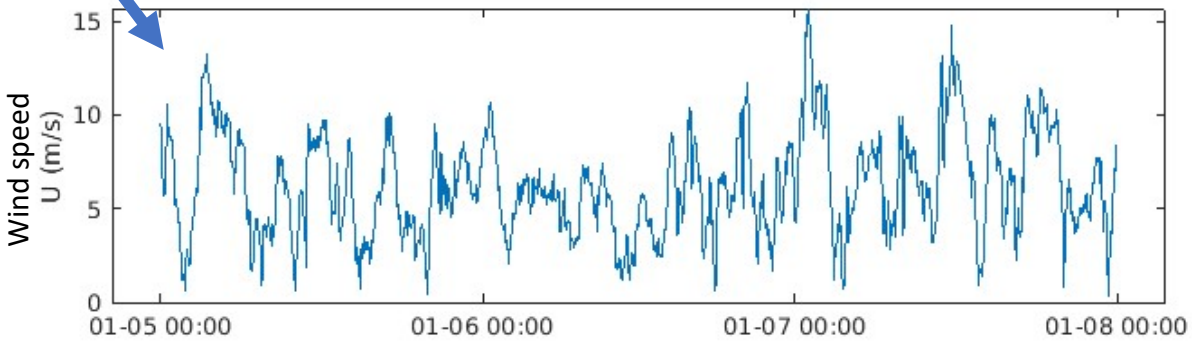
Charlotte Williams, NOC

- Gliders completed 36 transects between waypoints over 3 months - sampled over 7 spring and neap periods.
- Next steps are to use model to separate high natural variability from the effect of the wind farms.

