ANNUAL REPORT 2022

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1. Brief Project Description

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

2. This Report

This report summarises the first year of the PrePARED project, a project jointly funded by the Crown Estates and Crown Estates Scotland. The report is broken down into the workstreams, workpackages and tasks of the project. The report has been written by all PrePARED task leaders, and edited by Marine Scotland. A table assesses progress against each quarterly target of the project using a traffic light system, where green indicates a target which was achieved or is ongoing, amber a target that is ongoing but has been delayed, and red a target that was missed. All missed targets have mitigation measures described in the text. Other tables summarise the field work undertaken within the project, the meetings held or attended, the presentations made and the communications issued. Recruitment of new staff and students is also listed. A glossary at the end of the report explains all acronyms used. Section 3 presents a brief summary of the year for all tasks, while Section 4 goes into the details of project delivery.

3. Year Summary

Target Achievement

In year 1 of PrePARED there were 32 tasks and sub-tasks, leading to 75 individual quarterly targets. Of these targets, 61 (81%) were either completed or are ongoing and are on target for final delivery. Delivery of 13 targets (17%) has been delayed for various operational issues, described in Section 3. One target was not achieved although mitigating actions are described also in Section 3.

Workstream A – Forth and Tay

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

In this task the compilation and collection of historic fish data needed to generate baseline fish distribution data (i.e., the state of the prey before OWF construction under the form of point abundance per prey species) was undertaken. Two contract staff were recruited to work on the project, a fish community ecologist and a fisheries acoustician. Survey work was undertaken including a broad-scale fish distribution survey in the Forth completed in Q2/Q3 when biological samples (whole fish and otoliths), fish distribution data (catch composition) and seabed characteristics (hardness, roughness) were collected. Analysis of this data has been started, including otolith analyses and acoustic and catch data processing. An additional sampling survey for sandeel densities in the sandy areas of the Forth OWF sites (meeting with developers, risk assessment and survey planning) was completed.

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

A survey of the fine-scale fish distribution in the Forth was completed (Q3) and biological samples (whole fish and otoliths), fish distribution data (fish trap records and BRUV video footage) and seabed characteristics (hardness, roughness) were collected. Analysis of this data has started.

Task 2.1 Seabird spatial distribution models in the Forth

Owing to the absence of bird tracking data due to avian flu, there was an increased focus on collating as much historic data as possible in this task. Existing data describing seabird, prey, offshore wind farm, and environmental covariates was identified and obtained. A post-doc was recruited to work on the project. Processing of the historic data commenced using software code that is being developed by the project to be generalisable and reproducible.

Workstream B – Moray Firth

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

Acoustic biomass data from historical and previous surveys in the Moray Firth were collated. Acoustic fisheries biomass and Baited Remote Underwater Video (BRUV) surveys were designed and completed during 2022. These were designed to assess fish distribution in and around the two operational and two pre-construction wind farm

sites in the Moray Firth. Acoustic biomass data and video data from these surveys are being processed for analysis in 2023. Planned seabed sediment grab samples and unbaited camera surveys did not take place this year, and have been moved to 2023.

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

A BRUV survey was designed and completed around two operational wind farms in the Moray Firth. The survey was successfully aligned with the marine mammal passive acoustic monitoring in Task 4.1 to simultaneously collect prey and predator data in the same locations. Over 100 deployments were made at turbines and reference sites, providing over 80 hours of video data, which are currently being processed for analysis and downstream provision in 2023. These data will be used to assess the extent of the reefing effect around turbines and how this may affect the presence of marine mammal predators. The planned unbaited camera survey did not take place and has been moved to 2023 due to the later than anticipated start of the project and the time taken to procure necessary equipment.

Task 3.3. Fish acoustic telemetry in the Moray Firth

An acoustic telemetry array was designed and deployed in the two operational wind farms in the Moray Firth. Acoustic receivers (n=84) were moored to the seabed close to wind turbines, and fish (n=60; cod, haddock and whiting) were acoustically tagged. The data the receivers will detect from tagged fish will provide details of the movement of these individuals around and between turbines.

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

Moray Firth predator (i.e. birds and cetaceans) data from digital aerial surveys, telemetry and PAM (Passive Acoustic Monitoring) collated, processed and archived. Moray Firth prey and environmental covariates were also collated. State of the art harbour seal and harbour porpoise distribution models were reviewed. R scripts needed to process and analyse seal and harbour porpoise distribution models were developed.

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

A PAM array was designed to characterize variation in harbour porpoise occurrence and foraging around two operational wind farms in the Moray Firth. Additional data were collected at reference sites within a third site where construction is planned for 2023. Within the operational sites, echolocation detectors were deployed at 28 turbines in a paired design to explore fine-scale reef effects. At each site, one device was deployed within 50m of the turbines and one mid channel between adjacent turbines. Devices were deployed in late July to complement BRUV studies (Task 3.2) that aim to characterize fish communities around these PAM sites during August.

All PAM devices were recovered between September and November, and data were recovered from all paired devices and all but one device in the reference area. Porpoises were recorded on a daily basis throughout August. These data are currently being analysed to explore how porpoise occurrence and activity vary in relation both

to the presence of structures and fine-scale variation in prey communities using data from Task 3.2.

Task 4.3. Dose response curves in the Moray Firth

The main activities for this task will commence in 2023 when construction is expected to start at the third offshore windfarm site in the Moray Firth. Regular updates were received on the likely construction schedule for this windfarm. A provisional PAM array design, to be deployed during construction, was developed and presented to the MFRAG-MM group in September.

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

A bomb calorimetry laboratory and analytical protocols for the PrePARED study were developed and finalised in 2022. Fish samples collected from the Moray Firth region in 2021 by Marine Scotland Science were analysed in 2022. Fish samples from the Firth of Forth 2022 surveys (from Marine Scotland) and from the Moray Firth (sandeels from 2019) have been collated. Energy density values for 107 fish of 11 species (all between 10-30 cm in total length) have been generated using the MSS samples from the Moray Firth. The activities in this task will continue in 2023 using initial PrePARED survey data from 2022 and the sandeel samples from 2019.

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

The activities in this task will commence in 2024 when survey data for each site has been collected and analysed.

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

Preparations of the Seagreen and NnG offshore wind farm PAM datasets have continued throughout 2022. These data will provide the response data to be used in statistical analyses to understand the transferability of patterns observed in the Moray Firth to outside the region. This has involved multiple discussions with the University of Aberdeen marine mammal team to understand the approaches undertaken in the Moray Firth. Data and code has been kindly shared to facilitate the transferability assessments. Continued close collaboration with the University of Aberdeen team will continue in 2023 and beyond. Initial work has focused on the dose response developed by Graham et al. (2019) and exploring how the manual degradation of CPOD datasets (via subsampling of input data to the dose response model). This approach reduces the total data available to parameterise the dose response models. We are investigating the point at which the resulting dose response relationships deviate significantly from the original (i.e. full) dataset. The outputs are expected to elucidate the levels of effort (i.e. PAM stations) required to derive robust dose responses for harbour porpoises. This work will also feed into Task 6.4. Additional work in this task has focused on mapping out plans for 2024 and 2025. These include exploring patterns in the foraging buzzes at the Firth of Forth OWF sites (the main focus of Seagreen and NnG post-consent monitoring analyses is on occurrence). This

will involve utilising approaches published by Benhemma- Le Gall (2021) from the Moray Firth. As noted above, work will also involve engagement with Task 6.4.

Task 6.1 Minimum data requirements for marine mammal distribution models

A meeting was convened with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters. Data was collated and archived for predators in the Moray Firth (from Task 4.1) and is now ready to be used to conduct simulations to explore the impact of using lower resolution data. A workshop is scheduled with BioSS for March 2023.

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

Work on Task 5.1 is helping to inform Task 6.3. Otherwise the activities in this task will commence in late 2024 in coordination with Task 6.3.

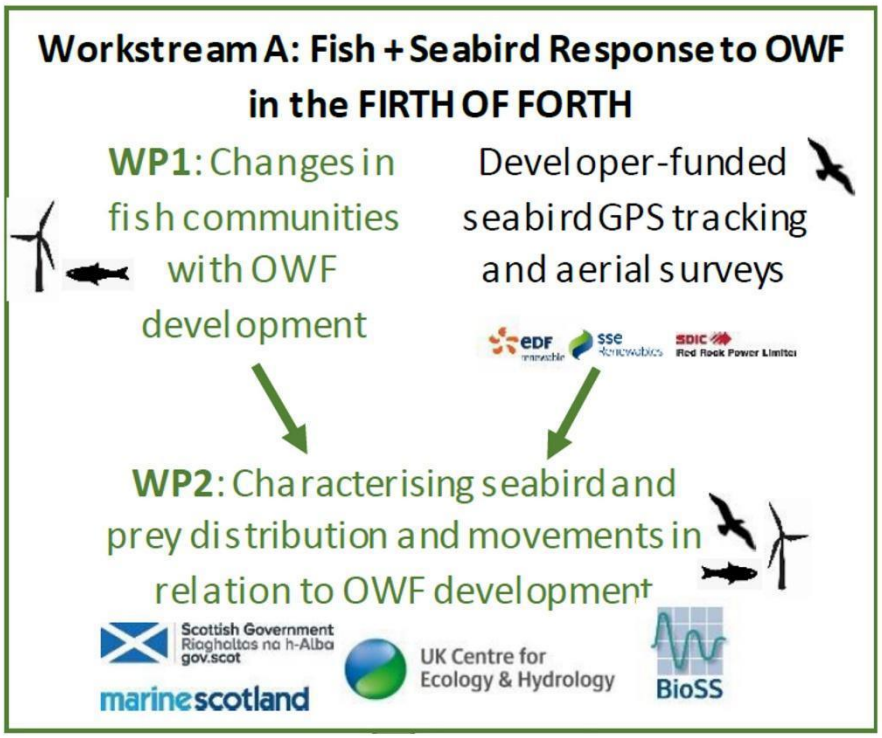
Task 7.1 Validate revised impact assessment tools (i.e. DEPONS/iPCoD) using historic data from constructed OWF in the Moray Firth

The activities in this task will commence in 2024 and 2025 as the iPCoD and DEPONS models are developed further. Discussions with the teams behind the development of iPCoD (SMRU Consulting; John Harwood) and DEPONS (Aarhus University) were carried out through 2022 and will continue in 2023 to understand how the tools are developing and to discuss appropriate validation approaches considering the data available. A workshop is planned for February 2023 to discuss this further.

Task 7.4 Updating Cumulative Impact Assessments for marine mammals

The bulk of this Task is to commence in 2024-2026. However, in 2022 a Cumulative Impact Assessment (CIA) spreadsheet has been compiled, building on the data stores from the Cumulative Effects Framework (Marine Scotland Science funded). This spreadsheet provides extensive details on the approaches listed in EIA for many OWF. This will be extended in 2023 with information on how many OWF were actually constructed (to allow comparison with EIA plans – and the predicted cumulative impact). In 2025-2026, the outputs of multiple tasks within PrePARED will be synthesised to understand how updated CIA compare to the state of knowledge before the PrePARED project commenced.

