PrePARED
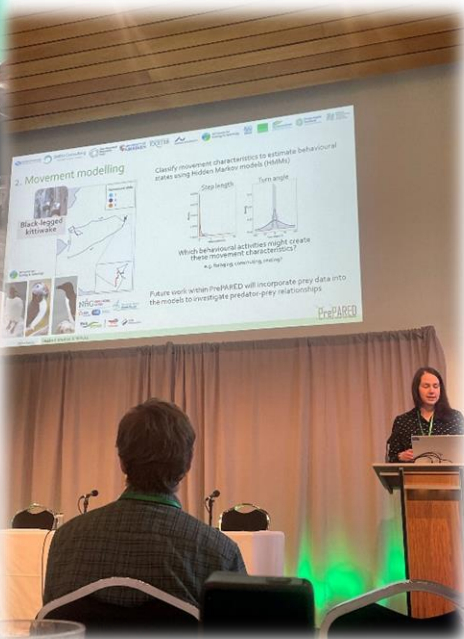
Predators + Prey Around Renewable Energy Developments

Quarterly Report: Q1 2024
Date: 28/03/2024

Project Overview

This quarter has focussed on delivering the Annual Knowledge Exchange Meeting (AKEM) in Edinburgh and providing project updates to key stakeholders, alongside data processing and analysis, and planning for 2024 field work.

Summary of activities undertaken in Q1 2024

Task 1.1 Broadscale fish response to OWF in Firth of Forth: A map of sandeel abundance in the sand per age class has been produced following the winter dredge survey. Seabed characteristic (roughness/hardness) layers have been updated with 2023 survey data and now used in the Species Distribution Models. Broadscale prey fields for pelagic fish (sandeel and clupeids) from acoustic transects in progress and a first output was made available.

Task 1.2 Finescale fish response to OWF in Forth: Baited Remote Underwater Video (BRUV) footage analyses have been completed; the generated data is now used in the finescale/broadscale analyses of 2023 survey data.

Task 2.1 Seabird spatial distribution models in Forth: BioSS have incorporated the sandeel model into seabird distribution models for the Forth-Tay and Kittiwake spatial distributions have been explored for data collected in 2021 and 2023. A prototype Shiny App was developed to explore how (1) data availability, (2) data relationships and (3) the spatial modelling approach used relates to our ability to understand and predict seabird distributions, particularly in the context of how prey fields drive models predicting predator distributions.

Task 2.2 Seabird movement models in Forth: Code was developed to model seabird movement and behaviour, using hidden Markov models (HMMs). The models use movement characteristics to divide movement tracks into different behaviours. Frameworks have been developed for each of the four seabird species: kittiwakes, guillemots, razorbills, and puffins.

Task 3.1 Large-scale fish distribution in Moray: Acoustic and trawl data processing was completed by SGMD.

Task 3.3 Fish acoustic telemetry in Moray: Protracted weather delays have meant the acoustic array remains in the water, as such no new detection data have been available since the prior service in the first half of 2023. The weather is improving as we move into the spring and servicing of the array is likely in the coming weeks. Once data are available, they will be rapidly processed.

Task 4.1 Drivers of broadscale marine mammal distribution in Moray: Harbour porpoise report finalised and released as PrePARED Report No. 001 which can be found on our webpage. Poster presented at Annual Knowledge Exchange Meeting. Delay in draft Harbour seal foraging in relation to sandeels report due to decision to fast-track analysis of initial data for Task 4.3, but draft report shared within project team for internal review, and decision made for BioSS to check all code and extend analysis to improve the way we account for autocorrelation in the tracking data. This will now be done in Q2, with anticipated delivery of the report in Q3.

Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray: Meetings held with UoE, SGMD, BioSS and SMRU to discuss integration of porpoise Passive Acoustic Monitoring (PAM) and fish data. Initial analyses conducted on 2022 data to explore variation in harbour porpoise occurrence (from PAM) in relation to variation in prey availability (from BRUV).

