ANNUAL REPORT 2025

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UK Centre for Ecology & Hydrology

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NatureScot

Natural England

Funded by:

Offshore Wind Evidence + Change Programme

The Crown Estate

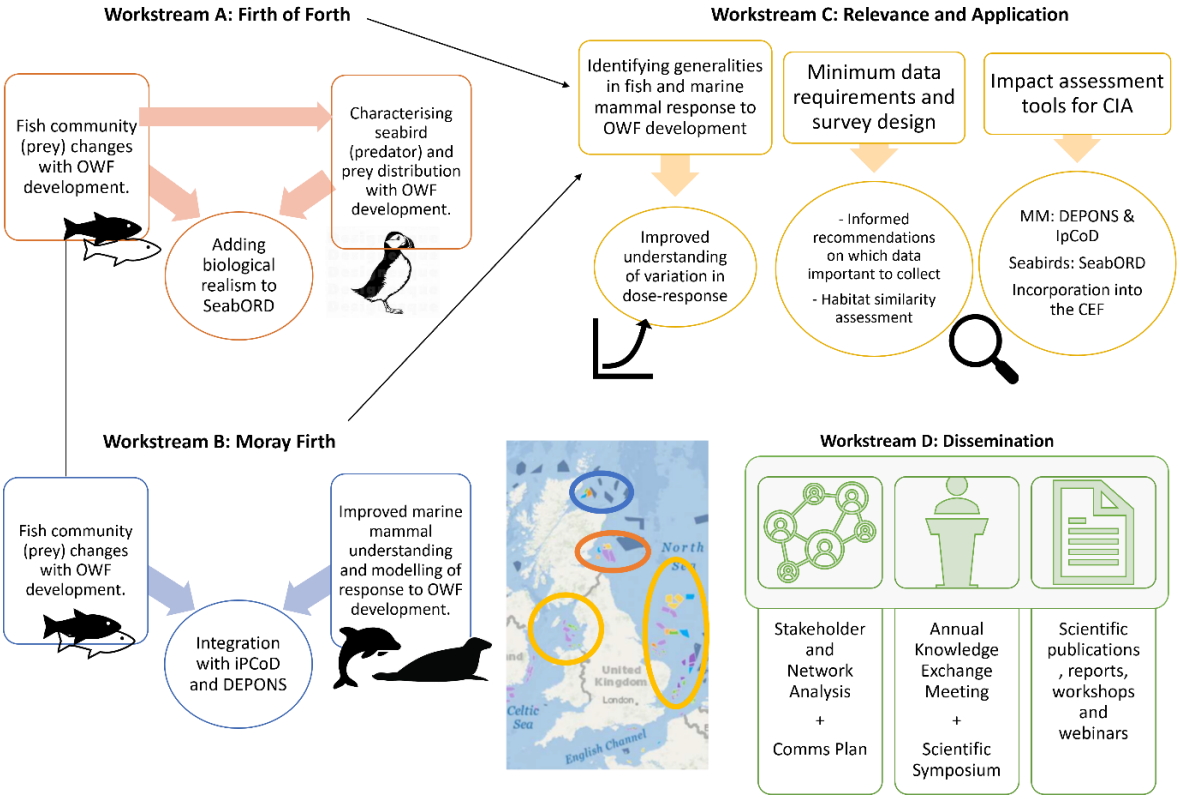
Crown Estate Scotland
Oighreachd a' Chrùin Alba

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). This project forms part of the OWEC programme, led by The Crown Estate in partnership with the Department for Energy Security and Net Zero and Department for Environment, Food & Rural Affairs. The OWEC programme is an ambitious strategic research and data-led programme. Its aim is to facilitate the sustainable and coordinated expansion of offshore wind to help meet the UK's commitments to low carbon energy transition whilst supporting clean, healthy, productive and biologically diverse seas.

The PrePARED project concurrently studies predator (seabird and marine mammal) and prey (fish) distribution and behaviour in and around offshore wind farms, providing critical insight into cumulative effects from large-scale developments on key marine species. Bringing together expertise from government, academia, nature conservation agencies and industry, PrePARED will address critical knowledge gaps that are considered barriers to sustainable offshore wind development, which is required to help meet the Scottish Government's renewable energy targets and reach net-zero emissions.



2. This Report

This report summarises the fourth year (2025) of the PrePARED project. The report is broken down into the workstreams, work packages and tasks of the project. The project activity has been written by all PrePARED task leaders and edited by the PrePARED Project Management Team.

Section 3 presents a summary of the PrePARED achievements in 2025. Annexes A to D provide the details of these achievements. Section 4 provides a new overview of PrePARED's impact statements and their current status.

At the end of the report, in a series of tables, we document: all field work undertaken within the project in 2025 (Table 1); dissemination and communication undertaken in 2025 such as reports or papers published (Table 2), presentations delivered (Table 3); webinars hosted (Table 4); meetings held or attended (Table 5), social media communications (Table 6); engagement of the Project Advisory Group (PAG) (Table 7); progress against each quarterly target of the project using a RAG system, where green indicates a target which was achieved or is ongoing and on schedule, amber a target that is ongoing but has been delayed, and red a target that has failed (Table 8). Any mitigation measures are described in the text. Finally, a summary of PrePARED activity in numbers (Table 9) and Milestones for the coming year, 2025 (Table 10).

A glossary at the end of the report explains all acronyms used.

3. Year Summary

Target Achievement

In Year 4 (2025) of PrePARED there were 28 tasks, leading to 79 targets. Of these targets, 61 (77%) were either completed or are ongoing and are on target for final delivery. Delivery of 15 targets (19%) were delayed for various operational issues, described below. 0 targets (0%) were not achieved.

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

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

In this reporting year, SGMD have finalised the processing of the 2024 fisheries acoustic data (post-processing and formatting) and shared the data with PrePARED partners. SGMD updated models of pelagic fish distributions to include the 2024 data. SGMD have developed a model using pelagic prey distributions as well as environmental variables (e.g., distance to the shore, surface currents…) and offshore windfarm variables (e.g., turbine density) to describe seabird at sea distributions collected in 2023 and 2024 as well as historic data. Outputs from these models were presented at the MASTS annual conference in November 2025 and a manuscript for publication in a scientific review is in progress.

In 2025, two additional surveys (0825A and 0925A) were also planned (communication with OWFs, planning and preparation) and completed in June and July 2025. These surveys took place across the entire area (Moray Firth and Forth and Tay regions) and included a survey of demersal fish at fixed stations for 0825A and a fisheries acoustic survey (to record schools of pelagic fish) and a seabird at sea survey for 0925A. The surveys also recorded environmental variables such as sea temperature and salinity or seabed hardness and roughness at fixed stations and along the survey track. Both surveys were successful with over 36,000 fish measured by length across 55 species for survey 0825A and 1,800km of fisheries acoustic transects recorded and over 23,000 seabirds recorded across 17 species.

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

In 2025, the analyses of video from Baited Remote Underwater Video (BRUV) collected in 2024 were finalised. The generated data were combined with fish trap data (deployments of BRUVs and fish traps within and outside OWFs) and data from the demersal surveys (PrePARED and historic) to model the distributions of demersal fish at both broad-scales (i.e., across an area extending from the Moray Firth to the Forth and Tay region) and fine-scales (i.e., within OWFs). The models were finalised in 2025 for 4 species including: Haddock, Plaice, Common dab and Long rough dab. Witing is now being finalised and a manuscript for publication in a scientific review is being planned. RoxAnn data (seabed hardness and roughness) collected during PrePARED surveys and other SGMD surveys have been compiled and analysed (Including all available 2025 data). The layers produced have now been used in the models described above as well as in Task 1.1.

Task 2.1 Seabird spatial distribution models in the Forth

BioSS developed, tested, and applied robust spatial analytical methods for linking seabird tracking data with prey layers (from Task 1.1) to produce seabird distributions with uncertainty. The team developed an R-package to simulate movement tracks across environments and used them to evaluate different habitat selection models. Methods providing comparison analyses were finalised, characterising how central place foraging bias affects parameter estimation and providing recommendations for modelling frameworks best suited to tracking data. A full draft of a methods comparison manuscript, accompanied by R code and user guide with case studies, is being prepared for submission to Journal of Animal Ecology.

Using the methodology outlined above, BioSS fitted models to predicted prey maps delivered by SGMD (Task 1.2) and seabird tracking data to produce seabird distribution maps with uncertainty for key species (kittiwake, guillemot, razorbill, puffin) in the Forth & Tay region. The team provided document workflow and outputs in multiple formats of seabird distributions for integration into tool development (Task 7.2).

Task 2.2 Seabird movement models in the Forth

BioSS incorporated an additional year of seabird tracking and fish data from 2024 to model seabird movement across scales, linking it to prey distributions. They considered how to incorporate the adjustments to the Langton et al. (2021) sandeel map (work being undertaken under Task 6.1) into the movement models to improve the link between seabirds and sandeel across a larger spatial area (beyond the Forth and Tay). Predicted prey layers were incorporated into the movement modelling framework and continued refinement of multiscale movement analyses has included aligning tracking locations with updated prey predictions to generate fully contemporaneous predator-prey datasets.

Linked to Task 2.3, BioSS explored alternative movement model structures to improve understanding of predator–prey relationships and to parameterise Individual Based Models (IBMs) for realistic simulations (Task 7.2). Differences in movement characteristics across the four tracked seabird species have been analysed to inform species-specific parameterisation. Appropriate time resolutions were selected based on initial models to ensure the best possible match with the empirical (real) data and integration of prey data into these models is ongoing.

A draft manuscript on movement modelling, quantifying and comparing scales of matching movement to prey, is being prepared for delivery in early 2026.

Task 2.3 Simulating realistic foraging tracks in IBMs

BioSS and UKCEH developed statistical and computational frameworks that translate empirical movement analyses into realistic IBMs. This included evaluating alternative movement model structures, accounting for different behaviours and foraging stages, and integrating prey data. The team developed and refined a full framework for comparing real and simulated tracks, supported by an Approximate Bayesian Computation (ABC) algorithm, while finalising parameter sets and building a robust, repeatable code pipeline. Species-specific movement characteristics were explored to enable parameterisation tailored to each of the focal seabird species. Parameterisation algorithms were tested at scale, and a draft report was prepared outlining the full bridging framework linking empirical data (Tasks 2.1 & 2.2) to simulation development for Task 7.2.

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

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

To assess the large-scale distribution of fish in the Moray Firth, fisheries acoustic and trawl surveys have been conducted each year since 2022 using the Alba Na Mara vessel. The 2025 survey took place in June with the subsequent post-processing and conversion of raw data to biomass estimates completed at the end of this year. These

data will be included in analysis to determine whether there is evidence to suggest the offshore wind farms in the Moray Firth are influencing the distribution of pelagic or demersal fish species, and also to update the species distribution models (SDMs) that have provided prediction maps/layers for the Moray Firth (Task 1.2). Reporting for both will be complete in 2026.

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

In 2025, UoE published/submitted for publication two research papers related to the fine-scale effect of offshore wind turbine foundations on the abundance and biomass of demersal fish in the Moray Firth. These were based on data gathered from baited remote underwater video (BRUV) surveys in 2022 and 2024, with the latter being processed using AI fish detection models developed for the project.

The results showed an increase in abundance and biomass of flatfish spp. and haddock close to turbine foundations with the highest amount within 30 m of the structures. Video footage from unbaited camera systems (Cuttlefish) deployed for 24hrs (overnight) at turbine foundations (30m) and reference sites (500m) were processed using a retrained version of the AI fish detection model during the latter part of 2025 with the resulting data currently being analysed for reporting in 2026.

Task 3.3. Fish acoustic telemetry in the Moray Firth

The final retrieval (and data download) of the acoustic telemetry receiver array in the Moray Firth wind farms was completed in the spring of 2025. The post-processing and ongoing analysis of >2 million detections from ~250 fish (cod, haddock and whiting) tagged between 2022-2024 has revealed 6 predation events of cod by a marine mammal, and previously unknown variation in intraspecific movement behaviour in haddock (horizontal and vertical). A research paper describing the possible prey selection (cod over haddock) by the likely marine mammal (seal) and its consequences has been drafted and will be submitted for publication in early 2026.

The initial results of tagged fish movement and behaviour analysis conducted in 2025, where haddock were found to either show residency or roaming/exploratory behaviour, was presented at the Conference on Wind Energy and Wildlife Impacts in combination with the haddock biomass results from Task 3.1. A more comprehensive analysis of the tracking dataset in conjunction with environmental and wind farm variables is ongoing for submission as a publication in 2026.

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

Work describing how harbour porpoise distribution is related to the prey distribution (using the new Scottish Government sandeel distribution data) was delivered in PrePARED Report No. 1 in 2024. An additional report exploring how archive harbour seal tracking data can be used to develop a second case-study for a seal species had been proposed for completion in Q1 2025. However, initial analyses had highlighted the need to account for temporal autocorrelation in the data and additional model

development was carried out by BioSS. Modelling work has now been completed but, due to the need to prioritise more policy relevant work under Task 4.3, delivery of this report has been delayed until Q4 2026.

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

In 2025, UoA extended the PAM-BRUV analyses conducted and presented throughout 2024. These additional analyses aimed to investigate the extent to which harbour porpoise foraging activity varied with length-specific flatfish and haddock biomass estimates. We wanted to understand whether higher biomass estimates were driven by either an increase in small prey abundance that could be predated upon by porpoises or by a few larger (piscivorous) individuals that may compete with porpoises.

Fish length could not always be measured for the individuals observed in the BRUV, but for those measured, biomass estimates were calculated using length-bins of 10 cm increment. Overall, biomass estimates derived for each length group was similar between monitoring sites, and no significant differences in porpoise foraging activity was detected in relation to availability of prey of specific sizes/varying length-specific flatfish and haddock biomass at operating windfarm sites.

Further, to investigate fine-scale variation in harbour porpoise behavioural response to disturbance in relation to prey availability at an operating windfarm site, UoA estimated the time to first porpoise acoustic detections following close approaches by service vessels and compared the extent of behavioural response between monitoring sites of varying habitat quality i.e. with differing levels of vessel traffic and overall foraging activity. They found that, following the passage of a service vessel transiting, harbour porpoises seemed to come back faster at sites close to a turbine than at sites between rows of turbine. As shown in Task 3.2 (*Fine-scale fish distribution in the Moray Firth*), these turbine foundations aggregate demersal fish species and therefore may provide more predictable foraging opportunities. These structures could also act as shelter as they may be less frequently exposed to disturbance and vessel traffic.

However, when focusing solely on the monitoring sites around structures, we found porpoises had a higher level of response following exposure to service vessels at turbines (e.g., for equipment and crew transfer) in comparison to those transiting. This could be due to the difference in the level and duration of disturbance between service vessel activities. In addition, we found that porpoise level of response to service vessel traffic was reduced in areas with higher foraging activity. These areas were strongly correlated with areas of higher probability of sandeel occurrence. These results may suggest that porpoise levels of response to disturbance may be mediated by prey availability and predictability. This study was presented at the CWW 2025 conference in Q3 2025, and a report is currently being drafted and will be submitted in Q1 2026.