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



WP1: Changes in fish communities with OWF development in the Firth of Forth	
Task 1.1 Lead: Dr Thomas Regnier (MSS)	How do broad-scale prey landscapes and fish communities change in relation to OWF development in the Forth?
Task 1.2 Lead: Dr Thomas Regnier (MSS)	How do fine-scale fish communities change in relation to OWF development in the Forth?
WP2: Characterising seabird and prey distribution and movements in relation to OWF development in the Firth of Forth	
Task 2.1 Lead: Dr Esther Jones (BioSS)	Characterising seabird spatial distribution in relation to prey abundance and OWF development
Task 2.2 Lead: Dr Adam Butler (BioSS)	Movement modelling to link seabirds and prey, detecting changes in response to prey movement in relation to OWF development
Task 2.3 Lead: Dr Adam Butler (BioSS)	Evaluating potential for use of prey data to reduce uncertainty and increase power when estimating displacement rates for seabirds

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

Task 1.1 Broadscale fish response to OWF in the Forth

Q1 Targets: Identify all data sources; Initiate the processing of raw acoustic data

- Collated data from previous FoF and Moray Firth surveys (pelagic and demersal tows, acoustic surveys), produced Age-Length-Keys
- Obtained data from International Bottom Trawl Surveys (IBTS)

- Collated environmental data (bathymetry, salinity, zooplankton, primary productivity, temperature)
- Produced maps of point abundance per year for herring and sprats using haul data and processed acoustic data (see Fig. 1).

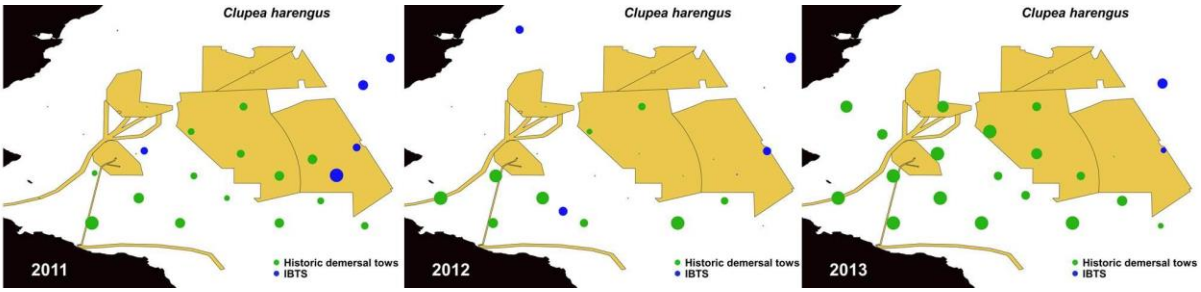


Fig. 1. Point herring (*Clupea harengus*) abundance for years 2011-2013 in International Bottom Trawl Surveys (IBTS) and historic demersal tows.

Q2 Targets: Produce a map of point abundance per prey species; Prepare fisheries acoustic/ seabird at sea survey: Design surveys based on previous studies and development site conditions

- Conducted interviews for the 2 PrePARED posts (acoustic scientist, fish community ecologist)
- Attended meetings with NnG, Seagreen, Berwick Bank developers
- Attended meetings as Project Licence Holder for fish tagging under PrePARED
- Produced point abundance maps from historic surveys
- Spent most of Q2 preparing Risk Assessments (RAs), RAMS, and survey planning for PrePARED surveys
- Designed survey 1 and produced a cruise programme for 1st PrePARED survey
- Started first PrePARED survey on 23/06/2022 (See Table 2).

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

- Despite spending a lot of time on recruitment for PrePARED we managed to gather all necessary data.
- We produced spatial abundance data for key prey species and started the process to model their distributions.
- Collated data for the Moray Firth were also provided to our partners at UoA.
- Preparation of the surveys, including an enormous time investment in the production and modification of risk assessment documents satisfying the developers.
- PrePARED broad-scale survey took place in June-July (See Fig. 2. And Table 2)

- The **Fish Community Ecologist (Charlie Cooper) hired on this project started on 08/08/2022** (initially planned for 01/04/2022) and, despite lengthy processes in getting access to the required IT equipment, has started to work on the modelling of fish distributions from the collected data.
- The **Fisheries Acoustician (James Dunning) hired on the project started on 19/09/2022** (for 01/04/2022) and again despite not having access to the right IT equipment, started processing the acoustic signal collected during the first survey.

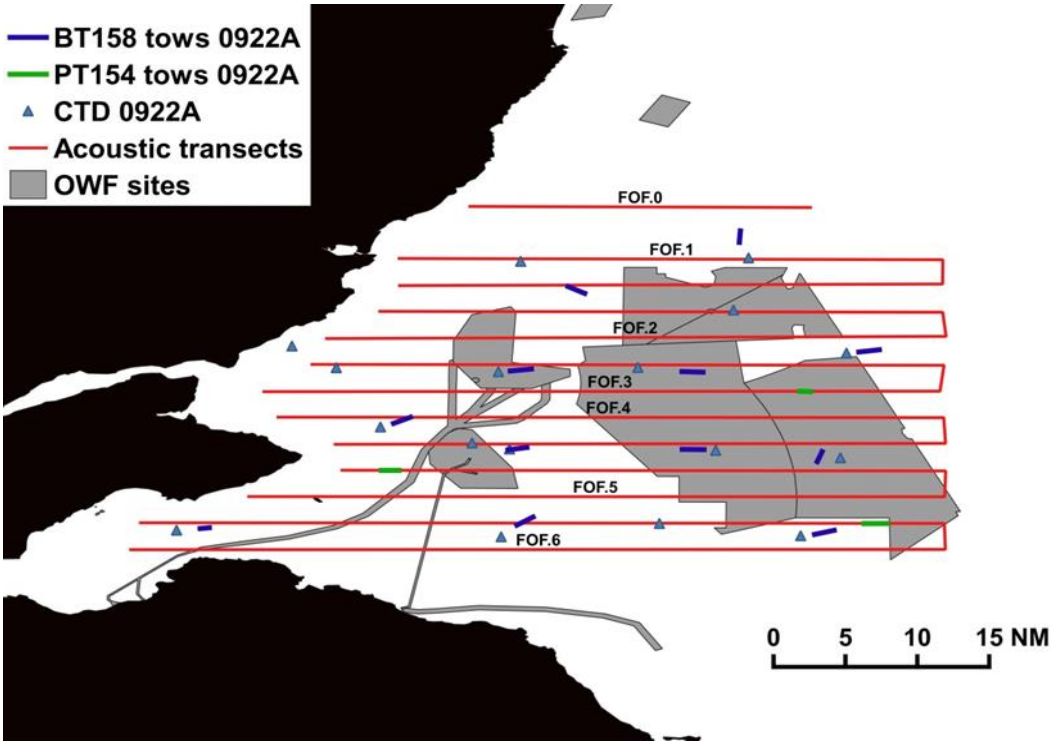


Fig. 2. PrePARED Broad-scale fish survey in the Forth. Acoustic transects and fishing tows are indicated.

Q4 Targets: Produce point biomass estimates of pelagic fish from acoustic transects; Completion of otolith analyses

- Target 1 is underway but delayed due to the late starting date of the fisheries acoustician, instead a compilation of point biomass estimates of pelagic fish from historic surveys have been sent to our PrePARED partners.
- Target 2 – Otolith analysis: Pelagic – all sandeel otoliths from prepared survey aged, herring and sprat still to read. Demersal – Fish trap fish measured & otoliths extracted. Trained in mounting and sectioning, gadoids otoliths to be analysed in the new year (Training was delayed due to the late starting date). Until this is finalised we use Age Length Keys from historic surveys and IBTS surveys.
- Additional Work: Plans to sample sandeel in the sand within NnG and Seagreen OWF have been made, permits obtained and the **survey took place (See Table 2).**

Task 1.2 Finescale fish response to OWF in the Forth

Q1 Targets: None

Q2 Targets: None

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

- Survey was planned, required documentation produced (Ras, etc.)
- BRUV/Fish trap surveys were conducted in August 2022 in Forth and Tay windfarms (See Fig. 3 and Table 2)
- The project fish ecologist was introduced to the post survey video analyses
- Grab sample could not be collected due to the time pressure on the survey Instead RoxAnn data were collected and post-processing started.

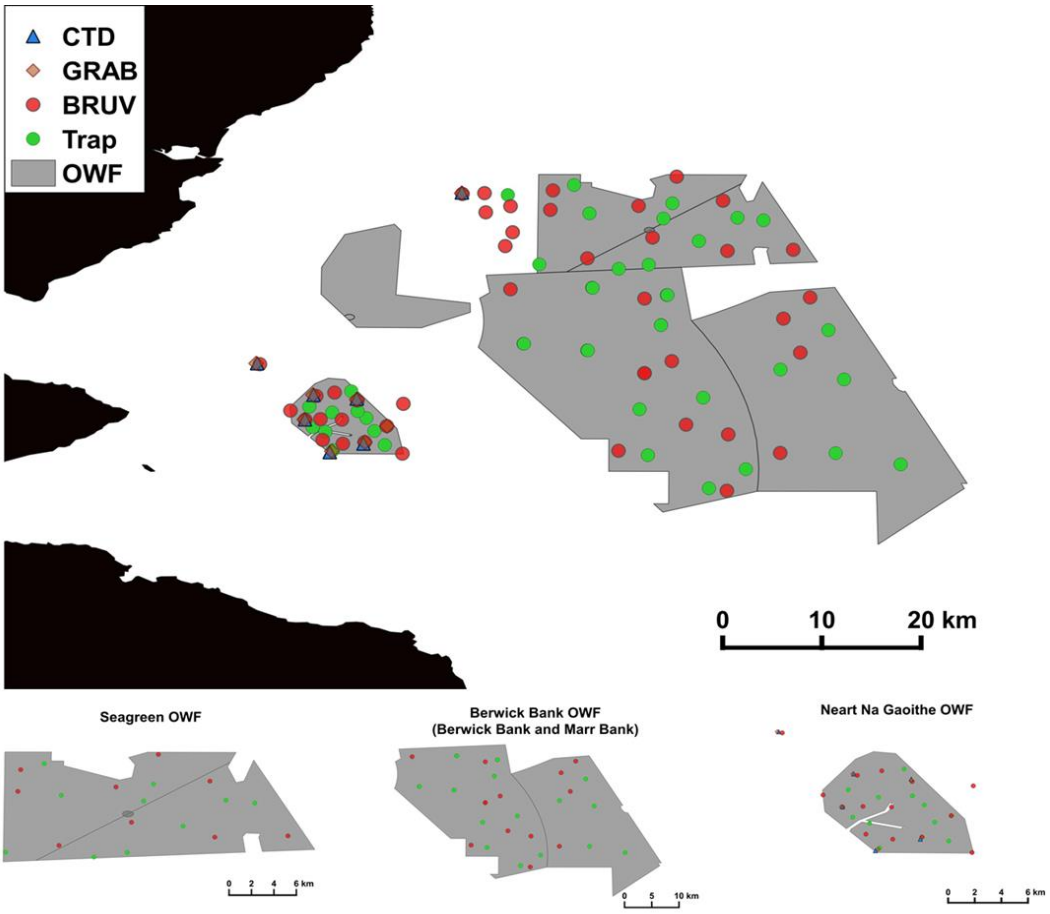


Fig 3. PrePARED fine-scale fish survey in the Forth. Locations of fish traps and Baited Remote Underwater Video (BRUV) are indicated.

Q4 Targets: Completion of PSA analyses

- No grab samples were taken, hence methodology changed to using acoustic data
- Seabed data is derived from existing environmental layers and new hardness and roughness layers being produced from past RoxAnn data
- **Compilation of all available data is complete** and interpolation by Inverse Distance Weighing and Krigging is underway.

