ANNUAL REPORT 2023

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 to be 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 second year of the PrePARED project, a project jointly funded by The Crown Estate and Crown Estate Scotland. The report is broken down into the workstreams, work packages and tasks of the project. The report has been written by all PrePARED task leaders and edited by the PrePARED Project Management team. A table assesses progress against each quarterly target of the project using a traffic light 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 was missed. All missed targets have mitigation measures described in the text. Other tables summarise the field work undertaken within the project, the meetings held or attended, the presentations made, and the communications issued. Recruitment of new staff and students is also listed. A glossary at the end of the report explains all acronyms used. Section 3 presents a brief summary of the year for all tasks, while Section 4 goes into the details of project delivery.

3. Year Summary

Target Achievement

In Year 2 (2023) of PrePARED there were 29 tasks, leading to 109 individual quarterly targets. Of these targets, 98 (90%) were either completed or are ongoing and are on target for final delivery. Delivery of 7 targets (6%) has been delayed for various operational issues, described below. 4 targets (4%) were not achieved although mitigating actions are also described below.

Workstream A – Forth and Tay

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

Work realised in 2023 was partitioned between the analyses of fish distribution data collected by PrePARED in 2022 and the acquisition and processing of 2023 data. Databases comprising georeferenced fish abundance data from demersal tows and from the processing of the 2022 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). Particular effort was put into the estimation of uncertainty around the predicted distributions. This uncertainty will then be propagated to the seabird distributions to account for the error associated with the estimated ecological processes and the sampling error. The 2023 surveys were planned and executed and generated a large amount of useful data (see Table 9 Q4 WSA-WP1). In addition to the type of data collected in 2022, the 2023 broad-scale survey included a seabird at sea survey that generated useful contemporaneous data on seabird occupancy of the area.

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

Work realised in 2023 included the conclusion of the 2022 data analyses and the collection of new data. Video footage analyses from baited cameras deployed in 2022 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 2023 fine-scale surveys were planned and executed in 2023, provided a good amount of data (see Table Q3 WSA-WP1).

Across the surveys realised in 2023 (see Table 1), 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

In 2023 work focused on defining baseline data, processing of additional data and identification of data for transferability to continue development of spatial and movement modelling frameworks utilising prey data from Task 1.1 and 1.2. Modelling frameworks were developed using frequentist and Bayesian approaches with a manuscript currently being developed on the comparison between spatial modelling frameworks and efficient use with simulated predator and prey data.

Task 2.2: Seabird movement models in the Forth

Work started for this Task in Q4 2023 utilising acoustic data from Task 1.1 to develop movement analysis approaches on several scales: regional, area-specific and localised.

Workstream B – Moray Firth

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

Works realised in 2023 include the successful completion of an extended 2023 fisheries acoustic and trawl survey (Table 9 Q2 WSB-WP3), and the processing of acquired fish distribution data. These processed data 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

Work in 2023 focused on processing and analysing the baited underwater camera systems survey data collected in 2022. Fish species presence, abundance and individual lengths were extracted from the footage and converted into biomass for each species (Table 2 Q1 WSB WP3). These metrics have been used in generalised linear mixed effect models to test the effect of the wind farms turbines and/or other environmental variables on fine and large-scale fish distribution. The data has been made available to other project partners for use in predator models to assess whether any changes in fish (prey) distribution may influence 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 5 further fish (1 cod and 4 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. Initial processing and analysis of the acoustic ping data indicates 44 of the 60 total fish tagged (73%) have been detected, with 3 showing temperature and depth patterns indicative of being predated by a marine mammal.

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

Industry funded data collected in the Moray Firth were used to explore whether variation in the occurrence and foraging behaviour of harbour porpoises and harbour seals could be related to recent Marine Scotland outputs on the broadscale distribution of sandeels in UK waters. Analyses indicated these new data on distribution of this key prey species informed patterns of distribution and foraging behaviour within this region, with evidence of individual specialisation amongst seals, and potential changes in the importance of sandeels as prey for harbour porpoises when comparing baseline and post-construction passive acoustic monitoring (PAM) data.

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

We conducted analyses of PAM data collected in two operational wind farms and compared these with pre-construction baseline data. Porpoises were detected regularly, for between 6 to 18 hours a day, throughout operational wind farm sites in August 2022. Comparison with pre-construction baseline suggested that, on average, porpoise occurrence was slightly lower (~17%) in operational windfarms. Comparison of paired data collected adjacent to and between turbines found no evidence of reef effects, with slightly higher porpoise occurrence within corridors rather than at structures. These data confirm that porpoises were not displaced from the operational windfarms. While there was a slight decrease in occurrence within operational windfarms, this difference was small relative to inter-annual variation observed within the baseline data. The lack of a reef effect was unexpected based on work at older structures, and additional data collected in 2023 will be used to further investigate whether reef effects can be detected one year later.

Task 4.3: Dose response curves in the Moray Firth

PrePARED worked with industry partners to design and deploy a broadscale PAM array to detect responses of harbour porpoises to pile driving noise during the installation of XXL monopiles at the Moray West OWF. An array of 65 CPODs was deployed in August 2023 prior to construction, providing a gradient of exposure to piling noise both through both existing OWF and areas with no OWF present. The array remained in place through the installation of the first 18 piles, and the first of the moorings were successfully recovered in late Dec 2023. Recoveries will continue through Q1 2024.

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

In 2023, we processed samples from the Moray Firth and Firth of Forth PrePARED surveys (from 2022 and 2023). Over 400 bomb calorimetry runs have been carried out. The following species having been processed to date (across a variety of size

classes): mackerel, herring, cod, sprat, viviparous eelpout, bull-rout, lemon sole, long rough dab, flounder, whiting, common dab, grey gurnard. As of the end of 2023, the PrePARED project has generated 163 new energetic density estimates (for different species and size classes). Many of these species have not had energetic density (i.e. energy per g of wet tissue), so these analyses represent a step change in knowledge.

The analysis of the PrePARED samples will continue into 2024. Additionally, we are developing resourcing solutions to support analysis through 2024-2026 and engaging with PrePARED partners on sampling. We are in discussion with Moray East OWF developers regarding obtaining post-construction survey fish samples to help estimate changes in foodscapes between pre-construction (2019) and post-construction (2024).

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

This task has not yet begun.

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

In 2023, we have continued refining 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 internal knowledge exchange meetings to present the results and discuss their implications for future studies. Preparation of a draft manuscript will continue into early 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 6.4).

Task 6.1: Minimum data requirements for marine mammal distribution models

Analyses of harbour seal tracking data under Task 4.1 revealed new evidence of individual variation in foraging activity within areas of high predicted sandeel density. If individuals in other regions specialize on different prey or habitats, variation in sample size across tracking studies may constrain regional comparison of habitat use and distribution at sea. As a result of these findings, work within Task 6.1 is therefore being re-focused upon harbour seal tracking data sets, extending collaboration with PrePARED partners at the University of St Andrews to explore both minimum data requirements for distribution models and transferability of these findings to other parts of the North Sea

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

Work has continued engaging with the UoExeter team to align with Task 6.3. Data on offshore wind farms around the North Sea has been expanded and plotting is

underway in GIS. Meetings are planned for Q1 '24 with UoExeter 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. This will be further advanced in 2024 – considering the bang for buck and to help identify sites for sampling in Wales and England to maximise transferability of results from PrePARED.

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. This work likely will occur in 2024-2025 due to developments of the DEPONS model coming out in late Q4 2023 and resourcing changes required for Aarhus and Aberdeen. These instances have resulted in unforeseen delays on this task in 2023.

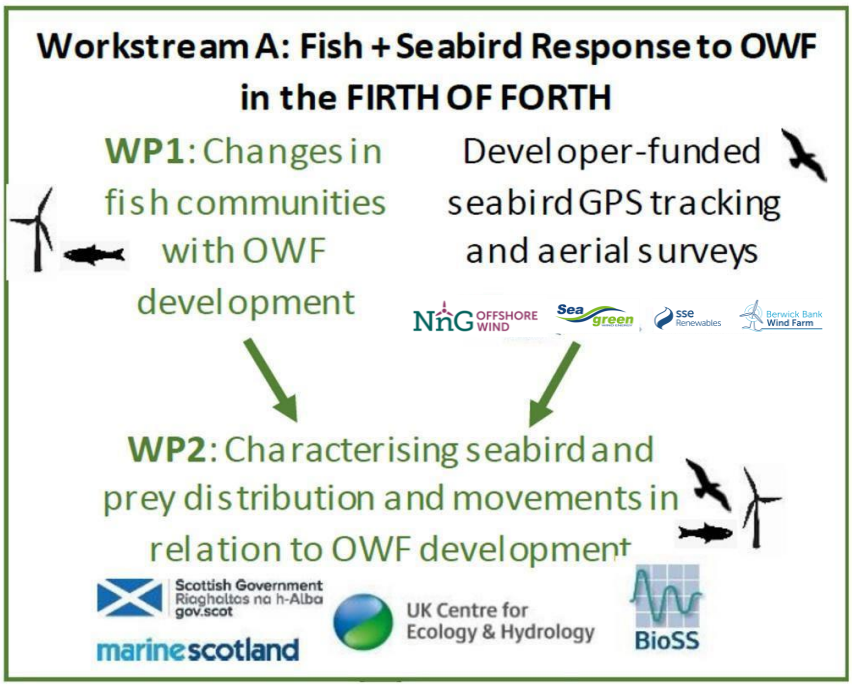
A benefit of delaying this work to 2024-2025 is the re-development of the iPCoD model (Scottish Government funded) which will allow for closer comparison of cumulative impact assessment tools (as the redevelopment involves an energetic engine, as in the DEPONS model). These developments to iPCoD will be ready in Q2 2025.

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

Task 7.4: Updating Cumulative Impact Assessments for marine mammals

Data collation of wind farm data for UK OWF has continued to support CIA assessments. Additionally, discussions of the elements of the CIA which can be considered here and how to achieve project objectives have been discussed among the project team and with developer representatives. 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 delay this work to Q2-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 (i.e., by also capturing the latest developments in offshore wind timelines).

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



WP1: Changes in fish communities with OWF development in the Firth of Forth	
Task 1.1 Lead: Dr Thomas Regnier (MSS)	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 (MSS)	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 Firth of Forth	
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 Adam Butler (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 Adam Butler (BioSS)	Evaluating potential for use of prey data to reduce uncertainty and increase power when estimating displacement rates for seabirds

Workpackage 1 – Changes in fish communities with OWF development in the Firth of Forth

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 PSA analyses.

Delayed from Q4-2022: Point biomass estimates of pelagic fish from acoustic transects now produced for Moray Firth and Forth and Tay. Otolith analyses from Q4 targets still ongoing. All sandeel otoliths from 1st year survey aged.

Remaining species analysis ongoing, expected completion Q2 2023. In the meantime, age-length keys for herring and sprat derived from ICES HERAS data. Gadoid age-length keys being compiled from DATRAS data.

Q1-2023: 1) Maps of sandeel point abundance in the sand per age class produced.

2) Broadscale prey fields from acoustic transects delayed due to late starting date of acoustician.

Q2 Targets: 1) Produce a map of point habitat characteristics (from PSA). 2) Prepare fisheries acoustic/ seabird at sea survey. 3) Design surveys based on previous studies and development site conditions.

Delayed from Q1-2023: Broadscale prey fields from acoustic transects are progressing and are expected for Q3 (due to 5 months delay in Fisheries acoustician start date). Prey surfaces, modelled for 8 species, and derived from historic data were made available to project partners to mitigate this delay.

