ANNUAL REPORT 2024

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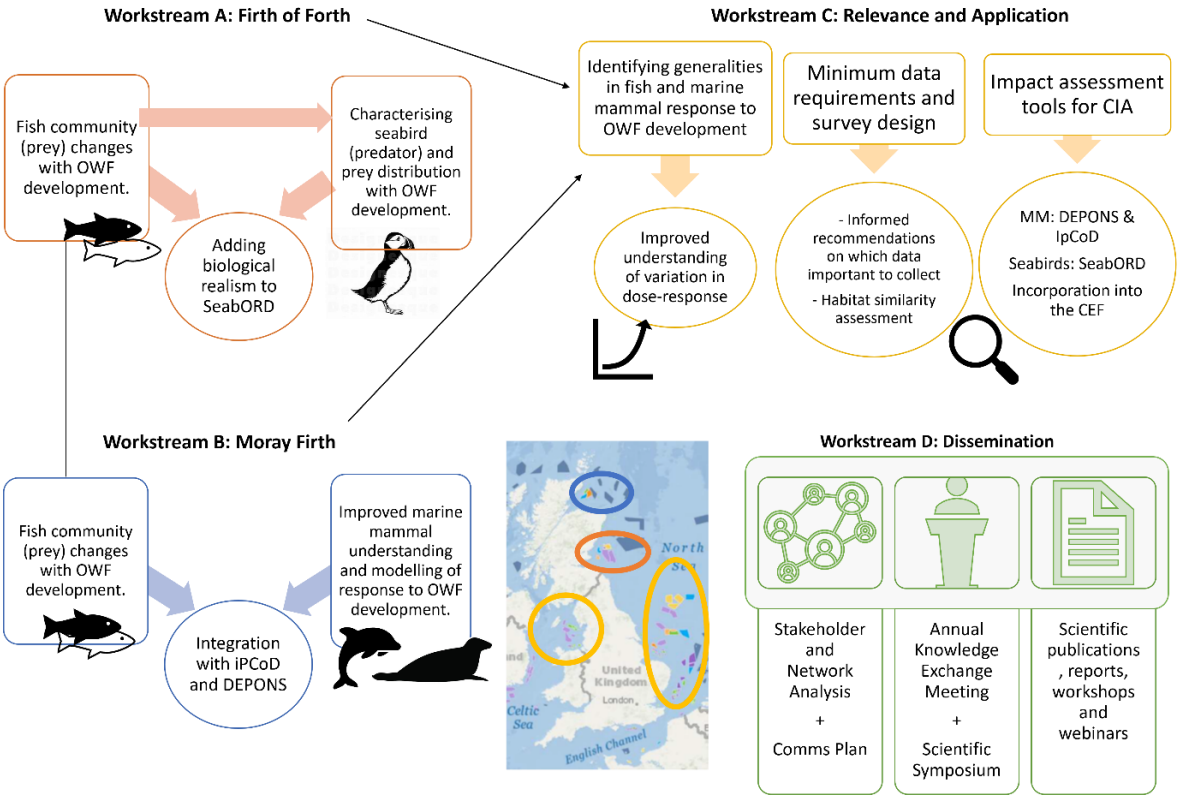
Contents

1. Brief Project Description

PrePARED (Predators and Prey Around Renewable Energy Developments) is a collaborative research project, funded by The Crown Estate (TCE) Offshore Wind Evidence and Change (OWEC) Programme and Crown Estate Scotland (CES). The project will concurrently study predator (seabird and marine mammal) and prey (fish) distribution and behaviour in and around offshore wind farms, providing critical insight into cumulative effects from large-scale developments on key marine species. Bringing together expertise from government, academia, nature conservation agencies and industry, PrePARED will address critical knowledge gaps that are considered barriers to sustainable offshore wind development, which is required to help meet the Scottish Government's renewable energy targets and reach net-zero emissions.



2. This Report

This report summarises the third year (2024) of the PrePARED project. The report is broken down into the workstreams, work packages and tasks of the project. The project activity has been written by all PrePARED task leaders and edited by the PrePARED Project Management Team.
Section 3 presents an overview of PrePARED's impact statements and their current status, Section 4 a summary of the year for all tasks, while Section 5 goes into the details of project delivery.
At the end of the report, we set out field work undertaken within the project in 2024 (Table 1) and identify any field work for the coming year (Table 2). The following tables track dissemination and communication undertaken such as reports or papers published (Table 3), presentations delivered (Table 4), meetings held or attended (Table 5), social media communications (Table 6). Recruitment of new staff and students is also listed (Table 7) and engagement of the Project Advisory Group (PAG) listed (Table 8). Table 9 assesses progress against each quarterly target of the project using a RAG system, where green indicates a target which was achieved or is ongoing, amber a target that is ongoing but has been delayed, and red a target that has failed. Any mitigation measures are described in the text. Finally, a summary of PrePARED activity in numbers (Table 10) and Milestones for the coming year, 2025 (Table 11). A glossary at the end of the report explains all acronyms used.

3. Year Summary

Target Achievement

In Year 3 (2024) of PrePARED there were 29 tasks, leading to 101 individual quarterly targets. Of these targets, 84 (83%) were either completed or are ongoing and are on target for final delivery. Delivery of 17 targets (17%) has been delayed for various operational issues, described below. 0 targets (0%) were not achieved.

Workstream A – Fish and Seabird Response to Offshore Wind Farm Development Forth and Tay

Task 1.1 Broad-scale fish response to OWF in the Forth

Work realised in 2024 were partitioned between the analyses of fish distribution data collected by PrePARED in 2023 and the acquisition and processing of 2024 data. Databases comprising georeferenced fish abundance data from demersal tows and from the processing of the 2023 fisheries acoustic survey were compiled and made available to PrePARED partners. The data were also analysed to produce broad-scale fish distributions for 8 demersal species (including gadoids and flatfish) and 3 pelagic species (sandeel, sprat and herring). Different modelling approaches were adopted to account for species covariation. Joint species distribution models have been developed using Random Forest and now using Bayesian generalized multivariate multilevel models. These models use both historic and PrePARED data to predict fish

and seabird-at-sea distributions. The 2024 surveys were planned and executed and generated a large amount of relevant data (see Table 10 Q4 WSA-WP1). As in 2023, the 2024 broad-scale survey included a seabird-at-sea survey that generated contemporaneous data on seabird occupancy of the area.

Task 1.2 Fine-scale fish response to OWF in the Forth

Work realised in 2024 included the conclusion of the 2023 data analyses and the collection of new data. Video footage analyses from baited cameras deployed in 2023 were finalised and the resulting data were combined with fish trap data to analyse how fish are distributed within the OWF in the Forth and Tay. These analyses aim at understanding how other variables (OWF related, such as distance to turbines, cables, etc.) than the environmental processes identified by the broad-scale approach (Task 1.1) affect fish distributions within windfarms. The new 2024 fine-scale surveys were planned and executed and provided a good amount of data (see Table 10 Q3 WSA WP1). Similarly to the approach described in Task 1.1, demersal fish distribution data collected in both the broad and fine-scale surveys (including demersal tows, baited cameras and fish traps) are being analysed with a combination of joint Species Distribution Models to account for species covariation and improve the modelling of the distribution of uncommon species. Across the surveys realised in 2024 (see Table 1), additional (RoxAnn) data corresponding to seabed hardness and roughness were collected, compiled and interpolated to the survey region. This approach replaced the use of grab data, and the outputs of these analyses proved to be important environmental variables in the fish distribution modelling realised under both tasks.

Data and predicted distributions from both tasks were made available to PrePARED partners to progress dependent workstreams such as the modelling of predator distributions.

Task 2.1 Seabird spatial distribution models in the Forth

The PrePARED partner BioSS developed a Shiny App to explore how (1) data availability, (2) data relationships, and (3) the spatial modelling approach used relate to our ability to understand and predict seabird distributions, particularly in the context of how prey fields drive models predicting predator distributions. The app was used in the technology highlights session at the 2024 AKEM.

Forming the basis of the approach to modelling seabird and prey data, BioSS drafted a paper, “Using telemetry data for estimating animal resource selection”, to compare and suggest improvements to spatial modelling approaches, with an emphasis on how approaches can be used efficiently with (simulated) tracking and prey data. Approaches that were considered were Inhomogeneous Poisson Point Process regression, Log-Gaussian Cox regression, and Resource Selection Functions with autocorrelation-adjusted weights. Code is written in R using the mgcv package and a Generalised Additive Mixed Model (GAMM) framework. The Shiny App is being further developed as part of the paper (Task 2.1 deliverable), and the paper is due for submission in 2025.

Due to a new staff member joining the team, BioSS developed a revised analysis plan which they are using to complete Task 2.1 throughout the remainder of the project. BioSS incorporated sandeel distributional and abundance information into seabird distribution models for the Forth-Tay, and kittiwake spatial distributions were explored for data collected in 2021 and 2023. A modelling approach based on Log-Cox Gaussian processes (LCGP) with an autocorrelation-informed weighting has been used to. model kittiwake, guillemot, and razorbill seabird species along with prey fields generated from the modelling in Task 1.1 and the Langton et al. (2021) sandeel map. The outputs from these models are species distribution maps with uncertainty, which will feed into Task 7.2.

Task 2.2 Seabird movement models in the Forth

In 2024, BioSS continued work on this Task by further developing the movement models of seabirds using the GPS tracking data collected in the Forth and Tay. These consist of Hidden Markov Models (HMMs) for each of the four tracked species (kittiwake, guillemot, razorbill, and puffin), which are used to classify movement tracks into ecologically relevant behaviours (e.g. commuting, foraging, resting). A key challenge in this Task is robustly matching the predator and prey data, as predator-prey interactions will occur on multiple spatial, temporal, and ecological scales. Prey data within the project are also available on different scales, e.g. individual prey school detections, predicted prey maps (from Task 1.1), and North Sea sandeel predicted maps (Langton et al., 2021).
BioSS have been developing approaches to best match the predator and prey data within these movement models. When incorporating prey data, these approaches must consider appropriate metrics for (1) prey presence and quantity, (2) prey accessibility to predators, and (3) prey reliability for predators. Predator-prey matching must also account for any mismatches in space and time between the two datasets, as this may alter the uncertainty in, or interpretation of, any observed relationships. The integration of these different prey datasets into the movement models will provide quantitative relationships between different measures of prey, and the movement and behaviour of different seabird species.
Additionally, in 2024 BioSS submitted a movement modelling paper on seal behaviour during offshore wind farm construction, entitled "*Movement responses of harbour seals during pile driving at an offshore wind farm*".
BioSS scaled down work in this Task fromQ2 onwards, to enable them to support work on Task 4.1.

Task 2.3 Simulating realistic foraging tracks in IBMs

This task consists of collaborative work between BioSS and UKCEH, and work started for this Task in Q2 2024. Following a change request to alter the scope of this Task to its current form, BioSS and UKCEH developed a research plan to bridge the seabird movement modelling work (Task 2.2) with the seabird foraging track simulation work (Task 7.2). Given the new data and modelling results being generated within this project, there are strong opportunities to transfer this new knowledge into simulation tools (such as Individual-Based Models; IBMs); however, there is limited guidance available within the research community on the best and most robust way to do this.

We have identified that the key steps to achieve this goal are to: (1) scope alternative movement model structures for generating IBM parameters; (2) test different movement model structures on sample tracking data to develop best practice guidance; (3) identify key parameters and data requirements; and (4) develop frameworks for testing and validation of simulated vs. real foraging tracks. Within the work conducted this year, several meetings were held between BioSS and UKCEH to begin the development of these frameworks. Additionally, behavioural classifications (e.g. commuting, foraging) were developed for some of the existing seabird tracking data; these estimated behaviours will aid in the quantification of behaviour-specific parameters for IBM simulations.

Workstream B – Fish and Marine Mammal Response to Offshore Wind Farms Moray Firth

Task 3.1. Large-scale fish distribution in the Moray Firth

Works realised under Task 3.1 includes the successful completion of the 2024 fisheries acoustic and trawl survey (Table 10 Q2 WSB-WP3), and the ongoing processing of acquired fish distribution data. These processed data will provide georeferenced large-scale fish density (biomass) and distribution data for 3 pelagic species (sandeel, sprat and herring) inside and outside the operational wind farms in the Moray Firth.

Task 3.2. Fine-scale fish distribution in the Moray Firth

Works realised as part of Task 3.2 includes the successful completion of baited remote underwater video (BRUV) camera surveys (Table 10 Q3 WSB WP3), extending data collected from surveys in 2022. Un-baited 24-hour remote underwater video cameras were also successfully deployed as part of Task 3.2 (Table 10 Q3 WSB WP3). Fish species presence, abundance and individual lengths will be extracted from the footage and will be converted into biomass for each species. These metrics will be used in generalised linear mixed effect models to test the effect of distance from wind farms turbines, time of day and/or other environmental variables on fish distribution. These data will be made available to other project partners for use in predator models to assess whether any change in fish (prey) distribution is influencing the behaviour of marine mammals.

Task 3.3. Fish acoustic telemetry in the Moray Firth

Work realised as part of Task 3.3 includes the capture and tagging of 193 further fish (2 whiting, 15 cod and 176 haddock) and the complete servicing (data download and replacing batteries) of the 84 acoustic receivers around the two operational wind farms in the Moray Firth. Analysis of the data obtained during the servicing interval is underway and a draft research paper has been produced describing several observed predation events of the tagged fish. These events were revealed by tags transmitting ambient temperatures of 37°C, which is the internal temperature of marine mammals. Hence, it is likely these fish were consumed by seals visiting turbine structures to feed.

Given the success of the tracking network and data from the BRUV surveys, an application was made to the Home Office Animals in Science Regulation Unit to permit attachment of acoustic tags to flatfish. This is the most dominant group of fish using the Moray Firth PrePARED sites and for which no fine scale movement data exist. Discussions around the practicalities and financial implications of flatfish tagging are ongoing.

Task 4.1. Drivers of broad-scale marine mammal distribution in Moray Firth

During 2024, work under this Task has involved using two complementary datasets to explore whether recently published maps of sandeel occurrence and density can be used to inform understanding of the baseline distribution of marine mammals.

In Q1, the first of these analyses was presented in PrePARED Report No 1 “Using modelled sandeel distribution maps to characterise spatio-temporal variation in the occurrence and foraging behaviour of harbour porpoises around offshore windfarms”. This report used industry-funded PAM data to investigate how predicted sandeel density and the presence of windfarms influenced spatiotemporal variation in both occurrence and foraging behaviour of harbour porpoises in the Moray Firth, NE Scotland. We found a consistent positive predator-prey relationship in this area, which matched the seasonal presence of sandeel prey in the water column. Analyses also suggest that the installation of wind turbine structures may have modified predator-prey interactions and highlight how additional work within the OWEC funded PrePARED project can be used to better understand this effect.

In Q1, analyses were also conducted to explore how predicted sandeel distribution may have influenced the foraging distribution of 54 GSM-GPS tagged harbour seals that had been tracked as part of industry pre-construction and construction monitoring. We identified seal foraging locations using Hidden Markov Models and found a significant positive increase in the probability of foraging in relation to predicted sandeel density. However, this positive relationship was seen only amongst female seals and not males. The initial analyses highlighted the need to improve the way that these models deal with the temporal autocorrelation inherent in these tracking datasets. Release of these findings has therefore been delayed subject to additional modelling that has been carried out by collaborators at BioSS, who reviewed existing code and a draft report and undertook a reanalysis to account for autocorrelation in the tracking data, setting out caveats and limitations, and scenarios for future work. An internal report was shared between project partners in Q4, describing how autocorrelation in this dataset can be accounted for by using neighbourhood cross-validation to fit a generalized additive model. Results from this work will now be used to finalise the second PrePARED Report from this Task in Q1 2025.

Task 4.2. Fine-scale marine mammal distribution in the Moray Firth

Data collected in August 2022 from arrays of Passive Acoustic Monitoring (PAM) echolocation click detectors (CPODs) were analysed to investigate variation in harbour porpoise occurrence and foraging activity across two operating OWFs (Beatrice and Moray East) and a reference area in relation to pre-construction baseline data. In Q1

2024, these findings were presented in the PrePARED Report 002 “Changes in the occurrence of harbour porpoises following the construction of Moray Firth offshore windfarms”. Overall, harbour porpoise occurrence was (~17.7%) lower at two- and four-year old operating OWF in comparison to before construction. At a finer scale, no differences in harbour porpoise occurrence and foraging activity were detected between paired sites (i.e. between sites within 50 m of a turbine foundation and sites between rows of turbines), within the two operating OWFs.

In 2024, work under this Task focussed on collating and analysing the data collected in August 2022 from PAM arrays and Baited Remote Underwater Video (BRUV) systems (cf. Task 3.2). These devices had been deployed, simultaneously, within the two operating OWFs, in the vicinity of turbine jacket foundations (< 50 m) and at reference sites, both within and outside these operating OWFs. BRUV analyses (conducted in Task 3.2) focused on the two most abundant demersal fish species recorded with the BRUV systems (flatfish and haddock). PAM data were used to investigate fine-scale variation in harbour porpoise acoustic detections (occurrence) and foraging activity in relation to local changes in flatfish and haddock biomass, and vessel traffic within and around OWFs. Harbour porpoise occurrence was higher outside operating OWFs and decreased with higher levels of vessel intensity. During the daylight hours, the probability of porpoise foraging activity increased in areas with higher flatfish biomass but decreased in areas with higher haddock biomass. The porpoise-flatfish positive relationship may indicate that porpoises predate either directly on flatfish or on other species sharing the same habitat preferences as flatfish (e.g. sandeel, whiting). The porpoise-haddock negative relationship may, on the one hand, suggest possible competition between porpoises and larger haddock (which were observed around turbine foundations within operating OWFs) over forage fish prey. On the other hand, this negative relationship may result from porpoises being displaced from areas with higher levels of vessel traffic which, co-incidentally, overlapped with the areas with higher haddock biomass. Further analyses are currently being undertaken to investigate to what extent porpoise foraging activity varied with length-specific flatfish and haddock biomass estimates. These results will be used to explore potential roles of competition and predation as drivers of the observed relationships.

