OFFSHORE RENEWABLES JOINT INDUSTRY PROGRAMME (ORJIP) FOR OFFSHORE WIND

Recommendations and roadmap (D05)

Closing the Loop: Feasibility study to determine a feedback approach for post-consent monitoring to reduce consenting risk in future assessments

September 2025

working to accelerate offshore consenting

ORJIP Offshore Wind

The Offshore Renewables Joint Industry Programme (ORJIP) for Offshore Wind is a collaborative initiative that aims to:

- Fund research to improve our understanding of the effects of offshore wind on the marine environment.
- Reduce the risk of not getting, or delaying consent for, offshore wind developments.
- Reduce the risk of getting consent with conditions that reduce viability of the project.

The programme pools resources from the private sector and public sector bodies to fund projects that provide empirical data to support consenting authorities in evaluating the environmental risk of offshore wind. Projects are prioritised and informed by the ORJIP Advisory Network which includes key stakeholders, including statutory nature conservation bodies, academics, non-governmental organisations and others.

The current stage is a collaboration between the Carbon Trust, EDF Energy Renewables Limited, Ocean Winds UK Limited, Equinor ASA, Ørsted Power (UK) Limited, RWE Offshore Wind GmbH, Shell Global Solutions International B.V., SSE Renewables Services (UK) Limited, TotalEnergies OneTech, Crown Estate Scotland, Scottish Government (acting through the Offshore Wind Directorate and the Marine Directorate) and The Crown Estate Commissioners.

For further information regarding the ORJIP Offshore Wind programme, please refer to the Carbon Trust website, or contact Ivan Savitsky (ivan.savitsky@carbontrust.com) and Žilvinas Valantiejus (zilvinas.valantiejus@carbontrust.com).

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- Joint Nature Conservation Committee (JNCC)
- Natural England

- NatureScot
- Royal Society for the Protection of Birds (RSPB)
- Scottish Government Marine Directorate

This report was sponsored by the ORJIP Offshore Wind programme. For the avoidance of doubt, this report expresses the independent views of the authors.

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List of Abbreviations

CES	Crown Estate Scotland
BEAM	Balance Evidence Assessment Method
DAERA	Department of Agriculture, Environment and Rural Affairs
DAS	Digital Aerial Survey
DCO	Development Consent Order
Defra	Department for Environment, Food & Rural Affairs
DESNZ	Department for Energy Security and Net Zero
DML	Deemed Marine Licence
DOI	Digital Object Identifier
ECOFlow	Ecological Effects of Floating Offshore Wind

ECOWIND	Ecological Consequences of Offshore Wind
EDR	Effective Deterrent Range
EIA	Environmental Impact Assessment
FAIR	Findable, Accessible, Interoperable, Reusable
GW	Gigawatt
HRA	Habitats Regulations Assessment
IEMA	Institute of Environmental Management and Assessment
ImpUDis	Improving understanding of distributional change for relevant seabird species (ORJIP)
JCDP	Joint Cetacean Data Programme
JNCC	Joint Nature Conservation Committee
MD	Marine Directorate
MDE	Marine Data Exchange
MD-LOT	Marine Directorate Licencing Operations Team
MD-Science	Marine Directorate Science
MEDIN	Marine Environmental Data and Information Network
MMO	Marine Management Organisation
MRF	Marine Recovery Fund
NE	Natural England
NEEOG	North East, East Developers Ornithology Group
NESO	National Energy System Operator
NPS	National Policy Statement
NRW	Cyfoeth Naturiol Cymru / Natural Resources Wales
OCLG	Offshore Consenting and Licencing Group
ODIS	Ocean Data and Information System
OG	Oversight Group
ORJIP	Offshore Renewables Joint Industry Programme
OW	Offshore Wind
OWD	Offshore Wind Development
OWEC	Offshore Wind Evidence and Change Programme
OWEER	Offshore Wind Environmental Evidence Register
OWEKH	Offshore Wind Evidence and Knowledge Hub
OWES	Offshore Wind Environmental Standards
OWF	Offshore Wind Farm
OWGRE	OWEER Gap Analysis and Prioritisation
OWIC	Offshore Wind Industry Council
OWS	Offshore Wind Sector
P2G	Pathways to Growth
PCM	Post-Consent Monitoring
PEP	Project Expert Panel
POSEIDON	Planning Offshore Wind Strategic Environmental Data and Information Network (OWEC)
PrediCtOr	Prevalence of Seabird Species and Collision Events in Offshore Wind Farms (ORJIP)
Q-FAIR	Quality, Findable, Accessible, Interoperable, Reusable

RAG	Regional Advisory Group
ScotMER	Scottish Marine Energy Research
SEA	Strategic Environmental Assessment
SNCB	Statutory Nature Conservation Body
SUPERGEN	Sustainable PowER GENeration
TCE	The Crown Estate
TRUST	Transparency, Responsibility, User focus, Sustainability and Technology
TTG	Technical Topic Group
UNESCO	United Nations Educational, Scientific and Cultural Organization
WOE	Weight of Evidence

Executive Summary

This report presents the outcomes of the 'Closing the Loop: Feasibility study to determine a feedback approach for post-consent monitoring to reduce consenting risk in future assessments' project.

There is not **currently a strategic feedback mechanism** or requirement for data collected during **post-consent monitoring (PCM)** of offshore windfarm developments to be integrated back into the **assessment process**. Using these data effectively could help **reduce uncertainty** in the consenting process and is crucial in the context of both **cumulative** and **future project-based assessments**.

Using **seabirds as a key receptor group**, we focused on the **barriers and potential solutions** to incorporate post-consent monitoring data back into the consenting process for the offshore wind sector using existing tools, thereby 'closing the loop' as part of the wider and essential adaptive management paradigm. This is particularly important to the offshore wind sector because developers are typically required to conduct post-consent monitoring of offshore wind farms (OWF) impacts as part of their licence conditions, which is costly and may be challenging to implement.

A set of recommendations was developed to remove barriers and set out pathways for proposed solutions to be implemented, providing a mechanism for 'closing the loop'. Development of the **recommendations** was based on **detailed engagement** with a **diverse set of relevant stakeholders** to ensure recommendations are specific and reflect the context and constraints around the current legal, policy, regulatory and process frameworks.

Outputs and findings from a **second receptor group, marine mammals**, are integrated into the report. An **'evidence bridges'** approach was used for marine mammals to develop and demonstrate a swift, transparent and auditable mechanism to facilitate evidence transfer and uptake.

The **high-level recommendations** from the project are:

A: **Improve communication and coordination** within and between organisations to benefit the sector

B: Stakeholders across the industry **establish greater clarity on governance and responsibility** of post-consent monitoring data and reporting requirements

C: Continue to **improve and invest in data management frameworks**, communicating this facility to stakeholders

D: **Develop FAIR data** and data standards for PCM, working with developers to achieve this

E: **Develop best practice**, industry standards or/and codes of conduct, producing guidance for technologies and methodologies in a timely manner

F: Facilitate dissemination and translation of **data into guidance** through improved governance and better communication to stakeholders

G: **Invest in additional resources** across the sector

H: Continue to **invest in research and regional level monitoring** to answer key questions around identified evidence gaps, moving the knowledge base forward

I: Moving to **a strategic monitoring approach** to PCM is a long-term solution

J: Use an **evidence bridges** approach as a mechanism for evaluating evidence into guidance

A **roadmap** is also included, which shows all high-level and specific recommendations, and is intended to promote the dissemination and uptake of outputs from this project.

1. Introduction

The UK government is committed to accelerating to net zero with ambitions to deliver 43-50 GW of offshore wind power under the Clean Power 2030 Action Plan (UK Government, 2024), and to protecting 30% of UK land and sea for nature by 2030 (United Nations, 2022). To meet the Department for Energy Security and Net Zero (DESNZ) 'Clean Power Capacity Range' will require deployment at an accelerated scale and pace (UK Government, 2024). Deployments are constrained on the requirements for planning approval, so these barriers must be overcome to facilitate the sector's full potential. Environmental assessments for Offshore Renewable Developments are undertaken with respect to the EIA Directive (2011/92/EU, Marine Strategy Framework Directive (EC/2008/56), the Habitats Directive (EC/92/43), the Birds Directive (EC/79/409) and derived legislation. However, there is broad acknowledgement that environmental assessment regimes, namely Environmental Impact Assessments (EIAs), Strategic Environmental Assessments (SEAs) and Habitats Regulations Appraisals (HRAs) are not operating as well as they should within the UK. Although a recent report from the Offshore Wind Industry Council (OWIC) set out recommendations for a revised architecture to address key policy and legislative barriers to offshore wind consenting, it was noted that regulatory reforms would be unlikely to address consenting risks (OWIC, 2024).

For the assessment process, one underlying cause is the issue of integrating post-consent monitoring data back into assessments, which currently has no strategic feedback mechanism in place. Post-consent monitoring is mandated by HRA and EIA requirements and regulators oversee PCM to ensure compliance with marine licences. However, although PCM is specified in the early stages of a planning for a development, it takes place many years later once a development has been built and is operational. Therefore, there is a long time between PCM being planned and agreed and its implementation – in this time, approaches to data collection and analysis may have advanced, and environmental issues may have changed, which needs to be recognised and accounted for when considering ways to improve the PCM process. PCM plays a critical role in understanding the impacts of Offshore Wind Developments (OWD) on key receptors through validating predictions made at earlier stages of assessment process, as well as potentially detecting unforeseen impacts. Due to the timings around consent and construction of OWD, the UK administrations vary in the amount of PCM monitoring data that have been collected; with England having quite a lot of PCM data available, Scotland having much less, and Wales having very few data at the present time. There are opportunities to improve the current process and make recommendations for

future changes so that PCM can fulfil its potential of helping to reduce uncertainty in consenting risk in the context of both cumulative and future project-based assessments, inform adaptive management, and set up a formal feedback mechanism so that valuable learnings from post-consent monitoring can be fed directly back into the system. Recognising that collecting PCM data is timely and expensive and so ensuring that data have added value (i.e. measure once, use many times) is an important consideration. Setting up a strategic feedback mechanism will become increasingly important as large numbers of projects will typically translate into high levels of uncertainty, and impact estimates for a development will be used repeatedly across multiple assessments. Facilitating this feedback mechanism will help enable offshore wind consenting to accelerate to the pace required to achieve energy targets.

Post-consent monitoring can be a broad term so throughout the project, we have defined it to include data that are currently collected or could plausibly be collected in future as part of post-consent requirements (i.e. excluding baseline data that are collected to inform the consent process). This can include data that are collected during pre-construction, during construction, or post-construction periods. It excludes other relevant data that are collected during these periods through publicly funded long-term monitoring programmes or research projects.

Although the project focuses on ornithology as a key receptor group, we also included a second receptor group, marine mammals, within the project. The underlying motivation and urgency to 'close the loop' between post-consent monitoring and decision-making is shared across taxa such as seabirds and marine mammals due to high ecological risk leading to increased consent risks and the expensive and time-consuming nature of data collection. While both face common challenges, the paths to solutions differ: For seabirds, a bottom-up approach is needed to identify technical and organisational barriers and clarify roles and responsibilities, whilst for marine mammals the focus is on operationalising a clearer path for the uptake of evidence using an 'evidence bridges' approach (**Closing the Loop – Evidence Bridges: Marine mammal case study (D08)**). This structured approach, derived from a conceptual framework that has been used extensively in other areas (e.g. evidence-based medicine) helps translate science into policy, but must be tailored to each taxon's specific scientific and decision-making context.

We identified three distinct sets of issues involved in closing the loop between evidence generation and decision-making: procedural barriers related to policy, process, and data availability; scientific and technical challenges in ensuring monitoring data are transferable and relevant across time, space, and/or species; and the potential to adapt future post-consent monitoring requirements to improve the type and quality of data collected. Throughout the project, we used a pluralistic research approach to understand these distinct sets of issues from a range of perspectives using different research modes, so that we could produce recommendations based around each of the procedural, scientific and technical, and future PCM challenges.

We undertook sets of activities to understand the three distinct sets of key issues through a review of current policy, process and data availability, seabird case studies reviewing data types, site-specific case studies, and an interactive app. Further details can be found in the **Closing the Loop – Synthesis of evidence (D01)** report. We embedded co-development with stakeholders within the project lifecycle, identifying key issues and potential solutions through semi-structured interviews (**Closing the Loop – Summary report of stakeholder interviews (D04a)** report), refining and evaluating solutions in a focused group workshop (**Closing the Loop – Summary report of focused group workshop (D04b)** report), and evaluating and forming recommendations in a final stakeholder workshop (Appendix: Stakeholder workshop of this report).

We present the outcomes from the project set out in recommendations to 'close the loop' for PCM data, focusing on maximising the use of evidence in decision making and reducing consenting risk and uncertainty. These have been developed in the context of seabirds and linked to the evidence bridges approach from the marine mammal case study. A final workshop was held (see Appendix: Stakeholder workshop) and participants were invited from a wide range of organisations across the offshore renewable energy sector to ensure a diverse range of viewpoints were expressed and to promote engagement with the project and uptake of its outputs. The workshop was intended to inform project outputs through co-developing a set of recommendations through the evaluation of the potential solutions we presented. Each high-level recommendation is supported by a set of specific recommendations. These are introduced with an explanation to provide motivation and context behind the recommendation. The specific recommendations listed underneath show steps that, if implemented, will help achieve the overall goal of the high-level recommendation. To aid dissemination of the outputs and promote uptake of the recommendations, a roadmap has been produced which presents all recommendations and highlights those that are prioritised.

