

ECOWind / OWEC Annual Impact Meeting 2023 Summary Report



ECOWind Summary

The Ecological Consequences of Offshore Wind programme, [ECOWind](#), (2022-2026) is a co-designed partnership between the Natural Environment Research Council (NERC), the Crown Estate (TCE), Crown Estate Scotland (CES) and Defra. ECOWind seeks to address critical gaps in understanding how large-scale expansion of Offshore Wind Farms (OWF) affects marine ecosystems.

OWEC Summary

The Offshore Wind Evidence and Change Programme, ([OWEC](#)) brings together a coalition of 26 government organisations, industry bodies, and environmental NGOs for the delivery of a range of prioritised projects that will create a data and evidence base that can be used to shape the future of offshore wind and the marine environment.

Executive Summary

The joint ECOWind and OWEC Annual Impact Meeting (AIM) brought together stakeholders from across the marine sector to share the pioneering OWF science, coordinate impending outcomes and translate research into actionable insights. Calls were made for a more collaborative approach to OWF research, an approach which would allow for both improved accessibility of advice for developers and maximised effectiveness of scientific research outputs. The research will directly impact policy by building Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) evidence to include ecosystem dynamics and interactions. It will identify opportunities for restoration, compensation and MNG, while also assisting in marine spatial planning to optimise marine space up to 2050.

Contributors

This report was prepared by Howell Marine Consulting and Mindfully Wired Communications using evidence gathered by the contributing government, industry and scientist speakers (below), as presented at the first Annual Impact Meeting held on the 21-23 November 2023.

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Acronyms

AIM	Annual Impact Meeting
BOWL	Beatrice Offshore Windfarm Limited
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CES	Crown Estate Scotland
CEF	Cumulative Effects Framework (Scottish Government & CEH Project)
CEH	UK Centre for Ecology & Hydrology
CIA	Cumulative Impact Assessment
COWSC	Collaboration on Offshore Wind Strategic Compensation
Defra	Department for Environment, Food and Rural Affairs
EcoConnect	Ecological Connectivity between man-made structures
ECOFlow	Ecological Consequences of Floating Offshore Wind Programme
EcoNex	The Marine Energy, Biodiversity and Food Nexus
EcoSTAR	Ecosystem level importance of Structures as Artificial Reefs Project
ECOWind	Ecological Consequences of Offshore Wind Programme
EFH	Essential Fish Habitat
EIA	Environmental Impact Assessment
FISHSPAMMS	Fish Spillover, Production and Aggregation at Marine Made Structures
FiSMaDiM	Fisheries Sensitivity and Mapping and Displacement Modelling
GES	Good Environmental Status
HRA	Habitat Regulations Assessment
INSITE	Influence of man-made structures in the ecosystem
JNCC	Joint Nature Conservation Committee
MaRePo+	Marine Restoration Potential Mapping + enhancement
mNCEA	Marine Natural Capital and Ecosystem Assessment Programme
MNG	Marine Net Gain
MSPACE	Marine Spatial Planning Addressing Climate Effects Project
MSPri	Marine Spatial Prioritisation Programme
NE	Natural England
NERC	Natural Environment Research Council
NGO	Non-governmental Organisation
ORJIP	Offshore Renewables Joint Industry Programme
OWEAP	Offshore Wind Enabling Actions Programme
OWEC	Offshore Wind Evidence and Change programme
OWEKH	Offshore Wind Evidence and Knowledge Hub
OWEIP	Offshore Wind Environmental Improvement Package
OWES	Offshore Wind Environmental Standards
OWF	Offshore Wind Farm
OWIC	Offshore Wind Industry Council
POSEIDON	Planning Offshore Wind Strategic Environmental Impact Decisions Project
PrePARED	Predators and Prey Around Renewable Energy Developments Project
ProcBe	Procellariiform Behaviour & Demographics Project
P2G	Pathways to Growth
ReSCUE	Reducing Seabird Collisions Using Evidence Project
RSPB	Royal Society for the Protection of Birds
ScotMER	Scottish Marine Energy Research
SEA	Strategic Environmental Assessment
SMMR	Sustainable Management of Marine Resources
TCE	The Crown Estate
WoS	Whole of Seabed Programme
RCP8.5	Representative Concentration Pathway 8.5

Introduction

Representatives from academia, policy and industry were brought together at the ECOWind/OWEC AIM to better understand how the transition to offshore wind in the UK will affect marine ecosystems. Attendees reflected on research from the previous year, identified gaps in project research, and pinpointed key actions for the programme moving forward. Not only did the AIM contextualise ECOWind project work in the changing world of OWF development, it also facilitated discussion on ways to establish a long-term legacy for the plethora of work underway across both ECOWind and OWEC, to benefit the sector and environment for years to come.

