

ECOFlow and ECOWind Research Programmes: Offshore Wind Policy and Delivery Landscape 2025

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Acronyms/ Units

ACCELERATE	Accelerated Seabed Mobility around Windfarms
AIM	Annual Impact Meeting
ATSEA	Autonomous Techniques for anthropogenic Structure Ecological Assessment
AUV	Autonomous Underwater Vehicle
BESS	British Energy Security Strategy
BOWIE	Benthic Offshore Wind Interactions Evaluation
CNP	Critical National Priority
CSNP	Centralised Strategic Network Plan
CIA	Cumulative Impact Assessment
COWSC	Collaboration on Offshore Wind Strategic Compensation
Defra	Department for Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
EA	Exclusivity Agreement
ECOFlow	Ecological Consequences of Floating Offshore Wind
EcoSTAR	Ecosystem level importance of Structures as Artificial Reefs
ECOWind	Ecological Consequences of Offshore Wind
ECOWINGS	Ecosystem Change, Offshore Wind, Net Gain and Seabirds
eDNA	Environmental DNA
EDP	Environmental Delivery Plan
EIA	Environmental Impact Assessment
EIP	Environmental Improvement Plan
eSWEETS3	Enabling Sustainable Wind Energy Expansion in Seasonally Stratified Seas
FISHSPAMMS	Fish Spillover, Production and Aggregation at Marine Made Structures
FLOW	Floating Offshore Wind
FLOW	Floating Offshore Wind Farm
FuECoMMS	Functionality and Ecological Connectivity of Man Made Structures
GES	Good Environmental Status
GW	Gigawatts
HPMA	Highly Protected Marine Areas
HRA	Habitat Regulations Assessment
INF4INiTY	Integrated Designs for Future FLOW Technology
INSITE	Influence of man-made structures in the ecosystem
INTOG	Innovation and Targeted Oil and Gas Round

JFS	Joint Fisheries Statement
JNCC	Joint Nature Conservation Committee
MaRePo+	Marine Restoration Potential Mapping + enhancement
MCZ	Marine Conservation Zones
MPA	Marine Protected Area
MMO	Marine Management Organisation
MPS	Marine Policy Statement
MSPri	Marine Spatial Prioritisation Programme
MW	Megawatts
NSIP	Nationally Significant Infrastructure Project
NERC	Natural Environment Research Council
NGO	Non-Governmental Organisations
NPPF	National Planning Policy Framework
NPS	National Policy Statements
O&G	Oil & Gas
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
OWF eDNAMonitorBiodiv	Marine microbial and invertebrate meiobenthic diversity in OWF using environmental DNA
OWIC	Offshore Wind Industry Council
P2G	Pathways to Growth
PELAgIO	Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms
POSEIDON	Planning Offshore Wind Strategic Environmental Impact Decisions
PrediCtOr	Prevalence of Seabird Species and Collision Events in OWF
PrePARED	Predators and Prey Around Renewable Energy Developments
ProcBe	Procellariiform Behaviour & Demographics
ReSCUE	Reducing Seabird Collisions Using Evidence
SEA	Strategic Environmental Assessment
ScotMER	Scottish Marine Energy Research
SNCB	Statutory Nature Conservation Bodies

SRA	Strategic Resource Areas
SSEP	Strategic Spatial Energy Plan
TCE	The Crown Estate
UK	United Kingdom
UKMS	UK Marine Strategy
WoS	Whole of Seabed Programme
25YEP	25 Year Environmental Plan

1 Executive Summary

As 2025 marks the midpoint of the decade, with only five years remaining to meet the 2030 environment and energy targets, the focus has begun to shift from planning to delivery (Figure 1).

The Government's Clean Power 2030 Action Plan provides a delivery pathway to fully decarbonise the power sector by 2030, setting out reforms to accelerate consenting, streamline project timelines, and strengthen grid connections. The Crown Estate (TCE) estimates that 20–30 GW of new seabed rights in England and Wales will need to be brought to market by 2030 for delivery out to 2040. Key opportunity regions include the Celtic Sea, with up to 12 GW of potential capacity, and the North East, where up to 16 GW could be realised through new leases by 2030. These ambitions are supported by TCE's Marine Delivery Routemap, a long-term spatial strategy that integrates digital seabed mapping, scenario planning, and stakeholder engagement to deliver a thriving marine economy that aligns clean energy deployment with nature recovery and economic development.

The policy and legislative landscape for offshore wind has evolved rapidly, reflecting commitments to accelerate clean energy deployment, strengthen energy security, and reform planning and consenting systems. However, market pressures and increased delivery risks present significant challenges. These setbacks underline the urgent need for regulatory reform and more holistic solutions that integrate planning, consenting, supply chain resilience, financing mechanisms, and environmental responsibilities to keep projects viable and on track to contribute to net zero.

The UK Energy Act 2023 represents the most comprehensive package of energy legislation in over a decade. It establishes a statutory framework to accelerate offshore wind consenting while strengthening environmental protection, recognising that fragmented, project-by-project compensation is insufficient to address cumulative impacts on habitats and species. The Act introduces provisions for offshore wind strategic compensation, enabling measures to be coordinated and delivered at scale. Building on this, Defra and the Scottish Government consulted in 2025 on offshore wind Environmental Compensatory Measures Reforms, seeking to broaden the scope of compensatory measures to deliver ecologically effective outcomes across the protected site network. The Marine Recovery Fund (MRF), due to launch in autumn 2025, will provide a voluntary, offshore wind industry-funded mechanism to support strategic compensation, reducing duplication, speeding up decision-making, and targeting investment towards measures with the greatest ecological benefit.

The Planning and Infrastructure Bill, currently in Parliament, seeks to fast-track critical infrastructure decisions and embed mechanisms such as the Nature Restoration Fund to pool resources for conservation and environmental improvement. Together with reforms to the Nationally Significant Infrastructure Project (NSIP) system, these measures are intended to accelerate delivery while embedding nature recovery into clean energy expansion.

Updates to Part One of the UK Marine Strategy (UKMS) in 2025 confirmed that Good Environmental Status (GES) has been achieved for only two of fifteen indicators, a decline from four in 2019. This trajectory signals the need for significant reform of the UKMS. At the same time, it presents an opportunity to position GES as a unifying framework, linking monitoring, compensation, Marine Net Gain (MNG), and restoration efforts.

The Scottish Biodiversity Strategy to 2045 sets a long-term ambition to restore and regenerate biodiversity across our land, freshwater and seas. The Strategic Framework for Biodiversity includes rolling 6-yearly rolling delivery plans along with statutory targets for nature restoration which will provide a credible pathway to achieving the outcomes of the Scottish Biodiversity Strategy. The proposed Marine and Coastal Restoration Plan will help to deliver and support these vision and outcomes. In parallel, TCE published the first update to its Nature Recovery Ambition in January 2025, outlining accountable actions to double the area leased for marine and coastal nature recovery by 2030 and to embed nature priorities into the Marine Delivery Routemap.

Taken together, these reforms highlight both the ambition and the challenges of delivering a rapid offshore wind build-out in a way that is resilient, environmentally responsible, and socially beneficial. Achieving this balance will require coordinated action across government, regulators, industry, and academia. Research will be needed across multiple fronts, including strengthening ecosystem baselines, understanding cumulative and climate-driven impacts, and reducing uncertainties around ecological functions, food webs, and fisheries interactions. Robust evidence is essential to inform mitigation and compensation measures, support UKMS targets and MNG frameworks, and improve monitoring efficiency through innovative methods. Addressing these priorities will enable confident consenting decisions, de-risk development, and guide strategic marine planning, with programmes such as ECOWind and ECOFlow central to generating the knowledge needed to shape policy, practice, and long-term restoration outcomes.

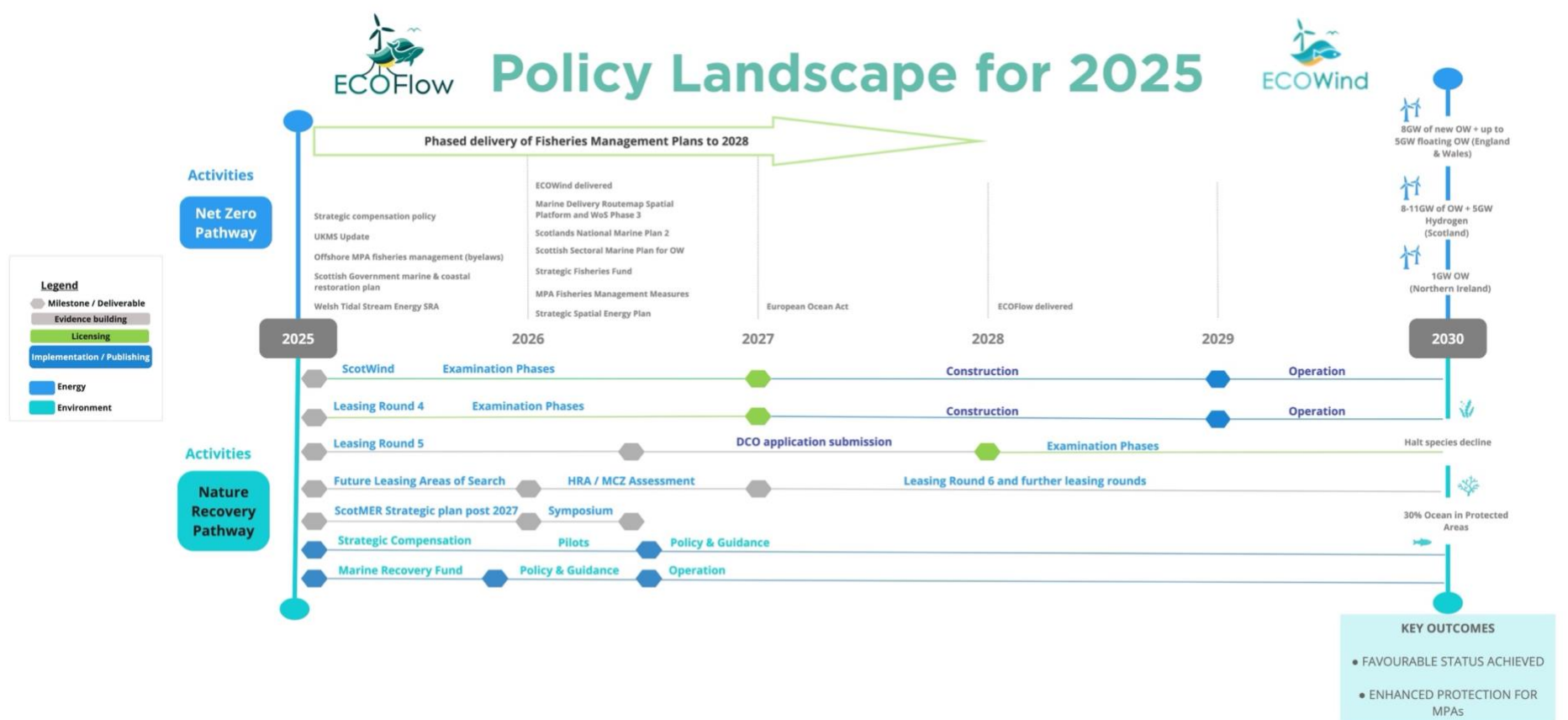


Figure 1. Timeline predictions of consenting and policy developments.

2 Introduction

The UK stands at a critical moment, with ambitious targets set for the expansion of offshore wind to meet the challenges of net zero whilst combating the twin crises of biodiversity loss and climate change. The Ecological Consequences of Floating Offshore Wind (ECOFlow) and the Ecological Consequences of Offshore Wind (ECOWind) research programmes have been designed to bridge the gaps regarding the impacts of Offshore Wind Farm (OWF) development and expansion, to facilitate the achievement of energy and environmental targets.

This report serves as an examination of the existing and upcoming policies and projects that are relevant to offshore wind either directly or indirectly, as of September 2025, and opportunity areas for research impact in the UK. It covers the following:

- An overview of the offshore wind-related policy and project delivery landscape in the UK, setting out key challenges and targets across government departments and delivery bodies.
- Timelines for delivering these policies and projects.
- Key opportunity areas and research programmes for impact creation in relation to the optimal outcomes for fixed and floating offshore wind delivery, climate change adaptation and marine ecosystems.