2. Guide to using the recommendations tables

2.1. How to use the recommendations tables

The recommendations are constructed as a **high-level recommendation** in a statement preceded by a letter (A, B…) followed by **motivation** text. A table is presented for each set of **specific recommendations** (A1, A2…) following the high-level recommendation. The text below explains how to use and interpret the remaining columns in each recommendation table.

2.1.1. Timescales & actions

The tables use a colour-coding system to denote the timescale over which actions to achieve the recommendation could take place. Timescales are categorised as 'Quick win', 'Tactical', and 'Strategic' and Table 1 shows the definition, explanation, and colour-coding of the categories. For some recommendations, actions have been allocated alongside the timescales. This is not feasible for all recommendations.

Table 1. Definition of timescale categories

Category	Timescale	Constraints and dependencies	Resourcing
Quick win	Could begin immediately and deliver benefit rapidly	No substantive constraints, dependencies or risk that would prevent implementation, i.e. could be implemented in the current assessment framework	No substantive new resources required

Tactical win	Could begin immediately but may take time to deliver benefits	Some dependencies, but does not require major changes to underlying processes in the current assessment framework	May require some redistribution or addition of existing resources
Strategic win	Longer term delivery and benefit Could be applicable to future leasing rounds (e.g. R6)	Dependent on substantial changes to underlying processes that are outside the scope of this project	May require substantial changes or increases in resourcing

2.1.2. Roles & responsibilities

Roles and responsibilities were evaluated in the stakeholder workshop. We have tried to be specific in assigning roles and responsibilities at either an organisation level or aggregated to a grouping, which is more applicable for recommendations that include all UK administrations or require cross-border collaboration. Table 2 shows designated grouping and organisations within those groupings.

Table 2. Designated groupings by organisation used in the recommendations

Grouping	Organisation included
Regulators	Marine Management Organisation (MMO), Scottish Government (Marine Directorate Licencing Operations Team (MD-LOT), MD-Science), Cyfoeth Naturiol Cymru / Natural Resources Wales (NRW), Department of Agriculture, Environment and Rural Affairs (DAERA)*, Department of Environment, Fisheries & Rural Affairs (Defra)
SNCBs (Statutory Nature Conservation Bodies)	Joint Nature Conservation Committee (JNCC), Natural England (NE), NatureScot, Cyfoeth Naturiol Cymru / Natural Resources Wales (NRW), Department of Agriculture, Environment and Rural Affairs (DAERA)*
Industry	Developers, consultants, sub-contractors, data collection contractors
Researchers	Academics, consultants, research positions within wider organisations

*DAERA were not specifically engaged within this project as there are no offshore wind farms built yet, although the Energy Strategy 2022 Action Plan Report includes aimed to 'develop an action plan to deliver 1GW of offshore wind from 2030'.

The Offshore Wind Evidence and Knowledge Hub (OWEKH) has a UK-wide remit. At the time of publication Oversight Group membership was The Crown Estate (TCE), Institute of Environmental Management and Assessment (IEMA), Department for Energy Security and Net Zero (DESNZ), Defra, DAERA, NRW, Welsh Government, Planning Inspectorate, and MMO. The Scottish Government are currently observers on the Oversight Group and OWEKH is awaiting confirmation of level of participation. Membership of the topic specific Technical Topics Groups is broader from across the UK and includes academics, SNCB's and

industry representatives. OWEKH has expected contributions from Scottish Marine Energy Research (ScotMER), Tethys, Offshore Wind Evidence and Change Programme (OWEC), Ecological Consequences of Offshore Wind (ECOWIND) and Ecological Effects of Floating Offshore Wind programme (ECOFlow), and SUstainable PowER GENeration (SUPERGEN) as well as other relevant research programmes. OWEKH is underpinned by a community of practice. Knowledge will be disseminated through Evidence Notes which capture the current state of evidence for the sector, alongside a digital hub signposting guidance and best practice across topics with a UK wide remit. The first agreed Evidence Notes are expected to be available late 2025/early 2026.

2.1.3. Constraints & dependencies

Clearly, many of the recommendations being made here require resourcing of staff and/or investment. There are specific, separate recommendations around these points but where issues have been identified, we have also included these as constraints within the specific recommendations.

Dependencies were identified in the stakeholder workshop through an evaluation exercise. Intrinsically, almost all recommendations are linked. However, we have defined dependencies in this context as those that need to be in progress or completed *before* the recommendation that is being viewed, can be started.

2.1.4. Priority & forward dependencies

Priorities were evaluated in the stakeholder workshop (see Appendix: Stakeholder workshop). These were defined as the most important recommendations (to the workshop participants). This definition carries through, and therefore, priority is categorised as high, medium and low in order of importance to the success of the sector.

2.2. Pathways to impact

To promote uptake of recommendations, we constructed a **transparent** process for producing recommendations through:

- **Co-development with stakeholders through the project lifecycle** to identify barriers and potential solutions, evaluate those solutions, and feedback to form recommendations. This was achieved through **communication modes** such as verbal (through Project Expert Panel (PEP) and Steering Group meetings, interviews, focused group and sector-wide workshops) and written (using email, interactive Miro boards, formal feedback from the PEP and Steering Group). Formal rounds of stakeholder engagement were at specific points throughout the project:
    - The first stage (**Closing the Loop – Summary report of stakeholder interviews (D04a)**) focused on capturing a detailed understanding of barriers to using post-consent monitoring data, and potential mechanisms for resolving them, through a series of **semi-structured interviews** with individuals representing organisations playing a role in the regulatory and consenting processes, along with a practitioner and industry representation. These interviews sought to understand processes within different organisations and identify where steps to 'closing the loop' may be missing, implemented partially, or could be improved. Outcomes from these interviews were integrated into a **Closing the Loop – Synthesis of evidence (D01)** report, which is an output of this project.

- The second stage, an online **focused group workshop** is detailed in the **Closing the Loop – Summary report of focused group workshop (D04b)** report. Participants evaluated the feasibility of possible solutions, and the report produces a set of potential solutions along with narrative themes.
- The third stage of stakeholder engagement is detailed in the Appendix: Stakeholder workshop of this report, which presents the outputs of a **workshop** with a broad set of stakeholders from across the offshore wind industry. The workshop presented the potential solutions and asked participants for **feedback to identify gaps or limitations**. Potential solutions were evaluated.

- **Evaluation** of recommendations around feasibility, priorities in terms of importance to the success of the sector (from stakeholders' points of view), and role & responsibilities to map a pathway to impact.
- Focus on **timescales** and **dependencies**, especially to identify recommendations that could be taken rapidly and within the current context of the assessment framework.
- Identifying and setting out further links between the recommendations in terms of forward dependencies.

A **Roadmap** has been produced to promote dissemination of the outcomes of this project, particularly to build engagement and uptake with actors in the sector who may not have been directly involved with the stakeholder engagement of this project.

3. Recommendations

3.1. Recommendation A: Improve communication and coordination within and between organisations to benefit the sector

Motivation: Resource limitations (see Recommendation G: Invest in additional resources across the sector) are a challenge across the sector. However, previous rounds of stakeholder engagement supported working 'smarter' to create opportunities to achieve change that could benefit actors across the industry. This included working to improve communication and transparency of information about how post-consent monitoring data and reporting are progressing through the consenting process, and engagement to support stakeholders in understanding the importance and value of uploading post-consent monitoring data in a timely manner. In previous rounds of stakeholder engagement, it was highlighted that it was important to find time and space for higher-level thinking about the overall purposes of PCM requirements and their implications for the understanding of the marine environment and the impacts of OWFs.

Specific recommendation	Timescales & actions	Roles & responsibilities	Constraints & dependencies	Priority & forward dependencies
A1: Engagement to support stakeholders in understanding the importance and value of uploading post-consent monitoring data in a timely manner	**Quick win:** could begin immediately and have immediate benefit	**Regulators, TCE/CES:** drive this forward and help facilitate; **OWEKH, ScotMER:** raise awareness across stakeholders; **all stakeholders, particularly developers, consultants, and contractors:** developers to instruct survey contractors and consultants to upload data (to confirm no commercial sensitivity and/or responsibility)	Recognising resource constraints within public sector and across the sector. UK government need policy to support the use of PCM data	Medium

Specific recommendation	Timescales & actions	Roles & responsibilities	Constraints & dependencies	Priority & forward dependencies
A2: Specific engagement with survey contractors, consultants and developers to increase awareness of dissemination mechanisms and MDE, in relation to using evidence from PCM over time, processes to utilise new evidence become more streamlined and accessible	**Quick win:** this can have immediate benefits	**Regulators, TCE/CES:** engage with stakeholders; **MDE team:** provide support**; OWEKH:** promote awareness to sector; **industry**: engage	F5	Medium
A3: Greater visibility for progress on reporting and discharge of monitoring reports by regulators to improve communications and provide more transparency for industry partners, academia, and other interested parties in relation to progress on review processes	**Tactical win**	**Regulators**: lead; **all stakeholders:** engage		Medium

Specific recommendation	Timescales & actions	Roles & responsibilities	Constraints & dependencies	Priority & forward dependencies
A4: Improved transparency of delivery of data and reports, along with quality checking and publication timelines, within data repositories handling PCM data. This will provide clarity for users and prospective users of the data around timelines for the availability of data and reports from PCM programmes	**Strategic win: in progress** possible under current assessment process but requires time to develop and implement	**TCE/CES:** lead; **regulators**: communicate timelines of reports; **industry:** liaise to provide relevant information on reports and data	Will take time to design and test for implementation and ensure it will be impactful. Requires refinement and engagement with stakeholders to improve usability and impact of the MDE TCE aspect of recommendation will be subject to further consideration of cost and resource requirement to successfully deliver Datasets can be embargoed for a specified period on the MDE due to quality checking processes A3	Medium

3.2. Recommendation B: Stakeholders across the industry establish greater clarity on governance and responsibility of post-consent monitoring data and reporting requirements

Motivation: Post-consent monitoring data have the potential to improve cumulative assessments by providing direct estimates of windfarm-related impacts at monitored sites. Data collected for PCM is also relevant for assessment tool inputs, updating estimates of the likely impact of the monitored projects, and validating assumptions made during the original assessment. Post-consent monitoring data also have potential to improve future project-based assessments through using information that has been pooled across projects (e.g. as a basis for updating SNCB guidance around assessments). PCM can be used to inform decisions regarding mitigation and compensation of the monitored project within the context of adaptive management as well as to inform and improve assessments. However, the focus of this project was to focus on the role of PCM data in strengthening and improving the assessment process itself, and working across UK administrations will be required to improve governance structures around PCM.

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
B1: Use *as built* parameters to update predicted impacts of individual projects that will be used to assess cumulative effects	**Quick win: work is in progress,** led by OWIC of an 'as built' register (OWIC, 2025) that will enable the use of as built parameters to update predicted impacts	**OWIC:** continue to progress work on as built register; **industry:** provide as built designs	Since 2022, Data Consent Orders (DCO) have had an as-built condition included. Options for amending Deemed Marine Licences (DML) to be amended are currently under consideration 'As built' designs can be commercially sensitive so these may be difficult to share openly	High
B2: PCM used to update (where possible) individual project impact assessments with *as monitored* impacts reflected in future in-combination/cumulative assessments	**Strategic win:** requires changes to current assessment process OWIC as-built register initiative already considering options to achieve this (OWIC, 2025)	**Regulators and SNCBs:** oversight; **OWIC:** contribute through as built register project of considering options to progress; **industry:** provide as built designs	Will require a long-term commitment from all stakeholders to ensure realised impacts are evidenced, agreed, disseminated and fed-back into cumulative assessments in a consistent manner Requires regulators, and SNCBs to approve PCM outputs for this purpose Monitored impacts can be difficult to ascertain B1, data (D3) and monitoring standards (E2, E3), and regional monitoring (I) would help to achieve this	High

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
B3: PCM outputs clearly linked with adaptive management within the same development, or in future wind farm assessments, through building the potential for adaptive management changes based on PCM into the DCO	**Strategic win:** will require changes to the assessment process	**Regulators:** oversight; **SNCBs:** liaise; **industry:** engage	Regulators, SNCBs, and industry need to agree on implications for specific projects H2	Medium
B4: Regulators and others develop a comprehensive overview about what monitoring reporting is due when	**Quick win:** enacting A3 would go some way to achieving this	**Regulators:** write overview**; OWEKH:** signpost and disseminate where information brought by those on the Oversight Group; **ScotMER:** disseminate (where needed)	Although management and monitoring plans are produced at a project level, there is not currently a comprehensive overview of when monitoring is taking place, due to inevitable delays for different reasons. Following a model similar to the Scottish RAGs, who publish minutes from regular meetings, there is a requirement for a UK-wide overview of a schedule of monitoring reports that are visible publicly Requires engagement from SNCBs to avoid duplication or wasted effort OWEKH facilitates regular review of evidence through the TTGs, where consensus is reached. This will be logged in an update to the Evidence Note which is then taken to the Oversight Group for publishing	Low

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
B5: Include reminders to upload data to the MDE in communications to developers regarding licence discharge and monitoring plan requirements	**Quick win: in progress** MMO have rolled this out since Feb-25, sending reminders to upload data to the MDE in relevant discharge letters	**Regulators:** implementation; **industry**: upload data to MDE (developers liaise with **contractors** and **TCE/CES** to upload data in appropriate format)	Datasets can be embargoed for a specified period on the MDE OWES propose pre-consent monitoring is uploaded within 6 months of consent being granted, so a similar duration could be appropriate here. The mechanism to implement this would need engagement and agreement	Medium

3.3. Recommendation C: Continue to improve and invest in data management frameworks, communicating this facility to stakeholders

Motivation: Data management frameworks (such as the MDE) need to be fit for purpose to move the sector forward. We recommend the development of a data management pipeline across the OWF lifecycle, which is not just applicable to PCM data. Providing oversight, developing, and implementing this pipeline is essential to facilitate many of the recommendations we are making, including recommendations relating to strategic governance, linking PCM outputs to adaptive management and using PCM to update future individual-based projects, and informing in-combination or cumulative assessments. All pooled analysis including long-term research goals are dependent on having access to FAIR (findable, accessible, interoperable, and reusable) data within a data management framework with appropriate capabilities. However, stakeholder engagement throughout the project has highlighted a disconnect between the expectation that this can be achieved quickly and highlighting that although progress is underway (TCE/CES, 2024) and can be made under the current assessment process, a significant amount of time and investment is required for tangible benefits to be realised.