Key reflections

Four interactive themes formed the focus of discussions to identify critical knowledge gaps and next steps within the ECOWind programme. The primary reflections emerging from each core theme are summarised below:

Benthic	
Compensation	<ul style="list-style-type: none"> Recognising benthic compensation as a key consenting challenge, it is imperative to conduct assessments to understand both the positive and negative effects of OWF on the benthos. This research will build further understanding of ecological functioning around OWFs, assisting in the identification of effective compensation measures.
Strategic Monitoring	<ul style="list-style-type: none"> A pressing need exists for the establishment of a framework for more strategic monitoring (i.e. coordinated across several wind projects and not just on a project-by-project basis), bringing enhanced coordination as well as cost and efficiency benefits. Options discussed include developer-led regional monitoring, cross-sector regional monitoring or government-led strategic monitoring. Monitoring activities should be guided by research predictions; can direct data needs, level of effort and locations.
Marine Net Gain	<ul style="list-style-type: none"> There is a need to determine what we accept as a healthy benthos and decide upon which management scenarios align with environmental goals/targets and could support the development of the MNG concept.

Fish and Fisheries	
Research aims	<ul style="list-style-type: none"> Research on the behaviour and distribution of fish species in relation to OWFs will inform food web and ecosystem functions, can optimise benefits and inform planning scenarios, management measures and climate change conditions. Research will consider the wider impacts of OWF on predator-prey interactions e.g. changes to (bio)physical features that influence prey availability to predators.
Fish aggregation	<ul style="list-style-type: none"> Preliminary research suggests that fish aggregate within OWFs, where a survey showed fish school density to be 6x higher than in the surrounding 10km. Research in this area is critical in underpinning how fisheries may interact with OWFs in future, influencing how subsequent spatial management is approached.

Collaborative monitoring	<ul style="list-style-type: none"> Monitoring of fish populations and their behaviour is required to fully understand changes with respect to OWFs, and will likely require new ways of measuring fish behaviour such as making use of low-cost semi-autonomous observational platforms using active acoustic, optical and perhaps eDNA techniques.
Fisheries management measures	<ul style="list-style-type: none"> The research can build understanding on how climate change will affect fish and ecosystems, predict population distribution changes, and inform on climate adaptive and resilient measures for fisheries. The research needs to identify co-existence opportunities for fisheries and offshore wind, build information on socio-economic impacts, and natural capital elements to identify best options for marine use and spatial planning.

Ornithology	
Aligning spatial data	<ul style="list-style-type: none"> Mapping and spatial data from projects was seen to have useful application across the programmes, but standardisation of methods is required to improve comparability of results. Going forward, POSEIDON will manage data availability in relation to ECOWINGS outputs.
Avoidance	<ul style="list-style-type: none"> Developers should aim to follow the 'mitigation hierarchy', with avoidance of impacts forming the primary approach to limit OWF impacts on seabirds, and compensation being the final consideration.

Cumulative Effects	
Framework for cumulative effects	<ul style="list-style-type: none"> The creation of ensembles of models within an agreed framework would enable academics and stakeholders to have stronger confidence in the likely complex outcomes of interactions between OWF, climate change, and fisheries displacement on marine ecosystems.
Climate change	<ul style="list-style-type: none"> The incorporation of climate change into assessments is a key consideration to assess the counterfactual situation of different levels of OWF.

Several overarching reflections were captured throughout discussion on all four streams, including the need to:

- Engage with government regulators further, fostering a more collaborative approach to OW research.
- Translate research into accessible, effective advice for OWF developers and government teams alike, enabling a better understanding of the key messages from science outputs.
- Involve all relevant parties in engagement activities, to improve understanding of evidence requirements, therefore further focusing research.
- Identify interlinkages between the numerous different research projects to aid collaboration, reduce overlap and enable greater consolidation of scientific evidence when presenting outputs to policy makers and developers
- Attendees compiled a timeline demonstrating the research they had been presented or were aware of, along with insights into how and when such research could be translated into actionable strategies to address key challenges (Figures below).