Task 4.3. Dose response curves in the Moray Firth

In Q4 2023, an array of 65 CPODs was deployed along a gradient of exposure to piling noise within both existing OWFs (Beatrice and Moray East) and areas both in development (Moray West) and in planning (Caledonia). The primary aim of PrePARED analyses of these industry-funded data was to understand how behavioural responses vary in relation to piling noise levels in combination with other contextual factors such as distance from source, vessel activity and prey abundance. However, presentation of initial data on the magnitude of harbour porpoise responses to disturbance during the 2024 AKEM also highlighted that these data could be used to inform current OWF planning and consenting issues in the Southern North Sea sparking further discussions and development of work under Task 4.3 to inform the use of Effective Deterrence Ranges (EDR). This work is described below.

UoA assessed disturbance responses during the first three months of the installation of 9.5-10 m diameter monopiles without noise abatement systems at Moray West OWF. They found that, for the first two piling events, the probability of harbour porpoise behavioural response was ≥ 50% at distances up to 5 km in the 24 h after piling cessation. These levels of harbour porpoise responses to monopile installation at Moray West were similar to those observed during the installation of pin-piles at Beatrice, an adjacent OWF. The resulting Effective Deterrence Range (EDR) was estimated to be <10 km. These results have been presented in PrePARED Report No 4 “Harbour porpoise responses to the installation of XXL monopiles without noise abatement; implications for noise management in the Southern North Sea”, and a series of events have been used to share these outputs with relevant stakeholders.

Additional analyses have also been undertaken to feed into the DEFRA-JNCC review of EDRs in response to suggestions received at the Sept 24 OWEC PSG Impact Workshop. Alongside these additional outputs, work on dose-response functions has been ongoing, involving investigation of variation in harbour porpoise responses between the three Moray Firth OWFs. These analyses aim to identify the natural, anthropogenic and experimental drivers likely to shape the magnitude of observed response to different piling noise levels.

Task 4.4. Nutritional information on key prey species over time and space for informing impact assessment tools:

In 2024, we continued processing samples from the 2023 PrePARED surveys in the Moray Firth and Forth and Tay, and obtained fish samples collected during the 2024 surveys in the Forth and Tay. To date, 860 bomb calorimetry runs have been completed as part of the project. Of the 37 fish species collected, 29 have been processed to date with sizes ranging from 7 – 58.2 cm. As of the end of 2024, the PrePARED project has generated 430 new energetic density estimates (for different species and size classes).

For many of the species analysed in PrePARED, energy density measurements (i.e., energy per gram of wet tissue) had not been previously reported in the scientific literature, marking a significant contribution toward developing a comprehensive energy density database for fish and cephalopods in the northern North Sea. Furthermore, these data provide updated length-weight relationships for a variety of species in the Moray Firth and Forth and Tay regions.

The analysis of the PrePARED samples will continue into 2025. Additionally, we have obtained fish samples (sandeel and haddock) from post-construction surveys carried out by the Moray East Offshore Wind Farm developers. These samples will be processed and compared with pre-construction data from 2019 to assess potential changes in the foodscape of the Moray Firth.

Workstream C – Relevance and Application of PrePARED Project Results Throughout the UK

Task 5.1. To what extent are fish in the Forth and Tay and Moray Firth responding to offshore wind farm developments in a similar way?

In late 2024, preparation began to exchange and/or design integrated analyses of fish diversity, species abundance and biomass data that has been collected using comparable surveys (BRUV, hydroacoustic and trawl) in and around Moray Firth and Forth and Tay wind farm sites. The discussions and analyses will continue to feed into the assessment of whether fish respond similarly across the sites for reporting by the end of 2025.

Task 5.2. Assessing transferability of Moray Firth learning on marine mammal responses to OW development, to other regions and developments:

In 2024, we have finalised the analyses of the effects of array designs on porpoise dose response studies to pile driving using acoustic loggers, in collaboration with the University of Aberdeen team. We have had knowledge exchange meetings to present the results and discuss their implications for future studies. This has included direct input into the design of a study being carried out at Dogger Bank C during 2025, which will also use PAM equipment made available through PrePARED partners. A draft manuscript will be finalised by the end of 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 (see Task 6.4), and provides a series of recommendations the design and analysis of dose-response studies using acoustic logger arrays.

Task 6.1 Minimum data requirements for seabird distribution and movement models

It is imperative that data collected in the project, and any historical data, are used in a way that (1) maximises the amount of data that can used to develop models, and (2) matches data as closely as possible in space and time, to ensure that ecological insights gained from model outputs are valid and useful. During 2024, BioSS began to address the challenge of data mismatch between some years of historical predator and prey data. To do this, they collaborated with the lead author of Langton et al. (2021) to obtain uncertainty estimates of mean sandeel probabilities through sets of simulations. BioSS intend to use these, together with ICES sandeel stock assessment data, to create maps with variation and temporal components in them. This will aid prey matching in contemporaneous predator-prey models, providing a better empirical estimate of predator-prey relationships over time and space, which will aid transferability to other UK regions.

Task 6.2 Minimum data requirements for marine mammal distribution models

Work under this Task had originally planned to use existing Digital Aerial Survey and tracking datasets to explore the minimum data requirements for using these types of

data within marine mammal distribution models. Following the resignation of the UoA WP lead responsible for this Task in Q3 2023, this work has been on hold subject to re-assessment of a) priorities driven by potential impact on EIA and consenting timescales tables and b) outcomes of the modelling of seal distribution being undertaken under Task 4.1. Further review of this Task will be undertaken in Q1 2025.

Task 6.3 UK EEZ habitat similarity analysis to PrePARED windfarms

Work realised under this task included the successful completion of the research and finalisation of the report (for release in early 2025). This work took multiple environmental datasets for the UK EEZ and quantified similarity to the PrePARED windfarms, seeking to understand the potential for transferability of PrePARED results to other areas of the UK. The report revealed similarities in habitat between PrePARED sites and Dogger Bank sites in England, while revealing notable dissimilarity with sites in the Celtic Sea. Forth and Tay sites revealed greatest similarity to geographic areas proposed for floating offshore wind in Shetland, Scotland and North England. The report will be accompanied by a narrated PowerPoint presentation that will be hosted online.

Task 6.4 Recommendations on survey design for predator-prey studies in relation to OWF development in other UK marine areas

Work in 2024 on this task has mostly been based around the alignment with Task 6.3. The Task 6.3 report is being reviewed internally. Once finalised we will leverage off this analysis and in consultation with Task 5.1 and 6.3 (and other PrePARED leads) to understand the best combination of monitoring effort to consider any future equivalent projects to PrePARED. A report is intended to be finalised by end of Q2 2025.

Task 7.1 Validate revised impact assessment tools (i.e. DEPONS/iPCoD) using historic data from constructed OWF in the Moray Firth

Discussion and collaboration are ongoing with the University of Aberdeen and Aarhus teams. Updates to the DEPONS model are being made and work from Task 4.3 and 5.1 is feeding into this. The updated versions of iPCoD (v6.0 and a new energetics-based version called iPCoD+DEB v1.0) are being finalised currently. 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 and vessels (from OWF and other marine users) and might include different prey scenarios. Test simulations are being prepared to run in Dec 2024-Jan 2025 with further simulations in early 2025.

Task 7.2 Adding biological realism to SeabORD and testing

Target 1 – Initial development of simulated seabird foraging tracks for exemplar species

We have developed code for implementing more biologically realistic seabird movement simulations for use within Individual-Based Models (IBMs) currently used within ornithological offshore wind impact assessments (e.g., SeabORD). Simulated foraging tracks have been visually assessed to compare with observed foraging tracks in GPS tracking data. This work will continue into 2025 working closely with BioSS in Task 2.3 to determine which parameters and metrics are best extracted from empirical GPS tracking data to compare with the simulated tracks to ensure biological realism is maximised for each species. This will deliver a new framework for formal assessment of the biological realism of simulated foraging tracks, which is both quantitative and reproducible, with strong relevance to impact assessment tools used in the UK and more globally. This framework will be applied across our four exemplar species (kittiwake, guillemot, razorbill, puffin) to ensure delivery of foraging tracks that adequately represent the characteristics seen for the respective species, whilst being achieved in a manner that does not compromise model data requirements and processing speeds.

Work has begun involving UKCEH's internal data specialists with the following three aims:

1. Software testing of key processes and functions in the model by following standard protocol for testing of model components. This will ensure that the model is robust and operating as intended prior to making code publicly available through GitHub.

2. Producing documentation, in the form of CRAN style vignettes, on a publicly available webpage to aid understanding in the model's key components for those intending to use SeabORD.

3. To create a standalone R module for the visualisation of simulated foraging tracks, most likely in the format of an R Shiny application. Visual assessment plays a key role in early development of track simulations, and an interface to display the outputs of such simulations will assist in this respect. Additionally, it will be a useful feature for the end users of the fully developed product.

Target 2 – Development of initial parameterisation to work with joint predator-prey maps

This task has not yet been completed due to delays in concurrent predator-prey data collection, resulting in delays to the delivery of joint predator-prey maps for use within the IBM SeabORD. As such, this task has been postponed to 2025 Q3. Collaborative discussions between UKCEH and BioSS have begun to ascertain the format of joint predator-prey maps to be delivered by BioSS to UKCEH in Q3 2025, which will be used by UKCEH to guide SeabORD development and validation. The joint predator-prey maps will serve a dual purpose in the development of the IBM SeabORD within PrePARED. Firstly, they will be used directly within the current version of SeabORD to improve estimates of impacts from OWFs within the region covered by the maps, resulting in more biologically informed estimates of impacts due to improved accuracy of bird and prey distributions. Secondly, the maps can be used to validate the more

biologically realistic foraging tracks being developed within PrePARED by providing a concurrent estimate of both prey and seabird distribution, which can be matched against the distribution of simulated birds developed within Task 7.2.

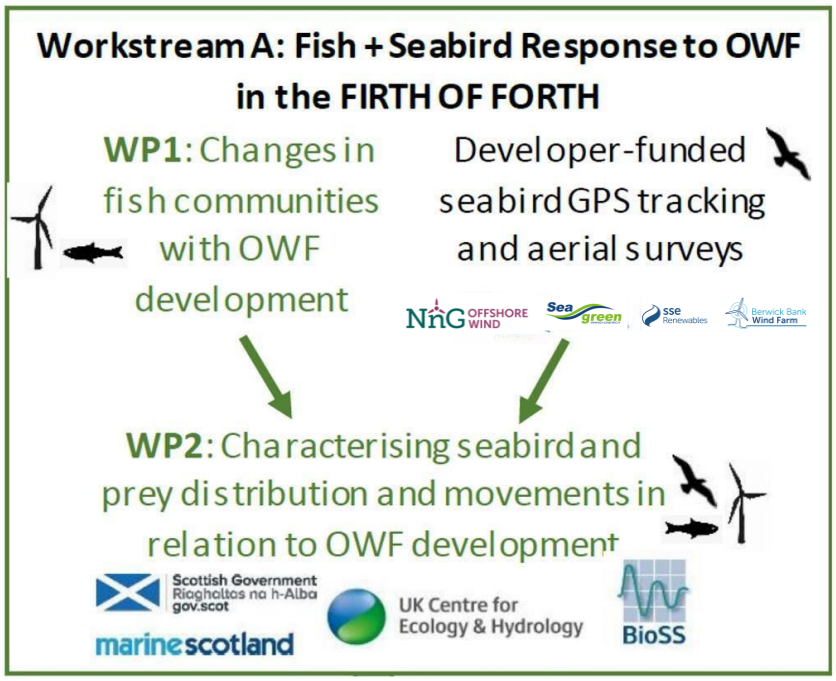
Target 3 – Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.

We have completed work to re-parameterise the seabird prey intake rate functions within the IBM SeabORD to accommodate alternative prey abundance ranges, including 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. This work ensures that the intake rate function within the model has the required flexibility to reproduce expected seabird time-activity budgets observed in empirical data, when confronted with prey maps of differing format and units. The final developments in relation to the incorporation of prey in the model will be delivered under later tasks in 7.2 to be completed in 2025

Task 7.4 Updating Cumulative Impact Assessments for marine mammals

A position paper has been written summarising the current issues with Cumulative Effects/Impacts Assessment (CEA). This is in the final stages of drafting and highlights the differences between impacts from the EIA phase versus the build-phase. This will be finalised in Q1 2025. This task will also use the iPCoD model to quantify the impact of this on predicted impacts. This work will run through 2025. To achieve this, collation of wind farm data for UK OWF has continued. SMRUc intend to engage with Pathways to Growth in Q1 2025 to ensure further access to parameters from as built windfarms (to be used in iPCoD simulations). Further updates are being made to the iPCoD model (v6.0) and this will be used for simulations in Q1-Q2 2025.

4. Year Details: Workstream A – Fish and Seabird Response to Offshore Wind Farm Development in the FORTH AND TAY



WP1: Changes in fish communities with OWF development in the Forth and Tay	
Task 1.1 Lead: Dr Thomas Regnier (SGMD)	How do broad-scale prey landscapes and fish communities change in relation to OWF development in the Forth?
Task 1.2 Lead: Dr Thomas Regnier (SGMD)	How do fine-scale fish communities change in relation to OWF development in the Forth?
WP2: Characterising seabird and prey distribution and movements in relation to OWF development in the Forth and Tay	
Task 2.1 Lead: Dr Esther Jones (BioSS)	Characterising seabird spatial distribution in relation to prey abundance and OWF development
Task 2.2 Lead: Dr Esther Jones (BioSS)	Movement modelling to link seabirds and prey, detecting changes in response to prey movement in relation to OWF development
Task 2.3 Lead: Dr Katherine Whyte (BioSS) and Dr Christopher Pollock (UKCEH)	Development of statistical methods to facilitate simulation of realistic foraging tracks in IBMs

Workpackage 1 – Changes in fish communities with OWF development in the Forth and Tay

Task 1.1 Broadscale fish response to OWF in the Forth

Q1 Targets: 1) Produce a map of sandeel point abundance in the sand per age class (from Grab and dredge). 2) Broadscale prey fields from acoustic transects (pelagic prey). 3) Completion of RoxAnn analyses.

1) Map of sandeel abundance in the sand per age class produced following the winter dredge survey;
2) Broadscale prey fields for pelagic fish (Sandeel and clupeids) in progress and a first output made available in Q1 2024;
3) Seabed characteristic (roughness/hardness) layers were updated with 2023 survey data and now used in the Species Distribution Models.

Q2 Targets: 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.

1) All RoxAnn data from 2023 surveys were included in the database and models and predictions were updated (maps produced) and the habitat characteristics (hardness/roughness) were used in the Species Distribution Models
2) Fisheries acoustic/seabird at sea/demersal fish survey was planned, agreed with developers, and took place from 13 June – 1 July 2024.

Q3 Targets: 1) Feedback on fisheries acoustic survey/ seabird-at-sea survey: (June-July). 2) Initiate laboratory work (otolith analyses, PSA analyses (subject to laboratory availability)). 3) Initiate post processing of acoustic signal and trawl data analyses.

1) Fisheries acoustic, demersal fish and seabird-at-sea surveys were completed on 2 July 2024. Fish and seabird distribution data have been acquired, compiled and are now being used to a) refine species distribution models necessary to predict both prey and predator distributions and b) assess the quality of current species distributions models by confronting newly acquired data with model predictions. RoxAnn data have been acquired, compiled and will be used to update models of seabed roughness and hardness (used as covariates in fish distribution models). PrePARED partners have been informed of the survey outcomes through quarterly meetings and workstream dedicated meetings.
2) As for 2023, length frequency analyses are being used instead of otolith analyses and have proven to be a robust alternative due to the ability to discriminate juveniles from adults based on size for all target species. RoxAnn data collected on PrePARED surveys have been collected and data from other MD surveys will be used to complete the 2024 database and update the spatial resolution of seabed models.
3) The fisheries acoustician is working on the acoustic data post processing.

Q4 Targets: 1) Produce point biomass estimates of pelagic fish from acoustic transects. 2) Completion of otolith analyses.

1) The acoustic raw data have been pre-processed by SGMD staff after the departure of the PrePARED acoustician. The pre-processed data was received on and are now being processed by Dr Thomas.Regnier. The point abundance estimates have just been produced for the Forth and Tay.
2) Whiting and haddock ages estimated from age length keys derived from length frequency distributions. Sandeel otoliths to be completed Q1 2025.

Task 1.2 Finescale fish response to OWF in the Forth

Q1 Targets: 1) Process Baited Remote Underwater Video (BRUV) and AI camera video footage from 2022 camera surveys – completion of video processing from surveys.

BRUV video footage analyses have been completed and the generated data is now used in the finescale/broadscale analyses of 2023 survey data.

Q2 Targets: 1) Completion of 2023 analysis. 2) Map fish (predator) abundance from BRUV/Traps.

1) 2023 laboratory analyses were completed and broadscale prey surfaces produced. Work continued on fine-scale distributions due to carried over delays and staff loss/contingency planning.
2) The processed fish abundances from BRUVs/Traps were used to produce maps and are in use to refine fine-scale fish distributions.

Q3 Targets: 1) Conduct BRUV/Fish trap surveys in the Forth and Tay. 2) Design surveys considering development site conditions. 3) Completion of surveys. 4) Initiate analyses of SBRUV data. 5) Initiate grab data analyses (PSA).

1) and 2) The BRUV/Fish trap survey was completed in Q3 2024. 47 fish trap and 68 BRUV deployments were successfully completed during the survey both within and outside windfarms. The data generated will be used to refine species distribution models and understand the effects of offshore windfarms on fish distributions. RoxAnn data (seabed characteristics) have been collected and temperature, salinity and primary productivity data collected at sites within and outside windfarms.
3) BRUV footage analyses are now underway.
4) RoxAnn data have been compiled and are being collated with data acquired on other MD surveys.

Q4 Targets: 1) Completion of RoxAnn analyses.

RoxAnn Analyses have been completed with all 2024 Alba na Mara surveys up to August 2024. The model was updated, and the seabed hardness and roughness layers were produced and are now in use in the Species Distribution Modelling. Survey data from the second half of the year will be downloaded from the ship in December 2024.

Workpackage 2 – Characterising seabird and prey distribution and movements in relation to OWF development in the Forth and Tay

Task 2.1 Seabird spatial distribution models in the Forth

Q1 Targets: 1) Working distribution models using the sandeels model. 2) Seabird spatial distributions and uncertainty for selected species within Forth-Tay region

BioSS have incorporated the sandeel model into seabird distribution models for the Forth-Tay region and explored Kittiwake spatial distributions 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.