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
C1: Continue to invest in the MDE, working to ensure it is fit for purpose as a data management framework for offshore renewables	**Tactical win:** Possible under current assessment process but requires significant long-term investment and time to implement	**TCE, CES:** responsible; **developers:** end users; **regulators, academics & researchers:** contributors and collaborators to help ensure data can be reused	Providing a more extensive search facility on the MDE would be of benefit. Digital Object identifier (DOI) capability would be an advantage TCE aspect of recommendation will be subject to further consideration of cost and resource requirement to successfully deliver	High
C2: Clear oversight of the data management pipeline across all OWFs	**Strategic win**	**Regulators, TCE, CES:** oversight; **all stakeholders:** liaise and provide input as appropriate	The MDE is the most likely framework to use for the pipeline development. Resources are required to provide oversight needed C1	Medium
C3: A pipeline for data management developed across the OWF lifecycle	**Strategic win:** Possible under current assessment process but requires specific ongoing resources to develop and implement	**Regulators, TCE, CES, industry:** Investment and develop pipeline	Each developer has existing internal processes that need to be considered Resources are required to develop the pipeline C2	Medium

3.4. Recommendation D: Develop FAIR data and data standards for PCM, working with developers to achieve this

Motivation: To enable data pooling, meta-analyses, and for insights to be transferable across space, time, and species, it is essential that data adhere to standards and are FAIR (findable, accessible, interoperable, and reusable; Wilkinson et al., 2016). Developers have their own processes of standardisation – however, these do not necessarily facilitate data that can be adequately pooled, and so collating and analysing data across multiple projects means that interoperability and reuse of data are challenging, as they are stored across different repositories, and in varying formats (e.g. challenges that have been demonstrated by the OWEC Planning Offshore Wind Strategic Environmental Impact Data and Information Network (POSEIDON) project). Recognising limitations that data already created often cannot be retrospectively made FAIR, there is a necessity to introduce data standards for new data that are being collected. Currently, there are international data standards agreed for Passive Acoustic Monitoring and standardisation has been suggested for bio-logging data (which includes tracking data often collected for seabirds; Sequeira et al., 2021). FAIR is a relatively well-known set of data principles but there are others such as TRUST (Transparency, Responsibility, User focus, Sustainability and Technology) that take further considerations into account and can be used in conjunction with FAIR. Standardised data can also be linked explicitly to the questions that the sector is trying to answer, which are what are the effects of offshore renewables on seabirds in terms of collision risk, displacement, and ultimately demographic population impacts? These critical questions can be better answered by facilitating data standardisation at different levels of data, such as raw, processed, interpolated, and gridded, and at different spatial and temporal scales to allow better opportunities for data pooling.

There are wider benefits to standardisation, which includes contributing to initiatives such as the Global Ocean Observing System, led by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), which aims to build a global ocean observing system by 2030 including physics, biochemistry, and biology and ecosystems. The Essential Ocean Variable Specification Sheet for Seabirds provides useful information for how data can be standardised to achieve ecological objectives (in this case providing information leading to knowledge of seabird abundance and distribution). The offshore renewables industry could develop similar data standards, using these specification sheets as a template. Given the MDE already uses Marine Environmental Data and Information Network (MEDIN) metadata, it links through to Ocean Data and Information System (ODIS), a metadata platform of UNESCO's Intergovernmental Oceanographic Commission, and therefore can leverage existing technical infrastructure and support.

TCE/CES have published "Marine Data Exchange Data Holding" which sets out the requirements and processes for providing and managing survey data, which serves as a guide to support the data clause in agreements (TCE/CES, 2025). MEDIN also use Data Standards for some types of marine data and the MDE ask for data to be compliant with MEDIN data guidelines where they exist (e.g. Joint Cetacean Data Programme (JCDP) guidance for marine mammals). A draft standard is currently being developed for Digital Aerial Survey (DAS) data, and the MDE will ask for DAS deliverables to be compliant with MEDIN DAS guidelines when this is published.

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
D1: MDE continue work with developers to ensure data are FAIR - data should be interoperable and reusable for pooled analyses	**Tactical win: in progress** Possible under current assessment process but requires significant long-term investment and time to implement MDE has already adopted the MEDIN metadata standard, to improve data holdings in line with Q-FAIR (i.e. including Quality with FAIR principles)	**TCE, CES:** responsible; **OWEKH**: Evidence notes aim to include templates for monitoring, where agreed standards would be signposted; **Developers:** end users; **regulators, researchers:** contributors and collaborators to help ensure data can and are reused	Developers have their own internal data management processes and so conforming to data standards may take time External data sources that may be useful to put on the MDE would also need help to conform to standards TCE/CES request that end products are compliant with MEDIN guidelines and have MEDIN metadata, but they have limited capacity to shape the FAIR-ness of data deliverables produced by contractors for developers Regulators could play a larger role here by requiring/suggesting data standards for survey types within monitoring plans, helping to ensure that the final deliverables FAIR from the start – D3	High
D2: Develop case studies of FAIR data principles in data collection leading to benefits for actors across the industry	**Quick win**	**Regulators, TCE, CES:** develop case studies; **industry:** provide data examples	TCE aspect of recommendation will be subject to further consideration of cost and resource requirement to successfully deliver	Low

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
D3: Develop data standards for key types of PCM data	**Tactical win:** Possible under current assessment process but requires time and resources to implement Data standards for DAS data are in progress	**Regulators:** develop data standards; **TCE/CES:** support process; **SNCBs, industry:** feed into process		Medium

3.5. Recommendation E: Develop best practice, industry standards or/and codes of conduct, producing guidance for technologies and methodologies in a timely manner

Motivation: Throughout previous rounds of stakeholder engagement, developing best-practice (Parker et al., 2022a; Parker et al., 2022b)and industry standards or codes of conduct was proposed as an opportunity to address some of the barriers in PCM. Work to address these barriers began at least 10 years ago with the Renewable UK Offshore Consenting and Licencing Group (OCLG) paper a *Proposed strategy for post-consent monitoring of offshore wind farms in England* (OCLG, 2015). The MMO have published a list of recommended standards for monitoring, although further work will need to be ongoing to ensure any gaps are filled appropriately (MMO, 2025a, 2025b).

The timely release of guidance for new approaches such as technologies and methods are essential for innovation and progress of the sector, and to ensure that the UK remains a world-leader in the renewables sector. Other countries such as Germany have taken a prescriptive approach to guidance around types of monitoring equipment (StUK4; BSH, 2013). From a data perspective, this is ideal as it ensures data collection protocols and methods are consistent, allowing for data pooling and facilitating transferable learnings. However, this could act as a barrier to innovation, leading to situations where more advanced methods are either underutilised or require extensive justification for use. In contrast, it seems reasonable that there is underlying guidance, and untested or emerging approaches go through testing and validation processes to ensure they are fit for purpose.

There can be a significant delay between the development of novel approaches and their incorporation into guidance. This lag can create a disconnect where end users are aware of more effective approaches but feel constrained by outdated guidance. To produce guidance on new approaches, SNCBs and regulators need

enough expertise to be able to appraise them appropriately. Therefore, training will be required to ensure clarity about the proposed approaches to produce new guidance and provide project-level guidance for monitoring plans. The inclusion of a mechanism or pathway for the rapid review and approval of new or alternative approaches that demonstrate equivalent or improved outcomes could be considered, perhaps using the evidence bridges approach (see Recommendation J) in the first instance.

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
E1: Define key monitoring questions at leasing stage for each campaign, so that specific guidance can be given	**Tactical win:** possible within current assessment process but may be dependent on resources	**SNCBs, regulators, industry:** collaborate; **TCE/CES** help align pre-consent phase monitoring with PCM	There are differences in both guidance and PCM data that are required to be collected across UK administrations Public sector resource may be an issue, particularly for smaller administrations	High
E2: Develop list of recommended standards for monitoring	**Quick win: in progress** MMO have recently published a set of standards (MMO, 2025a, 2025b)	**Regulators**: lead; **TCE/CES, SNCBs:** collaborate; **industry**: collaborate to follow standards	There are gaps in the list so further work to develop standards will be required	High
E3: New approaches that are becoming established (e.g. technology, data collection protocol, modelling and analysis) reflected in best practice guidance	**Tactical win:** can be achieved under the current assessment process but requires additional resources	**Regulators, SNCBs:** responsible for new guidance; **OWEKH:** TTGs to review new/novel approaches and evaluate for best practice; **industry:** liaise	OWEKH to facilitate regular reviews of new/novel approaches with best practice/guidance signposted on the hub per topic (which may be more frequent that standard regulatory review and provide interim agreed positions on new approaches, e.g. through Evidence Notes which will be live)	Medium

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
E4: Staff receive training about new developments and technologies to ensure clarity about proposed technologies presented in monitoring plans	**Quick win**	**Regulators, SNCBs**: receive training; **tool and methods developers:** give training and support	Will need to be ongoing. Stretched resources in the public sector could limit the ability to implement this recommendation. Complexity of AI based tools coupled with lack of transparency around training data sets and QA processes are a significant barrier to use	Medium

3.6. Recommendation F: Facilitate dissemination and translation of data into guidance through improved governance and better communication to stakeholders

With the continued expansion of the UK offshore wind industry and increasing uncertainty given the impacts of climate change (i.e. both physical impacts, such as stronger and more sustained extreme events, and knowledge impacts, such as uncertainty about how seabirds will respond to climatic changes), workshop participants discussed challenges in understanding baselines for evidence going forward. Decisions are made on the best-available data, but the uncertainty caused by factors such as climate change, along with increasing amounts of data and PCM reporting from OWFs already in operation or coming into operation, means that incorporating data and evidence into guidance will become more challenging in future.

The provision of advice needs consistency but also relies on precedence and must account for potentially unintended consequences of new evidence. These factors make the development of new guidance a complex task. New findings and evidence can sometimes create a push for change, but there is a distinction between adding to the body of evidence on which SNCBs *draw from* rather than such evidence *being* the body of evidence. Yet the challenge of UK-wide introduction of such findings was raised, given the different habitats (e.g. nesting sites of gannets) around the UK coastline, and hence transferability to different areas is still uncertain.

Both within the workshop and in previous rounds of stakeholder engagement, there was support for taking the opportunity to learn from others across the industry and internationally (see Recommendation I: Moving to a strategic monitoring approach to PCM is a long-term solution). Workshops bringing experts across the industry together such as the ScotMer/NatureScot workshop "Evidence to Guidance Workshop – Displacement of Seabirds", held 3 October 2024 and the ScotMER Symposium are considered important opportunities for understanding different perspectives on data and hearing directly from researchers. Such workshops are

felt to be a good way of collating views from different experts, but challenges arise when reporting or evidence raises more questions than it answers, and/or opens other doors of uncertainty. The role of the Offshore Wind Environmental Evidence Register (OWEER) identifies where evidence gaps have been addressed and where outstanding knowledge gaps remain (see Strategic Monitoring - Evidence gaps and ecological learnings). This will ensure that PCM remains focussed on key issues and guidance remains current. JNCC are currently undertaking such a review under the OWEER OWGRE project.