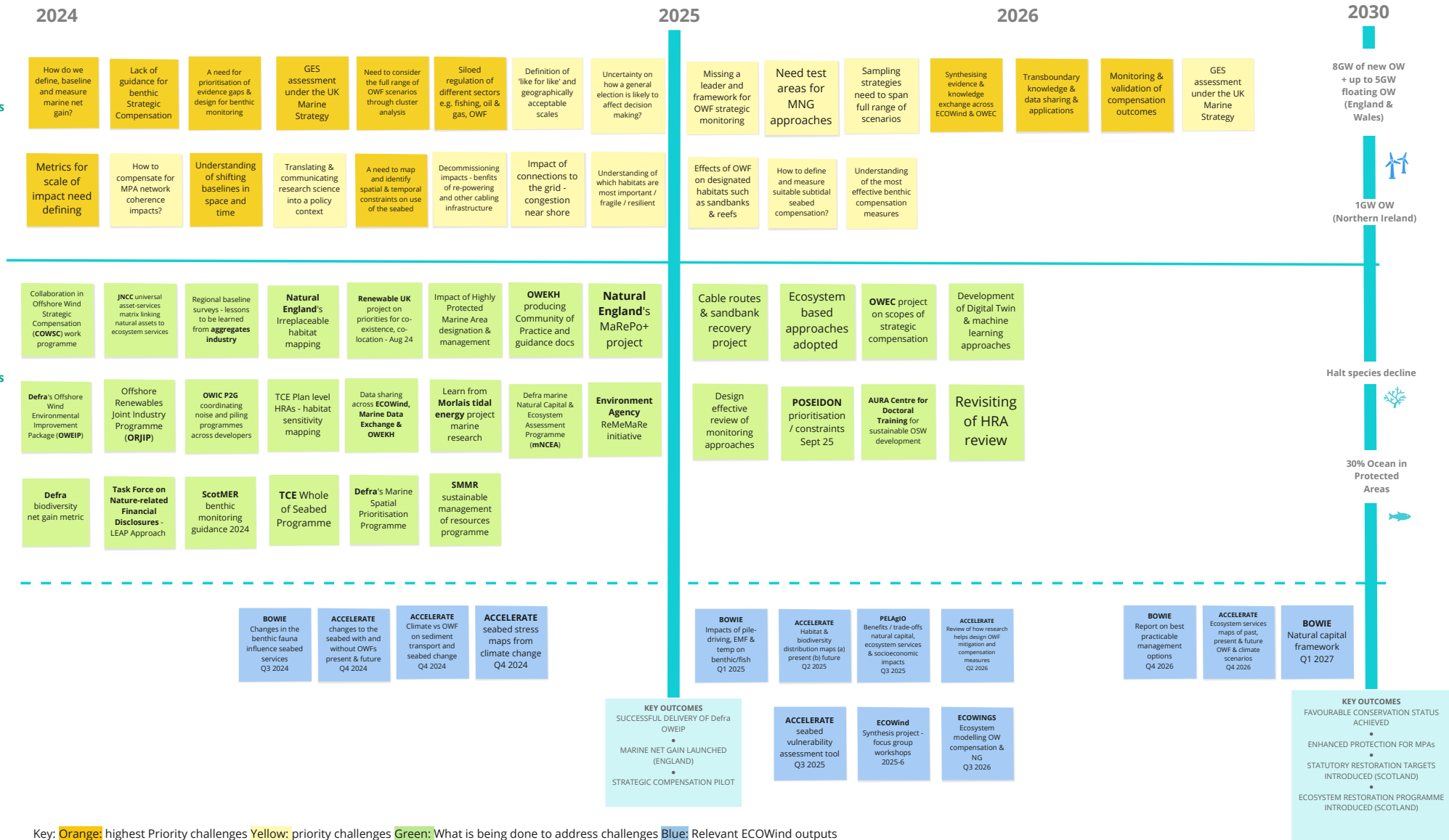
Benthic

ECOWind AIM - BENTHIC GROUP TIMELINE OF PRIORITY CHALLENGES & RELATED PROJECT & PRODUCTS

Evidence Gaps and Priority challenges

Wider research outputs, programmes & initiatives

ECOWind outputs



Key: Orange: highest Priority challenges Yellow: priority challenges Green: What is being done to address challenges Blue: Relevant ECOWind outputs