Task 4.3 Dose response curves in Moray: Weather conditions have constrained recovery of all CPODs but, as off 20/3/24, 61 of 65 moorings have been recovered, and four were missing. Autumn storms appear to have resulted in some movement of moorings, and a wider search may yet allow UoA to recover the final four moorings. Data from the first 39 CPODS, including all devices from Moray West and Caledonia, have been processed and preliminary analysis conducted of porpoise occurrence across Moray West during the first 3 months of monopile installation.

Task 4.4 Fish nutritional value: Analysis of the Moray Firth and Firth of Forth surveys continued - analyses are now largely complete for the PrePARED 2022 samples, with the following species having been processed: Mackerel, Viviparous eelpout, Bull-rout, Lemon sole, Long rough dab, Flounder, Whiting, sprat, Common dab, Grey gurnard. Additionally, SMRUc are developing resourcing solutions to support analysis through 2024-2026 - and engaging with PrePARED team mates on sampling. SMRUc are in discussion with Moray East OWF developers regarding obtaining post-construction survey fish samples to help estimate changes in foodscapes between pre-construction (2019) and post-construction (2024).

Task 5.2 Generalities in marine mammal response to OWF: SMRUc have continued refining the analyses of the effects of array designs on porpoise dose response studies to pile driving using acoustic loggers. SMRUc had meetings with the University of St Andrews (UoSA) and University of Aberdeen (UoA) teams to present the results and discuss their implications for future studies. Preparation of a draft manuscript will continue, and a draft is expected to be ready for submission in Q2 2024. 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 ties into Task 6.4.

Task 6.1 Minimum data requirements for seabird distribution and movement models: BioSS have identified prey and environmental data that can be used in transferring model to wider North Sea region. Prey: the sandeel model (Langton 2021) represents a North-sea wide prey dataset that could aid in transferring the models and relationships identified in the Forth and Tay to a wider region. Environmental data: available on online portals (e.g. EMODnet) represent broad-scale environmental information that could be used in transferability.

Task 6.2 Minimum data requirements for marine mammal distribution models: UoA colleagues, through meetings with SMRU, have identified key harbour seal tracking datasets (data used in Carter et al (2022) which could be used to extend the analyses conducted in Task 4.1 to other parts of the North Sea.

Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites: Work is progressing well with the habitat similarity research with primary results being shared at the Annual Knowledge Exchange Meeting (AKEM) 2024 and positive and helpful feedback received. The team have begun drafting the associated report, which is due in Q2.

Task 6.4 Survey design for predator-prey studies: Work has continued engaging with the University of Exeter (UoE) team to align with Task 6.3. Data on offshore wind farms around the North Sea has been expanded and plotting is underway in GIS. Meetings are planned for Q1 '24 with UoE to explore overlaps and guide where surveys could be designed (and what surveys provide the greatest return on investment). Work from Task 5.2 also informs this task by guiding the number of PAM stations required to produce suitable survey design requirements. SMRUc will consult with the PrePARED team in Q2-4 about the sampling that has worked best to support a PrePARED note on survey design concepts to emulate elements of PrePARED.

Task 7.1 IPcoD and DEPONS integration of new data and testing: This work is ramping up in 2024-2025 due to developments of the DEPONS model coming out in late Q4 2023 and resourcing changes required for Aarhus and UoA. These instances have resulted in unforeseen delays on this task in 2023. A benefit of delaying this work to 2024-2025 is the re-development of the iPCoD model (Scottish Government funded) which will allow for closer comparison of cumulative impact assessment tools (as the redevelopment involves an energetic engine, as in the DEPONS model). That will be

ready in Q2 2024. A Moray Firth case study using DEPONS has been developed (between SMRUC, UoA and Aarhus) which will be implemented utilising inputs from PrePARED and published literature to explore the impacts of pile driving, vessels (from OWF and other marine users) and different prey scenarios.

Task 7.2 Adding biological realism to SeabORD and testing: UKCEH have done initial work to reparameterise the intake rate functions of SeabORD to accommodate alternative prey ranges, such as those estimated in the sandeel suitability maps for the North Sea, and those arising from the new empirical sandeel density maps in the Forth-Tay. The final developments in relation to the incorporation of prey in the model will be delivered under later tasks in 7.2 to be delivered in 2025.