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
F1: Stakeholders develop annual evidence review programme. SNCBs and regulators work together to co-produce a regular schedule for evidence review across all parts of the UK	**Quick win**: JNCC currently undertaking review of OWEER in OWGRE project	**OWEKH or Defra, other UK administrations:** coordination**; SNCBs:** collaborate; **OWEER:** use latest version to identify where evidence gaps have closed and where outstanding knowledge gaps remain; **NGOs, academia, industry:** contributors	OWEKH has a UK wide remit, however Scottish Government are currently observers on the Oversight Group (level of participation is awaiting confirmation). Evidence Notes and TTGs include representation from whole of UK Subject to resource, OWEKH could facilitate reviews aligned to the TTGs and where consensus take forward to the Evidence Note for sign off from Oversight Group	High
F2: Produce lay summaries to clearly communicate findings, assumptions, limitations & confidence levels of research outputs (e.g. peer-reviewed publications) to help stakeholders assess relevance and transferability of findings to different contexts	**Quick win**	**SNCBs:** oversight; **researchers:** implementation	Requires clear guidance on how academic outputs can be integrated into the assessment process to be effective. Requires effective mechanism to ensure the information reaches the correct audience Requires resource for SNCBs and academic researchers	Medium

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
F3: Facilitate discussion of when evidence will be adopted through OWEKH TTGs (or alternative) and documented in Evidence Notes (or equivalent)	**Quick win: Currently underway** Interim mechanism would for Evidence Notes to be endorsed by the Oversight Group, which could be published for use in scoping/monitoring. Discussion can be facilitated at a UK-wide level using the TTG/OG framework (although not all topics are currently established) A longer-term mechanism is the potential for Evidence Notes to be formally referenced in National Policy Statements (NPS; applicable to England and Wales)	**OWEKH**: responsible; **SNCBs, regulators:** accountable; **all stakeholders:** participate	Not all UK administrations are currently part of OWEKH Oversight Group and consideration must be given for how these can be linked in. ScotMER can possibly play a part in linking with OWEKH This recommendation is dependent on the process of developing guidance to take up this evidence TCE aspect of recommendation will be subject to further consideration of cost and resource requirement to successfully deliver This will take time to complete across all receptors given the resource constraints across relevant organisations	Medium

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
F4: Develop further examples of how and where PCM reports have helped update advice, to provide clarity to industry and demonstrate how PCM findings can benefit the sector	**Quick win:** Examples are reported within the WP reports of this project (**Closing the Loop – Synthesis of evidence (D01)** report). Other studies would cover a wider range of contexts and situations	**SNCBs, regulators**: develop examples; **industry**: contributors	Resource constraints within SNCBs on time to develop examples	Medium
F5: OWEKH TTGs could provide some governance in terms of agreeing evidence suitability for closing evidence gaps and approving new technology for data collection	**Tactical win**: could be a quick win where signposting to already agreed outputs but would take longer to reach agreement on other subject areas as would require time to get consensus Disseminate information on PCM when papers and reporting become available. OWEKH will signpost relevant holding area of reports to avoid duplication	**OWEKH**: responsible; **SNCBs, regulators:** accountable; **all stakeholders:** participate	Evidence Bridges (J) could be one appropriate mechanism	Medium

3.7. Recommendation G: Invest in additional resources across the sector

Motivation: Resourcing is a challenge under the current context for actors across the industry (not just the public sector bodies), in terms of limited staffing resources, turnover of staff, and upskilling new staff. Specific challenges include having sufficient staffing and necessary expertise which directly impact the ability to overcome barriers and delays in the current assessment process, as well as challenges for creating more robust management frameworks and infrastructures. Unless addressed, resourcing issues will continue to constrain progress, given the rapid increase in offshore wind renewable energy anticipated from the UK Government Clean Power Action Plan to quadruple offshore wind by 2030 to 43-60GW.

Throughout rounds of stakeholder engagement, resourcing issues both in terms of time and investment were raised. Staffing resource is a constraint across the sector with public sector areas experiencing recruitment freezes and industry representatives emphasising that constraints applied in their context as well. Concern was raised that if multiple recommendations rely on SNCBs having much higher levels of staffing resource than is currently the case, a discussion needs to include *what should SNCBs stop doing* to accommodate any additional responsibilities. The enormous scope of areas of existing responsibility (covering the whole of the seabed and thus including responsibility for developments relating to e.g. cables, oil and gas, and pollution response, in addition to offshore renewables), was highlighted in relation to workloads, as well as the current operating context for many in the public sector. There has been emphasis that pre-consent casework is necessarily prioritised and that, in the current context, even if additional resourcing were made available, it would likely go towards meeting statutory deadlines in case management rather than data management roles. These roles and responsibilities were noted to require distinct skillsets and thus should not be considered interchangeable. Further, if platforms or spaces for effective review are created, finding time to participate in such initiatives on additional to existing responsibilities, was considered extremely challenging, or not feasible. Concern was expressed that, without further resourcing, progress would be limited.

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
G1: SNCBs, regulators and other organisations resourced to invest in new staff to meet demand of continued expansion of offshore wind, including the evaluation of evidence and updating guidance	**Tactical win**: does not require changes to assessment process but will require sustained long-term investment DESNZ and National Energy System Operator (NESO) to map out how much MW/offshore wind is required to help with planning	**Industry**: make case to government that SNCB and regulator resources should be made available; **Pathways to Growth (P2G):** advocate for this approach; **SNCBs and other organisations**: implementation		High

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
G2: SNCBs and other organisations resourced to sustainability invest in data managers, to help manage and facilitate access to and use of PCM data	**Tactical win:** does not require changes to assessment process but will require sustained long-term investment	**Central government:** investment; **industry**: make case to government that SNCB and regulator resources should be made available; **SNCBs and other organisations**: implementation		High

3.8. Recommendation H: Continue to invest in research and regional level monitoring to answer key questions around identified evidence gaps, moving the knowledge base forward

Motivation: Even with data standardisation and data availability, pooling data across projects is challenging due to the project-level nature of PCM data collection in the UK. Comparability of data across different studies (including practical constraints such as timing of data collection, seasonality, location-specific focus on different species, location in relation to nesting habitats etc) mean there will always be inconsistences when pooling data across projects. Both the workshop and previous rounds of stakeholder engagement cited studies from other countries, where pooled analysis is feasible (e.g. Peschko et al., 2024), and many of the recommendations we are making here are designed to help facilitate pooled analysis of data within the UK. Getting access to and collating data from across the industry is currently challenging. The recommendations set out here around collaboration, continuing to support the MDE to be fit for purpose, setting data standards and making data FAIR will all contribute to making this task more feasible. Projects such as OWEC POSEIDON and ORJIP Improving understanding of distributional change for relevant seabird species (ImpUDis) have begun to collate and aggregate disparate datasets for pooled and meta-analyses for multi-taxa distributional and seabird displacement insights respectively.

Examples of regional monitoring already in practice, such as the North East, East Developers Ornithology Group (NEEOG), were highlighted as effective, industry-led models. NEEOG partners have pooled resources for initiatives like digital aerial surveys and seabird tagging, expanding monitoring efforts beyond what is typically achievable at the project level. Their collaboration with SNCBs and regulators has allowed them to fulfil individual licencing requirements while contributing to broader regional monitoring goals. Similarly, the Regional Advisory Group (RAG) model implemented in Scotland was noted as an example of good practice of an industry-led initiative for developers to work together for mutual benefit, while enabling a more strategic approach to be adopted. Therefore, there is the potential for developer collaborations to achieve monitoring at a wider level (whilst still complying with project-level licencing requirements), rather than

necessarily being government-led initiatives. Another example of a regional approach is the pre-consent surveys undertaken for Round 5 led by TCE. Regional monitoring could be considered a form of strategic monitoring or an alternative to single project-based monitoring, offering quality data and funding efficiencies, with better opportunities for joint analyses and more transferable findings. Further, given the scale of investment in monitoring and research, we stress the value of modest investment (compared to costs associated with collecting data and synthesising evidence) in support of Recommendation G (above).

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
H1: Continue to invest in strategic research projects to undertake relevant pooled data or meta-analysis, filling key evidence gaps	**Strategic win:** possible under current assessment process	**Government (e.g. ScotMER), industry (e.g. ORJIP), OWEC:** investment; **researchers:** undertake research; **SNCBs:** evaluate research to incorporate into evidence; **sector** needs to drive ministers to support this	Financial and staff resource required to support this Effective pooled analysis requires data standardisation as well as data availability and accessibility	High
H2: Consolidate data across multiple projects, contributing to strong opportunities for collation of regional or meta-analysis projects	**Tactical win:** can be done now but will take time to consolidate data Data from other countries could also be investigated for collation	**Government, SNCBs, industry:** oversight and investment; **researchers:** implement	ORJIP PrediCtOr (Prevalence of Seabird Species and Collision Events in Offshore Wind Farms) - challenges with organisations needing to 'opt-in' to sharing data and data access rights unclear in places like MDE Requires FAIR data that are formalised and in place and can be shared, along with robust data management frameworks Dependent on H1	High

Specific recommendation	Timescales and actions	Roles and responsibilities	Constraints & dependencies	Priority & forward dependencies
H3: Consider other data collection for PCM (e.g. tracking, radar, rangefinder), ensuring collision risk & sub-lethal effects can be quantified & linked to population consequences at a more strategic level	**Tactical win:** possible under current assessment process	**Regulators, SNCBs:** oversight; **industry:** coordination & monitoring; **researchers**: input into methodologies	How and which data are collected at a project-level depends on specific issues linked to original PCM requirements, i.e. those identified from the HRA assessment. However, where regional monitoring is undertaken, additional data collection could be required, to fulfil wider monitoring objectives	Medium

3.9. Recommendation I: Moving to a strategic monitoring approach to PCM is a long-term solution

In the workshop and throughout the stakeholder engagement in this project, a more strategic monitoring approach to PCM, combined with project-level monitoring that will always be required, has received widespread support so that the impacts of offshore wind farms can be better understood. Such an approach would mitigate some of the issues arising from the current approach of project-level studies. A strategic approach would enable more effective allocation of resources to issues like collision risk and cumulative effects. However, for strategic monitoring to be feasible, significant changes to current governance frameworks would be required, including greater flexibility and policy support, while still enabling developers to meet existing licencing conditions.

It is beyond the scope of this project to define what strategic monitoring should look like. However, in the workshop we asked participants about considerations they would like to see in forming a strategic monitoring approach. Overall, participants agreed that while strategic PCM offers significant benefits, its success hinges on shared definitions, clear governance structures, and active collaboration among developers, regulators, and conservation bodies.

Important work has already been undertaken in this area that seems not to have led to change but could be revisited. For example, the Renewable UK OCLG (Offshore Consenting and Licencing Group) published a discussion paper *Strategic ornithological post-consent monitoring plan* (OCLG, 2017). The workshop highlighted a need to clearly define the benefits of strategic monitoring across all stakeholders to facilitate engagement, and co-developing a process with stakeholders across the sector would allow a system to be designed to focus on issues that have the greatest benefit. DEFRA is currently leading a Strategic Monitoring initiative that is due for release imminently.

There was also a call for clearer definitions of *strategic monitoring* as interpretations vary. Ensuring clarity around responsibilities, particularly the role of developers within their regions of interest, was seen as essential.

3.9.1. Funding considerations

There was widespread support for a more strategic approach to PCM data, but recognition that any change in approach would have to be appropriately funded. Additionally, clarity about how a strategic approach would interact with project-level consent conditions would be necessary, including clear levels of accountability and responsibility between project-level and strategic monitoring requirements, and how those could be coordinated and delivered. While it was felt that a more strategic approach to post-consent monitoring would offer greater certainty to the sector, any system that adds additional financial cost on developers was considered unlikely to gain support from the industry.

PCM needs to link with Strategic Compensation monitoring work to ensure its effectiveness but not duplicate it. There were calls to ensure that any funding mechanism proposed would not duplicate the Marine Recovery Fund (MRF) work, but that a system for PCM would also take time to commission, work with delivery partners, and develop standardised/agreed monitoring protocols. Concern was raised of how strategic studies would be funded and conducted when projects are consented and 'join' at irregular intervals. There are practical considerations when monitoring spans multiple projects due to timing in consent and construction that may vary between individual projects due to a range of issues including grid connection, supply chain, and construction vessels, even where neighbouring projects have been

leased in the same round. However, there was general agreement that regional monitoring examples (see Recommendation H: Continue to invest in research and regional level monitoring to answer key questions around identified evidence gaps, moving the knowledge base forward) could be considered a form of strategic monitoring, and this model has proven to be successful.

3.9.2. Learning from, and collaborating with countries on strategic monitoring

Participants emphasised the importance of learning from approaches adopted internationally. Examples included the implementation of long-term monitoring systems, similar to the Dutch model, where the efficacy of mitigation measures is continually assessed, and findings are used to inform future development. The German approach was also highlighted, notably its more prescriptive requirements under the Standard for Environmental Impact Assessment (StUK4; BSH, 2013), which include expectations around specific types of monitoring equipment such as cameras and radar (also reflected in the ORJIP PrediCtOr project). It was highlighted that although it is important to ensure clarity and reliability through guidance, there needs to be a balance to ensure innovation and new approaches can be developed. To ensure continued advancement, guidance should remain flexible and allow for the integration of novel and emerging technologies and methods. In some countries, lease areas are pre-surveyed for baseline data, while a higher emphasis is placed on PCM to deliver outcomes that benefit the entire sector. There was support for considering international data and modelled outputs, especially when investigating key questions such as impacts during the non-breeding season (see Recommendation H2). Participants noted the value of aligning with other countries in understanding population and colony dynamics at appropriate spatial scales.