Q2 Targets: 1) Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data

BioSS hired a Senior Spatial Statistician who began work on seabird spatial modelling in the Forth & Tay, environmental and prey data, and transferability (tasks 2.1 and 6.1). BioSS continued drafting a paper on how spatial modelling frameworks can be used efficiently with (simulated) tracking and prey data.

Q3 Targets: 1) Integrate prey data into distribution models.

The spatial modelling comparison paper is currently being drafted. This forms the basis of the analytical approach that BioSS is using for the predator-prey spatial models. BioSS have reformulated an analysis plan, based on Senior Statistician joining the team, and are applying the modelling approaches to the seabird-fish datasets.

Q4 Targets: 1) Working distribution models using prey data from Forth-Tay.

In Q4 2024, BioSS held an internal research day to discuss progress on PrePARED. They continued with the tasks from Q3 2024 including drafting the spatial modelling comparison paper. They have requested some additional historical tracking data from RSPB that may be helpful for investigating changing baselines.

Task 2.2 Seabird movement models in the Forth

Q1 Targets: Working code for movement modelling framework

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.

Q2 Targets: Applying movement models to Forth and Tay prey data collected within project

BioSS continuing work on seabird movement models on different scales. The team also contributed to Task 4.1 by reviewing R code and the draft report on harbour seal foraging in relation to sandeel habitat.

Q3 Targets: Applying movement models to Forth and Tay prey data collected within project

Work was temporarily scaled down this quarter, as BioSS have been contributing to the seal foraging report in Task 4.1. They have reviewed the R code and report. BioSS have implemented a new analytical approach called 'Neighbourhood Cross Validation' (NCV) to deal with autocorrelation in the seal tagging data and have also written caveats and limitations to the analysis, to aid with correct interpretation of the results. Working with SGMD, BioSS have been comparing spatial overlap between predictions from some of the models in Task 1.1 (using the fish and seabird-at-sea data) with estimated foraging locations from the seabird movement models in Task 2.2 (using the GPS tracking data).

Q4 Targets: Initial development of movement modelling framework

Work was temporarily scaled down this quarter, as BioSS have been contributing to the seal foraging report in Task 4.1. They finished their main contributions to this work by finalising the updated analyses they developed on harbour seal and sandeel relationships and writing an internal report which is now with UoA (preparations are underway to publish this as a PrePARED report in Q1 2025). Paper submitted on "Movement responses of harbour seals during pile driving at an offshore wind farm" (partially PrePARED-funded)

Task 2.3 Simulating realistic foraging tracks in IBMs

Q1 Targets: No target this quarter

Q2 Targets: Identify and develop framework for movement model structure and outputs to use in IBMs

BioSS conducted meetings during Q2 2024 with UKCEH to discuss developing frameworks for simulation-based approaches (simulating seabird foraging tracks). Katherine Whyte also attended an Agent Based Model workshop led by UKCEH/NINA.

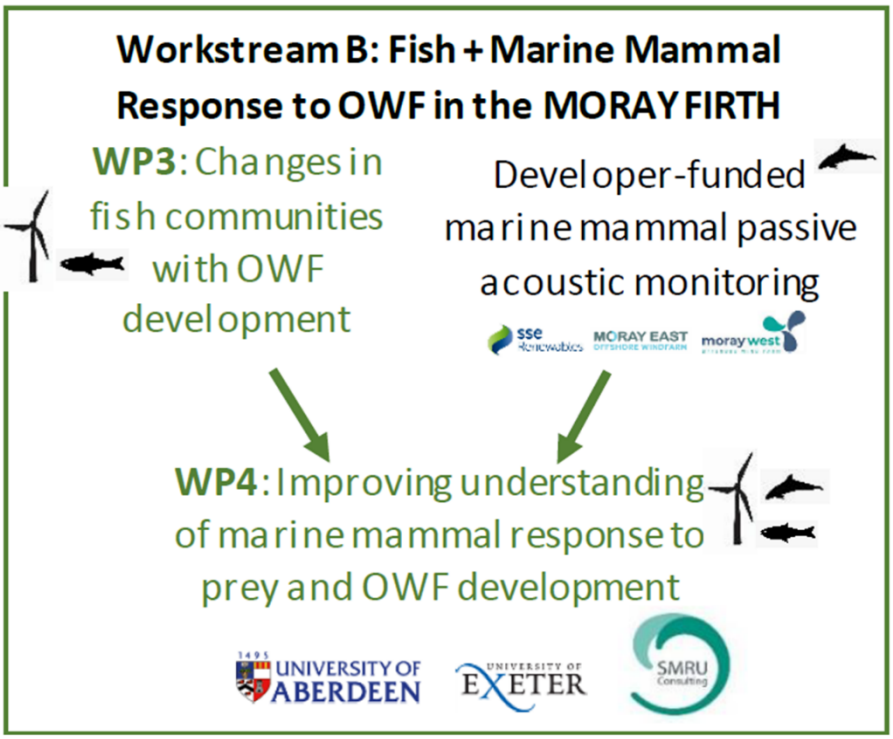
Q3 Targets: 1) Identify and develop framework for movement model structure and outputs to use in IBMs. 2) Producing behavioural classifications from movement models

Meetings to discuss developing frameworks for simulation-based approaches (simulating seabird foraging tracks) ongoing. Task 2.3 work has been scaled down this quarter due to the delivery of the Task 4.1 report.

Q4 Targets: 1) Identify and develop framework for movement model structure and outputs to use in IBMs. 2) Producing behavioural classifications from movement models

Meetings to discuss developing frameworks for simulation-based approaches (simulating seabird foraging tracks) ongoing. Task 2.3 work has been scaled down this quarter due to the delivery of the Task 4.1 report. Initial behavioural classifications are available for the 2023 tracking data to help inform simulation development.

5. Year Details: Workstream B – Fish and Marine Mammal Response to Offshore Wind Farms In the MORAY FIRTH



WP3: Changes in fish communities with OWF construction and operation in the Moray Firth	
Task 3.1 Lead: Dr Anthony Bicknell (UoE)	Broad-scale assessment of fish: How do abundance, diversity, assemblage and biomass patterns of fish vary with OWF construction and operation?
Task 3.2 Lead: Dr Anthony Bicknell (UoE)	Fine-scale assessment of fish: How does the presence, age and design of turbine structures affect fish abundance/biomass, assemblages and diversity?
Task 3.3 Lead: Dr Matthew Witt (UoE)	Prey connectivity: How does a network of wind turbines influence the behaviour and movement of fish?
WP4: Improving understanding and modelling of marine mammal response to OWF development in the Moray Firth	
Task 4.1 Lead: Dr Ana Payo-Payo/Prof Paul Thompson (UoA)	Assessment of broad scale distribution of marine mammals in relation to habitat and prey fields and OWF development in the Moray Firth
Task 4.2 Lead: Dr Aude Benhemma-Le Gall (UoA)	How does windfarm presence affect fine-scale distribution of prey and marine mammal foraging behaviour?
Task 4.3 Lead: Dr Isla Graham/Prof Paul Thompson (UoA)	How does windfarm presence affect marine mammal responses to pile-driving & vessel disturbance?
Task 4.4 Lead: Dr Cormac Booth (SMRUc)	Nutritional information on key prey species over time and space for informing impact assessment tools

Workpackage 3 – Changes in fish communities with OWF construction and operation in the Moray Firth

Task 3.1 Large-scale fish distribution in the Moray Firth

Q1 Targets: 1) Completion of fisheries acoustic and trawl data processing

Acoustic and trawl data processing was completed by SGMD PrePARED Acoustician.

Q2 Targets: 1) Prepare fisheries acoustic survey: Design surveys based on previous studies and development site conditions: 2) Conduct fisheries acoustic survey

Fisheries acoustic transect and trawl survey completed in Q2 2024.

Q3 Targets: 1) Conduct BRUV and AI camera surveys in Moray Firth: Design surveys considering development site conditions.

The BRUV and 24-hour lander surveys were successfully completed in Q3 2024.

Q4 Targets: 1) Initiate post processing of acoustic signal, trawl and RoxAnn analyses from June survey

Post processing of acoustic data resides within SGMD and has been initiated, with point abundance estimates expected to be made available in Q1 2025.

Task 3.2 Fine-scale fish distribution in the Moray Firth (reef effects)

Q1 Targets: No target this quarter

Q2 Targets: No target this quarter

In Q2 2024 UoE colleagues presented 2022 BRUV results at the EIMR conference, Orkney. A BRUV survey was designed to assess the effects of distance from turbines and turbine density on fish and this was agreed with OWF, and the BRUV lander tested.

Q3 Targets: Conduct BRUV and AI camera surveys in Moray Firth – Design surveys considering development site conditions

The BRUV and 24-hour lander surveys were successfully completed in July 2024.

Q4 Targets: Start processing BRUV and AI camera video footage from the 2024 camera surveys

Analysis of BRUV and AI camera datasets underway. All BRUV data have been analysed using computer vision models and results obtained. Selected validation is now underway. AI camera system analysis pipeline is being developed with analysis emerging.

Task 3.3 Fish acoustic telemetry in the Moray Firth

Q1 Targets: 1) Process acoustic ping data

There were no new acoustic ping data available due to protracted weather delays preventing acoustic array servicing. The previous service took place in the first half of 2023. Once data are available, this will be rapidly processed.

Q2 Targets: 1) Catch and tag gadoid fish and service array in the Moray Firth: 1. Completion of annual tagging; 2. Completion of 6-month data download. 2) Update on delayed processing of acoustic ping data

Annual fish tagging and array servicing completed in Q2 2024 with ~193 fish tagged and 66 out of 80 receivers serviced (4 did not respond and 10 failed to surface meaning they will be retrieved by ROV at a later date). Due to delay in array servicing, it was not possible to process the acoustic ping data which was subsequently delayed to Q3 2024.

Q3 Targets: 1) Process acoustic ping data

Fish tracking array remains active and collecting data. Awaiting ROV retrieval of 14 problematic receivers (with onboard data) that would not release from the seabed.

Q4 Targets: 1) Service array in the Moray Firth: Completion of 6-month data download

All data now received from array service, including those units that were stuck on the seabed, which required ROV retrieval. The data warehouse (ETN) hosting all acoustic data is experiencing some technical difficulties regards sensor data (depth and temperature) from the tags, which has delayed some elements of analysis, though UoE can quickly catch-up once those technical issues with data handling have been resolved.

Workpackage 4 – Improving understanding and modelling of marine mammal response to OWF development in the Moray Firth

Task 4.1 Drivers of broadscale marine mammal distribution in the Moray Firth

Q1 Targets: 1) Finalise report on harbour porpoises and prey. 2) Submit draft report on Moray Firth studies of harbour seal foraging in relation to sandeels.

Harbour porpoise report finalised and released as PrePARED Report No. 001. Poster presented at PrePARED 2024 Annual Knowledge Exchange Meeting. Delay in draft Harbour seal report due to decision to fast-track analysis of initial data for Task 4.3, now 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 to autocorrelation in the tracking data.

Q2 Targets: No target this quarter

UoA shared data and code with BioSS and met to discuss analysis to be undertaken to finalise report.

Q3 Targets: 1) Finalise harbour seal report and explore transferability through Task 6.2

Draft report has been written. Meetings have been held between UoA and BioSS to QA data and finalise analysis.

Q4 Targets: Update on delayed harbour seal report

BioSS have developed a new analysis to account for autocorrelation when using tracking data to explore how sandeel occurrence drives harbour seal foraging distribution, and this has been documented in an internal report for project partners. Further discussion of results between project members is required before the report can be finalised.

Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in the Moray Firth

Q1 Targets: 1) Finalise framework for incorporating prey data for analyses on reef effect

Meetings held during Q1 2024 with University of Exeter, SGMD, BioSS and SMRU to discuss integration of porpoise 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). Delivery of PrePARED Report No. 002: Changes in the occurrence of harbour porpoises following the construction of Moray Firth offshore windfarms.

Q2 Targets: 1) Present preliminary results to key stakeholders at suitable event or online workshop

Results were presented in Q2 2024 at the EIMR conference in Orkney. In addition, UoA shared preliminary results combining haddock and flatfish abundances (derived from UoE BRUV data) with harbour porpoise occurrence and foraging activity with UoE. Additional cross-institution meetings will be organised to discuss further the BRUV-PAM analyses and present the results at the ICES Annual meeting.

Q3 Targets: 1) Deliver draft report on relationship between porpoises and prey around OWF

Target not achieved, with delays as a result of re-direction of staff time to Task 4.3. Analysis of BRUV and PAM data was conducted to develop a presentation for ICES Conference in Q4 2024. Revised time scales are dependent upon progress of additional work within Task 4.3 and will be finalised in Q1 2025.

Q4 Targets: 1) Deliver final report on relationship between porpoises and prey around OWF

After presenting the initial results on the relationship between porpoises and prey around OWF at the ICES conference, UoE and UoA have decided to refine the prey covariates derived from BRUV sampling, to investigate whether porpoise foraging activity varied with length-specific fish biomass estimates. During Q4 2024, UoE estimated prey biomass by length bin of 10 cm increment and UoA re-run the analyses. The target of Q4 was consequently not achieved, but progress to finalise the analyses will be made in Q1 2025 to deliver the report later that year.

Task 4.3 Dose response curves in the Moray Firth

Q1 Targets: 1) Recover PAM array deployed during initial construction phase at Moray West OWF

Weather conditions complicated recovery of all CPODs but 61 of 65 moorings were recovered, and four were missing. Autumn storms appear to have resulted in some movement of moorings, and a wider search will take place in an attempt to find the other 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.

Q2 Targets: 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.

PAM data were processed, and deterrence functions estimated to describe how porpoises responded at different distances from piling. Two online stakeholder meetings took place in Q2 2024 to allow engagement with DEFRA, MMO, MOD and SNCBs.

Q3 Targets: 1) Extract data on porpoise occurrence and foraging buzzes and liaise with industry to estimate received noise levels at each PAM location

Target partially achieved. All porpoise occurrence and foraging buzz data have been extracted. However, dose-response work has been re-focussed onto deterrence functions for outputs related to management of SNS SAC through EDRs. Also, some delays on availability of industry funded noise data.

Q4 Targets: 1) Complete dose-response analyses

Not yet complete: emerging policy need for outputs relevant to other UK regulators has required additional analysis and outputs from Moray Firth studies to extend results presented in PrePARED report 004. In effort to respond to emerging needs and maximise project impact, the team have flexibly adapted their quarterly work and have provided this additional data to 3rd party contractors (SMRUc) for inclusion in a new DEFRA/JNCC funded review of Effective Deterrence Ranges (due early 2025). In addition, work to develop Dose-Response analysis has progressed. Received levels at all PAM locations used at Beatrice, Moray East and Moray West have been re-modelled using the same acoustic propagation methods, and data have been obtained from developers to validate these predictions against field measurements made during construction. These data are now being incorporated into the dose-response analyses to compare variation in porpoise responses between the three windfarms.

Task 4.4 Fish nutritional value

Q1 Targets: 1) Processing of summer 2023 prey samples

In Q1 2024, analysis of the Moray Firth and Forth and Tay surveys continued – analyses largely complete for the PrePARED 2023 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 resource solutions to support analysis through 2024-2026 – and engaging with PrePARED colleagues 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).

Q2 Targets: 1) Analysis of PrePARED and Moray East fish samples

As above. Haddock collected around Moray East OWF was received and samples from the sandeel surveys are expected to help estimate changes in foodscapes between pre-construction (2019) and post-construction (2024).

Q3 Targets: 1) Analysis of PrePARED and Moray East fish samples

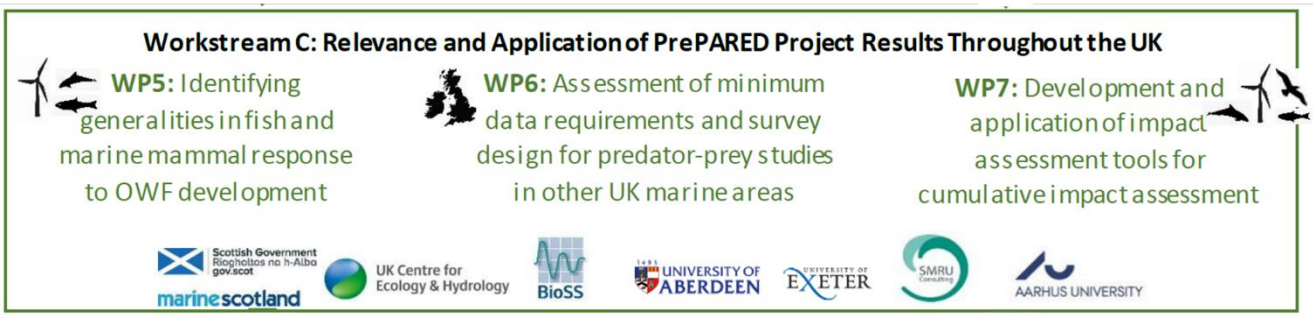
In Q3 2024, analysis of fish samples ongoing.

This expanded bomb calorimetry analysis has continued with over 500 new energy density values produce as part of Task 4.4. A full-time technician is being trained in Q4 2024; they will focus on processing sandeels for the next few months to bolster a key gap for a species of critical importance.

Q4 Targets: 1) Processing of summer 2024 prey samples

In Q4 2024, analysis of the Moray Firth and Forth and Tay PrePARED survey 2022 samples are now complete, with over 500 new energy density estimates in progress across 29 prey species (out a total of 37 species we have samples for). A full-time technician is now in post. The technician is currently focused on sandeel samples from NE Scotland to bolster a key gap for a species of critical importance.