This report builds on previous editions (2023, 2024), reflecting annual updates to policy developments and delivery commitments.

2.1 Offshore Wind Pipeline

Aspirations for offshore wind in the UK are high to meet the demands of the British Energy Security Strategy (BESS), which aims to deliver up to 50 GW of offshore wind capacity by 2030, including 5GW of floating wind. In addition to this government target, there is a potential need for up to 140 GW of offshore wind by 2050 to meet the requirements identified by the Climate Change Committee.¹

Scotland has raised its ambition considerably, moving from 11 GW by 2030 to 40 GW by 2035–2040, aligned with consultation on the updated Sectoral Marine Plan 2025 ([section 4.3.2](#)). At the UK level, the Clean Power 2030 Action Plan provides a delivery pathway, with reforms to accelerate consenting and streamline project timelines ([section 3.6](#)).²

The current offshore wind pipeline, including operational, committed, under development, pre-planning and identified potential totals 95GW ([Figure 2](#)).³ TCE estimates that 20–30 GW of new seabed rights in England and Wales will need to be brought to market by 2030 for delivery out to 2040.⁴ Successive leasing rounds are under consideration, with scale and timing informed by evidence from the Whole of Seabed (WoS) programme ([section 4.3.6](#)).

¹<https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Electricity-generation.pdf>

²<https://assets.publishing.service.gov.uk/media/677bc80399c93b7286a396d6/clean-power-2030-action-plan-main-report.pdf>

³<https://www.datocms-assets.com/136653/1747814298-osw-report-2024.pdf>

⁴<https://www.datocms-assets.com/136653/1742378325-future-offshore-wind-2024.pdf>

In 2024, TCE published the Future of Offshore Wind Report, in partnership with Great British Energy ([section 3.7](#)).⁵ The report confirmed the need to lease small proportions of each identified opportunity area before 2040 to meet long-term targets. Key opportunity regions include:

- **Celtic Sea** – potential for up to 12GW, with 4–10 GW to be leased through future rounds by 2030.
- **North East** – potential for up to 10–16 GW, with leases anticipated by 2030 and operations commencing between 2035 and 2040.
- **Dispersed opportunities** – smaller-scale projects (2–8 GW) in the Southern North Sea, English Channel, Welsh waters, and North West England, also expected to come online from 2035–2040.

These areas will be refined through successive stages of spatial planning from broad areas of opportunity to Project Development Areas (PDAs). This process will be supported by plan-level strategic environmental measures, including:

- Early integration of Habitats Regulations Assessment (HRA) at plan level.
- Consideration of the Marine Protected Area (MPA) network.
- Pre-consent surveys and evidence gathering.
- Additional upfront work to de-risk consenting and accelerate project delivery.

TCE Marine Delivery Routemap is a long-term spatial strategy to assist in net zero objectives alongside nature recovery and economic development.⁶ Drawing on the WoS evidence base, this Routemap integrates digital seabed mapping, scenario planning, and stakeholder input to present a forward strategy for a thriving marine economy.

The Routemap aims to:

- Optimise use of marine space for multiple outcomes.
- Identify areas of high opportunity for biodiversity and nature recovery.
- Provide visibility and certainty on future seabed use.
- Accelerate progress towards net zero.
- Support economic development and community benefits, including skills, port infrastructure, and supply chain investment.

⁵ <https://www.datocms-assets.com/136653/1742378325-future-offshore-wind-2024.pdf>

⁶ <https://www.thecrownestate.co.uk/our-business/marine/Marine-Delivery-Routemap>

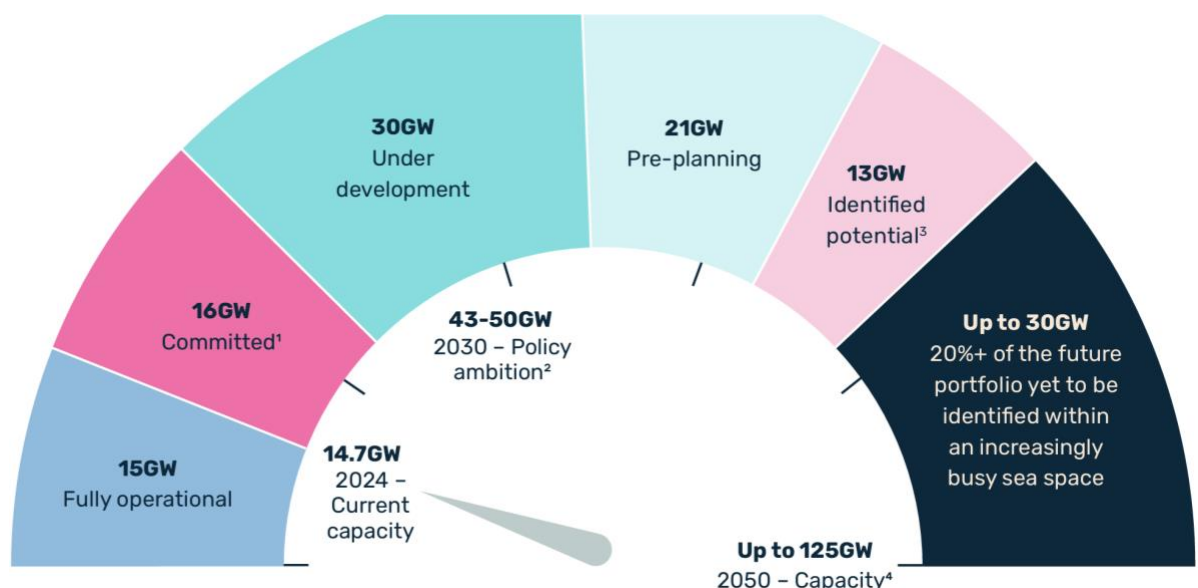


Figure 2. UK Offshore Wind development pipeline capacity, taken from the TCE Offshore Wind Report 2024⁷:

1. Projects under construction or projects that have government support on offer.
2. Clean Power 2030 Action Plan (2024) (section 3.6).
3. Potential from current leasing rounds and additional capacity requests, including Innovation and Targeted Oil & Gas (INTOG) and Leasing Round 5.
4. 'Balanced Pathway' recommendation: The Seventh Carbon Budget: The UK's Path to Net Zero.

2.2 Current Seabed Leasing Rounds

There are 52 OWFs either operational or under construction across UK waters. All UK OWF projects from pre-leasing through to operational phases are listed in the TCE 2024 Report.⁸

2.2.1 Round 4

TCE Offshore Wind Leasing Round 4 created the opportunity for around 8GW of new fixed offshore wind projects in the waters around England and Wales by 2030. The Agreements for Lease process concluded in January 2023, with the addition of six new projects. The plan level HRA concluded that the possibility of an adverse effect on integrity on protected sites could not be ruled out ([section 2.2.2.1.2](#)).

The Round 4 plan level HRA concluded that an adverse effect on the integrity as a result of the Round 4 plan cannot be ruled out for kittiwakes from the Flamborough and Filey Coast Special Protection Area (SPA) and sandbanks within the Dogger Bank Special Area of Conservation (SAC).⁹ A derogation was sought from the Department for Energy Security and Net Zero (DESNZ), which would allow the plan to progress if certain tests are met, while ensuring that any impacts to the designated sites are fully offset through environmental compensatory measures.

Strategic, plan-level compensation measures are being identified by TCE as the plan promoter. The kittiwake plan level compensation plan was published in February 2024 with

⁷ <https://www.datocms-assets.com/136653/1747814298-osw-report-2024.pdf>

⁸ Ibid

⁹ <https://www.marinedataexchange.co.uk/details/TCE-3582/2022-the-crown-estate-2020-offshore-wind-round-4-plan-habitats-regulations-assessment/packages?type=Report>

the preferred measure of kittiwake prey enhancement through the management of sandeel fisheries.¹⁰ Prey enhancement via the management of sandeel fisheries and associated ecosystem-based management was considered by the Kittiwake Steering Group to be the most ecologically effective means of increasing the breeding success of kittiwake. However, the permanent closure of sandeel fisheries in English and Scottish waters of the North Sea from 1st April 2024 raised doubts as to the viability of this option as a compensatory measure.¹¹ Given the uncertainty around prey enhancement and the possibility of future policy changes to the fisheries closure, the Steering Group agreed that Round 4 strategic compensation resources should instead prioritise measures that can be directly delivered by developers, e.g. offshore strategic artificial nesting structures.

The Mona, Morecambe and Morgan OWFs have been granted a Development Consent Order (DCO) by DESNZ. Dogger Bank South OWF examination formally closed in July 2025, with a consent decision expected within six months.¹² Outer Dowsing OWF is expecting a consent decision in October 2025.

2.2.3 Capacity Increase Programme

TCE is adding 4.7 GW of additional capacity across seven OWFs that are already in development. This reflects advances in offshore wind technology since the original seabed rights were awarded, which now allow more energy to be generated from the same seabed area. The OWFs are: Awel y Mor, Dudgeon Extension, Sheringham Shoal Extension, North Falls, Five Estuaries, Rampion 2, and Dogger Bank D.

A plan-level HRA was carried out to evaluate the potential impacts of the Capacity Increase Programme on protected habitats and species. Following this assessment, TCE recommended to the DESNZ that the programme should proceed under a derogation, supported by compensation measures to address the identified effects on marine habitats and species. The Secretary of State has accepted this recommendation.¹³

2.2.4 Round 5 Celtic Sea

Floating offshore wind (FLOW) is entering a critical phase of deployment in the UK. Current operational capacity stands at 78MW, delivered through earlier projects including Hywind Scotland (30MW) and Kincardine (48MW).¹⁴ In addition, three demonstrator projects are contributing to technological development: TetraSpar in the North Sea, DemoSath in the Bay of Biscay, and the Blyth Offshore Demonstrator off the Northumberland coast. Further progress is underway through Erebus, a 100MW project located offshore Pembrokeshire, Wales, with construction scheduled to commence in 2026 as part of Round 4 delivery.

Building on this foundation, Leasing Round 5 for the Celtic Sea aims to deliver 4.5GW of FLOW capacity by 2035. The round identifies:

¹⁰ https://assets.ctfassets.net/nv65su7t80y5/17AnpAwydDxhtwpalkUOzv/0f96aa29b63fa32bf9f500e9a5b5cc32/43569-TCE-DOC-062_Kittiwake_Strategic_Compensation_Plan_FINAL_SIGNED.pdf

¹¹ <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010125/EN010125-001387-kittiwake.pdf>

¹² <https://uk.rwe.com/project-proposals/dogger-bank-south/#:~:text=RWE%20entered%20into%20Agreements%20for,doggerbanksouth.co.uk>

¹³ <https://www.thecrownestate.co.uk/our-business/marine/capacity-increase-programme>

¹⁴ <https://assets.publishing.service.gov.uk/media/64a54c674dd8b3000f7fa4c9/offshore-wind-investment-roadmap.pdf>

- Three Project Development Areas (PDAs), each with a potential capacity of up to 1.5 GW, have been identified for the Round 5 leasing process (Figure 3).
- Three Test and Demonstration sites (Liŷr 1, Liŷr 2, and WhiteCross), each of up to 100 MW.

For the first time in the leasing process, a HRA was undertaken for Offshore Wind Leasing Round 5 before any leasing agreements. This upfront HRA assessed potential environmental impacts to understand necessary mitigation measures before leases were granted, reducing future delays and uncertainty, particularly for the new FLOW in the Celtic Sea. The HRA concluded that the plan, both alone and in combination with other plans or projects, would not have an adverse effect on the integrity of any designated sites considered in the array assessment. The Round 5 tender process formally closed in April 2024.

