Offshore Wind Evidence & Change Programme

Project Initiation Plan

(including post-delivery outcome and benefits review)

Submission Date: 30th June 2021

Version Purpose: *Funding Application (PIP-v2)*

A. PROJECT DETAILS

1. Project Name

PrePARED: Predators and Prey Around Renewable Energy Developments

2. Lead Organisation

Marine Scotland

3. Project Team

The Project Team comprises organisations and individuals who are at the forefront of applied research to inform environmental issues around offshore wind farm (OWF) consenting in the UK. Almost all of the tools currently used in UK impact assessments for seabird and marine mammal receptors were developed by members of the Project Team. Furthermore, the team has a long history of working together to deliver high-quality research that addresses key evidence needs around OWF consenting. Details of the organisations and individuals on the project team were given in the Project Terms of Reference, summarised in Table 1 below, with reference to the PrePARED project structure Workstreams (described in the following section and also in Fig. 1).

Table 1. Roles of the nine organisations on the PrePARED Project Team

Marine Scotland Science (MSS) and Marine Scotland Policy & Planning
MSS are responsible for project management of PrePARED as well as leading on work to understand how fish communities respond to OWF development in the Firth of Forth (Workstream A). MS Policy & Planning will disseminate project findings to inform Scottish OWF policies (Workstream D).
Biomathematics & Statistics Scotland (BioSS)
BioSS will develop seabird spatial distribution and movement models plus integrating new PrePARED project findings into seabird impact assessment frameworks (Workstream A & C).
UK Centre for Ecology and Hydrology (UKCEH)
UKCEH will incorporate PrePARED project findings on seabird distribution, movement and prey into seabird impact assessment frameworks and validate models (SeabORD) (Workstream C)
University of Exeter (UoE)
University of Exeter are responsible for work on fish in the Moray Firth including assessing reef effects from OWF development and movements of tagged fish in an OWF (Workstream B).
University of Aberdeen (UoA)
University of Aberdeen will focus on marine mammal aspects of the project (Workstreams B & C). This work will include studies on behavioural responses to OWF construction and operation in relation to prey, spatial distribution modelling and combining fish and mammal distribution data.
SMRU Consulting / University of St Andrews
SMRU Consulting and the University of St Andrews will focus on marine mammals including prey energetics and integrating project findings into impact assessment frameworks (Workstreams B & C).
Aarhus University
Aarhus University will also work on integrating new project findings into impact assessment frameworks and model validation (Workstream C).
NatureScot
NatureScot will work under Workstream D to disseminate PrePARED project findings to inform impact assessment guidance and policy considerations.
Natural England (NE)
NE specialist advisors will also work under Workstream D to disseminate project findings, translating evidence into policy and guidance for planning and licensing of OWF.

4. Project Structure

Note, since submitting the PrePARED PToRS to OWEC, we have restructured the first two workstreams to more clearly demonstrate the work across trophic levels (i.e. collaboration among fish and seabird/marine mammal experts) so Workstreams A and B have changed compared with the PToRS.

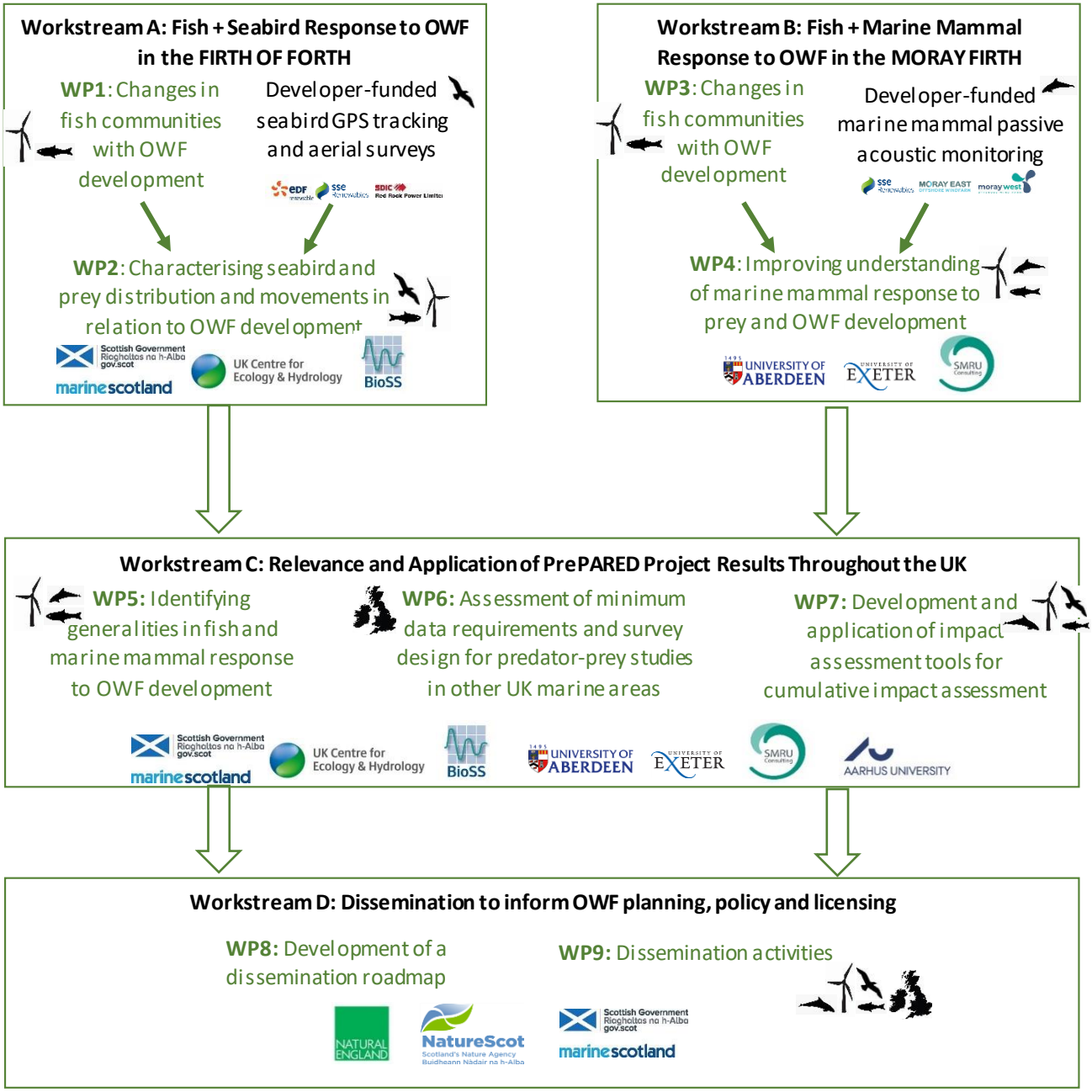


Figure 1. Project structure, illustrating the four PrePARED project workstreams (A to D) and work packages (WP). Logos indicate which organisation is involved with each workstream.