Task 4.3. Dose response curves in the Moray Firth

Following the 2024 delivery of PrePARED Report No 4 "*Harbour porpoise responses to the installation of XXL monopiles without noise abatement; implications for noise management in the Southern North Sea*", this work package has been expanded to

maximise the impact of PrePARED research on consenting and delivery of UK OWF projects. During Q1, additional analyses were conducted to allow incorporation of PrePARED results into the JNCC review of Effective Deterrence Distances (EDR), resulting in a reduction in conservatism within the revised JNCC guidance on EDR that was published in Q3 2026.

Results of these PrePARED field campaigns and analyses, together with work carried out under WP B, were also used to facilitate a major study of responses of porpoises to unabated pile-driving noise in the Southern North Sea to improve transferability of our results. Following discussions with the SSER and SMRUC, the UoA PrePARED team was able to help provide PAM equipment and inform the design of a PAM array that was successfully deployed around Dogger Bank C during construction Q2 and Q3 2025.

Impact focused discussions with SNCBs in Q1 2025 highlighted the value of an additional report that compared observed disturbance responses of porpoises with those predicted in the Moray West EIA. As a result, at the end of Q2, we delivered PrePARED Report No 8 "*Predicted and observed responses of harbour* porpoises *to pile driving noise at Moray West Offshore Wind Farm*". These comparisons highlighted that predicted noise levels provided a good fit (typically within 1 dB (range -2.4 dB to + 3 dB)) to measured levels. However, predictions of disturbance to harbour porpoises were highly conservative; monitoring data indicated that < 100 porpoises would be disturbed by each piling event, compared to worst-case predictions of > 4,500 in regulatory assessments.

In Q3, these results were presented at two international conferences. Importantly, PrePARED Report No 8 suggested that observed levels of disturbance were a better fit to predictions made using a distance-based deterrence function rather than a dose-response function. This issue is now being explored further through the main analyses that were originally outlined under Task 4.3. Delivery of this report has been delayed due to the decision to prioritise work on Reports No 4 and 8 and their associated impact activity.

During 2025, we have integrated available data on noise levels and porpoise behavioural responses from monitoring studies at the three Moray Firth Windfarms (Beatrice, Moray East and Moray West). These data are being used to explore how dose and proximity shape response functions. As suggested in Report 8, these analyses show that deterrence functions at all three wind farms are similar. In contrast, the relationship between disturbance and received noise differs between wind farms. A paper on this work is currently in draft form and will be submitted in Q1 2026.

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

In 2025, processing of prey samples continued with a focus throughout the year on increasing the number of species and refining the data available on both large and small size classes to improve the generated length-weight and length-energy relationships. In Q1 the existing data were integrated with distribution and biomass maps produced from Task 1.1 and Task 3.1 to create energyscapes for the Firth of

Forth and Moray Firth. In Q2 there was a focus on sandeel processing and samples from both summer and winter surveys were processed and incorporated into the expanding database. In Q3 processing continued so that 35 of the 37 species for which we have samples was completed and presented at the CWW meeting.

At the end of 2025, bomb calorimetry and sample processing has been completed including 1,500 sample runs, the database now includes data from 37 species of fish and cephalopod totalling 662 new prey energy estimates. The database is being finalised and discussions with project partners are underway to ascertain the most useful way for the data to be formatted for sharing in 2026.

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

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

The assessment of any generalities in fish response to offshore wind farms between the two PrePARED study sites (Moray Firth and Forth and Tay) has been reliant on the collection, post- processing and analysis of data from various surveys conducted as part of Tasks 1.1, 1.3, 3.1 and 3.2. The majority of these were completed during 2025, and will now allow inter-site comparison of composition, behaviour and biomass distribution for pelagic and demersal fish species. Haddock has been identified as an abundant species that will allow a detailed evaluation of whether there is a similar fine-scale response to turbine density within wind farms in each location. This assessment will be completed in Q3 2026, using data from corresponding baited camera surveys.

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

Work throughout the year was focused on production of two manuscripts to explore the effect of PAM array design on EDRs and calculation of dose-response functions. The outputs of this task will inform PAM array designs for future response studies. The main findings are contained within two manuscripts: 1. The first has been submitted to Ecological Applications and focuses on the PAM array design for EDRs and dose response functions and reveals that the number of PAM stations & spatial extent of the array affects the probability of detecting behavioural responses and influences the variability in resulting response ranges. 2. The second manuscript accepted as a paper from the Effects of Noise on Aquatic Life Conference Proceedings reveals that the distribution pattern of hydrophones within the array (e.g., uniform/increasing/decreasing gradient) is also important.

Task 6.1 Minimum data requirements for seabird distribution and movement models

BioSS focused on improving the spatial and temporal transferability of the Langton et al. (2021) sandeel distribution map. They addressed computational constraints in producing uncertainty layers by reproducing the original Langton et al. (2010) hurdle

model in a Bayesian framework, which enabled rapid posterior sampling (to quantify spatial uncertainty). They tested the Bayesian model outputs against the original outputs to ensure the models were equivalent.

Temporal variability was investigated by exploring ICES stock assessment datasets. The team ran periodicity and permutation tests to identify any temporal pattern in fish abundance and there is no clear evidence of patterns detected. They constructed a framework for integrating stock assessments with spatial models. They then finalised the approach for adding temporal variability, engaged with project partners to refine integration pathways, and prepared sandeel data products, with a manuscript preparation planned for 2026.

Task 6.2 Minimum data requirements for marine mammal distribution models

This task was removed from the project scope in 2025.

Task 6.3 UK EEZ habitat similarity analysis to PrePARED windfarms

This task was completed in 2024.

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

This task as originally envisioned builds on the similarity assessment in Task 6.3 as well as Task 6.2 and other PrePARED workstream C outputs. With the cancellation of Task 6.2 and delays in delivery of other outputs in 2025 SMRUC suggested a small change in focus to a synthesis of lessons learned on predator and prey surveys across the project. A questionnaire was designed with feedback from project partners to elicit the lessons learned and responses from five partners had been collected as of the end of the year. In 2026, SMRUC will complete data collection, summarise the responses and create a 2-page infographic to clearly communicate the lessons learned from PrePARED that can be applied to similar projects in the future with a wide stakeholder audience.

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

Work to build the model with existing datasets progressed through the first half of 2025. After sharing a draft report, additional feedback from project partners was taken on board and revised datasets were identified and prepared for integration into the model.

Final modelling and reporting will occur in early 2026.

Task 7.2 Adding biological realism to SeabORD and testing

Across the year, substantial progress was made in developing, refining, and preparing to validate more realistic seabird movement simulations within SeabORD. In Q1, UKCEH advanced movement modelling by implementing a biased correlated random walk that captures exploratory movement away from the colony, area-restricted search (ARS) behaviour in high-prey patches, and subsequent return to the colony, allowing individuals to adaptively respond to heterogeneous prey distributions, including those potentially altered by OWFs.

In Q2, these developments were consolidated into a “generic” seabird movement framework incorporating key behaviours such as land avoidance and distinct movement modes (travel and ARS), enabling alignment with SeabORD. Once attained, this set the stage for developing our parameterisation approach, in conjunction with Task 2.3, using Approximate Bayesian Computation to arrive at species-specific models for four focal seabirds, alongside initial discussions with UKCEH and BioSS on integrating realistic track simulations into SeabORD.

In Q3, predator–prey maps were selected as the basis for validating simulated track distributions, with ongoing discussion on implementation and a slight delay caused by extensive manuscript revisions, ahead of the SeabORD paper submission to the Journal of Applied Ecology in December 2025, to be accompanied by preprint release, and publication of SeabORD 2.0 code on GitHub.

In Q4, coordination with project partners focused on assembling new empirical and modelled data for validation in the Forth–Tay region, using BioSS seabird distribution maps (due January 2026) to assess simulated foraging tracks.

Task 7.3 Testing and validating SeabORD in the Forth and Tay and at UK SPAs

Across the year, progress on Task 2.3 focused on assembling empirical data, engaging stakeholders, and preparing targeted case studies to test and validate SeabORD in the Forth and Tay region and at UK SPAs. In Q1, local GPS tracking data from the Isle of May were processed to produce utilisation distributions for four focal species (razorbill, guillemot, kittiwake and puffin), providing a robust basis for developing joint predator–prey distribution maps. In Q2, following a dedicated training day with Natural England on SeabORD 2.0, discussions were initiated to agree on appropriate model settings and inputs (including the potential use of RSPB GPS tracking data), enabling the next steps of completing simulation runs and preparing a dissemination report. UKCEH met with Natural England in late October to establish the Flamborough and Filey SPA as a focused case study, with Natural England committing to provide recent seabird foraging distribution maps, confirm relevant OWF footprints and scenarios, and specify key parameters (e.g. displacement and barrier rates) for black-legged kittiwake model runs.

Task 7.4 Updating Cumulative Impact Assessments for marine mammals

Work on this task in 2025 resulted in completion of PrePARED Report 7: “Challenges and Solutions for Offshore Wind Farm Cumulative Effects Assessments for Marine Mammals.” The work was also presented at the Effects of Noise on Aquatic Life conference and as part of a dedicated stakeholder webinar. In addition to the main report, work continued in 2025 on two case study reports. The first, focusing on the effect of including projects without an EIA in the cumulative impact assessment was published as PrePARED report 009. The second, focusing on the effect of including the wind farms “as built” versus as included in the EIA, in the cumulative impact assessment ran into some delays as it relies on data provision from developers. The second case study and another stakeholder webinar to present both case studies is planned for Q1 2026.

Task 7.5 Integration of PrePARED findings for seabird Cumulative Impact Assessment

Collation of new empirical learning on responses of prey and seabirds around OWFs has begun and will primarily focus on work delivered by Marine Directorate. This evidence will be summarised as a PrePARED Report in Q4 2026.

Workstream D – Dissemination to inform OWF planning, policy and licensing

Task 9.1 Annual Knowledge Exchange workshops

In lieu of a 2025 AKEM, the team agreed with OWEC to undertake webinars alongside PrePARED reports. More information on the webinars can be found under Table 4.

Task 9.2 Dissemination of project findings

Project findings have been disseminated via the website blog, reports, peer reviewed papers, webinars, stakeholder meetings, social media and conference attendance.

Task 9.3 PrePARED project scientific symposium

Planning for the 2027 final project symposium is underway. The Technology and Innovation Centre, Glasgow has been booked for the 20th and 21st January 2027. Planning for this event will progress throughout 2026.

Task 9.4 Website and Social Media

The website continues to be updated throughout the year, with all project outputs listed here alongside a bi-monthly blog. Due to central staff constraints, social media was reduced in 2025 but main project outputs were posted as soon as possible.

4. Annual Project Impact Review

The following table demonstrates actions completed by the PrePARED project team in 2025 towards impact delivery. These are activities in addition to the core PrePARED scope.

Impact Statement	Action	Completed by
PrePARED science will improve our understanding of the response of marine mammals to OWF developments, particularly to the generation of impulsive noise. This will provide greater certainty concerning marine mammal impacts and allow relevant guidance to be updated so that current constraints on construction scheduling will be reduced.	Built on work in PrePARED Report 4 by carrying out further data analysis from other Moray Firth wind farms and provide outputs that was used within the JNCC EDR review.	University of Aberdeen
	Produced an additional PrePARED report and briefing note comparing observed noise levels and disturbance to porpoises with predictions from the Moray West EIA and Piling Strategy that were based upon dose-response relationships used in assessments within Scottish & Welsh waters. Report was submitted to OWEKH once published.	University of Aberdeen
	Developed knowledge exchange activities to embed new understanding within SNCB and broader stakeholder community, and update guidance on use of dose-response relationships for Scottish & Welsh waters.	University of Aberdeen / NatureScot
PrePARED science will provide greater certainty regarding project level impacts predicted using knowledge of seabird interactions with OWF developments and by IBM seabird models (e.g., SeabORD). This will reduce consenting uncertainties by robustly adding to the evidence base used to support a consistent and more proportionate approach to seabird impact assessments, agreed by	Training provision to NatureScot for use of new version of SeabORD model (version 2.0) to facilitate NatureScot internal capacity for model use, and for updating of NatureScot guidance upon wider model release later on in 2025. UKCEH are training 3 NS ornithologists on the use of the new version of SeabORD (v2.0) to allow them to increase their capacity for internal use of the model, as well as in updating their guidance on its use in assessments.	UKCEH / NatureScot
	Training provision to SG Marine Directorate for use of new version of SeabORD model (version 2.0) to facilitate internal capacity for model use, and for understanding of model updates in the wider model release in 2025. UKCEH are training 5 Marine Directorate	UKCEH / SGMD

SNCBs in updated guidance.	ornithologists on the use of the new version of SeabORD (v2.0)	
	Training provision to Natural England for use of new version of SeabORD model (version 2.0) to facilitate Natural England internal capacity for model use and assessment of case work, and for updating of Natural England guidance upon wider model use in English assessments. UKCEH are training 9 Natural England ornithologists on the use of the new version of SeabORD (v2.0) to allow them to increase their capacity for internal use of the model, assessment of case work, and in updating their guidance on its use in assessments.	UKCEH / Natural England
Knowledge from PrePARED will improve assessments of the potential environmental impacts of offshore wind farms on marine fish and their predators (marine mammals and seabirds) through a better understanding of predator and prey dynamics (including spatial and temporal overlap and energetics). This research feeds into other PrePARED work packages and may have implications for how fish are accounted for in EIAs (both in their own right, and as prey). Findings from PrePARED may also inform monitoring approaches for fish.	Manuscript submitted to journal summarising empirical learning from the PrePARED project in relation to impacts of OWFs on demersal fish distribution.	University of Exeter
	Manuscript submitted to journal summarising empirical learning from the PrePARED project in relation to impacts of OWFs on demersal fish behaviour and interactions with predators.	University of Exeter

5. TABLE 1 – PrePARED Surveys 2025

Survey Code	Vessel	Scientist in Charge	Days	Dates	Survey Description	Area
N/A	Charter	R. Main	15	13th May – 1st June 2025	Recovery of acoustic receivers	Moray Firth
0825A	Alba na Mara	T. Regnier	16	3rd – 19th June 2025	Demersal fishing survey with RoxAnn survey and CTD samples.	Moray Firth and Firth of Forth
0925A	Alba na Mara	T. Regnier	17	23rd June – 10th July 2025	Acoustic fish survey and seabird at sea.	Moray Firth and Firth of Forth

6. TABLE 2 – PrePARED Published Outputs 2025

Published 2024

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

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

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

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

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

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

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

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

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

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

Published 2025

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Hastie, G. D., Matei, M., Benhemma-Le Gall, A., Brown, A., Graham, I., Thompson, P., Booth, C. (2025). Acoustic array configurations for dose-response studies: impact gradient designs influence predictions of noise impacts on cetaceans. Effects of Noise on Aquatic Life IV.