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

Task 2.1 Seabird spatial distribution models in the Forth

Q1 Targets: No targets or deliverables. Additional work undertaken was:

- Advertising for a postdoc to work on Tasks 2.1 seabird spatial distribution models, 2.3 seabird displacement rates, and 6.1 transferability of distribution models.
- Continuing to review and collate existing data for requirements inventory with metadata for existing seabird, prey, offshore wind farm, and environmental covariates

Q2 Targets: Review and process existing prey data for use in distribution and movement modelling, and process seabird GPS data and environmental data

- Recruited Ana Couto (began in August 2022)
- File storage for large datasets was agreed.
- File structures for storing data being investigated.
- Continued data review and began processing seabird GPS and environmental data

Q3 Targets: Review and process existing prey data for use in distribution and movement modelling, and process seabird GPS data and environmental data

- Processed relevant environmental, hydrodynamic, historic prey (sandeel model and HERAS), and some seabird GPS data.
- Developed scripts for data importing, cleaning, summarising.
- R code is being developed to be generalisable and reproducible, held on BioSS' GitLab (transferrable to GitHub). All data processing is in R Markdown & R functions. This work will continue to develop to include building an R package and formal code testing.
- Met with MSS to discuss prey data and implications of delays for task 1.1 and 1.2 to tasks 2.1 and 2.2

Q4 Targets: Begin developing analytical framework for distribution modelling

- Continued with data requests for OWF and seabird data.
- Processing additional data provided by developers.
- To try and mitigate lack of seabird GPS data from 2022, reduced prey data from 2022, and potential issues with data collection in 2023, we are focusing

on collating as much historic data as possible to produce a robust baseline of predator and prey distributions and movement.
- Began building a data catalogue as we have much more historic data that anticipated due to the reason given above.

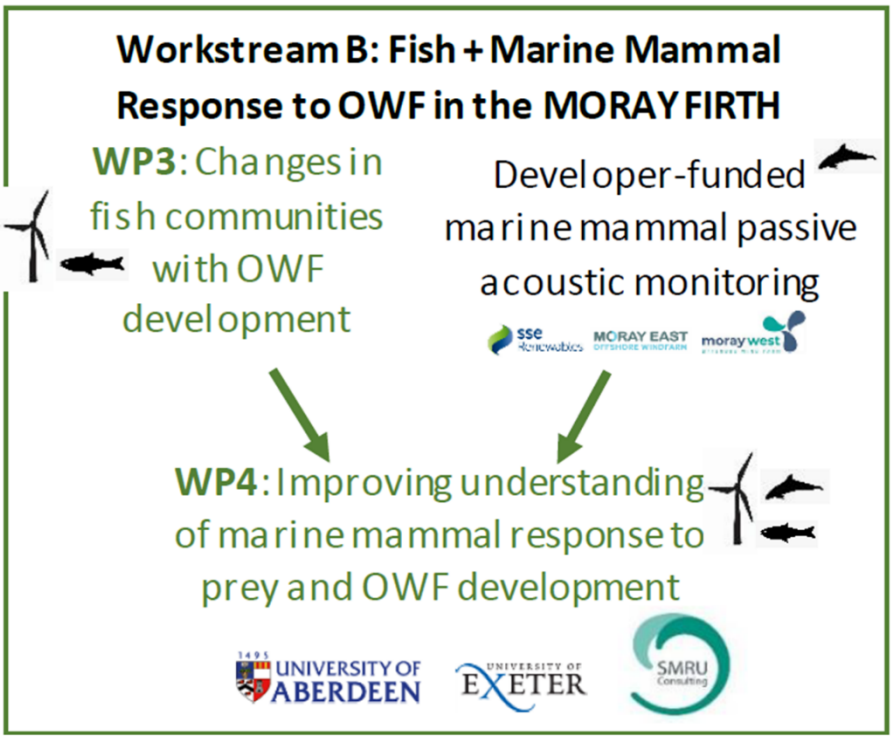
Task 2.2 Seabird movement models in the Forth

- No targets in 2022

Task 2.3 Seabird displacement rates in the Forth

- No targets in 2022

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



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

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

Task 3.1 Large-scale fish distribution in the Moray Firth

Q1 Targets: Collate existing fisheries biomass data from Moray Firth studies

- Ongoing collation of previous/historical survey data for Moray Firth, including recent UoA surveys and MSS data from the 90's. Database created and waiting for archived data after request to MSS

Additional work:
- Moray Firth fisheries biomass and trawl surveys rearranged to fit with reduced sea time (3 days) on MSS Alba Na Mara vessel
- Benthic grab samples and processing of samples not possible in 2022

Q2 Targets: Completion of data acquisition for existing fisheries biomass data from Moray Firth studies; Prepare fisheries acoustic survey; Design surveys based on previous studies and development site conditions; Conduct fisheries acoustic survey (end of June); Complete annual surveys

- Meetings regarding OWF Operations & Management requirements for conducting surveys work at sites (number of meetings unexpected and time consuming)
- Method statement and risk assessment documentation created for Beatrice OWF O&M to enable fisheries acoustic survey (not required by other OWFs).
- Three day fisheries acoustic survey completed by MSS on Alba Na Mara (8 of 9 transects successfully completed) (See Table 2 and Figure 4)

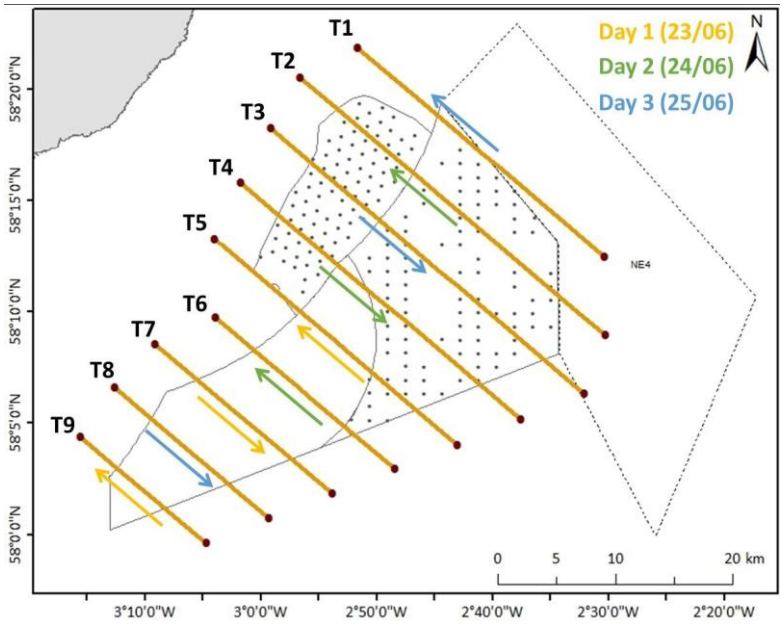


Fig. 4. Alba Na Mara fisheries biomass survey transects and schedule around Moray Firth wind farms (operational and pre-construction). Black dots = wind turbines.

- Collation of available previous/historical fisheries biomass survey data completed

Q3 Targets: Conduct BRUV and unbaited camera surveys in Moray Firth; Design surveys considering development site conditions; Completion of surveys.

- BRUV design and survey completed (see Task 3.2)
- Unbaited camera survey delayed till 2023 due to problems with camera system supplier.
- New supplier for unbaited camera systems required. Will go to tender in October.

Q4 Targets: Completion of laboratory analyses of grab samples

- Grab samples were not collected for the Moray Firth sites due to limited time available on the MSS vessel (Alba Na Mara) for the acoustic biomass and trawl surveys

- Lack of MSS vessel time has led to the grab samples and lab analysis being unavailable for 2022. The grab sampling and analysis was included for the Moray Firth to mirror the planned Alba prey surveys for Forth and Tay site (grab sampling was not conducted at either site). It was to be used as a habitat descriptor for the fisheries acoustic surveys, i.e. particle size relates to preferred sandeel habitat. MSS will now produce a more coarse/general habitat description based on the acoustic data for 2022. Conducting grab samples as part of future fisheries surveys would provide these data for subsequent years, but this needs to be discussed with MSS to understand whether resources (MSS vessel and lab time) will allow, and if it is essential.

Other activities:
- New supplier appointed for unbaited camera systems through tender process. Delivery expected Summer 2023.

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

Q1 Targets: None

Q2 Targets: None

Other activities:
- Initial camera survey design completed and aligned with PAM array
- Additional stereo baited camera systems ordered after meeting with supplier
- Unbaited (IR/long term) camera supplier meeting (probable delay)
- **Project Graduate Research Assistant appointed and started employment:** Sam Gierhart

Q3 Targets: Conduct BRUV and AI camera surveys in Moray Firth; Design surveys considering development site conditions; Completion of surveys.

- Created method statement and risk assessments for remote camera survey in August. Involved detailed analysis of current/tide data, area of attraction when using bait and mooring surface marker drift in various turbine depths.
- **Short literature review on evidence for localised fish aggregation around artificial structures.** Needed to help inform the need for deployment of cameras in close proximity to turbine jackets.
- Remote camera survey altered multiple times and re-confirmed due to changes in PAM array caused by OWF O&M restraints/requirements

- BRUV survey designed and completed during August (See Table 2 & Figure 5).
- **All 108 deployments were successful in 2 operating windfarms and 2 pre-construction windfarms.**
- Deployments were completed around 21 turbines and at 15 reference sites.
- Over 80 hours of video data collected.

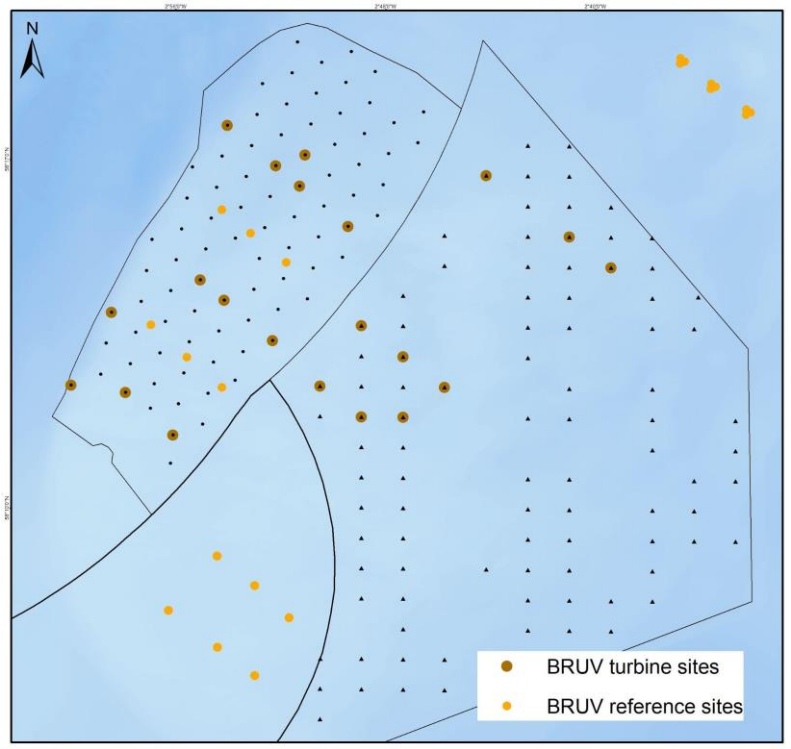


Fig. 5. Baited remote underwater video survey sites. Three camera deployments were completed at each site. (Black dot = Beatrice wind farm turbines, black triangle = Moray East wind farm turbines).

Other activities:
- Unbaited camera survey moved to 2023 as a full public open international tender was required to identify the camera system supplier.

Q4 Targets: Process BRUV video data from camera surveys.
- The BRUV video footage is currently being processed manually for fish species, composition and biomass.

- Automated (AI) approaches for species detection, identification and length measurements are being tested in parallel to reduce the time required for analysis.

Other activities:
- New supplier appointed for unbaited camera systems through tender process. Delivery expected Summer 2023.

Task 3.3 Fish acoustic telemetry in the Moray Firth

Q1 Targets: Collate and review data on using fish telemetry for impact assessment.

- Review of data and literature ongoing.