5. Project Purpose

There is an urgent need to better understand the magnitude of OWF environmental impacts on protected seabird and marine mammal populations. Uncertainties currently constrain impact assessments and delay consent decisions. Better evidence on how key receptors respond to OWF development will increase stakeholder confidence and consensus in predicted impacts from future OWF development and allow regulators to determine, with confidence, when derogation is required. Increased certainty on magnitude

of cumulative impacts may create opportunities for further OWF development, facilitating deployment of OWF at pace and scale.

At its simplest, OWF environmental impact assessments comprise a four-step process:

1. Assess receptor (seabird/marine mammal) distribution at sea to identify the numbers of individuals that may be affected by a planned OWF development;
2. Assess receptor behaviour in response to the development (e.g. avoidance of collision, displacement or disturbance);
3. Assess how that changed behaviour influences survival and productivity of affected individuals (collision mortality, reduced survival/productivity following displacement or disturbance);
4. Assess how this affects protected populations (Special Protection Area (SPA) and Special Area of Conservation (SAC) interest features).

To assess the potential population impact of a planned OWF development, a series tools have been developed, including energetics frameworks such as iPCoD[1], DEPONS[2] and SeabORD[3]. Whilst extensive monitoring, modelling and other strategic research has contributed to considerable improvements in the evidence base underpinning impact assessment tools, robust predictions of receptor responses to planned OWF developments must consider the interaction between prey availability and effects of OWF construction and operation activities. Some prey species could potentially benefit from the introduction of hard substrates, such as turbine jackets, due to a change in the composition of benthic fauna and, possibly, reduced fishing pressure. Understanding how predators respond to changes in prey distribution arising from OWF development, in addition to their direct response to OWF construction and operation activities, will substantially reduce uncertainty in OWF impacts on protected populations.

Predator and prey distribution and behaviour in and around OWF during construction and operation has never been studied concurrently, and rarely done in other marine settings, e.g. Greenstreet *et al*. (2010)[4]. Existing surveys of fish populations, such as ICES fisheries surveys, are usually conducted at different temporal and spatial scales to seabird and marine mammal monitoring, limiting the extent to which such fish data can be used to explain predator distribution and behaviour (Ransijn *et al*. 2020[5]). Detailed monitoring of seabirds and marine mammals in areas of active OWF development is increasing but comprehensive information on prey has never been collected at the same time and in the same location.

The PrePARED project will, for the first time, ***concurrently*** study predator (seabird and marine mammals) and prey distribution and behaviour in and around OWF at the same spatial and temporal scales. The focal predators include marine mammals (focussing on harbour porpoise but also harbour seal, grey seal and dolphin species) and seabirds (black-legged kittiwake, common guillemot, razorbill and Atlantic puffin) as species that can cause high consent risk for OWF development in the UK. Extensive surveys of benthic and pelagic fish, including sandeels, will provide prey information for the PrePARED project. This project is unique in that it will obtain an understanding of the *mechanisms* that drive observed changes in seabird and marine mammal behaviour and distribution in response to OWF development. This will be a step-

[1] King, S. L., Schick, R. S., Donovan, C., Booth, C. G., Burgman, M., Thomas, L., & Harwood, J. 2015. An interim framework for assessing the population consequences of disturbance. *Methods in Ecology and Evolution*, *6*(10), 1150-1158.

[2] Nabe-Nielsen, J., van Beest, F.M., Grimm, V., Sibly, R.M., Teilmann, J. & Thompson, P.M. 2018. Predicting the impacts of anthropogenic disturbances on marine populations. *Conservation Letters*, 11, e12563.

[3] Searle, K.R. Mobbs, D.C., Butler, A., Furness, R.W., Trinder, M.N. & Daunt, F. 2018. Finding out the Fate of Displaced Birds. *Scottish Marine and Freshwater Science Vol 9 No 8. DOI: 10.7489/12118-1*

[4] Greenstreet, S., Fraser, H., Amrstrong, E., Gibb, I. 2010. Monitoring the Consequences of the Northwestern North Sea Sandeel Fishery Closure. *Scottish Marine and Freshwater Science* Vol 1 No 6. Edinburgh: Scottish Government, 31pp.

[5] Ransijn, J., Lacey, C., Smout, S., Hammond, P.S. and Booth, C.G. 2020 Exploring harbour porpoise distribution in the context of prey in the North Sea. *Unpublished JNCC report*.

change in our understanding of what drives key receptor responses to OWF development and hence impacts on populations.

6. Project scope

The PrePARED project will operate in two focal studies areas, the Firth of Forth (Workstream A) and the Moray Firth (Workstream B). We will then explore transferability of predator-prey relationships in the context of OWF development, from the study sites to other UK marine areas (Workstream C). Project findings will be disseminated to inform planning and licensing of OWF around the UK (Workstream D). The PrePARED project comprises 29 Tasks, each with its own Task Lead, set of objectives, methods and deliverables. Tasks that address similar components of the PrePARED project are grouped into Work Packages, which sit in one of the four Workstreams. Some Tasks have been altered slightly and new tasks have been added, compared to the PToRS, to address comments received from the OWEC Project Evaluation Board. Tasks are briefly described below but more information is available on request.

Workstream A: Fish + Seabird Response to OWF development in the FIRTH OF FORTH

Table 2. Workstream A Tasks and Work Packages (WP)

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

WP1: Changes in fish communities with OWF development in the Forth

During 2022-24, new empirical data on fish responses to the Neart na Gaoithe (NnG) and Seagreen OWF in the Firth of Forth, will be collected. Using fish biomass acoustic surveys, trawls, baited fish traps, cameras and sandeel grabs from Marine Scotland's research vessels (*Alba na Mara* and *Scotia*), distribution of fish during construction and operation of the OWFs will be assessed. Broad-scale fish communities will be characterised and prey landscapes will be generated using data from surveys across the Firth of Forth region (Task 1.1), while fine-scale prey landscapes will assess changes in prey around individual turbine bases, compared with reference areas outside of the development site (Task 1.2). OWF-induced changes in fish communities, biomass and abundance will be assessed.