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Bicknell, A. W., Gierhart, S., Lambrette, M., Witt, M. J. (2025). Fine-scale proximity to offshore wind turbine foundations increases biomass of benthic fish species (In review)

Hastie, G. D., Matei, M., Benhemma-Le Gall, A., Brown, A., Graham, I., Thompson, P., Booth, C. (2025). Effects of acoustic logger array design on studies of cetacean responses to anthropogenic noise. Ecological Applications. (In review)

Pollock, Christopher; BUTLER, ADAM; Mobbs, Deena; Daunt, Francis; Searle, Kate. (2025). Predicting demographic impacts from sublethal cumulative effects of offshore renewable developments on breeding seabirds. Journal of Applied Ecology. (In review)

Task 7.4 – PrePARED Report – “Offshore Wind Farm Cumulative Effects Assessments – Case Study 2: EIAR vs. As Built”

Task 4.3 – PrePARED Report – Harbour porpoise responses to pile driving are driven by distance to source rather than received levels of impulsive noise.

Thompson, P., Benhemma-Le Gall, A., Lee, R., Stephenson, S., Mason, T. & Abad Olivia, N. (In Press) Measurements of noise levels and porpoise disturbance during pile-driving at Moray West Wind farm; comparison with model predictions used in regulatory assessments. Effects of Noise on Aquatic Life IV.

7. TABLE 3 – PrePARED Presentations 2025

Date	Who To?	Subject	Presenter
26/02/2025	ScotMER Symposium 2025	Prey energetics calculations and energy mapping (PrePARED)	Gordon Hastie & Philippa Wright (University of St Andrews)
28/02/2025	ScotMER Symposium 2025	Seabird, prey and offshore wind: novel evidence on predator-prey distributions and behaviour around offshore wind farms, and use in UK impact assessments	Charlie Cooper (SGMD), Katherine Whyte (BioSS), Christopher Pollock (UKCEH)
22/05/2025	R-INLA past, present, future workshop	Poster: Comparing modelling approaches for estimating resource selection in central place foragers species	Ana Couto (BioSS)
10/06/2025	Workshop on OWF displacement effect models of marine birds	SeabORD	Chris Pollock, Kate Searle (UKCEH)
12/06/2025	Scottish Offshore Wind Energy Council	Highlighting emerging PrePARED findings in relation to implementation of DEFRA Noise Policy	Paul Thompson (UoA)
16/06/2025	NatureScot	Workshop: discussing how data from PrePARED Report 008 can be used to update recommended dose-response curves for ScotWind developments	Paul Thompson (UoA)
18/06/2025	Centre for Statistics Annual Conference 2025	Renewable energy and wildlife: the role of statistics in assessing ecological impacts	Katherine Whyte (BioSS)
29th June – 4th July 2025	The Effects of Noise on Aquatic Life 2025	Poster and speed talk	Paul Thompson (UoA)
29th June – 4th July 2025	The Effects of Noise on Aquatic Life 2025	Task 5.2 and 7.4 presentation	Gordon Hastie (UoA)
8th-12th September 2025	CWW2025	Measurements of noise levels and porpoise disturbance during pile-driving at Moray West Offshore Windfarm; comparison with model predictions used in regulatory assessments	Paul Thompson (UoA)
8th-12th September 2025	CWW2025	Effects of acoustic logger array design on studies of cetacean responses to offshore wind farms	Gordon Hastie (SMRU)
8th-12th September 2025	CWW2025	Fish for thought: The nutritional quality of prey species within a developing offshore wind landscape	Philippa Wright (SMRU)
8th-12th September 2025	CWW2025	Cumulative effects using SeabORD – POSTER	Christopher Pollock (UKCEH)

8th-12th September 2025	CWW2025	Seabirds and fish distributions and behaviour: understanding predator-prey interactions to build evidence for cumulative impact assessment	Esther Jones (BioSS)
8th-12th September 2025	CWW2025	Marine mammal foraging activity at an offshore windfarm site: Do changes in prey fields influence marine mammal response to disturbance?	Aude Benhemma-Le Gall (UoA)
18/11/2025	MASTS Annual Science Meeting	Integrating predator-prey distributions in marine spatial planning	Charlie Cooper (SGMD)
20/11/2025	MASTS Annual Science Meeting	Movement modelling of top predators to understand predator-prey interactions at multiple scales	Katherine Whyte (BioSS)

8. TABLE 4 – PrePARED Webinars 2025

Date	Subject	Presenter	No. of registrations	No. of attendees	Attendee stakeholder groups
21/05/2025	Report 006: Habitat Similarity Assessment	Sam Gierhart and Matthew Witt (UoE)	111	60	PAG, Funders, SNCBs, Industry, Academia, Government, Consultancy
15/07/2025	PrePARED Report 007: Challenges and Solutions for Offshore Wind Farm Cumulative Effects Assessments for Marine Mammals	Rachael Sinclair and Sam Simmons (SMRUC)	120	81	Industry, Consultancy, SNCBs, Government, Academia, Funder

These presentations have been recorded and added to the PrePARED website alongside the reports.

9. TABLE 5 – PrePARED Meetings 2025

When	Date	Name of Meeting	Who Attended
Q1	20/01/2025	CWW conference coordination	UoE, UoA, SMRUC, UoSA, UKCEH
Q1	29/01/2025	NatureScot SeabORD training day	UKCEH, NatureScot
Q1	29/01/2025	PrePARED Management Group	Management Group
Q1	03/02/2025	PIP-022 PrePARED – CRF09 discussion	OWEC, Project Management
Q1	10/02/2025	PIP022 PrePARED quarterly progress meeting	OWEC, Project Management
Q1	11/02/2025	PrePARED Workstream C meeting	Workstream C partners
Q1	14/02/2025	PrePARED PAG Catch Up	Lauren Donachie (PM) and Kat Route-Stephens (PAG chair)
Q1	19/02/2025	PrePARED Management Group	Management Group
Q1	06/03/2025	PrePARED Catch Up	NatureScot, UoA, UKCEH, Project Management
Q1	11/03/2025	PrePARED – NE Catch Up*	Natural England, Project Management, UoA, UKCEH, SMRUC
Q1	19/03/2025	CRF09	OWEC, Project Management
Q1	20/03/2025	PrePARED Q1 Progress/PAG meeting	Project team, PAG
Q1	18/03/2025	PrePARED Workstream A meeting	Workstream A
Q1	26/03/2025	PrePARED Management Group	Management Group
Q1	04/04/2025	PrePARED Impact Actions Update	OWEC, Project Management
Q2	15/04/2025	PrePARED Impacts Actions	OWEC, Project team
Q2	16/04/2025	PrePARED CRF09 – next steps	OWEC, Lauren Donachie (PM)
Q2	28/04/2025	PrePARED Management Group	Management Group
Q2	12/05/2025	PIP 022 – PrePARED quarterly progress meeting	OWEC, Project Management
Q2	13/05/2025	PrePARED Workstream A meeting	Workstream A
Q2	22/05/2025	OWEC PEP & Template Updates	OWEC, Lauren Donachie (PM)
Q2	28/05/2025	PrePARED Management Group	Management Group
Q2	03/06/2025	PrePARED Workstream C Meeting	Workstream C
Q2	10/06/2025	POWEM Piling Noise Limit Pilot PAG Meeting	Paul Thompson (UoA)
Q2	18/06/2025	PrePARED Q2 Progress Meeting	Project Team, PAG
Q2	18/06/2025	PrePARED Milestone Schedule	OWEC, Lauren Donachie (PM)
Q2	25/06/2025	PrePARED Management Group	Management Group
Q3	22/07/2025	POWEM Piling Noise Limit Pilot PAG Meeting	Paul Thompson (UoA)
Q3	30/07/2025	PrePARED Management Group	Management Group
Q3	04/08/2025	PIP 022 – PrePARED quarterly progress meeting	OWEC, Project Management
Q3	18/08/2025	PrePARED OWGRE Discussion	Management Group
Q3	19/08/2025	PrePARED SGMD Q3 Checkin	Lauren Donachie, Thomas Regnier
Q3	20/08/2025	PrePARED UoE Q3 Checkin	Lauren Donachie, Matthew Witt

Q3	21/08/2025	PrePARED BioSS Q3 checkin	Lauren Donachie, Esther Jones
Q3	21/08/2025	PrePARED UoA Q3 checkin	Lauren Donachie, Paul Thompson, Aude Benhemma-Le Gall
Q3	21/08/2025	PrePARED UKCEH Q3 checkin	Lauren Donachie, Chris Pollock
Q3	27/08/2025	PrePARED Management Group	Management Group
Q3	27/08/2025	UKCEH catch up	Lauren Donachie, Kate Searle, Chris Pollock
Q3	04/09/2025	OWEC – PrePARED CRF12	Lauren Donachie, OWEC
Q3	25/09/2025	PrePARED Workstream C: DEPONS report	Workstream C
Q3	30/09/2025	PrePARED Q3 Progress Meeting	Project Team, PAG
Q4	02/10/2025	PrePARED Finances	Lauren Donachie, OWEC
Q4	27/10/2025	PIP 022 – PrePARED quarterly progress meeting	OWEC, Project Management
Q4	28/10/2025	PrePARED Workstream A	Workstream A
Q4	29/10/2025	PrePARED Management Group	Management Group
Q4	11/11/2025	PrePARED – BioSS Q4 checkin	Lauren Donachie, Esther Jones
Q4	12/11/2025	PrePARED Workstream C	Workstream C
Q4	12/11/2025	PrePARED – UKCEH Q4 checkin	Lauren Donachie, Kate Searle, Chris Pollock
Q4	13/11/2025	PrePARED – SGMD Q4 checkin	Lauren Donachie, Thomas Regnier
Q4	13/11/2025	PrePARED – UoA Q4 checkin	Lauren Donachie, Paul Thompson, Aude Benhemma-Le Gall
Q4	13/11/2025	PrePARED – SMRUC Q4 checkin	Lauren Donachie, Sam Simmons
Q4	20/11/2025	POWEM Piling Noise Limit Pilot PAG Meeting	Paul Thompson (UoA)
Q4	25/11/2025	PrePARED MDE Streamlining	Project Management, MDE
Q4	26/11/2025	PrePARED Management Group	Management Group
Q4	26/11/2025	PrePARED Workstream A Meeting	Workstream A, Andrew Gill (PAG)
Q4	09/12/2025	PrePARED Q4 Progress Meeting	Project Team, PAG

*Actions agreed: 1) Dose response workshop with UoA/NE/NS, 2) SeabORD training/workshop, 3) Interaction with NE through quarterly NE calls, webinars and during the report writing period.

10. TABLE 6 – PrePARED Social Media 2025

Social Channel	Posted by	Date	Link
LinkedIn	Anthony Bicknell	February 2025	https://www.linkedin.com/posts/anthony-tony-bicknell-706ab912_the-role-of-acoustic-telemetry-to-assess-activity-7287072765906411520-C5ms?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	University of Exeter Marine	February 2025	https://www.linkedin.com/posts/exetermarine_the-role-of-acoustic-telemetry-to-assess-activity-7287118297827868673-t7nj?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SGMD	March 2025	https://www.linkedin.com/posts/marine-directorate_preparedproject-renewableenergy-offshorewind-activity-7295044771927019520-K1JB?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SGMD	March 2025	https://www.linkedin.com/posts/marine-directorate_flatfish-and-haddock-filmed-using-baited-activity-7305534414074105856-nKAZ?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	BioSS	March 2025	https://www.linkedin.com/posts/esther-jones-ab6874315_statisticalecology-offshorerenewables-statistics-activity-7311030540206301184-xpxz?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	March 2025	https://www.linkedin.com/posts/laurendonachie_scotmer-offshorerenewables-marineenergy-activity-7299870847316512769-rnul?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
Podcast (Spotify/Apple/YouTube)	Anthony Bicknell	April 2025	Spotify: https://open.spotify.com/episode/4hR6ytdE02RiUvyPrw5rd7?si=yDMz-Fr6RlO2Xx6eQGv6yQ Apple: https://podcasts.apple.com/us/podcast/usea-power-sector-podcast-episode-132-university-of/id1778696682?i=1000704464445 YouTube: https://www.youtube.com/watch?v=FZ2M_QSPRK4
LinkedIn	Cormac Booth	May 2025	https://www.linkedin.com/posts/cormacbooth_cumulativeeffects-report007-prepared-activity-7325036020876394498-zXaO?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SMRUC	May 2025	https://www.linkedin.com/posts/smru-consulting_prepared-report-007-cea-challenges-and-solutionspdf-activity-7325436351116410880-1aw5?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SMRUC	May 2025	https://www.linkedin.com/posts/smru-consulting_preparedproject-renewableenergy-offshorewind-activity-7326753037782306816-aAFT?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	May 2025	https://www.linkedin.com/posts/laurendonachie_microsoft-virtual-events-powered-by-teams-activity-7327974792383414273-c7WW?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	May 2025	https://www.linkedin.com/posts/laurendonachie_news-activity-7328345275041738752-x-Wq?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8

LinkedIn	Rachael Sinclair	May 2025	https://www.linkedin.com/posts/rachael-sinclair-56125467_outputs-activity-7328367938871214081-eTUn?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	University of Exeter Marine	May 2025	https://www.linkedin.com/posts/exetermarine_offshorewind-owf-preparedproject-activity-7328720519745187840-Jcmv?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	July 2025	https://www.linkedin.com/posts/laurendonachie_news-activity-7344319856529358849-1XSN?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SMRUC	July 2025	https://www.linkedin.com/posts/smru-consulting_prepared-owec-decaf-ugcPost-7347967812675493888-i558?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	July 2025	https://www.linkedin.com/posts/laurendonachie_preparedproject-activity-7348705894420889600-PGsm?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SMRUC	July 2025	https://www.linkedin.com/posts/smru-consulting_microsoft-virtual-events-powered-by-teams-activity-7348697061942300672-VgKy?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	August 2025	https://www.linkedin.com/posts/laurendonachie_news-activity-7358760972292878337-EM5t?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SMRUC	September 2025	https://www.linkedin.com/posts/smru-consulting_preparedproject-activity-7363911884716089344-vAZA?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	The Crown Estate	September 2025	https://www.linkedin.com/posts/the-crown-estate_thecrownestate-owec-offshorewind-activity-7369288667527417857-i9mF?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	September 2025	https://www.linkedin.com/posts/laurendonachie_thecrownestate-owec-offshorewind-activity-7369656797776887809-Nc__?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Jesper Kyed Larsen	October 2025	https://www.linkedin.com/posts/jesper-kyed-larsen-83a5172a_preparedproject-activity-7372193599133880320-Gs_I?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SGMD	October 2025	https://www.linkedin.com/posts/marine-directorate_preparedproject-activity-7384874612628615168-inQh?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	SMRUC	October 2025	https://www.linkedin.com/posts/smru-consulting_cww-prepared-predatorsandpreyaroundrenewableenergydevelopments-activity-7372199231610331136-TDpA?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Katherine Whyte	October 2025	https://www.linkedin.com/posts/activity-7372212877681803264-yzQ5?utm_source=share&utm_medium=member_desktop&rcm=ACoAACkdwpIBa-Kr4-KYQRwptnRnmIro_GfcbQ8
LinkedIn	Lauren Donachie	December 2025	https://www.linkedin.com/feed/update/urn:li:activity:7407071576367685632/