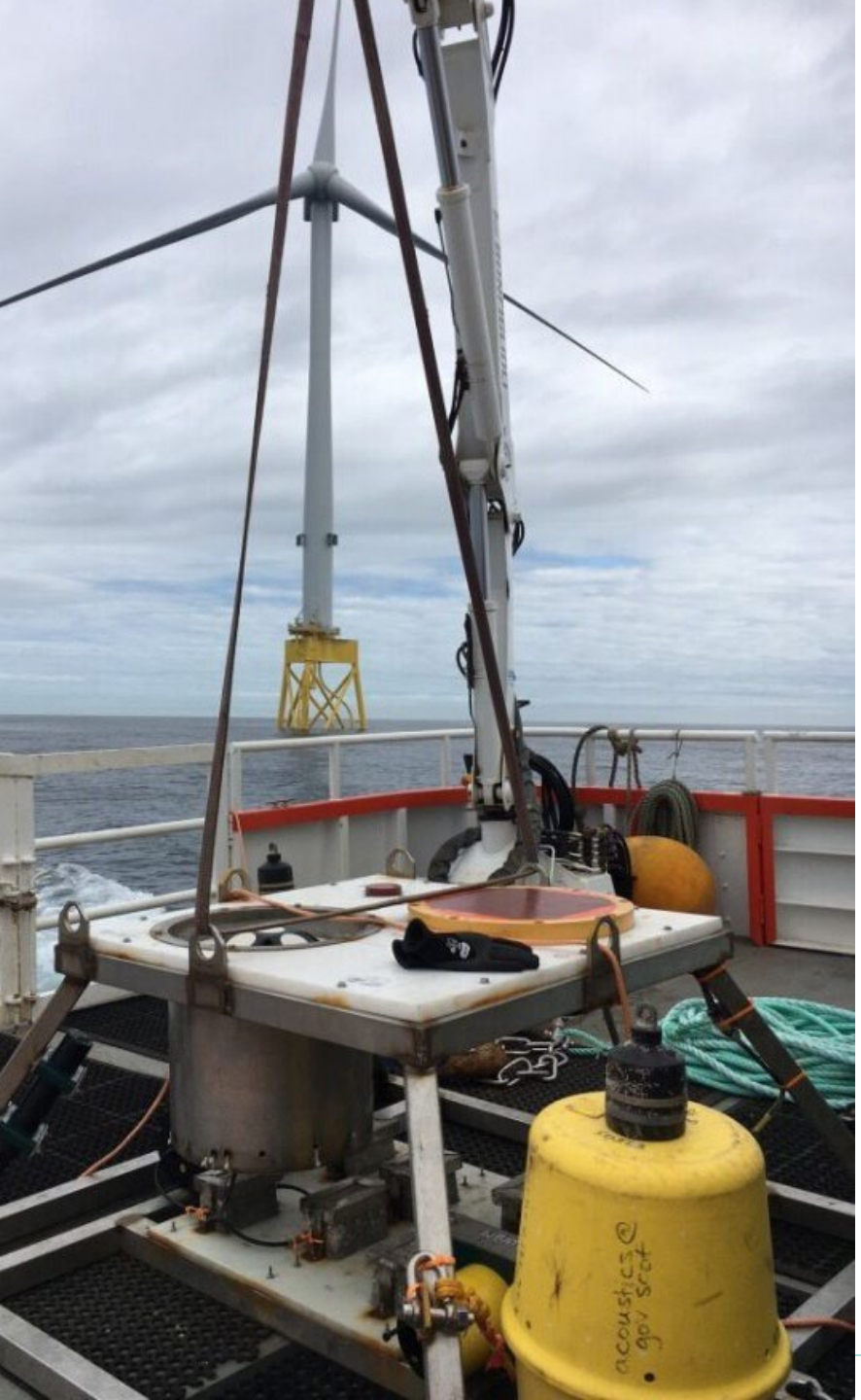


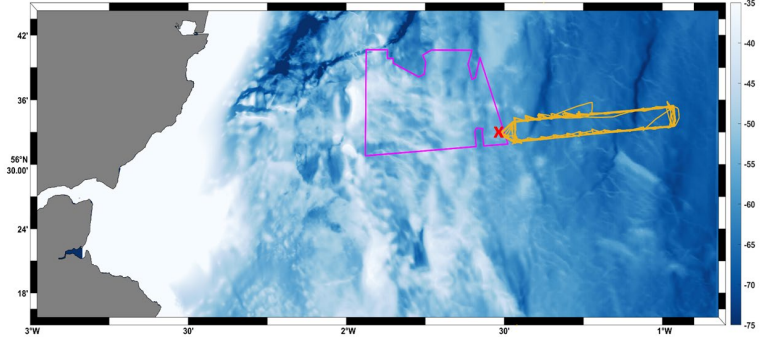


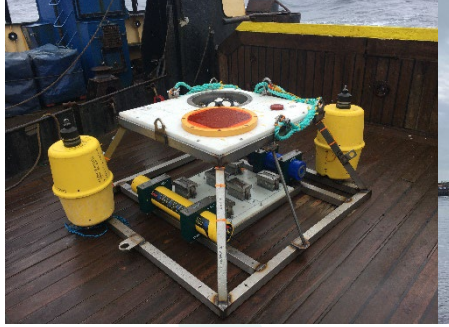




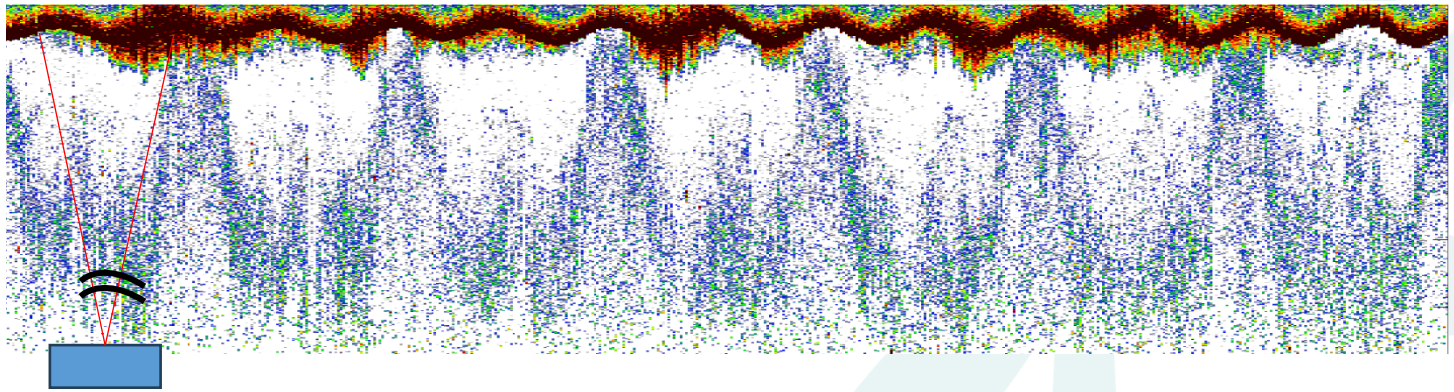
Time (May to Aug)

