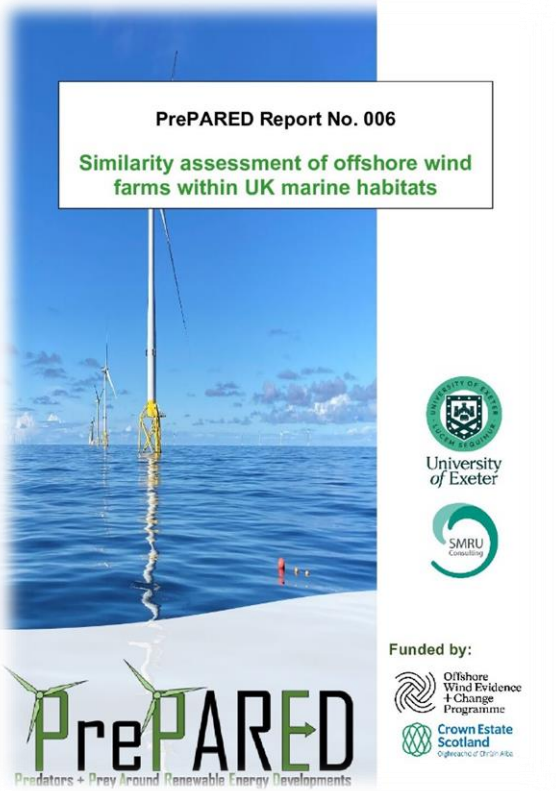
Quarterly Report: Q1 2025
Date: 24/01/2025

Project Overview

This quarter has focussed on data processing and analyses, and modelling. There were also new reports released including peer-reviewed papers, and report 006 – please find these on our webpage here.



Summary of activities undertaken in Q4 2024

Task 1.1 Broadscale fish response to OWF in Forth: Following the December sandeel survey, age estimations of sandeel (samples) were completed and maps of point abundance (in catch per unit effort) per age class were produced. Sandeel 2024 data have been included in the species distribution model and predictions have been produced. Predictions have also been produced for 6 demersal fish species (originally planned for Q2). RoxAnn analyses have been completed, the model updated with 2024 data, new predictions made and are now in use in the species-distribution-models. Clupeids (sprat and herring) predictions are still being worked on (possible slight delay into Q2).

Task 1.2 Finescale fish response to OWF in Forth: All BRUV video footage have now been analysed, the output formatted and used in the species-distribution models (with updated predictions for 6 demersal species now available).

Task 2.1 Seabird spatial distribution in Forth: Journal article on the comparison of different spatial modelling approaches is undergoing a second draft. BioSS built a standalone R package to support the delivery of the spatial methods comparison paper, which is also being used to fit seabird and fish data. This can be made publicly available on GitHub. The package provides tools for simulating habitat maps and seabird movements, as well as fitting spatial models and visualising/summarising outputs, and the simulations now incorporate habitat selection explicitly. They have also produced an accompanying vignette which is a detailed tutorial demonstrating package features and presenting results of comparative analysis of two model types under different scenarios of data thinning.

Task 2.2 Seabird movement models in Forth: BioSS have been continuing to build on the seabird movement models, integrating seabird tracking data with prey data collected within the project (and the Langton sandeel map). In particular, they have been considering how we may be able to incorporate the adjustments to the Langton sandeel map (work being undertaken under Task 6.1) into the movement models to provide a better link between seabirds and sandeel across a larger spatial area (beyond the Forth and Tay).

Task 2.3 Simulating realistic foraging tracks in IBMs: BioSS have been examining different possible ways to structure (seabird) movement models, in order to generate the required values used to build robust IBM simulations. This includes considering how different at-sea behaviours and stages of foraging trips are accounted for within the model structure. The goal is to use these different options to deliver best practice guidance for (i) our PrePARED work feeding the movement modelling analysis in Task 2.2 into the impact assessment tools in Task 7.2, and (ii) future research attempting to bridge movement modelling and IBM simulations more broadly.

Task 3.1 Broad-scale fish distribution in Moray: Fisheries acoustic and trawl data processing completed and provided to relevant Task partner. Processing of 2024 BRUV survey video footage has been completed. Unbaited longer term (24-48hr) camera video processing is ongoing for completion in early Q2.

Task 3.2 Fine-scale fish distribution in Moray (reef effects): Analysis of 2024 BRUV data are now complete. Data products have been shared with relevant project partners as needed/requested. A manuscript using BRUV data is now in preparation.

Task 3.3 Fish acoustic telemetry in Moray: Analysis pipeline has been completed on data available to date. UoE are now waiting for the array to be removed in May 2025 at which point they will perform the complete analysis of the tracking data and progress data to a manuscript.