11. TABLE 7 – PAG Engagement

Date	Contact	Action
30/01/2025	Annual report distributed to PAG for review and feedback	Report
14/02/2025	Email update to advise on new PAG chair and reminder to review annual report	Email
14/02/2025	Meeting between PAG chair and project manager to discuss	Meeting
19/02/2025	PAG chair attended Management Group meeting to discuss how PAG can support delivery of impact and transferability of outputs	Meeting
04/03/2025	Request to PAG to feedback on actions to support project impact and transferability	Email
19/03/2025	Email clarifying actions agreed with the PAG to support the PrePARED project	Email
20/03/2025	Attendance at PAG/Q1 Progress Meeting	Meeting
26/03/2025	Minutes provided from PAG/Q1 Progress Meeting	Email
09/04/2025	2025 output schedule provided with identification of PAG actions throughout the year	Email
10/04/2025	Report 007 distributed to PAG for review and feedback	Report
02/05/2025	Report 008 distributed to PAG for review and feedback	Report
06/05/2025	Invitation to attend webinar on report 006	Webinar invite
13/05/2025	Request for PAG to share webinar details within their networks	Webinar advertisement
28/05/2025	PAG chair attended PrePARED Management Group meeting	Meeting
18/06/2025	Attendance at PAG/Q2 Progress Meeting	Meeting
24/06/2025	Email update including date of next progress meeting, request to review PrePARED impact document, reminder to keep up to date with PrePARED activity via the website	Email
25/06/2025	Minutes provided from PAG/Q2 Progress Meeting	Email
27/06/2025	Email advising Report 008 was released and available through the website	Email
09/07/2025	Invitation to attend webinar on report 007	Webinar invite
09/09/2025	Email with Q3 progress meeting agenda and highlighting new output approval process	Email
30/09/2025	Attendance at PAG/Q3 Progress Meeting	Meeting
06/10/2025	Provided PAG with output schedule listing which reports require PAG input	Email
06/10/2025	Reminder to 2 PAG members to review and provide feedback on UKCEH manuscript	Report
07/10/2025	Some PAG members asked to review and provide feedback on UoE draft manuscript	Report
16/10/2025	Minutes provided from PAG/Q3 Progress Meeting	Email
21/10/2025	Report 009 distributed to PAG for review and feedback	Report
09/12/2025	Attendance at PAG/Q4 Progress Meeting	Meeting

12. TABLE 8 – 2025 Target Achievement

Result	Description	2025	2025	From project start
Completed	A piece of work that is fully completed	39	49%	68%
On Target	An ongoing piece of work with partial running monitoring targets that have been met	22	28%	11%
Delayed	A piece of work that has been delayed due to operational reasons. Mitigating actions are given in the main report.	15	19%	8%
Failed	A piece of work that has not been carried out due to various operational reasons. Details and mitigating actions in main report.	0	0%	0%
No Target	No targets were set for this quarter as the Task is either completed or pending a future date.	3	4%	
	Total	79		

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

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

		Initiate laboratory work (~~otolith analyses~~ length-frequency analyses, ~~PSA~~ **RoxAnn** analyses (subject to laboratory availability)).	**Completed**
		Initiate post processing of acoustic signal and trawl data analyses.	**Completed**
	2023 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects.	**Completed**
		Completion of ~~otolith analyses~~ length-frequency analyses.	**Completed**
	2024 Q1 Targets	Produce a map of sandeel point abundance in the sand per age class (from Grab and dredge)	**Completed**
		Broadscale prey fields from acoustic transects (pelagic prey)	**Completed**
		Completion of RoxAnn analyses	**Completed**
	2024 Q2 Targets	Produce a map of point habitat characteristics (from RoxAnn)	**Completed**
		Prepare fisheries acoustic/ seabird-at-sea survey: Design surveys based on previous studies and development site conditions	**Completed**
	2024 Q3 Targets	Feedback on fisheries acoustic survey/ seabird-at-sea survey: (June-July)	**Completed**
		Initiate laboratory work (otolith analyses, RoxAnn analyses (subject to laboratory availability))	**Completed**
		Initiate post processing of acoustic signal and trawl data analyses	**Completed**
	2024 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects	**Completed**
		Completion otolith analyses	**Completed**
	2025 Targets	**Deliverable:** Produce fish (prey/predators) abundance layers	**Completed**
		2025 offshore data collection surveys	**Completed**
		RoxAnn analyses to produce a map of point habitat characteristics	**Completed**
		Fish acoustic data processing	**Delayed to Q1 2026**
		Analyse the effects of environmental variables/OWF on broadscale prey distributions	**On Target**
Task 1.2	**Finescale fish response to OWF in Forth (Dr Thomas Regnier, SGMD)**		
	2022 Q1 & Q2 Targets	No Targets	**No Target**
	2022 Q3 Targets	Conduct BRUV/Fish trap surveys in the Forth and Tay	**Completed**
		Design surveys considering development site conditions	**Completed**
		Completion of surveys	**Completed**
		Initiate analyses of SBRUV data	**Completed**
		Initiate grab data analyses (PSA)	**Method Changed**
	2022 Q4 Targets	Completion of PSA analyses	**Method Changed**
	2023 Q1 Targets	Process BRUV and AI camera video footage from 2022 camera surveys.	**Completed**
		Completion of video processing from surveys.	**Completed**
	2023 Q2 Targets	Completion of 2022 analysis.	**Completed**
		Map fish (predator) abundance from SBRUV/Traps.	**Completed**

	2023 Q3 Targets	Conduct BRUV/Fish trap surveys in the Forth and Tay.	**Completed**
		Design surveys considering development site conditions.	**Completed**
		Completion of surveys.	**Completed**
		Initiate analyses of SBRUV data.	**Completed**
		~~Initiate grab data analyses (PSA~~). **RoxAnn analyses**	**Completed**
	2023 Q4 Targets	~~Completion of PSA analyses~~. **Completion of RoxAnn analyses**	**Completed**
	2024 Q1 Targets	Process BRUV and AI camera video footage from 2022 camera surveys	**Completed**
		Completion of video processing from surveys	**Completed**
	2024 Q2 Targets	Completion of 2023 analysis	**Completed**
		Map fish (prey) abundance from SBRUV/Traps	**Completed**
	2024 Q3 Targets	Conduct BRUV/Fish trap surveys in the Forth and Tay: Design surveys considering development site conditions	**Completed**
		Completion of surveys	**Completed**
		Initiate analyses of SBRUV data	**Completed**
		Initiate RoxAnn analyses	**Completed**
	2024 Q4 Targets	Completion of RoxAnn analyses	**Completed**
	2025 Targets	Analyse SBRUV footages and produce Nmax and size distributions	**Completed**
		Produce finescale fish abundance estimates	**Completed**
		Analyse the effects of environmental variables/OWF on finescale changes in fish communities	**On Target**

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

Task 2.1	**Seabird spatial distribution models in Forth (Dr Esther Jones, BioSS)**		
	2022 Q1 Targets	Review existing prey data	**Completed**
	2022 Q2 Targets	Process seabird GPS data	**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	**Completed**
	2023 Q1 Targets	Develop working code for distribution modelling.	**Completed**
	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.	**Completed**
	2023 Q4 Targets	Working distribution models using prey data from Forth-Tay.	**Completed**
	2024 Q1 Targets	Working distribution models using the sandeels model.	**Completed**
		Seabird spatial distributions and uncertainty for selected species within Forth-Tay region	**Completed**

	2024 Q2 Targets	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	**Completed**
	2024 Q3 Targets	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	**Completed**
	2024 Q4 Targets	Applying spatial framework to Forth-Tay prey data with contemporaneous seabird tracking data	**Completed**
		Draft manuscript on spatial modelling methods	**Delayed to 2026**
	2025 Targets	Process seabird GPS data	**On Target**
		Process environmental data	**On Target**
		Process project-collected prey data (from Task 1.1 and 1.2)	**On Target**
		Refinement and further development of framework using first year of prey data collected by project	**Completed**
		Deliverable: initial models and model outputs for seabird spatial distribution and uncertainty for each species within Forth-Tay region	**Completed**
		Update distribution models to incorporate all available prey data	**On Target**
		Deliverable: Final estimates of spatial distributions and uncertainty for each species within Forth-Tay region Jan 2026 and Dec 2026	**On Target**
		Preparation of journal article	**Completed**
Task 2.2	**Seabird movement models in the Forth (Dr Esther Jones, BioSS)**		
		No 2022 Targets	**No Targets**
		No 2023 Q1, Q2 or Q3 Targets	**No Targets**
	2023 Q4 Targets	Initial development of movement modelling framework	**Completed**
	2024 Q1 Targets	Working code for movement modelling framework	**Completed**
	2024 Q2 Targets	Applying movement models to Forth and Tay prey data collected within project	**Completed**
	2024 Q3 Targets	Applying movement models to Forth and Tay prey data collected within project	**Completed**
	2024 Q4 Targets	Applying movement models to Forth and Tay prey data collected within project	**Completed**
	2025 Targets	Apply initial movement modelling framework to prey data collected by project (Task 1.1 and 1.2)	**Completed**
		Deliverable: initial models for seabird movement	**Completed**
		Revise movement models to incorporate all available prey data	**On Target**
		Deliverable: Algorithm to produce more realistic simulations of foraging tracks for SeabORD - Final movement model	**Delayed to 2026**
		Preparation of journal article	**Completed**
Task 2.3	**Simulating realistic foraging tracks in IBMs (Dr Katherine Whyte, BioSS and Dr Christopher Pollock, UKCEH)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
		No 2024 Q1 Targets	**No Targets**
	2024 Q2 Targets	Identify and develop framework for movement model structure and outputs to use in IBMs	**Completed**
	2024 Q3 Targets	Identify and develop framework for movement model structure and outputs to use in IBMs.	**Completed**
		Producing behavioural classifications from movement models	**Completed**
	2024 Q4 Targets	Identify and develop framework for movement model structure and outputs to use in IBMs.	**Completed**

		Producing behavioural classifications from movement models	**Completed**
	2025 Targets	Scope alternative movement model structures for generating IBM parameters	**Completed**
		Test different movement model structures on sample tracking data. Develop best practice guidelines for using movement models to generate IBM parameters.	**Completed**
		Identify key parameters and data required for parameterising IBMs.	**Completed**
		Develop framework for testing and validation of simulated v.s. real foraging tracks	**Completed**
		Deliverable: Framework for using outputs from movement models to develop and validate movement simulations for IBMs	**Delayed to 2026**
		Deliverable: Short report for PrePARED for website	**Delayed to 2026**

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

Task 3.1	**Large-scale fish distribution in Moray (Dr Anthony Bicknell, UoE)**		
	2022 Q1 Targets	Collate existing fisheries biomass data from Moray Firth studies	**Completed**
	2022 Q2 Targets	Completion of data acquisition for existing fisheries biomass data from Moray Firth studies	**Completed**
		Prepare fisheries acoustic survey	**Completed**
		Design surveys based on previous studies and development site conditions	**Completed**
		Conduct fisheries acoustic survey (end of June)	**Completed**
		Conduct grab sample survey	**Failed**
	2022 Q3 Targets	BRUV and unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
		Conduct BRUV camera surveys in Moray Firth - Completion of surveys.	**Completed**
		Conduct unbaited camera surveys in Moray Firth - Completion of surveys.	**Completed**
	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.	**Completed**
	2023 Q4 Targets	~~Completion of laboratory analyses of grab samples (subject to lab availability).~~ **Now RoxAnn Analysis**	**Completed**

		Completion of post-processing of fisheries acoustic and trawl data for 2023 survey.	**Completed**
	2024 Q1 Targets	Completion of fisheries acoustic and trawl data processing	**Completed**
	2024 Q2 Targets	Prepare fisheries acoustic survey: Design surveys based on previous studies and development site conditions	**Completed**
		Conduct fisheries acoustic survey (end of June)	**Completed**
	2024 Q3 Targets	Conduct BRUV and AI (unbaited) camera surveys in Moray Firth: Design surveys considering development site conditions	**Completed**
	2024 Q4 Targets	Initiate post processing of acoustic signal, trawl and RoxAnn analyses from June survey	**Completed**
	2025 Targets	Process fisheries acoustic data	**Completed**
		Deliverable: Data analysis and downstream provision	**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 camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
	2022 Q3 Targets	Conduct unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Delayed to 2024**
	2022 Q4 Targets	Process BRUV video footage from camera surveys	**Completed**
	2023 Q1 Targets	Process BRUV camera video footage from 2022 camera surveys.	**Completed**
		Completion of video processing from surveys.	**Completed**
	2023 Q2 Targets	Video footage data analysis and downstream provision: (a) Downstream provision for UoA predator models. (b) Completion of 2022 data analysis (relative fish diversity, abundance, biomass and composition).	**Completed**
	2023 Q4 Targets	Process unbaited camera survey video footage.	**Delayed to 2024**
	2024 Q1 & Q2 Targets	No targets	**No Target**
	2024 Q3 Targets	Conduct BRUV and AI camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
	2024 Q4 Targets	Start processing BRUV and AI camera video footage from the 2024 camera surveys	**Completed**
	2025 Targets	Process BRUV video footage from camera surveys	**Completed**
		Process AI video footage from camera surveys	**Completed**
		Deliverable: Data analysis and downstream provision	**On Target**
		Deliverable: Publish research paper on fish responses to offshore wind turbines	**Completed**
Task 3.3	**Fish acoustic telemetry in the Moray Firth (Dr Matthew Witt, UoE)**		
	2022 Q1 Targets	Collate and review data on using fish telemetry for impact assessment	**Completed**
	2022 Q2 Targets	Deploy VEMCO acoustic receiver array and start tagging in Moray Firth	**Completed**
		Catch and tag gadoid fish in the Moray Firth	**Completed**
		Complete annual tagging	**Completed**

	2022 Q3 Targets	Process acoustic ping data	**Completed**
	2022 Q4 Targets	Service array and ping data download from VEMCO receivers.	**Completed**
		Complete 6-month data download	**Completed**
	2023 Q1 Targets	Service acoustic array and download ping data in the Moray Firth.	**Completed**
	2023 Q2 Targets	Catch and tag gadoid fish in the Moray Firth.	**Completed**
		Process acoustic ping data.	**Completed**
	2023 Q3 Targets	Service acoustic array and download ping data in the Moray Firth: (a) Completion of annual data download. (b) Completion of annual tagging	**Completed**
	2023 Q4 Targets	No Target	**No Target**
	2024 Q1 Targets	Process acoustic ping data	**Completed**
	2024 Q2 Targets	Catch and tag gadoid fish and service array in the Moray Firth: (a) Completion of annual tagging (b) Completion of 6-month data download	**Completed**
	2024 Q3 Targets	Process acoustic ping data	**Completed**
	2024 Q4 Targets	Service array in the Moray Firth.	**Failed**
	2025 Targets	Recovery of VEMCO acoustic receiver array in Moray Firth	**Completed**
		Process tag ping data	**Completed**
		Data analysis	**On Target**
		Deliverable: Produce research paper focusing on the multi-year individual fish tracking dataset	**On Target**
		Deliverable: Produce research paper on seal predation of acoustically tracked fish within windfarms	**Delayed to 2026**
		Deliverable: Produce topic sheet on research paper findings	**Delayed to 2026**