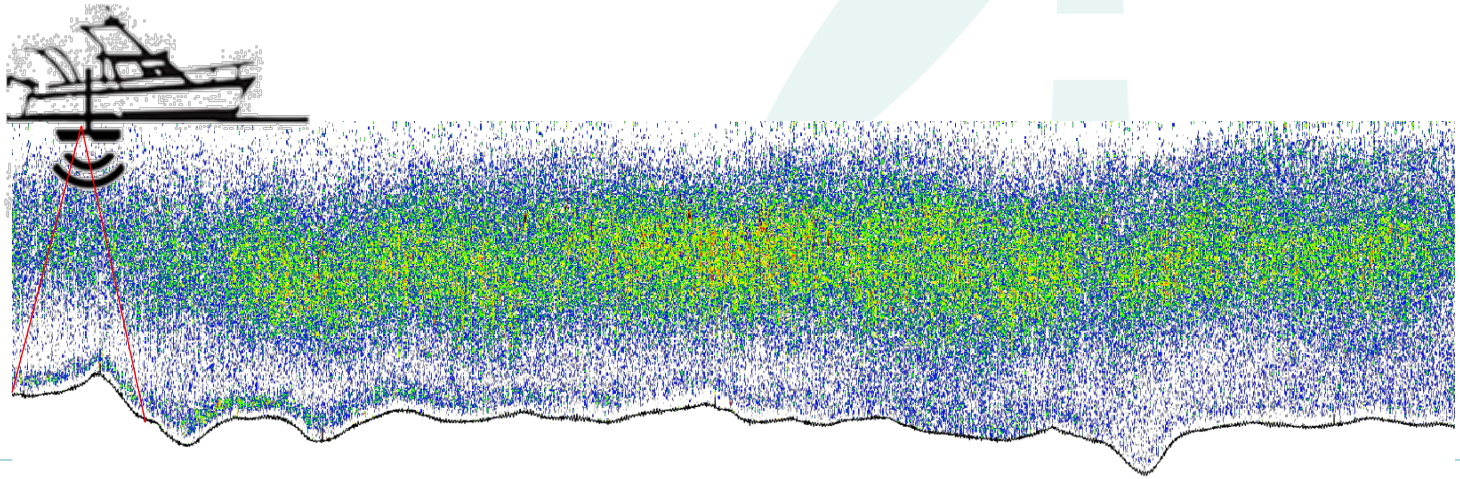






WP2 Collecting fish and seabird data

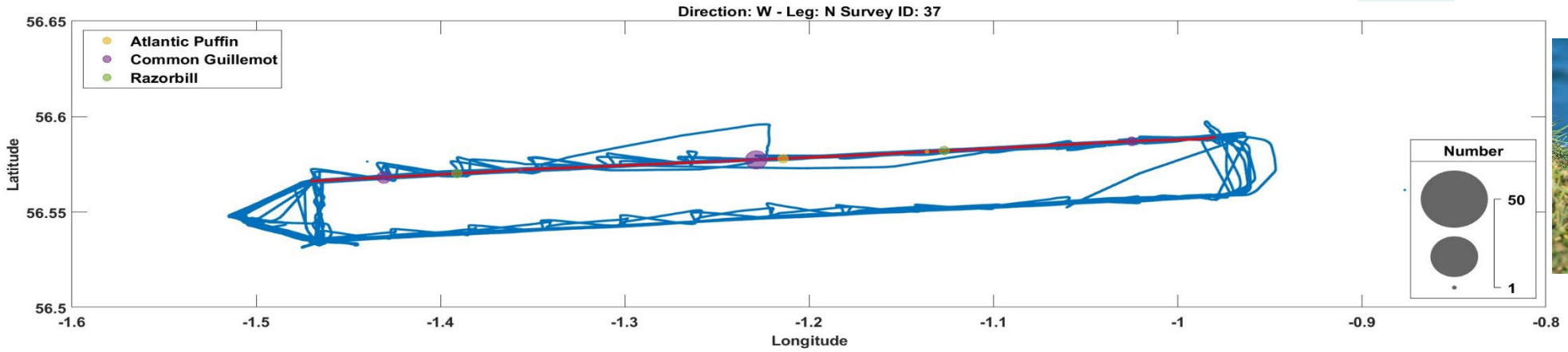


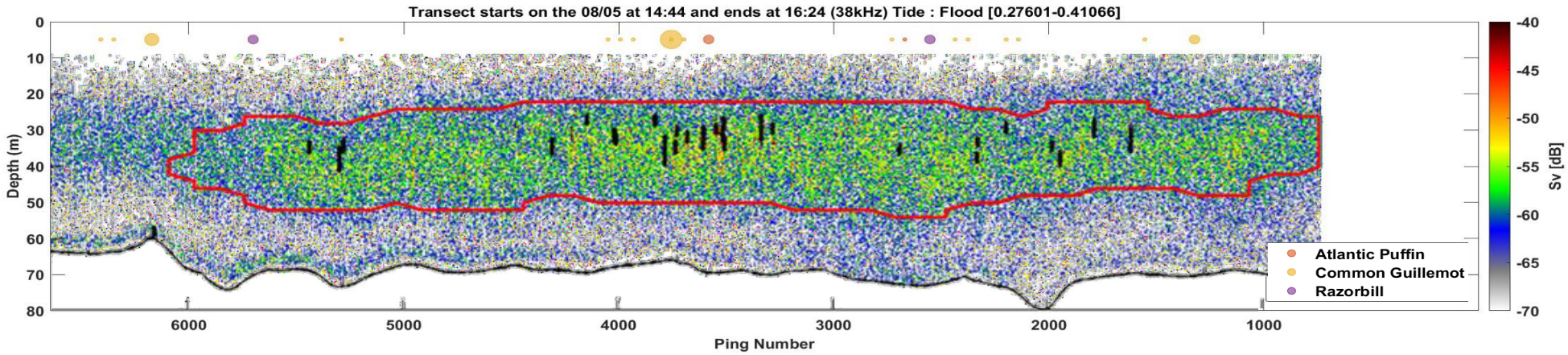


WP2: Location, depth and # of fish schools and # of foraging seabirds