6. Year Details: Workstream C – Relevance and Application of PrePARED Project Results Throughout the UK



WP5: Identifying generalities in fish and marine mammal response to OWF development	
Task 5.1 Lead: Dr Anthony Bicknell (UoE)	To what extent are fish in the Forth and Tay and Moray Firth responding to OWF development/presence in a similar way?
Task 5.2 Lead: Dr Gordon Hastie (SMRUc)	Assessing transferability of Moray Firth porpoise responses to OWF development, to other regions and developments
WP6: Assessment of minimum data requirements and survey design for predator-prey studies in other UK marine areas	
Task 6.1 Lead: Dr Esther Jones (BioSS)	Minimum data requirements to understand how prey + OWF development influence seabird distribution and movements
Task 6.2 Lead: Dr Ana Payo-Payo/Prof Paul Thompson (UoA)	Minimum data requirements to understand how prey + OWF development influence marine mammal distribution and behaviour
Task 6.3 Lead: Dr Matthew Witt (UoE)	Assessment of habitat similarity between northern North Sea and rest of the UK, using biotic and abiotic variables
Task 6.4 Lead: Dr Cormac Booth (SMRUc)	Recommendations on survey design for predator-prey studies in relation to OWF development in other UK marine areas
WP7: Development and application of impact assessment tools for cumulative impact assessment	
Task 7.1 Lead: Dr Cormac Booth (SMRUc)	Integration of PrePARED learning into DEPONS + iPCoD; validation of DEPONS using data from constructed OWFs in the Moray Firth
Task 7.2 Lead: Dr Kate Searle (UKCEH)	Adding biological realism to individual-based models for estimating consequences of OWF impacts on protected seabird populations
Task 7.3 Lead: Dr Kate Searle (UKCEH)	Testing and validating SeabORD in the Forth and Tay and at Flamborough & Filey Coast SPA
Task 7.4 Lead: Dr Cormac Booth (SMRUc)	Realistic cumulative impact assessment (CIA) using learning from PrePARED + 10 years of marine mammal + OWF research
Task 7.5 Lead: Dr Kate Searle (UKCEH)	Integration of PrePARED findings to provide recommendations on updated approaches to cumulative impact assessment for seabirds

Workpackage 5 – Identifying generalities in fish and marine mammal response to OWF development

Task 5.1 – To what extent are fish in the FoF and MF responding to OWF development/presence in a similar way?

Q1, Q2 & Q3: No targets

Q4 Target: 1) Collate and compare Moray Firth and Forth and Tay acoustic and camera footage processed data.

Data preparation for transfer to SMRUc/St Andrews is near complete (this mostly represents completing of body length measurements etc. from fish detected in BRUV data gathered in 2024). Analysis of all fish body lengths will be completed in Q1 2025.

Task 5.2 – Assessing transferability of Moray Firth marine mammal responses to OWF development to other regions and developments

Q1 Targets: 1) Processing of response and covariate data 2) Preparation of manuscript on dose response sampling

In Q1 2024, SMRUc continued refining the analyses of the effects of array designs on porpoise dose response studies to pile driving using acoustic loggers. They had meetings with the University of St Andrews and UoA teams to present the results and discuss their implications for future studies. Preparation of a draft manuscript continued. 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.

Q2 Targets: 1) Processing of response and covariate data

SMRUc continued refining the analyses as above. SMRUc are delaying the manuscript fractionally to integrate the latest findings from Task 4.3 and supporting those tasks by coming up with transferable rules for analysis in support of dose response functions being generated from PAM data.

Q3 Targets: 1) Final collation of PAM data and covariates

Work on manuscript on the effect of PAM array design on dose response functions for harbour porpoises continues. Analysis is now focusing on establishing rules for truncation distances for the functions (i.e. the range from the source at which to truncate the data). 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 ties into Task 6.4.

Q4 Targets: 1) Complete the dose-response analyses

Work on manuscript on the effect of PAM array design on dose response functions for harbour porpoises is now almost complete. Analyses on establishing rules for truncation distances for the functions 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 early in Q1 2025. A position paper has been prepared on how to ensure Transferability via an Evidence Bridge process – this is a key need to advance transferability and was developed by the SMRUC and SMRU team.

Workpackage 6 – Assessment of minimum data requirements and survey design for predator-prey studies in other UK marine areas

Task 6.1 – Minimum data requirements for seabird distribution and movement models

Q1 Targets: Identify prey and environmental data that could be used in transferring model to wider North Sea region

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.

Q2 Targets: Select and process prey and environmental data to be used in transferring model to wider North Sea region

BioSS are investigating whether the sandeel map (Langton et al) can be used in a way that allows it to be temporally dynamic. BioSS and Wageningen University met to discuss whether BioSS can use ICES yearly stock assessment data (that has uncertainty), combined with uncertainty estimates from the sandeel map, to create maps with some variation/uncertainty with space and time incorporated.

Q3 Targets: Develop revised version of spatial distribution model that uses only variables that are available throughout North Sea region

BioSS met with Rebecca Langton to discuss producing uncertainty layers for the sandeel map (Langton et al,2021). Once received, BioSS will incorporate

these uncertainty layers, along with ICES stock assessments, to investigate whether the (static) sandeel map can be adapted to be more dynamic.

Q4 Targets: Compare revised version of model against that derived using Forth-Tay prey data

BioSS have liaised with Rebecca Langton (SGMD), who has now produced uncertainty layers for the sandeel map (Langton et al., 2021). They plan to use these sandeel uncertainty layers to improve the linkages between seabirds and prey, in particular with respect to transferability (as the sandeel map covers the largest spatial area of all available prey data).

Task 6.2 – Minimum data requirements for marine mammal distribution models

Q1 Targets: 1) Identify key harbour seal tracking datasets available for assessing transferability of patterns observed in Moray Firth.

Meetings with SMRU confirmed that data used in Carter et al (2022) could be used to extend analyses conducted in Task 4.1 to other parts of the North Sea.

Q2 & Q3 Targets: No targets this quarter

Q4 Targets: 1) Scope further simulations using data sets of different resolutions, and transferability, in relation to outputs from Task 4.1

On hold pending completion of Task 4.1

Task 6.3 – UK EEZ marine habitats similarity assessment for OWF sites

Q1 Target: Perform habitat similarity assessment with suitable model

Work progressed well with the habitat similarity research. Primary results were shared at the PrePARED AKEM 2024 with positive and helpful feedback received. The team begun drafting the associated report, due in Q2 2024.

Q2 Targets: Write and produce final report

A draft of the final report was ready for the end of Q2 2024 with the final version to be delivered in Q3 2024.

Q3 Targets: Delayed delivery of final report

Report production is underway and has been shared with SMRUc. Introduction, methods and results completed with discussion sections drafted. Awaiting comments from SMRUc.

Q4 Targets: Update on delayed report.

The report is now complete and has been reviewed by the Management Group and the PAG. Feedback has been received and the report will be released in Q1 2025.

Task 6.4 – Survey design for predator-prey studies

Q1 Targets: 1) Cross-ref with 6.3 and 2) Preparation of manuscript on dose response sampling

Work continued engaging with the 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 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 2024 about the sampling that has worked best to support a PrePARED note on survey design concepts to emulate elements of PrePARED.

Q2 Targets: Cross-ref with Task 6.4

This work was delayed until the outputs of Task 5.2 and 6.3 were made available.

Q3 Targets: Update on delayed Cross-ref with Task 6.3

SMRUc received the draft outputs from Task 6.3 and will work in Q4 2024 and Q1 2025 to develop a briefing paper on best ‘bang for buck’ monitoring methods (using the investment in PrePARED as a means)

Q4 Targets: Update on delayed Cross-ref with Task 6.3

The Task 6.3 report is being reviewed internally. Once finalised SMRUc will prepare a report – in consultation with Task 5.1 and 6.3 (and other PrePARED leads). A report is intended to be finalised by end of Q1 2025.

Workpackage 7 – Development and application of impact assessment tools for cumulative impact assessment

Task 7.1 – IPCoD and DEPONS integration of new data and testing

Q1 Targets: 1) Assessment of how integration of PrePARED project outputs into populations models, helps improve models

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.

Q2 Targets: 1) Assessment of how integration of PrePARED project outputs into populations models, helps improve models

Updates to the DEPONS model are being made and work from Tasks 4.3 and 5.1 will feed into this analysis. The updated version of iPCoD (called iPCoD+DEB v1.0) was being finalised during Q2 2024.

Q3 Targets: 1) Assessment of how integration of PrePARED project outputs into populations models, helps improve models

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. The first results of the DEPONS simulations will be available by February 2025, and when the new version of DEPONS with more detailed porpoise energetics (v.4.0) becomes available more detailed simulations will be conducted using the new version of the model.

Q4 Targets: 1) Delivery of the draft report (final report in Q2 2025)

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 are being prepared to run in Dec-Jan 2025 and further simulations will be run in early 2025. The Moray Firth is the case study for the DEPONS simulations.

Task 7.2 – Adding biological realism to SeabORD and testing

Q1 Targets: 1) Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.

Initial work completed to re-parameterise 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.

Q2 Targets: 1) Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.

As above

Q3 Targets: 1) Initial development of simulated foraging tracks for exemplar species

Work has begun in developing movement simulations with the aim of capturing the core components shared across exemplar species using the NetLogo program. UKCEH aim to simulate movement modes corresponding with those from movement modelling of empirical data (e.g., hidden Markov models), including commuting and foraging behaviour, using a biased correlated random walk where the bias towards the colony increases with time resulting in a generic seabird central-placed foraging trip simulation. This should be fully established in Q4 2024, at which point they can define the framework for parameterising the different species from modelling of empirical data (i.e., how the characterisations of different movement modes vary between species, and the probability of switching between them) to develop this model further to represent our focal species.

Q4 Targets: 1) Initial development of simulated foraging tracks for exemplar species. 2) Development of initial parameterisation to work with joint predator-prey maps

1) We have code in place for developing movement simulations, with some reproductions of foraging tracks which at this stage have only been visually assessed. The next step is to work closely with BioSS in Task 2.3 to determine which parameters are best extracted from empirical data to compare our simulated data to. This will formalise assessment of simulated tracks by creating a quantitative and reproducible framework. This framework will then be applied consistently across our four exemplar species (kittiwake, guillemot, razorbill, puffin) with the goal of obtaining foraging tracks which adequately represent the characteristics seen for the respective species, while being as parsimonious as possible with how this is achieved.

2) Due to delays in acquiring the data to make predator-prey maps this task has been postponed to Q3 2025.

Task 7.3 – Testing and validating SeabORD in the FoF and at UK SPAs

No targets in 2024

Task 7.4 – Integration of PrePARED findings for harbour porpoise Cumulative Impact Assessment

Q1 Targets: 1) Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)

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.

Q2 Targets: 1) Development of CIA scenarios

Data collation of wind farm data for UK OWF has continued to support CIA assessments.

Q3 Targets: 1) Development of CIA scenarios

Data collation of wind farm data for UK OWF has continued to support CIA assessments. SMRUc intend to engage with Pathways to Growth in Q4 2024 to ensure further access to CIA parameters from as built windfarms. Due to the re-development of the iPCoD model which will allow for closer comparison of cumulative impact assessment tools, they intend to carry out this work in Q4 2024 and Q1 2025 to capitalise on the new version of iPCoD being available (once released by Marine Directorate). By delaying this work, it also ensures the CIA undertaken is as realistic as possible.

Q4 Targets: 1) Updated CIA analyses

SMRUc intend to engage with Pathways to Growth in Q1 2025 to ensure further access to CIA parameters from as built windfarms. Further updates are being made to the iPCoD model (v6.0) and this will be used for simulations in Q1-Q2

2025. A PrePARED report on improving CIA assessments to streamline consenting has been prepared under this task and will be circulated internally (and is expected to be finalised in Q1 2025).

Task 7.5 – Integration of PrePARED findings for seabird Cumulative Impact Assessment

No targets in 2024

7. Year Details: Workstream D – Dissemination to inform OWF planning, policy and licensing

WP8: Development of a dissemination roadmap	
Task 8.1 Lead: Project Management (SGMD)	Stakeholder and network analysis + reporting
Task 8.2 Lead: Project Management (SGMD)	Production of a Communications Plan
WP9: Dissemination activities	
Task 9.1 Lead: Project Management (SGMD)	Knowledge exchange with stakeholders
Task 9.2 Lead: Project Management (SGMD)	Scientific publications with non-technical summary of relevance to OWF development; published reports
Task 9.3 Lead: Project Management (SGMD)	Scientific symposium on research on ecosystem effects of OWF development; events including workshops, webinars, etc.
Task 9.4 Lead: Project Management (SGMD)	PrePARED project dedicated website hosting project outputs, updates, and other information; social media communications

Workpackage 8 – Development of a dissemination roadmap

Task 8.1 – Stakeholder and network analysis

This task was completed in 2023.

Task 8.2 – PrePARED Communications Plan

Q1 Targets: No targets this quarter

Q2 Targets: 1) Review communications plan

The Management Group (MG) met to discuss the communications plan and a working document is in place providing guidelines to project management colleagues.

Q3 Targets: No targets this quarter

Q4 Targets: 1) Review communications plan

No changes to communications plan necessary. There will be updates required following agreement on targeted webinar process.

NEW Task – OWEC Output: Impact: Action Analysis

During 2024 a new task arose which the PrePARED Project Management Team implemented with the aid of the Management Group. This was the creation of an Output – Impact – Action (OIA) matrix at the request of OWEC. The aim of this matrix is to develop a dashboard tool which will aid OWEC understand what impact their funded projects will have and to ensure this is delivered.

To support this work, the project management team met with OWEC and the Management Group several times to discuss and create an impact – action log. Management Group members provided OWEC with a suggested action list to ensure maximum impact of PrePARED outputs.

Workpackage 9 – Dissemination activities

Task 9.1 – Annual knowledge exchange workshops

Q1 Target: 1) Host annual knowledge exchange meeting

The PrePARED team hosted a 2-day Annual Knowledge Exchange Meeting from 27-28 February 2024 at Dynamic Earth, Edinburgh. Day 1 saw ~100 attendees from a range of stakeholder categories with discussions based around PrePARED science updates, external factors such as avian flu, transferability, and planning and consenting. The event also allowed attendees to have a 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 on this event has been positive.

Q2 Target: No target

Q3 Target: 1) Begin planning for AKEM 2025.

Discussions ongoing within the Management Group as to the format of stakeholder engagement in 2025. There has been overall agreement, and approval from OWEC, to consider targeted meetings, webinars or other events instead of another PrePARED AKEM.

Q4 Target: 1) Complete planning AKEM 2025.

Agreement that PrePARED will not host a large event in Q1 2025. Instead, there will be a focus on targeted webinars following each project output, to ensure key stakeholders are receiving information in a digestible manner with opportunities to ask questions. These targeted webinars will begin in Q1 2025,

replacing the AKEM. The team will review their effectiveness and request stakeholder feedback to determine if this should be used moving forward.
We plan to return to the AKEM format again in the future.

Task 9.2 – Dissemination of project findings

Q1 Target: 1) Support for technical and non-technical dissemination of project findings

Summary pages are being created for upcoming PrePARED reports to aid the dissemination of information.

Q2 Target: 1) Support for technical and non-technical dissemination of project findings

Dissemination of PrePARED reports through project website, blog, social media, and email distribution. The Management Group (MG) met to discuss dissemination to ensure a plan is in place for successful uptake of PrePARED outputs. Initial steps are in place to begin targeted engagement with key stakeholders and the MG will meet again to discuss next steps.

Q3 Target: 1) Support for technical and non-technical dissemination of project findings

As above

Q4 Target: 1) Support for technical and non-technical dissemination of project findings

Agreement from the Management Group that release of any future reports/papers will be accompanied with a webinar date, allowing stakeholders to listen to findings and ask questions.

Task 9.3 – Organise PrePARED project scientific symposium

No targets in 2024

Task 9.4 – Establish PrePARED website and social media

Q1 to Q4 Targets: 1) Maintain project website and social media comms

Q1: A social media timeline was followed with approximately 2 posts per month via SGMD social channels (*LinkedIn* and *X*). Webpage analytics show that in March 2024 there was 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 to the website 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.

Q2: Webpages have been updated to improve accessibility, readability and aesthetics. Webpage analytics in June 2024 showed significantly less traffic than in previous months. It is believed that this is due to the SGMD communications team being unable to post on the central social media channels due to general election. Social media postings will return to normal when the election ends.

Q3: Webpages continue to be updated to improve accessibility, readability and aesthetics. Webpage analytics in September 2024 showed an increase in page visits and users. A site visit to Seagreen OWF allowed project manager to receive positive feedback from developers (SSE) that they actively use the project website reviewing PrePARED reports in their day-to-day work and finding the monthly blog to be a digestible way to read project updates. Social media postings, particularly on LinkedIn, are being well received.

Q4: Webpage analytics show a positive increase in website use over the past year with approximately 250 more page views and 160 more users per month in Q4 2024 compared to Q4 2023. Social media posts continue to see good engagement with posts reaching ~100 likes and up to 16 reposts. SGMD communications team have also supported the project to undertake a social media 2024 rundown of PrePARED reports.

Social media posts throughout the year (see Table 6)

8. TABLE 1 – PrePARED Surveys 2024

Survey Code	Vessel	Scientist in Charge	Days	Dates	Survey Description	Area
N/A	Waterfall	Barbara Cheney (UoA – MMMP)	9 + (1)*	Feb-Apr 2024 + (Sept 2024)	Recover PAM devices	Moray Firth
N/A	Waterfall	R. Main (M. Witt)	8	20/04/2024 – 28/04/2024	PrePARED: marine fish tagging	Moray Firth
0824A	Alba na Mara	R. Main	14	27/05/2024 – 10/06/2024	PrePARED Task 3.1 broadscale fish survey	Moray Firth
0924A	Alba na Mara	T. Regnier	18	13/06/2024 – 01/07/2024	PrePARED Task 1.1 broadscale fish survey	Forth and Tay
N/A	Waterfall	A. Bicknell	10	15/07/2024 – 25/07/2024	BRUV and unbaited long term camera surveys	Moray Firth
1124A	Alba na Mara	T. Regnier	18	29/07/2024 – 16/08/2024	PrePARED Task 1.2 finescale fish survey	Forth and Tay
2024A	Alba na Mara	T. Regnier	19**	30/11/2024 – 19/12/2024	SGMD Sandeel survey	East Coast

* doesn't include weather days.
**2 days costed to PrePARED

9. TABLE 2 – Planned PrePARED Surveys 2025

Survey Code	Vessel	Scientist in Charge	Days	Dates	Survey Description	Area
N/A	Charter	R. Main	15	May 2025	Recovery of acoustic receivers	Moray Firth

10. TABLE 3 – PrePARED Published Outputs 2024

Published

Fernandez-Betelu, O., Iorio-Merlo, V., Graham, I. M., Benhemma-Le Gall, A., Cheney, B.J., Payo-Payo, A., Thompson, P.M. (2024). PrePARED Task 4.1 – Using modelled sandeel distribution maps to characterise spatio-temporal variation in the occurrence and foraging behaviour of harbour porpoises around offshore windfarms. PrePARED Report, No. 001. March 2024.