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

Task 4.1	**Drivers of broadscale marine mammal distribution in Moray (Prof. Paul Thompson UoA)**		
	2022 Q1 Targets	Collation of pre-construction Moray Firth predator data from digital aerial surveys, telemetry and PAM	**Completed**
	2022 Q2 Targets	Collation of prey and environmental co-variates	**Completed**
	2022 Q3 Targets	Internal project meeting to discuss modelling framework	**Completed**
	2022 Q4 Targets	Review of analyses for harbour porpoise distribution models	**Completed**
	2023 Q1 Targets	Review of analyses of seal distribution models.	**Completed**
	2023 Q2 Targets	Hold stakeholder workshop.	**Failed**
	2023 Q3 Targets	Completion of distribution modelling and draft report.	**Completed**
	2023 Q4 Targets	Deliver final report.	**Completed**
	2024 Q1 Targets	Finalise report on harbour porpoises and prey.	**Completed**

		Submit draft report on Moray Firth studies of harbour seal foraging in relation to sandeels	**Completed**
	2024 Q2 Targets	No target	**No Targets**
	2024 Q3 Targets	Finalise harbour seal report and explore transferability through Task 6.2	**Delayed to 2026**
	2024 Q4 Targets	No Target	**No Targets**
	2025 Targets	No Targets	**No Targets**
Task 4.2	**Finescale marine mammal distribution in response to OWF and prey fields in the Moray Firth (Dr Aude Benhemma-Le Gall, UoA)**		
	2022 Q1 Targets	Finalisation of the PAM array design and submission for marine licenses	**Completed**
	2022 Q2 Targets	Deployment of the PAM array	**Completed**
	2022 Q3 Targets	Plan retrieval and collate covariates data for all PAM sites	**Completed**
	2022 Q4 Targets	Recover PAM devices	**Completed**
	2023 Q1 Targets	Complete processing of PAM data.	**Completed**
	2023 Q2 Targets	Present interim results at stakeholder workshop to inform design of construction array.	**Completed**
	2023 Q3 Targets	Delivery of draft report.	**Completed**
	2023 Q4 Targets	Internal project meeting to discuss prey field results from 2023.	**Completed**
	2024 Q1 Targets	Finalise framework for incorporating prey data for analyses on reef effect	**Delayed to 2025**
	2024 Q2 Targets	Present preliminary results to key stakeholders at suitable event or online workshop	**Completed**
	2024 Q3 Targets	Deliver draft report on relationship between porpoises and prey around OWF	**Delayed to 2026**
	2024 Q4 Targets	Deliver final report on relationship between porpoises and prey around OWF	**Delayed to 2026**
	2025 Targets	Integration of prey data (from Task 3.1 and 3.2) to explore drivers of porpoise activity at OWF	**On Target**
Task 4.3	**Dose response curves in the Moray Firth (Prof. Paul Thompson, UoA)**		
	2022 Q1 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2022 Q2 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2022 Q3 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2022 Q4 Targets	Quarterly meetings to liaise with Moray West on construction schedule	**Completed**
	2023 Q1 Targets	Convene meeting to liaise with Moray West on construction schedule.	**Completed**
	2023 Q2 Targets	Finalise the design of construction PAM array.	**Completed**
	2023 Q3 Targets	Deploy the construction PAM array.	**Completed**
	2023 Q4 Targets	Initiate collation of engineering data from developers.	**Completed**
	2024 Q1 Targets	Recover PAM array deployed during initial construction phase at Moray West OWF	**Completed**
	2024 Q2 Targets	Process data from PAM array	**Completed**
		Arrange meeting to discuss data availability with OWEC, DEFRA & MMO colleagues to explore potential for fast-tracking and adapting planned analyses to support current policy and management issues in the Southern North Sea.	**Completed**
	2024 Q3 Targets	Extract data on porpoise occurrence and foraging buzzes and liaise with industry to estimate received noise levels at each PAM location	**Completed**
	2024 Q4 Targets	Complete dose-response analyses	**Delayed to 2025**
	2025 Targets	Analyses and production of context specific dose-response curves.	**Completed**

		Deliverable: Final dose response report	**Delayed to 2026**
Task 4.4	**Fish nutritional value (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Preparatory lab work	**Completed**
	2022 Q2 Targets	Preparatory lab work	**Completed**
	2022 Q3 Targets	Initial processing of any available samples	**Completed**
	2022 Q4 Targets	Processing of summer 2022 prey samples	**Completed**
	2023 Q1 Targets	Process summer 2022 prey samples.	**Completed**
	2023 Q2 Targets	Summarise interim bomb calorimetry analyses	**Completed**
	2023 Q3 Targets	Initial processing of any available samples.	**Completed**
	2023 Q4 Targets	Processing of summer 2023 prey samples	**Completed**
	2024 Q1 Targets	Processing of summer 2023 prey samples	**Completed**
	2024 Q2 Targets	Analysis of PrePARED and Moray East fish samples	**Completed**
	2024 Q3 Targets	Analysis of PrePARED and Moray East fish samples	**Completed**
	2024 Q4 Targets	Processing of summer 2024 prey samples	**Completed**
	2025 Targets	Collection, processing of samples for bomb calorimetry	**Completed**
		Deliverable: Present interim result at stakeholder workshop	**Completed**
		Deliverable: Final report	**Delayed to 2026**

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

Task 5.1	**Generalities in fish response to OWF (Dr Anthony Bicknell, UoE)**		
	2022	No 2022 Targets	**No Targets**
	2023	No 2023 Targets	**No Targets**
	2024 Q1, Q2, Q3	No Targets	**No Targets**
	2024 Q4 Targets	Collate and compare Moray Firth and Forth and Tay acoustic and camera footage processed data.	**On Target**
	2025 Targets	Analysis of acoustic and camera survey data to determine similarities in fish composition, behaviour and biomass distribution between study sites with comparable habitat.	**On Target**
Task 5.2	**Generalities in harbour porpoise response to OWF (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Completed**
	2022 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Completed**
	2022 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Completed**
	2022 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**Completed**
	2023 Q1 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Completed**
	2023 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Completed**
	2023 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Completed**

	2023 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses.	**Completed**
	2024 Q1 Targets	Processing of response and covariate data	**Completed**
		Preparation of manuscript on dose response sampling	**Completed**
	2024 Q2 Targets	Processing of response and covariate data	**Completed**
	2024 Q3 Targets	Final collation of PAM data and covariates	**Completed**
	2024 Q4 Targets	Complete the dose-response analyses	**Completed**
	2025 Targets	**Deliverable:** Present interim result at stakeholder workshop	**Completed**
		Deliverable: Final report	**Completed**

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

Task 6.1	**Minimum data requirements for seabird distribution and movement models (Dr Esther Jones, BioSS)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
	2024 Q1 Targets	Identify prey and environmental data that could be used in transferring model to wider North Sea region	**Completed**
	2024 Q2 Targets	Select and process prey and environmental data to be used in transferring model to wider North Sea region	**Completed**
	2024 Q3 Targets	Develop revised version of spatial distribution model that uses only variables that are available throughout North Sea region	**Completed**
	2024 Q4 Targets	Compare revised version of model against that derived using Forth-Tay prey data	**Delayed to 2025**
	2025 Targets	Develop revised version of spatial distribution model that uses only variables that are available throughout North Sea region	**Completed**
		Deliverable: framework for predicting joint seabird-prey distributions in new regions	**Completed**
		Compare revised version of model against that derived using Forth-Tay prey data	**Delayed to 2026**
		Deliverable: evaluation of benefits of local prey data when predicting spatial distributions of seabirds	**Delayed to 2026**
Task 6.2	**Minimum data requirements for marine mammal distribution models (Prof. Paul Thompson, UoA)**		
		Task 6.2 was deleted from the project scope in 2025	
Task 6.3	**UK EEZ marine habitats similarity assessment for OWF sites (Dr Matthew Witt, UoE)**		
	2022	No 2022 Targets	**No Targets**
	2023 Q1, Q2 & Q3 Targets	No target	**No Targets**
	2023 Q4 Targets	Evaluate potential modelling approaches.	**Completed**
		Collate available data for biotic and abiotic variables to use in assessment	**Completed**
	2024 Q1 Targets	Perform habitat similarity assessment with suitable model	**Completed**

	2024 Q2 Targets	Write and produce final report	**Completed**
	2024 Q3 & Q4 Targets	No Targets	**No Targets**
	2025 Targets	No Targets	**No Targets**
Task 6.4	**Survey design for predator-prey studies (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1, Q2 & Q3 Targets	No Target	**No Target**
	2022 Q4 Targets	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	**Completed**
	2023 Q1 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Completed**
	2023 Q2 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Completed**
	2023 Q3 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Completed**
	2023 Q4 Target	Collate and review data from English and Welsh OWF, other marine mammal monitoring projects.	**Completed**
	2024 Q1 Target	Cross-ref with Task 6.3	**Completed**
		Preparation of manuscript on dose response sampling	**Completed**
	2024 Q2 Target	Cross-ref with 6.3	**Completed**
	2024 Q3 & Q4 Target	No Target	**No Target**
	2025 Target	**Deliverable**: Final identification of sites & produce final report	**Delayed to 2026**

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

Task 7.1	**IPCoD and DEPONS integration of new data and testing (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 & Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**Completed**
	2022 Q4 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**Completed**
	2023 Q1 Targets	Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development.	**Completed**
	2023 Q2 Targets	Convene quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**Completed**
	2023 Q3 Targets	Integration of project learning into latest DEPONS and iPCoD	**Completed**
	2023 Q4 Targets	Assessment of how integration of PrePARED project outputs into populations models helps improve models.	**Completed**
	2024 Q1 Targets	Assessment of how integration of PrePARED project outputs into populations models, helps improve models	**Completed**

	2024 Q2 Targets	Assessment of how integration of PrePARED project outputs into populations models, helps improve models	**Completed**
	2024 Q3 Targets	Assessment of how integration of PrePARED project outputs into populations models, helps improve models	**Completed**
	2024 Q4 Targets	Delivery of the draft report (final report in Q2 2025)	**On Target**
	2025 Targets	Integration of latest knowledge into updated DEPONS model	**Completed**
		Prediction of cumulative impacts in Moray Firth using updated DEPONS	**Completed**
		Deliverable: Present interim result at stakeholder workshop	**Delayed to 2026**
		Deliverable: Final report	**On Target**
Task 7.2	**Adding biological realism to SeabORD and testing (Dr Kate Searle, UKCEH)**		
	2022 Q1 & Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Development of initial model parameterisation to simulate hypothesized redistribution of prey around OWFs.	**Completed**
	2022 Q4 Targets	Development of initial model parameterisation to work with sandeel suitability estimates	**Completed**
	2023 Q1 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**Completed**
	2023 Q2 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**Completed**
	2023 Q3 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**Completed**
	2023 Q4 Targets	Development of initial model parameterisation to work with sandeel suitability estimates.	**Completed**
	2024 Q1 Targets	Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.	**Completed**
	2024 Q2 Targets	Development of initial model parameterisation to work with sandeel suitability estimates and sandeel maps in Forth-Tay.	**Completed**
	2024 Q3 Targets	Initial development of simulated foraging tracks for exemplar species	**Completed**
	2024 Q4 Targets	Initial development of simulated foraging tracks for exemplar species	**Completed**
	2025 Targets	**Deliverable**: Updated version of SeabORD including redistribution of prey around OWFs (Q1 2025)	**Completed**
		Deliverable: Updated version of SeabORD including redistribution of prey around OWFs (Q4 2025)	**Delayed to 2026**
		Deliverable: Release of standalone updated SeabORD version (2024)	**Completed**
		Development of SeabORD to work with new joint predator-prey distribution maps within the Forth-Tay	**On Target**
		Validation of SeabORD in the Forth-Tay against independent data on the demographic consequences of displacement and barrier effects, measured empirically.	**Delayed to 2026**
		Deliverable: Application of SeabORD to Forth-Tay for model validation and submission of peer-reviewed manuscript (joint paper with Task 2.3)	**On Target**
Task 7.3	**Testing and validating SeabORD in the FoF and at UK SPAs (Dr Kate Searle, UKCEH)**		
		No 2022 Targets	**No Targets**
		No 2023 Targets	**No Targets**
		No 2024 Targets	**No Targets**

	2025 Targets	Application of the model developed in Tast 7.2 to the region around Flamborough and Filey, in order to demonstrate transferability of the models to a new region, and to provide the inputs needed to run SeabORD for this region.	**Completed**
		Application of SeabORD using available data, as agreed with NE, at Flamborough and Filey SPAs to demonstrate transferability for black-legged kittiwake	**On Target**
Task 7.4	**Integration of PrePARED findings for harbour porpoise Cumulative Impact Assessment (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Initial preparations for Cumulative Impact Assessment development	**Complete**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	Quarterly meetings to understand progress on CIA components	**Complete**
	2022 Q4 Targets	No target	**No Target**
	2023 Q1 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2023 Q2 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2023 Q3 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2023 Q4 Targets	Convene quarterly meetings to understand progress on CIA components	**Complete**
	2024 Q1 Targets	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)	**Complete**
	2024 Q2 Targets	Development of CIA scenarios	**Complete**
	2024 Q3 Targets	Development of CIA scenarios	**Complete**
	2024 Q4 Targets	Updated CIA analyses	**Complete**
	2025 Targets	Developing CIA scenarios	**Complete**
		Running CIA scenarios with latest iPCoD and DEPONS	**Complete**
		Deliverable: Present interim result at stakeholder workshop	**Complete**
		Deliverable: Final report	**Delayed to 2026**
Task 7.5	**Integration of PrePARED findings for seabird Cumulative Impact Assessment (Dr Kate Searle, UKCEH)**		
	2022 Targets	No targets	**No Targets**
	2023 Targets	No targets	**No Targets**
	2024 Targets	No targets	**No Targets**
	2025 Targets	Report summarising and assessing the evidence arising from PrePARED on prey and seabirds to provide a comprehensive overview. This will summarise the application of the new inference within cumulative assessment frameworks for seabirds (e.g., SGMD CEF project), and identify areas of development of new research.	**On Target**

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

Task 8.1	**Stakeholder and network analysis (Project Lead, SGMD)**		
	2022 Q1 Targets	No target	**No Target**