WP2: Characterising seabird and prey distribution and movements in relation to OWF development

At the same time as fish surveys, information on seabird distribution and movement will be obtained via developer[6]-funded GPS tracking and digital aerial surveys.

The role of prey and OWF construction/operation in influencing patterns of seabird distribution, behaviour and movement will be characterised using the fish and seabird data, plus environmental covariates from

[6] Funded by EDF-R and SSER

the MSS Scottish Shelf Model[7]. The spatial distribution (Task 2.1) and movement (Task 2.2) of seabirds in relation to prey and OWF development will be modelled to allow full quantification of uncertainty. Linking seabird movement with prey will allow assessment of how changes in prey distribution and OWF construction/operation affect seabird movement, as well as facilitating modelling of barrier effects. The extent to which inclusion of prey with spatial distribution and movement modelling of seabirds will be assessed. This has the potential to (a) reduce uncertainty in estimating baseline densities (used in collision risk modelling or the displacement matrix) and (b) increase power when quantifying displacement rates of seabirds, caused by OWF development (Task 2.3).

Workstream B: Fish + Marine Mammal Response to OWF in the MORAY FIRTH

Table 3. Workstream B Tasks and Work Packages (WP)

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

WP3: Changes in fish communities with OWF construction and operation in the Moray Firth

During 2022-24, broad- and fine-scale surveys of fish in the Moray Firth will be carried out using similar methods to fish surveys in the Firth of Forth. Sampling will take place in and around the Beatrice and Moray East OWFs to assess changes in bentho-pelagic prey abundance, distribution, diversity and biomass in relation to presence and age of OWF (Task 3.1). 'Reef effects' created by OWF structures will be investigated, providing insight into whether introducing hard structures to the marine environment provides a place for fish biomass aggregation/refuges or increased biomass production (Task 3.2). Behaviour and movement of fish will be studied by tagging fish and tracking their movement with an array of acoustic receivers (Task 3.3). This will provide data on fish use of space in relation to wind turbines, aggregation behaviour and individual residency/fidelity, which will affect their spatiotemporal availability as food to marine top predators.

[7] De Dominicis, M., O'Hara Murray, R., Wolf, J., & Gallego, A. (2018). The Scottish Shelf Model 1990 – 2014 climatology version 2.01. doi: 10.7489/12037-1

WP4: Improving understanding and modelling of marine mammal response to OWF development in the Moray Firth

Concurrent to prey data collection, marine mammal distribution and behaviour will be monitored using passive acoustic monitoring, funded by developers[8]. These data, along with fish data from WP3, will allow assessment of the roles of OWF construction/operation, prey and environment, as drivers of marine mammal spatial distribution (Task 4.1). The fine-scale prey data will be used to understand how prey drives variation in marine mammal abundance and foraging, close to and between turbines of different ages[9] (Task 4.2). Dose-response models obtained at the Beatrice OWF will be extended to incorporate new data on prey fields and reef effects to provide context-specific dose-response curves, characterising disturbance from both pile-driving and vessel traffic[10] (Task 4.3). Finally, fish samples will be collected during surveys of the Moray Firth and Firth of Forth which will be subsequently analysed for prey quality (species, size, nutritional content) and how that changes through time and space and in relation to construction and operation of OWF (Task 4.4). These findings will be integrated with the seabird and marine mammal energetics models (iPCoD, DEPONS, SeabORD).

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

This workstream comprises activities to evaluate the transferability of new understanding on mechanisms driving seabird and marine mammal response to OWF development, from the Moray Firth and Firth of Forth, to other marine areas of interest for OWF development around the UK (Table 4). Recommendations on survey design, informed by work in the northern North Sea, will be developed to inform scopes for complementary predator-prey studies elsewhere in the UK.

Table 4. Workstream C tasks and work packages

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

[8] Marine mammal monitoring will be funded by SSER and Ocean Winds, as part of their monitoring programmes

[9] Benhemma-Le Gall, A., Graham, I.M., Merchant, N.D. & Thompson, P.M. (*in press*). Broad-scale responses of harbour porpoises to pile-driving and vessel activities during offshore windfarm construction. In: *Before-After Control-Impact (BACI) Studies in the Ocean. (ed.) Frontiers in Marine Science Marine Ecosystem Ecology.*

[10] Graham, I.M., Merchant, N.D., Farcas, A., Barton, T.R., Cheney, B., Bono, S., and Thompson, P.M. (2019). Harbour porpoise responses to pile-driving diminish over time. *R Soc Open Sci* 6, 190335

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

WP5: Identifying generalities in fish and marine mammal response to OWF development

Generalities in changes in ecological niches available to fish assemblages and functional groups (e.g. an increase in demersal fish species) related to installation and age of OWF structures in the marine environment will be identified, as well as species-specific changes, and will therefore be widely relevant to areas of future OWF development around the UK (Task 5.1).

The transferability of documented harbour porpoise responses to OWF development in the Moray Firth[11] will be tested using passive acoustic monitoring data from the Firth of Forth region (NnG and Seagreen), from Marine Scotland's East Coast Marine Mammal Acoustic Study (ECOMMAS[12]), plus data from any other UK sites where data collection can be encouraged using similar study designs, particularly at sites with contrasting ecological conditions and/or porpoise densities (Task 5.2). This will improve understanding of variation in dose-response in different ecological and OWF construction contexts.

WP6: Assessment of minimum data requirements and survey design for predator-prey studies in other UK marine areas

Seabird and marine mammal spatial distributions will be linked to prey for the data-rich areas of the Firth of Forth and Moray Firth, in Workstreams A and B (Tasks 2.1 and 4.1). However, no other areas around the UK have the same quantity and quality of data on fish, marine mammals and seabirds, as will be available to the PrePARED project. Work under Task 6.1 and Task 6.2 will evaluate the extent to which seabird and marine mammal species distribution model performance changes as data quality or availability declines. These results will inform recommendations on which data are important to collect when undertaking predator-prey studies in other marine areas and the potential contribution of prey data to reducing uncertainty in impact assessment tool outputs.