Q2-2023: 1) Grab and PSA analyses were replaced by a compilation of RoxAnn survey data and historic grab data. Data were compiled and modelled and outputs consisting of layers of hardness, roughness, percentage silt/sand/gravel were produced for the Forth and Tay and extended to the whole area of interest (East coast of Scotland).

2) Fisheries acoustic surveys (Forth and Tay and Moray Firth) were designed, documentation made available and reviewed by the developers and the survey executed.

3) Surveys were designed according to site restrictions and complied with developers requests (meetings and email exchanges, direct communication with Marine coordination centres).

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

Delayed task from Q1 2023: Broadscale prey fields for 2022 were produced for: Common dab, Long-rough dab, Flounder, Plaice, Lemon sole, Norway pout, Poor cod, Grey Gurnard, Haddock (age 0 and age 1+), whiting, Lesser sandeel, Sprat and Herring. Note that the difference in format between historic and 2022 data resulted in pelagic surfaces not being integrated by age and depth at the moment, but work is underway to achieve this.

Q3-2023: 1) Fisheries acoustic survey and seabird at sea survey were completed and generated a good amount of data.

2) Sorting and selection of otoliths to analyse underway, to save time to catch-up with delays associated with the estimation of 2022 prey surfaces, length frequency distribution analyses were completed for haddock and whiting. The good predictive ability of this method saved significant analyses time in the laboratory.

3) Processing of the acoustic data collected in 2023 is underway.

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

1) Processing of acoustic data from 2023 completed and data has been shared with BioSS, University of Aberdeen and University of Exeter.

2) Sandeel otolith analysis completed and whiting otoliths to be photographed, mounted, sectioned, and aged in the new year. Haddock otoliths redundant as utilising length frequency distributions.

Task 1.2 Finescale fish response to OWF in the Forth

Q1 Targets: 1) Process BRUV and AI camera video footage from 2022 camera surveys. 2) Completion of video processing from surveys.

BRUVS footage from 2022 survey processing complete.

Q2 Targets: 1) Completion of 2022 analysis. 2) Map fish (predator) abundance from SBRUV/Traps.

Due to the delay associated with the late start of the fish community ecologist and the Fisheries acoustician (4 and 5 months respectively), 2022 analyses are not completed yet but have progressed well. Fish distributions modelled from historic data being used to control for the effect of habitat suitability on fish abundance within and outside OWFs. First results have been obtained for flatfish and are underway for gadoids. SBRUV and trap data are also used for the modelling of broadscale fish distribution as these constitute the only source of data for demersal fish within OWFs.

Demersal fish abundances obtained from SBRUV/traps have been mapped and some of the preliminary results presented at the 2023 Knowledge Exchange Meeting.

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

Update on delayed tasks: A fine-scale distribution has been produced for Common dab, however, the lack of sufficient data for other fish in 2022 precluded fine-scale distribution analyses for 2022 but the abundance of data collected in 2023 is promising.

Q3-2023: 1) BRUV/Fish trap surveys in the Firth of Forth have been completed and after refining the sampling strategy from 2022 and with no technical issues, generated a lot more data this year (traps: 62 deployments against 41 in 2022, BRUVs 70 deployments against 42 in 2022). The main species were also a lot more abundant this year (e.g. haddock captured in 71% of the traps in 2023 against 36% in 2022, whiting captured in 75% of the traps in 2023 against 2% in 2022), therefore we expect to be able to produce fine-scale distributions for a greater diversity of fish this year.

2) Surveys were designed according to developer's requirements and reviewed by them.

4) SBRUV data have been compiled and edited to allow the maxN analyses to start in the next quarter.

5) RoxAnn data (replacing PSA) from PrePARED and other 2022-2023 surveys have been compiled and will be used to update the seabed hardness/roughness layers.

Q4 Targets: 1) Completion of RoxAnn analyses.

RoxAnn data from six surveys in 2023 have been compiled and the ensemble model for spatial interpolations has been updated. The new hardness and roughness layers are now available and the spatial resolution is improved.

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

Task 2.1 Seabird spatial distribution models in the Forth

Q1 Targets: 1) Develop working code for distribution modelling.

BioSS continued to define baseline data, process additional data, and identify data for transferability to North Sea (6.1). BioSS had in-person meetings with Marine Scotland/UKCEH & a 2-day workshop with the University of Aberdeen. BioSS continued to develop spatial (2.1) and movement (2.2) modelling frameworks using available data, whilst waiting for a NDA to be finalised for access to seabird tracking data for the spatial and movement modelling frameworks.

Q2 Targets: 1) Begin processing prey data from Task 1.1 and 1.2.

BioSS received historic prey data fields from Task 1.1 and incorporated these into the modelling frameworks. BioSS received a 2019 run of a physics-only Forth and Tay Scottish Shelf Models from SGMD and incorporated these covariates into the modelling framework.

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

Broad-scale prey data was received from SGMD in Sep-23 and seabird tracking data received from UKCEH in Jul-23 as NDA was finalised. BioSS began processing these data.

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

BioSS developed modelling frameworks using frequentist (Generalised Additive Models) and Bayesian (Integrated Nested LaPlace Approximation) approaches and are working towards developing a manuscript on the comparison between spatial modelling frameworks and how these can be used efficiently with simulated predator and prey data. The context for the comparison is that the approach that best models the predator, prey, and environmental data, taking transferability (Task 6.1) in account, will be progressed to use full datasets when available.

Task 2.2 Seabird movement models in the Forth

Q1, Q2, Q3 Targets: No targets

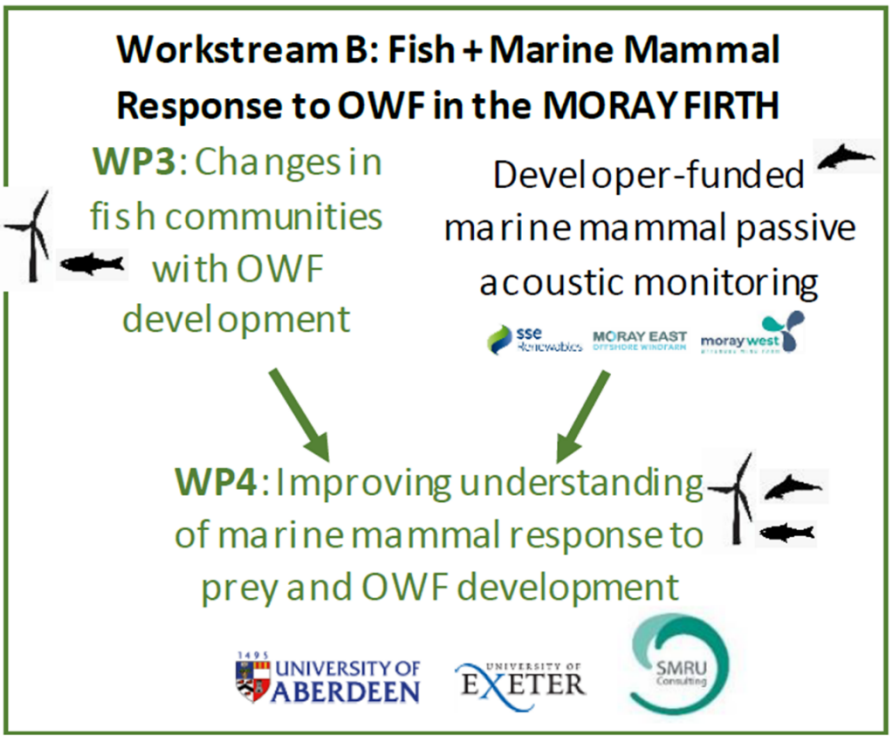
Q4 Targets: 1) Initial development of movement modelling framework

BioSS received processed acoustic data from task 1.1 on in Dec-23. Movement analysis approaches are being developed at several scales: regional, area-specific, and localised. This allows research questions to be answered using data that are available at different ecological, spatial, and temporal scales, such as the sandeel map (Langton et al. 2021), prey fields (1.1), and processed acoustic data (1.1).

Task 2.3 Seabird displacement rates in the Forth

- No targets this year

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 (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: 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 (UoA)	How does windfarm presence affect marine mammal responses to pile-driving & vessel disturbance?
Task 4.4 Lead: Dr Cormac Booth (SMRU Consulting)	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 for 2022 survey. 2) Process BRUV camera video footage from 2022 camera surveys. 3) Completion of video processing from survey

1) Completed. Acoustic and trawl data processing was completed by SGMD acoustician.

2. & 3.) Partially completed. BRUV footage processing has been complete for fish identification and abundance. Length measurements for biomass estimates are still ongoing with 75% complete.

Q2 Targets: 1) Prepare fisheries acoustic survey. 2) Design surveys based on previous studies and development site conditions. 3) Conduct fisheries acoustic survey (end of June). 4) 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).

Fisheries acoustic survey completed, along with associated trawl effort to validate acoustic data. Fish samples collected for SMRU. Video data now watched and digitised, and analysis is well progressed. A University of Exeter staff member has been on long-term leave and so discussions on downstream provision have been delayed. Users of the data at Aberdeen are also changing and so immediate need for data has not posed a challenge.

Q3 Targets: 1) Laboratory analyses of grab samples (subject to lab availability). 2) Post-processing of fisheries acoustic and trawl data.

Update on Q2 delayed task: Data analysis of BRUV footage has been completed for demersal fish abundance, biomass, richness, length, and community composition. Processed abundance and biomass data has been made available for use in downstream predator models (University of Aberdeen). Discussions are ongoing as to when the latter analysis will be possible given the staff changes. It is hoped this can be started in Q4.

Q3-2023: Grab samples were not collected as part of the fisheries acoustic survey. However, in mitigation, RoxAnn data was collected and will replace the particle size analysis (PCA) that would have been conducted using the grab data to assess seabed habitat. Post-processing of fisheries acoustic and trawl data from the 2023 survey is underway and should be completed by the end of Q4.

Q4 Targets: 1) Completion of laboratory analyses of grab samples (subject to lab availability). 2) Completion of post-processing of fisheries acoustic and trawl data for 2023 survey.

Grab samples were not collected as part of the fisheries acoustic survey. RoxAnn data was collected and will replace the particle size analysis (PCA) that would have been conducted using the grab data to assess seabed habitat.
Post-processing of fisheries acoustic and trawl data from the 2023 survey completed by SGMD Fisheries Acoustician.

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

Q1 Targets: 1) Process BRUV camera video footage from 2022 camera surveys. 2) Completion of video processing from surveys.

1. & 2). Partially completed. BRUV footage processing has been complete for fish identification and abundance. Length measurements for biomass estimates are still ongoing with 75% complete.

Q2 Targets: 1) 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).

Video data now watched and digitised, and analysis is well progressed. A University of Exeter team member has been on long-term leave and so discussions on downstream provision have been delayed. Users of the data at Aberdeen are also changing and so immediate need for data has not posed a challenge.

Q3 Targets: 1) Unbaited camera surveys in Moray Firth. 2) Design surveys considering development site conditions. 3) Conduct unbaited camera surveys.

Target was not achieved. The delivery of the unbaited camera systems has been delayed due to parts and design issues at manufacturer. Surveys have been delayed until 2024 due to late delivery, winter weather conditions not conducive for surveys and they need to be completed in the same season as BRUV cameras surveys for comparability.

Update on Q2 delayed task: Data analysis of BRUV footage has been completed for demersal fish abundance, biomass, richness, length and community composition. Processed abundance and biomass data has been made available for use in downstream predator models (University of Aberdeen). Discussions are ongoing as to when the latter analysis will be possible given the staff changes. It is hoped this can be started in Q4.

Q4 Targets: 1) Process unbaited camera survey video footage.