Other Activities:
- RAMS and Risk Assessments created for acoustic array deployment, fish cages and tagging work in April, after weekly meetings (plus presentations) with OWFs O&M.
- Acoustic receiver array designed and deployment in April.
- Acoustic receivers and tags ordered for delivery before survey in April.
- Moray Firth vessel tendered for survey work in April.
- 90 Acoustic receiver moorings prepared for the April survey.
- Fieldwork preparations ongoing (accommodation, travel etc.).
- Home Office project licence amendment completed for tagging gadoid species.
- Training for implanted acoustic tags into gadoid fish species completed by MSS staff.

Q2 Targets: Deployment of acoustic receiver array and start tagging in Moray Firth: 1. Deploy array; 2. Catch and tag gadoid fish in the Moray Firth; 3. Completion of annual tagging.

- Deployment of acoustic array completed in OWFs - 84 acoustic receivers (See Table 2 & Figure 6)

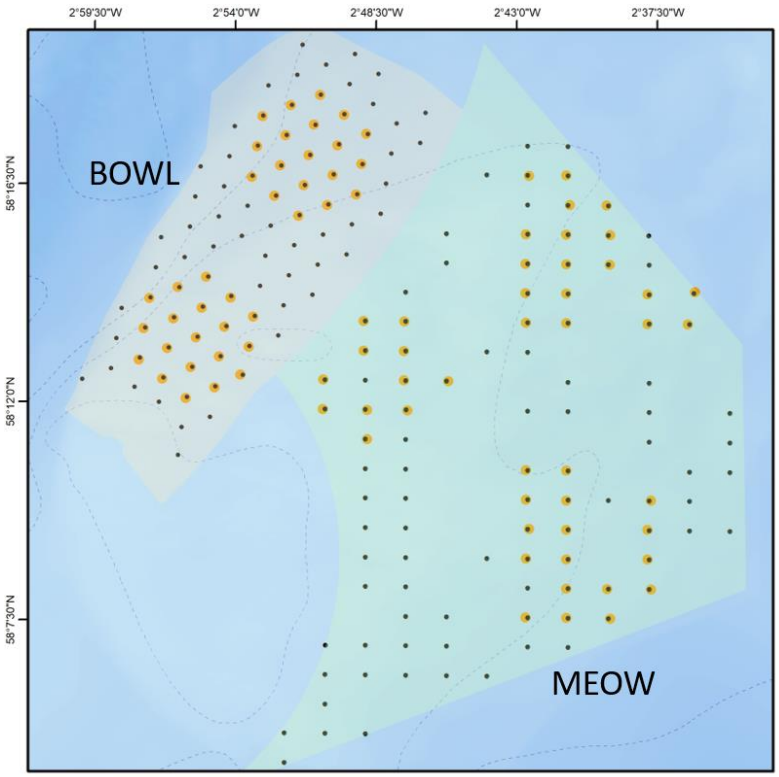


Fig. 6. Acoustic receiver array in two operational wind farms in the Moray Firth. (Black dot = wind turbine, orange dot = receiver deployment, BOWL = Beatrice offshore wind farm, MEOW = Moray East wind farm).

- **First fish tagging trip completed in April - 51 fish tagged (See Table 2)**
- Problems with catch method has meant alteration to the catch cages was required before subsequent tagging trip.

- Second fish tagging trip complete in June - 9 fish tagged (See Table 2)
- Redeployment and repositioning of 3 acoustic receivers completed during 2nd tagging trip in June.

- Tagging summary: 60 fish were tagged: 7 Cod, 3 Whiting & 50 Haddock

Other Activities:
- Review of data on using fish telemetry for impact assessment not finished due to the time and effort required for creating method statements and risk assessment documentation for OWFs O&M for this and other surveys.
- UoE research assistant completed Home Office PILA and B training.

Q3 Targets: Process acoustic ping data.

- Acoustic array servicing and data retrieval trip planned for October.

Q4 Targets: Service array and ping data download from VEMCO receivers. Complete 6 month data download.

- Array servicing was scheduled for Q4 but logistical and administrative challenges meant this was not possible. MSS ships had originally been scheduled for work, but an external contractor is now required. Planned for early 2023.

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: Collation of pre-construction Moray Firth predator data from digital aerial surveys, telemetry and PAM

- Organised meeting with CEH, BioSS and UoA to liaise on methodological approaches.
- Organized keep in touch meetings with CEH, BioSS and UoA to update progress on parallel tasks.
- Started data collation and systematic archiving (including metadata) for historic digital aerial surveys.
- Started literature review on methods available to integrate different data sources to predict species distributions.
- Thorough exploration of methods developed by Matthiopoulos et al. (2022) to integrate different spatial datasets.
- Started developing R code scripts to automate pre-processing of aerial survey data.
- Started developing R code scripts associated with Matthiopoulos et al. (2022) to process digital aerial survey data.

Q2 Targets: Collation of prey and environmental co-variates **(See Fig. 7)**.

- Attended meeting with CEH, BioSS and UoA to liaise on methodological approaches, data sharing and progress on parallel tasks.
- Continued data collation and systematic archiving (including metadata) for historic digital aerial surveys.
- Continued literature review on methods available to integrate different data sources to predict species distributions.
- Completed exploration of methods developed by Matthiopoulos et al. (2022) to integrate different spatial datasets.
- Continued developing R code scripts to automatize pre-processing of aerial survey data.
- Continued developing R code scripts associated with Matthiopoulos et al. (2022) to process digital aerial survey data.
- Continued environmental data collation and systematic archiving (including metadata).

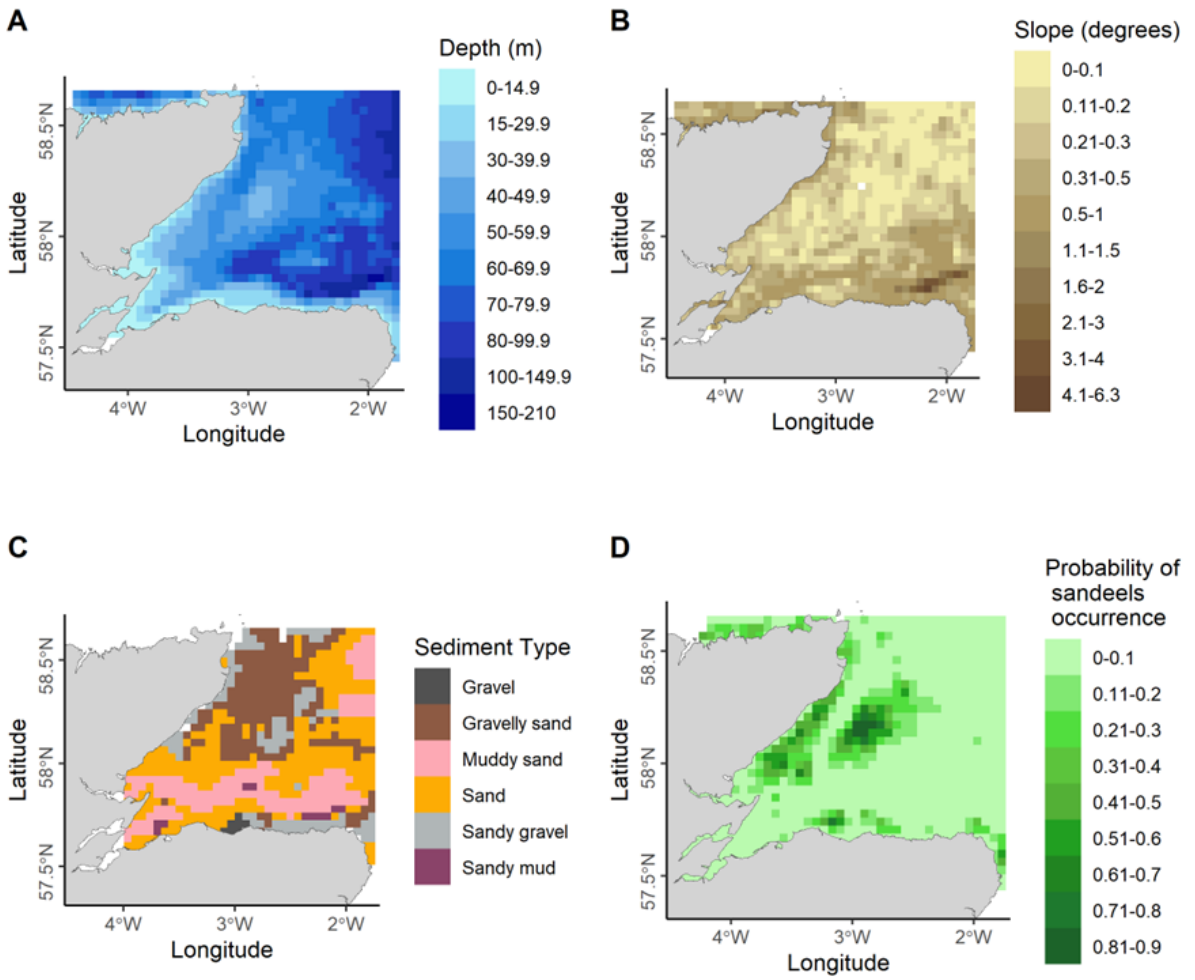


Fig. 7. Environmental covariates in the Moray Firth over the 4 x 4 km grid. A) water depth, B) seabed slope, C) seabed sediment type and D) probability of sandeels occurrence.

Q3 Targets: Internal project meeting to discuss modelling framework

- Organized internal UoA meeting to discuss modelling framework.
- Drafted outline for report content, data available and methodologies.
- Continued developing R code scripts to pre-process and analyse data.

Q4 Targets: Review of analyses for harbour porpoise distribution models

- Review of analyses for harbour porpoise distribution models completed
- Review of analyses for harbour seal distribution models started
- Organized a meeting with BioSS in March 2023 to discuss data and code sharing for common processing tasks.

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

Q1 Targets: Finalisation of the PAM array design and submission for marine licenses

- **Designed PAM array consisting of 28 paired turbine and non-turbine sites in conjunction with UoE and MSS (to integrate with fish studies)**
- Liaised with Beatrice and Moray East about O & M activities that might affect PAM array design and ensured that the proposed design met industry and regulator needs for post-construction monitoring.
- Presented Addendum to the Moray Firth MMMP to MFRAG-MM meeting, 9th February. These included detail of the PAM array designed for this PrepARED Task, and resulted in agreement that industry funded post construction monitoring programmes would support this data collection.
- In discussion with Marine Scotland we reviewed Marine Scotland's Scientific Instrument Deposit and Removal Guidance. This confirmed that the PAM equipment moorings meet the criteria for exemption for a Marine Licence. Additional preparatory work included application for a CES licence and procurement of mooring equipment and consumables for the PAM deployments.

Q2 Targets: Deployment of the PAM array

- **Liaised with Beatrice and Moray East about PAM array design and finalised precise locations for PAM devices close to turbine sites to avoid cables, CTV push on points and O & M activities.**
- SHE documents and RAMs for PAM deployments submitted to Moray West and adapted in response to comments on these from Beatrice, Moray East and Moray West.
- CES licence for PAM array granted
- Testing and preparation of equipment for PAM deployment, and submission of Notice to Mariners for PAM deployments sent to developers for wider stakeholder distribution.