Using biotic and abiotic variables, a detailed assessment of habitat similarity between areas of interest for future OWF development and the Moray Firth/Firth of Forth study sites will be conducted (Task 6.3). This work will be carried out in close collaboration and discussion with the NE-led POSEIDON project to ensure there is no duplication of effort and that seabed habitat mapping is shared between the two projects, where possible. This habitat similarity analysis will be used to assess the confidence with which we would expect seabird, marine mammal and prey response to OWF development to be similar to that documented in the PrePARED project for English/Welsh OWF project impact assessments. The assessment will also feed into survey design recommendations (Task 6.4), determining whether extensive surveys will be required (for non-similar sites) or more targeted surveys for 'ground truthing' (for marine areas with similar habitat types to Moray/Forth), and scoping as to where a complementary predator/prey project would be best located.

Minimum data requirements to inform predator-prey studies, informed by work in Tasks 6.1 and 6.2, along with outputs from the habitat similarity analysis (Task 6.3) will be integrated to form a set of recommendations and a high-level scope, describing how best to carry out a complementary project to PrePARED (Task 6.4). Both the habitat similarity work and the survey design recommendations will be

[11] Graham, I.M., Merchant, N.D., Farcas, A., Barton, T.R., Cheney, B., Bono, S., and Thompson, P.M. (2019). Harbour porpoise responses to pile-driving diminish over time. R Soc Open Sci 6, 190335

[12] East Coast Marine Mammal Acoustic Study (ECOMMAS) | Marine Scotland Information

developed in close collaboration and discussion with Natural England, Natural Resources Wales, BEIS, Defra and TCE, plus any other parties interested in taking forward a complementary project. The understanding of mechanisms driving observed predator response to OWF development, elucidated by the PrePARED project could be fed into a North Sea ecosystem model such as that being developed by EcoSTAR[13]. The ecosystem model could then be used to make predictions for other regions such as the southern North Sea and these predictions could be tested and validated with empirical data collected in the southern North Sea.

WP7: Development and application of impact assessment tools for cumulative impact assessment

The PrePARED project's new insights into marine mammal behaviour in and around OWF in relation to prey will be integrated into the impact assessment models, DEPONS and iPCoD (Task 7.1). DEPONS will be validated using known construction scenarios from Beatrice and Moray East OWFs and empirical data collected in the Moray Firth on changes in porpoise distribution and feeding associated with pile driving and vessel noise.

More biological realism will be integrated into the impact assessment tool, SeabORD, which will then be tested and validated by assessing whether observed changes in breeding success of seabirds at the Isle of May correlate with those predicted by SeabORD (Task 7.2). To date, SeabORD has only been used in impact assessments in the Forth & Tay region of Scotland. In the PrePARED project, SeabORD will be applied to the region around the Flamborough & Filey Coast SPA to test transferability of the tool to a new region for which prey data are currently lacking (Task 7.3).

Finally, the PrePARED project will provide recommendations on improved cumulative impact assessment approaches, informed by the project's findings. The new evidence on how predator distribution, behaviour and energetics changes in relation to prey fields and OWF development, both from the PrePARED project, along with other relevant emerging evidence arising during the course of the project where possible, will be integrated into updated approaches and recommendations on cumulative effects assessment (Task 7.4 and 7.5). We will provide a set of recommendations for how updated impact assessment models could be used to improve cumulative impact assessments. This will include how PrePARED project findings could be incorporated into the Cumulative Effects Framework (CEF)[14] (noting that the CEF project will finish before the PrePARED recommendations on cumulative impact assessments will be available).

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

Table 5. Workstream D Tasks and Work Packages

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

[13] EcoSTAR | SMRU (st-andrews.ac.uk)

[14] Cumulative Effects Framework for Key Ecological Receptors | UK Centre for Ecology & Hydrology (ceh.ac.uk)

WP8: Development of a dissemination roadmap

Use of evidence generated by the PrePARED project in impact assessments and OWF policy and planning will be ensured via the many existing networks and routes for dissemination that already exist within the PrePARED project team. In order to understand the strengths, weaknesses and gaps of these existing networks, a stakeholder analysis, followed by a network analysis will be undertaken (Task 8.1). Targeted additional dissemination can then be designed around the findings of these analyses in order to ensure the project findings are communicated efficiently to all relevant networks and stakeholders. A short report describing the results of the stakeholder and network analyses will be produced. A Communications Plan will be developed with involvement of Marine Scotland Communications Team, the PAG and OWEC (Task 8.2).

WP9: Dissemination activities

Dissemination activities were described in the PToRS in detail (see Section 7, p. 27) and so are only briefly summarised here.

Annual knowledge exchange workshops (Task 9.1) will be held each year, with the primary purpose of sharing the most recent results and project outputs and plans for the forthcoming year with all relevant stakeholders. A wide audience will be invited to the workshop, including SNCBs, governments, industry, consultants, eNGOs and scientists in the UK, Europe and elsewhere. The project team will encourage feedback from those undertaking similar research studies elsewhere (e.g. EcoSTAR[15], WinMon.BE, POSEIDON) thereby ensuring there is no duplication of effort but that opportunities for collaboration are investigated, with the aim of further increasing benefits arising from the PrePARED project. Many scientific publications will be produced by the PrePARED project, to ensure all evidence generated by the project undergoes full scientific peer review and scrutiny (Task 9.2). Each scientific publication will also have a short non-technical summary drafted by the project team, to explain the relevance of the findings to OWF policy and licensing. The project team will also produce reports on project findings, where the PAG advise that this is more useful than a scientific publication. A scientific symposium will be held specifically on research on ecosystem effects of OWF development in the UK and Europe[16] (Task 9.3), synthesising the latest understanding in ecosystem effects of OWF development, ensuring evidence from within and outside the UK is available to feed into policy and licensing. Throughout the course of the PrePARED project, the project team will run workshops, webinars and other events to ensure findings are disseminated as rapidly and effectively as possible. The PrePARED project will have a dedicated website, hosting project news, updates, latest findings and all project outputs (papers, reports, videos of conference presentations). The website will be similar to the JONAS EU Project website (https://www.jonasproject.eu/) which has been identified as an excellent online format for a marine research project website. Additionally, the PrePARED project will use press releases and social media to ensure project news is quickly disseminated (Task 9.4).