3.9.3. Policy and regulatory considerations including licence conditions

Implementing strategic monitoring will require substantial flexibility within the current governance framework, including a wholesale shift in the rationale for undertaking monitoring. This transition requires support through the creation of appropriate policy environments and may need significant changes to existing processes and regulatory approaches (DEFRA is currently completing work on a broader strategic monitoring approach). Strategic monitoring should be developed in a way that aligns with consent conditions so that developers can meet their existing project-specific licensing conditions while also realising the broader benefits of a more integrated, strategic approach. Given the financial constraints on many projects, any strategic monitoring approach should avoid becoming a 'shopping list' of requirements but should instead seek to replace or integrate existing consent conditions.

Participants emphasised the value of standardising data collection, which can provide greater insight and added value at a broader scale. This consideration needs to be balanced with the core objectives of project-level monitoring to address specific local environmental issues, which are required to fulfil certain licensing conditions. To manage these dynamics effectively, contractual frameworks could be considered to accommodate differing project timelines and commitments. Flexibility in how conditions are discharged, such as where monitoring equipment is deployed across multiple sites (as is done across the Scottish RAGs) could be an effective mechanism to manage potential misalignments in project timelines or site-specific delays. A flexible regulatory approach, including the ability to amend licence conditions, could streamline the implementation of strategic monitoring and facilitate insights from future sites to be applied retroactively to existing developments, for example, in instances where licence conditions may not allow for adaptive management. However, review of consent is a specific process and so any changes to consent conditions would have to be negotiated with developers, which may make this approach

infeasible. Overall, successful implementation of strategic monitoring hinges on a coordinated effort to embed flexibility, maintain regulatory coherence, and optimise the value of collected data.

3.9.4. Evidence gaps and ecological learnings

To strengthen the evidence base for understanding offshore wind impacts, moving from PCM at a project level that only addresses project-specific issues and uncertainties, to more statistically viable strategic studies across multiple projects, will help solve the fragmented data collection that currently inhibits pooled/meta-analysis in the UK.

Strategic monitoring can start to address the priority evidence gaps that have been identified, with developers encouraged to contribute data that are potentially already being collected under existing PCM agreements. However, a current barrier to data pooling is transparency and issues of site-specific confidentiality, so a starting point could be agreement of wider metadata or parameters among developers. Existing forums such as OWEKH and ScotMER, and the OWEER initiative have broad stakeholder membership and engagement across the sector. These may be effective mechanisms for clear alignment between regulators, SNCBs, and other stakeholders on the evidence needed to effectively 'move the needle' to address prioritised knowledge gaps.

Concern was raised about possible 'fragmentation' of research, and therefore a UK-wide overview of research priorities, including location-specific recommendations could be fed into a framework that can regularly update and refine evidence gaps based on learnings from strategic monitoring, utilising the current OWEER framework (Mogensen et al., 2022; TCE & JNCC, 2025) along with the OWEER Evidence Gap Analysis and Reprioritisation (OWGRE) project that JNCC are undertaking, which is identifying evidence gaps that have been partly or fully addressed. This could enable research needs to be fed through to project PCM requirements so that research could be undertaken in different areas (e.g. the effect of artificial light on Manx Shearwater *Puffinus puffinus* has been raised as a concern in the North Sea but could be investigated in the Celtic Sea).

A strategic approach offers the potential to improve understanding of key issues, particularly if monitoring can take place at biological scales to reflect the realities of population movement and distribution, which often extend beyond individual project boundaries. Monitoring over longer timescales could allow for better understanding of how impacts change over time such as habituation, as well as integrating research from other environmental pressures like fisheries and climate change. Strategic monitoring should evolve alongside scientific and technological advances. Participants highlighted that the lag between as-predicted and PCM has sometimes meant that changes or improvement in technology or methods have made it difficult to link back into the assessment process.

3.10. Recommendation J: Use an evidence bridge approach as a mechanism for evaluating evidence into guidance

The evidence base for seabirds is increasing quickly, but there is no structured process for meta-analysis of the evidence. With increasing numbers of developments that require consent and the assessments that entails, *how do we streamline consenting in an evidence-based manner over the next 10 years*? To do so, it is critical that guidance is reviewed in a timely manner, and as a sector, we formally assess the current state of evidence that is being generated. There are key questions where evidence is sometimes contradictory, or the transferability context or limitations are difficult to understand. The evidence bridges approach, developed using a marine mammal case study, offers a way to tackle these obstacles through

a practical approach of systematically reviewing evidence - both existing evidence and when new studies are released that add to the evidence base.

Participants were introduced to the 'evidence bridges' approach, using the marine mammal case study, as a viable way to work collaboratively to assess evidence that has been gathered, and help the transition from the evidence base to decision-making. This approach is considered a transparent, repeatable and generalised process, but does require confidence and buy-in from stakeholders, as well as a time and resource requirement to be implemented. We have included an executive summary of the case study report, so that readers can understand the context given to the workshop participants.

3.10.1. Executive summary of D08 Evidence Bridges - Marine mammal case study report

Please refer to the WP4 report **Closing the Loop – Evidence Bridges: Marine mammal case study (D08)** for full details. Below is a summary of the findings and recommendations.

Introduction

The focus of WP4 was to develop and demonstrate an a swift, transparent and auditable mechanism to facilitate evidence transfer and uptake. This 'evidence bridges' approach was developed using a marine mammal case study, seeking to develop and test a process to bridge the gap between research and decision making, to help ensure the effective translation of evidence to decision making. This framework is designed to assist decision makers (with the potential to also support how we can close the loop at a broader scale).

In the context of offshore wind consenting processes, there is a drive to ensure that the evidence base is up to date, fit for purpose and that it feeds back into the assessment process and decision making. The collection of data for marine mammals, birds and other taxa is expensive and time consuming and therefore the absence of this feedback loop is indicative of a missed opportunity, a waste of resources and can delay consent decisions and erode confidence in processes. Therefore, there is a requirement for a mechanism that can promote the uptake of evidence into decision making processes (particularly as it relates to consenting decisions for offshore wind) to drive a virtuous cycle.

The evidence bridges approach (for marine mammals)

Evidence bridges can provide an appropriate approach to ensure that science can be translated into decision making, evidence bridges have the following steps (sensu Sutherland, 2022),which can apply to any taxa or domain:

ASK: The first step is to establish the need for review of a given topic or scenario or assumption. For example, the effect of disturbance on harbour porpoises or the collision risk probability of an animal with a turbine**.** This step requires working with stakeholders to identify and refine review question both to identify the variables that affect transferability / applicability of studies and consider characteristics that can be assessed via review.

ASSEMBLE: Collate the evidence from peer reviewed and grey literature to assess the agreed question.

APPRAISE: Carry out rapid reviews of the evidence base (Collins et al. (2015) by trained expert group and utilise a 'Weight of Evidence' (WoE) approach (see Christie et al., 2023; Figure 1).

APPLY: Preparation of a short briefing note on the current state of the evidence and where the weight of evidence lies for a given topic (i.e. whether there is evidence to support or refute a particular position or statement).

By assessing both the weight and distribution of evidence can also help highlight the evidence gaps that challenge this process. These evidence gaps therefore would become the highest priority gaps to be filled.

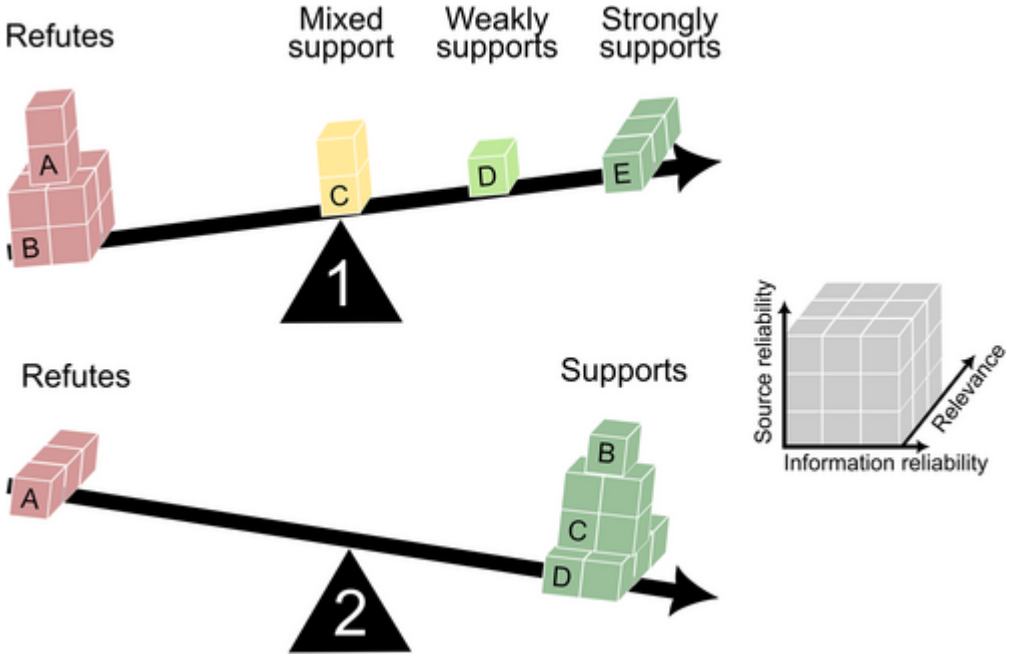

Figure 1 - Reproduced from Christie et al. 2023: "A diagram illustrating the Balance Evidence Assessment Method (BEAM), an intuitive way to visualise weighing different pieces of evidence supporting or refuting an assumption. Note that if the relevance or reliability of a piece of evidence is zero, then the block of evidence has no weight and disappears. Balance 1 shows an assumption that can be assessed by five different pieces of evidence (A)–(E) of varying weights (shown by their size) that can support or refute an assumption on an ordinal scale. Balance 2 shows a situation where an assumption can be assessed by four different pieces of evidence (A)–(D) that can only either support or refute an assumption (in a binary manner). In many situations, Balance 1 (using an ordinal scale for support) is most likely to be appropriate."

Conclusions

We developed and tested a process that appears fit for purpose to deliver evidence bridges, aiding decision makers and closing the loop between the generation and uptake of evidence.

We demonstrated how per evidence gaps can be addressed with this kind of dedicated and focused process – which addresses targeted questions or statements and provides, as an output, clear and decisive take-home messages to aid decision makers. This kind of process likely works best with targeted statements or questions - a narrow focus means it is best suited to underpin key elements of position statements. A benefit of this approach is that it can be repeated or expanded relatively easily (e.g. asking participants to review and new paper or report and re-running an existing analysis).

In situations where a broader understanding of the state of knowledge is required, broader reviews can help provide a narrative on a topic area, potentially helping identify where to collect new data (using targeted studies), or carry out meta-analyses (if extensive datasets exist. e.g. to estimate Effective

Deterrent Ranges (EDRs) in porpoises). This study has generated a transparent, repeatable and generalised process with a marine mammal case study – but can be utilised on a wide range of taxa or topic areas.

Critically this process requires dedicated funding and resourcing as time is a critical limitation. However, the investment required to build evidence bridges in this manner is very modest to the investment in collection of new evidence, which historically, has had no mechanism to incorporate this into decision-making.

Recommendations

Following on from the trial conducted for marine mammals, we recommend the following:

- The evidence bridges process is further developed and refined to ensure confidence and buy-in from stakeholders. This development could include codifying approaches for the collation and synthesis of evidence and updating outputs to ensure the outputs are appropriate for use by decision makers or their advisors.
- The process detailed here is tested on another taxa (e.g. birds) and/or different issues to confirm its broader utility and feasibility.
- Given that time and resourcing have been identified as the biggest barrier to success, it is prudent that investment is set aside to fully resource an evidence bridges process to support decision makers and research funding mechanisms over the next decade.
- This continued development should include dedicated training to develop a cadre of experts to assess the evidence. By training a cadre of experts for each taxon (e.g. a marine mammal group, an ornithology group etc), it is possible draw down on a smaller group of experts for any specific topic within taxonomic groups.
- A logical avenue to advance this topic would be via engagement with the Offshore Wind Evidence and Change (OWEC) Programme, Offshore Wind Evidence Knowledge Hub (OWEKH) and Offshore Wind Industry Council (OWIC) roadmaps and the many industry stakeholder groups and programmes.

3.10.2. Assessing whether the evidence bridges approach is viable for seabirds

Evidence bridges can be used in a seabird or any other context where a position is sought as to whether the evidence is 'for or against' a statement. There are well established expert elicitation methods (e.g. the Sheffield Elicitation Framework) that can be employed to quantify the scale of effect, rates, input parameters for models. Such methods yield a probabilistic distribution (where the mean, median and associated uncertainty can be considered). Workshop participants were asked whether they considered the evidence bridges approach to be a viable mechanism to apply to seabirds, and if so, the considerations that may be needed to implement this approach.

- Participants expressed support that there is potential for this approach to be adopted for seabirds.

- The use of different methods in relation to seabirds means that some evidence seems to indicate contradictory findings. This was also identified in the marine mammal case study (and is expected to be the case in most assessments of evidence). The value of the evidence bridges approach is that it allows decision makers to see the balance of evidence for and against a specific matter. This helps to consider which pieces of evidence are more representative and

therefore provide a better understanding of some of the differences that are identified in seabird studies. Evidence or data coming from different sources or survey modalities can be included in the evidence bridges approach.