Iorio-Merlo, V., Fernandez-Betelu, O., Benhemma-Le Gall, A., Graham, I. M., Thompson, P.M. (2023). Task 4.2. Work Package 4 – Changes in the occurrence of harbour porpoises following the construction of Moray Firth offshore windfarms. PrePARED Report, No. 002. March 2024.

Benhemma-Le Gall, A., Hastie, G.D., Brown, A.M., Booth, C.G., Graham, I.M., Fernandez-Betelu, O., Iorio-Merlo, V., Bashford, R., Swanson, H., Cheney, B.J., Abad Oliva, N. & Thompson, P.M. (2024). Harbour porpoise responses to the installation of XXL monopiles without noise abatement; implications for noise management in the Southern North Sea. PrePARED Report, No. 004. August 2024.

Booth, C.G., Hastie, G., Sparling, C.E. (2024). Ensuring Transferability: An evidence bridge approach. PrePARED Report, No. 005. October 2024.

PrePARED (2024a). PrePARED – The First Two Years. Report from the PrePARED Annual Knowledge Exchange Meeting 2024 (AKEM24). PrePARED Report No. 3, April 2024.

PrePARED (2024b). Project Summary. PrePARED Output Summary No. 1.

PrePARED (2024c). Spatio-temporal variation in occurrence and foraging of harbour porpoises around offshore windfarms. PrePARED Output Summary No. 2.

PrePARED (2024d). Assessing harbour porpoise occurrence and the reef effect of operational windfarms. PrePARED Output Summary No. 3.

PrePARED (2024e). Harbour porpoise responses to the installation of monopiles without noise abatement. PrePARED Output Summary No. 4.

PrePARED (2024f). Measuring the energetic content of prey around offshore wind farms. PrePARED Output Summary No. 5.

In Press

Task 2.2 (BioSS): Whyte, K.F., Hastie, G.D., Sparling, C.E., Binnerts, B., and Russell, D.J.F. Movement responses of harbour seals during pile driving at an offshore wind farm.

Task 3.1 (UoE): Bicknell AWJ, Gierhart S, Witt MJ. Site and species dependent effects of offshore wind farms on fish populations. Marine Environmental Research

Task 3.3 (UoE): Bicknell AWJ, Gierhart S, Newton M, Main R, Thompson P, Witt MJ. The role of acoustic telemetry to assess the effects of offshore wind infrastructure on fish behaviour, populations and predation. Renewable and Sustainable Energy Reviews.

Task 4.1 (UoA/BioSS): Individual and sex differences in harbour seal responses to broad-scale predictions of sandeel occurrence

Task 5.2 (SMRUc): Manuscript: Effect of PAM array design on dose response functions for harbour porpoises

Task 6.3 (UoE): Habitat Similarity Assessment report

Task 7.5 (UKCEH): ‘Tracking back: the role of GPS tracking data in ornithological offshore wind energy assessments’. To be submitted to Marine Policy with associated pre-print February 2025 (jointly funded by industry funding to UKCEH).

11. TABLE 4 – PrePARED Presentations 2024

Date	Who To?	Subject	Presenter
08/02/2024	ScotMER Symposium	Fish and offshore windfarms: PrePARED Baited Underwater Remote Video Analysis	Matthew Witt
27/02/2024	PrePARED AKEM	Foodscapes	Tony Bicknell
27/02/2024	PrePARED AKEM	Fish and Seabirds in Forth and Tay	Thomas Regnier, Katherine Whyte and Chris Pollock
27/02/2024	PrePARED AKEM	Marine Mammal Dose Response	Gordon Hastie and Paul Thompson
27/02/2024	PrePARED AKEM	Exploring external factors	Francis Daunt and Adam Butler
27/02/2024	PrePARED AKEM	Transferability in the evidence base	Cormac Booth
27/02/2024	PrePARED AKEM	Similarity Assessment	Sam Gierhart
28/02/2024	OWEC programme Steering Group	PrePARED stakeholder analysis and communications plan	Bill Turrell
16/04/2024	EIMR 2024 – Session 1: Collision and other animal interactions I	Impact of operating windfarms on a marine top predator (See Abstract 1)	Aude Benhemme-Le Gall
16/04/2024	EIMR 2024	The role of habitat and prey quality in marine mammal responses to developing offshore energy landscapes (See Abstract 2)	Philippa Wright
17/04/2024	EIMR 2024 – Session 2: Impact on fish	Scale and species dependant effects of offshore wind farms on fish populations	Anthony Bicknell
26/04/2024	Norwegian Institute for Nature Research (NINA) collaborative workshop	Using agent-based models for conservation biology	Chris Pollock, Kate Searle and Katherine Whyte
14/05/2024	Ocean Winds, DEFRA, JNCC, NatureScot, Natural England, Natural Resources Wales, MD-LOT, DESNZ, RenewableUK, MOD	Porpoises and Piling Noise	Paul Thompson
15-19 July 2024	International Statistical Ecology Conference (ISEC) 2024	Using movement modelling to understand predator-prey interactions at multiple scales	Katherine Whyte
15-19 July 2024	International Statistical Ecology Conference (ISEC) 2024	Using telemetry data for estimating animal resource selection: a comparison of difference statistical approaches (poster)	Ana Couto
16-19 July 2024	NYSERDA State of the Science conference	Integrating offshore wind, wildlife and fish: the 'Predators and Prey Around Renewable Energy Developments' (PrePARED) project (See Abstract 3)	Cormac Booth
07/08/2024	SNSOWF UWN Group	Extensive discussion about the implications of the results of PrePARED Report 004 on EDRs.	Paul Thompson

2-6 Sept 2024	Seabird Group Conference	"How do cumulative effects of offshore wind farms scale with increasing exposure to seabird breeding colonies?" – poster	Christopher Pollock
07/09/2024	National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), Australia	Strategic Marine Mammal Monitoring and PrePARED	Paul Thompson
9-12 Sept 2024	ICES Annual Science Conference 2024	Predator-prey interactions at operating offshore windfarms (See Abstract 4)	Aude Benhemme-Le Gall
9-12 Sept 2024	ICES Annual Science Conference 2024	Effects of offshore wind farms on distribution and behaviour of fish with potential consequences for predation	Anthony Bicknell
17/09/2024	OWEC PSG	Impact workshop on PrePARED Report 004 on EDRs	Paul Thompson
08/10/2024	North-East Scotland Ecology Network (NESEN)	Poster; "Quantifying the effects of offshore wind development on seabird-prey dynamics".	Phil Bouchet
24/10/2024	BOU Birds and Net Zero conference	"How do cumulative effects of offshore wind farms scale with increasing exposure to breeding seabirds?"	Christopher Pollock
24/10/2024	BOU Birds and Net Zero conference	"Understanding predator-prey interactions in the context of offshore wind farm development"	Katherine Whyte
05/11/2024	MASTS Annual Science meeting	'Predicting the cumulative effects of offshore wind farms on seabird demography and consequent population viability.'	Christopher Pollock
11-15 Nov 2024	Society for Marine Mammalogy (SMM) 2024 conference	"Responses of harbour porpoises to construction & operation of OWF in Scottish waters."	Aude Benhemma Le-Gall
11-15 Nov 2024	Society for Marine Mammalogy (SMM) 2024 conference	"Ensuring transferability and translation; an evidence bridge approach."	Carol Sparling

Abstract 1: **IMPACT OF OPERATING WINDFARMS ON A MARINE TOP PREDATOR**

Assessments of animal responses to windfarm developments have generally focused on disturbance during construction, but less is known about whether operational windfarms are linked to longer-term effects on marine wildlife. To decrease the uncertainties around the impacts from windfarm developments, there is a need to better understand how key receptors, such as marine mammals, respond to operational windfarms. In this study, we used passive acoustic monitoring and a recently developed sandeel distribution model, to assess variations in harbour porpoise occurrence, foraging activity, and predator-prey relationships between pre- and post-construction periods at three windfarms sites. In 2022, we deployed a broad array of echolocation click detectors (CPODs) across two windfarms after 1 and 3 years of operation, and a reference site that had not yet been constructed. Following a Before-After Control-Impact (BACI) design, we compared 2022 data to pre-construction data collected in 2009, 2010 and 2011 to assess broadscale changes in the occurrence and foraging activity of porpoises in relation to the operational windfarms. Additionally, we investigated how sandeel density influenced porpoise occurrence and foraging activity before the construction of the windfarms and assessed whether the introduction of wind turbines modified this relationship. The BACI analyses revealed that the probability of harbour porpoise occurrence decreased by up to 13 % at the operating windfarms relative to the reference site. We found a consistent positive relationship between sandeel density and porpoise occurrence during pre-construction period. However, during the post-construction year, the positive relationship was weaker at one of the windfarms and absent at the second, while the relationship remained positive at the reference site. We hypothesise that changes in prey species distribution and/or composition associated with the presence of the wind turbines may have caused the differences in porpoise

occurrence and predator-prey relationships detected here. Although limited to just one year of post-construction data, our findings provide evidence on the effect of operational windfarms on marine mammals that requires further investigation.

Abstract 2: **THE ROLE OF HABITAT AND PREY QUALITY IN MARINE MAMMAL RESPONSES TO DEVELOPING OFFSHORE ENERGY LANDSCAPES**
As top predators, seals play a key role within marine ecosystems, having top-down effects on fish communities and the food web structure. With the installation and expansion of fixed and floating offshore wind farms (OWFs) in coastal waters, there is an urgent need to understand how these developments may impact these top predators and their interactions with surrounding ecosystems. Seals have been shown to change their diving and movement behaviour in response to pile driving associated with the construction phase of OWF developments, but the nature and magnitude of behavioural responses showed marked variation both within- and between-individuals. At present, there is a paucity of data on how factors such as an individual seal's behavioural state (e.g., foraging or travelling), and the underlying habitat and prey quality, may modify these behavioural responses to construction. Importantly, this lack of knowledge limits our understanding of the nature of the observed responses, and our ability to predict the future consequences of OWF developments in new areas. To address these knowledge gaps, this project is investigating the effects of different phases of OWF developments (installation and operation) on prey quality, and on seal diving behaviour, movements, energetics, and spatial distributions. Fish samples collected off the east coast of Scotland from 2022 to 2024 are being analysed using bomb calorimetry to determine prey quality, in terms of energetic content by species and size. Preliminary results indicate broad variations between species and size classes, with energy content values ranging from 3.7 kJ/g for haddock to 9.0 kJ/g for sprat. In addition, GPS tag data from wild seals in south-east England (n = 45) and north-east Scotland (n = 30) are being analysed to determine the influence of their behavioural state, habitat type, and prey quality and abundance, on seal behavioural responses to pile driving, with the aim of developing a series of context-specific dose-response relationships to pile driving sound. The findings from this project will improve our understanding of the underlying mechanisms driving seal responses to OWF developments and will aid in reducing uncertainty in the impact assessment process.

Abstract 3: **INTEGRATING OFFSHORE WIND, WILDLIFE AND FISH: THE 'PREDATORS AND PREY AROUND RENEWABLE ENERGY DEVELOPMENTS' (PREPARED) PROJECT**
The Predators and Prey Around Renewable Energy Developments (PrePARED) is a 4-year collaborative research project concurrently studying predator (seabird and marine mammals) and prey (fish) distribution and behavior in and around offshore wind farms in the United Kingdom. The project commenced in 2022 and has brought together expertise from government, academia, nature conservation agencies and industry, to address critical knowledge gaps that currently are barriers to sustainable offshore wind development. Some of these gaps relate to how seabirds and marine mammals and their prey respond to OWF development and the mechanisms underpinning these responses. We are using a range of techniques and datasets collected around 5 wind farms at different stages of development (from pre-application through to five years of operation). Data from Passive Acoustic Monitoring, telemetry, hydroacoustic surveys, baited remote underwater (stereo) video monitoring and bomb calorimetry are being used to inform how the presence of turbine affects the biomass of key fish species (and their energy content as prey for predators), fish and higher trophic level predators and outline plans for the remaining two years on the project as we integrated findings to improve cumulative assessment tools (and ensure translation of robust science into evidence to inform decision-making).
These outputs are designed to improve the evidence base to help evaluate the effects of OWF development on key receptors, de-risk the permitting process (where the evidence base supports this) and to help increase stakeholder confidence in the magnitude of cumulative effects. We intend that the outputs of the PrePARED project will also help support improved marine spatial planning and colocation of industries (e.g., offshore wind, shipping, fisheries).

Abstract 4: **PREDATOR-PREY INTERACTIONS AT OPERATING OFFSHORE WINDFARMS**

Authors: Aude Benhemma-Le Gall, Oihane Fernandez-Betelu, Paul M. Thompson, Matthew J. Witt, Sam Gierhart, Anthony W.J. Bicknell

Given the rapid growth of the offshore renewable energy industry, there is a need to better understand the potential ecological effects of operating offshore windfarms on marine wildlife to de-risk consenting and optimise future sustainable development. Whilst the impacts of offshore windfarm construction on marine mammals have been well studied, less is known about the distribution and behaviour of these predators and their prey at operating windfarms. As part of the PrePARED (Predators and Prey Around Renewable Energy Developments) project, this study investigates harbour porpoise (Phocoena phocoena) distribution and behaviour within and around two- and four-year old operating offshore windfarms in the Moray Firth (NE Scotland), in relation both to prey availability and vessel activity. In August 2022, Baited Remote Underwater Video (BRUV) systems and Passive Acoustic Monitoring (PAM) echolocation click detectors (CPODs) simultaneously collected data on predator and their prey communities across the two windfarms, close to turbine jackets (< 50 m), and at reference sites, both within and outside windfarms. Harbour porpoise acoustic detections and buzzing activity were used to investigate variations in occurrence and foraging behaviour. As porpoises are likely to respond to vessel disturbance, we used AIS vessel-tracking data to characterise levels of vessel activity within a 3 km buffer around each PAM site. We focused our analyses on the two most abundant fish species groups recorded with the BRUV systems; flatfish spp. (Limanda limanda and Platichtys flesus) and haddock (Melanogrammus aeglefinus). Harbour porpoise occurrence was significantly higher outside the windfarms, but no differences were detected within the windfarms between the sites close to structures vs those at reference locations. Furthermore, whilst porpoise occurrence increased with flatfish abundance, occurrence decreased under higher levels of vessel intensity. These preliminary findings suggest that the distribution of top predators, such as harbour porpoises, may be driven by direct disturbance from vessels routinely present at operating windfarms sites and indirectly by localised changes in prey availability. As our study develops, we will provide more comprehensive evidence-based results and insights that will help predict the long-term cumulative effects of commissioned windfarms and inform effective decision-making towards sustainable offshore wind energy development.
Keywords: offshore windfarm, passive acoustic monitoring, BRUV, predator-prey, anthropogenic activities

Abstract 5: **USING MOVEMENT MODELLING TO UNDERSTAND PREDATOR-PREY INTERACTIONS AT MULTIPLE SCALES**

Authors: Katherine Whyte, Ana Couto, Charlie Cooper, James Dunning, Charlotte Reagan, Thomas Cornulier, Adam Butler, Thomas Regnier, Kate Searle, Francis Daunt, Esther Jones

Interactions between predators and their prey occur at multiple spatial, temporal, and ecological scales. Understanding and quantifying these interactions is important for (1) improving our ecological knowledge of the drivers of animal movement, and (2) increasing our ability to robustly predict how animals will respond to human alterations to the environment.

As part of the PrePARED (Predators and Prey Around Renewable Energy Developments) project concurrent data are being collected on marine top predators and their prey, but there are statistical challenges in using these data to understand predator-prey relationships. First, determining an appropriate spatiotemporal scale at which to analyse these interactions, accounting for data resolution and the scales at which these interactions can meaningfully be examined ecologically. Second, accounting for mismatches in space and/or time since, in practice, exact overlap between predator movements and prey data collection occurs only occasionally. Third, considering how to maximise the benefits of the different spatiotemporal scales of prey data that are available: regional prey surfaces, area-specific prey surfaces, and individual prey school detections.

Here, we discuss the challenges and opportunities of using movement modelling to examine predator-prey interactions, using GPS tracks of individual seabirds (e.g. kittiwakes, auks) and contemporaneous data on fish distributions (e.g. sandeel, clupeids) from dedicated acoustic and trawl surveys. In particular, we consider how we can incorporate prey data directly into Hidden Markov Models describing the movements and at-sea behaviours of different seabird species, allowing us to improve our understanding of the mechanisms driving predator-prey interactions. We show how we are using this work to (1) further understand the drivers of seabird movements and foraging behaviour, (2) develop approaches that account for the variable spatial and temporal scales of ecological processes and observations, and (3) ultimately improve our ability to predict seabird movements in an environment altered by anthropogenic activities.

Abstract 6: **UNDERSTANDING PREDATOR-PREY INTERACTIONS IN THE CONTEXT OF OFFSHORE WIND FARM DEVELOPMENT**

Authors: Katherine Whyte, Ana Couto, Christopher Pollock, Charlie Cooper, James Dunning, Phil Bouchet, Thomas Cornulier, Adam Butler, Thomas Regnier, Kate Searle, Francis Daunt, Esther Jones

To predict cumulative impacts of offshore wind developments (OWD) on seabirds, a key component is understanding how seabird foraging may be altered (e.g. via displacement of seabirds and/or redistribution of prey); however, understanding the mechanisms behind these possible impacts is currently limited. The PrePARED project collects concurrent data on seabirds (GPS tracks) and their prey (dedicated acoustic and trawl surveys) in an area of OWD. Predator-prey interactions are being examined to characterise these relationships, examine how they may alter in the presence of OWD, and incorporate this new quantitative information into impact assessment tools (e.g. SeabORD). We show how we are (1) collecting new evidence on predator-prey interactions, (2) improving understanding of the drivers of seabird movements and foraging behaviour, (3) developing approaches that account for variable spatial, temporal, and ecological scales, and (4) ultimately improving our ability to predict seabird movements as we transition towards net zero.

