PrePARED
Predators + Prey Around Renewable Energy Developments

Fine-scale proximity to offshore wind turbine foundations increases biomass of demersal fish species

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PrePARED Output Summary No. 8

Background

The expansion of offshore wind energy capacity is changing the seascape with the large-scale introduction of turbines and associated infrastructure. Subsurface structures can influence the abundance, distribution and behaviour of some marine fish species by providing artificial habitat and food resources that supplements natural occurrence. Understanding the fine-scale effects of proximity to turbine foundations on fish populations is a prerequisite for broader-scale predictions of ecosystem changes.

What we did

Stereo Baited Remote Underwater Video (BRUV) equipment were used to survey fish abundance, biomass and diversity at the Beatrice offshore wind farm in the Moray Firth (North Sea), Scotland. This farm uses "jacket" foundations to secure turbines to the seabed. These are multi-legged subsurface structures.

BRUVs were deployed at 30, 60, 120 and 240 metre distances from 24 turbine jacket foundations (96 total deployments), with sampling designed to test whether fish abundance decreases with distance from foundations. A custom computer vision model was used alongside manual video analysis to produce relative abundance estimates.

The study took place summer 2024, building on earlier work that revealed higher abundance near jackets compared to reference sites >500 m away.

Key Findings

- 2,626 fish from 12 species across 7 taxonomic families recorded
- 94% of individuals were flatfish (predominantly common dab) or haddock
- ~1.5–1.6× more individuals and biomass at 30 m vs 240 m from foundations
- Haddock abundance declined steeply within 60 m; flatfish declined more gradually
- No change in body length with distance from foundations
- Results could inform future wind farm design and marine net gain assessments

Haddock and flatfish aggregating near a jacket foundation at the Beatrice offshore wind farm.

Results

BRUV equipment provided data on species richness, relative abundance (MaxN) and fish body lengths for 2,626 individual fish from 12 species across 7 taxonomic families.

94% of individuals were flatfish (Pleuronectiformes spp.; predominantly common dab) or haddock (*Melanogrammus aeglefinus*). Both showed significantly higher abundance and biomass closer to turbine foundations – approximately 1.5–1.6× more individuals and biomass at 30 m compared to 240 m.

Haddock showed a steeper decline in the first 60 m from structures, while flatfish exhibited a more gradual, linear decrease. No significant change in body length with distance was observed.

These findings provide further evidence that jacket foundations act as artificial reefs, attracting demersal fish at fine spatial scales with implications for understanding the ecological role of offshore wind infrastructure and informing future wind farm design.

Scottish Government Riaghaltas na h-Alba · University of Aberdeen · SMRU Consulting · Sea Mammal Research Unit · University of Exeter · UK Centre for Ecology & Hydrology · BioSS · Aarhus University · NatureScot Scotland's Nature Agency Buidheann Nàdair na h-Alba · Natural England

Results – Distance from Turbine Foundations. Scatter plots show relative abundance (a) and biomass (b) data derived from BRUV deployments at 30, 60, 120 and 240 m from turbine jacket foundations within the Beatrice offshore wind farm, with GLMM/GAMM model predictions (± standard errors). Grey circles = raw data points, blue line = model prediction, shaded area = standard errors.

Figure 1. Flatfish (Pleuronectiformes spp.; predominantly Dab Limanda limanda)