Fish / Fisheries

ECOWind AIM - FISH GROUP TIMELINE OF PRIORITY CHALLENGES & RELATED PROJECT & PRODUCTS

2024

2025

2026

2030

Evidence Gaps and Priority challenges

Map/identify Essential Fish Habitat (EFH), including the whole life cycle & temporal use	Understanding how to define, measure & deliver Marine Net Gain (MNG)	Understand socioeconomic impacts on communities	Predicting fish & fisheries displacement, legal liability & socioeconomic impacts	Future abundances of forage fish to seabirds under different OWF & climate scenarios	Consideration of shifting baselines from climate change	Synthesis of existing knowledge	Need to understand how early life history stages are affected by OWF	Effect on tidal stream, particulates, suspended material, biogeochemistry & food web base
Understanding the impact of existing OWF for fish & fisheries	Designing better monitoring to include areas outside OWF, funded by developers	Need to tie existing fisheries data (e.g. VMS) to community importance	Understand if nature inclusive design can increase climate resilience	Need consensus on future OSW (including floating) & MPA spatial scenarios to inform fisheries displacement in space & time	Is RCP 8.5 an appropriate regional model scenario?	Need for monitoring approaches to inform movement and modelling of fisheries		Determining potential thresholds of sensitivity for species & life stages

Understanding and predicting fish behaviour in relation to hydrodynamics	Developing transferable tools & metrics, including of socioeconomic impacts/value	How will different habitat restoration activities benefit fish species?	Need a more local view of CC impacts through downscaling of models
Determining the reality of Electromagnetic Fields (EMF) associated with power transmission	Need effective fisheries monitoring approach	Need a socioeconomic evaluation of the synthesis work	How will behaviour be impacted by floating wind?

8GW of new OW + up to 5GW floating OW (England & Wales)

1GW OW (Northern Ireland)

Wider research outputs, programmes & initiatives

Published work on EFH, including in the Scottish National Marine Plan	Published report by Chris Leakey on MNG	ScotMER Sectoral SEA for socioeconomic impacts	Published work on fisheries displacement, including ScotMER projects	ICES fisheries spatial distribution working group	MSPACE SMMR project	OWIC P2G work programme	EcoNex project	PrePARED project
Data available through the PrePARED project	SUDG & ABPMer review of net gain prioritisation work	The Crown Estate's Whole of Seabed (WoS) programme	INSITE EcoStar project - Debbie Russell	INSITE EcoConnect project - Kieran Hyder	POSEIDON project	Determining biodiversity change in context of nature inclusive design	FISHSPAMMS distribution & climate effects for fish populations	

OWEC FISMADIM project	Chevron Anchor Project	PrePARED project outputs informing EFH in Firth of Forth & Moray Firth	Cefas larval & juvenile surveys to inform EFH
		EA/NE work on coastal fish nursery habitats	ORE Catapult work on floating structures

Halt species decline

ECOWINGS effects of fishery closure advice from 2023

ECOWINGS Predictions of zooplankton and fish abundance under climate change Q2 2024

PELAgIO OWF local and regional mixing impacts on fish distribution Q3 2024

ACCELERATE seabed stress maps from climate change Q4 2024

BOWIE Impacts of pile-driving, EMF & temp on benthic/fish Q1 2025

PELAgIO Report cards on ecosystem change (biophysical env up through fish & top predators) from OWF Q1 2025

PELAgIO Ecosystem service changes under OWF / fishing / climate scenarios Q3 2025

PELAgIO Advice on CEA (OWF, Fisheries displacement, climate change) Q3 2025

ACCELERATE Ecosystem services maps of past, present & future OWF & climate scenarios Q4 2026

BOWIE Report on best practicable management options Q4 2026

BOWIE Natural capital framework Q1 2027

ACCELERATE Habitat & biodiversity distribution maps (a) present (b) future Q2 2025

PELAgIO Risk-benefit maps of areas of high ecosystem risk Q3 2025

PELAgIO Benefits / trade-offs natural capital, ecosystem services & socioeconomic impacts Q3 2025