In June 2025, TCE announced that Equinor and Gwynt Glas, a joint venture between EDF Renewables and ESB had been selected as preferred bidders to take forward two of the Round 5 project sites. TCE reaffirmed its commitment to ensuring the full potential capacity available under Round 5 is delivered through the development of a third site. Work is currently underway to identify options for this, with next steps expected to be outlined by the end of September 2025.¹⁵

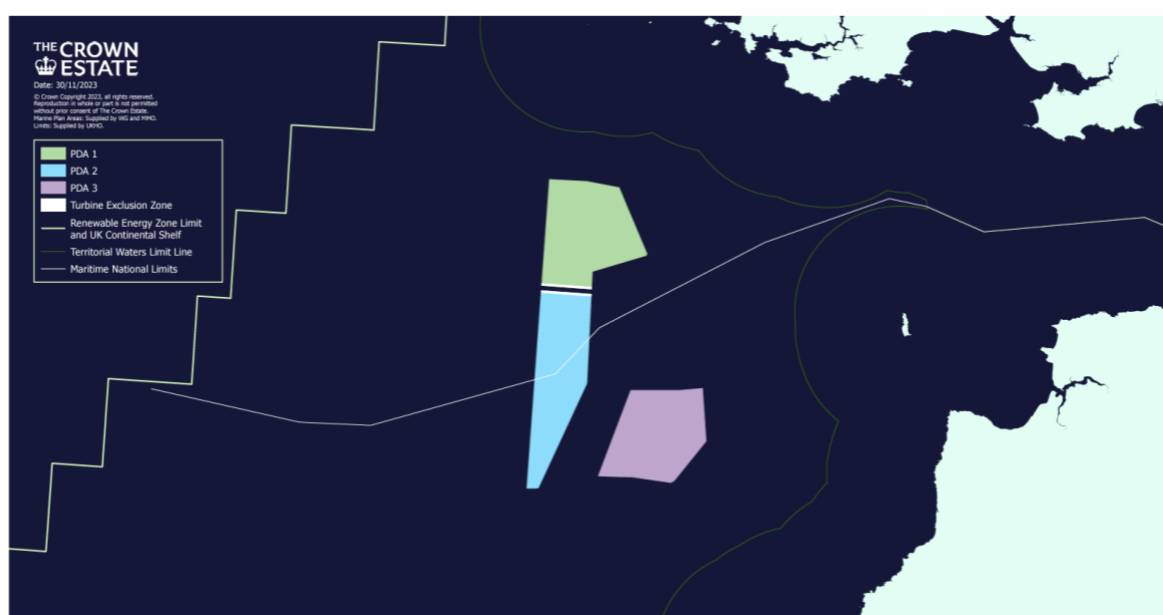


Figure 3. Round 5 Project Development Areas¹⁶

2.2.5 ScotWind

The ScotWind leasing round was announced in 2021 and resulted in 20 projects securing seabed option agreements, 13 of which are floating and 7 are fixed OWFs. ScotWind is 'plan-led', meaning that all sites are within the areas of seabed identified in the Scottish Government's Sectoral Marine Plan for Offshore Wind (4.3.2). The draft updated Sectoral Marine Plan for Offshore Wind has been developed specifically because the potential

¹⁵ <https://www.thecrownestate.co.uk/our-business/marine/round-5>

¹⁶ <https://www.thecrownestate.co.uk/our-business/marine/project-development-areas>

generation capacity awarded through the ScotWind Option Agreements and Innovation and Targeted Oil and Gas (INTOG) Exclusivity Agreements (EAs) exceeded the previous planning scenario. The central scenario assesses a total potential generation capacity of 37.4 GW.¹⁷

The West of Orkney OWF has become the first project from the ScotWind leasing round to secure planning approval from the Scottish Government. In addition, four further projects, Ossian, Caledonia, Muir Mhòr, and Buchan have already entered the planning system with applications currently under consideration.¹⁸

The Berwick Bank OWF, located in the Firth of Forth, was leased prior to the Scotwind leasing round by Crown Estate Scotland. In July 2025, the Scottish Government granted consent for the project, which is expected to begin construction later in 2025. At an estimated capacity of 4.1 GW and up to 307 turbines, Berwick Bank is significantly larger than any other current offshore wind project in UK waters. Given the site's importance for wildlife, particularly seabirds, consent is conditional on the developer, SSE Renewables, preparing a detailed seabird compensation plan. This plan must demonstrate how adverse impacts on seabird populations will be addressed and will require regulatory approval before construction can progress.

2.2.6 The Innovation and Targeted Oil and Gas Round (INTOG)

The INTOG leasing round facilitated applications for seabed rights to develop OWFs in Scottish waters that either supply renewable electricity directly to Oil and Gas (O&G) infrastructure or comprise small-scale innovative projects of 100MW or less. Among the applicants, 5 innovative OWF projects were chosen, alongside 7 targeted O&G leases, potentially adding a total capacity of 4-5.5GW.¹⁹

3 Offshore Wind Policy and Legislation Landscape

At the UK level, the policy and legislative framework for offshore wind has evolved rapidly, with governments committed to accelerating clean energy deployment, strengthening energy security, and reforming planning and consenting systems. However, recent market developments have highlighted the pressures facing delivery. In May 2025, Ørsted announced its decision to discontinue the Hornsea 4 project in its current form, citing escalating supply chain costs, higher interest rates, and increased delivery risks following its Contract for Difference award in Allocation Round 6. Similarly, Vattenfall discontinued the Norfolk Boreas project, pointing to inflationary pressures and supply chain constraints that rendered the scheme financially unviable. These developments underscore the urgent need for regulatory reform and a more holistic approach to offshore wind deployment, one that integrates planning, consenting, supply chain resilience, financial mechanisms, and environmental responsibilities to ensure projects remain deliverable while contributing to net zero and energy security objectives.

¹⁷ <https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-paper/2025/05/draft-updated-sectoral-marine-plan-offshore-wind-energy-2025/documents/draft-updated-sectoral-marine-plan-offshore-wind-energy/draft-updated-sectoral-marine-plan-offshore-wind-energy/govscot%3Adocument/draft-updated-sectoral-marine-plan-offshore-wind-energy.pdf>

¹⁸ <https://www.offshorewindscotland.org.uk/the-offshore-wind-market-in-scotland/scotwind-leasing-round/>

¹⁹ <https://www.offshorewindscotland.org.uk/the-offshore-wind-market-in-scotland/intog-leasing-round/>

3.1 The British Energy Security Strategy

Published in April 2022, the British Energy Security Strategy (BESS) set the foundation for delivering up to 50 GW of offshore wind, including 5 GW of floating wind, by 2030. To achieve this, it committed to a suite of reforms: strengthening the energy National Policy Statements (NPSs) ([section 2.2.2](#)), streamlining the consenting process to reduce timelines from up to four years to one year, and embedding environmental considerations at a strategic level to improve outcomes for both infrastructure and the marine environment.

3.2 Offshore Wind Environmental Improvement Package

The Offshore Wind Environmental Improvement Package (OWEIP) was announced as part of the BESS to help accelerate offshore wind deployment whilst continuing to protect the marine environment. The OWEIP is being developed by Government to address unavoidable impacts of offshore wind on Marine Protected Areas (MPAs) at a strategic level. It is underpinned by powers secured in the Energy Act 2023 ([section 3.3](#)), with implementation progressing through secondary legislation.²⁰

OWEIP measures include:

- **Marine Recovery Fund (MRF):** Strategic compensation mechanism enabling developers to contribute to collective environmental recovery (section 3.3).
- **Environmental Assessment Reform:** Targeted updates to HRA and Marine Conservation Zones (MCZs) assessment guidance (Defra consultation, February 2024).
- **Offshore Wind Environmental Design Standards (OWES):** Minimum design requirements for mitigation, reducing reliance on compensation.
- **Strategic Monitoring:** Coordinated evidence collection to better understand cumulative impacts and improve decision-making.

3.3 The UK Energy Act 2023

The UK Energy Act 2023 represents the most comprehensive energy legislation enacted in the UK in over a decade.²¹ The Energy Act introduces a new statutory framework to address one of the central challenges facing OWF deployment, delivering robust environmental protection while ensuring consenting timelines do not delay progress towards the UK's ambitious offshore wind targets.

The Act recognises that project-by-project compensation has become increasingly fragmented and insufficient to address the cumulative impacts of offshore wind, particularly on habitats and species protected under the Habitats Regulations. To address this, it introduces provisions for strategic compensation, enabling measures to be planned and delivered at scale.

²⁰ <https://www.gov.uk/government/publications/strategic-compensation-measures-for-offshore-wind-activities-marine-recovery-fund-interim-guidance/strategic-compensation-measures-for-offshore-wind-activities-marine-recovery-fund-interim-guidance>

²¹

3.3.1 Strategic compensation policy

The Energy Act provides the statutory framework and legal clarity needed to implement the OWEIP, embedding strategic compensation and environmental design standards directly into legislation. This framework enables the delivery of strategic compensatory measures that are intended to be more ecologically robust than project-level approaches, offering scalable solutions to address cumulative impacts across multiple projects and sectors. By formalising OWEIP within the Act, government establishes a clear delivery pathway that integrates biodiversity recovery with offshore wind expansion, advancing a nature-positive approach.

To support delivery, the Collaboration on Offshore Wind Strategic Compensation working group (COWSC) has been set up by Defra and the Offshore Wind Industry Council (OWIC) and involves the offshore wind industry, Non-Governmental Organisations (NGO), government departments, devolved administrations, TCE and CES to develop strategic compensation measures to include in a government endorsed 'library of measures' which will be used by the MRF.

The first measures for the strategic compensation library have been recommended by COWSC, these are:

- Predator reduction or eradication for seabirds.
- Artificial nesting towers for black legged kittiwakes in the English North Sea.
- Designation of additional MPAs for benthic habitats.

These are to compensate for the impacts of offshore wind plans and projects currently in the consenting pipeline in English Waters e.g. Round 3, Extensions and Round 4. More evidence is needed to support these measures, as well as developing additional measures, including other measures that are already being investigated by COWSC, particularly as offshore wind development moves into new locations e.g. the Celtic Sea.

Compensation measures implementation roadmap projects are ongoing in Scotland from summer 2025 to February 2026, which include:

- Predator control and biosecurity;
- Habitat management and restoration, including colony disturbance reduction;
- Fisheries management;
- Enhancement of prey habitats; and
- Marine litter removal.

In summer 2025, the Scottish Government and Defra consulted on proposed Environmental Compensatory Measures Reforms (ECMR) for offshore wind, to be delivered under powers granted by the Energy Act 2023. The reforms seek to create a more flexible and pragmatic approach, broadening the range of available measures to deliver 'wider compensatory measures' that deliver the most ecologically effective outcomes. Wider measures are defined as compensatory measures that provide an ecological benefit to the protected site network as a whole rather than the specific feature impacted.

Examples include:

- Supporting recovery or improving the condition of features across the network.
- Alleviating key pressures (e.g. predation, fisheries disturbance).
- Enhancing resilience to climate change and other stressors.

- Delivering actions that can be monitored for effectiveness.

A tiered compensation hierarchy has been proposed. The first priority is to deliver measures that directly benefit the impacted feature. Where this is not possible, the second tier allows for measures that support ecologically similar features e.g. for seabirds, if a surface feeding seabird is impacted, then an alternative surface feeding seabird species which has a similar function or service might be deemed a similar feature. As a last resort, the third tier permits measures that provide broader benefits to the wider protected site network. The outcomes of the consultation will be reviewed over winter 2025/26, with final guidance expected in spring 2026.

3.3.2 Marine Recovery Fund (MRF)

The UK Energy Act 2023 establishes the MRF, a fund that OWF developers or plan promoters (i.e. TCE) can optionally pay into to deliver strategic compensatory measures that are within the library of measures, for offshore wind in England, Wales and Northern Ireland. This approach enables government to coordinate compensation at a strategic and ecosystem scale, delivering more effective measures to compensate for the adverse environmental impacts of offshore wind activities on protected sites. It is intended to reduce duplication, accelerate project delivery by speeding up decision-making and target investment towards measures that provide the greatest ecological benefit.

Defra will act as the MRF operator. Developers will be able to make applications to the MRF once it is live, which is expected to be in Autumn 2025.

3.4 The Planning and Infrastructure Bill

At the time of writing, the Planning and Infrastructure Bill is at the Committee Stage in the House of Lords, and therefore subject to amendment.²² The Bill seeks to accelerate and streamline the delivery of critical infrastructure by fast-tracking planning decisions. It will support the delivery of the Clean Power 2030 target by ensuring clean energy projects are built at pace.

Key provisions include:

- **Reforms to the Nationally Significant Infrastructure Project (NSIP) system:** including streamlined consultation requirements, more frequent updates of NPS, and reduced opportunities for judicial review ([section 3.5](#)).
- **Introducing a more strategic approach to nature recovery:** The Bill introduces a Nature Restoration Fund, which developers would contribute to for the delivery of actions within **Environmental Delivery Plans (EDPs)** prepared by Natural England. These plans will set out conservation measures addressing impacts on protected sites and species, pooling resources to deliver environmental improvement.