12. TABLE 5 – PrePARED Meetings 2024

When	Date	Name of Meeting	Who Attended
2024 Q1	10/01/2024	PrePARED: Workstream C meeting	Workstream C
2024 Q1	11/01/2024	PrePARED: Workstream A meeting	Workstream A
2024 Q1	11/01/2024	PrePARED: Workstream B meeting	Workstream B
2024 Q1	12/01/2024	PrePARED AKEM Planning	Management Group
2024 Q1	23/01/2024	PrePARED PIP-022 Marine Scotland Directorate – Q4 Progress Meeting	OWEC & Project Management team
2024 Q1	31/01/2024	PrePARED Management Group	Management Group
2024 Q1	01/02/2024	PrePARED AKEM	Project Management team and SG offshore wind planning/consenting.
2024 Q1	05/02/2024	PrePARED: Workstream A meeting	Workstream A
2024 Q1	14/02/2024	PrePARED AKEM Planning	Management Group
2024 Q1	19/02/2024	PrePARED: Workstream A meeting	Workstream A
2024 Q1	21/02/2024	PrePARED AKEM Planning	Management Group & Speakers
2024 Q1	27/02/2024	PrePARED Annual Knowledge Exchange Meeting (AKEM)	Project Team, PAG and Stakeholders
2024 Q1	28/02/2024	PrePARED Annual Knowledge Exchange Meeting (AKEM) – Day 2	Project Team and PAG
2024 Q1	18/03/2024	PrePARED: Workstream C meeting	Workstream C
2024 Q1	20/03/2024	PrePARED Management Group	Management Group
2024 Q1	27/03/2024	PrePARED Q1 Progress Meeting	All project team
2024 Q2	22/04/2024	PrePARED PIP-022 Quarterly Progress Meeting (Jan-Mar 24)	OWEC & Project Management team
2024 Q2	24/04/2024	PrePARED Management Group	Management Group
2024 Q2	30/04/2024	PrePARED: Workstream A meeting	Workstream A
2024 Q2	01/05/2024	Project Impact Review	OWEC & Project Management team
2024 Q2	01/05/2024	PrePARED: Workstream C meeting	Workstream C
2024 Q2	29/05/2024	PrePARED Management Group	Management Group
2024 Q2	04/06/2024	PrePARED: Workstream A meeting	Workstream A
2024 Q2	11/06/2024	PrePARED Management Group	Management Group, Task Leads and John Mitchell (MDE)
2024 Q2	13/06/2024	PrePARED: Workstream B meeting	Workstream B
2024 Q2	20/06/2024	PrePARED Q2 Progress Meeting	Project Team and PAG
2024 Q3	09/07/2024	PrePARED Catch Up	Project Management Team and Rachael Mills (OWEC)
2024 Q3	23/07/2024	PIP022 - PrePARED - Quarterly Progress Meeting (Apr-June)	OWEC & Project Management team
2024 Q3	31/07/2024	U.S. GAO's Study of Offshore Wind Energy Development – providing recommendations r.e. potential impacts.	Paul Thompson and U.S. Government Accountability Office

2024 Q3	07/08/2024	Moray West: Harbour porpoise response to monopile installation without NAS	Paul Thompson, SNSOWF UWN
2024 Q3	27/08/2024	PrePARED: Workstream C meeting	Workstream C
2024 Q3	28/08/2024	PrePARED Management Group	Management Group
2024 Q3	18/09/2024	PrePARED Management Group	Management Group
2024 Q3	26/09/2024	PrePARED Q3 Progress Meeting	Project Team
2024 Q3	27/09/2024	PrePARED EDR Report Review	Paul Thompson, P2G OWIC, Developers
2024 Q4	01/10/2024	PrePARED Workstream A	Workstream A
2024 Q4	03/10/2024	PrePARED Workstream B	Workstream B
2024 Q4	30/10/2024	PrePARED Management Group	Management Group
2024 Q4	06/11/2024	PIP022 - PrePARED - Quarterly Progress Meeting (July-Sept)	OWEC & Project Management team
2024 Q4	27/11/2024	PrePARED Management Group	Management Group
2024 Q4	27/11/2024	PrePARED Workstream A	Workstream A
2024 Q4	28/11/2024	PrePARED Workstream B	Workstream B
2024 Q4	10/12/2024	PrePARED Q4 Progress Meeting	Project Team and PAG
2024 Q4	17/12/2024	PrePARED Workstream C	Workstream C
2024 Q4	18/12/2024	PrePARED Management Group	Management Group

13. TABLE 6 – PrePARED Social Media 2024

Social Channel	Posted by	Date	Link
LinkedIn & X	SGMD	15/01/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7152704870758694913-GYFH?utm_source=share&utm_medium=member_desktop X: https://x.com/scotgovmarine/status/1746938371979592003?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn & X	SGMD	05/02/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7160228166916038659-JH0O?utm_source=share&utm_medium=member_desktop X: https://x.com/scotgovmarine/status/1754463769852322098?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn & X	SGMD	08/02/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7161332610013528065-nd4W?utm_source=share&utm_medium=member_desktop X: https://x.com/scotgovmarine/status/1755580564294214100?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	SGMD	16/02/2024	https://www.linkedin.com/posts/marine-directorate_last-chance-to-get-your-hands-on-a-ticket-activity-7164247917392818177-G_7Q?utm_source=share&utm_medium=member_desktop
LinkedIn	Stakeholder	27/02/2024	https://www.linkedin.com/posts/saikat92_preparedproject-knowledgeexchange-renewableenergy-activity-7168266781986435072-ZBjT?utm_source=share&utm_medium=member_desktop
LinkedIn	Stakeholder	27/02/2024	https://www.linkedin.com/posts/saikat92_highlights-part-prepared-activity-7169317166847098880-GYQ7?utm_source=share&utm_medium=member_desktop
LinkedIn & X	SGMD	28/02/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7168588939342110721-tegy?utm_source=share&utm_medium=member_desktop X: https://x.com/scotgovmarine/status/1762822437295526020?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	Kat Route-Stephens (PAG)	28/02/2024	https://www.linkedin.com/posts/kat-route-stephens-29829776_preparedproject-prepared-owec-activity-7168696620585332736-8ic5?utm_source=share&utm_medium=member_desktop
LinkedIn	Lauren Donachie	29/02/2024	https://www.linkedin.com/posts/laurendonachie_preparedproject-offshorewind-renewableenergy-activity-7168921058689945600-ng8M?utm_source=share&utm_medium=member_desktop
X	BioSS	01/03/2024	https://x.com/biosscotland/status/1763508784247292017?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	BioSS	05/03/2024	https://www.linkedin.com/posts/biomathematics-and-statistics-scotland_preparedproject-activity-7170746585750953984-CSO3?utm_source=share&utm_medium=member_desktop
LinkedIn & X	SGMD	07/03/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7171447238152413184-P6bP?utm_source=share&utm_medium=member_desktop X: https://x.com/scotgovmarine/status/1765683098589515798?s=46&t=MiEsr-oRRKuiWKYMDRephw
X	SGMD	02/04/2024	https://x.com/scotgovmarine/status/1775081017310580742?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	SGMD	22/04/2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7186688005577842688-dWYY?utm_source=share&utm_medium=member_desktop

LinkedIn & X	BioSS	25/04/2024	LinkedIn: https://www.linkedin.com/posts/biomathematics-and-statistics-scotland_preparedproject-offshorewind-activity-7189189145024495617-GPnw?utm_source=share&utm_medium=member_desktop X: https://x.com/biosscotland/status/1783422659792965815?s=46&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	SGMD	26/04/2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7189584460185526272-IXOK?utm_source=share&utm_medium=member_desktop
LinkedIn & X	SGMD	10/07/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7216778590095364096-EmER?utm_source=share&utm_medium=member_desktop X: https://x.com/ScotGovMarine/status/1811011807114342806
X	Katherine Whyte	29/07/2024	https://x.com/katey_whyte/status/1817851647697043646?s=46
X	SGMD	08/08/2024	https://x.com/scotgovmarine/status/1821552479315558830?s=46
LinkedIn	Cormac Booth	August 2024	https://www.linkedin.com/posts/cormacbooth_sots-bioss-activity-7219365698731425792-_dZR?utm_source=share&utm_medium=member_desktop
LinkedIn	Paul Thompson	September 2024	https://www.linkedin.com/posts/paul-thompson-9369a0182_preparedproject-activity-7234155004918452225-Sm1A?utm_source=share&utm_medium=member_desktop
LinkedIn	SGMD	September 2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7227320640985337856-ysy8?utm_source=share&utm_medium=member_desktop
LinkedIn & X	SGMD	20/09/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7242864759094530049-268A?utm_source=share&utm_medium=member_desktop X: Scot Gov Marine (@ScotGovMarine)
LinkedIn	Paul Thompson	September 2024	https://www.linkedin.com/posts/paul-thompson-9369a0182_preparedproject-activity-7235261886932393986-MeKT?utm_source=share&utm_medium=member_desktop
LinkedIn	SGMD	September 2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7229799484065497090-ZyRg?utm_source=share&utm_medium=member_desktop
LinkedIn	SGMD	September 2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7236674918321455106-Axrk?utm_source=share&utm_medium=member_desktop
LinkedIn	Lauren Donachie	September 2024	https://www.linkedin.com/posts/laurendonachie_preparedproject-activity-7241800212527087617-uyQg?utm_source=share&utm_medium=member_desktop
LinkedIn	SGMD	October 2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7247920851801489409-mMWg?utm_source=share&utm_medium=member_desktop
X	Katherine Whyte	24/10/2024	https://x.com/katey_whyte/status/1849426875635876243?s=46
X	Christopher Pollock	24/10/2024	https://x.com/tony_auk/status/1849410770389422418?s=46

LinkedIn	Cormac Booth	24/10/2024	https://www.linkedin.com/posts/cormacbooth_output-report-005-transferability-and-evidence-bridges-activity-7255168559394279424-Lxqv?utm_source=share&utm_medium=member_desktop
LinkedIn & X	SGMD	25/10/2024	LinkedIn: https://www.linkedin.com/posts/marine-directorate_harbour-seal-takes-an-interest-in-a-baited-activity-7255513719831506944-km2w?utm_source=share&utm_medium=member_desktop X: https://x.com/scotgovmarine/status/1849748645974786179?s=46
LinkedIn & X	SMRU Consulting	26/11/2024	X: https://x.com/smru_consulting/status/1861389410329145844?s=46
LinkedIn & X	SGMD	02/12/2024	LinkedIn: https://www.linkedin.com/feed/update/urn:li:activity:7269364541250015233 X: https://x.com/ScotGovMarine/status/1863599528026185815
LinkedIn	SGMD	16/12/2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-renewableenergy-offshorewind-activity-7273333047087796224-_Xww?utm_source=share&utm_medium=member_desktop
LinkedIn	SGMD	17/12/2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-preparedproject-renewableenergy-activity-7274358864865644544-H3-l?utm_source=share&utm_medium=member_desktop
LinkedIn	SGMD	20/12/2024	https://www.linkedin.com/posts/marine-directorate_preparedproject-preparedproject-renewableenergy-activity-7275812172855681024-bRwN?utm_source=share&utm_medium=member_desktop

14. TABLE 7 – PrePARED Recruitment 2024

Host Organisation	Job Title	Start Date	End Date	Appointee Name
BioSS	Senior Statistician	16/04/24	Permanent	Phil Bouchet
SMRUc/SMRU	Technician	October 2024	September 2025	Laura Oller Lopez

15. TABLE 8 – PAG Engagement

Date	Contact	Action
08/01/2024	Reminder to register for 2024 Annual Knowledge Exchange Meeting	Email
07/02/2024	Request for comments on PrePARED 2023 Annual Report	Annual Report
27/02/2024	Annual Knowledge Exchange Meeting (AKEM)	Meeting
28/02/2024	PAG annual meeting around AKEM	Meeting
21/03/2024	Creation of PAG Membership document	PDF
24/04/2024	Invitation for PAG to join Q2 and Q4 progress meetings	Meeting
25/04/2024	Highlighting release of 2 PrePARED reports	Outputs
01/05/2024	Q1 progress report	Email
03/06/2024	AKEM24 PrePARED Report	Output
20/06/2024	PAG attended PrePARED Q2 Progress Meeting	Meeting
21/06/2024	PAG provided with Q2 Progress Meeting slidedecks and minutes	PDFs
12/07/2024	Report: Task 4.3 Monopile EDRs – request to review and feedback	Output
13/08/2024	Release of Report 004 and summary – Porpoise responses to monopiles EDR	Output
14/10/2024	PrePARED Update email including Q3 progress report and invite to Q4 progress meeting	Email
28/10/2024	Release of Report 005 – transferability and evidence bridges	Output
06/11/2024	Request to some PAG members to review Change Request relating to Task 2.3	Email
28/11/2024	Invitation to PAG to join Q1 Progress/PAG meeting to discuss annual report and 2025 plans.	Email
09/12/2024	Report: Task 6.3 Habitat Similarly Assessment – Request to review and feedback	Output
10/12/2024	PAG attended PrePARED Q4 Progress Meeting	Meeting

16. TABLE 9 – 2024 Target Achievement

Result	Description	2024	2024	From project start
Completed	A piece of work that is fully completed	49	36%	48%
On Target	An ongoing piece of work with partial running monitoring targets that have been met	35	26%	14%
Delayed	A piece of work that has been delayed due to operational reasons. Mitigating actions are given in the main report.	17	13%	6%
Failed	A piece of work that has not been carried out due to various operational reasons. Details and mitigating actions in main report.	0	0%	1%
No Target	No targets were set for this quarter as the Task is either completed or pending a future date.	33	25%	31%
	Total	134		

***Workstream A - Workpackage 1* - Changes in fish communities with OWF development in the Forth and Tay**

	Broadscale fish response to OWF in the Forth (Dr Thomas Regnier, SGMD)		
Task 1.1	2022 Q1 Targets	Identify all data sources	**Completed**
		Initiate the processing of raw acoustic data	**Completed**
	2022 Q2 Targets	Produce a map of point abundance per prey species	**Completed**
		Prepare fisheries acoustic/ seabird-at-sea survey	**Completed**
		Design surveys based on previous studies and development site conditions	**Completed**
	2022 Q3 Targets	Conduct fisheries acoustic survey/ seabird-at-sea survey (mid July)	**Completed**
		Initiate laboratory work (otolith analyses, PSA analyses. Subject to laboratory availability)	**Completed**
		Initiate post processing of acoustic signal and trawl data analyses	**Completed**
	2022 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects	**Completed**
		Completion of otolith analyses	**Completed**
		Additional target: Large scale sandeel survey	**Completed**
	2023 Q1 Targets	Produce a map of sandeel point abundance in the sand per age class (from Grab and dredge)	**Completed**
		Broadscale prey fields from acoustic transects (pelagic prey)	**Completed**
		Completion of PSA analyses	**Method Changed**
	2023 Q2 Targets	Produce a map of point habitat characteristics (from ~~PSA~~ **RoxAnn**)	**Completed**
		Prepare fisheries acoustic/ seabird-at-sea survey.	**Completed**
		Design surveys based on previous studies and development site conditions.	**Completed**
	2023 Q3 Targets	Conduct fisheries acoustic survey/ seabird-at-sea survey: (mid July).	**Completed**

		Initiate laboratory work (~~otolith analyses~~ length-frequency analyses, ~~PSA~~ **RoxAnn** analyses (subject to laboratory availability)).	**Completed**
		Initiate post processing of acoustic signal and trawl data analyses.	**Completed**
	2023 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects.	**Completed**
		Completion of ~~otolith analyses~~ length-frequency analyses.	**Completed**
	2024 Q1 Targets	Produce a map of sandeel point abundance in the sand per age class (from Grab and dredge)	**Completed**
		Broadscale prey fields from acoustic transects (pelagic prey)	**Completed**
		Completion of RoxAnn analyses	**Completed**
	2024 Q2 Targets	Produce a map of point habitat characteristics (from RoxAnn)	**Completed**
		Prepare fisheries acoustic/ seabird-at-sea survey: Design surveys based on previous studies and development site conditions	**Completed**
	2024 Q3 Targets	Feedback on fisheries acoustic survey/ seabird-at-sea survey: (June-July)	**Completed**
		Initiate laboratory work (otolith analyses, RoxAnn analyses (subject to laboratory availability))	**Completed**
		Initiate post processing of acoustic signal and trawl data analyses	**Completed**
	2024 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects	**Completed**
		Completion otolith analyses	**Delayed to Q1 2025**
Task 1.2	**Finescale fish response to OWF in Forth (Dr Thomas Regnier, SGMD)**		
	2022 Q1 & Q2 Targets	No Targets	**No Target**
	2022 Q3 Targets	Conduct BRUV/Fish trap surveys in the Forth and Tay	**Completed**
		Design surveys considering development site conditions	**Completed**
		Completion of surveys	**Completed**
		Initiate analyses of SBRUV data	**Completed**
		Initiate grab data analyses (PSA)	**Method Changed**
	2022 Q4 Targets	Completion of PSA analyses	**Method Changed**
	2023 Q1 Targets	Process BRUV and AI camera video footage from 2022 camera surveys.	**Completed**
		Completion of video processing from surveys.	**Completed**
	2023 Q2 Targets	Completion of 2022 analysis.	**Completed**
		Map fish (predator) abundance from SBRUV/Traps.	**Completed**
	2023 Q3 Targets	Conduct BRUV/Fish trap surveys in the Forth and Tay.	**Completed**
		Design surveys considering development site conditions.	**Completed**
		Completion of surveys.	**Completed**
		Initiate analyses of SBRUV data.	**Completed**
		~~Initiate grab data analyses (PSA)~~. **RoxAnn analyses**	**Completed**

	2023 Q4 Targets	~~Completion of PSA analyses~~. **Completion of RoxAnn analyses**	**Completed**
	2024 Q1 Targets	Process BRUV and AI camera video footage from 2022 camera surveys	**Completed**
		Completion of video processing from surveys	**Completed**
	2024 Q2 Targets	Completion of 2023 analysis	**Completed**
		Map fish (prey) abundance from SBRUV/Traps	**Completed**
	2024 Q3 Targets	Conduct BRUV/Fish trap surveys in the Forth and Tay: Design surveys considering development site conditions	**Completed**
		Completion of surveys	**Completed**
		Initiate analyses of SBRUV data	**Completed**
		Initiate RoxAnn analyses	**Completed**
	2024 Q4 Targets	Completion of RoxAnn analyses	**On Target**