	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Completion/delivery of a stakeholder & network analysis report	**Completed**
	2023 Q1 Targets	Negotiate contract for the SNA	**Completed**
	2023 Q2 Targets	Allocate contract	**Completed**
	2023 Q3 Targets	Monitor contractor progress	**Completed**
	2023 Q4 Targets	Publish SNA	**Completed**
	2024	No Targets	**No Target**
	2025	No Targets	**No Target**
Task 8.2	**Communications Plan (Project Lead, SGMD)**		
	2022 Q1, Q2 & Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Completion of PrePARED communications plan	**Completed**
	2023 Q1 Targets	Update draft plan	**Completed**
	2023 Q2 Targets	Finalise draft comms plan and disseminate	**Completed**
	2023 Q3 Targets	Implement Comms Plan	**Completed**
	2023 Q4 Targets	Implement Comms Plan	**Completed**
	2024 Q1 Targets	No target	**No target**
	2024 Q2 Targets	Review comms plan	**Completed**
	2024 Q3 Targets	No target	**No target**
	2024 Q4 Targets	Review comms plan	**Completed**
	2025 Targets	Q2 Review communications plan with project team and PAG and update as required	**Completed**
		Q4 Review communications plan with project team and PAG and update as required	**Completed**

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

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

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

13. TABLE 9 – PrePARED Numbers

2025 Q2	WSA-WP1	>100 hours of BRUV footage processed for presence, abundance and length of fish
2025 Q3	WSA-WP1	Fisheries acoustic data recorded along 900km of transects across the Forth and Tay region and 800km across the Moray Firth, 6 pelagic tows and 38 demersal tows were realised and over 36,000 fish measured across 55 species
2025 Q4	WSB-WP4	1,500 bomb calorimetry runs have been completed as part of the project. 37 prey species analysed across sizes 4.7 – 58.2 cm. The PrePARED project has generated 662 new energetic density estimates.
2025 Q2	WSB – WP3	84 acoustic receivers retrieved in the Moray Firth
2025 Q3-4	WSB – WP3	288 hours of unbaited camera (‘Cuttlefish’) footage processed for presence and abundance of demersal fish

14. TABLE 10 – Targets for 2026

Task lead	Task	Q1 - Targets 2026 Jan Feb Mar	Q2 - Targets 2026 Apr May Jun	Q3 - Targets 2026 Jul Aug Sep	Q4 - Targets 2026 Oct Nov Dec
Thomas Regnier	Task 1.1 Broadscale fish response to OWF in Forth	Finish production of fish abundance layers	Finish analysing effects of environmental variable on prey distributions	Draft manuscript	Manuscript for peer-review: Effects of OWF development on broadscale prey distributions
Thomas Regnier	Task 1.2 Finescale fish response to OWF in Forth		Begin drafting manuscript	Draft manuscript	Manuscript for peer-review: Effects of OWF development on fish communities
Esther Jones	Task 2.1 Seabird spatial distribution models in Forth	1) Produce draft manuscript for submission to peer-reviewed journal 2) Begin finalising estimates of spatial distributions and uncertainty for each species within Forth-Tay region	Continue updating distribution models to incorporate available prey data	Preparation of journal article	1) Preparation of journal article 2) Final version of distribution models
Esther Jones	Task 2.2 Seabird movement models in Forth	1) Produce draft manuscript for submission to peer-reviewed journal on movement modelling 2) Produce algorithm to produce more realistic simulations of foraging tracks for SeabORD	Continue revising movement models to incorporate available prey data	Begin preparation of journal article	Finish preparation of journal article
Katherine Whyte/ Christopher Pollock	Task 2.3 Simulating realistic foraging tracks in IBMs	**COMPLETE**			
Anthony Bicknell	Task 3.1 Large-scale fish distribution in Moray	Draft report - Delivery of the draft report	Final report - Delivery of the final report		
Anthony Bicknell	Task 3.2 Fine-scale fish distribution in Moray (reef effects)	1) Deliverable: Publish research paper on fish responses to offshore wind turbines 2) Deliverable: Produce topic sheet on paper findings	Deliverable: Produce a report on use of unbaited camera landers (“Cuttlefish”)	Draft a research paper on use of use of unbaited camera landers (“Cuttlefish”)	Deliverable: Produce a research paper on use of unbaited camera landers (“Cuttlefish”)

Matthew Witt	Task 3.3 Fish acoustic telemetry in Moray	1) Deliverable: Produce research paper focusing on the multi-year individual fish tracking dataset 2) Deliverable: Produce topic sheets on research paper findings			
Paul Thompson	Task 4.1 Drivers of broadscale marine mammal distribution in Moray			Delivery of draft report	Delivery of second report under the Task, highlighting how harbour seal foraging distribution is related to sandeel distribution.
Aude Benhemma -Le Gall	Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray	Draft final report	Delivery of final report		
Paul Thompson	Task 4.3 Dose response curves in Moray	**COMPLETE**			
Cormac Booth	Task 4.4 Fish nutritional value	Delivery of final database and report in the form of a revised draft manuscript			
Anthony Bicknell	Task 5.1 Generalities in fish response to OWF	Analysis of acoustic and camera survey data to determine similarities in fish composition, behaviour and biomass distribution between study sites with comparable habitat.	Draft final report	Final report - Delivery of the final report	
Cormac Booth	Task 5.2 Generalities in harbour porpoise response to OWF	**COMPLETE**			
Esther Jones	Task 6.1 Minimum data requirements for seabird distribution and movement models	Begin drafting manuscript	Update on manuscript	Delivery of draft manuscript	Delivery of manuscript
Paul Thompson	Task 6.2 Minimum data requirements for marine mammal distribution models	**CANCELLED**			
Matthew Witt	Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites	**COMPLETE**			
Cormac Booth	Task 6.4 Survey design for predator-prey studies	Complete data collection and analyses	Final infographic		

Cormac Booth	Task 7.1 IPCoD and DEPONS integration of new data and testing	Final report			
Kate Searle	Task 7.2 Adding biological realism to SeabORD and testing	1) Deliverable: updated SeabORD versions for empirical prey availability maps and joint pred-prey distributions 2) Deliverable: Application of SeabORD to Forth-Tay for model validations and submission of peer-reviewed manuscript (with Task 2.3) 3) Deliverable: Updated version of SeabORD including redistribution of prey around OWFs	1) Developing and testing simulations of interactions with OWFs for use in individual movement simulations 2) Empirical quantification of behavioural responses 3) Quantify proportion of individuals/trips directly impacted by OWFs 4) Quantify characteristic of disturbance events - development of modelling methodology	1) Developing and testing simulations of interactions with OWFs for use in individual movement simulations 2) Empirical quantification of behavioural responses 3) Quantify proportion of individuals/trips directly impacted by OWFs 4) Quantify characteristic of disturbance events - fitting model to initial data	1) Integration of new foraging track interactions with OWFs for use in individual movement simulations 2) Empirical quantification of behavioural responses 3) Quantify proportion of individuals/trips directly impacted by OWFs 4) Quantify characteristic of disturbance events - Finalisation of model fitting
Kate Searle	Task 7.3 Testing and validating SeabORD in the FoF and at UK SPAs	Working with Natural England towards deliverable	Demonstration of SeabORD at new location for Flamborough and Filey SPA and project report		
Cormac Booth	Task 7.4 Integration of PrePARED findings for harbour porpoise CIA	**COMPLETE**			
Kate Searle	Task 7.5 Integration of PrePARED findings for seabird Cumulative Impact Assessment				Deliverable: PrePARED Report
PrePARED Project Manager	Task 8.1 Stakeholder and network analysis	**COMPLETE**			
PrePARED Project Manager	Task 8.2 Communications Plan	**COMPLETE**			

PrePARED Project Manager	Task 9.1 Annual knowledge exchange meeting	Project team day and provide series of report-based webinars.	Provide series of report-based webinars.	Provide series of report-based webinars.	Provide series of report-based webinars.
PrePARED Project Manager	Task 9.2 Dissemination of project findings	Support for technical and non-technical dissemination of project findings	Support for technical and non-technical dissemination of project findings	Support for technical and non-technical dissemination of project findings	Support for technical and non-technical dissemination of project findings
PrePARED Project Manager	Task 9.3 PrePARED project scientific symposium	organise symposium	organise symposium	organise symposium	organise 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

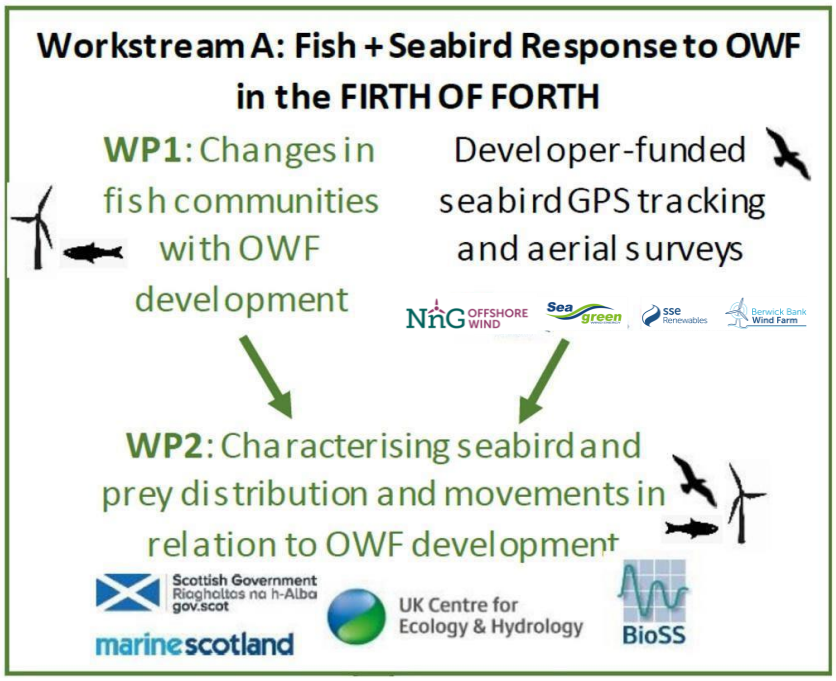
15. Glossary of acronyms used in the PrePARED project

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

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

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

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



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

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

Task 1.1 Broadscale fish response to OWF in the Forth

Q1 Targets: Produce a map of sandeel point abundance in the sand per age class; Broadscale prey fields from acoustic transects (pelagic prey); Completion of RoxAnn analyses

Following the December sandeel survey, age estimations of sandeel (samples) were completed and maps of point abundance (in catch per unit effort) per age class were produced.
Sandeel 2024 data were included in the species distribution model and predictions produced. Clupeids (sprat and herring) predictions were still being worked on (slight delay into Q2), however, predictions for 6 demersal fish species (planned for Q2) were produced.
RoxAnn analyses were completed, the model updated with 2024 data, new predictions made and used in the species-distribution-models.

Q2 Targets: Produce a map of point habitat characteristics (from RoxAnn)

RoxAnn data from all 2024 surveys (PrePARED and others) were used to refine the seabed hardness and roughness layers (maps) and now used to model fish distributions. New data was being collected on the 2025 surveys which will be used to further update the layers.
Surveys were planned, prepared and underway.

Q3 Targets: Complete 2025 data collection

All 2025 surveys (Demersal survey and Acoustic & seabird survey) were completed successfully. Analyses were progressing and a manuscript and presentation at MASTS Annual Science Meeting (November 2025) was being prepared.

Q4 Targets: 1) Analyses, 2) Begin production of fish abundance layers

1) The extension of the fish ecologist post is still uncertain, so analyses of 2025 data is on hold and priority was given to finalising the analyses with data up to 2024 and publication of the outputs.
2) The processed acoustic data were received, and post processing can start with the post processed data aiming to be shared in January 2026. As above, the models and publication are planned without the 2025 data.

Task 1.2 Finescale fish response to OWF in the Forth

Q1 Targets: Process BRUV and AI camera video footage from 2024 camera surveys - completion of video processing from surveys

All video footage were analysed, the output formatted and used in the species-distribution models (with updated predictions for 6 demersal species now available)

Q2 Targets: Completion of 2024 analysis; Map fish (predator) abundance from SBRUV/Traps

Baited camera (SBRUVS) videos and trap data were analysed and used to model fish distributions.

No Targets in Q3 or Q4.

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

Task 2.1 Seabird spatial distribution models in the Forth

Q1 Targets: Preparation of journal article

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

Q2 Targets: 1) Begin incorporating all available prey data into distribution models. 2) Begin preparation of journal article

BioSS produced preliminary maps of kittiwake distribution in the Forth and Tay and delivered output layers from predator-prey spatial models to UKCEH. They integrated prey maps from Task 1.1 with seabird GPS tracking data into the spatial modelling framework and have provided document workflow and outputs in multiple formats to UKCEH for integration into Task 7.2 (tool development).

Q3 Targets: 1) Final version of distribution models. 2) Preparation of journal article

BioSS continued to work on the draft paper for peer-review submission. Currently in paper draft, with an R code library and a user guide, which will be published alongside the paper as open source.

Q4 Targets: Preparation of journal article

The next draft of the methods comparison paper is being circulated to co-authors by the end of December. The seabird distribution maps (including prey) are being delivered to UKCEH by mid-January.

Task 2.2 Seabird movement models in the Forth

Q1 Targets: Applying movement models to Forth and Tay prey data collected within project

BioSS continued to build on the seabird movement models, integrating seabird tracking data with prey data collected within the project (and the Langton sandeel map). They considered how they may be able to incorporate the adjustments to the Langton sandeel map (work being undertaken under Task 6.1) into the movement models to provide a better link between seabirds and sandeel across a larger spatial area (beyond the Forth and Tay).

Q2 Targets: 1) Begin incorporating all available prey data into movement models. 2) Deliverable: initial models for seabird movement

Linked to Task 2.3, different approaches to structuring the movement models have been considered. This is relevant for both (i) understanding the predator-prey relationships in the collected data, and (ii) parameterising the IBMs to appropriately simulate movements. BioSS continued to develop approaches to integrate the prey data into these models.

Q3 Targets: 1) Begin incorporating all available prey data into movement models. 2) Begin preparation of journal article.

Linking to Task 2.3, differences in movement characteristics (and models) across the four tracked seabird species have been further explored, aiding in the parameterisation of the IBMs for each species. BioSS have continued work to integrate prey data into each of the different models and began working towards the movement modelling manuscript.

Q4 Targets: 1) Finish preparation of journal article. 2) Continue revising movement models to incorporate available prey data

Linking to Task 2.3, BioSS have considered how best to accommodate known differences in movement behaviours across the different tagged seabird species, whilst aiming to maximise coherence across the simulation framework. Based on the initial movement models developed in this Task, appropriate time

resolutions have been chosen for the simulation work in Task 2.3, to ensure the best possible match with the empirical (real) data. The team have continued work on the movement modelling manuscript for this task.

Task 2.3 Simulating realistic foraging tracks in IBMs

Q1 Targets: Scope alternative movement model structures for generating IBM parameters.

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

Q2 Targets: 1) Test different movement model structures on sample tracking data. 2) Develop best practice guidelines for using movement models to generate IBM parameters.

Methodology for validating Individual Based Models (IBMs) was explored, building towards developing a formal framework for comparing simulated to real data in this project. We began shortlisting key summary statistics (patterns) for characterising seabird movement across data analyses and simulations.