3.5 The Energy National Policy Statements

Revised NPSs came into force in January 2024, providing updated planning guidance and reinforcing the critical role of renewable energy infrastructure. EN-3 explicitly referenced the

²² <https://bills.parliament.uk/bills/3946>

OWEIP, OWES, and strategic compensation, highlighting the need to strengthen the evidence base for future measures.²³

In 2025, further consultations were launched to align the NPSs with the Clean Power 2030 Action Plan ([section 3.6](#)). Key reforms include:

- **Draft EN-1 (2025)**²⁴: Extends Critical National Priority status to projects under Clean Power 2030, establishing a presumption in favour of consent where impacts remain after mitigation. It also promotes system-wide planning for the transmission network via the Centralised Strategic Network Plan (CSNP) positioned as the primary tool to deliver a long-term, holistic approach to network development.
- **Draft EN-3 (2025)**: Introduces new guidance on wake effects between offshore wind farms, encouraging developers to assess potential interactions with neighbouring projects at the design stage.²⁵ However, residual impacts, where all reasonable steps have been taken, will carry limited weight in decision-making, and there is no requirement for compensation agreements.

3.6 Clean Power 2030 Action Plan

Published in March 2024, the Clean Power 2030 Action Plan sets out the UK Government's roadmap to fully decarbonise the power sector by 2030.²⁶ It prioritises accelerating renewable deployment, reforming planning and consenting processes, and addressing delays to grid connections. Importantly, the plan commits to embedding environmental protection and restoration into clean energy delivery, ensuring offshore wind is developed in a nature-positive way. Throughout 2025, DESNZ has engaged widely with stakeholders to explore how best practice in nature-positive design and delivery can be embedded.²⁷

The Clean Power 2030 Action Plan commits to:

- **Equipping the planning system**: Providing organisations across the planning system with the tools needed to deliver Clean Power 2030 and wider government missions.
- **Updating the policy framework**: Revising the NSPs and Planning Policy Guidance in 2025, alongside confirmed changes to the National Planning Policy Framework (NPPF), to improve certainty for developers and examining authorities.
- **Legislative reform**: Delivering an ambitious programme of reform, including through the **Planning and Infrastructure Bill** ([section 3.4](#)).
- **Embedding nature protection**: Ensuring that environmental protection and enhancement are integral to the delivery of Clean Power 2030, aligning clean energy deployment with long-term restoration goals.

²³ https://assets.publishing.service.gov.uk/media/64252f5f2fa848000cec0f52/NPS_EN-3.pdf

²⁴ <https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-2025-revisions-to-national-policy-statements/draft-national-policy-statement-for-renewable-energy-infrastructure-en-3-accessible-webpage>

²⁵ <https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-2025-revisions-to-national-policy-statements/draft-national-policy-statement-for-renewable-energy-infrastructure-en-3-accessible-webpage>

²⁶ <https://assets.publishing.service.gov.uk/media/677bc80399c93b7286a396d6/clean-power-2030-action-plan-main-report.pdf>

²⁷ <https://questions-statements.parliament.uk/written-questions/detail/2025-04-17/46393>

3.7 The Great British Energy Act 2025

The Great British Energy Act 2025 establishes Great British Energy (GB Energy) as a state-owned company under DESNZ, to accelerate investment in clean energy infrastructure, improve energy security, and drive progress towards net zero.²⁸

GB Energy's activities include:

- **Project development:** Partnering with industry, landowners, and communities to deliver new clean energy projects and critical infrastructure;
- **Community benefits:** Delivering the Local Power Plan, which funds and supports community-led energy initiatives, offering expert advice and creating mechanisms for communities to take a direct financial stake in local projects; and
- **Innovation and supply chain resilience:** Supporting domestic manufacturing and reducing reliance on imports through targeted investment in research, development, and clean energy supply chains.²⁹

3.7.1.1 Cumulative Impact Assessment

Requirements for Cumulative Impact Assessments (CIAs) fall under several legislative frameworks and policies, including the Marine and Coastal Access Act 2009, the Habitats Regulations, the UK Marine Policy Statement and the NPS (EN-1). The NPS mandates consenting authorities to consider cumulative effects when assessing individual applications, so developers have to provide project-level EIA and CIA assessments.

Current licensing conditions have been criticised as inadequate, particularly for failing to account for cumulative impacts on ecological shifts and for not linking population-level impacts to spatio-temporal changes across local, regional, and ecosystem scales.

Scottish Government and the European Maritime and Fisheries Fund funded the Cumulative Effects Framework for Key Ecological Receptors project led by the UK Centre for Ecology and Hydrology. This project produced an online tool to predict impacts at a population level for both individual projects and cumulative assessments, with a clear audit trail to provide transparency and reproducibility for evidence in consenting.³⁰

3.7.1.2 Decommissioning

Blyth OWF was decommissioned in 2019 after 19 years of operation. However, many of the early projects will begin approaching the end of their design lives in the 2030s, raising critical questions about decommissioning. Selecting the most appropriate decommissioning approach requires a careful balance of technical feasibility, financial implications, environmental impacts, and social considerations, alongside regulatory and policy requirements.

The Marine Management Organisation (MMO) Strategic Renewables Unit is leading efforts to establish a proactive framework for offshore wind decommissioning.³¹ A cross-government

²⁸ <https://www.gov.uk/government/publications/great-british-energy-bill-factsheets/great-british-energy-bill-overarching-factsheet>

²⁹ <https://www.gbe.gov.uk/>

³⁰ <https://www.ceh.ac.uk/our-science/projects/cumulative-effects-framework-key-ecological-receptors>

³¹ <https://marinedevelopments.blog.gov.uk/2025/04/30/end-of-life-of-an-offshore-wind/>

working group is being convened in 2025 to raise awareness of end-of-life issues, clarify regulatory expectations, and provide industry with guidance on decommissioning responsibilities. The group will bring together representatives from government departments, regulators, TCE, and Statutory Nature Conservation Bodies (SNCBs) to align policy, share expertise, and ensure a strategic, coordinated approach.

4 Marine Planning Policy and Legislative Landscape

Significant effort is underway to optimise marine areas to reach energy and environmental ambitions and targets for 2030, 2042, and 2050. This section gives an overview of the marine planning policies, strategies and programmes to be aware of. The section is concluded with how ECOWind and ECOFlow research can contribute to marine planning initiatives.

4.1 UK Marine Policy Statement

This Marine Policy Statement (MPS) is the framework for preparing Marine Plans and taking decisions affecting the marine environment across the UK marine areas. The MPS framework is designed to ensure that authorities are considering the economic, social and environmental benefits and adverse effects of plans and proposals for the marine plan areas.

4.2 National and Regional Marine Plans

4.2.1 England

England has divided marine planning into 11 marine plan areas: South West (inshore and offshore), South (inshore and offshore), South East (inshore), East (inshore and offshore), North East (inshore and offshore) and North West (inshore and offshore).³² The Explore Marine Plans spatial tool identifies areas of potential conflict, policies to be considered, opportunities for co-existence and relevant stakeholders.³³

The East Marine Plans are being replaced following the 3-year reporting cycle³⁴ that identified changes in national priorities since 2014. The outputs of the Marine Spatial Prioritisation (MSPri) programme ([section 2.1.4](#)), will evolve the marine planning approach and inform the development of the East Inshore and East Offshore Marine Plans for adoption by 2027.

4.2.2 Scotland

Scotland's National Marine Plan (NMP) provides the guiding framework for sustainable management of marine activities and resources. Other plans, such as the Sectoral Marine Plan for Offshore Wind Energy ([section 2.1.3.2](#)), provide further policy and spatial frameworks for sustainable development and have been developed in accordance with the NMP. The NMP is currently being updated to the NMP2, which will support sustainable development of our seas, protect our marine environment and deliver for our coastal communities. NMP2 is required to account for Scottish Government's commitment to Net-Zero by 2045 and to help address the twin crises of climate change and biodiversity loss by managing the increased

³² <https://www.gov.uk/government/publications/marine-plan-areas-in-england>

³³ <https://explore-marine-plans.marineservices.org.uk/>

³⁴ https://assets.publishing.service.gov.uk/media/6422d1032fa8480013ec0d1b/East_Report_2023.pdf

competition for space and resources in the marine environment. The NMP2 and the terrestrial planning framework (National Planning Framework 4) will act as companion documents, setting out a coherent vision for the future development of Scotland's land and seas.

To ensure NMP2 can provide the overarching planning framework for the sustainable development of Scotland's seas, it is essential that the outcomes from consultations and engagement with stakeholders on NMP2 are considered.^{35,36}

Outcomes from ongoing consultations and engagement on other plans and policies (for example: Sectoral Marine Plan for Offshore Wind, Offshore Marine Protected Areas) will also be considered in the development of NMP2. Therefore, the consultation on the draft NMP2 has been postponed to allow for further consideration of the feedback received and SG's approach to NMP2.

Key Priorities for the NMP2 include:

- **Sustainable development:** Providing the planning framework for sustainable management of marine space;
- **Biodiversity recovery:** Aligning with Scotland's biodiversity strategy, MPA network, and restoration initiatives;
- **Blue economy development:** Offering clarity for existing and emerging marine sectors such as aquaculture, hydrogen, and carbon capture and storage; and
- **Climate resilience:** Embedding adaptive approaches to respond to long-term environmental change.

4.2.3 Wales

The Welsh National Marine Plan was produced in 2019 and takes a 20-year view, with an objective to develop a sustainable marine economy, living within environmental limits.³⁷ The Welsh Marine Planning Portal provides detail on plan areas, policies, and sector policies.³⁸

4.2.4 Northern Ireland

The Department of Agriculture, Environment and Rural Affairs (DAERA) of Northern Ireland have produced the draft Marine Plan for Northern Ireland, which consists of two plans, one for the inshore region and one for the offshore region.³⁹ Plan approval and implementation is underway.

4.3 Sectoral Plans

4.3.1 The Strategic Spatial Energy Plan (SSEP)

In 2024, the UK, Scottish, and Welsh governments jointly commissioned the National Energy System Operator (NESO) to develop the first-ever Strategic Spatial Energy Plan (SSEP) for

³⁵ <https://www.gov.scot/publications/national-marine-plan-2-planning-position-statement-consultation-analysis-report/>

³⁶ <https://www.gov.scot/publications/analysis-synthesis-community-engagement-events-national-marine-plan-2/>

³⁷ https://www.gov.wales/sites/default/files/publications/2019-11/welsh-national-marine-plan-document_0.pdf

³⁸ <https://lle.gov.wales/apps/marineportal/#lat=52.5145&lon=-3.9111&z=8&tgt=false&layers=231,390>

³⁹ <https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Marine%20Plan%20for%20NI%20final%2016%2004%2018.PDF>

Great Britain, scheduled to be completed by 2026.⁴⁰ The SSEP will be a spatial energy plan that sets out the location and timing of energy infrastructure delivery to support the UK's target for a decarbonised energy system. The plan will give increased certainty for investors and industry and provide an opportunity for community engagement. It will be produced by the Electricity Systems Operator and NESO through close working with the government, including the Marine Spatial Prioritisation (MSPri) ([section 2.1.4](#)) and WoS ([section 2.1.5](#)) programmes. The SSEP represents a foundational shift toward spatial, system-level planning across energy sectors and regions, aligning top-down national strategy with local and regional priorities via tools such as Regional Energy Strategic Plans.

4.3.2 Scottish Sectoral Marine Plan for Offshore Wind

The Scottish Sectoral Marine Plan for Offshore Wind Energy, first published in 2020, provides the strategic basis for identifying areas suitable for offshore wind development in Scottish waters. Its central purpose is to balance the rapid expansion of offshore wind with the need to protect the environment, manage interactions with other marine sectors, and support Scotland's transition to net zero. The 2020 Sectoral Marine Plan was specifically the spatial framework for commercial scale offshore wind (scotwind leasing round).

The draft updated Sectoral Marine Plan for Offshore Wind Energy was consulted on during summer 2025.⁴¹ This plan is the updated spatial framework for ScotWind as well as INTOG and test & demonstration for offshore wind. The draft sets out a spatial framework for the future deployment of offshore wind, integrating national and regional-level considerations of opportunities and constraints. It draws on the best available evidence to assess potential in-combination and cumulative impacts, propose mitigation approaches, and identify where strategic compensation may be necessary to address environmental pressures.