Task 4.1 Drivers of broadscale marine mammal distribution: Delivery of a second report highlighting how harbour seal foraging distribution is related to sandeel distribution has not yet been completed. This was an additional output for this Task following re-shaping of deliverables to focus on harbour porpoise data following departure of the original Task lead. Recent discussions with OWEC over a PrePARED extension have highlighted that analyses of seal-predator data are not a priority, so any further work on this Task has been halted to prioritise outputs and impacts from Task 4.2 and Task 4.3.

Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray: Good progress made on PAM-BRUV extended analyses and the target for Q2. Using the BRUV data collected for Task 3.2, flatfish and haddock biomass were re-estimated (by length bin of 10 cm increment; work done by UoE) to investigate variation in harbour porpoise occurrence and foraging activity in relation to availability of prey of specific sizes. These covariates have been integrated in the models. Information on overall porpoise foraging activity, prey availability and vessel traffic was used to infer habitat quality at each site. UoA estimated times to first porpoise acoustic detections (and buzz) following close approaches by crew-transfer vessels. The extent of behavioural response following exposure to CTVs are then compared between sites of varying habitat quality (work in progress).

Task 4.3 Dose response curves in Moray: Good progress under both targets (1. Dose-response analyses combining existing datasets from the 3 Moray Firth OWFs, 2. Develop additional report comparing observed responses of porpoises during Moray West Piling with EIA predictions), with additional work undertaken to address actions identified under Impact No 1, 2 and 5. All data for dose-response analyses based upon datasets from three Moray Firth windfarms have been collated and initial exploratory models have been run. Analyses for the additional report comparing Moray West EIA predictions of noise propagation and porpoise disturbance with monitoring data have been completed. A draft report has been written and is being reviewed within the project team, Ocean Winds and external collaborators. Actions under Impact 1 include additional analyses of EDR for all three Moray Firth Windfarms which have been supplied to SMRUc for integration into their JNCC funded review of EDRs. A Draft EDR review report is currently being reviewed by JNCC and DEFRA. Actions under Impact 2 include discussions with SNCBs to identify avenues for sharing and discussing outputs from Moray West EIA/monitoring comparison. Actions under impact 5 have included discussions with SSER Dogger Bank C team to support SMRUc design and equipment procurement for additional PAM studies in SNS that will provide comparative data to PrePARED studies in the Moray Firth.

Task 4.4 Fish nutritional value: In Q1 2025, analysis continued on PrePARED and other fish samples to further enhance the database. The processing of PrePARED 2023 samples remains ongoing, with the final priority species currently being analysed. To date, we have over 500 new energy density estimates across 31 prey species, out of the 37 species for which we have samples. Sandeel samples from both summer and winter surveys have now been processed and incorporated into the expanding database. Significant progress has been made in developing a prey energy database for use within PrePARED, with the long-term goal of integrating published data to create a comprehensive database of energy estimates in the North Sea.
In Q2 2025, we will see a continued focus on addressing the priority prey species identified for each of the predators highlighted in the PrePARED project. This includes refining data on both large and small size classes to improve the generated length-weight and length-energy relationships. These relationships will be integrated with distribution and biomass maps produced from Task 1.1 and Task 3.1 to create energyscapes for the Firth of Forth and Moray Firth.

Task 5.1 Generalities in fish response to OWF: Moray Firth and Firth of Forth acoustic and camera footage data has been collated, compared and shared between Task partners for evaluation and analyses.

Task 5.2 Generalities in marine mammal response to OWF: Work on manuscript on the effect of PAM array design on dose response functions for harbour porpoises is now almost complete. Analysis is focusing on establishing rules for truncation distances for the functions (i.e. the range from the source at which to truncate the data) have been completed using data from Beatrice and Moray East wind farms (and this can be replicated for other sites). This paper is planned for submission in Q2 2025. Work on seals is advancing, via Philippa Wright's PhD – exploring overlap with prey data and expanding on Whyte et al response to noise studies. Collaboration with the University of Aberdeen team continues to streamline these efforts and maximise impact. This work highlights the importance of survey design in using PAM stations for dose-response estimation (and the benefits and challenges of PAM stations at large distances from the source. This work has been presented to and referenced in the development of the Dogger Bank C PAM monitoring programme which is now part of the Defra Reducing Noise Pilot study. The results were extremely influential in securing agreement for a deployment of 30 stations to help ensure the transferability of PrePARED findings to the wider community.