7. Delivery partners/selected suppliers

The project will be delivered by the nine partners that have been involved in the development of the project proposal over the last 6 months. Any procurement that may be required will adhere the relevant partners' procurement rules.

[15] EcoSTAR | SMRU (st-andrews.ac.uk)

[16] If possible, we will hold this symposium as part of the European Conference on Wind Energy and Wildlife Impacts (CWW) that will be due to be held in 2024

8. Procurement / contracting strategy for Project Team

Marine Scotland, acting on behalf of Scottish Ministers, will be the Lead Organisation for the PrePARED project and will act as the granting body for project partners. TCE shared a template agreement document with Marine Scotland, and there was advance discussion on the Terms and Conditions and any amendments that may be appropriate in light of both organisations being part of the Crown. Due to the collaborative approach taken in the development of the proposal, and the focus on research rather than commercial nature of the work to be undertaken, the grant approach was identified by MS as the most appropriate mechanism for disbursing funds across partners. This approach has been discussed with TCE.

9. Project budget / funding request

The project will be dependent upon (i) direct financial support, (ii) in kind support, and (iii) added value support, i.e. data and outputs being delivered in the study areas by offshore wind farm developers and project partners that are not part of the PrePARED programme of work and would take place irrespective of whether the PrePARED project goes ahead.

The total PrePARED project budget is £6,810,997, of which £1,565,475 is in-kind contributions from the project team organisations (Table 6). The direct financial support required for the project is therefore £5,214,888. There is a commitment from Crown Estate Scotland to contribute £400,000 to OWEC in support of the PrePARED project, and so **the funding requested of OWEC is £4,845,522**. See Supporting Information for an annual breakdown of the PrePARED budget.

The PrePARED project is also capitalising on substantial monitoring data being gathered by OWF developers in the region, without which the PrePARED project would not be possible. The added value of the developer monitoring activity that will be utilised is estimated to be approximately £15M. There is also substantial added value being delivered by the project partners in the form of data collection, model development and scientific equipment. The total cost of undertaking the PrePARED project without the added value contributions made by project partners and developers is estimated to be approximately £22M. See Supporting Information for more details.

Table 6. PrePARED Project budget by partner and budget category, and level of in-kind contribution from Project Partner

Costs by Budget Category							
	Total Budget	Staff Costs	Equipment	External Expertise	Vessels	Travel & Subsistence	In Kind
MSS	£ 1,942,883	£ 1,173,124	£ 364,500	£ 36,260	£ 356,478	£ 12,522	£ 800,700
NatureScot	£ 60,099	£ 60,099	£ -	£ -	£ -	£ -	£ 60,099
University of Aberdeen	£ 1,305,646	£ 1,253,080	£ 47,566	£ -	£ -	£ 5,000	£ 261,129
University of Exeter	£ 1,720,733	£ 1,169,733	£ 387,000	£ -	£ 120,000	£ 44,000	£ 416,147
UKCEH	£ 521,566	£ 506,566	£ -	£ -	£ -	£ 15,000	£ -
BioSS	£ 561,914	£ 550,715	£ -	£ -	£ -	£ 11,200	£ -
SMRUC	£ 575,676	£ 552,176	£ 20,000	£ -	£ -	£ 3,500	£ -
Natural England	£ 27,400	£ 27,400	£ -	£ -	£ -	£ -	£ 27,400
Aarhus University	£ 95,080	£ 91,180	£ -	£ -	£ -	£ 3,900	£ -
TOTALS	£ 6,810,997	£ 5,384,073	£ 819,066	£ 36,260	£ 476,478	£ 95,122	£ 1,565,475
In Kind	£ 1,565,475	£ 894,523	£ 386,913	£ -	£ 274,239	£ 9,800	
Total Cost to OWEC*	£ 5,245,522	£ 4,489,550	£ 432,152	£ 36,260	£ 202,239	£ 85,322	

* OWEC contribution values ignore the £400k matched funds from Crown Estate Scotland

10. Outline programme

The PrePARED project will run from January 2022 to March 2026, with data collection during summer of 2022, 2023 and 2024. Analyses and modelling will commence in January 2022, using existing data to inform survey design within the project and to develop frameworks into which new empirical data will be integrated, as it becomes available during the course of the project. Dissemination will occur at all stages of

the project, with outputs disseminated as early as possible. Recommendations on cumulative impact assessments will be delivered near the end of the project. Reporting to OWEC will occur on a monthly basis, with quarterly project team and PAG meetings. See Supporting Information for an outline programme by Task.

11. Supporting information

The following supporting information is provided with the PiP-v2:

File name	Details
1_PrePARED SUPPORTING INFORMATION -feedback from OWEC+response from Project Team	Detailed comments and response to OWEC PEB feedback on the PToRS
2_PrePARED SUPPORTING INFORMATION - NE letter of support	Letter of support for the PrePARED project from Natural England
3_PrePARED SUPPORTING INFORMATION - PAG views on PrePARED statement	Support from the PAG on a statement expressing the need for work in the northern North Sea before undertaking predator-prey studies elsewhere in the UK
4_PrePARED SUPPORTING INFORMATION - list of PrePARED outputs	Longlist of outputs that the PrePARED project will produce
5_PrePARED SUPPORTING INFORMATION - project budget details	Detail of PrePARED budget including in-kind and added value contributions
6_PrePARED SUPPORTING INFORMATION - outline programme	Outline programme showing data collection, analysis/modelling and dissemination by Task, Work Package and Workstream
7_PrePARED SUPPORTING INFORMATION- risk register	Risk register from the PToRS

B. EVIDENCE THAT THE PROJECT WILL HELP DELIVER THE PROGRAMME'S MISSION AND OBJECTIVES

Lead Organisations should provide evidence that their project will help deliver the Programme's Mission and Objectives and how this relates to the Programme requirements as set out in the Statement of Needs.