Unbaited (low light) camera systems will be delivered from manufacturer in January 2024 to be tested and prepared for use in summer 2024 Moray Firth fish surveys.

Task 3.3 Fish acoustic telemetry in the Moray Firth

Q1 Targets: 1) Service acoustic array and download ping data in the Moray Firth.

Partially completed. Servicing of the array is ongoing but has been delayed due to bad weather. Approximately 60% of the receivers have been serviced at the end of the Q1.

Q2 Targets: 1) Catch and tag gadoid fish in the Moray Firth. 2) Process acoustic ping data.

Analysis of ping data is ongoing. The network of receivers has been activated on the European Tracking Network, the tagged animals remain under moratorium and so data access limited to project staff only. Some receivers from initial deployment last year remain on seabed due to technical reasons and need to retrieve using an ROV. A second trip to catch and tag fish went ahead but catch rates were very poor. Still experiencing challenges with two main capture routines. Further work being undertaken by SGMD to limit the problems.

Q3 Targets: 1) Service acoustic array and download ping data in the Moray Firth: (a) Completion of annual data download. (b) Completion of annual tagging

Servicing of acoustic array and downloading of data from all receivers was completed in September. A further servicing of the array is planned for November (weather dependant). Tagging of fish has completed for 2023 with the next tagging trip planned for spring 2024. Analysis of the fish detection data has started.

Q4 Targets: No Target

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) Review of analyses of seal distribution models.

Completed. Review of analyses for harbour seal distribution models completed. Held a meeting with BIOSS in March 2023 to discuss data and code sharing for common processing tasks.

Q2 Targets: 1) Hold stakeholder workshop.

Requirement for stakeholder workshop under review at this stage due to the need for key stakeholders to prioritise more urgent tasks related to consenting. Analyses under this task have focussed on assessment of the value of using SGMD sandeels as an explanatory variable in models of harbour porpoise and harbour seal distribution and foraging activity.

Q3 Targets: 1) Completion of distribution modelling and draft report.

Update on the Q2 Stakeholder Workshop: we propose that this is reviewed in the context of the results of Task 8.1 and 8.2, and Management Group discussion on the best approach to maximise the impact of future workshops.

Q3-2023: Analyses exploring the extent to which variation in harbour porpoises and harbour seal foraging activity can be explained by broad scale predictions of sandeel density have been completed, and draft reports are at an advanced stage. Data from both species highlight the value of incorporating sandeel density estimates in these analyses.

Harbour porpoise data were based on passive acoustic monitoring in both pre-construction (2009-2011) and post-construction (2022) periods. As well as showing a general pattern of increased occurrence and foraging in relation to sandeel density, there is an indication that this pattern may be moderated by the presence of windfarm structures; a result that could result from changes in the availability of alternative prey. This will now be explored further with additional post-construction data and incorporated in **a report to be delivered in Q4.**

Harbour seal data were based on pre-construction GPS tracking studies (2014-2017). These data also highlight that the average foraging distribution of harbour seals in the Moray Firth is related to predicted sandeel densities. However, this relationship appears to vary both by sex and individual, meaning that predicted overall distributions may be influenced by non-representative selection of individuals for tagging. This finding will be outlined in **a second report to be delivered in Q4** which will also outline proposed work to explore the implications of these findings within a revised Task 6.1.

Q4 Targets: 1) Deliver final report.

A report on relationships between Harbour Porpoise and sandeel prey has been submitted to the PrePARED Management Group and PAG for internal review prior to wider disseminations.
A full draft of the report on Harbour Seal foraging in relation to sandeel prey is undergoing final review by co-authors and will be circulated amongst the Management Group and PAG early in Q2 2024.

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

Q1 Targets: 1) Complete processing of PAM data.

Completed. Processing and archiving of PAM data has been completed. Further analysis of data has been carried out, investigating changes in harbour porpoise occurrence and foraging activity before and after construction within operational windfarm sites relative to reference sites. Writing of draft report has started.

Q2 Targets: 1) Present interim results at stakeholder workshop to inform design of construction array.

Preliminary results arising from the data collected in 2022 were presented to key Moray Firth stakeholders through the MFRAG-MM. Following this, plans for the 2023 construction PAM array were presented to the same meeting to finalise agreement on the design from key stakeholders (as required for industry-funded data collection under consent conditions).

Q3 Targets: 1) Delivery of draft report.

A report outlining the results of the 2022 PAM surveys conducted around constructed windfarms in the Moray Firth has now been drafted. This fieldwork has been funded by developers as part of their pre- and post-construction consent monitoring programmes, and results include a BACI analysis to explore potential broad and fine-scale changes in porpoise occurrence. The draft has been presented to MFRAG-MM as part of the developers consent monitoring in September 2023, and is awaiting review by members of MFRAG-MM. Outputs will then be available for integration with those on prey from Tasks 3.2 and 3.3.

Q4 Targets: 1) Internal project meeting to discuss prey field results from 2023.

Report provided to external stakeholders within Moray Firth Regional Advisory Group - Marine Mammals (MFRAG-MM) and key results presented at MFRAG-

MM meeting held at Beatrice Offshore Wind Farm marine control centre. MFRAG-MM members requested extension of deadline for comments, so this report will now be finalised in Q1 2024. In the meantime, key results from this report and Task 4.1 report are being integrated into a paper for submission to a peer-reviewed journal.
Two internal Workstream B meetings were held this quarter to discuss integration with prey results. A further meeting is planned for January 2024 when Task 4.2 Principal Investigator has returned from maternity leave and PrePARED Fisheries Acoustician has completed analyses of fisheries acoustics data.

Task 4.3 Dose response curves in the Moray Firth

Q1 Targets: 1) Convene meeting to liaise with Moray West on construction schedule.

Completed. A meeting with Moray West took place on 19th January, at which an update on Moray West construction schedule was received. Subsequent meeting with Moray West and SNCBs to discuss Piling Strategy on 10/2/23.

Q2 Targets: 1) Finalise the design of construction PAM array.

Plans for the 2023 construction PAM array were presented to key Moray Firth stakeholders through the MFRAG-MM on 31/03/23 to agree the final design (see Task 4.2 above). An application for Consent for the survey works was submitted to the Crown Estate Scotland and a draft consent has been received conditional on securing a number of 3rd party consents and notifications, which is in progress. Consumables and equipment for the PAM devices and moorings, including acoustic releases, were ordered, and received. Acoustic releases have been set up, and assembly of the moorings has started in preparation for deployment in Q3.

Q3 Targets: 1) Deploy the construction PAM array.

PAM devices were set up in Cromarty and transported to Buckie Harbour in July ready for deployment. Regular meetings were held between PrePARED researchers and Moray West to liaise over planned piling schedules, procedures for deploying monitoring equipment and plans for developer-led collection of piling noise data that will be required to place PrePARED PAM data in context. In late August, Moray West contracted Moray First Marine to deploy the array of 65 CPODs in a gradient design through Moray West, where piling will be undertaken in Q4, and through existing windfarms at Beatrice and Moray East.

Q4 Targets: 1) Initiate collation of engineering data from developers.

Regular meetings with Moray West team to discuss progress in their piling campaigns and liaise over piling noise monitoring being conducted for them by Seiche.
Piling records for first 7 weeks of construction collated and summarised to identify 4 key installations where there is sufficient baseline before and after piling to assess responses of harbour porpoises to construction noise.

Task 4.4 Fish nutritional value

Q1 Targets: 1) Process summer 2022 prey samples.

Processing of samples for bomb calorimetry has carried on and we're working on Summer 2022 prey samples collected by the PrePARED team.

Q2 Targets: 1) Summarise interim bomb calorimetry analyses

In Q2 of 2023, SMRUc received the PrePARED 2023 samples from the Moray Firth surveys. Once the Forth and Tay surveys are completed on the 5th of July, they will collect the samples from those surveys as well. Currently, they are analysing the PrePARED 2022 samples, with the following species having been processed: mackerel, bull-rout, viviparous eelpout, lemon sole, long-rough dab, and flounder. Our analysis of the PrePARED 2022 samples will continue throughout Q3.

Q3 Targets: 1) Initial processing of any available samples.

In Q2 of 2023, SMRUc received the PrePARED 2023 samples from the Moray Firth surveys and now have samples from the Forth and Tay surveys from July. Currently, analyses are focused on the PrePARED 2022 samples, with the following species having been processed: Mackerel, Viviparous eelpout, Bull-rout, Lemon sole, Long rough dab, Flounder, Whiting, Common dab, Grey gurnard. Our analysis of the PrePARED 2022 samples will continue throughout Q4. Additionally, SMRUc are developing resourcing solutions to support analysis through 2023-2026 - and engaging with PrePARED partners on sampling.

Q4 Targets: 1) Processing of summer 2023 prey samples.

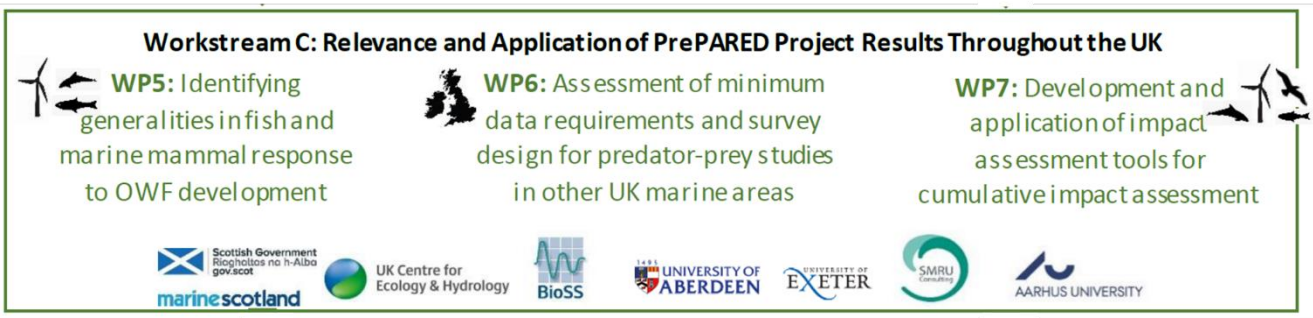
In Q3-4 of 2023, SMRUc processed samples from the Moray Firth and Firth of Forth surveys.

Analyses are ongoing for the PrePARED 2022 samples, with the following species having been processed: Mackerel, Viviparous eelpout, Bull-rout, Lemon sole, Long

rough dab, Flounder, Whiting, Common dab, Grey gurnard. Analysis of the PrePARED 2022 samples will continue into 2024.

Additionally, we are developing resourcing solutions to support analysis through 2023-2026 - and engaging with PrePARED team mates on sampling. We 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).

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 Firth of Forth and Moray Firth responding to OWF development/presence in a similar way?
Task 5.2 Lead: Dr Gordon Hastie (SMRU Consulting)	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 and OWF development influence seabird distribution and movements
Task 6.2 Lead: Dr Ana Payo-Payo (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 (SMRU Consulting)	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 (SMRU Consulting)	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 Firth of Forth and at Flamborough & Filey Coast SPA
Task 7.4 Lead: Dr Cormac Booth	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?

- No targets this year

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

Q1 Targets: 1) Convene quarterly meetings to discuss progress on data collection and coincidental analyses.

SMRUc achieved the target of convening quarterly meetings to discuss progress. Data from the University of Aberdeen team has been provided along with code to allow the exploration of dose response functions from the Moray Firth and how they might change under different data conditions. Similarly, we are developing covariates using code from University of Aberdeen re: intensity and density of vessels in the Firth of Forth - all of which helps us improve understanding of transferability of existing findings.