Q3 Targets: Plan retrieval and collate covariates data for all PAM sites

- Reached final agreement with developers about SHE documents, RAMs & location of PAM sites close to turbines
- Updated Notice to Mariners for PAM array sent to developers before and after deployments and before recoveries.
- **Equipment for PAM deployments was setup, and the PAM array deployed across operational and pre-construction sites at the end of July. (Figure 8)**
- **Recovery of PAM array started on 31st August: 38 sites within Beatrice recovered by 26th September.**

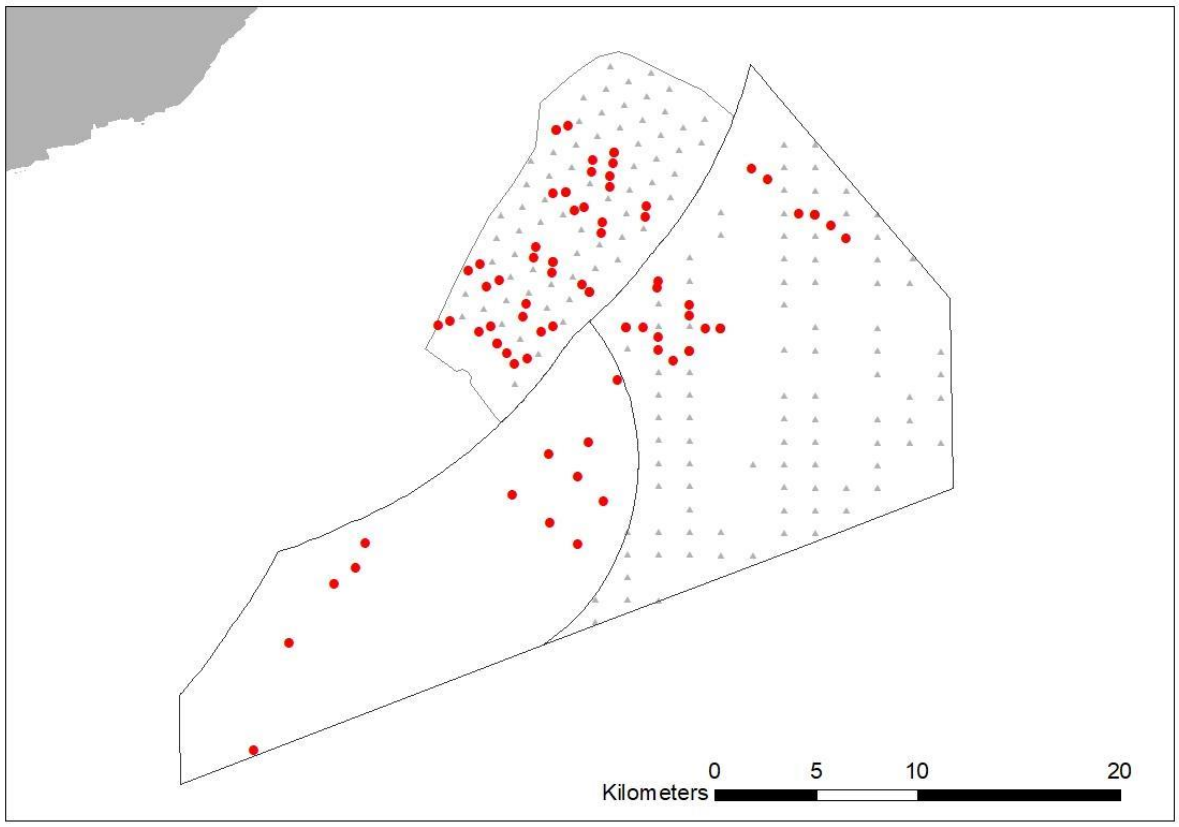


Fig. 8. Locations of echolocation detectors (CPODs) deployed within operational (Beatrice & Moray East) and pre-construction (Moray West) offshore wind farm sites during August 2022. Operational turbines are represented as grey triangles. CPOD mooring locations are represented as red circles.

Q4 Targets: Recover PAM devices

- **Remaining PAM devices recovered by November. Devices were successfully retrieved from all 56 sites in the operational wind farm sites and 13 sites in the pre-construction reference area.**
- **Data downloaded, processed to identify echolocation clicks and foraging buzzes and archived. Only one device failed to collect data.**
- Preliminary analysis initiated, investigating variation in harbour porpoise occurrence and foraging activity at turbines and away from structures.

Task 4.3 Dose response curves in the Moray Firth

Q1 Targets: Quarterly meetings to liaise with Moray West on construction schedule

- Received update on Moray West construction schedule at MFRAG-MM meeting, 9th February

Q2 Targets: Quarterly meetings to liaise with Moray West on construction schedule

- Received update on Moray West construction schedule

Q3 Targets: Quarterly meetings to liaise with Moray West on construction schedule

- Received update on Moray West construction schedule
- Presented initial plans to MFRAG-MM (22nd Sept) for PAM array to study porpoise responses during piling at Moray West.

Q4 Targets: Quarterly meetings to liaise with Moray West on construction schedule

- Received update on Moray West construction schedule
- Likely delay to Task 4.3 2023 Q2 – Target (Deploy the construction PAM array).

Task 4.4 Fish nutritional value

Q1 Targets: Preparatory lab work

- Logistics, H&S and ethical considerations all being advanced to get ready for PrePARED samples to be analysed Q3-Q4 2022

- Initial discussions with third parties regarding sampling from outside the PrePARED project.

Q2 Targets: Preparatory lab work

- Have ethics approval - need to procure new equipment. Proceeding with that now

Q3 Targets: Initial processing of any available samples

- Bomb calorimetry analyses are underway and we're discussing samples with project team and external sources.

Q4 Targets: Processing of summer 2022 prey samples **(See Figure 9)**

- Processing underway. Also largely finished with 2021 samples provided by Marine Scotland Science and coordinating with CEH re: an spreadsheet of past energy density values for seabird and marine mammal prey species (from Wanless et al. 2018 and others). Intend to compile results of the analysis within PrePARED with this spreadsheet and the supplementary information of Booth and Guiplin et al. (in press). This will create a master spreadsheet of the current state of knowledge on energy density in prey species.

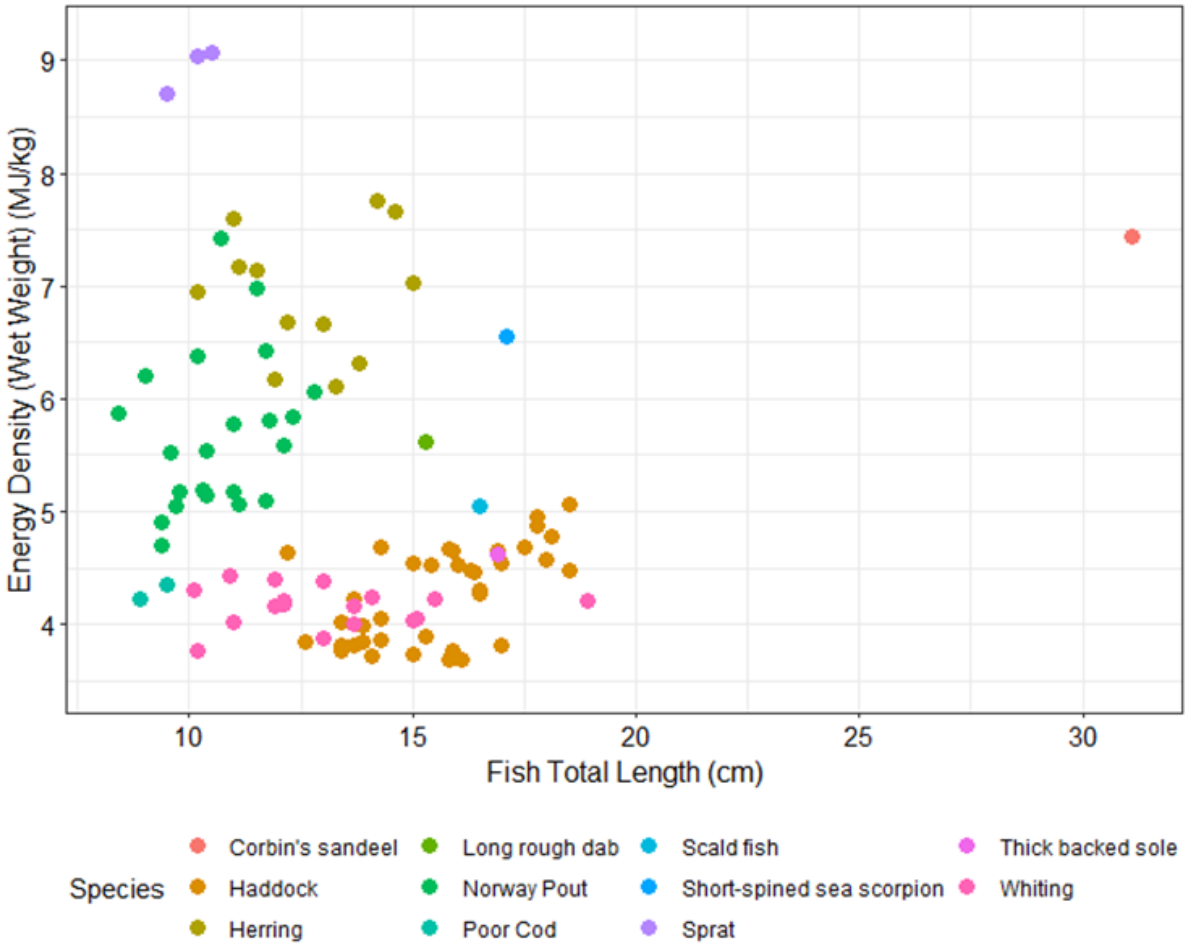
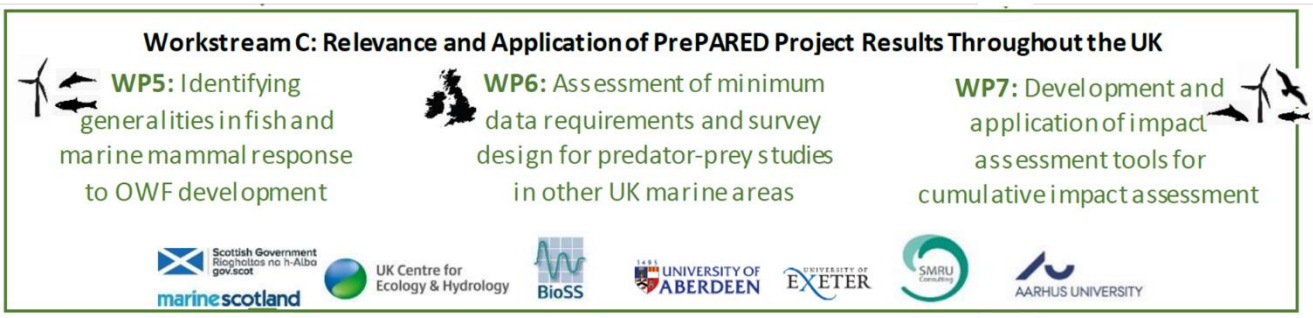


Fig. 9. Energy density values (by length) for samples processed as part of the PrePARED project in 2022. Species shown with colour codes.

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



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

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

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

- No targets in 2022

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

Q1 Targets: Quarterly meetings to discuss progress on data collection and coincidental analyses

- Liaised with other PrePARED marine mammal project team members (UoA) about meeting up to discuss synergies between PrePARED Tasks and other MM projects
- Analysis continues on Seagreen and NnG PAM datasets and further discussions planned with those funders (funded by developers - but linked to PrePARED.

Q2 Targets: Quarterly meetings to discuss progress on data collection and coincidental analyses

- Continuing PAM data preparations as per Seagreen and NnG separate contracts.
- Meeting U of A team in autumn to discuss.

Q3 Targets: Quarterly meetings to discuss progress on data collection and coincidental analyses

- Continuing PAM data preparations as per Seagreen and NnG separate contracts. - Meeting U of A team more often to discuss progress and harmonise approaches.
- Also developing other MM species ideas (with SMRU Gordon Hastie).