Information Required	Lead Organisation Response	Scoring (to be completed by PEB)
1. Contribution to the Mission: *To facilitate the sustainable and coordinated expansion of offshore wind helping the sector to meet the UK's commitments to the low carbon energy transition whilst supporting action to secure clean, healthy, productive and biologically diverse seas.*	The PrePARED project will deliver new evidence that will reduce uncertainty about marine mammal and seabird response to OWF development, leading to greater stakeholder confidence in impact assessments, contributing to de-risking the consenting process in the UK. New insights emerging from the PrePARED project will assist regulators with licensing decisions, enabling better-informed decision making. PrePARED project outputs will assist with OWF policy, planning and licensing decisions, thereby facilitating OWF development at pace and scale in the UK.	
2. Projects should fit into one or both of the following high-level categories: *a) Research projects to resolve gaps in evidence and understanding of the cumulative environmental impacts and benefits of offshore wind deployment and other commercial activities in the marine and onshore environments in order to reduce impacts and allow recovery of the environment.* *b) Projects, activities and initiatives to address strategic deployment issues associated with interactions in the sea-space and onshore.*	The PrePARED project fits in both high level categories. a) It will fill key evidence gaps around cumulative impacts through collecting and analysing new empirical data to better understand and reduce uncertainty around key receptor response to OWF development. b) The PrePARED project will also explore changes to distribution and behaviour of commercial fish species following OWF development, thereby informing multi use of seaspace by both the OWF and fisheries sectors.	

3. Within these high-level categories, projects should fit within one or more of the following themes: **a) Spatial co-ordination and co-location -** increasing strategic coordination of different activities and interests in the seaspace and onshore, opening-up new opportunities for offshore wind through co-location and innovation allowing multi-use of space **b) Improving the understanding of environmental impacts and benefits -** strategic research, evidence gathering and data sharing projects to: reduce impacts, uncertainty and risk, foster innovation, enabling more offshore wind to be deployed with confidence that impacts will not impede recovery of the environment and preservation of our cultural heritage. **c) Investigating the derogation process to unlock further offshore wind deployment** - investigate the availability and use of the Habitats Regulations Assessment (HRA) derogation process and Measures of Equivalent Environmental Benefit (MEEB) to help the consenting of offshore wind whilst maintaining the integrity of Marine Protected Areas – including alternatives and compensatory measures. **d) Delivery of net environmental gains** - investigating the delivery of net environmental gains to evidence and secure the benefits of deployment of offshore wind	The PrePARED project will contribute primarily to theme (b) but will produce evidence of benefit to all four themes: a) The PrePARED project will produce evidence on how OWF development changes fish, seabird and marine mammal distribution and behaviour. This will inform marine spatial planning. Additionally, new insights into fish movements in and around OWF will inform co-location of fishing and OWFs. b) The PrePARED project will significantly improve the understanding of environmental impacts of OWF through gaining insight into the mechanisms driving marine predator response to OWF development, thereby reducing uncertainty in the impact assessment process. c) Whilst the derogation process is not a primary focus of the PrePARED project, the project will deliver an improved understanding of how changes to prey availability, particularly sandeels, influences seabird distribution, behaviour and breeding success, which will be of benefit when considering compensatory measures. d) Potential effects (both positive and negative) of the development of a network of structures, including an increase in fish habitat complexity (e.g. artificial reefs) offering refuge for species generally absent or at low density on and around the development sites, will be explored and are of direct relevance to understanding the potential for net environmental gain. The study of a potential increase in the diversity of marine communities through cascading trophic effects will add to the understanding of how, beyond reducing emissions, offshore wind farms could provide net environmental benefits.	

C. CONFIRMATION OF COMPLIANCE WITH PROGRAMME / FUNDING CRITERIA – 1 OF 2 - REQUIREMENTS

The following criteria apply to all candidate projects. Lead Organisations should demonstrate either within associated project documentation (or in the boxes below) how their projects will comply with the stated Programme / funding criteria.

Information Required	Lead Organisation Response	Scoring (to be completed by PEB)
1. That they **build on existing knowledge** and complement, rather than duplicate, any existing work already contained within programmes.	The PrePARED project builds on decades of baseline monitoring of seabirds and marine mammals, as well as the extensive research and scientific knowledge that the project team hold. It will not duplicate existing work as a project of this scale, collecting marine predator and prey data concurrently, has never been undertaken previously.	
2. That they are **supported by a Project Advisory Group** or groups with recognised subject matter experts and that **robust processes are in place for project management, quality control and validation of findings**.	The PrePARED project is supported by a PAG comprising subject matter experts in ornithology, marine mammals and fish. All PAG members have extensive experience with OWF development constraints, challenges and issues. Processes for project management and quality control were described in detail in the PToRS; Marine Scotland Science will manage the PrePARED project, using government procedures and systems. Impact assessment tools will be validated during the project; scientific publications will undergo peer review while other deliverables will be subject to Marine Scotland's evidence quality controls.	
3. That they are **collaborative, with involvement and support from different sectors** – including, for example: industry, NGO, regulator, government and academia.	The PrePARED project team comprises researchers from a consortium of nine universities, research institutions and advisory bodies working together to deliver the project. The project will also work closely with the developers with OWF projects in the study areas. The PAG comprises representatives from industry, eNGOs (RSPB and TWT), regulators (MS-LOT and BEIS), SNCBs and others.	
4. That **match funding opportunities** have been investigated, and included, where relevant, in the event that there are other project beneficiaries and areas of mutual interest	The PrePARED project team have secured match funding from Crown Estate Scotland. Additional match funding was sought from offshore wind developers with projects in the Moray Firth and Forth & Tay. Whilst no cash contribution has been forthcoming to date, these developers are making very substantial added value contributions through funding monitoring of seabirds and marine mammals in the PrePARED study areas. Additionally, substantial in kind and added value contributions	