***Workstream A - Workpackage 2* - Characterising seabird and prey distribution and movements in relation to OWF development in the Forth and Tay**

Task 2.1	**Seabird spatial distribution models in Forth (Dr Esther Jones, BioSS)**		
	2022 Q1 Targets	Review existing prey data	**Completed**
	2022 Q2 Targets	Process seabird GPS data	**Delayed to 2025**
		Process environmental data	**Delayed to 2025**
	2022 Q3 Targets	Process seabird GPS data	**Delayed to 2025**
		Process environmental data	**Delayed to 2025**
	2022 Q4 Targets	Begin developing analytical framework for distribution modelling	**Completed**
	2023 Q1 Targets	Develop working code for distribution modelling.	**On Target**
	2023 Q2 Targets	Begin processing prey data from Task 1.1 and 1.2.	**On Target**
	2023 Q3 Targets	Integrate prey data into distribution models.	**Delayed to 2025**
	2023 Q4 Targets	Working distribution models using prey data from Forth-Tay.	**Delayed to 2025**
	2024 Q1 Targets	Working distribution models using the sandeels model.	**Completed**
		Seabird spatial distributions and uncertainty for selected species within Forth-Tay region	**Completed**
	2024 Q2 Targets	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	**On Target**
	2024 Q3 Targets	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	**On Target**
	2024 Q4 Targets	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	**Delayed to 2025**
		Draft manuscript on spatial modelling methods	**Delayed to 2025**
Task 2.2	**Seabird movement models in the Forth (Dr Esther Jones, BioSS)**		
		No 2022 Targets	**No Targets**
		No 2023 Q1, Q2 or Q3 Targets	**No Targets**
	2023 Q4 Targets	Initial development of movement modelling framework	**Completed**

	2024 Q1 Targets	Working code for movement modelling framework	**Completed**
	2024 Q2 Targets	Applying movement models to Forth and Tay prey data collected within project	**Delayed to 2025**
	2024 Q3 Targets	Applying movement models to Forth and Tay prey data collected within project	**Delayed to 2025**
	2024 Q4 Targets	Applying movement models to Forth and Tay prey data collected within project	**Delayed to 2025**
Task 2.3	**Simulating realistic foraging tracks in IBMs (Dr Katherine Whyte, BioSS and Dr Christopher Pollock, UKCEH)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
		No 2024 Q1 Targets	**No Targets**
	2024 Q2 Targets	Identify and develop framework for movement model structure and outputs to use in IBMs	**Completed**
	2024 Q3 Targets	Identify and develop framework for movement model structure and outputs to use in IBMs.	**Completed**
		Producing behavioural classifications from movement models	**Completed**
	2024 Q4 Targets	Identify and develop framework for movement model structure and outputs to use in IBMs.	**Completed**
		Producing behavioural classifications from movement models	**Completed**

Workstream B - Workpackage 3 **- Changes in fish communities with OWF construction and operation in the Moray Firth**

Task 3.1	**Large-scale fish distribution in Moray (Dr Anthony Bicknell, UoE)**		
	2022 Q1 Targets	Collate existing fisheries biomass data from Moray Firth studies	**Completed**
	2022 Q2 Targets	Completion of data acquisition for existing fisheries biomass data from Moray Firth studies	**Completed**
		Prepare fisheries acoustic survey	**Completed**
		Design surveys based on previous studies and development site conditions	**Completed**
		Conduct fisheries acoustic survey (end of June)	**Completed**
		Conduct grab sample survey	**Failed**
	2022 Q3 Targets	BRUV and unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
		Conduct BRUV camera surveys in Moray Firth - Completion of surveys.	**Completed**
		Conduct unbaited camera surveys in Moray Firth - Completion of surveys.	**Delayed to 2024**
	2022 Q4 Targets	Completion of laboratory analyses of grab samples (see Section 3 for mitigation actions)	**Failed**
	2023 Q1 Targets	Completion of fisheries acoustic and trawl data processing for 2022 survey.	**Completed**
		Process BRUV camera video footage from 2022 camera surveys.	**Completed**
		Completion of video processing from survey	**Completed**
	2023 Q2 Targets	Prepare fisheries acoustic survey	**Completed**
		Design surveys based on previous studies and development site conditions	**Completed**
		Conduct fisheries acoustic survey (end of June).	**Completed**
		Video footage data analysis and downstream provision:	**Completed**

		(a) Downstream provision for UoA predator models. (b) Completion of 2022 data analysis (relative fish diversity, abundance, biomass and composition)	
	2023 Q3 Targets	~~Laboratory analyses of grab samples (subject to lab availability).~~ **RoxAnn analyses**	**Completed**
		Post-processing of fisheries acoustic and trawl data.	**Completed**
	2023 Q4 Targets	~~Completion of laboratory analyses of grab samples (subject to lab availability).~~ **Now RoxAnn Analysis**	**Completed**
		Completion of post-processing of fisheries acoustic and trawl data for 2023 survey.	**Completed**
	2024 Q1 Targets	Completion of fisheries acoustic and trawl data processing	**Completed**
	2024 Q2 Targets	Prepare fisheries acoustic survey: Design surveys based on previous studies and development site conditions	**Completed**
		Conduct fisheries acoustic survey (end of June)	**Completed**
	2024 Q3 Targets	Conduct BRUV and AI (unbaited) camera surveys in Moray Firth: Design surveys considering development site conditions	**Completed**
	2024 Q4 Targets	Initiate post processing of acoustic signal, trawl and RoxAnn analyses from June survey	**On Target**
Task 3.2	**Fine-scale fish distribution in the Moray Firth (reef effects) (Dr Anthony Bicknell, UoE)**		
	2022 Q1 Targets	No 2022 Targets	**No Targets**
	2022 Q2 Targets	No 2022 Targets	**No Targets**
	2022 Q3 Targets	Conduct BRUV camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
	2022 Q3 Targets	Conduct unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Delayed to 2024**
	2022 Q4 Targets	Process BRUV video footage from camera surveys	**Completed**
	2023 Q1 Targets	Process BRUV camera video footage from 2022 camera surveys.	**Completed**
		Completion of video processing from surveys.	**Completed**
	2023 Q2 Targets	Video footage data analysis and downstream provision: (a) Downstream provision for UoA predator models. (b) Completion of 2022 data analysis (relative fish diversity, abundance, biomass and composition).	**Completed**
	2023 Q4 Targets	Process unbaited camera survey video footage.	**Delayed to 2024**
	2024 Q1 & Q2 Targets	No targets	**No Target**
	2024 Q3 Targets	Conduct BRUV and AI camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
	2024 Q4 Targets	Start processing BRUV and AI camera video footage from the 2024 camera surveys	**Completed**
Task 3.3	**Fish acoustic telemetry in the Moray Firth (Dr Matthew Witt, UoE)**		
	2022 Q1 Targets	Collate and review data on using fish telemetry for impact assessment	**Completed**
	2022 Q2 Targets	Deploy VEMCO acoustic receiver array and start tagging in Moray Firth	**Completed**
		Catch and tag gadoid fish in the Moray Firth	**Completed**
		Complete annual tagging	**Completed**
	2022 Q3 Targets	Process acoustic ping data	**Completed**

	2022 Q4 Targets	Service array and ping data download from VEMCO receivers.	**Completed**
		Complete 6-month data download	**Completed**
	2023 Q1 Targets	Service acoustic array and download ping data in the Moray Firth.	**Completed**
	2023 Q2 Targets	Catch and tag gadoid fish in the Moray Firth.	**Completed**
		Process acoustic ping data.	**Completed**
	2023 Q3 Targets	Service acoustic array and download ping data in the Moray Firth: (a) Completion of annual data download. (b) Completion of annual tagging	**Completed**
	2023 Q4 Targets	No Target	**No Target**
	2024 Q1 Targets	Process acoustic ping data	**Completed**
	2024 Q2 Targets	Catch and tag gadoid fish and service array in the Moray Firth: (a) Completion of annual tagging (b) Completion of 6-month data download	**Completed**
	2024 Q3 Targets	Process acoustic ping data	**Completed**
	2024 Q4 Targets	Service array in the Moray Firth.	**Delayed to 2024**

Workstream B - Workpackage 4 **- Improving understanding and modelling of marine mammal response to OWF development in the Moray Firth**

Task 4.1	**Drivers of broadscale marine mammal distribution in Moray (Prof. Paul Thompson UoA)**		
	2022 Q1 Targets	Collation of pre-construction Moray Firth predator data from digital aerial surveys, telemetry and PAM	**Completed**
	2022 Q2 Targets	Collation of prey and environmental co-variates	**Completed**
	2022 Q3 Targets	Internal project meeting to discuss modelling framework	**Completed**
	2022 Q4 Targets	Review of analyses for harbour porpoise distribution models	**Completed**
	2023 Q1 Targets	Review of analyses of seal distribution models.	**Completed**
	2023 Q2 Targets	Hold stakeholder workshop.	**Failed**
	2023 Q3 Targets	Completion of distribution modelling and draft report.	**Completed**
	2023 Q4 Targets	Deliver final report.	**Completed**
	2024 Q1 Targets	Finalise report on harbour porpoises and prey.	**Completed**
		Submit draft report on Moray Firth studies of harbour seal foraging in relation to sandeels	**Completed**
	2024 Q2 Targets	No target	**No Targets**
	2024 Q3 Targets	Finalise harbour seal report and explore transferability through Task 6.2	**Delayed to 2025**
	2024 Q4 Targets	No Target	**No Targets**
Task 4.2	**Finescale marine mammal distribution in response to OWF and prey fields in the Moray Firth (Dr Aude Benhemma-Le Gall, UoA)**		
	2022 Q1 Targets	Finalisation of the PAM array design and submission for marine licenses	**Completed**
	2022 Q2 Targets	Deployment of the PAM array	**Completed**

	2022 Q3 Targets	Plan retrieval and collate covariates data for all PAM sites	**Completed**
	2022 Q4 Targets	Recover PAM devices	**Completed**
	2023 Q1 Targets	Complete processing of PAM data.	**Completed**
	2023 Q2 Targets	Present interim results at stakeholder workshop to inform design of construction array.	**Completed**
	2023 Q3 Targets	Delivery of draft report.	**Completed**
	2023 Q4 Targets	Internal project meeting to discuss prey field results from 2023.	**Completed**
	2024 Q1 Targets	Finalise framework for incorporating prey data for analyses on reef effect	**Delayed to 2025**
	2024 Q2 Targets	Present preliminary results to key stakeholders at suitable event or online workshop	**Completed**
	2024 Q3 Targets	Deliver draft report on relationship between porpoises and prey around OWF	**Delayed to 2025**
	2024 Q4 Targets	Deliver final report on relationship between porpoises and prey around OWF	**Delayed to 2026**
Task 4.3	**Dose response curves in the Moray Firth (Prof. Paul Thompson, UoA)**		
	2022 Q1 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2022 Q2 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2022 Q3 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2022 Q4 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2023 Q1 Targets	Convene meeting to liaise with Moray West on construction schedule.	**Completed**
	2023 Q2 Targets	Finalise the design of construction PAM array.	**Completed**
	2023 Q3 Targets	Deploy the construction PAM array.	**Completed**
	2023 Q4 Targets	Initiate collation of engineering data from developers.	**Completed**
	2024 Q1 Targets	Recover PAM array deployed during initial construction phase at Moray West OWF	**Completed**
	2024 Q2 Targets	Process data from PAM array	**Completed**
		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.	**Completed**
	2024 Q3 Targets	Extract data on porpoise occurrence and foraging buzzes and liaise with industry to estimate received noise levels at each PAM location	**Delayed to 2025**
	2024 Q4 Targets	Complete dose-response analyses	**Delayed to 2025**
Task 4.4	**Fish nutritional value (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Preparatory lab work	**Completed**
	2022 Q2 Targets	Preparatory lab work	**Completed**
	2022 Q3 Targets	Initial processing of any available samples	**Completed**
	2022 Q4 Targets	Processing of summer 2022 prey samples	**Completed**
	2023 Q1 Targets	Process summer 2022 prey samples.	**Completed**
	2023 Q2 Targets	Summarise interim bomb calorimetry analyses	**Completed**
	2023 Q3 Targets	Initial processing of any available samples.	**Completed**
	2023 Q4 Targets	Processing of summer 2023 prey samples	**Completed**
	2024 Q1 Targets	Processing of summer 2023 prey samples	**On Target**

	2024 Q2 Targets	Analysis of PrePARED and Moray East fish samples	**On Target**
	2024 Q3 Targets	Analysis of PrePARED and Moray East fish samples	**On Target**
	2024 Q4 Targets	Processing of summer 2024 prey samples	**On Target**

***Workstream C - Workpackage 5* - Identifying generalities in fish and marine mammal response to OWF development**

Task 5.1	**Generalities in fish response to OWF (Dr Anthony Bicknell, UoE)**		
	2022	No 2022 Targets	**No Targets**
	2023	No 2023 Targets	**No Targets**
	2024 Q1, Q2, Q3	No Targets	**No Targets**
	2024 Q4 Targets	Collate and compare Moray Firth and Forth and Tay acoustic and camera footage processed data.	**On Target**
Task 5.2	**Generalities in harbour porpoise response to OWF (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Complete**
	2022 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Complete**
	2022 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Complete**
	2022 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Complete**
	2023 Q1 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Complete**
	2023 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Complete**
	2023 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Complete**
	2023 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Complete**
	2024 Q1 Targets	Processing of response and covariate data	**On Target**
		Preparation of manuscript on dose response sampling	**On Target**
	2024 Q2 Targets	Processing of response and covariate data	**On Target**
	2024 Q3 Targets	Final collation of PAM data and covariates	**On Target**
	2024 Q4 Targets	Complete the dose-response analyses	**On Target**

***Workstream C - Workpackage 6* - Assessment of minimum data requirements and survey design for predator-prey studies in other UK marine areas**

Task 6.1	**Minimum data requirements for seabird distribution and movement models (Dr Esther Jones, BioSS)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
	2024 Q1 Targets	Identify prey and environmental data that could be used in transferring model to wider North Sea region	**Complete**

	2024 Q2 Targets	Select and process prey and environmental data to be used in transferring model to wider North Sea region	**Complete**
	2024 Q3 Targets	Develop revised version of spatial distribution model that uses only variables that are available throughout North Sea region	**Delayed to Q1 2025**
	2024 Q4 Targets	Compare revised version of model against that derived using Forth-Tay prey data	**Delayed to Q3 2025**
Task 6.2	**Minimum data requirements for marine mammal distribution models (Prof. Paul Thompson, UoA)**		
	2022 Q1, Q2 & Q3 Targets	No Target	**No Target**
	2022 Q4 Targets	Quarterly meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters	**Completed**
	2023 Q1 Targets	Internal project meeting with CEH/BioSS to discuss progress on data collation and analyses.	**Completed**
	2023 Q2 Targets	Quarterly meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters.	**Under review**
	2023 Q3 Targets	Complete collation of digital aerial survey datasets for English waters.	**Target changed**
	2023 Q4 Targets	Decision on thinning the data approach (**Changed to "Meet with SMRUc to agree revised scope for work on harbour seal distribution")**	**Completed**
	2024 Q1 Targets	Identify key harbour seal tracking datasets available for assessing transferability of patterns observed in Moray Firth.	**Completed**
	2024 Q2 & Q3 Targets	No Target	**No Target**
	2024 Q4 Targets	Scope further simulations using data sets of different resolutions, and transferability, in relation to outputs from Task 4.1	**Delayed to 2025**
Task 6.3	**UK EEZ marine habitats similarity assessment for OWF sites (Dr Matthew Witt, UoE)**		
	2022	No 2022 Targets	**No Targets**
	2023 Q1, Q2 & Q3 Targets	No target	**No Targets**
	2023 Q4 Targets	Evaluate potential modelling approaches.	**Complete**
		Collate available data for biotic and abiotic variables to use in assessment	**Complete**
	2024 Q1 Targets	Perform habitat similarity assessment with suitable model	**Complete**
	2024 Q2 Targets	Write and produce final report	**Complete**
	2024 Q3 & Q4 Targets	No Targets	**No Targets**
Task 6.4	**Survey design for predator-prey studies (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1, Q2 & Q3 Targets	No Target	**No Target**
	2022 Q4 Targets	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	**Complete**

	2023 Q1 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Complete**
	2023 Q2 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Complete**
	2023 Q3 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Complete**
	2023 Q4 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Complete**
	2024 Q1 Target	Cross-ref with Task 6.3	**Complete**
		Preparation of manuscript on dose response sampling	**Delayed to Q1 2025**
	2024 Q2 Target	Cross-ref with 6.3	**Delayed to Q1 2025**
	2024 Q3 & Q4 Target	No Target	**No Target**

***Workstream C - Workpackage 7* - Development and application of impact assessment tools for cumulative impact assessment**

Task 7.1	**IPCoD and DEPONS integration of new data and testing (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 & Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**Complete**
	2022 Q4 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**Complete**
	2023 Q1 Targets	Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development.	**Complete**
	2023 Q2 Targets	Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**Complete**
	2023 Q3 Targets	Integration of project learning into latest DEPONS and iPCoD	**On track**
	2023 Q4 Targets	Assessment of how integration of PrePARED project outputs into populations models helps improve models.	**On track**
	2024 Q1 Targets	Assessment of how integration of PrePARED project outputs into populations models, helps improve models	**On track**
	2024 Q2 Targets	Assessment of how integration of PrePARED project outputs into populations models, helps improve models	**On track**
	2024 Q3 Targets	Assessment of how integration of PrePARED project outputs into populations models, helps improve models	**On track**
	2024 Q4 Targets	Delivery of the draft report (final report in Q2 2025)	**On track**
Task 7.2	**Adding biological realism to SeabORD and testing (Dr Kate Searle, UKCEH)**		
	2022 Q1 & Q2 Targets	No Target	**No Target**