Layers and fish schools with hotspots of seabird foraging

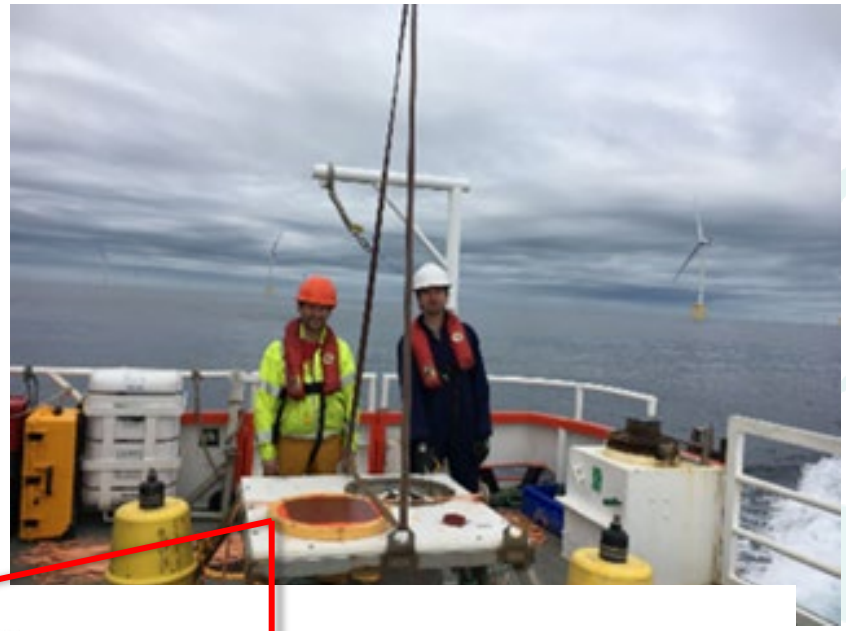
(PELAgIO Hypothesis: fish are more available for birds when fish themselves foraging)