- There was a proposal to 'review' project outputs in a manner of the evidence weighting approach presented.
- Participants suggested that the evidence bridges approach could clarify decisions where evidence is lacking or there are contradictory pieces of evidence, offering transparency to stakeholders on the rationale for taking a certain position.
- A driver of the use of the evidence bridges approach is that there is increasing levels of evidence. However, there is a lack of opportunity due to insufficient resources to assess the evidence collectively to understand situations (e.g. when assessing baselines), (Recommendation G).
- It would be helpful to understand, for example, which piece of guidance is potentially out of date, or whether there are key areas that could be developed into a question to be assessed or challenged. An example that could be refined for using the evidence bridge approach is that multiple questions could be posed about displacement rates of different species.
- Evidence bridges can be applied to PCM if desired but can also be used for evidence coming from any source (i.e. the approach is not limited to PCM).
- It was felt that this approach creates an opportunity to formalise interactions with other stakeholders.

4. Roadmap

Closing the Loop - Roadmap

Quick win | Tactical win | Strategic win | High priority

A. Improve communication and coordination within and between organisations to benefit the sector	A1: Engagement to support stakeholders in understanding the importance and value of uploading post-consent monitoring data in a timely manner	A2: Specific engagement with survey contractors, consultants and developers to increase awareness of dissemination mechanisms and data management frameworks (e.g. Marine Data Exchange (MDE)) – in relation to using evidence from PCM, over time processes to utilise new evidence become more streamlined and accessible.	A3: Greater visibility for progress on reporting and discharge of monitoring reports by regulators to improve communications and provide more transparency for industry partners, academia, and other interested parties in relation to progress on review processes.	A4: Improved transparency of delivery of data and reports, along with quality checking and publication timelines, within data repositories handling PCM data. This will provide clarity for users and prospective users of the data around timelines for the availability of data and reports from PCM programmes.	
B. Stakeholders across the industry establish greater clarity on governance and responsibility of post-consent monitoring data and reporting requirements	B1: Use as built parameters to update predicted impacts of individual projects, that will be used to assess cumulative effects	B2: PCM used to update (where possible) individual project impact assessments with as monitored impacts reflected in future in-combination/cumulative assessments.	B3: PCM outputs clearly linked with adaptive management within the same development, or in future wind farm assessments, through building the potential for adaptive management changes based on PCM into the DCO	B4: Regulators and others develop a comprehensive overview about what monitoring reporting is due when	B5: Include reminders to upload data to the MDE in communications to developers regarding licence discharge and monitoring plan requirements
C. Continue to improve and invest in data management frameworks, communicating this facility to stakeholders	C1: Continue to invest in the MDE, working to ensure it is fit for purpose as a data management framework for offshore renewables	C2: Clear oversight of the data management pipeline across all OWFs	C3: A pipeline for data management developed across the OWF lifecycle		
D. Develop FAIR data and data standards for PCM, working with developers to achieve this	D1: MDE continue work with developers to ensure data are FAIR - data should be interoperable and reusable for pooled analyses	D2: Develop case studies of FAIR data principles in data collection leading to benefits for actors across the industry	D3: Develop data standards for key types of PCM data		
E. Develop best practice, industry standards or/and codes of conduct, producing guidance for technologies and methodologies in a timely manner	E1: Define key monitoring questions at leasing stage for each campaign, so that specific guidance can be given	E2: Develop list of recommended standards for monitoring	E3: New approaches that are becoming established (e.g. technology, data collection protocol, modelling and analysis) reflected in best practice guidance	E4: Staff receive training about new developments and technologies to ensure clarity about proposed technologies presented in monitoring plans	
F. Facilitate dissemination and translation of data into guidance through improved governance and better communication to stakeholders	F1: Stakeholders develop annual evidence review programme. SNCBs and regulators work together to co-produce a regular schedule for evidence review across all parts of the UK	F2: Produce lay summaries to clearly communicate findings, assumptions, limitations & confidence levels of research outputs (e.g. peer-reviewed publications) to help stakeholders assess relevance and transferability of findings to different contexts	F3: Facilitate discussion of when evidence will be adopted through Technical Topic Groups and documented in Evidence Notes	F4: Develop further examples of how and where PCM reports have helped update advice, to provide clarity to industry and demonstrate how PCM findings can benefit the sector	F5: OWEKH Technical Topic groups could provide some governance in terms of agreeing evidence suitability for closing evidence gaps & approving new technology for data collection
G. Invest in additional resources across the sector	G1: SNCBs, regulators and other organisations resourced to invest in new staff to meet demand of continued expansion of offshore wind, including the evaluation of evidence and updating guidance	G2: SNCBs and other organisations resourced to sustainability invest in data managers, to help manage and facilitate access to and use of PCM data			
H. Continue to invest in research and regional level monitoring to answer key questions around identified evidence gaps, moving the knowledge base forward	H1: Continue to invest in strategic research projects to undertake relevant pooled data or meta-analysis, filling key evidence gaps	H2: Consolidate data across multiple projects, contributing to strong opportunities for collation of regional or meta-analysis projects	H3: Consider other data collection for PCM (e.g. tracking, radar, rangefinder), ensuring collision risk & sub-lethal effects can be quantified & linked to population consequences at a more strategic level		
I. Moving to a strategic monitoring approach to PCM is a long-term solution	**J. Use an evidence bridge approach as a mechanism for evaluating evidence into guidance**				

5. Conclusions

Work to address barriers in PCM began at least 10 years ago with the Renewable UK Offshore Consenting and Licencing Group (OCLG) paper a *Proposed strategy for post-consent monitoring of offshore wind farms in England* (OCLG, 2015). However, progress has been limited. Recently this issue has begun to be addressed more formally, and this project, along with a broader strategic monitoring approach being developed by DEFRA, and a project led by the MMO on guidance for offshore wind developers on post-consent monitoring standards (MMO, 2025a, 2025b) are a suite of initiatives to comprehensively address barriers in PCM.

There are recognised resource limitations across the industry, which are not specifically in the context of PCM. For large-scale change to effectively address the challenge of increasing numbers of developments that require decisions around consent, a rising body of evidence that needs to be reviewed, and data challenges around management and standardisation, these resource limitations must be addressed. However, solely focusing on more resources will not solve the challenges around PCM data either and we have sought to make recommendations that can use pathways to impact which are not reliant on large amounts of additional resources being in place. Making efficiencies in working practice (i.e. working 'smarter') through improving communication and coordination (Recommendation A: Improve communication and coordination within and between organisations to benefit the sector) and streamlining processes (Recommendation J) are also essential to ensure PCM data are fully utilised within the assessment process.

Throughout the stakeholder engagement process, there was low support for using legislative tools, such as statutory instruments from the Energy Act (2023), as a mechanism to force the improved use of PCM data. In general, there was feedback that collaborative working between regulators, SNCBs, and developers was preferential to implementing solutions around legislative tools such as marine licencing and site leasing. Improving communication to facilitate collaborative working was reflected more broadly (Recommendation A: Improve communication and coordination within and between organisations to benefit the sector) and directly through B5 for regulators to send reminders to developers to upload data to the MDE in their communications around discharge of licensing – the MMO introduced this recommendation in Feb-25.

Throughout the stakeholder engagement process, there was clear support to value PCM data that have already been collected, so that these data can be analysed, pooling across projects to for maximum insight. To achieve this, issues that could be addressed are (1) that only a small amount of PCM data that have been collected is available on the MDE. For various reasons, much of it remains on other repositories. The project reported this finding in the **Closing the Loop – Synthesis of evidence (D01)** report, Table 3. It would benefit the sector enormously if outstanding data could be uploaded and analysed appropriately; (2) pooling data that do not adhere to FAIR principles or use vastly different data collection protocols are difficult to analyse consistently. This does not mean it is unachievable, but the data use would be more limited. The recommendations we have set out, particularly those around data standards, monitoring standards, data management frameworks (MDE), and a regional approach to monitoring set out to form practical solutions to address these issues going forward.

Learning from other countries such as Germany, where the approach to standardisation and best practice is prescriptive has positives and negatives - strong guidance and compliance to best practice enables effective data pooling for analysis. However, fundamental differences in the UK approach to the

consenting process means that following this model is unlikely to be feasible. Recommendations arising from stakeholder engagement around take-up and guidance of new approaches (E3, E4) also suggest little support for this level of prescription.

Moving to a strategic monitoring approach in conjunction with project-level monitoring had strong support throughout rounds of stakeholder engagement. Stakeholders recognise the potential to improve understanding of offshore wind farm impacts and address cumulative effects more effectively. Participants emphasised the need for clear definitions, governance structures, funding mechanisms, and stakeholder collaboration. Strategic PCM must complement, not duplicate, existing efforts like mitigation or compensation monitoring and fit within current licensing frameworks. Questions were raised around funding, data sharing, and aligning timelines across projects. In particular, there was a call not to duplicate work undertaken setting up the Marine Recovery Fund. There was a strong view that regional monitoring, as has been undertaken by NEEOG and Scottish RAGs, have largely been successful models and were seen as viable starting points for developing strategic monitoring.

Workshop participants supported the potential use of the evidence bridges approach for seabirds, recognising its value in synthesising and evaluating evidence, which could be particularly useful to streamline the inclusion of new evidence. They noted that the approach could help clarify decisions and provide transparency around the rationale for specific positions, especially when evidence is limited or conflicting. Participants highlighted that it allows integration of diverse data sources and survey methods and could support reviews of guidance or project outputs. The growing volume of seabird evidence requires structured evaluation methods like evidence bridges, despite current resource limitations. This approach could also formalise stakeholder engagement and is applicable beyond PCM.

Finally, the roadmap has been designed as a dissemination tool to promote uptake of the recommendations to a wide range of stakeholders and begin discussions around implementing the recommendations from this project.

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Appendix: Stakeholder workshop

Introduction

The project undertook a range of activities including two previous rounds of stakeholder engagement to understand the barriers around integrating post-consent monitoring data back into the assessment process, to produce a set of potential solutions (**Closing the Loop – Synthesis of Evidence (D01)**). During the focused feedback workshop, and through Steering Group and Expert Panel feedback, these potential solutions were assessed for feasibility (**Closing the Loop – Summary report of focused group workshop (D04b)**) Discussions with stakeholders highlighted the need to produce more case studies where PCM has informed guidance, have better coordination and 'smarter' working, as well as sustained investment in strategic research and data management platforms such as the Marine Data Exchange. Industry-wide staffing and resourcing constraints, particularly in the public sector, that hinder the ability to implement proposed solutions, manage increasing data volumes and participate in initiatives like OWEKH need to be addressed. Solutions of applying FAIR data principles and enhancing communication and transparency are required and need to be flexible, with collaborative approaches preferred over rigid licensing conditions. Differences across UK administrations and technical inconsistencies limit the applicability of some findings, emphasising the need for adaptable, strategic, and well-resourced solutions.

The third stage of stakeholder engagement within the project was a workshop with a broader set of stakeholders from across the offshore wind industry. The workshop participants were asked to feedback on possible solutions in specific ways. The feedback from this workshop has been used to refine and finalise the set of recommendations and develop a high-level roadmap, outlining key measures and priorities to ensure the effectiveness of the use of post-consent monitoring data within future decision-making.

This appendix summarises the activities and outcomes of the stakeholder workshop. The workshop was divided into a series of interactive activities based around evaluating possible solutions, identifying gaps and limitations, providing feedback on broader solutions of strategic monitoring and 'evidence bridges', and finally providing input into pathways to impact for the project.

Stakeholder workshop approach

The final stakeholder workshop was devised to gain input and feedback from a range of actors across the sector to inform project recommendations and roadmap from the 'Closing the Loop' project.

A wide range of stakeholders were invited to participate in a 2-hour online workshop in June 2025. Invitees included individuals who had participated in previous rounds of stakeholder engagement (semi-structured interviews and a focused group workshop) were invited as well as a broader set of organisations from across the offshore renewable sector and across UK administrations, including the project team, oversight organisations, regulators, SNCBs, government, ministerial departments, consultants, developers, academics and research institutes, and NGOs. A total of 43 participants attended, representing 25 organisations (Appendix a).

Prior to beginning stakeholder engagement, the research proposal was reviewed by the Research Ethics Committee of the James Hutton Institute (reference: JHI-HRE-0261) to ensure the workshop would be conducted in line with good practice ethical research guidelines and the workshop was carried out in line with the ESRC's research ethics guidance for social research. Potential participants were sent an information sheet (Appendix b) and prior to the workshop commencing, each participant was asked to sign a consent form (Appendix c). The workshop participants agreed that 'Chatham House Rules' applied to the discussions, meaning that the topics of conversations can be discussed externally, but not attributed to individual participants.

The objectives of the final stakeholder workshop were to briefly present some of the possible solutions being discussed for 'Closing the Loop' of post-consent monitoring data, and feed into the development of recommendations and a roadmap from the project, including:

1. Evaluate the proposed solutions put forward through a series of exercises to label **roles & responsibilities**, **identify dependencies**, **map timelines**, and **prioritise** solutions in terms of importance to the success of the sector.
2. Identify any **gaps** that have not been addressed by the process or **limitations** that should be recognised when forming recommendations.
3. Identify whether the **evidence bridges** approach, which has been used for the marine mammal component of this project, could also be used for seabirds as a potential complementary approach.
4. Provide input into **pathways for impact** to facilitate project legacy.