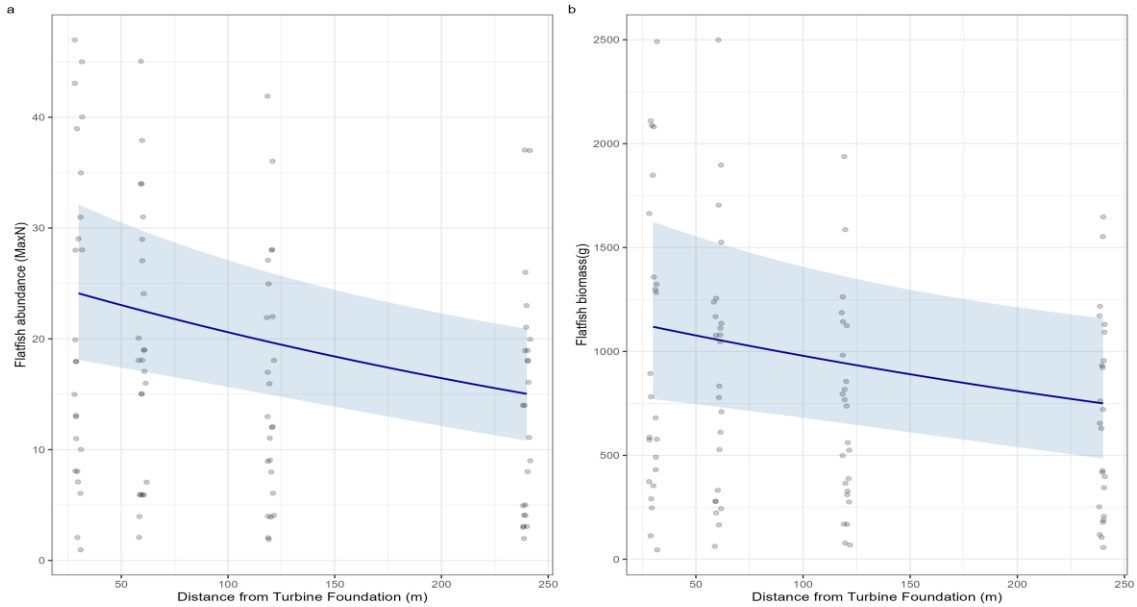
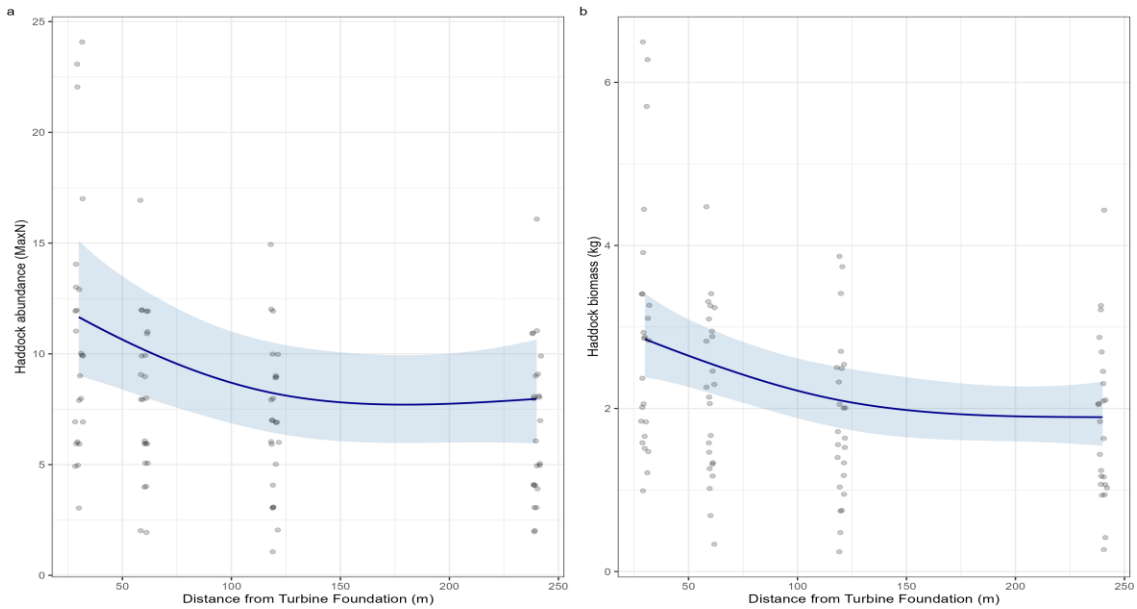


Figure 2. Haddock (Melanogrammus aeglefinus)



Conclusions

The effect of offshore wind foundations on demersal fishes can create significant fine-scale local change by aggregating fishes and potentially produce new biomass, but whose cumulative impacts and effect on the wider ecosystem are complex and not yet fully understood. For wind farm developers, knowledge of these fine- scale, site and foundation specific processes can be of strategic interest for optimizing project design including nature-inclusive measures. By strategically harnessing artificial reef effects and proactively managing its cumulative consequences, the offshore wind industry has the potential to become both a source of clean energy, and a significant driver of marine restoration and ecosystem gain.

For more information see: *Bicknell, A.W.J., Gierhart, S., Lambrette, M. & Witt, M.J. (2026). Fine-scale proximity to offshore wind turbine foundations increases biomass of demersal fish species. Frontiers in Marine Science 13, 1765872.*