Q2 Targets: 1) Convene quarterly meetings to discuss progress on data collection and coincidental analyses.

In Q2 of 2023, SMRUc completed the analyses of the effects of array designs on porpoise dose response studies to pile driving using acoustic loggers. SMRUc had meetings with the St Andrews and University of Aberdeen teams to present the results and discuss their implications for future studies. Preparation of a draft manuscript will continue throughout Q3.

Q3 Targets: 1) Convene quarterly meetings to discuss progress on data collection and coincidental analyses.

In Q3 of 2023, SMRUc have 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 St Andrews and University of Aberdeen teams to present the results and discuss their implications for future studies. Preparation of a draft manuscript will continue throughout Q4.

Q4 Targets: 1) Convene quarterly meetings to discuss progress on data collection and coincidental analyses.

In Q4 of 2023, SMRUc have continued refining the analyses of the effects of array designs on porpoise dose response studies to pile driving using acoustic loggers. SMRUc had meetings with the St Andrews and University of Aberdeen teams to present the results and discuss their implications for future studies.
Preparation of a draft manuscript will continue into early 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.

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

- No targets this year.

Task 6.2 - Minimum data requirements for marine mammal distribution models

Q1 Targets: 1) Internal project meeting with CEH/BioSS to discuss progress on data collation and analyses.

Completed. Held a meeting with BIOSS in March 2023 to discuss data and code sharing for common processing tasks. Made plans for a knowledge transfer workshop to be held in October.

Q2 Targets: 1) Quarterly meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters.

Scope of this work package under review to maximise relevance to future consenting.

Q3 Targets: 1) Complete collation of digital aerial survey datasets for English waters.

The target has not been met but has now been reviewed and re-focussed. Meetings were initially held with key partners at SMRUc and Aarhus (together with SMRU colleagues working on ECOSTAR) to review the scope of this Task. Since the original development of PrePARED's objectives, it has become apparent that survey designs for digital aerial surveys are being driven by external and commercial factors, and further analyses of archive digital aerial survey data from the Moray Firth is unlikely to influence approaches to data collection and analyses in a way that will affect consenting risk. Instead, we propose to build upon emerging results from Task 4.1 which highlight, first, that the average foraging distribution of harbour seals in the Moray Firth is related to predicted sandeel densities but, second, that this relationship varies both by sex and individual. We suggest that this provides a more valuable case study for exploring minimum data requirements for marine mammal distribution models. Furthermore, we have identified an opportunity to collaborate with the ECOSTAR project to access data sets that would provide opportunities to explore the transferability of these findings throughout the whole North Sea.

Q4 Targets: 1) Meet with SMRUc to agree revised scope for work on harbour seal distribution.

Meetings held with SMRUc in St Andrews w/c 18 Dec 2023. Revised targets and deliverables will be finalised during the next quarter.

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

Q1, Q2 and Q3: No targets for these quarters

Work on this task started in Q3. Initial analysis has been conducted using three habitats datasets. A database of windfarm meta data has been created (N=83) to support analysis, with a further possible ~75 farms to be identified and researched across European waters. The spatial scale of the assessment has been extended to include multiple European countries waters, including Ireland, Belgium, Norway, Denmark and France. Initial analysis suggests a wider range of environmental data are needed to better discriminate similarities in environment between PrePARED sites and other UK and European windfarms. Work will continue with the analysis through Q4 to ensure timely delivery of results.

Q4 Targets: 1) Evaluate potential modelling approaches. 2) Collate available data for biotic and abiotic variables to use in assessment.

Work is underway with this task and several meetings have been held between University of Exeter and SMRUc. The appropriate model framework has been chosen and the environmental data have been sourced. Several iterations of models have been made and analysis is nearing completion. Outputs will be ready for the PrePARED 2024 AKEM. Reporting to be complete by end-June.

Task 6.4 - Survey design for predator-prey studies

Q1 Targets: 1) Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.

SMRUc are continuing to collate and review data from English and Welsh OWF, other marine mammal monitoring projects.

Q2 Targets: 1) Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.

Work has continued engaging with the University of Exeter team to align with Task 6.3. Otherwise, collation of wind farm data for English and Welsh OWF has continued.

Q3 Targets: 1) Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.

Work has continued with SMRUc engaging with the University of Exeter team to align with Task 6.3. Data on offshore wind farms around the North Sea has been expanded and plotting is underway in GIS. Meetings are planned for Q4 with University of Exeter 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.

Q4 Targets: 1) Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.

Work has continued engaging with the University of Exeter team to align with Task 6.3. Data on offshore wind farms around the North Sea has been expanded and plotting is underway in GIS. Meetings are planned for Q1 2024 with University of Exeter 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.

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) Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development.

We met with the DEPONS team and Aberdeen team and are looking to determine timelines for final updates to the DEPONS model

Q2 Targets: 1) Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development.

Discussion and collaboration are ongoing with the University of Aberdeen and Aarhus University teams.

Q3 Targets: 1) Integration of project learning into latest DEPONS and iPCoD.

Discussion and collaboration are ongoing with SMRUc and the University of Aberdeen and Aarhus teams. This work likely will occur in 2024-2025 due to

developments of the DEPONS model coming out in late Q4 2023 and resourcing changes required for Aarhus and University of Aberdeen. 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).

Q4 Targets: 1) Assessment of how integration of PrePARED project outputs into populations models helps improve models.

Discussion and collaboration are ongoing with the University of Aberdeen and Aarhus University teams. This work likely will occur in 2024-2025 due to developments of the DEPONS model coming out in late Q4 2023 and resourcing changes required for both Aarhus and University of Aberdeen.

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).

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

Task 7.2 - Adding biological realism to SeabORD and testing

Q1 Targets: 1) Development of initial model parameterisation to work with sandeel suitability estimates.

This work has been largely postponed until the second quarter of 2023 when our postdoc will start at UKCEH. We have completed the hiring process for this position, and the selected candidate has accepted the position, and will start on 28th March 2023. The candidate has extensive experience working with individual based models for seabirds, and impacts of offshore wind farms, so do not anticipate any further delays with the Year 1 work. We have completed background work to facilitate this component of the project - sourcing and acquiring the sandeel habitat suitability layers and metadata for use in the IBM SeabORD, and also completing the revision of SeabORD into the open-source language 'R', and modularising the IBM to allow for efficient changes to different model functions to be made.

Q2 Targets: 1) Development of initial model parameterisation to work with sandeel suitability estimates.

Our new PrePARED postdoc, Chris Pollock, started at UKCEH on 28th March 2023. He has been working to understand and implement the individual-based model, SeabORD over the last few months. He is now working on this task and is currently assessing how the sandeel maps can be used within SeabORD, and the required changes necessary for this implementation. He is also working with SGMD to consider how the new prey maps for the Forth-Tay, developed by SGMD, may be used within SeabORD. Chris also attended a training course in statistical modelling in Lancaster to develop his modelling skills and will implement this training in a PrePARED analysis considering how non-breeding season attendance to colonies during the autumn and winter may affect exposure of seabirds to offshore windfarms.

Q3 Targets: 1) Development of initial model parameterisation to work with sandeel suitability estimates.

UKCEH have developed methods for integrating both the sandeel habitat suitability map and new PrePARED prey maps into the Individual-based Model (IBM) SeabORD. UKCEH are using spatial smoothing to facilitate the use of the raw data products within the IBM and are currently refining methods for calibrating behaviour and energetics of the IBM to fit with the new prey surfaces and current bird distributions (from the Marine Scotland Cumulative Effects Framework, CEF, project). We expect to have completed integration of the IBM with the new prey maps by the end of the year (Dec 2023).

Q4 Targets: 1) Development of initial model parameterisation to work with sandeel suitability estimates.

We have developed methods for integrating both the sandeel habitat suitability map and new PrePARED prey maps into the Individual-based Model (IBM) SeabORD. We are using spatial smoothing to facilitate the use of the raw data products within the IBM and are currently refining methods for calibrating behaviour and energetics of the IBM to fit with the new prey surfaces and current bird distributions (from the Marine Scotland Cumulative Effects Framework, CEF, project). We expect to have completed integration of the IBM with the new prey maps in Q1 2024.

In addition, we are preparing a manuscript on the IBM, SeabORD, as a joint output between PrePARED and SG Marine Directorate, in which we will describe the functionality of SeabORD with full release of underlying model code, apply the model to a hypothetical case study in NE Scotland, conduct a sensitivity analysis of the model to key parameters, and investigate how cumulative effects of multiple OWFs scale with number. We will submit the manuscript to a special issue of a journal on Cumulative Effects in February

2024. This manuscript will then serve as the baseline model upon which further developments within PrePARED will be built.

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

- No targets this year

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

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

Completed. We are having quarterly meetings and continuing to develop CIA components

Q2 Targets: 1) Convene 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. Additionally, discussions of the elements of the CIA which can be considered here and how to achieve project objectives have been discussed among the project team and with developer representatives.

Q3 Targets: 1) Convene 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. Additionally, discussions of the elements of the CIA which can be considered here and how to achieve project objectives have been discussed among the project team and with developer representatives. 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 delay this work to Q2-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.

Q4 Targets: 1) Convene 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. Additionally, discussions of the elements of the CIA which can

be considered here and how to achieve project objectives have been discussed among the project team and with developer representatives.
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 delay this work to Q2-Q4 2024 to capitalise on the new version of iPCoD being available. By delaying this work, it also ensures the CIA undertaken is as realistic as possible.

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

- No targets this year.

7. Workstream D - Dissemination to inform OWF planning, policy and licensing

WP8: Development of a dissemination roadmap	
Task 8.1 Lead: Erica Knott (NatureScot)	Stakeholder + network analysis and reporting
Task 8.2 Lead: PrePARED Project Officer (MSS)	Production of a Communications Plan
WP9: Dissemination activities	
Task 9.1 Lead: PrePARED Project Officer (MSS)	Knowledge exchange with stakeholders
Task 9.2 Lead: PrePARED Project Officer (MSS)	Scientific publications with non-technical summary of relevance to OWF development; published reports
Task 9.3 Lead: PrePARED Project Officer (MSS)	Scientific symposium on research on ecosystem effects of OWF development; events including workshops, webinars, etc.
Task 9.4 Lead: PrePARED Project Officer (MSS)	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

Q1 Targets: 1) Negotiate contract for the SNA

A tender for the Stakeholder and Network analysis was let by the procurement team of the Scottish Government Marine Directorate. Three potential contractors were identified and approached to bid. Only one contractor finally placed a bid, FastTrack Impact Ltd (supported by Institute for Methods Innovation). Details may be found at:

https://www.fasttrackimpact.com/
https://www.methodsinnovation.org/

After following standard SG procurement rules, the contract was let to FastTrack.

Q2 Targets: 1) Allocate contract

Stakeholder and Network analysis contract has been allocated to Fast Track Impact Ltd. after a successful bid and evaluation. A kick off meeting was

conducted on 22 June 2023 and contract is due to be completed by 31 July 2023.

Q3 Targets: 1) Monitor contractor progress

The Stakeholder and Network Analysis contract has now been completed and a report, communications plan and stakeholder contact list has been produced and circulated to all project partners. Actions are being identified through the report and communications plan and these will be implemented throughout Q4 and for the duration of the project.

Q4 Targets: 1) Publish SNA

The Stakeholder and Network Analysis was published and distributed in Q3.

Task 8.2 – PrePARED Communications Plan

Q1 Targets: 1) Update draft plan.

Draft communication plan under development.

Q2 Targets: 1) Finalise draft comms plan and disseminate

A draft communications plan has been produced and is expected to be updated accordingly by the results of the stakeholder and network analysis. Once finalised this will be distributed to all project partners, OWEC Communications Team and SGMD Communication team.