Q4 Targets: Quarterly meetings to discuss progress on data collection and coincidental analyses

- Multiple meetings with data collectors/holders/analysts

- Coordinated workshop with UoA, Exeter, MSS and Aarhus for Feb 2023.

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

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

- No targets in 2022
- However, additional work has taken place to build a robust baseline of predators and prey, to mitigate against data collection issues in the Forth and Tay in 2022/23. See task 2.1 Q4 for details.

Task 6.2 - Minimum data requirements for marine mammal distribution models

Q1 Targets: No Target

Q2 Targets: No Target

Q3 Targets: No Target

Q4 Targets: Quarterly meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters

- Meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters
- Organized a meeting with BioSS in March 2023 to discuss data and code sharing for common processing tasks

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

- No targets in 2022

Task 6.4 - Survey design for predator-prey studies

Q1 Targets: No target

Q2 Targets: No target

Q3 Targets: No target

Q4 Targets: Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects

- Have started a Cumulative Impact Assessment database captured information on OWF projects.

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: No target

Q2 Targets: No target

Q3 Targets: Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development

- Planning calls with Aarhus team for December to get updates on DEPONS progress.

- Discussing iPCoD developments with potential funders.

Q4 Targets: Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development

- Starting to build a Cumulative Impact Assessment database

- Coordinated workshop with UoA, Exeter, MSS and Aarhus for Feb 2023.

Task 7.2 - Adding biological realism to SeabORD and testing

Q1 Targets: No targets

Q2 Targets: No targets

Q3 Targets: Development of initial model parameterisation to simulate hypothesized redistribution of prey around OWFs.

- Postponed to early 2023 once new project postdoc hired at UKCEH. No anticipated impacts on other tasks or deliverables.

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

- This work has been largely postponed until the second quarter of 2023 when the postdoc will start at UKCEH. We have completed the hiring process for this position, and the selected candidate has accepted the position, and will start on March 28th 2023. The candidate has extensive experience working with individual based models for seabirds, and impacts of offshore wind farms, so do not anticipate any further delays with the Year 1 work.

- We have completed background work to facilitate this component of the project - sourcing and acquiring the sandeel habitat suitability layers and metadata for use in the IBM SeabORD, and also completing the revision of SeabORD into the open source language 'R', and modularising the IBM to allow for efficient changes to different model functions to be made.

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

- No 2022 targets

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

Q1 Targets: Initial preparations for Cumulative Impact Assessment development

- Have started initial preparations on the CIAs - which can take a long time to set up. This can help explore conservatism in assessments and how their

effects propagate through CIA. Will involve building off CEF tool, which is in development.

Q2 Targets: No target

Q3 Targets: Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)

- Have continued collating information from OWF impact assessments for large CIAs. This can help explore conservatism in assessments and how their effects propagate through CIA. Currently building off CEF tool datastores (which SMRUC compiled on MSS funded project).

Q4 Targets: No target

- Have continued collating information from OWF impact assessments for large CIAs. This can help explore conservatism in assessments and how their effects propagate through CIA. Currently building off CEF tool datastores (which SMRUC compiled on MSS funded project).

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

No 2022 targets

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

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

Workpackage 8 - Development of a dissemination roadmap

Task 8.1 - Stakeholder and network analysis

Q1 Targets: No targets

Q2 Targets: No targets

Q3 Targets: No targets

Q4 Targets: Completion/delivery of a stakeholder & network analysis report

- Contractor identified, but they can only deliver later in 2023, hence analysis is delayed.

Task 8.2 – PrePARED Communications Plan

Q1 Targets: No targets

Q2 Targets: No targets

Q3 Targets: No targets

Q4 Targets: Completion/delivery of a communications plan

- Comms plan prepared in draft form – will be finalised in early 2023

Workpackage 9 - Dissemination activities

Task 9.1 - Annual knowledge exchange workshops

Q4 Target: Plan Year 1 annual knowledge exchange workshop

- Meeting set for 24th February. Venue booked, and invitations issued

Task 9.2 - Dissemination of project findings

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

- **PrePARED web site up and running.** Available for information dissemination.
- See www.owecprepared.org

Task 9.3 - Organise PrePARED project scientific symposium

No 2022 targets

Task 9.4 - Establish PrePARED website and social media

Q1 to Q4 Targets: Issue social media posts as appropriate. Maintain PrePARED web site.

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

- PrePARED domain name agreed with OWEC and purchased.

- PrePARED web site established www.owecprepared.org

8. TABLE 1 - PrePARED Surveys 2022

Workpackage	Start	End	No. days*	Vessel	Description
WSB – WP3	11/04/2022	24/04/2022	13	FRV Waterfall	Deploy acoustic receivers and to catch/tag fish
WSB – WP3	20/06/2022	23/06/2022	3^	FRV Waterfall	Deploy acoustic receivers and to catch/tag fish
WSB – WP3	23/06/2022	25/06/2022	3	MRV Alba na Mara	Moray Firth broad scale (fisheries acoustic) survey 0922a
WSA – WP1	26/06/2022	11/07/2022	16	MRV Alba na Mara	Forth & Tay broad scale (fisheries acoustic) survey 0922a
WSB – WP4	27/07/2022	29/07/2022	7(3)	FRV Waterfall	Deploy PAM devices
WSA – WP1	05/08/2022	16/08/2022	13	MRV Alba na Mara	Forth & Tay fine scale (BRUV/fish traps) survey 1122a
WSB – WP3	01/08/2022	22/09/2022	20(9)	FRV Waterfall	Moray Firth fine scale survey (BRUV)
WSB – WP4	31/08/2022	12/11/2022	62(12)	FRV Waterfall	Recover PAM devices
WSB – WP1	06/12/2022	22/12/2022	2	MRV Alba na Mara	Sandeel Dredge Survey 2022a – Forth & Tay

*No. of survey days assigned to the PrePARED project (including weather days)
^ Survey curtailed due to COVID-19 issues
Number in brackets = boat days at sea conducting surveys
All boat survey costs for WSB - WP4 were covered by external industry funding

9. TABLE 2 - Planned PrePARED Surveys 2023

MRV Alba na Mara RV programme 2023-2024

Survey Code	S.I.C. (TBC)	Days	Preliminary Dates	Survey Description	Area
0822A	TBC	15	02 Jun - 16 Jun	PrePared	East Coast / Moray Firth
0922A	T. Regnier	17	19 Jun - 05 Jul	PrePared	East Coast / Firth of Forth
1122A	T. Regnier	17	29 Jul - 14 Aug	PrePared	East Coast / Firth of Forth
2022A	T. Regnier	19	****02 Dec - 20 Dec	Sandeel + PrePared (2)	East Coast

Charters

Survey Code	Vessel	Days	Preliminary Dates	Survey	Area
0423H	TBC	9	Mar-23	PrePARED, tagging	Moray Firth, <50m from turbine
0523H	TBC	9	Sep-23	PrePARED, tagging	Moray Firth, <50m from turbine
0623H	TBC	9	Mar-24	PrePARED, tagging	Moray Firth, <50m from turbine
	TBC	2-4 *	Sep-23	Unbaited long term camera survey	Moray Firth, <50m from turbine
	TBC	5 *	Aug-23	Deploy PAM devices	Moray Firth
	TBC	8 *	Feb-Apr-24	Recover PAM devices	Moray Firth

* doesn’t include weather days. Vessel to be procured by developers.

11. TABLE 3 – PrePARED Presentations 2022

Date	Who To?	Subject	Presenter
07/07/2021	DEFRA Underwater Noise Strategic Advisory Group	Overview of PrePARED	Paul Thompson
24/09/2021	DEFRA Offshore Wind Environmental Evidence Register (OWEER) forum	Assessing the impact of pile-driving noise on marine mammals Presentation included brief introduction to PrePARED WPB	Paul Thompson
09/02/2022	MFRAG-MM	PrePARED update and PrePARED Moray Firth fieldwork 2022	Paul Thompson
04/04/2022	CWW2022 conference	Conference presentation in cumulative effects session at international conference on wind energy and wildlife	Sue O'Brien
21/04/2022	OceanWinds Senior Managers	Overview of PrePARED for key OWF stakeholder senior managers with aim of reducing challenges of OWF site access for PrePARED	
31/03/2022	SSE Senior Managers	Overview of PrePARED for key OWF stakeholder senior managers with aim of reducing challenges of OWF site access for PrePARED	Sue O'Brien
04/05/2022	All Energy Conference	Overview of PrePARED and relevance to OWF consenting issues	Alexander Gilliland
16/06/2022	OWIC Meeting	overview of PrePARED project to assist those scoping EcoWIND projects with avoiding duplication and looking for opportunities for collaboration	Sue O'Brien
15/09/2022	RSPB Scotland Conservation Science Group	Recent Lighthouse Field Station Research relating to Energy Transition Presentation included brief introduction to PrePARED WPB	Isla Graham
22/09/2022	MFRAG-MM	Marine Mammal Monitoring Programme Update Update on Moray Firth PrePARED work	Paul Thompson
24/02/2022	FTRAG	Overview of the PrePARED project to Forth & Tay Regional Advisory Group	Sue O'Brien
08/11/2022	MASTS Annual Science Meeting	Scene setting: The importance of whole ecosystem, bottom-up processes, and interaction with higher trophic levels (an introduction to PrePARED)	Thomas Regnier
	SCOTMER Symposium	Update on prePARED	Paul Thompson

12. TABLE 4 – PrePARED Meetings 2022

When	Date	Name of Meeting	Who Attended	
2022 Kick Off Meeting	24/01/2022	Kick Off Meeting 001	All Task Leaders	
2022 Q1	24/03/2022	Quarterly Meeting 002	All Task Leaders	
2022 Q2	13/06/2022	Quarterly Meeting 003	All Task Leaders	
2022 Q3	28/10/2022	Quarterly Meeting 004	All Task Leaders	
2022 Q1	19/01/2022	Marine mammal tasks - start up meeting	UoStA & UoA	
2022 Q1	27/01/2022	Fish tracking array design meeting	UoE, MSS & UoA	
2022 Q1	01/03/2022	PrePARED survey plans in Moray Firth	MSS, developers, UoE & UoA	
2022 Q1	07/03/2022	PrePARED Moray Firth acoustic surveys	MSS, UoE & UoA	
2022 Q2	25/04/2022	Marine mammal tasks	UoStA & UoA	
2022 Q3	13/09/2022	PrePARED boat support	MSS, UoE & UoA	
2022 Q3	27/09/2022	Fish samples for PrePARED	UoStA & UoA	
2022 Q4	26/10/2022	Porpoise CPOD analyses	UoStA & UoA	
2022 Q4	07/11/2022	PrePARED, Moray Firth Fish Biomass Data	MSS, UoE & UoA	
2022 Q4	09/11/2022	Porpoise CPOD analyses	UoStA & UoA	