	2022 Q3 Targets	Development of initial model parameterisation to simulate hypothesized redistribution of prey around OWFs.	**On Target**
	2022 Q4 Targets	Development of initial model parameterisation to work with sandeel suitability estimates	**On Target**
	2023 Q1 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**On Target**
	2023 Q2 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**On Target**
	2023 Q3 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**On Target**
	2023 Q4 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**On Target**
	2024 Q1 Targets	Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.	**On Target**
	2024 Q2 Targets	Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.	**On Target**
	2024 Q3 Targets	Initial development of simulated foraging tracks for exemplar species	**On Target**
	2024 Q4 Targets	Initial development of simulated foraging tracks for exemplar species	**On Target**
Task 7.3	**Testing and validating SeabORD in the FoF and at UK SPAs (Dr Kate Searle, UKCEH)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
		No 2024 Targets	**No Targets**
Task 7.4	**Integration of PrePARED findings for harbour porpoise Cumulative Impact Assessment (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Initial preparations for Cumulative Impact Assessment development	**Complete**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	Quarterly meetings to understand progress on CIA components	**Complete**
	2022 Q4 Targets	No target	**No Target**
	2023 Q1 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2023 Q2 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2023 Q3 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2023 Q4 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2024 Q1 Targets	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)	**Complete**
	2024 Q2 Targets	Development of CIA scenarios	**On Target**
	2024 Q3 Targets	Development of CIA scenarios	**On Target**
	2024 Q4 Targets	Updated CIA analyses	**On Target**
Task 7.5	**Integration of PrePARED findings for seabird Cumulative Impact Assessment (Dr Kate Searle, UKCEH)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
		No 2024 Targets	**No Targets**

***Workstream D - Workpackage 8* - Development of a dissemination roadmap**

Task 8.1	**Stakeholder and network analysis (Project Lead, SGMD)**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Completion/delivery of a stakeholder & network analysis report	**Completed**
	2023 Q1 Targets	Negotiate contract for the SNA	**Completed**
	2023 Q2 Targets	Allocate contract	**Completed**
	2023 Q3 Targets	Monitor contractor progress	**Completed**
	2023 Q4 Targets	Publish SNA	**Completed**
	2024	No Targets	**No Target**
Task 8.2	**Communications Plan (Project Lead, SGMD)**		
	2022 Q1, Q2 & Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Completion of PrePARED communications plan	**Completed**
	2023 Q1 Targets	Update draft plan	**Completed**
	2023 Q2 Targets	Finalise draft comms plan and disseminate	**Completed**
	2023 Q3 Targets	Implement Comms Plan	**Completed**
	2023 Q4 Targets	Implement Comms Plan	**Completed**
	2024 Q1 Targets	No target	**No target**
	2024 Q2 Targets	Review comms plan	**Completed**
	2024 Q3 Targets	No target	**No target**
	2024 Q4 Targets	Review comms plan	**Completed**

***Workstream D - Workpackage 9* - Dissemination activities**

Task 9.1	**Plan annual knowledge exchange workshops**		
	2022 Q1, Q2 & Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Plan Year 1 annual knowledge exchange workshop	**Completed**
	2023 Q1 Targets	Convene Year 1 KEM	**Completed**
	2023 Q2 Targets	No Target	**No Target**
	2023 Q3 Targets	Begin planning 2023 AKEM	**Completed**
	2023 Q4 Targets	Complete planning Year 2 AKEM	**Completed**
	2024 Q1 Targets	Host annual knowledge exchange meeting	**Completed**

	2024 Q2 Targets	No Target	**No Target**
	2024 Q3 Targets	Begin planning for AKEM 2025	**On Track**
	2024 Q4 Targets	Complete planning for AKEM 2025. Come to agreement on strategy for 2025 stakeholder engagement	**On Track**
Task 9.2	**Dissemination of project findings**		
	2022 Q1, Q2 & Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2023 Q1 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2023 Q2 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2023 Q3 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2023 Q4 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2024 Q1 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2024 Q2 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2024 Q3 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
	2024 Q4 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
Task 9.3	**Organise PrePARED project scientific symposium**		
		No 2022 targets	**No Targets**
		No 2023 targets	**No Targets**
		No 2024 targets	**No Targets**
Task 9.4	**Establish PrePARED website and social media**		
	2022 Q1 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2022 Q2 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2022 Q3 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2022 Q4 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2023 Q1 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2023 Q2 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2023 Q3 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2023 Q4 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2024 Q1 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2024 Q2 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2024 Q3 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2024 Q4 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**

17. TABLE 10 – PrePARED Numbers

2024 Q2	WSA-WP1	>100 hours of BRUV footage processed for presence, abundance and length of fish
2024 Q3	WSA-WP1	Fisheries acoustic data recorded along >1000 km of transects across the Forth and Tay region, 1 pelagic tow and 16 demersal tows were realised and a total of 16333 fish measured
2024 Q4	WSA-WP1	3 sandeel tows realised in NnG and 6 in Seagreen with only 1 sandeel caught and measured.
2024 Q4	WSB-WP4	860 bomb calorimetry runs have been completed as part of the project. 29 prey species analysed across sizes 7 – 58.2 cm. The PrePARED project has generated 430 new energetic density estimates.
2024 Q2	WSB – WP3	Fisheries acoustic data recorded along 510 km of transects across the Moray Firth OWF, 5 pelagic tows realised and 133 fish measured, 7 demersal tows realised and 906 fish measured
2024 Q2	WSB – WP3	15 cod, 2 whiting and 176 haddock tagged in the Moray Firth
2024 Q3	WSB – WP3	96 BRUV deployments at Beatrice operational wind farm turbines. 12 RUV (“Cuttlefish”, unbaited camera) 24-hour deployments at Beatrice operational wind farm turbines and reference sites.
2024 Q2 – Q4	WSB – WP3	84 acoustic receivers serviced in the Moray Firth
2024 Q1-Q2 (Q3)	WSB – WP4	Equipment from 62 (out of the 65 PAM sites deployed) were successfully recovered between end of December 2023 and April 2024. One of the three sites at which equipment was considered lost was found and retrieved in September 2024 (N total = 63)

18. TABLE 11 – Targets for 2025

Task lead	Task	Q1 - Targets 2025 Jan Feb Mar	Q2 - Targets 2025 Apr May Jun	Q3 - Targets 2025 Jul Aug Sep	Q4 - Targets 2025 Oct Nov Dec
Thomas Regnier	Task 1.1 Broadscale fish response to OWF in Forth	1) Produce a map of sandeel point abundance in the sand per age class; 2) Broadscale prey fields from acoustic transects (pelagic prey); 3) Completion of RoxAnn analyses	Produce a map of point habitat characteristics (from RoxAnn)	Final report - Delivery of draft report	Final report - Delivery of the final report
Thomas Regnier	Task 1.2 Finescale fish response to OWF in Forth	Process BRUV and AI camera video footage from 2022 camera surveys - completion of video processing from surveys	1) Completion of 2024 analysis; 2) Map fish (predator) abundance from SBRUV/Traps	Final report - Delivery of draft report	Final report - Delivery of the final report
Esther Jones	Task 2.1 Seabird spatial distribution models in Forth	1) Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data. 2) Draft manuscript on spatial modelling methods.	1) Begin incorporating all available prey data into distribution models. 2) Draft manuscript on spatial modelling methods.	1) Models and model outputs for seabird spatial distribution and uncertainty for each species within Forth-Tay region. 2) Draft manuscript on spatial modelling methods	1) Models and model outputs for seabird spatial distribution and uncertainty for each species within Forth-Tay region. 2) Draft manuscript on spatial modelling methods
Esther Jones	Task 2.2 Seabird movement models in Forth	Applying movement models to Forth and Tay prey data collected within project	1) Applying movement models to Forth and Tay prey data collected within project 2) Begin incorporating all available prey data into movement models	1) Applying movement models to Forth and Tay prey data collected within project 2) Begin incorporating all available prey data into movement models	Begin drafting manuscript for submission to peer-reviewed journal on movement modelling.
Katherine Whyte/ Christopher Pollock	Task 2.3 Simulating realistic foraging tracks in IBMs	Scope alternative movement model structures for generating IBM parameters.	Test different movement model structures on sample tracking data. Develop best practice guidelines for using movement models to generate IBM parameters.	Identify key parameters and data required for parameterising IBMs.	Develop framework for testing and validation of simulated v.s. real foraging tracks. Delivery of report.
Anthony Bicknell	Task 3.1 Large-scale fish distribution in Moray	Completion of fisheries acoustic and trawl data processing & downstream provision Process BRUV and AI camera video	Video footage data analysis and downstream provision	Final report - Delivery of draft report	Final report - Delivery of the final report

		footage from 2024 camera surveys - completion of video processing from surveys			
Anthony Bicknell	Task 3.2 Fine-scale fish distribution in Moray (reef effects)	Process BRUV and AI camera video footage from 2024 camera surveys - completion of video processing from surveys	Video footage data analysis and downstream provision	Delivery of draft research paper and narrated PowerPoint	Delivery of final research paper and narrated PowerPoint
Matthew Witt	Task 3.3 Fish acoustic telemetry in Moray	Process acoustic ping data	Retrieval of acoustic array and data download in the Moray Firth: 1. Completion of array removal. 2. Completion of final 6 month data download	Delivery of draft research paper and narrated PowerPoint	Delivery of final research paper and narrated PowerPoint
Paul Thompson	Task 4.1 Drivers of broadscale marine mammal distribution in Moray	Delivery of second report under the Task, highlighting how harbour seal foraging distribution is related to sandeel distribution			
Aude Benhemma -Le Gall	Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray	Continue PAM-BRUV extended analyses	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	Delivery of draft report	Delivery of final report
Paul Thompson	Task 4.3 Dose response curves in Moray	1) Dose-response analyses combining existing datasets from the three Moray Firth OWFs. 2) Develop additional report comparing observed responses of porpoises during Moray West Piling with EIA predictions [see PrePARED Outcomes-Impacts-Actions]	Delivery of draft dose-response report	Delivery of final dose-response report	
Cormac Booth	Task 4.4 Fish nutritional value	Processing of summer 2024 prey samples	Present output at stakeholder workshop	Delivery of draft report	Delivery of the final report
Anthony Bicknell	Task 5.1 Generalities in fish response to OWF	Collate and compare Moray Firth and Forth and Tay acoustic and camera footage processed data.	Evaluate similarities/dissimilarities between sites.	Final report - Delivery of draft report	Final report - Delivery of the final report

Cormac Booth	Task 5.2 Generalities in harbour porpoise response to OWF	Present results at stakeholder workshop; Delivery of draft report	Delivery of the final report		
Esther Jones	Task 6.1 Minimum data requirements for seabird distribution and movement models		Analysis to increase transferability using the sandeel (Langton et al) map: exploring variability over space and time	Analysis to increase transferability using the sandeel (Langton et al) map: exploring variability over space and time	Evaluation of benefits of local prey data when predicting spatial distribution of seabirds.
Paul Thompson	Task 6.2 Minimum data requirements for marine mammal distribution models	Review scope of this task in relation to progress on Task 4.1 and re-prioiritisation of additional outputs required under Tasks 4.3 to maximise wider UK impact	Complete analyses of data on English water data. Present output at stakeholder workshop	Delivery of draft report	Delivery of the final report
Matthew Witt	Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites	**COMPLETE**			
Cormac Booth	Task 6.4 Survey design for predator-prey studies		Delayed from Q3 2024 - Short report summarising how future surveys could be carried out		
Cormac Booth	Task 7.1 IPCoD and DEPONS integration of new data and testing		Delivery of the final report		
Kate Searle	Task 7.2 Adding biological realism to SeabORD and testing		Refinement of model parameterisation for redistribution of prey	Development of initial parameterisation to work with joint predator-prey maps	Collation of required input data for SeabORD, and determiniation of OWD scenarios to be run (with PSG)
Kate Searle	Task 7.3 Testing and validating SeabORD in the FoF and at UK SPAs	Analysis of local GPS tracking data to derive a seabird utilisation distribution for validation of joint predator-prey distribution predictions			Application of SeabORD using new predictive joint predator-prey distribution maps at Flamborough and Filey SPAs to demonstrate transferability and perform validation using local GPS tracking data for black-legged kittiwake.
Cormac Booth	Task 7.4 Integration of PrePARED findings for harbour porpoise CIA	Updated CIA analyses	Present output at stakeholder workshop	Delivery of draft report	Delivery of the final report
Kate Searle	Task 7.5 Integration of PrePARED findings for	Review article summarising and assessing the evidence arising from	Review article summarising and assessing the evidence arising	Literature review summarising relevant	Review article summarising and assessing the evidence arising

	seabird Cumulative Impact Assessment	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.	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.	approaches for performing cumulative impact assessments for seabirds and offshore wind	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.
PrePARED Project Manager	Task 8.1 Stakeholder and network analysis	**COMPLETE**			
PrePARED Project Manager	Task 8.2 Communications Plan		review comms plan		review comms plan
PrePARED Project Manager	Task 9.1 Annual knowledge exchange meeting	Complete AKEM alternative activity e.g. webinars	Complete AKEM alternative activity e.g. webinars	Complete AKEM alternative activity e.g. webinars	
PrePARED Project Manager	Task 9.2 Dissemination of project findings	Support for technical and non-technical dissemination of project findings	Support for technical and non-technical dissemination of project findings	Support for technical and non-technical dissemination of project findings	Support for technical and non-technical dissemination of project findings
PrePARED Project Manager	Task 9.3 PrePARED project scientific symposium	organise symposium	organise symposium	organise symposium	Hold symposium
PrePARED Project Manager	Task 9.4 website and social media	Maintain project website and social media comms	Maintain project website and social media comms	Maintain project website and social media comms	Maintain project website and social media comms

19. Glossary of acronyms used in the PrePARED project

AI	Artificial Intelligence. Used in some data logging systems to reduce data demands by automatically detecting objects or sounds of interest.
BioSS	Biomathematics and Statistics Scotland. BiOSS principal funder is the Scottish Government's Rural and Environment Science and Analytical Services Division (RESAS). BiOSS is one of the Scottish Environment, Food and Agriculture Research Institutes (SEFARI), working collectively to deliver a portfolio of strategic research and translational activities commissioned by RESAS.
BOWL	Beatrice Offshore Windfarm
BRUV	Baited Remote Underwater Video. This is a technique used to survey for fish presence and distribution without using towed nets or vessel based acoustics. Very useful near fixed structures such as wind turbines. A fixed frame is lowered to the seabed carrying a video camera and lights. Bait is deployed in the field of view of the camera, and then records are made of what species of fish arrive at the bait, of what size and how frequently. This data can be used to calculate fish density in an area.
CEF	Cumulative Effects Framework
CEH	UK Centre for Ecology and Hydrology. An independent, not-for-profit research institute, carrying out excellent environmental science across water, land and air. Our science makes a difference underpinning environmental policies, commercial innovation and conservation action all around the world.
CES	Crown Estate Scotland
CIA	Cumulative Impact Assessment
CPOD	A cetacean acoustic logger developed by https://www.chelonia.co.uk/. This is a fully automated passive acoustic monitoring device. In PrePARED, CPODs were used in the Moray Firth by the University of Aberdeen.
DEPONS	Disturbance Effects On The Harbour Porpoise Population In The North Sea. DEPONS is a model which simulates individual animals' movements, energetics and survival in realistic landscapes. It builds on existing models of porpoise movement and energetics, where home ranges and population dynamics emerge from the animals' competition for food, but introduces a direct relationship between noise and the extent to which simulated animals are deterred.
EcoWIND	A programme funding projects. The programme has funding of around £7.5 million, provided by The Crown Estate's Offshore Wind Evidence and Change Programme (OWEC) and by the Natural Environment Research Council (NERC). It is supported by Defra.

EcoWINGS	EcoWINGS is a project funded by the EcoWIND programme. The project will address three research questions which will focus on a region of the UK North Sea, with key species including black-legged kittiwake, common guillemot, razorbill, and Atlantic puffin.
FaT	Forth and Tay region
FoF	Firth of Forth
GitLab	GitLab and Git hub are free-to-use web-based archives of software and data that allows these to be shared freely with others.
GitHub	GitLab and Git hub are free-to-use web-based archives of software and data that allows these to be shared freely with others.
GPS	Global Positioning System
IBTS	International Bottom Trawl Surveys. An internationally coordinated set of surveys of demersal fish in the North Sea and west of Scotland.
IPCoD	Interim Population Consequences of Disturbance Model. This model, written in R, is a protocol for implementing an interim version of the Population Consequences of Disturbance (PCoD) approach for assessing and quantifying the potential consequences for marine mammal populations of any disturbance and/or injury that may result from offshore energy developments. It has been designed to use the kinds of information that are likely to be provided by developers in their Environmental Statements and Habitats Regulations Assessments.
MEOW	Moray East Offshore Windfarm
MF	Moray Firth
MFRAG-MM	Moray Firth Regional Advisory Group - Marine Mammals
MMMP	Marine Mammal Monitoring Programme
NnG	Neart na Gaoithe Offshore Wind Farm
O&M	Operations and Maintenance
OWEC	Offshore Wind Evidence and Change (OWEC) Programme
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PrePARED	Predators and Prey Around Renewable Energy Developments
PELAgIO	Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms. PELAgIO is a project funded by the EcoWIND programme. PELAgIO will support the development of evidence-based policy and marine management through interdisciplinary research that explores the consequences of offshore wind development on marine environments, marine wildlife, and wider ecosystem structures.

Q1	Quarter 1 (Jan, Feb, Mar)
Q2	Quarter 2 (Apr, May, Jun)
Q3	Quarter 3 (Jul, Aug, Sep)
Q4	Quarter 4 (Oct, Nov, Dec)
PSA	Particle Size Analysis
R	R is a statistical computer language. See https://www.geeksforgeeks.org/r-programming-language-introduction/
RA	Risk Assessment
RAMS	Risk Assessment Method Statement
RoxAnn	RoxAnn is a system to process acoustic data collected using a ship's echo sounder. It can identify aspects of the seabed such as roughness and density and convert these into estimates of habitat type.
RUV	Remote unbaited video, similar to BRUV, but no bait is used and soak durations of cameras on the seabed can last up to 24 hour
SeabORD	SeabORD is a method that can assess displacement and barrier effects from offshore renewables on seabirds, but is currently limited to four species during the chick-rearing season. This review examined ways to improve the SeabORD model including extending to the entire breeding season.
SGMD	Scottish Government Marine Directorate
SHE	Safety, Health and Environment
SMRU	Sea Mammal Research Unit
SMRUC	Sea Mammal Research Unit Consultancy Ltd.
SPA	Special Protection Area
TCE	The Crown Estate
UoA	University of Aberdeen
UoE	University of Exeter