The updated plan also places emphasis on evidence and research needs, highlighting current knowledge gaps and setting priorities for future studies to improve the consenting process for offshore wind projects. In doing so, it aims to strengthen the evidence base, provide greater certainty for developers and regulators, and support more strategic environmental management.

The consultation feedback is being analysed, with a final draft of the revised plan expected in autumn 2025, followed by a formal derogation process in winter 2025/26, and adoption anticipated in spring 2026. Once in place, the plan will guide deployment of both fixed and FLOW and test and demonstration for offshore wind, ensuring development is delivered in a manner consistent with Scotland's climate, biodiversity, and marine policy objectives.

4.3.3 Welsh Strategic Resource Areas

Strategic Resource Areas (SRAs) are being mapped in Wales as a mechanism to safeguard areas of natural resources. The intention is that they will ensure that different sectors' interests are taken into account by others and encourage dialogue between sectors, including how they can co-exist within the same area. In January 2025, the Welsh Government formally

⁴⁰ <https://assets.publishing.service.gov.uk/media/67168359d100972c0f4c9b41/strategic-spatial-energy-plan-ssep-neso-commission.pdf>

⁴¹ <https://www.gov.scot/publications/draft-updated-sectoral-marine-plan-offshore-wind-energy-2025/>

introduced its first SRAs for Tidal Stream Energy.⁴² There is a proposed SRA for wave energy and FLOW.⁴³

4.3.4 Northern Ireland

An Offshore Renewable Energy Action Plan for Northern Ireland has been published as the implementation tool for Northern Ireland's commitment, under its Energy Strategy, to deploy 1 GW of offshore wind by 2030.⁴⁴ The overarching strategic priorities include working within the draft Marine Plan ([section 4.2.4](#)), using innovative approaches to co-location, coordinated consenting, coordinated research and decision making, maximising economic benefits, and legislative review to ensure delivery of targets.

4.3.5 Marine Spatial Prioritisation Programme

Defra has developed the cross-Government MSPri Programme in England, aiming to address the increasing demand for the use of the sea. The programme will increase understanding of the current and future demands for the sea, how to maximise colocation between all sea users, and prioritise use of marine space, to better manage the increasing spatial squeeze on seas.

The programme is undertaking modelling informed by geospatial data on existing and future sea uses across key sectors up to 2050. They are working in close collaboration with the TCE WoS programme ([section 2.1.5](#)) to ensure alignment. The MSPri programme will produce maps of optimal areas for marine activities, allowing for improved coordination of infrastructure and deployment of offshore wind and other energy uses. The outputs of the MSPri programme will inform the development of updated Marine Plans for England, starting with the East Inshore and East Offshore Marine Plans.

To represent the demands on marine resources and facilitate trade-off decisions, sectors such as offshore wind, fishing, and nature recovery (treated as a sector) are being considered under the MSPri programme.

4.3.6 Whole of Seabed (WoS) Programme

TCE has developed the WoS programme to catalyse the delivery of multiple priorities, including net zero and nature recovery, as well as the enhanced co-ordination of future activities out to 2050. The aim of the programme is to help de-risk and accelerate the ambitions of industry in a way that supports diverse marine environments and other users of the sea.

The WoS will account for a range of factors, including options for expanding offshore wind capacity, infrastructure such as cables and pipelines, nature efforts including habitat restoration, biodiversity enhancement, and nature recovery, coastal development such as ports and harbours, storage solutions including carbon capture, utilisation and storage, hydrogen, and natural gas facilities, as well as considerations related to mineral extraction such as reclamation, aggregate dredging, and marine mining.

The WoS programme is developing significant spatial planning capability within TCE that will be supporting the development of their marine delivery routemap ([section 2.1](#)) and other

⁴² <https://www.gov.wales/written-statement-introduction-strategic-resource-areas-tidal-stream-energy>

⁴³ <https://lle.gov.wales/apps/marineportal/#lat=52.5145&lon=-3.9111&z=8&tgt=false&layers=231,390>

⁴⁴ <https://www.economy-ni.gov.uk/articles/offshore-renewable-energy-action-plan-oreap>

bodies who are delivering marine planning, such as the MMO and the cross government MSPri programme.

5 Environment Policy and Legislative Landscape

This section provides an overview of key environment and nature legislation, policies, strategies, and programmes, highlighting key updates and potential contributions of research.

Environmental governance across the UK has been strengthened in recent years through the establishment of independent oversight bodies to hold governments to account for delivery against statutory environmental targets and commitments. The Office for Environmental Protection (OEP) was established under the Environment Act 2021 to monitor and report on environmental progress, advise government on environmental law, and take enforcement action where there are suspected failures to comply. In Scotland, the equivalent body is Environmental Standards Scotland (ESS), created under the UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021. Together, the OEP and ESS represent a new phase of environmental accountability in the UK post-Brexit, ensuring that governments are transparent in reporting progress, consistent in applying environmental law, and responsive to evidence.

An independent review of Defra's regulatory landscape assessed whether existing frameworks are fit for purpose in supporting both economic growth and nature recovery. The review made eight key recommendations, including⁴⁵:

- Introduce refreshed regulator outcomes aligned with the Environmental Improvement Plan with clear accountability;
- Publish new Strategic Policy Statements for all regulators to clarify government priorities and address the lack of uniformity;
- Establish a Defra Infrastructure Board to accelerate nationally significant projects;
- Consolidate statutory duties to reduce regulatory overload;
- Improve cooperation through the appointment of lead regulators for major projects;
- Increase pay flexibility to retain specialist staff;
- Ensure regulators balance environmental outcomes with enabling growth and investment; and
- Embed Local Nature Recovery Strategies as a foundation for local Environmental Improvement Plans.

Natural England's Action Plan 2025/26 sets out priorities for supporting both terrestrial and marine recovery.⁴⁶ Key actions include:

- Developing Environmental Delivery Plans to guide the use of the Nature Restoration Fund and Marine Recovery Fund, enabling faster infrastructure delivery and large-scale nature recovery;
- Completing 80 MPA condition assessments and reviewing the MPA network, including advice on new or expanded sites for offshore wind compensation;

⁴⁵ <https://www.gov.uk/government/publications/delivering-economic-growth-and-nature-recovery-an-independent-review-of-defras-regulatory-landscape>

⁴⁶ <https://www.gov.uk/government/publications/natural-england-action-plan-2025-to-2026>

- Advancing tools and evidence, such as the Natural England Spatial Seabed Sensitivity Tool to support decision-making on marine protected sites;
- Supporting the development of Marine Net Gain to improve ocean health while enabling sustainable growth ([section 5.5](#));
- Advising on Fisheries Management Plans, Strategic Environmental Assessments, and ecosystem-based approaches to fisheries management; and
- Exploring the role of private finance to strengthen green finance partnerships for nature recovery.

Together, these measures reflect a regulatory and delivery landscape that is increasingly focused on integration, accountability, and enabling large-scale environmental recovery, with implications for offshore wind development, marine management, and wider environmental governance.

5.1 Environment Act 2021

The Environment Act 2021 sets clear statutory targets for biodiversity, including a legally binding target on reversing species decline by 2030, alongside provisions for new developments to improve or create habitats for nature. This legislation translates the ambitions outlined in the 25 Year Environment Plan (25YEP) into actionable measures through the Environmental Improvement Plan (EIP).

A legally binding target for England was set within the Environmental Target (Marine Protected Areas) Regulations 2023, which requires:

- at least 70% of protected features in English MPAs to be in a favourable condition by 31 December 2042, with the rest in recovering condition,
- all other protected features in English MPAs will be in a recovering condition.

5.2 25 Year Environment Plan and Environmental Improvement Plan

The 25YEP sets out the Government's vision for action to help the natural world regain and retain good health. The Environmental Improvement Plan⁴⁷ (EIP) 2023 for England is the first revision of the 25YEP and sets out ten goals and interim targets to measure progress for improving nature. Progress on achieving these goals will be measured in the Outcome Indicator Framework⁴⁸, which includes the following indicators for Seas and Estuaries which align with UKMS indicators:

- [C1: Clean seas: marine litter](#)
- [C2: Seabed subject to high pressure from human activity](#)
- [C3: Diverse seas: status of marine mammals and marine birds](#)
- [C4: Diverse seas: condition of seafloor habitats](#)
- [C5: Diverse seas: condition of pelagic habitats](#)
- [C6: Diverse seas: status of threatened and declining features](#)
- [C7: Healthy seas: fish and shellfish populations](#)
- [C8: Healthy seas: marine food webs functioning](#)

⁴⁷ <https://www.gov.uk/government/publications/environmental-improvement-plan>

⁴⁸ <https://oifdata.defra.gov.uk/>

- [C9: Healthy seas: seafloor habitats functioning](#)
- [C10: Productive seas: fish and shellfish stocks fished sustainably](#)
- [C11: Productive seas: status of sensitive fish and shellfish stocks](#)

By the end of 2025, Defra will publish a revised Environmental Improvement Plan (EIP25), building on EIP23 and providing a clearer, prioritised pathway for meeting the Environment Act targets.⁴⁹

5.3 UK Marine Strategy

The UKMS is derived from the EU Marine Strategy Framework Directive and aims to provide the environmental framework for delivering marine policy at the UK level. It sets out how to achieve the vision of clean, healthy, safe, productive, and biologically diverse oceans and seas across three parts:

- **Part One – UK Assessment & Good Environmental Status (GES):** 11 descriptors of GES, each with targets and indicators for assessing status. Some of these descriptors are further subdivided across key species groups or habitats;
- **Part Two – UK Monitoring programmes:** An approach to monitoring these key descriptors, targets and indicators across UK administrations, drawing on the existing UK Marine Monitoring and Assessment Strategy; and
- **Part Three – Programme of Measures (PoM):** A programme setting out the measures that contribute to the achievement and maintenance of GES in UK seas by 2020.⁵⁰

The first cycle of UKMS publications spanned 2012–2015, followed by the second cycle, with Part One (2019), Part Two (2020), and Part Three (2025) published in sequence.

In Summer 2025, Defra consulted on an update to Part One of the UKMS, presenting a revised assessment of progress towards GES.⁵¹ The consultation highlights a worsening trend: GES has been achieved for only two of 15 indicators, compared to four of 15 in 2019, signalling a continued decline in UK seas.

The OEP's response to the consultation identified significant shortcomings in the Government's approach, including:

- **Methodological inconsistency:** Multiple, non-standardised approaches have been applied to aggregate indicator assessments into overall GES ratings, limiting transparency and comparability;
- **Data gaps and fragmentation:** A lack of systematic action to fill evidence gaps undermines the robustness of assessments, creating a partial and potentially misleading picture of progress; and
- **Weakness in target-setting:** None of the proposed targets are fully **SMART (Specific, Measurable, Achievable, Relevant, Time-bound)**. While some

⁴⁹ <https://www.gov.uk/government/publications/environmental-improvement-plan-annual-progress-report-2024-to-2025/environmental-improvement-plan-annual-progress-report-april-2024-to-march-2025>

⁵⁰ <https://moat.cefas.co.uk/introduction-to-uk-marine-strategy/>

⁵¹ <https://www.gov.uk/government/consultations/uk-marine-strategy-part-one-update-2025>

demonstrate improvements in clarity, most remain vague and lack time-bound commitments.⁵²

The OEP has raised concerns regarding both delivery and reporting. It is currently investigating Defra for a potential failure to put in place the necessary measures to achieve or maintain GES by the statutory deadline.⁵³ A report synthesising evidence on the UKMS governance and processes will be published in autumn 2025.