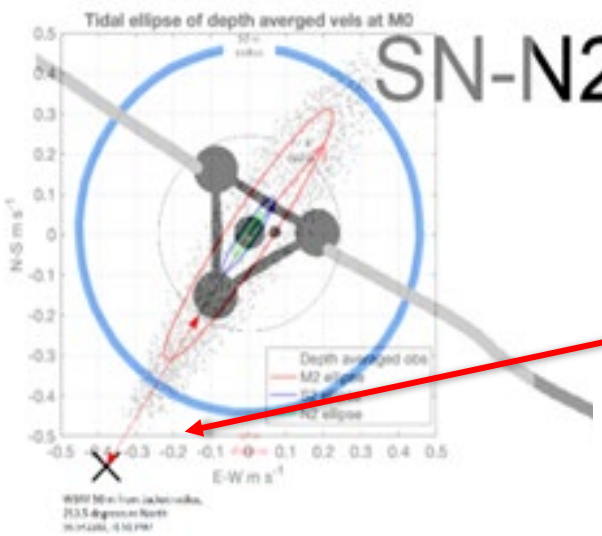


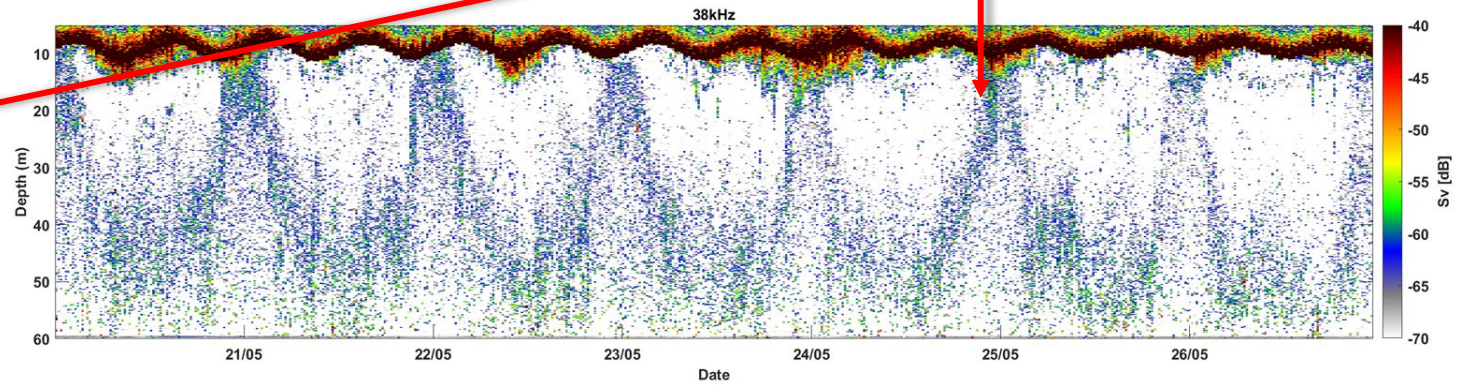


WP2. Predictability of (fish) Prey availability:

Upward facing platform put 500 m and 50 m from Turbine base so can see effect of drag in the main tidal flow direction







- Continuous fish behaviour and physical features sampled at local scales next to and away from turbine.
- Differences between locations and effects of daily tides and light levels are obvious in fish behaviour.

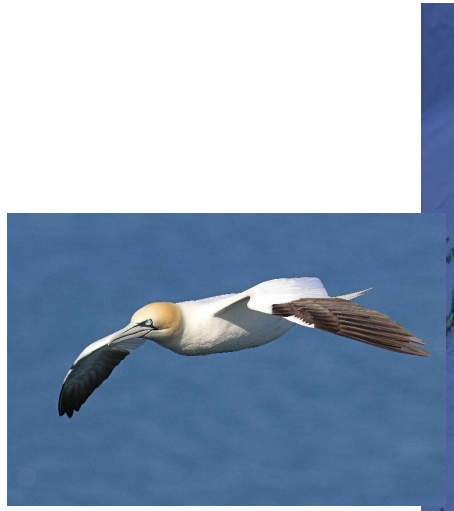
WP2: NEW Royal Society for Protection of Birds (RSPB) Seabird Tagging Programme