Q3 Targets: Identify key parameters and data required for parameterising IBMs.

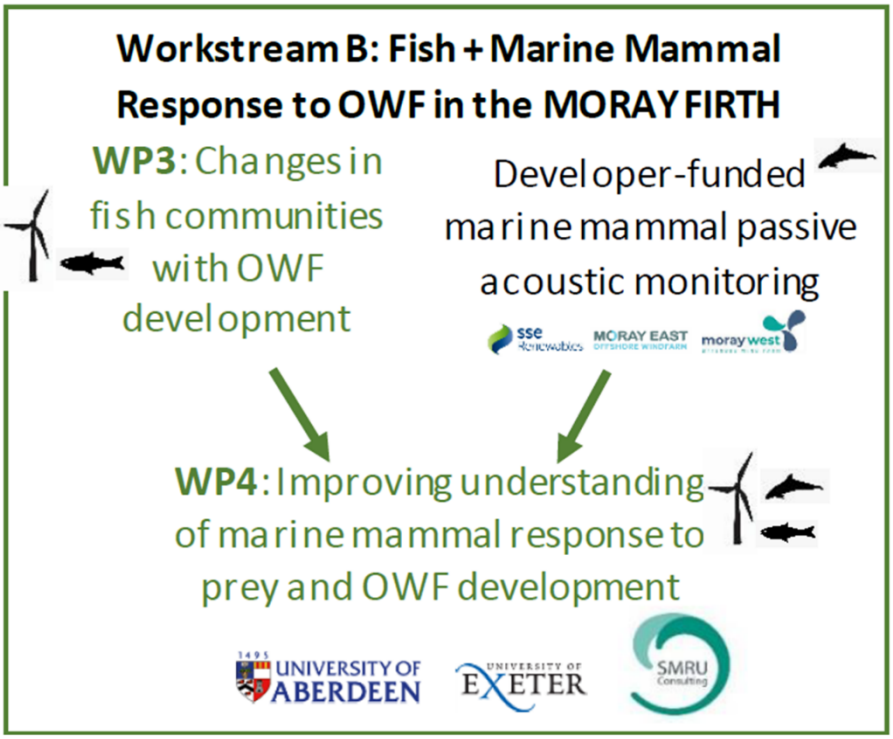
All simulation parameters for the IBM were reviewed, and decisions made on how each parameter value will be chosen for the simulations (e.g. fixed based on literature or optimised by ABC algorithm). A list of summary statistics defining both real and simulated movement tracks was collated and prioritised- this final list will be used in parameterising the simulated tracks so that they match as closely as possible to the real tracks. A general framework for comparing real and simulated tracks to parameterise the simulations (ABC algorithms) was identified, and BioSS began code development for this.

Q4 Targets: 1) Develop framework for testing and validation of simulated v.s. real foraging tracks. 2) Delivery of report.

1) The framework for parameterising the simulated foraging tracks (through comparison with real foraging tracks) is being developed and tested. The different segments of code are being developed to ensure that the pipeline and framework is repeatable across multiple simulations during the parameterisation process.

2) The report on this task is being drafted internally to be delivered early 2026.

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



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

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

Task 3.1 Large-scale fish distribution in the Moray Firth

Q1 Targets: Completion of fisheries acoustic and trawl data processing & downstream provision. Process BRUV and AI camera video footage from 2024 camera surveys - completion of video processing from surveys

Fisheries acoustic and trawl data processing was completed and provided to relevant task partner. Processing of 2024 BRUV survey video footage was also completed. Unbaited longer term (24-48hr) camera video processing was ongoing for completion in early Q2.

Q2 Targets: Video footage data analysis and downstream provision

Analyses of fisheries acoustic and trawl data was ongoing (UoA). Species distribution models for the Moray Firth based on these data and being produced by SGMD.

Q3 Targets: Continue data analysis

Ongoing analysis of 2022, 2023 and 2024 fisheries acoustic survey data (UoA) and updating species distribution models for Moray Firth (SGMD).

Q4 Targets: Continue data analysis

Ongoing analysis of 2022, 2023 and 2024 fisheries acoustic survey data (UoA) and updating species distribution models for Moray Firth (SGMD). Waiting for additional 2025 data to include in large scale site effects on fish distribution and fish species distribution models.

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

Q1 Targets: Process BRUV and AI camera video footage from 2024 camera surveys - completion of video processing from surveys

Analysis of 2024 BRUV data was completed. Data products were shared with relevant project partners as needed/requested. A manuscript using these data is now in preparation.

Q2 Targets: Video footage data analysis and downstream provision

Preliminary analysis of the BRUV data completed (by both the human analyst and an AI computer vision model). Results demonstrate declining abundance and biomass as distance increases from turbine structures. Preliminary analysis of AI camera video reveals the imagery to be contaminated by red light; this has arisen due to incorrect filters on the camera. As such, the existing AI-based fish detector struggled to count fish. The detector needs retraining. The AI detector is rather essential as each data is 24 hours is duration,

equivalent to x48 longer than out standard videos. Retaining the detector is underway but will take another 6-8 weeks to complete and validate.

Q3 Targets: Update on AI retraining

Lander data (cuttlefish) analysis ongoing. The UoE team took the decision to analyse all the data manually by evaluating MaxN and redness every hour on the hour for multiple minutes from all camera datasets.
Draft of 2024 BRUV survey paper completed for abundance, biomass and length distance effects for haddock and flatfish.

Q4 Targets: 1) Deliverable: Publish research paper on fish responses to offshore wind turbines

Paper “Bicknell et al. Fine-scale proximity to offshore wind turbine foundations increases biomass of benthic fish species” submitted to journal and will be available as pre-print

Task 3.3 Fish acoustic telemetry in the Moray Firth

Q1 Targets: Process acoustic ping data. Update on delayed analyses from Q4 2024

Analysis pipeline was completed on data available to date.

Q2 Targets: Retrieval of acoustic array and data download in the Moray Firth: 1) Completion of array removal. 2) Completion of final 6-month data download

The retrieval of the tracking array from the seabed is for the majority complete. However, 2 units remain on the seabed and need intervention using a Remotely Operated Vehicle (ROV) as the internal release mechanism of the receivers has failed and so the units need hauling to surface by a crane once the ROV can attach a manual retrieval rope. Given the full array data are incomplete the team cannot move to the analytical phase of the work. While this may result in only a short delay the units were not serviced at the 6-month interval and so each unit contains a year of data, which means data processing, including quality control is anticipated to take longer than originally projected.

Q3 Targets: Final report - Delivery of draft report

Detection data processing and analyses of tracked fish ongoing. Draft of cod predation paper ongoing.

Q4 Targets: 1) Detection data analyses. 2) Deliverable: Produce research paper on seal predation of acoustically tracked fish within windfarms. 3) Draft topic sheet on paper findings

1) Analysis of tagged fish detection data ongoing.

2) & 3) Predation paper with co-authors. Will submit as pre-print and then journal when co-authors and MG have commented. Topic sheet to follow once submitted.

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: Delivery of second report under the Task, highlighting how harbour seal foraging distribution is related to sandeel distribution.

Not completed - This was an additional output for this Task following re-shaping of deliverables to focus on harbour porpoise data following departure of the original Task lead. Recent discussions with OWEC over a PrePARED extension have highlighted that analyses of seal-predator data are not a priority, so any further work on this Task has been halted to prioritise outputs and impacts from Task 4.2 and Task 4.3.

Q2 Targets: Update on delivery of second report

Not yet completed - This was an additional output for this Task following re-shaping of deliverables to focus on harbour porpoise data following departure of the original Task lead. Recent discussions with OWEC over a PrePARED extension have highlighted that analyses of seal-predator data are not a priority, so any further work on this Task has been halted to prioritise outputs and impacts from Task 4.2 and Task 4.3.

Q3 Targets:

Work describing how harbour porpoise distribution is related to new Scottish Government data on sandeel distribution has been delivered in PrePARED Report No. 1. An additional report exploring how archive harbour seal tracking data can be used to develop a second case-study for a seal species had been proposed for completion in Q1 2025. Following acceptance of CRF12, this will now be delayed to Q4 2026 within PrePARED extension.

Q4 Targets: No Targets.

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

Q1 Targets: Continue PAM-BRUV extended analyses

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

CTVs are then compared between sites of varying habitat quality (work in progress).

Q2 Targets: Analyses of PAM and AIS vessel-tracking data to investigate variation in fine-scale porpoise occurrence and activity after exposure to disturbance at operating OWFs and reference areas.

Target achieved and analyses conducted for presentation at CWW2025.

Q3 Targets: Delivery of draft report

Delivery of draft report delayed as per CRF12. Ongoing integration of prey data (from Tasks 3.1 and 3.2) to explore drivers of porpoise activity at OWF

Q4 Targets: Integration of prey data (from Task 3.1 and 3.2) to explore drivers of porpoise activity at OWF

Target achieved through ongoing discussion with UoE and BioSS about how BRUV and sandeel data are being integrated into analyses for this Task. Internal meeting held to finalise scope of report that will be drafted in Q1 2026. Progress made on the draft report/manuscript highlighting variation in harbour porpoise response to service vessel traffic in relation to foraging activity and prey availability. Draft Abstract to be submitted for the ECS 2026 and EIMR 2026 conferences.

Task 4.3 Dose response curves in the Moray Firth

Q1 Targets: 1) Dose-response analyses combining existing datasets from the three Moray Firth OWFs. 2) Develop additional report comparing observed responses of porpoises during Moray West Piling with EIA predictions [see PrePARED Outcomes-Impacts-Actions]

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

Q2 Targets: Delivery of draft dose-response report

Target not achieved and deliverable delayed until Q4 2025 as outlined in CRF12. Work has continued on the additional deliverable (PrePARED Report 008) comparing Moray West EIA predictions with observed data. Report has been reviewed positively by the MG and PAG and will be finalised by the end of June.

Q3 Targets: Delivery of final dose-response report

Delivery of draft dose-response report now planned for Q4 2025 as agreed in CRF12. Work on this report has continued with emphasis on integrating data from multiple wind farms to explore how dose and proximity shape response functions

Q4 Targets: Delivery of final dose-response report

Target not achieved within Q4, but work progressing well and report being drafted with the intention of circulating early in Q1 2026.

Task 4.4 Fish nutritional value

Q1 Targets: Processing of summer 2024 prey samples

Analysis continued on PrePARED and other fish samples to further enhance the database. The processing of PrePARED 2023 samples remains ongoing, with the final priority species currently being analysed. To date, we have over 500 new energy density estimates across 31 prey species, out of the 37 species for which we have samples. Sandeel samples from both summer and winter surveys have now been processed and incorporated into the expanding database.
Significant progress has been made in developing a prey energy database for use within PrePARED, with the long-term goal of integrating published data to create a comprehensive database of energy estimates in the North Sea.

Q2 Targets: Present output at stakeholder workshop

In Q2 2025, analysis continued on PrePARED and other fish samples to further enhance the database. The processing of PrePARED 2023 samples remains ongoing, with the final priority species currently being analysed. To date, we have over 580 new energy density estimates across 33 prey species, out of the 37 species for which we have samples.
Significant progress has been made in developing a prey energy database for use within PrePARED, with the ongoing long-term goal of integrating published data to create a comprehensive database of energy estimates in the North Sea.

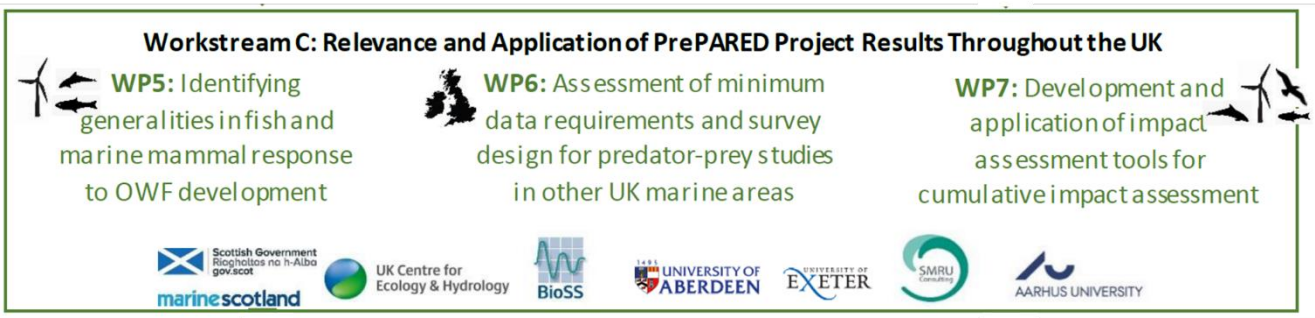
Q3 Targets: Delivery of draft report

Sample processing has continued through end of Q3 and draft MS is in process. Delivery of draft report (in the form of a draft MS) will be submitted to the management group at the end of Q4 now.

Q4 Targets: Delivery of the final report

Placeholder for the initial prey database compiled and is to be discussed at Q4 progress meeting. CRF to be drafted for new approach to deliverables within Task 4.4

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



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

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

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

Q1 Target: Collate and compare Moray Firth and Firth of Forth acoustic and camera footage processed data.

Data were collated, compared and shared between Task partners for evaluation and analyses.

Q2 Target: Evaluate similarities/dissimilarities between sites.

UoE and SGMD are progressing with evaluation of data between sites for broad- and fine-scale comparisons. This involves the use of fisheries acoustic and trawl data to compare species distribution models at each site and BRUV data for investigating wind farm level effects.

Q3 Target: Evaluate similarities/dissimilarities between sites.

Ongoing analyses 1) create/compare species distribution models using survey data from MF and F&T including fisheries acoustic, trawl and BRUV data. 2) Investigating if there are similar fine scale haddock and flatfish responses between sites using standarised BRUV data

Q4 Target: Analysis of acoustic and camera survey data to determine similarities in fish composition, behaviour and biomass distribution between study sites with comparable habitat.

Data management and analysis ongoing.

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

Q1 Targets: Present results at stakeholder workshop; Delivery of draft manuscript

Work on manuscript on the effect of PAM array design on dose response functions for harbour porpoises is almost complete. Analysis is focusing on establishing rules for truncation distances for the functions (i.e. the range from the source at which to truncate the data) have been completed using data from Beatrice and Moray East wind farms (and this can be replicated for other sites). This paper is planned for submission in Q2 2025. Work on seals is advancing, exploring overlap with prey data and expanding on Whyte et al response to noise studies. Collaboration with the UoA team continues to streamline these efforts and maximise impact. This work highlights the importance of survey design in using PAM stations for dose-response estimation (and the benefits and challenges of PAM stations at large distances from the source).