Q3 Targets: 1) Implement Comms Plan

The Stakeholder and Network Analysis contract has produced a communications plan which will be implemented during Q4 and throughout duration of project.

Q4 Targets: 1) Implement Comms Plan

An 'operational' communications plan is currently under review within the Management Group which outlines PrePARED policies and procedures for all stakeholder engagement strategies.

2023 Summary:

In summary, PrePARED has three documents supporting its communication and engagement strategy:

PrePARED Comms Plan Part 1 – Research Report
PrePARED Comms Plan Part 2 – Comms Plan Support Report
PrePARED Comms Plan Part 3 - Operational Plan

Workpackage 9 - Dissemination activities

Task 9.1 - Annual knowledge exchange workshops

Q1 Target: 1) Convene Year 1 KEM

The first PrePARED KEM was held at Aberdeen University (Sir Duncan Rice Library University of Aberdeen), Friday 24th February. 44 people attended the meeting in person, and a further 15 people virtually. The meeting agenda was as follows:

1. Welcome/introduction/aims
2. OWEC Programme and PrePARED project overview
3. Evidence: Forth & Tay Case study – findings from Year 1 and forward look
4. Evidence: Moray Firth Case Study – findings from year 1 and forward look
5. LUNCH
6. Change: Improving impact assessment models and cumulative effects assessment
7. Pelagio, EcoWings & PrePARED - Synergies & opportunities for collaboration
8. Change: Breakout session on knowledge exchange & integration into consenting
9. Breakout discussions
• PAG Feedback/review of PrePARED project [Chair Andrew Gill, Cefas]
• Main Group Networking / more inter-project discussions
• PAG feedback to main group on PrePARED project + discussion
10. Closing comments from OWEC

Q2 Target: No target

Initial discussions regarding the planning for this event occurred at the Management Group on 29 June 2023.

Q3 Target: 1) Begin planning 2024 KEM.

The Annual Knowledge Exchange Meeting will be held at Dynamic Earth, Edinburgh from 27-28 February. Invitations to key stakeholders will be sent in due course once an agenda has been finalised for the event, however, it is expected that Day 1 will be a wider event with external stakeholders and Day 2 will be an opportunity for internal discussion with the Programme Advisory Group.

Q4 Target: 1) Complete planning Year 2 KEM.

The agenda for the Annual Knowledge Exchange Meeting (AKEM) is currently being finalised by the PrePARED Management Group. Formal invitations have been sent to key stakeholders and a visit to the venue will take place in January 2024.

Task 9.2 - Dissemination of project findings

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

No findings to be disseminated this quarter.

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

Project Manager, Lauren Donachie, hired during Quarter 2 who can support with dissemination of project findings.

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

There have been no research outputs e.g. publication this quarter. Instead, general project updates have been disseminated via the monthly blog and social media posts. In addition to this, project members have presented PrePARED overviews at ICES, CWW and workshops.

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

Two reports have been circulated to PrePARED Task Leads and the PAG for internal review.

Task 9.3 - Organise PrePARED project scientific symposium

- No 2022 targets

Task 9.4 - Establish PrePARED website and social media

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

Q1 Update: Project website development completed and accessible.

Q2 Update: Project website continues to be updated and there are plans to begin a monthly blog from July 2023. We have connected with the SGMD communications team to discuss how we can best work together moving forward and there will be further movement regarding this once the communications plan is finalised.

Q3 Update: Webpage Analytics have now been in introduced and will be included in quarterly reports moving forward. As of 28/09/2023 the month of September saw 302 page views with a total of 112 users. 89% of visitors are new to the site with majority from the UK followed by USA and Europe. Sessions spiked on 13 September showing a correlation between page views and social media posts. The Project Manager has been working in collaboration with the SGMD Communications team and a timeline of scheduled posts on social media has been agreed with an average of 2 posts per month on both X and LinkedIn.

Q4 Update: Webpage analytics show that the month of December saw 430 page views with a total of 185 users – an increase from Q3 engagement. 90% of visitors are new to the site with majority from the UK followed by USA and Europe. Sessions spiked on 7 December showing a correlation between page views and social media post directing stakeholders to the monthly blog. The SGMD Communications team has been uploading at least 2 posts per month on LinkedIn and X, and the Project Manager is preparing a timetable for posts within Q1 2024.

- Social media posts throughout the year (see Table 5).

8. TABLE 1 - PrePARED Surveys 2023

MRV Scotia RV programme 2023-2024

Survey	SIC (TBC)	Days	Dates	Survey Description	Area
0523S	A. Gallego	20	03 May - 22 May	PelaGIO	North Sea

MRV Alba na Mara RV programme 2023

Survey Code	S.I.C. (TBC)	Days	Dates	Survey Description	Area
0823A	R. Main	15	02 Jun - 16 Jun	PrePARED	East Coast / Moray Firth
0923A	T. Regnier	17	19 Jun - 05 Jul	PrePARED	East Coast / Firth of Forth
1123A	T. Regnier	17	29 Jul - 14 Aug	PrePARED	East Coast / Firth of Forth
2023A	T. Regnier	19 ***	02 Dec - 20 Dec	Sandeel + PrePARED (2)	East Coast

Charters

Survey Code	Vessel	Days	Dates	Survey	Area
0423H	Waterfall	9	Mar-23	PrePARED, fish tagging	Moray Firth, <50m from turbine
0523H	Waterfall	9	Sep-23	PrePARED, fish tagging	Moray Firth, <50m from turbine
	Waterfall	5 *	Aug-23	Deployed PAM devices	Moray Firth

* doesn't include weather days. Vessel to be procured by developers.
***2 days costed to PrePARED

9. TABLE 2 - Planned PrePARED Surveys 2024

MRV Alba na Mara RV programme 2024-2025

Survey Code	S.I.C. (TBC)	Days	Preliminary Dates	Survey Description	Area
0824A	R. Main	19	01/06/2024	PrePARED Task 3.1	Moray Firth
0924A	T. Regnier	19	20/06/2024	PrePARED Task 1.1	Forth and Tay
1124A	T. Regnier	19	01/08/2024	PrePARED Task 1.2	Forth and Tay
2024A	T. Regnier	19 ***	02/12/2024	Sandeel + PrePARED (2)	East Coast

Charters

Survey Code	Vessel	Days	Preliminary Dates	Survey	Area
	TBC	8 *	Feb-Apr-24	Recover PAM devices	Moray Firth
	TBC	15	March/April 2024	PrePARED: fish acoustic receiver deployment and marine fish tagging	Moray Firth
	TBC	7-10 **	TBC (June-Aug 2024)	BRUV and unbaited long term camera surveys	Moray Firth, <50m from turbine
	TBC	15	01/11/2024	PrePARED: fish acoustic receiver deployment and marine fish tagging	Moray Firth
	TBC	15	March/April 2025	PrePARED: fish acoustic receiver deployment and marine fish tagging	Moray Firth

* doesn't include weather days. Vessel to be procured by developers.
** doesn't include weather days. Vessel to be procured by UoE.
***2 days costed to PrePARED

10. TABLE 3 – PrePARED Presentations 2023

Date	Who To?	Subject	Presenter
14/12/2022	MFRAG	High-level introduction to PrePARED, with focus on Workstream B	Paul Thompson
19/12/2022	BES Annual Meeting, Edinburgh	Using agent-based models for management of marine populations. Presentation here: JNN 221219 ABMs for marine mang – BES Edinburgh.pptx (dropbox.com)	Jacob Nabe-Nielsen
09/11/2022	MASTS Annual Science Meeting 2022 "Supporting Delivery of the Blue Economy Vision"	Scene setting: the importance of whole ecosystem, bottom up processes, and interaction with higher trophic levels (an introduction to PrePARED)	Thomas Regnier
01/02/2023	SCOTMER Symposium	Update on PrePARED	Paul Thompson
24/02/2023	PrePARED: Knowledge Exchange Workshop 2023	Forth & Tay case study: Prey	Thomas Regnier
31/03/2023	MFRAG-MM meeting (online)	MMMP passive acoustic monitoring: 2022 results and 2023 plans	Paul Thompson
25/04/2023	Operations and management team at Moray East Marine Coordination Centre	MMMP passive acoustic monitoring: 2022 results and 2023 plans	Paul Thompson
18/05/2023	RESAS Science, Evidence & Policy Conference	Poster: "Impacts of offshore renewables on the marine environment"	Esther Jones & Katherine Whyte
22/05/2023	OSW Research Coordination Meeting	Overview of research questions and key datasets	Lauren Donachie
22-26 May 2023	OCEANOISE Conference	"Seals and offshore wind farm construction: synthesis and future directions"	Katherine Whyte
23/05/2023	OWEC Programme Steering Group Meeting	Summer of surveys update	Sue O'Brien
15/06/2023	Building Interdisciplinary Solutions to Modern Ecological Challenges workshop	'Predator-prey dynamics: analysing contemporaneous spatio-temporal data in an ecological context'	Esther Jones
05/09/2023	OWIC Meeting	PrePARED Update	Polly Tarrant
11-14 September 2023	ICES Annual Science Conference 2023	*Changes in predator and prey in response to operating windfarm turbines* – Oral presentation	Oihane Fernandez

12/09/2023	JNCC Joint Committee field trip	*PrePARED Update*	Francis Daunt
12/09/2023	MROG: Marine Renewables Ornithology Group	*PrePARED Update*	Sue O'Brien
17/10/2023	Irish Whale and Dolphin Group Policy Lead/Codling Wind Farm	*High level overview of PrePARED work on porpoises around wind farms*	Paul Thompson
18-22 September 2023	CWW2023	*Predator and Prey Responses to Offshore Wind Farm Construction and Operation*	Jared Wilson
13/11/2023	University of Aarhus, Centre for Green Transition and Marine Ecology, Denmark	*Seminar on marine mammal wind farm interactions and planned work within PrePARED Workstream B*	Paul Thompson
17/11/2023	Young Irish Statistical Society meeting	*Ecological modelling for offshore renewable energy impact assessment*	Ana Couto
21/11/2023	ECOWIND: Science Coordination Day	*Fish and offshore windfarms: PrePARED research activities*	Matt Witt
22/11/2023	ECOWIND/OWEC Annual Impact Meeting (AIM)	***Fish and offshore windfarms**: research activities in OWEC & ECOWind funded programmes*	Matt Witt
23/11/2023	ECOWIND/OWEC Annual Impact Meeting (AIM)	*Cumulative Effects Approaches in ECOWind and OWEC: Models, Frameworks and Comparisons*	Kate Searle
November 2023	Hutton Symposium	*Impacts of offshore renewables on the marine environment*	BioSS
5-7 December 2023	MASTS Annual Science Meeting	• *Understanding predator-prey interactions from seabird movements* • *Predator-prey dynamics in a changing marine environment*	Esther Jones and Katherine Whyte
14/12/2023	NatureScot meeting	*PrePARED Update*	Paul Thompson