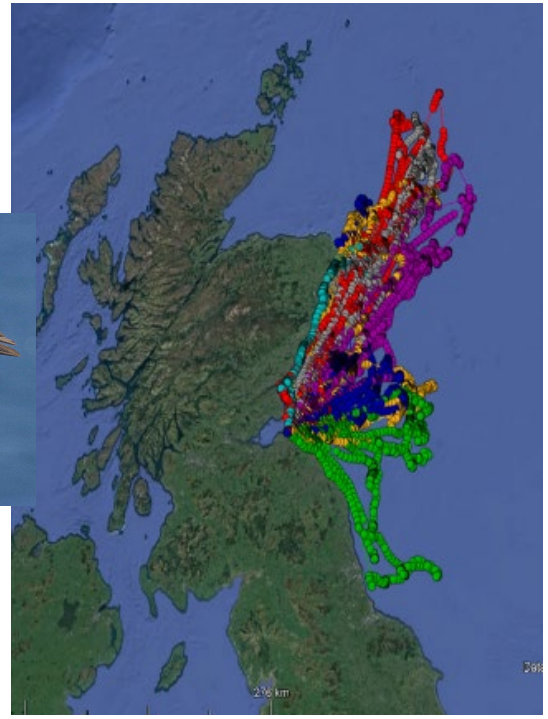
Successful despite bird flu in 2023:

New tags higher spatial resolution to determine foraging behaviour and for gannets can also do flight height.

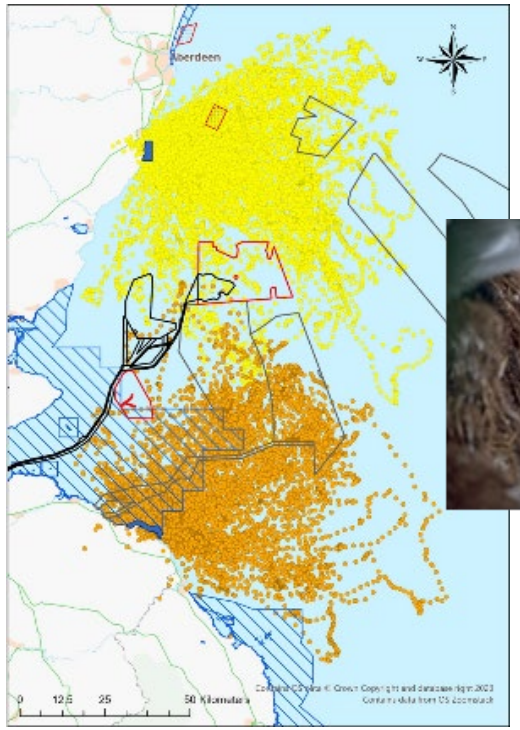
Geofence so more data downloaded within windfarms

Gannets





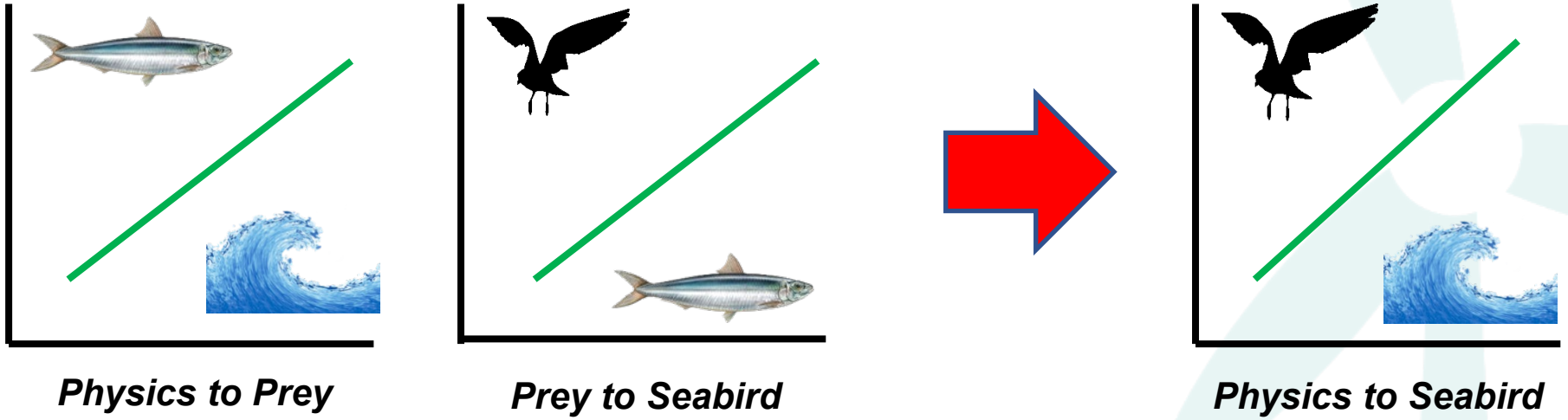
Kittiwakes (FS & St A)