	from the PrePARED project team organisations means that the request for funding from OWEC is small (estimated approximately 20%) compared with the total cost of undertaking a landmark project of this nature.	
5. That Programme funding **does not simply displace existing funding streams**, but adds genuine value.	There are no alternative funding streams available for this work. This novel programme of work complements historic and ongoing research initiatives being undertaken in the Moray Firth and Forth regions to add value and additional data collection and analyses to baseline industry-funded monitoring studies.	
6. That projects / activities have the **aim of generating learning for the benefit of the industry and offshore wind community as a whole** and in the long-term, rather than being niche/project-specific, although it is accepted that some project-specific learning may be able to be applied more generally.	The PrePARED project will generate new evidence on mechanisms driving key receptor response to OWF development. This will assist the industry and OWF community by creating more confidence in consequences of OWF development on the environment (both positive and negative) for all involved with OWF planning and licensing in the UK. Furthermore, while developing the PrePARED project, the project team discussed with the PAG how to make the project outputs of more direct benefit and relevance to stakeholders such as BEIS and TCE. The project scope has been broadened to augment the relevance of project findings to all the UK OWF community.	
7. That they are focussed on receptors and topics that pose greatest risk in terms of future offshore wind farm consents and deployment – need to know vs nice to know. Attempts should be made to quantify this risk, if possible. What happens if we don't do this project/activity?	The PrePARED project will focus on marine mammal and seabird species that are widely recognised as being of high consent risk in Scottish and English waters, e.g. by ScotMER and OWEER. Furthermore, the OWEER identifies '*Predator-prey interactions, relationship between prey density and prey availability, impacts of ORDs on prey distributions and availability*', as an evidence of gap of highest priority (score = 15). If this study is not undertaken in the Firth of Forth and Moray Firth, starting in 2022, the opportunity to understand the mechanisms driving observed seabird and marine mammal response to construction and operation of OWF will be missed, as the construction period will have passed. Developing a similar baseline of information elsewhere would take decades and cost many millions of pounds. The substantial and	

	significant gains to be made in reducing uncertainty and building stakeholder confidence via improvements to cumulative impact assessments cannot be replicated at a future time or location.	
8. That they have defined deliverables and include a timeframe for these.	Deliverables and timeframe were provided in the PToRS. Key deliverables include many peer-reviewed scientific publications, reports, workshops, webinars and knowledge exchange events. The time frame for delivery of these project outputs was described in detail in the PToRS and in the Project Outline Supporting Information with this PiP-v2.	
9. Key outputs must be available and in a form that can be shared with the Programme Steering Group, on TCE's website and the wider offshore wind community for their mutual benefit, although it is recognised that there may be some elements of commercial sensitivity regarding raw data.	Data collected during the duration of the project, directly by the project team, will be made freely available. The project team will seek to publish in open access journal articles, and data will be archived in appropriate data repositories. We will discuss availability of any data given for use for the project, with intellectual property from third parties or from partners with commercial sensitivity.	
10. There is a roadmap demonstrating how the findings will be disseminated; and how they could inform future policy, practice and decision-making to deliver the Programme's mission.	A dissemination roadmap is being developed during the PrePARED project (Task 8.1), informed by the stakeholder and network analysis and communications plan (see Workstream D: Dissemination to Inform OWF policy, planning and licensing).	

D. CONFIRMATION OF COMPLIANCE WITH PROGRAMME/FUNDING CRITERIA – 2 OF 2 - EXCLUSIONS

Lead Organisations should demonstrate either within associated project documentation (or in the boxes below) that none of the exclusion criteria specified apply to their projects. For avoidance of doubt, The Crown Estate reserves the right to make further exclusions based on its own legal advice and judgement.

Excluded from Programme	**Lead Organisation Response**	Scoring (to be completed by PEB)

1. Business as Usual	This project does not represent a business-as-usual scenario. It will be a novel project, building on a legacy of studies which have already helped inform the growth of the OWF industry across the UK.	
2. Projects or activities that are or could be viewed as political, religious, partisan or lobbying activity. This includes projects or activities that directly link to any offshore wind farm that is the subject of live planning application, where there could be propriety issues in relation to due process for government decision-making.	None of the activities could be viewed as political, religious, partisan or lobbying activity. Whilst the results of this work will look to inform future impact assessment in future applications and future post-consent monitoring, the results would not directly affect any live planning applications and no propriety issues in relation to due process for government decision making.	
3. Projects or activities outwith the UK and its waters and where a direct benefit to UK offshore wind farm deployment cannot be demonstrated.	Project activities will all take place within the UK, including all data collection, analysis and dissemination of project findings, meaning benefits will accrue to UK offshore wind deployment. One project partner (Aarhus University) is based in Denmark but their costs comprise a very small percentage of the budget and their expertise is essential for updating DEPONS, a tool used to inform OWF impact assessments in the UK.	
4. Open-ended research projects that cannot directly demonstrate potential to unlock deployment and deliver the Programme's mission	The PrePARED project has a clear end point, with data collection happening during 2022-24 and analyses and reporting concluding by end March 2026. Dissemination of project findings will occur at all stages of the project, at the earliest opportunity, ensuring that project findings assist with unlocking deployment as rapidly as possible.	
5. Projects or activities that appear to unduly benefit the commercial interests of an individual offshore wind farm developer or other commercial organisation.	The proposed project will not operate to unduly benefit any commercial organisations, developers or business interests. Whilst we have support from developers in the regions of interest, this is in the context of developments that have been through the planning process and have been awarded consent.	

E. PROJECT BENEFITS AND OUTCOMES

Lead Organisations are to list and describe in the left hand column of this table, the key benefits and outcomes expected from their project with their PIP-v1 and PIP-v2 submissions. These benefits and outcomes will then form the basis of a post project review to establish whether they were actually achieved (PIP-v3 only). This table should be expanded as necessary.

The PrePARED project will produce new evidence to inform OWF policy, planning and licencing. Work under Workstream D will guarantee that this new evidence reaches key stakeholders such as the SNCBs, Defra, BEIS, TCE, Marine Scotland and CES as rapidly as possible, to maximise the potential for this new evidence to be used. However, uptake and implementation of new evidence to produce outcomes that change approaches to OWF planning and licensing is beyond the control of the PrePARED project.

Lead Organisation Response (PIP-v1 & PIP-v2 only)	**Lead Organisation Response in conjunction with Workstream Lead on project completion (PIP-v3 only)**	**Scoring (to be completed by PEB)**
Identified at the outset	**Post Project Review**	
1. Mitigation and management strategies that incorporate trade-offs between short-term pile-driving and longer-term vessel disturbance on marine mammals		
2. Decision making on co-location of commercial fisheries and OWF is informed by changes to fish distribution, communities, biomass, etc. caused by OWF development, taking into account potential improved foraging opportunities for marine predators and potential improved fishing opportunities		
3. Stakeholders have increased confidence and consensus in predictions of impacts of planned OWF development on key receptors due to improved impact assessment models		
4. New approaches to cumulative impact assessment facilitate OWF development through clarity on magnitude of impacts and route to consenting (e.g. derogation)		
5. Evidence from the PrePARED project is used by stakeholders from across the UK, resulting in improved OWF policy, planning and licensing practices		
6. Use of new evidence to inform marine spatial planning, including English and Welsh marine plans and future iterations of the Marine Scotland Sectoral Marine Plan.		
7. Seabird compensatory measures are informed by PrePARED project evidence on how changes to prey availability influence seabird behaviour and distribution		
8. New evidence on the relative roles of prey and OWF development in driving key receptor distribution and behaviour is used to inform OWF planning and licensing decisions throughout the UK and Europe		

9. Future OWF environmental monitoring plans are informed by PrePARED evidence on minimum data requirements to ground truth mechanistic understanding of drivers of marine predator response to OWF development		

F. RISK ASSESSMENT

Lead Organisations should list below the key risks associated with their projects and the measures that will be put in place to manage and mitigate those risks. This table should be expanded as necessary.