The workshop adopted a participatory approach facilitated by members of the project team using Miro boards to evaluate the proposed solutions (Objective 1), with free discussion to identify gaps and limitations (Objective 2), evidence bridges (Objective 3), and pathways to impact (Objective 4). Information was captured on the Miro boards, and the workshop was recorded on MS Teams.

Stakeholder workshop results

The workshop began with an introduction and overview of the project by the research team, highlighting the aims of the project, the workshop objectives, and details of how the outputs from the workshop, in the

form of Miro boards, discussion, and additional written feedback, would inform the project recommendations and roadmap in the final report.

Miro boards were set up for the interactive activities (Figure 2). Possible solutions were grouped into themes (Procedural, policy & governance, Data & data management, and Dissemination & translating data to guidance). The workshop was split into seven activities, of which the first four were focused on the evaluation of (1) identifying **roles & responsibilities**, (2) **dependencies**, (3) mapping **timelines** for proposed solutions, and (4) identifying **priorities** (ranking importance). The final three activities focused on discussion of (5) **strategic monitoring** as a proposed solution, (6) whether **evidence bridges** could be a complementary approach useful to assessing evidence for seabirds, and (7) **pathways to impact**.

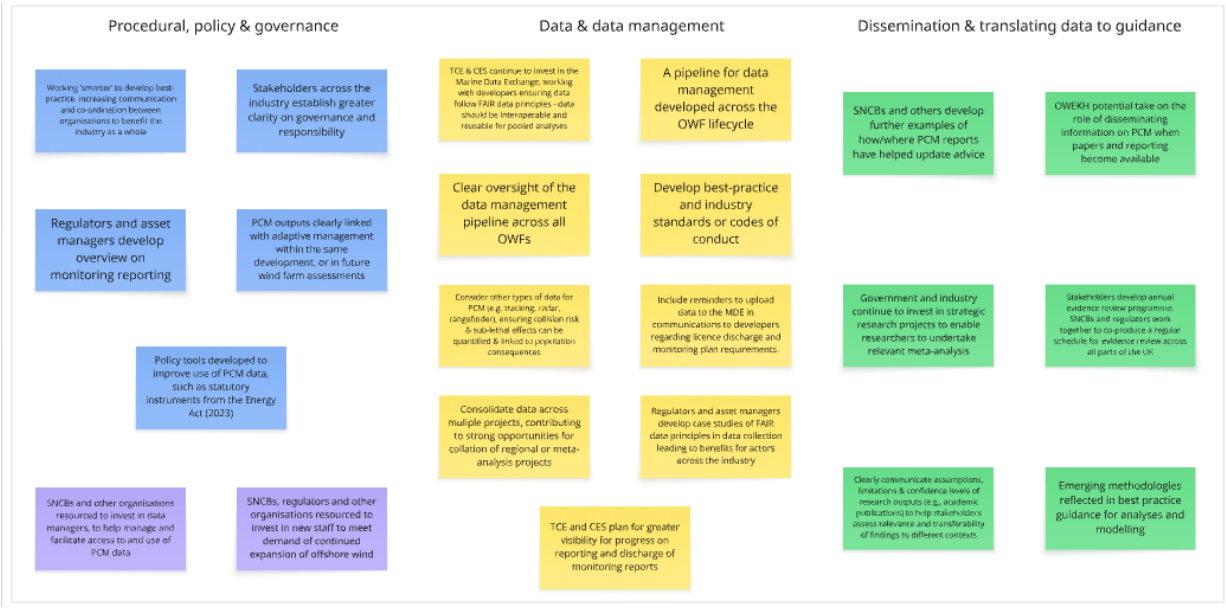

Figure 2 - Example of the Miro board set up for the stakeholder workshop, showing the possible solutions to Closing the Loop grouped by theme.

Activity 1: Who has a role, and who is responsible for each proposed solution?

The first session prompted questions about which organisations have a role in each solution, what that role is, and which organisations may be considered responsible for taking action to enable some of the possible solutions to be implemented. Participants were invited to indicate which organisations they felt could (or should) be responsible, and to draw attention to any topics that might have been missed to date (Figure 3).

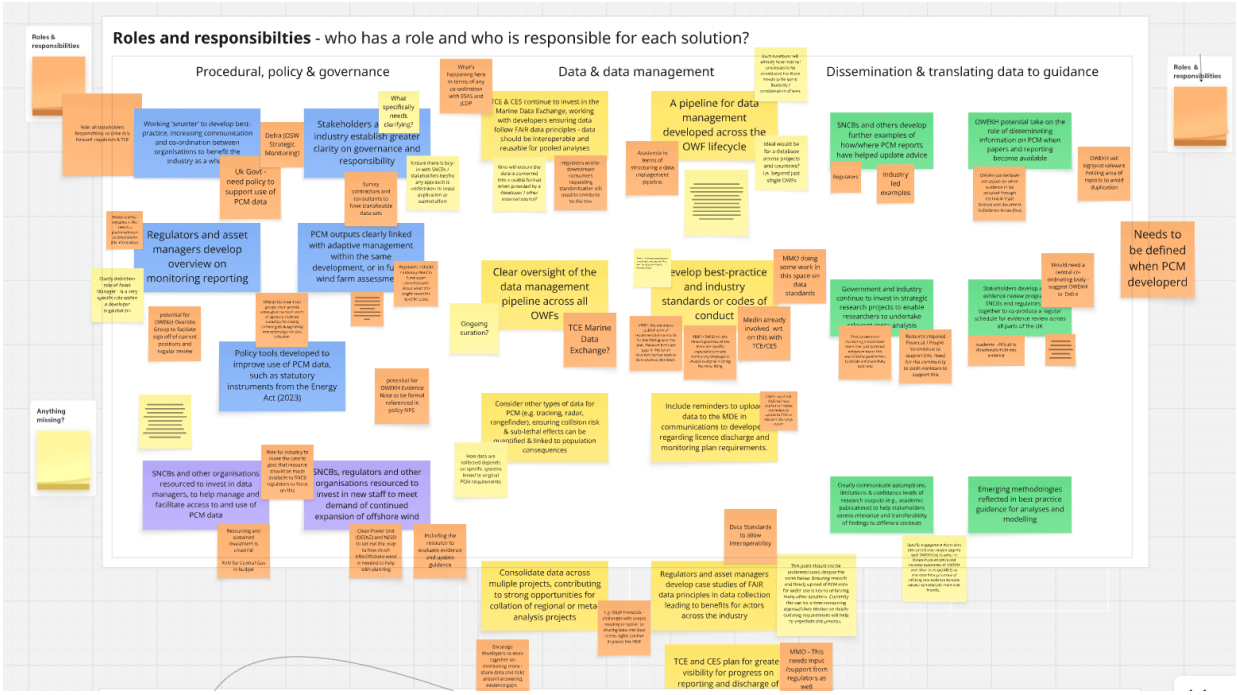

Figure 3 - Miro board results for identifying roles and responsibilities for possible solutions.

Activity 2: Mapping dependencies

Recognising the complexities of the assessment processes, and the position of post-consent monitoring within that process, workshop participants were then invited to highlight where proposed solutions may be dependent on another proposed solution being delivered before it could be implemented. Additional written input was also welcomed (Figure 4).

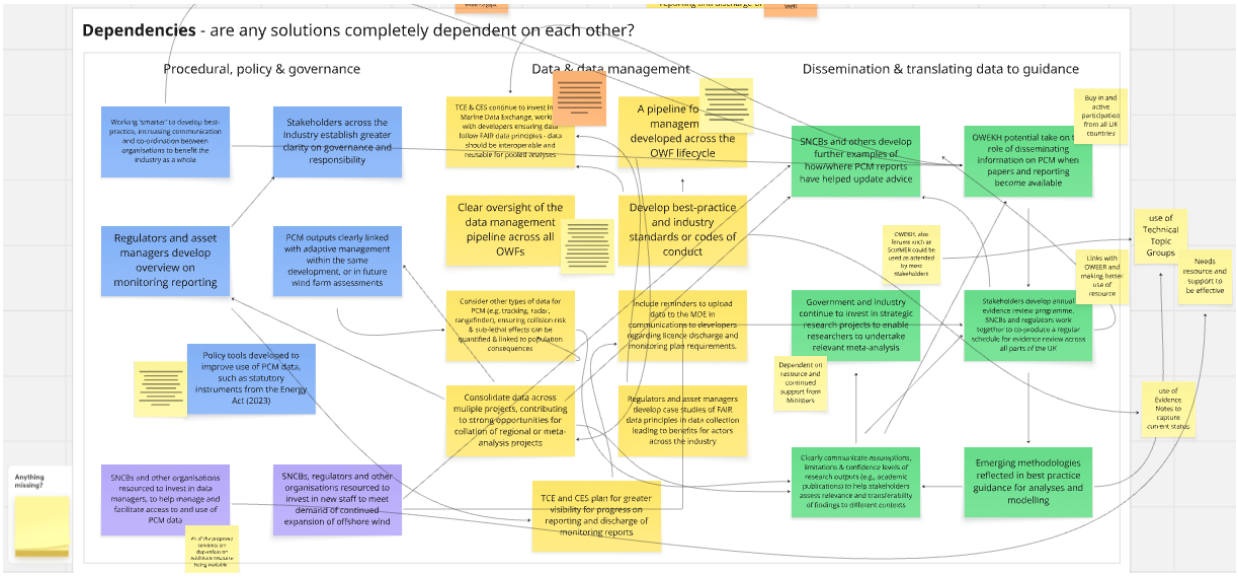

Figure 4 - Miro board results for identifying dependencies between possible solutions.

Activity 3: Mapping timelines

This session was intended to gain a rapid overview of which proposed solutions could be considered 'quick wins', which would require more tactical input to achieve change, and which proposed solutions might require a much larger-scale change to current processes.

A key challenge noted by workshop participants was that some possible solutions might be considered to deliver a 'quick win' for the sector as a whole (one example being the call for TCE and CES to work with developers on an ongoing basis to ensure the implementation of FAIR data practices), but that some of the underlying mechanisms, communication, tools and practices to ensure such changes can happen, will take time to be developed and implemented.

There was some discussion around the proposed solution to *Consider other types of data for PCM (e.g. tracking, radar, rangefinder)*, which stimulated discussion around the need for more widespread monitoring than can be requested for PCM (PCM can only be requested where there are consent conditions required in relation to the findings of an HRA). Such wider monitoring and data gathering could be crucial for developing understanding of the impacts of OWFs on a wider range of bird species, for example. There was also a call for clarification about what are project-level responsibilities, and what monitoring is necessary at a more strategic level.

There was support for an additional solution proposed in the workshop for PCM to be used to update individual projects' impact assessments, enabling as built, and as monitored impacts to be reflected in the future cumulative assessments.

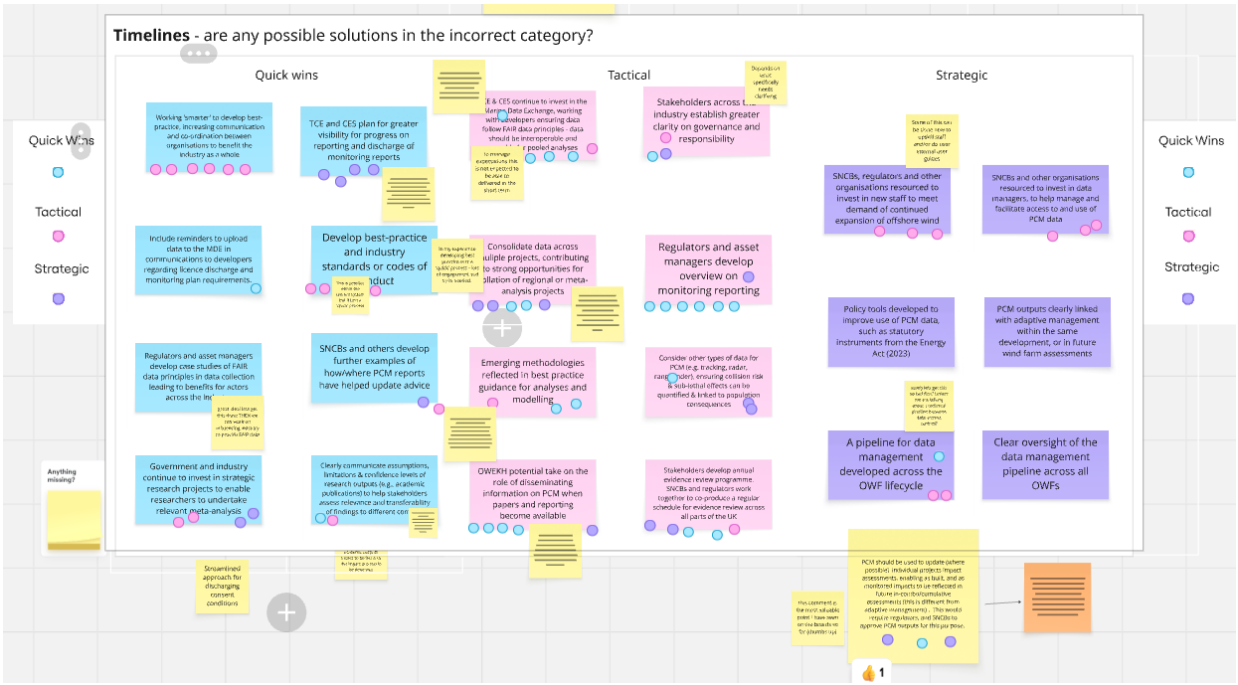

Figure 5 - Miro board results for mapping timelines for the proposed solutions

Activity 4: Identifying priorities

Participants were asked to indicate the relative importance of each of the proposed solutions to the success of the offshore wind sector. Of the 22 proposed solutions presented in the workshop, participants were given ten 'votes' to allocate to ten solutions they felt would be the most important ones to implement to effect change and success within the sector (Figure 6). These votes were not ranked in order of

preference and were not taken as a fully quantitative assessment, but instead total votes were used to inform the development of the roadmap. The scoring for priorities were divided into three (scoring bins, reflecting the range of scores obtained in the workshop during this exercise. They were low (2-8), medium (9-13), and high (14-20).