5.4 Scottish Biodiversity Strategy

The Scottish Biodiversity Strategy to 2045 was published in November 2024, providing the long-term framework for halting and reversing biodiversity loss in Scotland.⁵⁴ It is accompanied by the Scottish Biodiversity Delivery Plan 2024–2030, the first in a series of six-year rolling delivery plans that will set out specific actions, milestones, and priorities. Progress against the Strategy will be formally reported through the first statutory progress report in October 2027, with subsequent reports aligning with delivery plan cycles. Key features of the Strategy include:

- **Vision 2045:** By 2045, Scotland will have restored and regenerated biodiversity across its land, freshwater, and seas, ensuring resilient ecosystems that support climate adaptation, wellbeing, and a sustainable economy.
- **2030 Outcomes:** Meeting the interim goal of halting biodiversity loss by 2030 through nature restoration, expansion of protected areas, and embedding biodiversity in decision-making across government, industry, and society.
- **Marine and Coastal Focus:** Explicit recognition of the role of marine and coastal ecosystems in delivering biodiversity recovery, including the expansion and effective management of MPAs, the restoration of priority habitats (e.g. seagrass, saltmarsh, maerl), and the integration of biodiversity objectives into marine planning and offshore renewable energy development.
- **Delivery Framework:** Actions are structured under themes of nature recovery, ecosystem restoration, sustainable land and sea use, tackling climate change, and mainstreaming biodiversity across public policy and private sector investment.
- **Monitoring and Accountability:** A strengthened governance framework, with delivery progress overseen by an independent advisory group, and indicators aligned to both national outcomes and international biodiversity targets.

Taken together, the Strategy and its delivery plans provide the central framework for Scotland to contribute to global biodiversity goals and will be critical for ensuring coherence with the Scottish Marine Plan, the Sectoral Marine Plan for Offshore Wind, and commitments under the UK Marine Strategy.

5.4.1 Scottish Government Marine and Coastal Restoration Plan

The Scottish Government Marine and Coastal Restoration Plan was consulted on in autumn 2025. The draft plan sets out a strategic framework of actions to scale up and mainstream

⁵² <https://www.theoep.org.uk/report/oep-response-uk-marine-strategy-part-one-assessment-consultation>

⁵³ <https://www.theoep.org.uk/news/oep-launches-investigation-suspected-failure-defra-take-necessary-measures-achieve-good>

⁵⁴ <https://www.gov.scot/publications/scottish-biodiversity-strategy-2045/pages/2/>

marine and coastal restoration, building on commitments made under the Scottish Biodiversity Strategy to 2045 and its Delivery Plan 2024–2030. Once finalised, the Plan will sit alongside the Scottish Biodiversity Delivery Plan and complement other key marine policy instruments, including the National Marine Plan 2 (currently in development), the Sectoral Marine Plan for Offshore Wind, and commitments under the UK Marine Strategy. Together, these strategies create an integrated framework for restoring ecological resilience in Scotland's seas and coasts while balancing the pressures of climate change, renewable energy expansion, and sustainable marine resource use.

5.5 Marine Net Gain

The commitments in the 25YEP and the EIP23 are driving the implementation of biodiversity net gain and Marine Net Gain (MNG) in England. Net gain is an approach to development that aims to leave the natural environment in a measurably better state than beforehand. This means protecting, restoring, or creating environmental features that are of greater ecological value to wildlife, habitats and people than any losses associated with the new development.

MNG is at an early stage of development. The government published its response to its consultation on the principles of MNG in December 2023,⁵⁵ in this it stated that it:

- Will include impacts on both habitats and species within the MNG assessment framework.
- Will continue to consider impacts beyond site boundaries in the assessment framework
- Will recognise wider environmental benefits that biodiversity enhancement can deliver when assessing MNG interventions, but will maintain the 'nature first' approach, with net gain for biodiversity being the core requirement.
- Will continue to explore the role of positive incidental effects in developing the MNG assessment framework, particularly around artificial reefs and exclusionary effects e.g. fisheries pressure reduction.
- Will continue to explore potential design options for the delivery of MNG, including contributions-based and metric-style approaches.
- Will provide clarity on how MNG will sit alongside Biodiversity Net Gain (BNG) at the coast.

MNG will only apply to developments below the mean low water mark in English waters. This is a developing policy area, but the intention is that MNG interventions will consist of pressure reduction measures as well as active restoration/enhancement interventions and can be delivered at both a site based level and at a strategic scale.

5.6 Marine Protected Areas (MPAs)

The UK network of MPAs consists of 375 sites and is one of the primary tools for protecting our marine environment, and contributes to both national and international targets and commitments, including the achievement of Good Environmental Status under the UK Marine Strategy ([section 2.3.4](#)). There are several different types of MPAs within the UK:

⁵⁵<https://www.gov.uk/government/consultations/consultation-on-the-principles-of-marine-net-gain/outcome/government-response>

- SACs and SPAs protected under the Habitats Regulations, which together comprise the National Site Network.
- MCZs in England and Wales protected under the Marine and Coastal Access Act and in Northern Ireland under the Marine Act (Northern Ireland).
- Nature Conservation MPAs in Scotland protected under the Marine Scotland Act.

The effects of developments on MPAs must be considered through a HRA for SACs and SPAs, or an MCZ assessment for MCZs. The mitigation hierarchy of avoid, reduce, mitigate must be followed. If an HRA of a plan or a project cannot demonstrate that there will be no adverse effect on the integrity of an SAC or SPA, then it cannot be consented unless it is considered necessary for imperative reasons of overriding public interest, there are no alternatives, and compensatory measures have been secured to offset the impact. There are similar requirements in place for impacts to MCZs.⁵⁶

In September 2025, the Scottish Government laid the Offshore Fishing (Prohibition of Fishing Methods) (Scotland) Order 2025 before Parliament, with measures entering into force on 16 October 2025.⁵⁷ The Order introduces fisheries management measures across offshore MPAs (12–200 nm), with some extending into overlapping inshore areas. Prohibitions include the use of demersal mobile and static gear, dredging, and beam trawling. These measures were developed following consultation in summer 2024 and informed by scientific advice, environmental evidence, and socio-economic considerations. A programme of monitoring and evaluation will support adaptive management, ensuring effectiveness against conservation objectives and enabling adjustments as new evidence emerges.

The MMO is progressing with Stage 3 of its programme to introduce fisheries management measures across all English offshore MPAs. From July–September 2025, the MMO consulted on proposed byelaws covering 42 offshore MPAs, representing almost 31,000 km² of English waters.⁵⁸ The proposals include prohibiting the use of bottom-towed gear in 31 sites, introducing additional restrictions on static gear and traps in selected locations, and imposing a ban on the removal of spiny lobster within one designated MPA. Results of the consultation and final guidance is expected over winter 2025/2026.

5.6.1 Highly Protected Marine Areas

Highly Protected Marine Areas (HPMAs) are areas of the sea designated to prohibit extractive, destructive, and depositional uses, that will allow the protection and full recovery of marine ecosystems to a more natural state. HPMAs protect all species and habitats and associated ecosystem processes within the site boundary, including the seabed and water column. HPMAs will help the government achieve its key environmental goals and targets, such as in the EIP, 25YEP, 30 by 30 commitment, net zero, sustainable fisheries and marine nature recovery.⁵⁹

⁵⁶ <https://www.gov.uk/government/publications/marine-conservation-zones-mczs-and-marine-licensing>

⁵⁷ <https://www.gov.scot/publications/official-response-consultation-fisheries-management-measures-offshore-marine-protected-areas/pages/7/>

⁵⁸ <https://consult.defra.gov.uk/mmo/stage-3-formal-consultation/>

⁵⁹ <https://www.gov.uk/government/publications/highly-protected-marine-areas/highly-protected-marine-areas-hpmas>

The UK Government committed to designating pilot HPMAs in 2022 in English waters based on recommendations of the Benyon Review.⁶⁰ The first three HPMAs in English Waters were designated on 5th July 2023:⁶¹

- Allonby Bay
- North East of Farnes Deep
- Dolphin Head

This initial pilot phase of the three HPMAs will inform future policy and the exploration of additional sites for consideration as HPMAs. The delivery of the HPMAs will identify areas where development is prohibited as well as defining assessment requirements and evidence needs to allow the protection and recovery of marine ecosystems. It will provide an understanding of the recovery potential of different habitat types and ecosystems and help in defining what 'good' looks like in the absence of human activities and pressures.

In 2023 the Scottish Government consulted on proposals to designate at least 10% of Scotland's seas as HPMAs by 2026. In response to the findings of the consultation this proposal is not currently being taken forward.⁶² The Cabinet Secretary therefore announced her intention, that while remaining firmly committed to enhancing marine protection, the Scottish Government will no longer seek to implement HPMAs across 10% of Scotland's seas by 2026.

5.7 TCE Nature Recovery Ambition Update

In January 2025, The Crown Estate published its first detailed update on its Nature Recovery Ambition (originally launched in 2024).⁶³ TCE's Nature Recovery Ambition is structured around three interconnected goals:

- Increased biodiversity across TCE land, seabed and coastal holdings.
- Protection and restoration of freshwater, marine, and coastal systems.
- Social and wellbeing benefits by reconnecting people with nature.

The January update focuses on translating that ambition into accountable action, including integrating nature priorities into the Marine Delivery Routemap (section 2.1), identifying optimal sites for marine and coastal habitat recovery, and doubling the area leased for marine/coastal nature recovery-focused activities by 2030.

6 Fisheries Policy and Legislative Landscape

This section focuses on the fisheries policy and legislation. Providing an overview of key fisheries policies, strategies, and programmes that relate to offshore wind, highlighting key updates and potential contributions of research.

⁶⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890484/hpma-review-final-report.pdf

⁶¹ <https://www.gov.uk/government/publications/highly-protected-marine-areas/highly-protected-marine-areas-hpmas#how-we-will-manage-pilot-hpmas>

⁶² <https://www.gov.scot/publications/scottish-highly-protected-marine-areas-hpmas-consultation-scottish-government-response-consultation/>

⁶³ <https://www.datocms-assets.com/136653/1737391044-nature-recovery-update.pdf>

6.1 The Fisheries Act 2020

The Fisheries Act 2020 gives the UK full control of its fishing waters. The overall aim of the act is to deliver the following 8 objectives:

- Environmentally, economically, and socially sustainable fisheries.
- The precautionary approach to fisheries management is applied.
- An ecosystem-based approach to management is used.
- Best scientific advice is used to develop management measures.
- Bycatch is minimised and avoided.
- Equal access is applied to all British fishing boats.
- Fishing provides a national social or economic benefit.
- The impacts of fisheries on climate change is reduced and fisheries adapt to the effects of climate change.

The Act creates a legal requirement for the UK's four national fisheries policy authorities (MMO, Scottish Ministers, Welsh Ministers, and DAERA) to produce a Joint Fisheries Statement (JFS) that will lay out how these objectives will be met.

6.2 Joint Fisheries Statement

The JFS sets out the policies for achieving the 8 fisheries objectives in the Fisheries Act.⁶⁴ It outlines the responsibilities of the fisheries policy authorities as follows:

- Adopt an ecosystem-based approach to management.
- Implement management measures for protecting spawning and nursery areas of key stocks, reducing seabed abrasion, and reducing unwanted catches.
- Publishing Fisheries Management Plans (FMPs) for stocks of socio-economic importance, at risk of significant over-exploitation or hold ecosystem significance.
- Manage non-quota stocks through catch limits where appropriate, fisheries closures and other technical measures.
- Understand important areas for key fisheries for marine planning considerations and facilitating co-location of activities.
- Align FMPs with Marine Plans for the effective use of the marine space and resources.
- Develop the network of protected sites to protect specific habitats and species of national or international importance.
- Acknowledge the importance of the protection, restoration and sustainable management of blue carbon habitats to support adaptation and resilience to climate change, alongside benefits for carbon sequestration and biodiversity.

The UK Bycatch Mitigation Initiative outlines how the fisheries policy authorities will achieve the ambitions of the ecosystem objective by improving understanding through scientific monitoring and research, identifying bycatch hotspots of high risk, adopting effective mitigation measures, and working with partners to reduce the bycatch of sensitive species globally.⁶⁵

⁶⁴ https://assets.publishing.service.gov.uk/media/637cee048fa8f53f4af6850b/Joint_Fisheries_Statement_JFS_2022_Final.pdf

⁶⁵ <https://www.gov.uk/government/publications/marine-wildlife-bycatch-mitigation-initiative/marine-wildlife-bycatch-mitigation-initiative>

6.3 Fisheries Management Plans (FMPs)

The JFS commits the UK fisheries policy authorities (Defra, and the devolved administrations in Northern Ireland, Scotland and Wales) to publish 43 FMPs setting out policies and measures to manage fishing activity to restore and/or maintain fish stocks at sustainable levels.⁶⁶

Defra is now delivering on 15 FMPs.⁶⁷ The MMO has developed a set of infographics and short videos to help explain the goals and progress of the first FMPs that were published in December 2023.⁶⁸ Scottish Government are preparing 21 FMPs with consultations ongoing throughout 2025 with publication expected by spring 2026.⁶⁹

6.4 National Adaptation Plan

The third National Adaptation Programme lays out the UK government's approach to responding to climate change.⁷⁰ While fisheries and marine management are included, the scope is far wider, encompassing cross-cutting measures to support ecosystem resilience, climate-proof supply chains, and community well-being. However, importantly, policy makers and fisheries managers are now seeking to integrate climate change into fisheries management.