Q2 Targets: Delivery of the final manuscript

Analyses have been completed and a full draft of the manuscript (on the effect of PAM array design on dose response functions for harbour porpoises) has been shared with a few key experts for initial input. Revisions are planned late in Q2 before sharing with co-authors for final input before submission. Analyses focus on establishing rules for truncation distances for the functions (i.e. the range from the source at which to truncate the data) have been completed using data from Beatrice and Moray East wind farms (and this can be replicated for other sites). This paper is planned for submission at the end of Q2 or early Q3 2025. Collaboration with the University of Aberdeen team continues to streamline these efforts and maximise impact. This work highlights the importance of survey design in using PAM stations for dose-response estimation (and the benefits and challenges of PAM stations at large distances from the source). Work on seals continues, via Philippa Wright's PhD – exploring energetic aspects of seal/prey dynamics and the foraging behaviour of seals in relation to prey distributions and energyscapes.

Q3 Targets Update on delayed delivery of the final manuscript

Draft manuscript shared with management group (and PAG) for review along with a second manuscript from what was presented at Aquatic Noise Conference and will be a published volume.

Q4 Targets: Submission of manuscript

Two related manuscripts have been submitted. One "Hastie, G. D., Matei, M., Benhemma-Le Gall, A., Brown, A., Graham, I., Thompson, P., Booth, C. (2025). Acoustic array configurations for dose-response studies: impact gradient designs influence predictions of noise impacts on cetaceans. Effects of Noise on Aquatic Life IV." has been accepted but the original manuscript from this task is currently in review "Hastie, G. D., Matei, M., Benhemma-Le Gall, A., Brown, A., Graham, I., Thompson, P., Booth, C. (2025). Effects of acoustic logger array design on studies of cetacean responses to anthropogenic noise. Ecological Applications."

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

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

Q1 Targets: Evaluation of benefits of local prey data when predicting spatial distributions of seabirds

BioSS have developed a piece of work to adjust the Langton et al. 2021 sandeel map to account for uncertainty in predicted sandeel values (probability of occurrence) over space and time. They have worked with Langton to obtain bootstrapped samples of the sandeel map and are recruiting a post-doc who

will undertake this work in addition to resourcing some time from elsewhere in BioSS to deliver this is Q3.

*Q2 Targets: **Deliverable**: framework for predicting joint seabird-prey distributions in new regions*

Anastasia joined he project to take up the work to build spatial and temporal variability into the sandeel map. BioSS finalised a remit of work and begun to adapt example code provided by Rebecca Langton to generate (bootstrap) uncertainty layers for sandeel map predictions. BioSS are investigating run time as they are computationally intensive to produce.

Q3 Targets: Compare revised version of model against that derived using F-T prey data

BioSS have moved the Langton hurdle model into a Bayesian framework so that predictions with uncertainty can be generated quickly, which overcomes the computational constraint of generating bootstraps. They are checking that the Bayesian model produces the same outputs as the original Langton model. They have begun exploring the ICES stock assessment data (SSB) for sandeel, running periodicity and permutation tests to identify any temporal pattern in fish abundance and there is no clear evidence of patterns detected. Because the ICES stock assessment data that they need spans three areas, they are working out how to aggregate and spatially scale these areas so that they can vary abundance for the whole area over time.

*Q4 Targets: **Deliverable**: evaluation of benefits of local prey data when predicting spatial distributions of seabirds - provide to UKCEH*

Met with Andrew Gill (PAG), Thomas Regnier and UKCEH to discuss validity of approach to incorporate ICES data to vary the sandeel map. Finalised approach and BioSS will complete the analysis in Q1.

Task 6.2 – Minimum data requirements for marine mammal distribution models

Q1 Targets: Review scope of this Task in relation to progress on Task 4.1 and re-prioritisation of additional outputs required under Task 4.3 to maximise wider UK impact.

Target not achieved. It is proposed that this target should be deleted. Task was re-structured following re-shaping of deliverables to focus on seal tracking data after departure of the original Task lead.

Q2 Targets: Complete analyses of data on English water data. Present output at stakeholder workshop

Request to remove TASK 6.2 in CRF12

Q3 Targets: Delivery of draft report

Task 6.2 removed as agreed in CRF12.

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

This task was completed in 2024.

Task 6.4 – Survey design for predator-prey studies

Q1 Targets: Update on delayed manuscript

SMRUC reviewed the effort conducted as part of PrePARED and a summary infographic or short report was being planned

Q2 Targets: Delayed from Q3 2024 - Short report or infographic summarising how future surveys could be carried out

The short report was drafted and being reviewed within SMRUC.

Q3 Targets: Delayed from Q3 2024 - Short report or infographic summarising how future surveys could be carried out

CRF was drafted requesting a small change in scope (to focus on lessons learned from PrePARED) as well as a change in timing for delivery of a draft deliverable end of Q4 2025 and final product end of Q1 2026

Q4 Targets: Delivery of draft infographic

Not delivered. The survey questionnaire has been distributed and output now planned for end January 2026 with final product end of Q1 2026

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: Update on test simulations and delayed draft report

Updates to the DEPONS model are being made and work from Task 4.3 and 5.1 will feed into this analysis. The updated version of iPCoD (called iPCoD+DEB v1.0) is being finalised currently. SMRUC are engaging with Aarhus University to progress the DEPONS updates. Test simulations have been run in Q1 2025, and further simulations will be run in Q2 2025. The Moray Firth is the case study for the DEPONS simulations, and we are producing a PrePARED summary document entitled: "HARBOUR PORPOISE

POPULATON RESPONSE TO WINDFARM CONSTRUCTION, SERVICE TRAFFIC, AND CHANGES IN PREY AVAILABILITY."

Q2 Targets: Delivery of the final report

Draft report on track for delivery at the end of June 2025 for review and input from the management group and PAG and then final report incorporating comments planned for Q3.

Q3 Targets: Delayed delivery of final report

CRF submitted requested delay of final delivery following feedback from the PrePARED team on improvements to the report.

Q4 Targets: Update on final report

Report has received external input and a CRF approved to extend the deadline for the final report to February 2026, incorporating revisions suggested by the PrePARED team.

Task 7.2 – Adding biological realism to SeabORD and testing

Q1 Targets: Deliverable in GANTT: Updated version of SeabORD including redistribution of prey around OWFs and further development of movement simulations

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

Q2 Targets: Refinement of model parameterisation for redistribution of prey

Movement simulation developments to capture "generic" seabird movement have been completed, capturing essential behaviours like land avoidance and equivalent movement modes to SeabORD (e.g., travel and ARS) to facilitate integration of the two models. The next step is to run the approximate Bayesian computation (ABC) methods determined in Task 2.3 to attain a set of parameters for each of the four SeabORD species (razorbill, kittiwake, guillemot & puffin) with the result of four respective movement models aligning with key characteristics of each species. Discussions on the best way to integrate realistic track simulations into SeabORD with key staff from UKCEH and BioSS were also commenced.

Q3 Targets: Development of initial parameterisation to work with joint predator-prey maps

The decision has been made to use the predator-prey maps as validation for distributions of simulated tracks. Discussions are ongoing about the best way to approach this. Slight delay due to extensive round of revisions between co-authors of accompanying manuscript. Manuscript to be submitted to Journal of Applied Ecology, with submission to preprint server (e.g., BioArXiv or similar) and a release of SeabORD 2.0 R code on GitHub.

Q4 Targets: 1) Collation of required input data for SeabORD, and determination of OWD scenarios to be run (with PSG). 2) Validation of SeabORD in the Forth-Tay against independent data on the demographic consequences of displacement and barrier effects, measured empirically.

1) UKCEH have been coordinating with other project partners on the new empirical and modelled data available for validation of SeabORD in the Forth-Tay. This will comprise the use of the seabird distribution maps produced by BioSS (delivery Jan 2026) against which simulated seabird foraging tracks can be compared to validate the new mechanisms being added to SeabORD.
2) As mentioned before, it is not possible to validate SeabORD outputs against empirical data on demographic consequences for seabirds arising from OW impacts in the Forth-Tay, as these are not yet available from developer-funded work, due to delays in construction of OWFs in the region (estimates are due to be delivered late 2027).

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

Q1 Targets: Analysis of local GPS tracking data to derive a seabird utilisation distribution for validation of joint predator-prey distribution predictions

Local GPS tracking data from the Isle of May (Firth of Forth) has been completed with utilisation distributions for four species (razorbill, guillemot, kittiwake & puffin) ready to be used for joint predator-prey distribution maps.

Q2 Targets: Begin to establish model settings with Natural England staff to determine inputs and datasets to be used for running SeabORD at Flamborough Filey SPA to demonstrate model transferability

Following a training day with Natural England to provide more detail on SeabORD 2.0 (current R release), UKCEH have subsequently met with NE to finalise which settings should be used to run SeabORD, e.g., OWF footprint polygons, use of RSPB's GPS tracking data, displacement rate parameter value, size of buffer around OWF footprint and extent of displacement zone. Once this information is provided to UKCEH by NE, they will commence model simulation runs and write an accompanying PrePARED report to disseminate the findings.

Q3 Targets: Application of the model developed in Tast 7.2 to the region around Flamborough and Filey, in order to demonstrate transferability of the models to a new region, and to provide the inputs needed to run SeabORD for this region. Application of SeabORD using available data, as agreed with NE, at Flamborough and Filey SPAs to demonstrate transferability for black-legged kittiwake.

UKCEH are awaiting confirmation from NE for final model parameters and datasets to use in SeabORD runs for the Flamborough Filey SPA case study.

Q4 Targets: Application of SeabORD using available data, as agreed with NE, at Flamborough and Filey SPAs to demonstrate transferability for black-legged kittiwake

UKCEH are in discussions with NE on the data and parameters they wish to be used in the application of SeabORD at Flamborough and Filey. NE are to provide UKCEH with seabird foraging distribution maps derived from recent tracking data. NE are to confirm with UKCEH which OWF footprints and scenarios they wish to be used in the case study. NE have stated that they wish the case study to be for black-legged kittiwakes, and will confirm parameters such as displacement and barrier rates for UKCEH to use in model runs.

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

Q1 Targets: Updated CIA analyses

Data collation of wind farm data for UK OWF has continued to support CIA assessments. SMRUC intend to engage with Pathways to Growth in Q1 2025 to ensure further access to CIA parameters from as built windfarms. Further updates are being made to the iPCoD model (v6.0) and this will be used for simulations in Q2-Q3 2025 (delivery Q4 2025). A PrePARED report on improving CIA Assessments to streamline consenting has been prepared under this task and will be circulated internally at the very end of Q1 2025).

Q2 Targets: Present output at stakeholder workshop

Initial report finalised (report 007) with a stakeholder webinar summarising the findings held in July 2025 and two additional case studies now being drafted to support the initial report, with planned delivery at the end of June for case study 1 and the end of the year for case study 2.

Q3 Targets: Delivery of Case Study 1

Case study 1 delayed to Q4 2025, case study 2 on track for December 2025. Main results were presented at stakeholder webinar and recording uploaded to PrePARED website.

Q4 Targets: Delivery of Case Study 2

Case study 2 report delayed due to delays in obtaining hammer logs and NDAs from some offshore wind farms. Delays have created conflicts with other ongoing projects and fieldwork, so case study 2 report delayed till end of Q1 2026.

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

Q1 and Q2 Targets: Review article summarising and assessing the evidence arising from PrePARED on prey and seabirds to provide a comprehensive overview. The article will summarise the application of the new inference within cumulative assessment frameworks for seabirds (e.g., MS CEF project) and identify areas of development of new research.

Initial meetings between project partners involved in fish-seabird work have taken place to identify the main empirical outcomes and links to the impact assessment process.

Q3 Targets: Literature review summarising relevant approaches for performing cumulative impact assessments for seabirds and offshore wind

This task is progressing with an initial compilation of the new seabird-OW learning that has resulted from the PrePARED project.

Q4 Targets: Report summarising and assessing the evidence arising from PrePARED on prey and seabirds to provide a comprehensive overview. The report will summarise the application of the new inference within cumulative assessment frameworks for seabirds (e.g., MS CEF project) and identify areas of development of new research.

Collation of new empirical learning on responses of prey and seabirds around OWFs has begun and will primarily focus on work delivered by SGMD. A summary will be delivered in the form of a PrePARED report in Q2 2026.

Annex D - Year Details: Workstream D – Dissemination to inform OWF planning, policy and licensing

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

Workpackage 8 – Development of a dissemination roadmap

Task 8.1 – Stakeholder and network analysis

This task was completed in 2023.

Task 8.2 – PrePARED Communications Plan

Q1 Targets: No target

Q2 Targets: Review comms plan

Updates to communication plan following changes in SGMD central comms team resource.

Q3 Targets: No target

Q4 Targets: Review comms plan

Comms plan has been effective, no changes required

Workpackage 9 – Dissemination activities

Task 9.1 – Annual knowledge exchange workshops

Q1 Target: Begin new engagement strategy of dedicated report-based webinars.

The PrePARED team planned targeted webinars following outputs this year, to ensure key stakeholders are receiving information in a digestible manner with opportunities to ask questions. The team will review their effectiveness and request stakeholder feedback to determine if this should continue to be used moving forward.

Q2 Target: Provide series of report-based webinars

Webinars have replaced the AKEM in 2025, the first webinar based on Report 006 was successful with 60 attendees from a variety of stakeholder groups including SNCBs, industry, academia and government.

Q3 Target: Provide series of report-based webinars. Consider an in-person AKEM in 2026.

A webinar took place in July 2025 following Report 007 with 81 attendees from a variety of stakeholder groups including industry, government, SNCBs and consultancies. An in-person AKEM in 2026 is not currently planned, instead the targeted webinars will continue.

Q4 Target: Provide series of report-based webinars. Update on in-person AKEM in 2026.

There will not be a PrePARED AKEM in 2026, instead the team will focus on providing a set of webinars alongside outputs.

Task 9.2 – Dissemination of project findings

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

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

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

Project outputs are being disseminated on the website, blog, mailing list, through the PAG, social media and webinars.

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

Project outputs are being disseminated on the website, blog, mailing list, through the PAG, social media and webinars.

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

The team are supported through uploading of outputs on the website, distribution via mailing lists and social media, organisation of webinars, etc.

Task 9.3 – Organise PrePARED project scientific symposium

Q1 to Q4 Targets: organise symposium

Q1: Conversations are ongoing within the Management Group as to when the Scientific Symposium should take place following project extension noting not all partners are involved in the extension.

Q2: Asked OWEC for suggestions on The Crown Estate buildings/facilities to host the scientific symposium in London and have spoken to key stakeholders to determine what other events will happen at the same time of year

Q3: OWEC colleagues have confirmed that there are no suitable The Crown Estate buildings for this event. Next steps include identifying a venue and setting a date.

Q4: the Project Manager has now booked the Technology and Innovation Centre (TIC), Glasgow for the 20-21 January 2027. The date and location will be shared with key stakeholders and the Project Manager will encourage early creation of an itinerary throughout 2026.

Task 9.4 – Establish PrePARED website and social media

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

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

Q2: The website continues to be regularly maintained and updated. Social media has been reduced due to changes in the central comms team at SGMD, however, this was raised to OWEC and discussions are planned to support future comms.

Q3: The website continues to be regularly maintained and updated.

Q4: website is regularly monitored and maintained. Project Manager requests support from internal social media team alongside each PrePARED output.

Social media posts throughout the year (see Table 6)