11. TABLE 4 – PrePARED Meetings 2023

When	Date	Name of Meeting	Who Attended
2023 Q1	24/02/2023	PrePARED Annual Knowledge Exchange Meeting	PAG, Task Leads, Stakeholders
2023 Q2	18/04/2023	PrePARED: Q1 Meeting	All Task Leaders except UoE
2023 Q2	22/06/2023	PrePARED Project Kick Off Meeting	SGMD & Fast Track Impact
2023 Q2	26/06/2023	PrePARED Project Meeting Sarah/Lauren	SGMD & Fast Track Impact
2023 Q2	29/06/2023	PrePARED Management Group Meeting	SGMD, BioSS, UoA, SMRUc, Aarhus.
2023 Q3	04/07/2023	1-1 Meeting	Lauren Donachie & Ana Payo-Payo
2023 Q3	05/07/2023	1-1 Meeting	Lauren Donachie & Isla Graham
2023 Q3	06/07/2023	1-1 Meeting	Lauren Donachie & Esther Jones
2023 Q3	13/07/2023	PrePARED Q2 Progress Meeting	SGMD, UoA, BioSS, SMRUc, UKCEH, UoE, NatureScot
2023 Q3	24/07/2023	PrePARED Catch Up (SNA)	SGMD & Fast Track Impact
2023 Q3	26/07/2023	Moray Firth PAM Deployments	SGMD, UoA, Ocean Winds, Moray First Marine
2023 Q3	31/07/2023	OWEC Programme – September PSG	SGMD & OWEC
2023 Q3	02/08/2023	PrePARED SNA Catch Up	SGMD & Fast Track Impact
2023 Q3	14/08/2023	MMMP Campaign August 2023 – KOM	SGMD, UoA, Ocean Winds, Moray First Marine, SSE
2023 Q3	29/08/2023	PrePARED & ProcBe Chat	SGMD & ProcBe
2023 Q3	31/08/2023	PrePARED: Lauren, Kate and Francis	SGMD & UKCEH
2023 Q3	05/09/2023	PrePARED: Lauren, Matt and Tony	SGMD & UoE
2023 Q3	11/09/2023	Expert Working Group 5 – Prey Resource and Availability COWSC	DEFRA, UKCEH
2023 Q3	27/09/2023	PrePARED Q3 Progress Meeting	All Task Leaders
2023 Q4	01/11/2023	PrePARED Management Group – Autumn Workshop	MG
2023 Q4	09/11/2023	PrePARED: Workstream A meeting	Workstream A: SGMD, BioSS, UKCEH
2023 Q4	09/11/2023	PrePARED: Workstream B meeting	Workstream B: SGMD, UoA, SMRUc, UoE
2023 Q4	15/11/2023	PrePARED: Workstream C meeting	Workstream C: SGMD, BioSS, UKCEH, UoA, SMRUc, UoE

2023 Q4	29/11/2023	PrePARED Management Group Meeting	MG
2023 Q4	06/12/2023	PrePARED: Workstream B meeting	Workstream B: SGMD, UoA, UoE, SMRUc
2023 Q4	12/12/2023	PrePARED AKEM Planning	MG
2023 Q4	13/12/2023	PrePARED Q4 Progress Meeting	All Task Leads
2023 Q4	20/12/2023	PrePARED AKEM Planning	MG

12. TABLE 5 – PrePARED Social Media 2023

Social Channel	Posted by	Date	Link
LinkedIn	Oihane Fernandez-Betelu	6 February 2023	https://www.linkedin.com/posts/oihane-fernandez-betelu_preparedproject-preparedproject-offshorerenewables-activity-7038853405691244545-_CMV?utm_source=share&utm_medium=member_desktop
LinkedIn	Oihane Fernandez-Betelu	24 March 2023	https://www.linkedin.com/posts/oihane-fernandez-betelu_preparedproject-predators-prey-activity-7045051981584846849-v8mw?utm_source=share&utm_medium=member_desktop
LinkedIn	Paul Thompson	March 2023	https://www.linkedin.com/feed/update/urn:li:activity:7033849073249972224?updateEntityUrn=urn%3Ali%3Afs_feedUpdate%3A%28V2%2Curn%3Ali%3Aactivity%3A7033849073249972224%29
Blog	Ana Couto	15 June 2023	https://www.bioss.ac.uk/news-events/ocean-and-marine-science-policy-and-industry
LinkedIn	Lauren Donachie	26 July 2023	https://www.linkedin.com/posts/laurendonachie_blueeconomy-nationalmarineweek-activity-7089982432203923456-ZTTD?utm_source=share&utm_medium=member_ios
LinkedIn	SGMD	13 September 2023	https://www.linkedin.com/feed/update/urn:li:activity:7107682571999694848?updateEntityUrn=urn%3Ali%3Afs_feedUpdate%3A%28V2%2Curn%3Ali%3Aactivity%3A7107682571999694848%29
X	SGMD	13 September 2023	https://twitter.com/scotgovmarine/status/1701916827259904148?s=43&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	SGMD	29 September 2023	https://www.linkedin.com/posts/marine-directorate_preparedproject-scotclimateweek-activity-7114569928497614851-8bIX?utm_source=share&utm_medium=member_ios
X	SGMD	29 September 2023	https://t.co/ExyHkqGYif
LinkedIn	Paul Thompson	03 October 2023	https://www.linkedin.com/posts/paul-thompson-9369a0182_bokalift2-arrived-in-invergordon-last-night-activity-7114672872236662785-S1WL?utm_source=share&utm_medium=member_ios
LinkedIn	SGMD	26 October 2023	https://www.linkedin.com/posts/marine-directorate_preparedproject-preparedproject-activity-7123243943290417152-v70t?utm_source=share&utm_medium=member_desktop
X	SGMD	26 October 2023	https://x.com/scotgovmarine/status/1717463687768723602?s=43&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	SGMD	06 November 2023	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7127244386534330368-AvUo?utm_source=share&utm_medium=member_desktop
X	SGMD	06 November 2023	https://x.com/scotgovmarine/status/1721475698752168243?s=46&t=MiEsr-oRRKuiWKYMDRephw

X	SGMD	17 November 2023	https://twitter.com/ScotGovMarine/status/1725463455719674318
X	MASTS	20 November 2023	https://twitter.com/mastscot/status/1726562003446317140 https://twitter.com/mastscot/status/1726562012208279617
X	BioSS	20 November 2023	https://twitter.com/BioSScotland/status/1726603782312829183
X	Esther Jones	21 November 2023	https://twitter.com/estlanejones/status/1726986742119780633
X	Esther Jones	23 November 2023	https://twitter.com/estlanejones/status/1727666960488386847
LinkedIn and X	SGMD	7 December 2023	https://www.linkedin.com/feed/update/urn:li:activity:7138487793000882176?updateEntityUrn=urn%3Ali%3Afs_feedUpdate%3A%28V2%2Curn%3Ali%3Aactivity%3A7138487793000882176%29 https://twitter.com/scotgovmarine/status/1732703781475766640?s=43&t=MiEsr-oRRKuiWKYMDRephw
X	Katherine Whyte	7 December 2023	https://twitter.com/katey_whyte/status/1732745183609958735?s=43&t=MiEsr-oRRKuiWKYMDRephw
LinkedIn	SGMD	18 December 2023	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7142463242064330753-1RwG?utm_source=share&utm_medium=member_desktop

13. TABLE 6 – PrePARED Recruitment 2023

Host Organisation	Job Title	Start Date	End Date	Appointee Name
University of Aberdeen	Postdoc Research Assistant (Maternity Cover)	01/01/2023	31/12/2023	Virginia Lorio
SGMD	PrePARED Project Manager	02/05/2023	02/05/2026	Lauren Donachie
UKCEH	Quantitative Ecologist	28/03/2023	Permanent	Christopher Pollock

14. TABLE 7 – PAG Engagement

Date	Contact	Action
28/09/2022	Introduced new PL. Explained new ToRs and membership.	Update Email
10/10/2022	Sent PAG the Q3 Progress report plus a short project update.	Quarterly Report
31/10/2022	**PAG Meeting:** 1. Quick introductions. 2. An update on PrePARED progress. 3. Quick discussion of proposed new PAG ToRs. 4. Annual Knowledge Exchange meeting. 5. AOB	**Meeting**
31/10/2022	Also sent 2022 Q1, Q2 and Q3 Progress Reports	Quarterly Report
09/01/2023	Update plus link to new website. News of KEM.	Update Email
10/02/2023	Sent PAG Draft Annual Report [10 working days before KEM]	Annual Report
24/02/2023	**PAG Meeting:** At annual KEM. Report received.	**Meeting**

Date	Contact	Action
May 2023	Introduced new PM.	Update Email
05/07/2023	Requested availability for 2024 Annual Knowledge Exchange Meeting	Email
11/07/2023	Requested input from PAG members in stakeholder analysis survey	Email
12/07/2023	Q2 progress report	Quarterly Report
17/08/2023	Invitation to 2024 Annual Knowledge Exchange Meeting	Event Invitation
07/09/2023	Update on ECOWIND/OWEC Annual Impact Meeting	Email
28/09/2023	Provided Stakeholder Analysis Report and link to monthly blog	Outputs
07/12/2023	Reminder and Update on 2024 Annual Knowledge Exchange Meeting	Email
08/12/2023	2 draft reports delivered under Task 4.1 and 4.2 for review and comment.	Outputs

15. TABLE 8 – 2023 Target Achievement

Result	Description	2023	2023	From project start
Completed	A piece of work that is fully completed	53	38%	28%
On Target	An ongoing piece of work with partial running monitoring targets that have been met	45	32%	30%
Delayed	A piece of work that has been delayed due to operational reasons. Mitigating actions are given in the main report.	7	5%	6%
Failed	A piece of work that has not been carried out due to various operational reasons. Details and mitigating actions in main report.	4	3%	3%
No Target	No targets were set for this quarter as the Task is either completed or pending a future date.	32	23%	33%
Total		141		

***Workstream A - Workpackage 1* - Changes in fish communities with OWF development in the Firth of Forth**

Task 1.1	**Broadscale fish response to OWF in the Forth (Dr Thomas Regnier, SGMD)**		
	2022 Q1 Targets	Identify all data sources	**Completed**
		Initiate the processing of raw acoustic data	**On Target**
	2022 Q2 Targets	Produce a map of point abundance per prey species	**On Target**
		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)	**On Target**
		Initiate post processing of acoustic signal and trawl data analyses	**On Target**
	2022 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects	**Delayed**
		Completion of otolith analyses	**Delayed**
		Additional target: Large scale sandeel survey	**On Target**
	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, ~~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.	**Completed**
Task 1.2	**Finescale fish response to OWF in Forth (Dr Thomas Regnier, SGMD)**		
	2022 Q1 Targets	None	**No Target**
	2022 Q2 Targets	None	**No Target**
	2022 Q3 Targets	Conduct BRUV/Fish trap surveys in the Firth of Forth	**Completed**
		Design surveys considering development site conditions	**Completed**
		Completion of surveys	**Completed**
		Initiate analyses of SBRUV data	**On Target**
		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 Firth of Forth.	**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**

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

Task 2.1	**Seabird spatial distribution models in Forth (Dr Esther Jones, BioSS)**		
	2022 Q1 Targets	Review existing prey data	**On Target**
	2022 Q2 Targets	Process seabird GPS data	**On Target**
		Process environmental data	**On Target**
	2022 Q3 Targets	Process seabird GPS data	**On Target**
		Process environmental data	**On Target**
	2022 Q4 Targets	Begin developing analytical framework for distribution modelling	**On Target**
	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.	**On Target**

	2023 Q4 Targets	Working distribution models using prey data from Forth-Tay.	**On Target**
Task 2.2	**Seabird movement models in the Forth (Dr Adam Butler, BioSS)**		
		No 2022 Targets	**No Targets**
		No 2023 Q1, Q2 or Q3 Targets	**No Targets**
	2023 Q4 Targets	Initial development of movement modelling framework	**On Target**
Task 2.3	**Seabird displacement rates in the Forth (Dr Adam Butler, BioSS)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**