ECOWind Synthesis project - focus group workshops 2025-6

ECOWINGS Ecosystem modelling OW compensation & NG Q3 2026

KEY OUTCOMES

- SUCCESSFUL DELIVERY OF Defra OWEIP
- MARINE NET GAIN LAUNCHED (ENGLAND)
- STRATEGIC COMPENSATION PILOT

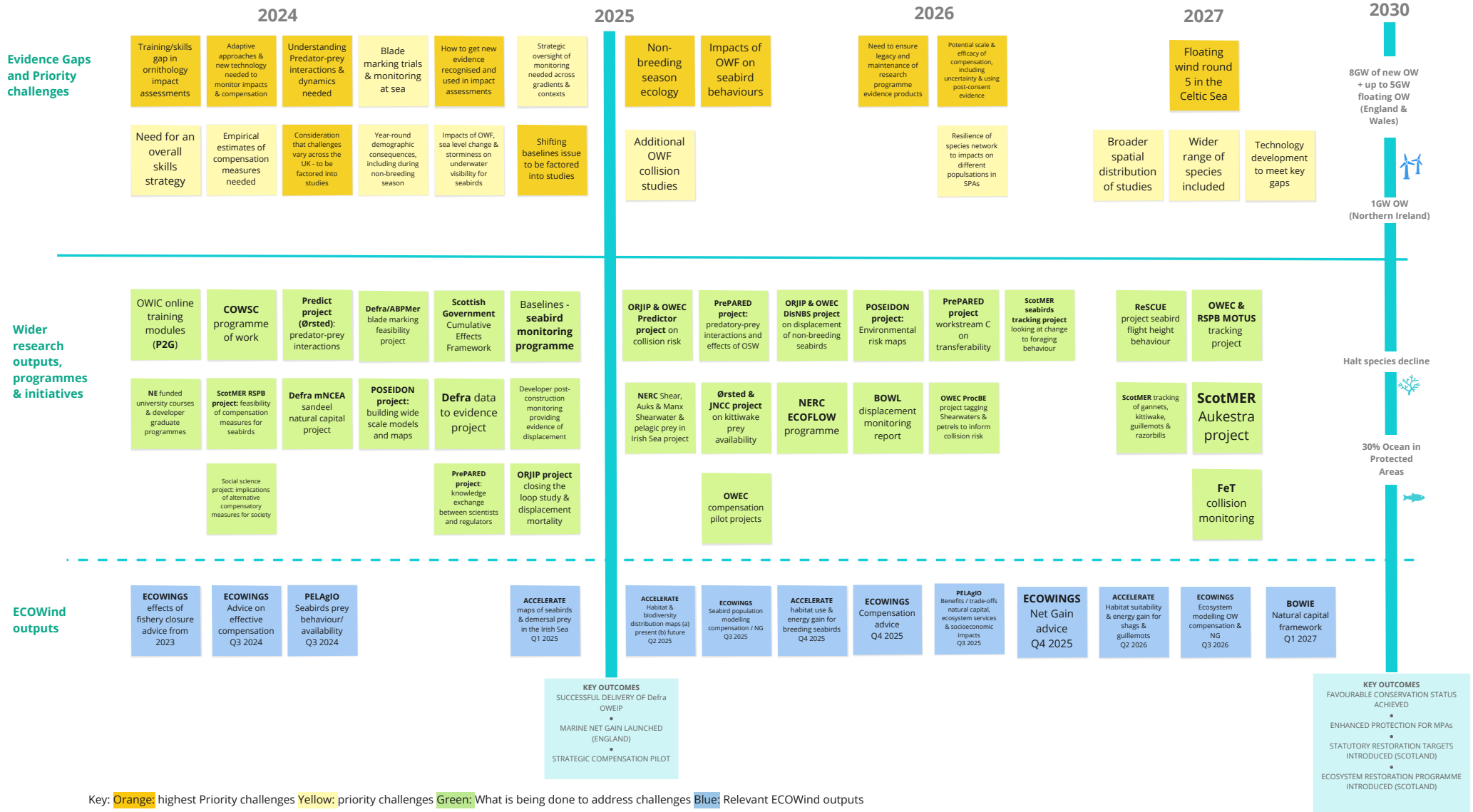
KEY OUTCOMES

- FAVOURABLE CONSERVATION STATUS ACHIEVED
- ENHANCED PROTECTION FOR MPAs
- STATUTORY RESTORATION TARGETS INTRODUCED (SCOTLAND)
- ECOSYSTEM RESTORATION PROGRAMME INTRODUCED (SCOTLAND)

Key: Orange: highest Priority challenges Yellow: priority challenges Green: What is being done to address challenges Blue: Relevant ECOWind outputs

Seabirds

ECOWind AIM - SEABIRDS GROUP TIMELINE OF PRIORITY CHALLENGES & RELATED PROJECT & PRODUCTS



Key: Orange: highest Priority challenges Yellow: priority challenges Green: What is being done to address challenges Blue: Relevant ECOWind outputs