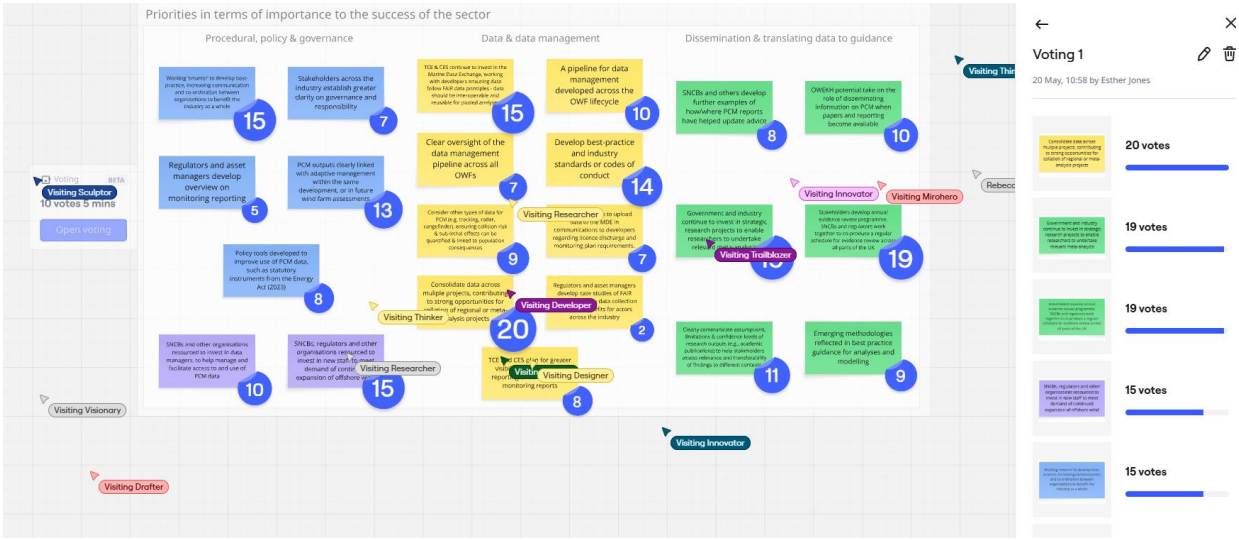

Figure 6 - Miro board results for identifying priorities of the proposed solutions.

There appeared to be low support for the solution "Policy tools developed to improve use of PCM data, such as statutory instruments from the Energy Act (2023)". One comment was "Don't consider the Energy Act / legislative requirements needed. Better to adopt through guidance and best practice…". This commentary was consistent with feedback from the previous round of stakeholder engagement, the focused group workshop, which was that in general it was felt that collaborative working between regulators, SNCBs, and developers was preferential to implementing solutions around legislative tools such as marine licencing and site leasing.

Some of the proposed solutions that were ranked as most important by participants included:

- Consolidate data across multiple projects, contributing to strong opportunities for collation of regional or meta-analysis projects.
- Stakeholders develop an annual evidence review programme. SNCBs and regulators work together to co-produce a regular schedule for evidence review across all parts of the UK.
- Government and industry continue to invest in strategic research projects to enable researchers to undertake relevant meta-analyses.

There was clear support across the sector, for continued investment in strategic research programmes, including an emphasis on the importance of gathering post-consent monitoring data, *and* of analysing that monitoring data, to inform the development of the sector. Participants emphasised the importance of working together across the sector to communicate with, and ensure that senior decision-makers, including government Ministers, understand the importance of such research for the continued successful development of the sector.

Activity 5: Discussion of strategic monitoring

Post-consent monitoring almost becomes an 'afterthought' in the consenting process. Any way of making it more strategic would be welcome and there was widespread support for a more strategic approach to PCM data. There was recognition that any change in approach would have to be appropriately funded, and ensure clarity about how a strategic approach would interact with project-level consent conditions (and/or need clarity about what would be expected of developers at a project-level, and what would be undertaken at a more strategic level). While it was felt that a more strategic approach to post-consent monitoring would offer greater certainty to the sector, any system that adds extra financial cost on developers was considered unlikely to gain support from the industry.

The Regional Advisory Group (RAG) model implemented in Scotland was noted as an example of good practice of an industry-led initiative for developers to work together for mutual benefit, while enabling a more strategic approach to be adopted.

PCM needs to link with work on Strategic Compensation but not duplicate it. There were calls to ensure that any funding mechanism proposed would not duplicate to what is already ongoing in relation to the Marine Recovery Fund, but that a system for PCM would also take time to commission and work with a delivery partner, as well as developing standardised/agreed monitoring protocols.

Participants expressed support for learning from approaches adopted elsewhere in Europe (particularly the Netherlands), and the ability to implement longer-term monitoring. Understanding how a strategic approach might increase knowledge about a broader set of species than is currently required under licence conditions.

There was acknowledgement that there are challenges in dealing with applications. OWEER and ScotMER collate key evidence gaps in relation to offshore wind, which is directing research priorities. These extend to PCM, and this fits in with trying to coordinate strategically. However, concern was raised by stakeholders that work appears to be becoming more fragmented, so there could there be a UK-wide overview of research priorities including identifying where the best locations do that specific work are. Further, creating a framework whereby research needs are fed through to project PCM requirement could enable some of the research to be undertaken in different areas (e.g. effect of artificial light on Manx shearwater (*Puffinus puffinus*) is being raised as a concern in the North Sea, but could be investigated already in the Celtic Sea).

Activity 6: Discussion of whether the evidence bridges approach viable for seabirds

Participants were introduced to the evidence bridges approach, undertaken within the project in relation to marine mammals (see report for full details **Closing the Loop – Evidence Bridges: Marine mammal case study (D08)**) as a possible way to work collaboratively to assess evidence that has been gathered, and help the transition from the evidence base to decision-making. This approach is considered a transparent, repeatable and generalised process, but does require confidence and buy-in from stakeholders, as well as a time and resource requirement to be implemented.

- There is potential for the approach to be adopted for seabirds.
- The use of different methods in relation to seabirds means that some of the evidence seems to indicate contradictory findings. There was a suggestion that an evidence bridge approach might help in understanding some of the differences that are identified in seabird studies. Proposal to 'review' project outputs in a manner similar to the evidence weighting approach presented.

- Driver from evidence bridges approach is increasing levels of evidence; but lack of opportunity to assess the evidence collectively to understand the situation.
- Would be helpful to understand e.g. which piece of guidance is potentially out of date; or whether there are key areas that could be developed into a question to be assessed or challenged.
- A question was raised about whether the evidence bridges approach applies at a higher level than PCM itself.

Outcomes

The outputs from the workshop were used directly to form the recommendations and roadmap in the main text of this report. Additional feedback was sought from specific stakeholders to clarify any outstanding factors (such as roles & responsibilities) in the recommendations, and these were reviewed by the project Steering Group and Project Advisory Group before finalisation.

Appendix a - Organisation attendance list

ABPMer
APEM Ltd
British Trust for Ornithology
Carbon Trust
CEFAS
Crown Estate Scotland (CES)
DEFRA
EDF Renewables
HiDef
Joint Nature Conservation Committee (JNCC)
Marine Management Organisation
McArthur Green
Natural England
Natural Resources Wales
NatureScot
NIRAS
Ørsted
Renewable UK
RWE
Scottish Government
SSE
The Crown Estate (TCE)
UK Centre for Ecology & Hydrology (UKCEH)
University of Aberdeen
University of the Highlands and Islands

Appendix b – Workshop information sheet

02 May 2025

The James Hutton Institute

CLOSING THE LOOP: PARTICIPANT INFORMATION SHEET

Feasibility study to determine a feedback approach for post-consent monitoring to reduce consent monitoring risk in future assessments

You are invited to take part in research about the barriers and potential solutions for incorporating post-consent monitoring data back into the consenting process for offshore renewable developments, thereby 'closing the loop' as part of the wider adaptative management paradigm.

RESEARCH AIMS

As part of a project to understand the institutional, technical, scientific and statistical challenges to 'closing the loop' of post-consent monitoring data, we are undertaking research with key institutions in the consenting process and in establishing requirements and standards in relation to post-consent monitoring data.

Discussions held as part of this research will be part of co-producing a strategic approach, relevant across devolved administrations, for improving the use of post-consent monitoring data, and will lead to recommendations identifying and resolving barriers to the use of post-consent monitoring data to improve assessments, thereby reducing consent risk.

This research is funded by ORJIP – the Offshore Renewables Joint Industry Programme through the Carbon Trust.

WHO IS INVOLVED?

The project team is led by [name] BioSS, and includes colleagues from the James Hutton Institute, UKCEH, ABPMer, SMRU Consulting, the University of St Andrews and SEFARI Gateway.

STAKEHOLDER ENGAGEMENT & COPRODUCTION

You have been invited to take part as a representative of an organisation with a key role in the consenting process of offshore wind in the UK. We acknowledge that we cannot cover everyone or everything but are keen to engage a wide range of stakeholder organisations.

No preparation work will be necessary. This will be an online workshop, with opportunity to provide feedback on findings from the study to date, and to feed into the development of recommendations, the key output from the project.

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02 May 2025

The workshop will be video recorded (in MS Teams) to allow the research team to focus on the conversation and ensure an accurate record of the discussion. The recording will only be available to the research team, all of whom are bound by relevant data privacy and confidentiality agreements.

We will not use your name in any outputs or reporting. With your consent, we would like to have the option to list the organisations represented in the workshop (by organisation name) in the final workshop report.

HOW WILL MY DATA BE STORED?

Any personal information will be confidential and will only be seen by the research team. The data gathered will be used to inform our research and develop presentations, reports and academic publications. Your information will be stored securely on Hutton systems for the purposes of this and potential relevant future contact on this topic.

DO I HAVE TO TAKE PART?

No. Participation is voluntary, and you can withdraw from the study at any point without giving reasons and without any negative consequences.

HOW CAN I WITHDRAW FROM THE STUDY?

If you wish to withdraw from the study, please contact [name, email] within one week of the workshop.

ETHICAL REVIEW

The project has been reviewed by the Research Ethics Committee of the James Hutton Institute. If you have any concerns about the way in which the project has been conducted, or you wish to make a complaint, please contact [email].

FURTHER INFORMATION

If you have any further questions, please contact [name, email].

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Appendix c – Consent form (by email)

Please delete any lines below to which you do not give your consent:

[email]

[telephone]

By participating in the Closing the Loop stakeholder workshop, I confirm that:

- I have read and understand the "Closing the Loop: participant information sheet". I have had the opportunity to ask questions, and these have been answered.
- I understand that my participation is voluntary, and I am free to withdraw at any time, without providing any reason, and without my legal rights being affected.
- I understand the study is conducted by researchers from The James Hutton Institute and partner organisations, funded through The Carbon Trust/Offshore Renewables Joint Industry Programme (ORJIP).
- I understand taking part will involve participating in co-production/stakeholder engagement activities that are audio-visually recorded on MS Teams, and the recording may be transcribed (without names) for notetaking purposes.
- I understand my words may be quoted in publications, reports, and other research outputs in anonymised format (e.g. 'an industry representative', 'SNCB representative').
- I agree my organisation's name can be included in a 'list of participants' in any outputs (e.g. workshop reports/academic papers).
- I agree my personal contact details can be retained in a secure database so that the researchers can contact for future studies.
- I agree to being contacted in the future in relation to this or other relevant studies.
- I have read and understood the privacy notice (below).
- I agree to take part in this study.

Privacy Notice

The James Hutton Institute ("Hutton", "us" or "we") will use your personal data for the purposes of the research undertaken in the project 'Assess' in accordance with our privacy notice at https://www.hutton.ac.uk/privacy-notice. The James Hutton Institute is a data controller for the data collected in this study.

This project is part of a project funded by the Carbon Trust/Offshore Renewables Joint Industry Programme.

Personal data will be retained for a period after the completion of the project to allow further contact in relation to this and future relevant projects. Our main privacy notice will explain what we do with personal data in more detail as well as your rights.

If you have any queries about your personal data, you can contact our Data Protection Officer [email].

carbontrust.com

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