Task 6.1 Minimum data requirements for seabird distribution and movement models: BioSS have developed a piece of work to adjust the Langton et al. 2021 sandeel map to account for uncertainty in predicted sandeel values (probability of occurrence) over space and time. They have worked with Beckie Langton to obtain bootstrapped samples of the sandeel map and are currently recruiting a post-doc who will undertake this work but are also looking at resourcing some time from elsewhere in BioSS so that they can deliver this is Q3.

Task 6.2 Minimum data requirements for marine mammal distribution models: Target to Review scope of this Task in relation to progress on Task 4.1 and re-prioritisation of additional outputs required under Task 4.3 to maximise wider UK

impact was not achieved. It is proposed that this target should be deleted. Task was re-structured following re-shaping of deliverables to focus on seal tracking data following departure of the original Task lead. Recent discussions with OWEC over a PrePARED extension have highlighted that analyses of seal data are not a priority, and outputs are unlikely to have impact given now standard approach to using existing data on seal distribution in Project EIA, and lack of requirements for additional tagging studies during consenting.

Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites: Report 006 (Habitat Similarity Assessment) was released in February 2025. A webinar will be conducted in May.

Task 6.4 Survey design for predator-prey studies: SMRUc are reviewing the effort conducted as part of PrePARED and a summary infographic or short report is intended to be finalised by end of Q2 2025.

Task 7.1 IPCoD and DEPONS integration of new data and testing: Updates to the DEPONS model are being made and work from Task 4.3 and 5.1 will feed into this analysis. The updated version of iPCoD (called iPCoD+DEB v1.0) is being finalised currently. SMRUc are engaging with Aarhus University to progress the DEPONS updates. Test simulations have been run in Q1 2025 and further simulations will be run in Q2 2025. The Moray Firth is the case study for the DEPONS simulations, and we are producing a PrePARED summary document entitled: "HARBOUR PORPOISE POPULATON RESPONSE TO WINDFARM CONSTRUCTION, SERVICE TRAFFIC, AND CHANGES IN PREY AVAILABILITY."

Task 7.2 Adding biological realism to SeabORD and testing: UKCEH have further developed the movement simulations by employing a biased correlated random walk movement, whereby individuals move away from the colony in an exploratory manner with more tortuous movements of patches of higher prey, analogous to area-restricted search (ARS) behaviour seen across seabird species to varying degrees, before heading back to the colony after a given time, representing the “bias” component. This will facilitate more realistic interaction between modelled seabirds and their environment, meaning that with heterogeneously distributed prey, including redistribution from OWFs, our models can account for this by individuals having an adaptive response.

Task 7.3 Testing and validating SeabORD in the FoF and at UK SPAs: Local GPS tracking data from the Isle of May (Firth of Forth) has been completed with utilisation distributions for four species (razorbill, guillemot, kittiwake & puffin) ready to be used for joint predator-prey distribution maps.

Task 7.4 Integration of PrePARED findings for harbour porpoise CIA: Data collation of wind farm data for UK OWF has continued to support CIA assessments. Further updates are being made to the iPCoD model (v6.0) and this will be used for simulations in Q2-Q3 2025 (delivery Q4 2025). A PrePARED report on improving CIA Assessments to streamline consenting has been prepared under this task and will be circulated internally at the very end of Q1 2025.

Task 7.5 Integration of PrePARED findings for seabird Cumulative Impact Assessment: Initial meetings between project partners involved in fish-seabird work have taken place to identify the main empirical outcomes and links to the impact assessment process.

Task 9.1 Annual knowledge exchange workshops: The PrePARED team are preparing for targeted webinars following outputs this year, to ensure key stakeholders are receiving information in a digestible manner with opportunities to ask questions. The team will review their effectiveness and request stakeholder feedback to determine if this should be used moving forward.

Task 9.2 Dissemination of project findings: Dissemination of PrePARED reports through project website, blog, social media, and email distribution. In addition to targeted webinars the team have also met with NatureScot and Natural England to discuss ways of ensuring outputs are in a useful format for them with plans now in place for some workshops and training days. The PAG have also fed back on how they can support PrePARED outputs.

Task 9.3 Organise symposium: Conversations are ongoing within the Management Group as to when the Scientific Symposium should take place following project extension noting not all partners are involved in the extension.

Task 9.4 Website and social media: Webpage analytics show positive increases in engagement. The website is regularly reviewed and updated for accessibility and readability. Social media posts continue to see fair engagement, however, there has been a reduction of social media posts from SGMD in Q1 due to the annual report, financial report and CRF09 taking priority.

Summary of activities to be undertaken in Q1 2025

Task 1.1 Broad scale fish response to OWF in Forth: Produce a map of point habitat characteristics (from RoxAnn); Fish surveys in June.