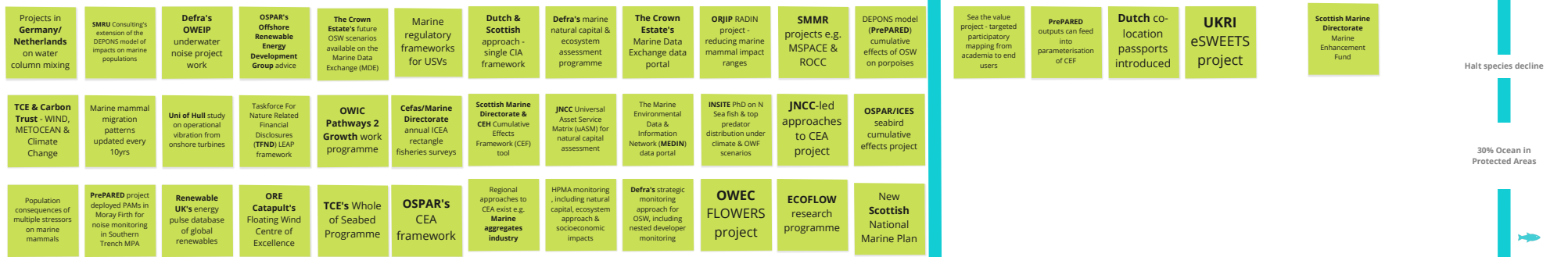
Cumulative Effects Assessments

ECOWind AIM - COMBINED TIMELINE OF PRIORITY CHALLENGES & RELATED PROJECT & PRODUCTS FOR CUMULATIVE EFFECTS ASSESSMENTS

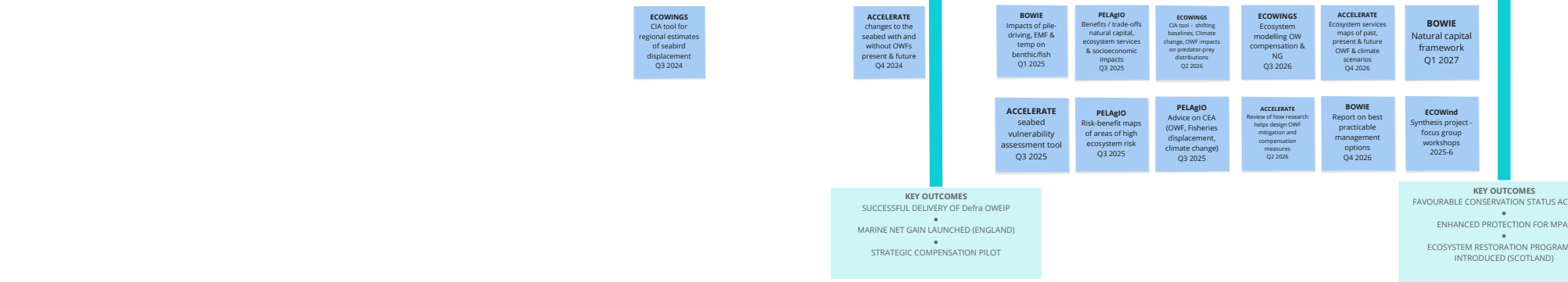
Evidence Gaps and Priority challenges



Wider research outputs, programmes & initiatives



ECOWind outputs



KEY OUTCOMES

- SUCCESSFUL DELIVERY OF Defra OWEIP
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KEY OUTCOMES

- FAVOURABLE CONSERVATION STATUS ACHIEVED
- ENHANCED PROTECTION FOR MPAs
- ECOSYSTEM RESTORATION PROGRAMME INTRODUCED (SCOTLAND)

Policy contributions

Contributions were made by representatives from the Scottish Government, TCE, the Defra Offshore Wind Enabling Actions Programme (OWEAP) and Marine Spatial Prioritisation Programme (MSPri), alongside OSPAR, ICES, and the Offshore Wind Industry Council (OWIC). The main challenges and evidence requirements raised included:

Building the EIA evidence base	Developing strategic compensation options	Developing adaptive management measures	Understanding socio-economic Impacts
Delivering dynamic ecosystem assessments	Compensation that considers whole-site effects	Cumulative impacts on ecosystems	Marine-use understanding and trade-off analysis
Climate change effects	Ecological networks and food web dynamics	Natural capital approaches	Mapping co-location opportunities
Effective environmental monitoring	Mapping essential/important habitats / species	Measuring and delivering MNG	Considering nature inclusive design

The AIM effectively connected these challenges with the anticipated impacts of the research. The subsequent section outlines these connections in detail.