Defra has in publication a Climate Adaptive Fisheries report pinpointing evidence gaps for integrating ecosystem and climate change considerations into management strategies.

Highlighted evidence gaps include:

- Identifying marine habitat and species location, extent and abundance.
- Metrics to assess the condition or health of marine habitats and species.
- Ecosystem dynamics including interactions, life history traits, habitat characteristics and primary productivity.
- The causal effects of species range shifts.
- Assessing short term socio-economic impacts on fishers.
- Designating areas for offshore developments.
- Monitoring the effectiveness of the interventions addressing biodiversity and climate change.

The report concludes that ecosystem-focused management including climate-induced impacts, can contribute to more adaptive and sustainable fisheries management. Recommendations include:

1. Embedding climate change at all steps of the fisheries management process, including demonstrating how climate change risks have been assessed and how management measures address those risks.
2. Viewing fisheries adaptation to climate change within an operating systemic framework.

⁶⁶ <https://www.gov.uk/government/publications/fisheries-management-plans/fisheries-management-plans>

⁶⁷ <https://defrafmp.blog.gov.uk/fmp-directory/>

⁶⁸ <https://defrafmp.blog.gov.uk/2025/09/17/crab-and-lobster-fmp-explained-goals-benefits-and-updates/>

⁶⁹ <https://www.gov.scot/policies/sea-fisheries/fisheries-management-plans/>

⁷⁰ <https://www.gov.uk/government/publications/third-national-adaptation-programme-nap3>

3. Implementing adaptation measures as a package, a suite of measures that work together and build towards climate adaptive fisheries.

7 Government Research Programmes

7.1 Offshore Wind Evidence and Change Programme

The Offshore Wind Evidence and Change Programme (OWEC) brings together a coalition of 27 government organisations, industry bodies, and environmental NGOs to collaborate and act as agents for change in the face of climate and biodiversity crises.

This is achieved through a range of prioritised projects at a national scale, that will create a shared data and evidence base held on the Marine Data Exchange, that can be used to shape the future of offshore wind and the marine environment.

Projects, which are led by individual members of the UK-wide programme and other important partners, are made possible through drawing down from a £50m funding commitment by The Crown Estate, who lead the programme. It is delivered in partnership with DESNZ and Defra.

Through its strategically selected research and evidence driven initiatives, the programme is filling critical knowledge gaps that aims to help speed up the consenting process by reducing uncertainties. The areas of focus include improving understanding of environmental impacts and benefits, improving the derogation process, spatial co-ordination and co-location opportunities and delivering net environmental gains.

OWEC has funded a total of 42 projects, with project details available online.⁷¹ Key projects of relevance include:

- The launch of the Offshore Wind Evidence and Knowledge Hub (OWEKH).⁷² This digital knowledge hub is set to accelerate the consenting process by streamlining EIA and providing a collaborative space where experts from across industry and academia can join forces to shape the future of offshore wind across the UK.
- Prevalence of Seabird Species and Collision Events in OWF (PrediCtOr) which is developing a coordinated approach for reducing uncertainty surrounding bird collision risk.
- Procellariiform Behaviour & Demographics (ProcBe) which is filling evidence gaps on seabird interactions with OWFs and improving and population modelling approaches.
- Reducing Seabird Collisions Using Evidence (ReSCUE) which is investigating seabird flight heights and collision risk with offshore wind turbines.
- Planning Offshore Wind Strategic Environmental Impact Decisions (POSEIDON) which will improve the knowledge of environmental risks across UK waters and provide new mapping tools.⁷³

⁷¹https://assets.ctfassets.net/nv65su7t80y5/4LFCe6T6rOVPk3LWqG5u0y/122544182bb7864e0ef2c2e6baf6ee84/OWEC_Projects.pdf

⁷² <https://owekh.com/home>

⁷³<https://mcas-proxyweb.mcas.ms/certificate-checker?login=false&originalUrl=https%3A%2F%2Fnaturalengland.blog.gov.uk.mcas.ms%2F2023%2F02%2F01%2Fposeidon-offshore-wind-and-nature%2F%3FMcasTsid%3D20892&McasCSRF=9fb91da87629f22f92c849a48837ee73ee5f1044411f779877cf4c9e56582b38>

- Predators and Prey Around Renewable Energy Developments (PrePARED) which will improve understanding of how seabirds, marine mammals and fish change their behaviour in response to offshore wind farms.⁷⁴

In 2024, five new research projects were awarded a combined £7.3 million in funding to advance the evidence base for offshore wind and marine environmental management.⁷⁵

Notable projects include:

- Disco Scallops – led by the OWIC, this project explores how static fishing methods could be deployed in areas where mobile gear is restricted, such as OWFs and MPAs.
- Ecosystem Consequences of Changes to Habitats and Implications for a Net Gain Energy Approach (ECOCHANGE) – led by the Scottish Government Marine Directorate, ECOCHANGE is investigating the extent to which colonisation and habitat changes around offshore developments influence wider ecosystems and marine food webs.
- Piloting of Offshore Wind Environmental Mitigation (POWEM) – a Defra–OWIC collaboration, POWEM is trialling innovative mitigation measures such as turbine blade painting to reduce bird collisions and the application of piling noise limits to lessen impacts on marine species during construction.
- Subsea Soundscape (S3) – led by the Offshore Renewable Energy Catapult, this project is developing a new regional framework for the Celtic Sea to map underwater noise conditions and marine mammal presence. These baselines will provide critical data to support environmental assessments for future FLOW projects in the region.

7.1.1 ECOFlow

The ECOFlow Programme is a four-year programme (2024 – 2028) which seeks to address critical gaps in understanding how large-scale expansion of FLOW infrastructure affects marine ecosystems.⁷⁶ In doing so, the programme seeks to inform decision making and outcomes which minimise negative impacts and harness positive impacts and opportunities. ECOFlow is a co-designed partnership between the Natural Environment Research Council (NERC) and TCE.

ECOFlow has three core objectives:

- Enhanced understanding of the novel effects of FLOW on marine ecosystems and, in doing so, transform the approach to deploying FLOW at scale whilst maintaining nature recovery, and its coexistence with other users of the sea, particularly fisheries.
- Utilise autonomous sensing technologies to establish innovative underwater sampling approaches within and around the complex infrastructure associated with FLOW.
- Deliver robust evidence, new approaches and tools that will enable the acceleration of impact in policy and industry, and support government's ambitions in the Celtic Sea and the North Sea's Scottish waters for the deployment of FLOW, nature recovery and fisheries management.

⁷⁴<https://mcas-proxyweb.mcas.ms/certificate-checker?login=false&originalUrl=https%3A%2F%2Fowecprepared.org.mcas.ms%2F%3FMcasTsId%3D20892&McasCSRF=9fb91da87629f22f92c849a48837ee73ee5f1044411f779877cf4c9e56582b38>

⁷⁵ <https://www.datocms-assets.com/136653/1744107121-owec-2024-annual-report.pdf>

⁷⁶ <https://www.ecoflow.org.uk/>

The ECOFlow Programme consists of two projects:

- EQUIFY (Establishing a Framework for Quantifiable Evidence and Impact of Ecosystem Change Throughout the Lifecycle of FLOW), to underpin predictions of likely future pressures including changing marine use and within the context of a changing climate.
- Frontline (Impacts of FLOW on Celtic Sea Ocean Fronts and Biodiversity) exploring FLOW impacts on shelf sea ecosystem dynamics in the Celtic Sea, from ocean physics to phytoplankton, zooplankton, forage fish, top predators, and fisheries.
- ECOFlow is also working closely with eSWEETS3 (Enabling Sustainable Wind Energy Expansion in Seasonally Stratified Seas). This project will observe the effects of FLOW water column mixing effects.

7.1.2 ECOWind

The ECOWind Programme is similar to ECOFlow but is focussing on fixed offshore wind infrastructure. It is a four-year programme (2022 – 2026) which seeks to address critical gaps in understanding how large-scale expansion of UK fixed offshore wind infrastructure affects marine ecosystems.⁷⁷ In doing so, the programme seeks to inform decision making and outcomes which minimise negative impacts and harness positive impacts and opportunities. ECOWind is a co-designed partnership between NERC, Offshore Wind Evidence and Change Programme (OWEC) (Department for Environment, Food and Rural Affairs (Defra), Department for Energy Security and Net Zero (DESNZ), TCE) and the Crown Estate Scotland (CES).

ECOWind has three core objectives:

- To understand how interactions between species are affected by offshore wind, and what this means for populations.
- To enhance marine observations through innovative technology to inform understanding of the effects of offshore wind on marine life.
- To use the knowledge gained from these first two objectives to inform marine policy and management, including net gain and marine environmental restoration.

The ECOWind Programme consists of four projects:

- ACCELERATE (Ecological Implications of Accelerated Seabed Mobility around Windfarms), investigating seabed conditions and how this can impact fish locations and the foraging success of seabirds.
- ECOWINGS (Ecosystem Change, Offshore Wind, Net Gain and Seabirds), transforming the evidence base on the cumulative effects of offshore wind on key seabird species, establishing pathways for strategic compensation and net gain options.
- PELAGIO (Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms), investigating the physical effects of OWF structures, changes in primary productivity and fish behaviour and the subsequent impact on seabirds.
- BOWIE (Benthic Offshore Wind Interactions Evaluation), assessing responses of invertebrates and fish to construction noise and vibration, EMF and elevated

⁷⁷ <https://ecowind.uk/>

temperatures associated with cabling in combination with trawling and climate change stressors.

7.2 Scottish Government Areas of Research Interest

The Scottish Government Marine Directorate has identified Marine Areas of Research Interest as a spatial focus for future management, restoration, and monitoring, providing a platform to align marine policy with wider environmental, social, and economic objectives⁷⁸. These areas are intended to guide ecosystem-scale decision-making, moving beyond the protection of individual features toward enhancing overall ecosystem function and resilience.

A central component of the research strategy is the use of guiding questions to identify priorities for evidence, policy, and management, the overarching themes of the relevant ARI questions are summarised below:

- **Systemic change:** How can we shift from protecting single features toward enhancing ecosystem function, measure recovery against shifting baselines, and capture cumulative benefits across interventions?
- **Policy design and implementation:** How can ecosystem service assessments inform marine planning and how can plans adapt to short- and long-term change while addressing key evidence gaps?
- **Renewable energy:** How can we improve assessment of offshore renewable impacts on protected habitats and species, integrate cumulative impacts into an ecosystem-based approach, and design effective compensatory measures or ecological enhancements?
- **Climate change and biodiversity:** What are the projected impacts of climate change on Scotland's marine ecosystems and sectors, and how can blue carbon and nature-based solutions be scaled to deliver both net zero and biodiversity recovery?
- **Clean seas and ecosystem restoration:** How do multiple stressors interact, what indicators are most effective for Good Environmental Status, and how can freshwater and marine carbon sequestration contribute to wider restoration?
- **MPAs:** How can monitoring be improved to demonstrate effectiveness, spillover benefits, and contributions to carbon sequestration and ecosystem productivity?
- **Transformation monitoring and data integration:** What novel technologies, indicators, and frameworks are needed to track ecosystem recovery, capture early warnings of systemic change, and ensure long-term data integration?
- **New technologies:** How can tools such as eDNA, artificial intelligence, remote sensing, automation, and ecosystem modelling be embedded into monitoring and decision-making to enhance efficiency and understanding of ecosystem dynamics?