Task 1.2 Fine scale fish response to OWF in Forth: Completion of 2024 analysis; Map fish (predator) abundance from SBRUV/Traps

Task 2.1 Seabird spatial distribution models in Forth: Begin incorporating all available prey data into distribution models.

Task 2.2 Seabird movement models in Forth: Begin incorporating all available prey data into movement models

Task 2.3 Simulating realistic foraging tracks in IBMs: Test different movement model structures on sample tracking data. Develop best practice guidelines for using movement models to generate IBM parameters.

Task 3.1 Large-scale fish distribution in Moray: Video footage data analysis and downstream provision

Task 3.2 Fine-scale fish distribution in Moray (reef effects): Video footage data analysis and downstream provision

Task 3.3 Fish acoustic telemetry in Moray: Retrieval of acoustic array and data download in the Moray Firth: 1. Completion of array removal. 2. Completion of final 6-month data download

Task 4.1 Drivers of broadscale marine mammal distribution in Moray: TBC following CRF12

Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray: Analyses of PAM and AIS vessel-tracking data to investigate variation in fine-scale porpoise occurrence and activity after exposure to disturbance at operating OWFs and reference areas.

Task 4.3 Dose response curves in Moray: Delivery of draft dose-response report

Task 4.4 Fish nutritional value: Present output at stakeholder workshop

Task 5.1: Generalities in fish response to OWF: Evaluate similarities/dissimilarities between sites.

Task 5.2 Generalities in marine mammal response to OWF: Delivery of the final report

Task 6.2 Minimum data requirements for marine mammal distribution models: Complete analyses of data on English water data. Present output at stakeholder workshop

Task 6.4 Survey design for predator-prey studies: Delayed from Q3 2024 - Short report summarising how future surveys could be carried out

Task 7.1 IPCoD and DEPONS integration of new data and testing: Delivery of the final report

Task 7.2 Adding biological realism to SeabORD and testing: Refinement of model parameterisation for redistribution of prey

Task 7.4 Integration of PrePARED findings for harbour porpoise CIA: Present output at stakeholder workshop

Task 7.5 Integration of PrePARED findings for seabird Cumulative Impact Assessment: Review article summarising and assessing the evidence arising from PrePARED on prey and seabirds to provide a comprehensive overview. The article will summarise the application of the new inference within cumulative assessment frameworks for seabirds (e.g., MS CEF project), and identify areas of development of new research.

Task 8.2 Communications plan: Review comms plan

Task 9.2 Dissemination of project findings: Support for technical and non-technical dissemination of project findings

Task 9.3 PrePARED project scientific symposium: organise symposium

Task 9.4 website and social media: Maintain project website and social media comms.

External Communications and Engagement

In Q1 2025:

- 7th annual ScotMER Symposium (25-28th February)
    - Presentation: Seabird, prey and offshore wind: novel evidence on predator-prey distributions and behaviour around offshore wind farms, and use in UK impact assessments. *Charlie Cooper (SG Marine Directorate), Katherine Whyte (BioSS), Christopher Pollock (UKCEH)*
    - Presentation: Prey energetics calculations and energy mapping (PrePARED). *Gordon Hastie & Philippa Wright (University of St Andrews)*
- Release of Report 006: Habitat Similarity Assessment in February 2025.
- Published paper - Bicknell, A. W. J., S. Gierhart and M. J. Witt (2025). "Site and species dependent effects of offshore wind farms on fish populations." Marine Environmental Research 205: 106977.
- Paper published - Bicknell, A. W. J., S. Gierhart, M. Newton, R. Main, P. Thompson and M. J. Witt (2025). "The role of acoustic telemetry to assess the effects of offshore wind infrastructure on fish behaviour, populations and predation." Renewable and Sustainable Energy Reviews 212: 115306.
- Abstracts submitted to Conference on Wind energy and Wildlife impacts (CWW) 2025 in Montpellier (8-12 Sept 2025)
    - "Seabirds and fish distributions and behaviour: understanding predator-prey interactions to build evidence for cumulative impact assessment" which includes Tasks 1.1, 1.2, 2.1, 2.2, 2.3
    - Bicknell, A. W. J., S. Gierhart, Main, R. and M. J. Witt. Offshore wind turbine foundations influence the distribution and behaviour of haddock Melanogrammus aeglefinus – a case study using complimentary methods in two operational wind farms in Scotland
    - "Marine mammal foraging activity at offshore windfarm sites: Do changes in prey fields influence marine mammal response to disturbance?"
- Abstract submitted (and accepted) for 7th "Effects of Noise on Aquatic Noise Conference" Prague, 29 June - 4 July 25 – University of Aberdeen