British Energy Security Strategy & Offshore Wind Environmental Improvement Package

EIA evidence base – Evidence base growth on biological and functional receptors will further understanding of ecosystem-wide changes throughout the food chain, support EIAs and offer insights to also support informed decision-making and efficient planning within the sector.

OneBenthic initiative – Projects are building onto the existing OneBenthic tool to provide new faunal insights for a strategic approach to assessment and monitoring.

Seabed vulnerability assessment - an interactive seabed vulnerability assessment tool can estimate impacts on sediment dynamics and simulate uncertainty levels in habitat distributions. By reducing uncertainty, it can facilitate a faster consenting process.

Strategic monitoring methods –Autonomous Underwater Vehicles and other innovative techniques are highly effective, providing a new era of strategic monitoring practices.

Optimisation of designs - Valuable insights are emerging on optimising project scales, array designs and micro-siting of turbine locations, to identify best ecological options to minimise impacts, and provide benefits such as seabird foraging areas.

Strategic compensation delivery – The research will address the effectiveness of compensation measures, provide evidence on uncertainty, and explore the interactions between various measures. It will also determine what limits populations, which populations will benefit and the compensation measures that prioritise ecological coherence.

Predictive modelling - Through modelling, the projects predict seabird breeding success and fish recruitment trends, predator-prey dynamics, foraging patches, and the sensitivity of ecological networks to climate change and OWF developments. By identifying strategies that promote ecosystem resilience and connectivity, the research can help ensure the long-term effectiveness of compensation efforts.

Marine Net Gain (25 Year Environment Plan / Environmental Improvement Plan)

Ecosystem Services - All projects are contributing to a dynamic assessment of ecosystem services including top-down, bottom-up approaches, mapping the ecosystem changes in functioning with OWF expansion and climate change. The research outcomes can provide evidence for developing strategies to mitigate adverse effects.

Marine Net Gain - The research explores avenues for ecosystem restoration and assessing options for developing the MNG concept. The research recommends appropriate MNG metrics, providing insights into functional diversity and resilience. The research also evaluates passive restoration and active nature-positive approaches and considers the effectiveness of these management approaches under various climate change scenarios.

Marine Spatial Planning

UK-wide modelling – The research progresses detailed modelling on increasing scales from single turbines up to entire shelf-sea scales, identifying areas of high ecological importance. This can inform understanding on avoiding critical habitats and key foraging areas during OWF planning, thus avoiding areas of ecological risk, while also creating opportunities for nature recovery as a sector by focusing planning efforts in suitable areas.

Cumulative impact assessments - The research contributes to the evidence base for CIA. The projects are developing various methods to support marine use and trade-offs, as well as balance sheets for assessing regional and local impacts.

Natural Capital and Ecosystem Services Frameworks - are being developed to provide insights into the stocks of natural capital (habitat and species), flows of ecosystem services and socio-cultural linkages to understand trade-offs in space use, and serve as a decision support system.

Climate Change - The projects are modelling the effects of warming, storm events and sea level rise which will all effect stratification, mixing, turbidity, thus affecting primary production and higher trophic levels populations. To be comparable, all projects will use the worst-case climate scenarios in their models (i.e. 'business as usual' RCP8.5).

Fisheries Management - The research will assess changes in fish behaviour, level of aggregation, factors driving production and spill-over effects, and the implications of these for fisheries management. The effects of spatial displacement on fishing activity and how this affects local fish mortality/survival rates and subsequent higher trophic levels (i.e. seabird) populations will also be explored.



Conference Takeaways

Through informative talks, panel discussions and workshops, participants addressed critical knowledge gaps in OWF research and identified key actions to address them. Notable takeaways are summarised below:

- The environmental effects of OWFs are being heavily researched and it is difficult to absorb information at the rate it is being produced. Deliverables need to be relevant, accessible, incorporate common language and answer critical questions to enable understanding by OW developers. Researchers are delivering high-quality science and going forward, efforts to strengthen communication between these different interest groups should be enhanced.
- An overarching consensus from project practitioners agreed that compensation has to be delivered before impact happens in the context of OWF's environmental interactions.
- Researchers, academics, industry and policymakers would find a commonly accepted framework to conduct cumulative effects assessments useful.
- A more strategic approach was discussed, with calls for programmes continually considering the numerous other initiatives that orbit closely to ECOWind/OWEC's aims. Examples of possible collaborations included [OSPAR](#) (and their relevant socio-economic groups), the National Grid, and UK fisheries. Accompanying this approach, a dedicated timeline of project work, including which projects and initiatives are relevant for the remaining duration of ECOWind, was thought to be an important resource that could be produced by OWEC.
- Opportunities to collaborate with other organisations and sectors in relation to developing more strategic monitoring approaches were identified:
 - Opportunities exist to develop regional strategic monitoring programmes. The Offshore Wind Industry Council ([OWIC](#)) has been developing lessons learned from the monitoring process in the aggregate sector.
 - Scottish Marine Energy Research (ScotMER) are in the process of developing benthic monitoring guidance, with a planned release of Spring 2024. It was noted that contributions from ECOWind/ OWEC may be possible.
- Consideration was given to ECOWind's legacy - how the data it has produced will be stored, collated and synthesised into useful outputs and built upon going forward - particularly in relation to the Offshore Wind Evidence and Knowledge Hub ([OWEKH](#)).
- Across the conference, many networks formed between industry, stakeholders and project practitioners, forming connections that are invaluable to the future of UK OWF environmental science. In the closing keynote of the meeting, Professor Colin Moffat argued that attendees should not continue 'business as usual' moving forward; instead, they should follow-up on new cross-sector networks formed at this gathering, "the green shoots", and move forward together to maximise research impact for the future.
- The ECOWind team will continue to synthesise the challenges brought forward across the conference, with the aim of incorporating conference takeaways into the future programme of work.

Videos of the AIM 2023 are available in a dedicated YouTube playlist [here](#).

Register your interest for AIM 2024
[here](#)



ECOWind/ OWEC Projects & Publications

<p>BOWIE Lead Principal Investigator: Professor Martin Solan, University of Southampton</p> <p>Benthic-Offshore Wind Interactions (BOWIE) aims to better understand the impact of OW expansion on seabed invertebrate and fish species, accounting for the multiple pressures associated with this process such as construction noise, electromagnetic fields, and temperature changes.</p>	<p>ECOWind-ACCELERATE Lead Principal Investigator: Professor Katrien Van Landeghem, Bangor University</p> <p>Ecological Implications of Accelerated Seabed Mobility around Windfarms (ECOWind-ACCELERATE) investigates how seabed sediments are disturbed in response to OW infrastructure, and the knock-on effects of this movement on the wider marine ecosystem.</p>
<p>ECOWINGS Lead Principal Investigator: Professor Francis Daunt, UK Centre for Ecology & Hydrology</p> <p>Ecosystem Change, Offshore Wind, Net Gain and Seabirds (ECOWINGS) tackles uncertainties surrounding OW impacts on seabird populations, in a bid to address key consenting issues for OW development in the UK.</p> <p>ECOWINGS, the StrathE2E Ecosystem Model</p> <p>Effects of a fishery closure and prey abundance on seabird diet and breeding success: Implications for strategic fisheries management and seabird conservation.</p> <p>A framework for improving treatment of uncertainty in OWF assessments for protected marine birds</p>	<p>PELAGIO Lead Principal Investigator: Professor Beth Scott, University of Aberdeen</p> <p>Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms (PELAGIO) explores OW impacts across all levels of the marine food chain up to the ecosystem level to support the development of evidence-based policy.</p> <p>Cumulative effects of OWF: From pragmatic policies to holistic MSP tools.</p> <p>A paradigm for understanding whole ecosystem effects of OWF in shelf seas.</p> <p>Ecosystem indicators: Predicting population responses to combined climate and anthropogenic changes in shallow seas.</p> <p>The bottom mixed layer depth as an indicator of subsurface Chlorophyll a distribution.</p>
<p>PrePARED Lead Principal Investigator: Dr Bill Turrell, Marine Scotland Science</p> <p>Predators + Prey Around Renewable Energy Developments (PrePARED) studies predator and prey dynamics in and around offshore wind farms, providing insight into cumulative effects from large scale development for key marine species.</p>	<p>POSEIDON Lead Principal Investigator: Alex Fawcett, Natural England</p> <p>Planning Offshore Wind Strategic Environmental Impact Decisions (POSEIDON) aims to establish a robust evidence base for offshore wind site development and mitigation opportunities.</p>