13. TABLE 5 – PrePARED Social Media 2022

Social Channel	Posted by	Date	Link
Twitter	Marine Scotland	12 April 2022	https://twitter.com/marinescotland/status/1513830073664786439
Twitter	UK Centre for Ecology and Hydrology	12 April 2022	https://twitter.com/UK_CEH/status/1513836776380633097?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	The Crown Estate	12 April 2022	https://twitter.com/TheCrownEstate/status/1513833154578161665?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	Dr Tony Bicknell	17 April 2022	https://twitter.com/DrTonyBicknell/status/1515614013731885058?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	Marine Scotland	15 June 2022	https://twitter.com/marinescotland/status/1536997074524332032?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	BioSS	16 June 2022	https://twitter.com/BioSScotland/status/1537351571566215168?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	Exeter Marine	16 June 2022	https://twitter.com/ExeterMarine/status/1537416006343217154?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	ECOWind	27 June 2022	https://twitter.com/ECOWind_UK/status/1541371766987169794?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	BioSS	28 July 2022	https://twitter.com/BioSScotland/status/1552592206321668097?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	Marine Scotland	28 July 2022	https://twitter.com/marinescotland/status/1552589050397212673?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	Marine Scotland	30 September 2022	https://twitter.com/marinescotland/status/1575831744825249793?s=20&t=auzDy-5xDrb-ikQsvIXnAg
Twitter	Marine Scotland	15 November 2022	https://twitter.com/marinescotland/status/1592478026516029440?s=20&t=ZENtF065Jsm-v4m4mk-BRg
Twitter	Cromarty Lighthouse	29 November 2022	https://twitter.com/CromartyLH/status/1597614776963977216?s=20&t=ZENtF065Jsm-v4m4mk-BRg
LinkedIn	Paul Thompson	March 2022	https://www.linkedin.com/posts/paul-thompson-9369a0182_predators-and-prey-around-renewable-energy-activity-6910725178201153536-vzs-?utm_source=share&utm_medium=member_desktop
LinkedIn	Marine Scotland		https://www.linkedin.com/posts/marine-scotland_netzero-offshorewind-offshorewind-activity-6910242321578041344-Zm7B?utm_source=share&utm_medium=member_ios

LinkedIn	Marine Scotland		https://www.linkedin.com/posts/marine-scotland_energyday-cop27-preparedproject-activity-6998253607020027905-u3nP?utm_source=share&utm_medium=member_ios

14. TABLE 6 – PrePARED Recruitment 2022

Host Organisation	Job Title	Start Date	End Date	Appointee Name
MSS	Fish Community Ecologist	08/08/2022	08/08/26	Charlie Cooper
MSS	Fisheries Acoustician	19/09/2022	19/09/25	James Dunning
University of Exeter	Graduate Research Assistant	06/06/2022	31/12/2025	Sam Gierhart
University of Aberdeen	Postdoc Research Assistant (Maternity Cover)	01/01/2023	31/12/2023	Virginia Lorio
BioSS	Ecological Statistician	08/08/2022	Permanent	Ana Couto

15. TABLE 7 – 2022 Target Achievement

Result	Description	2022 N	2022 %
Completed	A piece of work that is fully completed		
On Target	An ongoing piece of work with partial running monitoring targets that have been met		
Delayed	A piece of work that has been delayed due to operational reasons. Mitigating actions are given in the main report.		
Failed	A piece of work that has not been carried out due to various operational reasons. Details and mitigating actions in main report.		
No Target	No targets were set for this quarter as the Task is either completed or pending a future date.		
	Total		

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

Task 1.1	**Broadscale fish response to OWF in the Forth (Dr Thomas Regnier, MSS)**		
	2022 Q1 Targets	Identify all data sources	**On Target**
		Initiate the processing of raw acoustic data	**On Target**
	2022 Q2 Targets	Produce a map of point abundance per prey species	**On Target**
		Prepare fisheries acoustic/ seabird at sea survey	**Completed**
		Design surveys based on previous studies and development site conditions	**Completed**
	2022 Q3 Targets	Conduct fisheries acoustic survey/ seabird at sea survey (mid July)	**Completed**
		Initiate laboratory work (otolith analyses, PSA analyses. Subject to laboratory availability)	**On Target**
		Initiate post processing of acoustic signal and trawl data analyses	**On Target**
	2022 Q4 Targets	Produce point biomass estimates of pelagic fish from acoustic transects	**Delayed**
		Completion of otolith analyses	**Delayed**
		Additional target: Large scale sandeel survey	**On Target**
Task 1.2	**Finescale fish response to OWF in Forth (Dr Thomas Regnier, MSS)**		
	2022 Q1 Targets	None	**No Target**
	2022 Q2 Targets	None	**No Target**
	2022 Q3 Targets	Conduct BRUV/Fish trap surveys in the Firth of Forth	**Completed**
		Design surveys considering development site conditions	**Completed**
		Completion of surveys	**Completed**
		Initiate analyses of SBRUV data	**On Target**
		Initiate grab data analyses (PSA)	**Method Changed**

	2022 Q4 Targets	Completion of PSA analyses	**Method Changed**

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

Task 2.1	**Seabird spatial distribution models in Forth (Dr Esther Jones, BioSS)**		
	2022 Q1 Targets	Review existing prey data	**On Target**
	2022 Q2 Targets	Process seabird GPS data	**On Target**
		Process environmental data	**On Target**
	2022 Q3 Targets	Process seabird GPS data	**On Target**
		Process environmental data	**On Target**
	2022 Q4 Targets	Begin developing analytical framework for distribution modelling	**On Target**
Task 2.2	**Seabird movement models in the Forth (Dr Adam Butler, BioSS)**		
		No 2022 Targets	**No Targets**
Task 2.3	**Seabird displacement rates in the Forth (Dr Adam Butler, BioSS)**		
		No 2022 Targets	**No Targets**

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

Task 3.1	**Large-scale fish distribution in Moray (Dr Anthony Bicknell, UoE)**		
	2022 Q1 Targets	Collate existing fisheries biomass data from Moray Firth studies	**On Target**
	2022 Q2 Targets	Completion of data acquisition for existing fisheries biomass data from Moray Firth studies	**Completed**
		Prepare fisheries acoustic survey	**Completed**
		Design surveys based on previous studies and development site conditions	**Completed**
		Conduct fisheries acoustic survey (end of June)	**Completed**
		Conduct grab sample survey	**Failed**
	2022 Q3 Targets	BRUV and unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
		Conduct BRUV camera surveys in Moray Firth - Completion of surveys.	**Completed**
		Conduct unbaited camera surveys in Moray Firth - Completion of surveys.	**Delayed to 2023**
	2022 Q4 Targets	Completion of laboratory analyses of grab samples (see Section 3 for mitigation actions)	**Failed**
Task 3.2	**Fine-scale fish distribution in the Moray Firth (reef effects) (Dr Anthony Bicknell, UoE)**		
	2022 Q1 Targets	No 2022 Targets	**No Targets**
	2022 Q2 Targets	No 2022 Targets	**No Targets**

	2022 Q3 Targets	Conduct BRUV and unbaited camera surveys in Moray Firth - Design surveys considering development site conditions	**Completed**
	2022 Q4 Targets	Process BRUV video footage from camera surveys	**On Target**
Task 3.3	**Fish acoustic telemetry in the Moray Firth (Dr Matthew Witt, UoE)**		
	2022 Q1 Targets	Collate and review data on using fish telemetry for impact assessment	**On Target**
	2022 Q2 Targets	Deploy VEMCO acoustic receiver array and start tagging in Moray Firth	**Completed**
		Catch and tag gadoid fish in the Moray Firth	**Completed**
		Complete annual tagging	**Completed**
	2022 Q3 Targets	Process acoustic ping data	**Delayed to 2023**
	2022 Q4 Targets	Service array and ping data download from VEMCO receivers.	**Delayed to 2023**
		Complete 6 month data download	**Delayed to 2023**

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

Task 4.1	**Drivers of broadscale marine mammal distribution in Moray (Dr Ana Payo-Payo, UoA)**		
	2022 Q1 Targets	Collation of pre-construction Moray Firth predator data from digital aerial surveys, telemetry and PAM	**On Target**
	2022 Q2 Targets	Collation of prey and environmental co-variates	**On Target**
	2022 Q3 Targets	Internal project meeting to discuss modelling framework	**Completed**
	2022 Q4 Targets	Review of analyses for harbour porpoise distribution models	**Completed**
Task 4.2	**Finescale marine mammal distribution in response to OWF and prey fields in the Moray Firth (Aude Benhemma-Le Gall, UoA)**		
	2022 Q1 Targets	Finalisation of the PAM array design and submission for marine licenses	**Completed**
	2022 Q2 Targets	Deployment of the PAM array	**On Target**
	2022 Q3 Targets	Plan retrieval and collate covariates data for all PAM sites	**Completed**
	2022 Q4 Targets	Recover PAM devices	**Completed**
Task 4.3	**Dose response curves in the Moray Firth (Dr Isla Graham, 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**
Task 4.4	**Fish nutritional value (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Preparatory lab work	**On Target**
	2022 Q2 Targets	Preparatory lab work	**On Target**
	2022 Q3 Targets	Initial processing of any available samples	**On Target**
	2022 Q4 Targets	Processing of summer 2022 prey samples	**On Target**

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

Task 5.1	**Generalities in fish response to OWF (Dr Anthony Bicknell, UoE)**		
		No 2022 Targets	**No Targets**
Task 5.2	**Generalities in harbour porpoise response to OWF (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**
	2022 Q2 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**
	2022 Q3 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**
	2022 Q4 Targets	Quarterly meetings to discuss progress on data collection and coincidental analyses	**On Target**

***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**
Task 6.2	**Minimum data requirements for marine mammal distribution models (Dr Ana Payo-Payo, UoA)**		
	2022 Q1 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	No Target	**No Target**
	2022 Q4 Targets	Quarterly meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters	**On Target**
Task 6.3	**UK EEZ marine habitats similarity assessment for OWF sites (Dr Matthew Witt, UoE)**		
		No 2022 Targets	**No Targets**
Task 6.4	**Survey design for predator-prey studies (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	No Target	**No Target**
	2022 Q4 Targets	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	**On Target**

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

Task 7.1	**IPCoD and DEPONS integration of new data and testing (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	No Target	**No Target**
	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**On Target**
	2022 Q4 Targets	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	**On Target**
Task 7.2	**Adding biological realism to SeabORD and testing (Dr Kate Searle, UKCEH)**		
	2022 Q1 Targets	No Target	**No Target**

	2022 Q2 Targets	No Target	**No Target**
	2022 Q3 Targets	Development of initial model parameterisation to simulate hypothesized redistribution of prey around OWFs.	**Delayed**
	2022 Q4 Targets	Development of initial model parameterisation to work with sandeel suitability estimates	**Delayed**
Task 7.3	**Testing and validating SeabORD in the FoF and at UK SPAs (Dr Kate Searle, UKCEH)**		
		No 2022 Targets	**No Targets**
Task 7.4	**Integration of PrePARED findings for harbour porpoise Cumulative Impact Assessment (Dr Cormac Booth, SMRU Consulting)**		
	2022 Q1 Targets	Initial preparations for Cumulative Impact Assessment development	**On Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	Quarterly meetings to understand progress on CIA components	**On Target**
	2022 Q4 Targets	No target	**No Target**
Task 7.5	**Integration of PrePARED findings for seabird Cumulative Impact Assessment (Dr Kate Searle, UKCEH)**		
		No 2022 Targets	**No Targets**

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

Task 8.1	**Stakeholder and network analysis (Project Lead, MSS)**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Completion/delivery of a stakeholder & network analysis report	**Delayed**
Task 8.2	**Communications Plan (Project Lead, MSS)**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Completion of PrePARED communications plan	**Delayed**

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

Task 9.1	**Plan annual knowledge exchange workshops**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**
	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Plan Year 1 annual knowledge exchange workshop	**On Target**
Task 9.2	**Dissemination of project findings**		
	2022 Q1 Targets	No target	**No Target**
	2022 Q2 Targets	No target	**No Target**

	2022 Q3 Targets	No target	**No Target**
	2022 Q4 Targets	Support for technical and non-technical dissemination of project findings	**On Target**
Task 9.3	**Organise PrePARED project scientific symposium**		
		No 2022 targets	**No Targets**
Task 9.4	**Establish PrePARED website and social media**		
	2022 Q1 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2022 Q2 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2022 Q3 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**
	2022 Q4 Targets	Issue social media posts as appropriate. Maintain PrePARED web site.	**On Target**

16. TABLE 8 – PrePARED Numbers

2022 Q2	WSB – WP3	● 84 acoustic receivers deployed in the Moray Firth
2022 Q2 & Q3	WSB – WP3	● 60 cod and haddock tagged in the Moray Firth
2022 Q3	WSB – WP3	● 108 BRUV deployments in total ● Deployed in 2 operating windfarms and 2 pre-construction windfarms ● Deployed around 21 turbines and at 15 references sites ● 80 hours plus of video footage collected
2022 Q3-Q4	WSB – WP4	● CPODs deployed and recovered from 69 sites in total ● Deployed in 2 operating windfarms and 1 pre-construction windfarm ● Deployed at 28 paired sites (within 50m of turbine and mid-way between turbines) and at 13 reference sites ● 49,863 hours of data collected on all CPODs in August
2022 Q2-Q4	WSB - WP4	● 107 new estimates of energy density for seabird and marine mammal prey species
2022 Q3	WSA-WP1	● 42 BRUV deployments (63 hours of video footage collected), 41 fish trap deployments within 3 sites (2 in development, 1 in pre-construction)
2022 Q3	WSB-WP3	● Fisheries acoustic data recorded along 190km of transects across the Moray Firth OWF, 2 pelagic tows realised and 502 fish measured.
2022 Q3	WSA-WP1	● Fisheries acoustic data recorded along 1060km of transects across the Forth OWF, 3 pelagic tows realised and 1191 fish measured. 12 demersal tows realised and 12,205 fish measured.