***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	**On Target**
	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 2023**
	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: (a) Downstream provision for UoA predator models. (b) Completion of 2022 data analysis (relative fish diversity, abundance, biomass and composition)	**Completed**
	2023 Q3 Targets	~~Laboratory analyses of grab samples (subject to lab availability).~~ **RoxAnn analyses**	**Completed**
		Post-processing of fisheries acoustic and trawl data.	**On Target**
	2023 Q4 Targets	~~Completion of laboratory analyses of grab samples (subject to lab availability).~~ **Now RoxAnn Analysis**	**On Target**
		Completion of post-processing of fisheries acoustic and trawl data for 2023 survey.	**Completed**
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 and unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
	2022 Q4 Targets	Process BRUV video footage from camera surveys	**On Target**
	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).	**On Target**
	2023 Q3 Targets	Unbaited camera surveys in Moray Firth.	**Delayed to 2024**
		Design surveys considering development site conditions	**Delayed to 2024**
		Conduct unbaited camera surveys	**Delayed to 2024**
	2023 Q4 Targets	Process unbaited camera survey video footage.	**Delayed to 2024**
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	**On Target**
	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	**Delayed to 2023**
	2022 Q4 Targets	Service array and ping data download from VEMCO receivers.	**Delayed to 2023**
		Complete 6-month data download	**Delayed to 2023**
	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.	**On Target**
		Process acoustic ping data.	**On Target**
	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**

***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 (Dr Ana Payo-Payo/Prof. Paul Thompson UoA)**		
	2022 Q1 Targets	Collation of pre-construction Moray Firth predator data from digital aerial surveys, telemetry and PAM	**On Target**
	2022 Q2 Targets	Collation of prey and environmental co-variates	**On Target**
	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**
Task 4.2	**Finescale marine mammal distribution in response to OWF and prey fields in the Moray Firth (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	**On Target**
	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**
Task 4.3	**Dose response curves in the Moray Firth (Dr Isla Graham/ 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**
Task 4.4	**Fish nutritional value (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Preparatory lab work	**On Target**
	2022 Q2 Targets	Preparatory lab work	**On Target**
	2022 Q3 Targets	Initial processing of any available samples	**On Target**
	2022 Q4 Targets	Processing of summer 2022 prey samples	**On Target**
	2023 Q1 Targets	Process summer 2022 prey samples.	**On Target**
	2023 Q2 Targets	Summarise interim bomb calorimetry analyses	**On Target**
	2023 Q3 Targets	Initial processing of any available samples.	**On Target**
	2023 Q4 Targets	Processing of summer 2023 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)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
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	**On Target**
	2022 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**
	2022 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**
	2022 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**
	2023 Q1 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**On Target**
	2023 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**On Target**
	2023 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**On Target**
	2023 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental 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**
Task 6.2	**Minimum data requirements for marine mammal distribution models (Dr Ana Payo-Payo/ Prof. Paul Thompson, UoA)**		
	2022 Q1 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 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	**On Target**
	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")**	**On Target**
Task 6.3	**UK EEZ marine habitats similarity assessment for OWF sites (Dr Matthew Witt, UoE)**		
	2022	No 2022 Targets	**No Targets**
	2023 Q1 Targets	No target	**No Targets**
	2023 Q2 Targets	No target	**No Targets**
	2023 Q3 Targets	No target	**No Targets**
	2023 Q4 Targets	Evaluate potential modelling approaches.	**On Target**
		Collate available data for biotic and abiotic variables to use in assessment	**On Target**

Task 6.4	Survey design for predator-prey studies (Dr Cormac Booth, SMRU Consulting)		
	2022 Q1 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	No Target	**No Target**
	2022 Q4 Targets	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	**On Target**
	2023 Q1 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**On Target**
	2023 Q2 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**On Target**
	2023 Q3 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**On Target**
	2023 Q4 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**On 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 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**On Target**
	2022 Q4 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**On Target**
	2023 Q1 Targets	Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development.	**On Target**
	2023 Q2 Targets	Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**On Target**
	2023 Q3 Targets	Integration of project learning into latest DEPONS and iPCoD	**Delayed to 2024/25 (intentional)**
	2023 Q4 Targets	Assessment of how integration of PrePARED project outputs into populations models helps improve models.	**Delayed to 2024/25 (intentional)**
Task 7.2	**Adding biological realism to SeabORD and testing (Dr Kate Searle, UKCEH)**		
	2022 Q1 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Development of initial model parameterisation to simulate hypothesized redistribution of prey around OWFs.	**Delayed**
	2022 Q4 Targets	Development of initial model parameterisation to work with sandeel suitability estimates	**Delayed**
	2023 Q1 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**Delayed**
	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**

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**
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	**On Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	Quarterly meetings to understand progress on CIA components	**On Target**
	2022 Q4 Targets	No target	**No Target**
	2023 Q1 Targets	Convene quarterly meetings to understand progress on CIA components	**On Target**
	2023 Q2 Targets	Convene quarterly meetings to understand progress on CIA components	**On Target**
	2023 Q3 Targets	Convene quarterly meetings to understand progress on CIA components	**On Target**
	2023 Q4 Targets	Convene quarterly meetings to understand progress on CIA components	**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**

***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	**Delayed**
	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**
Task 8.2	**Communications Plan (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 of PrePARED communications plan	**Delayed**
	2023 Q1 Targets	Update draft plan	**Completed**
	2023 Q2 Targets	Finalise draft comms plan and disseminate	**Completed**
	2023 Q3 Targets	Implement Comms Plan	**On Target**
	2023 Q4 Targets	Implement Comms Plan	**On Target**

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

Task 9.1	**Plan annual knowledge exchange workshops**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Plan Year 1 annual knowledge exchange workshop	**On Target**
	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	**On Target**
Task 9.2	**Dissemination of project findings**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**
	2022 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**
Task 9.3	**Organise PrePARED project scientific symposium**		
		No 2022 targets	**No Targets**
		No 2023 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**

16. TABLE 9 – PrePARED Numbers

2023 Q3	WSA-WP1	● 70 BRUV deployments (105 hours of video footage collected), 62 fish trap deployments within 3 sites (1 in construction/operation, 2 in pre-construction) and 2701 fish and crustaceans measured.
2023 Q4	WSA-WP1	● 3 sandeel tows realised in NnG and 3 sandeel tows in Seagreen with only 6 sandeel measured.
2023 Q1	WSB – WP3	● >80 hours of BRUV footage processed for presence, abundance and length of fish ● Fish abundance and length data converted into biomass for each observed species
2023 Q2	WSB-WP3	● Fisheries acoustic data recorded along 510km of transects across the Moray Firth OWF, 5 pelagic tows realised and 133 fish measured, 7 demersal tows realised and 906 fish measured.
2023 Q2	WSB – WP3	● 1 cod and 4 whiting tagged in the Moray Firth
2023 Q2 – Q3	WSB – WP3	● 84 acoustic receivers serviced in the Moray Firth
2023 Q3	WSB – WP4	● CPODs deployed at 65 sites within 2 operating windfarms and 1 windfarm undergoing construction

17. TABLE 10 – Targets for 2024

Task lead	Task	Q1 - Targets	Q2 - Targets	Q3 - Targets	Q4 - Targets
		2024	2024	2024	2024
		Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov Dec
Thomas Regnier	Task 1.1 Broadscale fish response to OWF in Forth	- Produce a map of sandeel point abundance in the sand per age class (from Grab and dredge) - Broadscale prey fields from acoustic transects (pelagic prey) - Completion of RoxAnn analyses	- Produce a map of point habitat characteristics (from RoxAnn) - Prepare fisheries acoustic/ seabird at sea survey: Design surveys based on previous studies and development site conditions	- Conduct fisheries acoustic survey/ seabird at sea survey: (mid July) - Initiate laboratory work (otolith analyses, RoxAnn analyses (subject to laboratory availability)) - Initiate post processing of acoustic signal and trawl data analyses	- Produce point biomass estimates of pelagic fish from acoustic transects - Completion otolith analyses
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	- Completion of 2023 analysis - Map fish (predator) abundance from SBRUV/Traps	- Conduct BRUV/Fish trap surveys in the Firth of Forth: Design surveys considering development site conditions - Completion of surveys - Initiate analyses of SBRUV data - Initiate RoxAnn analyses	Completion of RoxAnn analyses
Esther Jones	Task 2.1 Seabird spatial distribution models in Forth	Working distribution models using the sandeels model. Seabird spatial distributions and uncertainty for selected species within Forth-Tay region	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data. Draft manuscript on spatial modelling methods.
Esther Jones	Task 2.2 Seabird movement models in Forth	Working code for movement modelling framework	Applying movement models to Forth and Tay prey data collected within project	Applying movement models to Forth and Tay prey data collected within project	Applying movement models to Forth and Tay prey data collected within project

Katherine Whyte	Task 2.3 Simulating realistic foraging tracks in IBMs		Identify and develop framework for movement model structure and outputs to use in IBMs.	Identify and develop framework for movement model structure and outputs to use in IBMs. Producing behavioural classifications from movement models.	Identify and develop framework for movement model structure and outputs to use in IBMs. Producing behavioural classifications from movement models.
Anthony Bicknell	Task 3.1 Large-scale fish distribution in Moray	Completion of fisheries acoustic and trawl data processing	Prepare fisheries acoustic survey: Design surveys based on previous studies and development site conditions: 1.Conduct fisheries acoustic survey (end of June)	Conduct BRUV and AI camera surveys in Moray Firth: Design surveys considering development site conditions.	Initiate post processing of acoustic signal, trawl and RoxAnn analyses from June survey
Anthony Bicknell	Task 3.2 Fine-scale fish distribution in Moray (reef effects)			Conduct BRUV and AI camera surveys in Moray Firth: Design surveys considering development site conditions	Start processing BRUV and AI camera video footage from the 2024 camera surveys
Matthew Witt	Task 3.3 Fish acoustic telemetry in Moray	Process acoustic ping data	Catch and tag gadoid fish and service array in the Moray Firth: 1. Completion of annual tagging 2. Completion of 6 month data download	Process acoustic ping data	Service array in the Moray Firth: 1. Completion of 6 month data download
Paul Thompson	Task 4.1 Drivers of broadscale marine mammal distribution in Moray	Finalise report on harbour porpoises and prey. Submit draft report on Moray Firth studies of harbour seal foraging in relation to sandeels		Finalise harbour seal report and explore transferability through Task 6.2	
Aude Benhemma -Le Gall	Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray	Finalise framework for incorporating prey data for analyses on reef effect	Present preliminary results to key stakeholders at suitable event or online workshop	Deliver draft report on relationship between porpoises and prey around OWF	Deliver final report on relationship between porpoises and prey around OWF