In an effort to reduce the length of this PiP-v2, we have included key risks as supporting information. The risks and mitigation are the same as those identified in the PToRS.

G. STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS

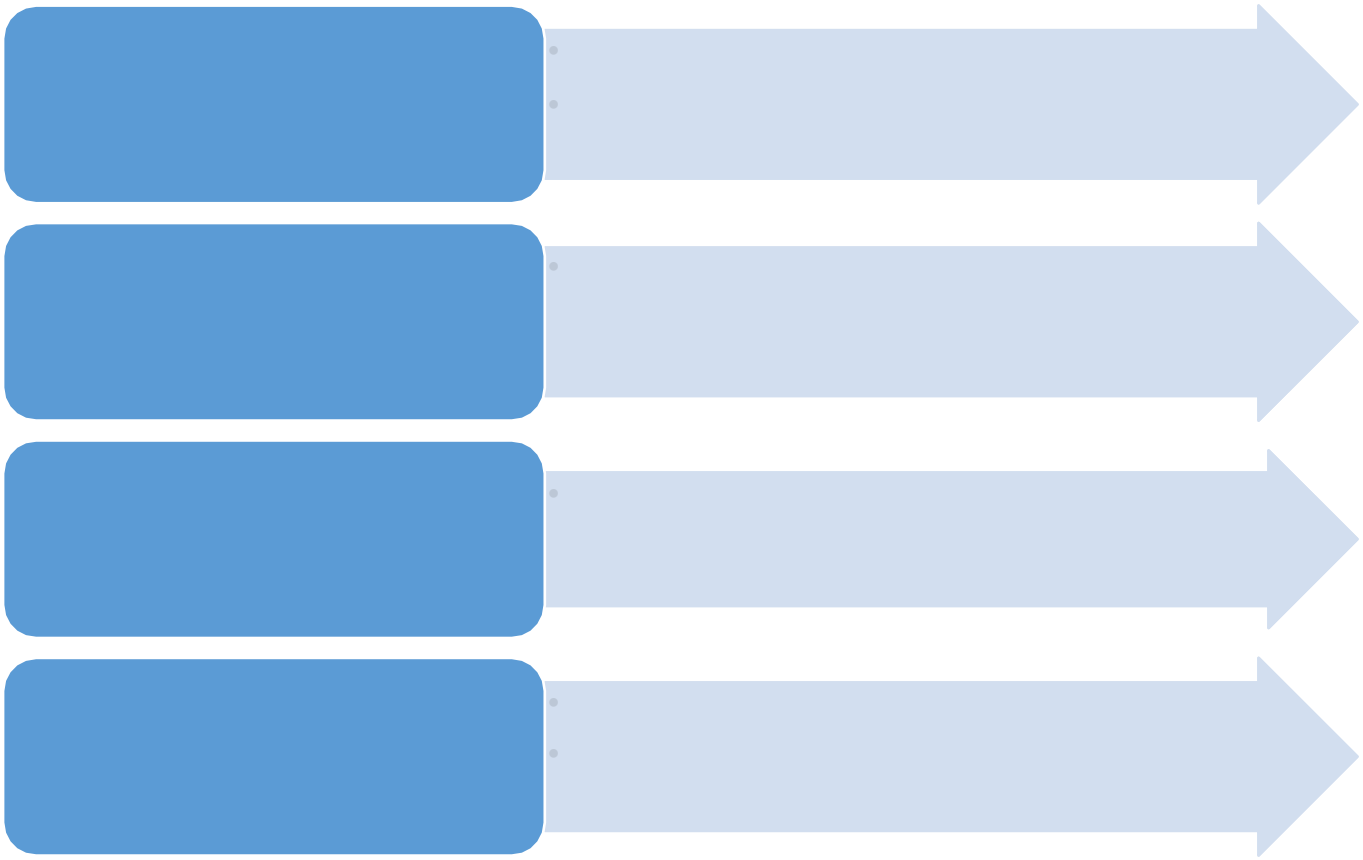
Lead Organisations should state what opportunities are expected for stakeholder engagement along with expected communication milestones

Information Required	Lead Organisation Response	Scoring (to be completed by PEB)
1. What are the opportunities for stakeholder engagement?	Opportunities for stakeholder engagement are described under **Workstream D: Dissemination to inform OWF planning, policy and licensing** (Project Scope). Work under this workstream includes a stakeholder and network analysis, development of a dissemination roadmap and a series of dissemination activities.	
2. What are the communications milestones?	Communications milestones are: 1. Stakeholder & Network Analysis Report [final report due June 2022] 2. Draft communication plan [March 2022], final communication plan [July 2022], subsequent annual updates 3. Annual knowledge exchange event [October 2022, 2023, 2024 and 2025] 4. Publication of scientific papers and other reports [throughout the project as evidence becomes available] 5. Scientific symposium [February 2026] 6. Project webinars, workshops and other events [as the scientific evidence becomes available] 7. Development and maintenance of a project website [April 2022] 8. Workshop to discuss habitat similarity analysis and survey design recommendations for predator-prey studies in other areas of the UK [November 2022] 9. Workshop on new approaches to CIA, informed by PrePARED project findings [January 2026]	

H. GOVERNANCE

(FOR COMPLETION BY PEB/THE CROWN ESTATE)

List RACI for the project



Record sheet of internal governance

Consultees	Name	Date consulted	No comments	Comments taken on board
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

Approvals	Name	Date approved
1		
2.		
3.		
4.		

Informed	Name	Date Informed
1.		
2.		
3.		
4.		

Link to Wisdom folder for document storage for this project: XXXX