17. TABLE 9 – Targets for 2023

Task lead	Task	Q1 - Targets	Q2 - Targets	Q3 - Targets	Q4 - Targets
		2023	2023	2023	2023
		Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov Dec
Thomas Regnier	Task 1.1 Broadscale fish response to OWF in Forth	Produce a map of sandeel point abundance in the sand per age class (from Grab and dredge); Broadscale prey fields from acoustic transects (pelagic prey); Completion of PSA analyses	Produce a map of point habitat characteristics (from PSA); Prepare fisheries acoustic/ seabird at sea survey: Design surveys based on previous studies and development site conditions	Conduct fisheries acoustic survey/ seabird at sea survey: (mid July); Initiate laboratory work (otolith analyses, PSA analyses (subject to laboratory availability)); Initiate post processing of acoustic signal and trawl data analyses	Produce point biomass estimates of pelagic fish from acoustic transects; Completion of otolith analyses
Thomas Regnier	Task 1.2 Finescale fish response to OWF in Forth	Process BRUV and AI camera video footage from 2022 camera surveys - completion of video processing from surveys	Completion of 2022 analysis; Map fish (predator) abundance from SBRUV/Traps	Conduct BRUV/Fish trap surveys in the Firth of Forth: Design surveys considering development site conditions; Completion of surveys; Initiate analyses of SBRUV data; Initiate grab data analyses (PSA)	Completion of PSA analyses
Esther Jones	Task 2.1 Seabird spatial distribution models in Forth	Working code for distribution modelling	Begin processing prey data from Task 1.1 and 1.2	Integrate prey data into distribution models.	Working distribution models using prey data from Forth-Tay
Adam Butler	Task 2.2 Seabird movement models in Forth	No Target	No Target	No Target	Initial development of movement modelling framework
Adam Butler	Task 2.3 Seabird displacement rates in Forth	No Target	No Target	No Target	No Target
Anthony Bicknell	Task 3.1 Large-scale fish distribution in Moray	Completion of fisheries acoustic and trawl data processing for 2022 survey. Process BRUV camera	Prepare fisheries acoustic survey: Design surveys based on previous studies and development site conditions:	Laboratory analyses of grab samples (subject to lab availability)	Completion of laboratory analyses of grab samples (subject to lab availability)

		video footage from 2022 camera surveys - completion of video processing from survey	1.Conduct fisheries acoustic survey (end of June) Video footage data analysis and downstream provision: 1. Downstream provision for UoA predator models 2. Completion of 2022 data analysis (relative fish diversity, abundance, biomass and composition)	Post-processing of fisheries acoustic and trawl data	Completion of post-processing of fisheries acoustic and trawl data for 2023 survey
Anthony Bicknell	Task 3.2 Fine-scale fish distribution in Moray (reef effects)	Process BRUV camera video footage from 2022 camera surveys - completion of video processing from surveys	Video footage data analysis and downstream provision: 1. Downstream provision for UoA predator models 2. Completion of 2022 data analysis (relative fish diversity, abundance, biomass and composition)	Unbaited camera surveys in Moray Firth - Design surveys considering development site conditions Conduct unbaited camera surveys	Process unbaited camera survey video footage
Matthew Witt	Task 3.3 Fish acoustic telemetry in Moray	Service acoustic array and download ping data in the Moray Firth	1. Catch and tag gadoid fish in the Moray Firth 2. Process acoustic ping data	Service acoustic array and download ping data in the Moray Firth: 1. Completion of annual data download 2. Completion of annual tagging	
Ana Payo-Payo	Task 4.1 Drivers of broadscale marine mammal distribution in Moray	Review of analyses of seal distribution models	Stakeholder workshop	Completion of distribution modelling and draft report	Final report
Paul Thompson	Task 4.2 Finescale marine mammal distribution in response to OWF and prey fields in Moray	Complete processing PAM data	Present interim results at stakeholder workshop to inform design of construction array	Delivery of draft report	Internal project meeting to discuss prey field results from 2023

Isla Graham	Task 4.3 Dose response curves in Moray	Meeting to liaise with Moray West on construction schedule	Finalise the design of construction PAM array	Deploy the construction PAM array	Initiate collation of engineering data from developers
Cormac Booth	Task 4.4 Fish nutritional value	Processing of summer 2022 prey samples	Summarising interim bomb calorimetry analyses	Initial processing of any available samples	Processing of summer 2023 prey samples
Anthony Bicknell	Task 5.1 Generalities in fish response to OWF	No Target	No Target	No Target	No Target
Cormac Booth	Task 5.2 Generalities in harbour porpoise response to OWF	Quarterly meetings to discuss progress on data collection and coincidental analyses	Quarterly meetings to discuss progress on data collection and coincidental analyses	Quarterly meetings to discuss progress on data collection and coincidental analyses	Quarterly meetings to discuss progress on data collection and coincidental analyses
Esther Jones	Task 6.1 Minimum data requirements for seabird distribution and movement models	No Target	No Target	No Target	No Target
Ana Payo-Payo	Task 6.2 Minimum data requirements for marine mammal distribution models	Internal project meeting with CEH/BioSS to discuss progress on data collation and analyses	Quarterly meeting with key members of the project team to discuss progress on access to developer digital aerial survey data from English waters	Complete collation of digital aerial survey datasets for English waters	Decision on thinning the data approach
Matthew Witt	Task 6.3 UK EEZ marine habitats similarity assessment for OWF sites	No Target	No Target	No Target	Evaluate potential modelling approaches & Collate available data for biotic and abiotic variables to use in assessment
Cormac Booth	Task 6.4 Survey design for predator-prey studies	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects	Collating and reviewing data from English and Welsh OWF, other marine mammal monitoring projects
Cormac Booth	Task 7.1 IPCoD and DEPONS integration of new data and testing	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	Quarterly meetings with Moray and DEPONS teams regarding ongoing analyses and development	Integration of project learning into latest DEPONS and iPCoD	Assessment of how integration of PrePARED project outputs into populations models, helps improve models

Kate Searle	Task 7.2 Adding biological realism to SeabORD and testing	Development of initial model parameterisation to work with sandeel suitability estimates	Development of initial model parameterisation to work with sandeel suitability estimates	Development of initial model parameterisation to work with empirical prey availability estimates	Development of initial model parameterisation to work with empirical prey availability estimates
Kate Searle	Task 7.3 Testing and validating SeabORD in the FoF and at UK SPAs	No Target	No Target	No Target	No Target
Cormac Booth	Task 7.4 Integration of PrePARED findings for harbour porpoise CIA	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)	Quarterly meetings to understand progress on CIA components (which PrePARED will update and improve upon)
Kate Searle	Task 7.5 Integration of PrePARED findings for seabird Cumulative Impact Assessment	No Target	No Target	No Target	No Target
PrePARED Project Manager	Task 8.1 Stakeholder and network analysis	Allocate contract for the SNA	Monitor contractor progress	Publish SNA	No Target
PrePARED Project Manager	Task 8.2 Communications Plan	Finalise draft comms plan and disseminate	Implement Comms Plan	Implement Comms Plan	Review comms plan
PrePARED Project Manager	Task 9.1 Annual knowledge exchange workshops	Implement 2022 KEM	Finalise 2022 KEM report and actions	No Target	Begin planning 2023 KEM
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	No Target – for last year of project	No Target – for last year of project	No Target – for last year of project	No Target – for last year of project
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

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Wanless et al. 2018

19. Glossary of acronyms used in the PrePARED project

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

FaT	Forth and Tay region
FoF	Firth of Forth
GitLab	GitLab and Git hub are free-to-use web-based archives of software and data that allows these to be shared freely with others.
GitHub	GitLab and Git hub are free-to-use web-based archives of software and data that allows these to be shared freely with others.
GPS	Global Positioning System
IBTS	International Bottom Trawl Surveys. An internationally coordinated set of surveys of demersal fish in the North Sea and west of Scotland.
IPCoD	Interim Population Consequences of Disturbance Model. This model, written in R, is a protocol for implementing an interim version of the Population Consequences of Disturbance (PCoD) approach for assessing and quantifying the potential consequences for marine mammal populations of any disturbance and/or injury that may result from offshore energy developments. It has been designed to use the kinds of information that are likely to be provided by developers in their Environmental Statements and Habitats Regulations Assessments.
MEOW	Moray East Offshore Windfarm
MF	Moray Firth
MFRAG-MM	Moray Firth Regional Advisory Group - Marine Mammals
MMMP	Marine Mammal Monitoring Programme
MSS	Marine Scotland Science. A Division of the Scottish Government.
NnG	Neart na Gaoithe Offshore Wind Farm
O&M	Operations and Maintenance
OWEC	Offshore Wind Evidence and Change (OWEC) Programme and Crown Estate Scotland
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PrePARED	Predators and Prey Around Renewable Energy Developments
PELAgIO	Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms. PELAgIO is a project funded by the EcoWIND programme. PELAgIO will support the development of evidence-based policy and marine management through interdisciplinary research that explores the consequences of offshore wind development on marine environments, marine wildlife, and wider ecosystem structures.
Q1	Quarter 1 (Jan, Feb, Mar)
Q2	Quarter 2 (Apr, May, Jun)
Q3	Quarter 3 (Jul, Aug, Sep)
Q4	Quarter 4 (Oct, Nov, Dec)
PSA	Particle Size Analysis
R	R is a statistical computer language. See https://www.geeksforgeeks.org/r-programming-language-introduction/
RA	Risk Assessment
RAMS	Risk Assessment Method Statement

RoxAnn	RoxAnn is a system to process acoustic data collected using a ship's echo sounder. It can identify aspects of the seabed such as roughness and density and convert these into estimates of habitat type.
SeabORD	SeabORD is a method that can assess displacement and barrier effects from offshore renewables on seabirds, but is currently limited to four species during the chick-rearing season. This review examined ways to improve the SeabORD model including extending to the entire breeding season.
SHE	Safety, Health and Environment
SMRU	Sea Mammal Research Unit
SMRUC	Sea Mammal Research Unit Consultancy Ltd.
SPA	Special Protection Area
TCE	The Crown Estates.
UoA	University of Aberdeen
UoE	University of Exeter