WP2: Observations to Predictions – getting from Physics to Birds

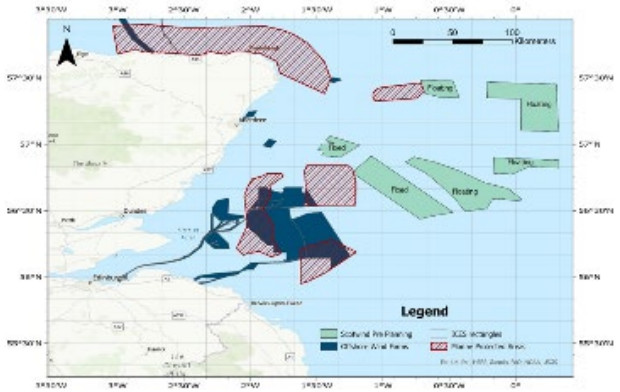
Seabird behaviour often associated with oceanography.

Why not predict seabird responses with physics-predator associations



Physics to Prey ***Prey to Seabird*** ***Physics to Seabird***

Providing **validated relationships** between physics and seabirds reduces uncertainty when predicting seabird responses to oceanographical shifts associated with OWF and Climate Change.

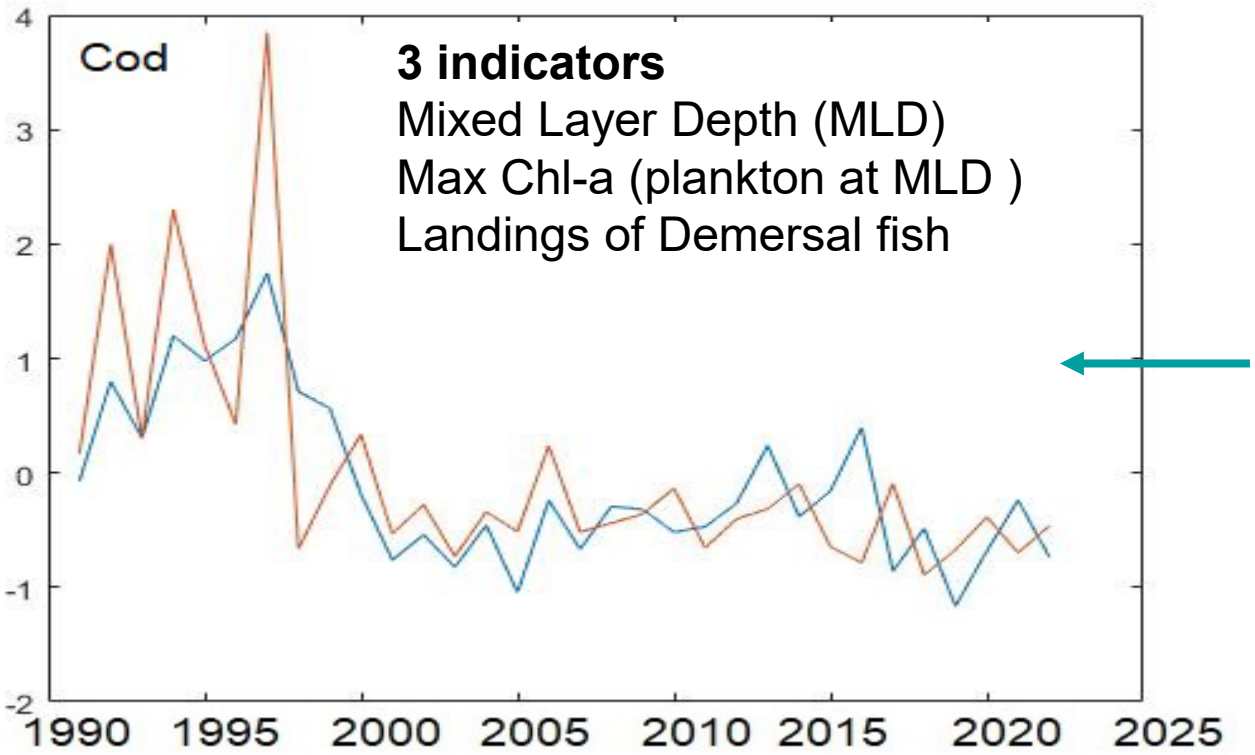


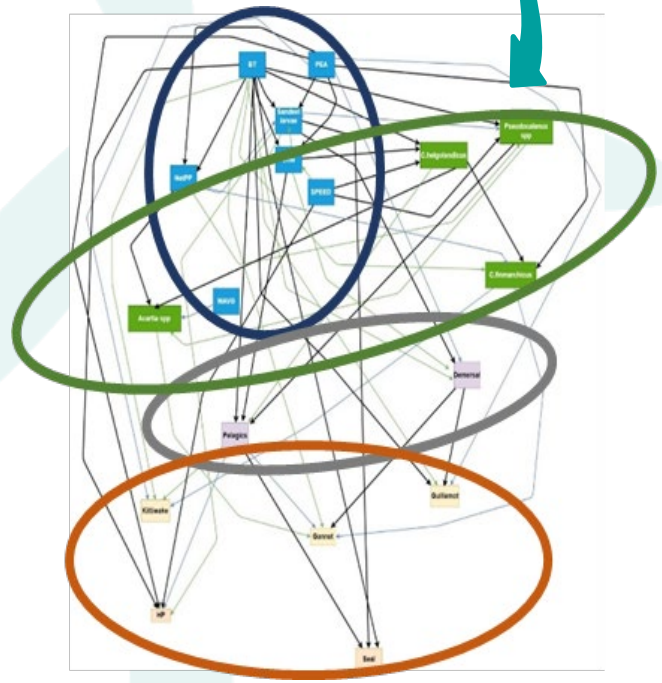
WP3: Bayesian Ecosystem model

Bottom-up oceanographic variables
(climate change and OWF)
Top-down effects from fishing displacement

Predicts trends and possible ‘drivers’

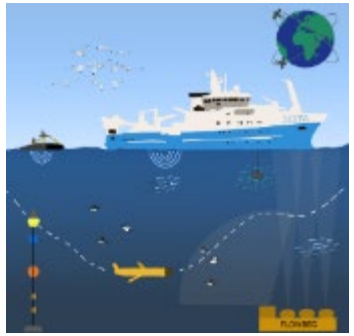
Run for 33-years: Predictions of commercial fish recruitment trends (Red = Real, Blue = Model)





Summary: PELAgIO

Use of **targeted field work** with novel combinations of gliders , surveys and upward-facing platforms is providing **validation for biophysical models**: quantifiable evidence of effects



Links to physical variables between **fish availability and seabird foraging** behaviour allows **greater predictability** of OWF effects

Ecosystem models provide methods to **identify physical and biological indicators** of changes by OWF and CC - can **quantify cumulative effects**

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WP2 Prey-to-predator understanding of fish availability providing foraging opportunities

WP3 Ecosystem-level cumulative effects on populations and tools for assessing trade-offs to inform policy

Main effects

Bottom-up and Climate Change

Planktivorous Fish

Direct top-down: inc'd windfarms and fishing

*all artwork by Ella Benninghaus

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UKRI Natural Environment Research Council | Offshore Wind Evidence + Change Programme | The Crown Estate

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