PrePARED
Predators + Prey Around Renewable Energy Developments

Site and species dependent effects of offshore wind farms on fish populations

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PrePARED Output Summary No. 6

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.

What we did

Baited Remote Underwater Video (BRUV) was used to survey fish abundance, biomass and species diversity within the Beatrice and Moray East offshore wind farms in the Moray Firth (North Sea), Scotland. These farms use "jacket" systems to secure turbines to the seabed rather than monopiles. At the point of construction, Beatrice was the deepest wind farm in the world.

These farms are located between 7.5 and 23 nautical miles offshore in water depths of between ~35 and 60 metres. Beatrice operates 84 7MW (megawatts) turbines with jacket foundations that have 4 legs giving each a square base, while Moray East operates 100 9.5MW turbines with 3 legged jackets that create a triangular base.

BRUVs were used at 21 turbine foundations (~30 metres from the foundation) and at 15 reference sites, which were either ~500 metres from a turbine within the wind farms (the maximum possible displacement from a turbines) or >2 kilometres away from a foundation outside the wind farms.

Baited Remote Underwater Video (BRUV)

This method is commonly used to survey fish in temperate and tropical waters with advantages over many traditional fish survey methods, including; non-destructive, no or limited observer bias, data reanalysis possible and unrestricted depth (cost-dependent).

Results

The survey created 81 hours of video footage from 108 BRUV deployments. Each deployment represented 30 minutes of continuous video. Analysis of these videos produced information on the number of seabed associated fish species (species richness), a measure of relative abundance (MaxN) and fish body lengths. Using abundance and length (converted into weight), relative biomass could be calculated for each sampled location.

(MaxN is the maximum number of individuals, of each species that occurred in a single video frame)

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Results – Haddock and Flatfish Violin plots (Figures 1 & 2) for relative abundance (a) and biomass (b) data derived from survey sites at turbines and reference locations within and outside the Moray Firth wind farms, with model predictions (± confidence intervals). Solid grey bars indicate the paired comparison that are significantly different and dashed grey lines where they are not. Significance labels: ns = not significant, * = p = value < 0.05, ** = p = value < 0.01 & *** = p = value < 0.001

Figure 1. Haddock (*Melanogrammus aeglefinus*)

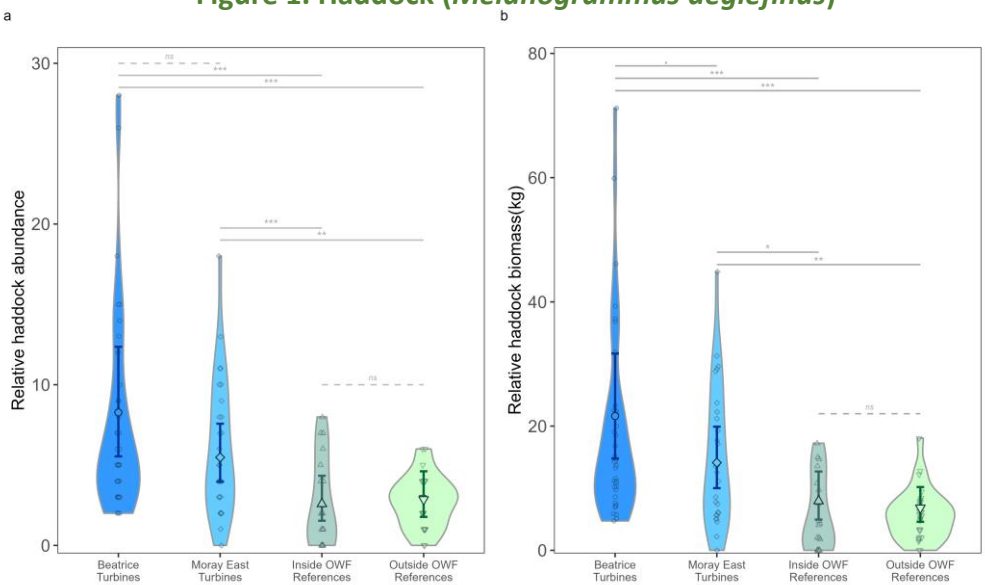
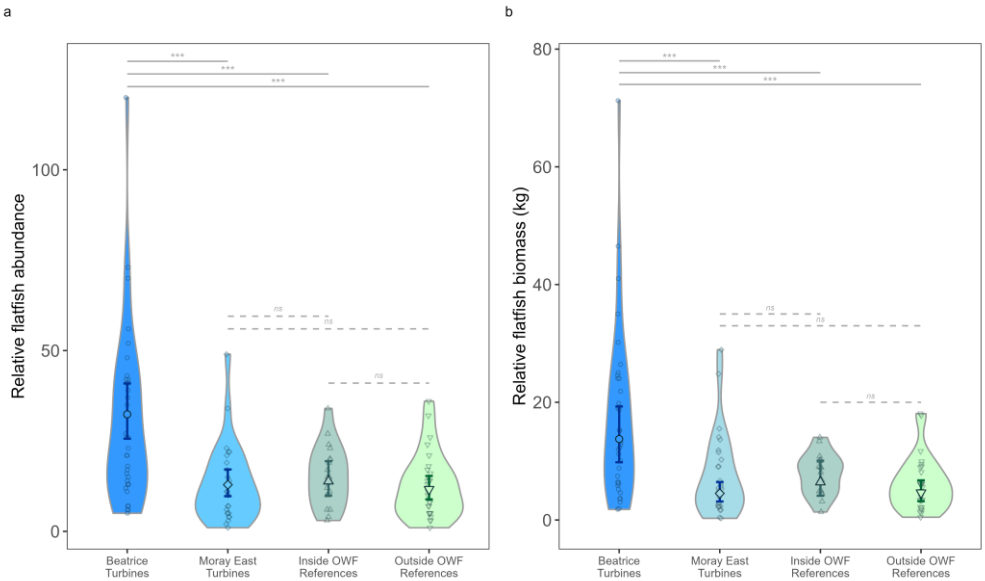


Figure 2. Flatfish (*Pleuronectiformes spp.*; majority Dab *Limanda limanda*)



Conclusions

At the two wind farms, abundance, biomass and size of haddock and flatfish was higher close to turbine foundations, with the effect larger at the older and more complex foundations. The results provide further evidence of the fine-scale impacts of offshore wind turbines on demersal fish and illustrate their species and site-specific nature. Quantifying how these changes may have positive or negative effects on local ecosystems and scale up to networks of wind farms is challenging but will be required if potential future wind farm consenting policies are to be addressed.

For more information see: *Bicknell, A.W.J., Gierhart, S. & Witt, M.J. (2025). Site and species dependent effects of offshore wind farms on fish populations. Marine Environmental Research 205, 106977.*