Paul Thompson	Task 4.3 Dose response curves in Moray	Recover PAM array deployed during initial construction phase at Moray West OWF	Process data from PAM array	Extract data on porpoise occurrence and foraging buzzes and liaise with industry to estimate received noise levels at each PAM location	Complete dose-response analyses
Cormac Booth	Task 4.4 Fish nutritional value	Processing of summer 2023 prey samples	Analysis of PrePARED and Moray East fish samples	Analysis of PrePARED and Moray East fish samples	Processing of summer 2024 prey samples
Anthony Bicknell	Task 5.1 Generalities in fish response to OWF				Collate and compare Moray Firth and Firth of Forth acoustic and camera footage processed data.
Cormac Booth	Task 5.2 Generalities in harbour porpoise response to OWF	Processing of response and covariate data. Preparation of manuscript on dose response sampling	Processing of response and covariate data	Final collation of PAM data and covariates	Complete the dose-response analyses
Esther Jones	Task 6.1 Minimum data requirements for seabird distribution and movement models	Identify prey and environmental data that could be used in transferring model to wider North Sea region	Select and process prey and environmental data to be used in transferring model to wider North Sea region	Develop revised version of spatial distribution model that uses only variables that are available throughout North Sea region	Compare revised version of model against that derived using Forth-Tay prey data
Paul Thompson	Task 6.2 Minimum data requirements for marine mammal distribution models	Identify key harbour seal tracking datasets available for assessing transferability of patterns observed in Moray Firth.		Scope further simulations using data sets of different resolutions, and transferability, in relation to outputs from Task 4.1	
Matthew Witt	Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites	Perform habitat similarity assessment with suitable model	Write and produce final report		
Cormac Booth	Task 6.4 Survey design for predator-prey studies	Cross-ref with 6.3. Preparation of manuscript on dose response sampling	Cross-ref with 6.3	Short report summarising how future surveys could be carried out	
Cormac Booth	Task 7.1 IPCoD and DEPONS integration of new data and testing	Assessment of how integration of PrePARED project outputs into	Assessment of how integration of PrePARED project outputs into	Assessment of how integration of PrePARED project outputs into	Delivery of the draft report (final report in Q2 2025)

		populations models, helps improve models	population models, helps improve models	population models, helps improve models	
Kate Searle	Task 7.2 Adding biological realism to SeabORD and testing	Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay	Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay	Initial development of simulated foraging tracks for exemplar species	Initial development of simulated foraging tracks for exemplar species; Development of initial model parameterisation to work with joint predator-prey maps
Kate Searle	Task 7.3 Testing and validating SeabORD in the FoF and at UK SPAs				
Cormac Booth	Task 7.4 Integration of PrePARED findings for harbour porpoise CIA	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)	Development of CIA scenarios	Development of CIA scenarios	Updated CIA analyses
Kate Searle	Task 7.5 Integration of PrePARED findings for seabird Cumulative Impact Assessment				
PrePARED Project Manager	Task 8.1 Stakeholder and network analysis				
PrePARED Project Manager	Task 8.2 Communications Plan		review comms plan		review comms plan
PrePARED Project Manager	Task 9.1 Annual knowledge exchange meeting	Host annual knowledge exchange meeting		Begin planning for AKEM 2025	Complete planning for AKEM 2025
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				

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

18. TABLE 11 – Associated Projects

ACTIVE PROJECTS

Name	Funder	Principal Contact	Link	Start	End	Description
PELAgIO	ECOWInd (OWEC/NERC)	Beth Scott Aberdeen University	Link Link			**Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms:** Marine ecosystems are inherently complex, and are strongly influenced by the forces of the physical environment. Care must be taken to ensure that the physical effects of deploying offshore wind, including cables, foundations, and the extraction of wind energy itself, are fully understood. These effects occur at every level within the marine ecosystem, from changes to ocean currents and plankton growth, through to changing behaviours of marine prey and their predators. 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. By observing and modelling over a large range of physical and biological scales, using a combination of autonomous platforms and ocean robots, research vessels and satellite observations, PELAgIO will build an ecosystem-level understanding of projected changes.
ACCELERATE	ECOWInd (OWEC/NERC)	Katrien Van Landeghem Bangor University	Link	2022	2026	**Ecological Implications of Accelerated Seabed Mobility around Windfarms:** When natural currents in the sea deviate around wind turbine foundations or anchors, the forces on the seabed enhance, disturbing sediments. This can change the shape and sediment composition of the seabed, alter the location of fish preyed on by seabirds and reduce the clarity of the water, potentially affecting areas far beyond the windfarms themselves. The climate crisis will exacerbate this, and it will extend to coastal zones, as future storm waves and rising sea levels will alter the ways energy from the sea is transferred to the seabed. The combined changes have associated effects on habitats, ecosystem services, and wildlife populations that surround offshore wind sites, both locally and further afield. By understanding the extent and implications of these changes, ECOWind-ACCELERATE will work out the relative scales of different impacts on the seabed, supporting progress towards the Government's 25 Year Environment Plan and proposing measures to monitor and mitigate against negative impacts.
ECOWINGS	ECOWInd (OWEC/NERC)	Francis Daunt CEH	Link			**Ecosystem Change, Offshore Wind, Net Gain and Seabirds:** Uncertainty around impacts on seabird populations remains a key consenting issue for offshore wind development in the UK, affecting progress towards the increase in deployment of offshore windfarms needed to meet the targets of the British Energy Security Strategy. Seabirds are impacted through collisions, displacement from feeding grounds, and barrier effects on migratory routes or regular flight paths. The cumulative effects of these impacts, the underlying causal relationships behind them, and the extent of habituation over time are currently not well understood. ECOWINGS will transform the existing evidence base on the cumulative effects of offshore wind on key seabird species, establishing pathways for strategic compensation to ensure net gain for seabird populations and the wider marine ecosystem, while accounting for the projected effects of climate change.
BOWIE	ECOWInd (OWEC/NERC)	Martin Solan Southampton University	Link			**Benthic-Offshore Wind Interactions:** The expansion of the offshore wind industry is expected to contribute to the UK's commitment to reach Net Zero by 2050, however, our understanding of the cumulative effects of this expansion is limited when considered alongside the anthropogenic pressures from other seabed users. In order to maintain the biodiversity and productivity of our seabed and associated ecosystems, as well as their supporting functions and services, it is critical that sustainable approaches align the offshore wind expansion with other marine spatial planning pressures. BOWIE will use a combination of environmental and social research to help to fill critical knowledge gaps and facilitate

						sustainable decision-making practices. Autonomous underwater vehicles will examine seabed habitats and species, while stakeholder engagement will seek to understand uncertainty and knowledge gaps in decision making. BOWIE will support industry, regulators and policy makers in implementing robust approaches to offshore wind development in consideration of marine environmental recovery, biodiversity and net gain targets.
POSEIDON	OWEC	Alex Banks NaturalEngland	Link	2022	2025	**Planning Offshore Wind Strategic Environmental Impact Decisions:** Different marine areas have different environmental sensitivities. To ensure new wind farms are built in the most sustainable locations, it's important to have a full picture of what those sensitivities – or risks – may be. The POSEIDON project will conduct analysis to strengthen the knowledge base of the potential risks of developing wind farms on different environmental receptors, such as seabirds, marine mammals, marine landscapes and benthic seabed habitats. New and existing data on environmental sensitivities will be combined using existing web-based tools where possible, to provide a comprehensive environmental baseline. These tools will be used by marine managers, scientists, developers and all those with an interest in offshore wind to ensure that decisions on marine planning and project development can factor in environmental risk from the outset. This collaborative UK-wide project is being led by Natural England, with support from an advisory group comprising Cefas, JNCC, the MMO, Natural Resources Wales, NatureScot and Bangor University. The project began in January 2022 and is due to continue until 2025.
Remote Tracking of Seabirds at Sea	OWEC	RSPB		2022		Aims to reduce uncertainty around the population level impacts on seabird populations from offshore wind by providing empirical data using novel MOTUS technology.
SeaShare	ScotMER	Kirsty Wright SGMD	Link Link	2022	?	1) Trials of deploying static fishing gear within HyWind site, 2) future plans for mobile gear.
Marine Data Exchange	OWEC	OWEC	Link	2020	ongoing	It provides a digital platform for offshore industries to share survey data collected throughout the lifetime of offshore projects, and hosts new data and research generated through programmes such as The Crown Estate's Offshore Wind Evidence and Change (OWEC) programme. Through this approach, we can ensure that existing data and evidence drives positive impact, whilst identifying and addressing data and evidence gaps. The significant evidence base on the MDE – which is currently over 260TB of data – will be important in accelerating offshore wind deployment to reach net zero by 2050, achieving energy security, and in driving holistic evidence-based decisions that support the protection and enhancement of the marine environment. By making this wealth of data freely available through cutting-edge technology, we give offshore projects in the UK a valuable head start, helping those involved to make informed, evidence-based decisions and address consenting and planning challenges.
ProcBe	OWEC	Bryony Baker	Link	2023	2026	The ProcBe (Procellariiform Behaviour and Demographics) project aims to improve our understanding of the at-sea behaviour, distribution and demography of three of the UK Procellariform species – Manx shearwater and both European and Leach's storm-petrels – through the use of existing data combined with novel research. The ProcBe project seeks to fill critical evidence gaps around how Procellariformes might interact with offshore wind farms and improve demographic rate and population modelling approaches. This will help to improve confidence in offshore wind impact assessments and allow expansion of offshore wind developments in the Celtic and Irish Seas and the west coast of Scotland in a sustainable way.
PrediCtOr	OWEC	Bethany White, Carbon Trust	Link			The PrediCtOr (Prevalence of Seabird Species and Collision Events in OWF) project aims to develop a coordinated approach for reducing uncertainty surrounding bird collision risk and influencing factors, and therefore reducing consenting risk, at offshore wind farms. This will be achieved by: • Developing a robust data framework that will allow the integration and combined analysis of datasets from past and future collision monitoring campaigns.

						• Establishing best practice guidance on the use of monitoring technologies, equipment installation offshore and data handling as well as recommendations for future study designs best suited to monitoring seabird behaviour around offshore wind farms. • Conducting an onshore field study to understand biases and limitations of monitoring equipment from various suppliers.
PREDICT	Orsted	Beth Scott	Link			PREDICT is an ambitious three-year project funded by Ørsted, the global leader in offshore wind, and a collaboration between the University of Aberdeen and Environmental Research Institute (ERI) at the University of the Highlands and Islands that aims to address knowledge gaps in offshore wind environmental characterisation by improving understanding of fish migration patterns and providing a vision for next-generation monitoring techniques. The project brings together a diverse team of expertise from academia and industry spanning a range of multi-disciplinary research disciplines including ecology, engineering, and data analysis, to investigate fish migration patterns as prey availability to better predict the locations and seasons where top-level predators (seabirds and mammals) may have increased interaction with windfarms. PREDICT will also look at how climate change may impact predictions of oceanographic changes to productive regions in time and space that may drive as well as use methodologies to assess the knock-on effects on seabird and marine mammals. The project will support building the evidence base of strategic prediction, survey and analysis methods, and help to increase confidence in developing and consenting offshore wind arrays. Outputs of the project will enable the industry to avoid using locations that have a higher likelihood of overlap with important feeding grounds for seabird and marine mammals for offshore wind developments now and into the future.
ReSCUE	OWEC	Tim Hill, Natural England	Link	2023	2026	Reducing Seabird Collisions Using Evidence. This three-and-a-half-year project will improve our knowledge of seabird flight heights and collision risk with offshore wind turbines in UK waters. This will reduce consenting risk for new offshore wind projects and, where needed, inform effective mitigation to aid the nature-friendly expansion of the offshore wind industry.
FiSMaDiM	OWEC	Kirst Wright		2023?		Fisheries Sensitivity Mapping and Displacement Modelling (FiSMaDiM): Cefas and St Andrews Uni are working on a fisheries displacement model looking at historic fishers behaviour to predict potential future behaviour in terms of displacement and incorporating socio-economics.
sWEETS3	NERC	Dr SL Wakelin, National Oceanography Centre, Science and Technology	Link	2023	2026	Enabling Sustainable Wind Energy Expansion in Seasonally Stratified Seas (eSWEETS3):

PROJECT BIDS

Name	Funder	Principal Contact	Link	Start	End	Description
ECOCHANGE	ScotMER / OWEC	Flora Kent		?	?	Ecosystem Consequences of habitat changes and the implications for a net gain energy approach: The first stage of the ECOCHANGE project would be to review any outputs from relevant projects (PrePARED, NorthSea3D, NEMOES, BenCh, etc.) along with stakeholder engagement to determine suitable sites etc.

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	An intelligent cetacean recorder 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.
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