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. SMRUc intend to engage with Pathways to Growth in Q2 2024 to ensure further access to CIA parameters from as built windfarms. Due to the re-development of the iPCoD model (Scottish Government funded) which will allow for closer comparison of cumulative impact assessment tools (as the redevelopment involves an energetic engine, as in the DEPONS model), we intend to carry out this work in Q3-Q4 2024 to capitalise on the new version of iPCoD being available. By delaying this work, it also ensures the CIA undertaken is as realistic as possible.

Task 9.1 Annual Knowledge Exchange Workshops: The PrePARED team hosted a 2-day Annual Knowledge Exchange Meeting (AKEM) from 27-28 February 2024 at Dynamic Earth, Edinburgh. Day 1 saw ~100 attendees from a range of stakeholder categories including consenting/policy, consultancies, developers, fishery groups, NGOs, academia and government with discussions based around PrePARED science updates, external factors such as avian flu, transferability, and planning and consenting of offshore wind. The event also

allowed attendees to have hands-on experience with the technology used within the PrePARED project. Day 2 saw the Project Team and PAG discuss element of the PrePARED project to date and guidance moving forward. Feedback thus far has been positive, and a PDF copy of survey responses have been sent to OWEC alongside this report.

Task 9.2 Dissemination of project findings: Alongside the AKEM, report summary pages have been created for upcoming PrePARED reports to aid understanding of information.

Task 9.4 Website and social media: A Q1 social media timeline was followed with approximately 2 posts per months via SGMD social channels (LinkedIn and X). Webpage analytics show that in the past month there has been an increase in website traffic with a 43% increase in sessions (browsing session of an individual user) and a 63% increase in pageviews. 84% of webpage visitors were new with most visitors being from the UK, followed by the USA and Europe. We believe that this large increase in webpage visitors is linked to the AKEM.

Summary of activities to be undertaken in Q2 2024

Task 1.1 Broadscale fish response to OWF in Forth: 1) Produce a map of point habitat characteristics (from RoxAnn); 2) Prepare fisheries acoustic/ seabird at sea survey: Design surveys based on previous studies and development site conditions

Task 1.2 Finescale fish response to OWF in Forth: 1) Completion of 2023 analysis; 2) Map fish (predator) abundance from SBRUV/Traps

Task 2.1 Seabird spatial distribution models in Forth: Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data

Task 2.2 Seabird movement models in Forth: Applying movement models to Forth and Tay prey data collected within project

Task 2.3 Simulating realistic foraging tracks in IBMs: Identify and develop framework for movement model structure and outputs to use in IBMs

Task 3.1 Large-scale fish distribution in Moray: 1) Prepare fisheries acoustic survey: Design surveys based on previous studies and development site conditions: 2) Conduct fisheries acoustic survey (end of June)

Task 3.3 Fish acoustic telemetry in Moray: Catch and tag gadoid fish and service array in the Moray Firth: 1. Completion of annual tagging; 2. Completion of 6 month data download; Update on delay processing of acoustic ping data

Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray: Present preliminary results to key stakeholders at EIMR 2024 conference.

Task 4.3 Dose response curves in Moray: 1) Process data from PAM array. 2) Arrange meeting to discuss data availability with OWEC, DEFRA & MMO colleagues to explore potential for fast-tracking and adapting planned analyses to support current policy and management issues in the Southern North Sea.

Task 4.4 Fish nutritional value: Analysis of PrePARED and Moray East fish samples

Task 5.2 Generalities in marine mammal response to OWF: Processing of response and covariate data

Task 6.1 Minimum data requirements for seabird distribution and movement models: Select and process prey and environmental data to be used in transferring model to wider North Sea region

Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites: Write and produce final report

Task 6.4 Survey design for predator-prey studies: Cross-ref with 6.4

Task 7.1 IPCoD and DEPONS integration of new data and testing: Assessment of how integration of PrePARED project outputs into populations models, helps improve models

Task 7.2 Adding biological realism to SeabORD and testing: Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.

Task 7.4 Integration of PrePARED findings for harbour porpoise CIA: Development of CIA scenarios

Task 8.2 Communications Plan: review communications plan

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

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