⁷⁸ <https://www.gov.scot/collections/areas-of-research-interest/>

7.3 Scottish Marine Energy Research (ScotMER) Programme

Scotland's National Marine Plan commits the Scottish Government to make decisions on the best available scientific evidence. Where knowledge gaps and uncertainties exist, the ScotMER programme seeks to address these evidence gaps, where it is most needed, and use the new information to inform planning, licencing, consenting and policy decisions. As an example, new evidence produced by the ScotMER programme is now feeding into the draft updated Sectoral Marine Plan for Offshore Wind Energy, and will be used to inform environmental assessments for new ScotWind developments.

The Scottish Government has worked with industry, environmental NGOs, SNCBs, and other interested stakeholders, to map out the gaps in knowledge when assessing the potential environmental and socioeconomic impacts of offshore renewable developments. The knowledge gaps identified are captured on evidence maps spanning seven receptor groups and help guide the identification and selection of ScotMER research projects, with the highest priority projects taken forward by the programme. An updated version (March 2024) of the evidence maps covering all receptor groups can be accessed online.⁷⁹ All published project outputs can be accessed on the website.⁸⁰

ScotMER projects that are ongoing and of relevance include:

- Aukestra - Foraging ecology of guillemots and razorbills in the non-breeding season to understand consequences of potential displacement.
- Bird reactions to avian influenza and developments at sea (BRAIDS).
- Updated Seabird Colony Counts for Scotland.
- Remote sensing, identifying technologies for remote, long-term seabird population and demographic monitoring in Scotland.
- Portfolio of Compensatory Measures (a suite of five projects):
 - Predator control and biosecurity;
 - Habitat management and restoration, and reduction of disturbance at colony;
 - Fisheries management compensatory measures;
 - Restore and enhance supporting prey habitats; and
 - Marine litter removal (at scale).
- Hosting and Supporting the Operation of the Beta Version of Cumulative Effects Framework (CEF).
- Running the CEF to inform the Sectoral Marine Plan for Offshore Wind Energy Iterative Plan Review.
- Sensitivity Analysis of the interim Population Consequences of Disturbance Model (iPCOD).
- Investigation into the potential risk of entanglement of marine mammals with discarded fishing gear associated with floating offshore wind farms.
- Expansion of the Scottish Passive Acoustic Network (SPAN).
- Recommendations to design an effective monitoring approach for marine fish and shellfish species in relation to offshore wind farms.

⁷⁹<https://www.gov.scot/policies/marine-renewable-energy/science-and-research/>

⁸⁰ <https://www.gov.scot/policies/marine-renewable-energy/science-and-research/>

- A Targeted Approach to Characterising EMF From Subsea Cables and Understanding Potential Impacts on Fish and Benthic Species.
- Salmonid tracking to inform spatial movements around OWFs.
- Expansion of the West Coast salmon tracking project to target northwest development sites.
- Environmental DNA (eDNA) as a tool to support the sustainable development of offshore renewable energy developments.
- Invasive non-native species (INNS) mitigation measures for offshore renewables – recommendations and best practice.
- Developing environmental DNA-based tools to monitor for presence of Ocean quahog (*Arctica islandica*).
- Exploring how communities experience the social and economic impacts of offshore wind development in Scotland.
- Development of marine physical processes environmental impact assessment guidelines for offshore wind farms in shelf seas.

8 Offshore Wind Research Programmes

8.1 SuperGen

The Supergen programme was set up in 2001 by the Engineering and Physical Sciences Research Council to deliver sustained and coordinated research on sustainable power generation and supply. The programme focused on several key research areas, including bioenergy; energy networks; energy storage; fuel cells; hydrogen and other vectors; marine, wave and tidal; solar technology; and wind power.

For phase four of the programme, the Supergen Wind and Supergen Marine Hubs were combined into one Offshore Renewable Energy Hub, following consultation with the wider research community and EPSRC. The Supergen Offshore Renewable Energy Hub⁸¹ builds on the work of the former Hubs, and looks at synergies between offshore wind, wave and tidal technologies as well as building on current research in each area.

The Hub has eight research themes⁸² across the current offshore renewable energy landscape, many of which are directly relevant to the work of the ECOWind projects:

- Resource and environment characterisation
- Fluid-structure seabed interaction
- Materials and manufacturing
- Sensing, control and electromechanics
- Survivability, reliability and design
- Operations, management, maintenance and safety
- Environmental and ecosystem aspects
- Marine planning and governance

⁸¹ <https://supergen-ore.net/>

⁸² <https://landscape.supergen-ore.net/>

8.2 INSITE

The Influence of man-made structures in the ecosystem (INSITE) programme is funded by NERC, Cefas and is sponsored by an industry partnership of North Sea asset operations. It seeks to provide all stakeholders with the science needed to better understand the effect of man-made structures on the North Sea and hence better inform any decision-making process.

All project information can be accessed on the website,⁸³ ongoing projects of relevance include:

- Autonomous Techniques for anthropogenic Structure Ecological Assessment (ATSEA), combining Autonomous Underwater Vehicle (AUV) with mapping and water column sensors to produce an integrated environmental assessment at sites.
- Ecosystem level importance of Structures as Artificial Reefs (EcoSTAR), improving understanding of structures for benthic communities, patterns and consumption of marine mammals.
- Fish Spillover, Production and Aggregation at Marine Made Structures (FISHSPAMMS), using AUV to determine the extent of enhanced productivity or the protection from fishing afforded.
- Functionality and Ecological Connectivity of Man Made Structures (FuECoMMS), uses AUV and eDNA to identify the roles of structures for marine ecosystem processes, carbon storage and biodiversity within the sediments.

8.3 Offshore Renewable Energy (ORE) Catapult Floating Offshore Wind Centre of Excellence (FOW CoE)

FOW CoE has been established by ORE Catapult to develop an internationally recognised initiative to reduce the cost of energy from floating wind.⁸⁴ It is a collaborative programme with industry, academic and other stakeholders, with the intention of accelerating the build-out of floating farms, creating opportunities for the UK supply chain and driving innovations in manufacturing, installation and operations & maintenance.

The centre is running several strategic programmes one of which is on environmental interaction to consider opportunities for FLOW that have a broader positive impact on biodiversity and health of the marine environment through:

- Identifying and prioritising key knowledge gaps associated with FLOW environmental interactions.
- Close knowledge gaps through research and testing.
- Assess and communicate project development risks and opportunities through research.
- Support innovative solutions and supply chain through communication, research and challenges.

⁸³ <https://insitenorthsea.org/research-projects>

⁸⁴ <https://fowcoe.co.uk/>

8.4 Offshore Renewables Joint Industry Programme (ORJIP) for Offshore Wind

ORJIP is a collaborative initiative that brings together industry, regulators, statutory nature conservation bodies, academics, NGOs and others with the aim of funding research to improve the understanding of the effects of offshore wind on the marine environment, in order to reduce consenting risk for offshore wind farm developments.⁸⁵

Stage 1 of the programme ran from 2013 to 2018 and included studies on the investigation into the efficacy of acoustic deterrent devices on different marine mammals and a study to record and quantify the avoidance behaviour of seabirds around offshore windfarms. Stage 2 ran from 2019 to 2023, with the option to extend until 2025, it has funded 10 different research projects ranging from understanding the impacts of offshore wind on seabirds, improving evidence base for co-existence of commercial fishing and offshore renewables, underwater noise, impact of cable protection measures.

9 Evidence gaps and entry points for research impact

The expansion of offshore wind through Round 4, Round 5, 6, ScotWind, INTOG and future leasing rounds presents significant evidence challenges for EIA and HRA. Evidence gaps are collected across the UK in both the [Offshore Wind Environmental Evidence Register](#) and the [ScotMER Evidence Maps](#). The most critical gaps and entry points for research impact include:

- **Baselines and long-term impacts:** The current evidence base on baseline characterisation and long-term ecosystem-scale change is weak, limiting the ability to assess how offshore wind farms interact with the wider marine environment.
- **Cumulative impacts:** There is limited evidence on cumulative impacts between offshore wind farms, with other sea users, and in combination with climate change. ECOWind research can inform national-scale understanding of the effects of offshore wind farms in changing seas.
- **Climate change:** Further evidence is required to understand how climate change will affect fisheries and ecosystems, predict future shifts in population distribution, and inform climate-adaptive and resilient measures.
- **Ecosystems:** There are gaps in understanding of ecosystem dynamics, ecological functions, and food webs, including predator–prey interactions and food web resilience. Consenting authorities increasingly advocate for an ecosystem-scale approach to impact assessments, with ECOWind research positioned to set benchmarks for best practice in future applications.
- **Mitigation measures:** Robust evidence is needed on best practice ecological mitigation measures, particularly for seabirds, benthic habitats, and fisheries. Insights into environmental design could help optimise offshore wind development to maximise positive ecosystem outcomes. A better understanding of ecosystem dynamics, predator–prey interactions, and bottom-up and top-down processes is also needed to inform fisheries management measures.
- **Strategic compensation** Strategic compensation remains at an early stage, with urgent requirements for evidence on effective measures and opportunities. Research

⁸⁵ <https://www.carbontrust.com/our-work-and-impact/impact-stories/offshore-renewables-joint-industry-programme-orjip-for-offshore-wind>

is needed to identify key areas of ecosystem significance with potential for restoration and compensation, and to assess the relative contribution of species population trends to the coherence and functioning of the MPA network. This would enable better targeting of management measures.

- **UKMS:** Evidence is needed to inform UKMS reform, target setting, management measure options, and opportunities for restoration. ECOWind research has the potential to feed into the latest GES assessments across all 11 descriptors, providing insights on pressures such as non-indigenous species, eutrophication, contaminants, litter, hydrographic change, and underwater noise, as well as updates to biodiversity, seafloor integrity, and food webs. An ecosystem approach should underpin target-setting, supported by a strategic nature restoration plan at the national scale and regional PoM within marine plan areas. Research can inform approaches for reducing pressures, supporting active restoration, and delivering outcomes at site, project, and regional levels.
- **MNG:** There is uncertainty over how to link marine development losses to MNG outcomes. Frameworks, tools, and metrics need further development to align with UKMS descriptors and regional programmes of measures. Ecosystem modelling should underpin assessments of GES and guide the design of MNG measures.
- **Monitoring:** Current monitoring approaches are fragmented and resource-intensive, limiting the ability of statutory nature conservation bodies and regulators to incorporate new evidence efficiently. The development and testing of innovative monitoring technologies, such as remote sensing, passive acoustics, and ecosystem models, could improve efficiency and provide greater confidence in impact assessments.
- **Fisheries co-existence and socio-economics:** Knowledge gaps remain around the ecological and socio-economic interactions between offshore wind and fisheries, including the implications of climate-driven shifts in fish populations. There is limited evidence on co-existence opportunities, natural capital values, and marine space trade-offs. Research can support ecosystem-based fisheries management, identify opportunities for co-location, and inform spatial planning decisions.
- **Spatial management:** Evidence, tools, and scenario modelling are required to support the Marine Delivery Routemap, the WoS Programme, and wider marine planning. ECOWind modelling of offshore wind and climate scenarios could guide prioritisation and trade-off decisions in future leasing rounds.
- **Governance and scientific advice:** SNCBs face challenges in digesting complex evidence and translating it into best practice guidance for examinations and consenting. Consultants and industry often adopt research only once it is established as best practice, slowing the uptake of innovation. Regulators face capacity constraints and need targeted, accessible evidence products. Research impact can be maximised through policy briefs, webinars, and facilitated knowledge exchanges, ensuring evidence is available, timely, and actionable.

10 Existing data tools used in Offshore Wind

It is important to understand the differing needs of end users, taking into consideration the existing data tools that are used and access and accessibility needs. Across the spectrum of end users, there is a vast array of data tools that exist including:

- Marine Data Exchange⁸⁶
- Natural England Designated Sites View⁸⁷
- JNCC Seabird monitoring⁸⁸
- JNCC Marine mammal and noise mitigation⁸⁹
- Marine Environmental Data and Information Network⁹⁰
- Cefas OneBenthic⁹¹
- Marine Life Information Network⁹²
- TCE Open Data⁹³
- Natural England Seabird Mapping & Sensitivity Tool
- Marine plans and marine activity data⁹⁴
- Marine Scotland map layers⁹⁵
- JNCC Offshore Wind Environmental Evidence Register⁹⁶
- JNCC UK Marine Noise Registry⁹⁷
- Pathways to Growth (P2G) programme developed an interactive tool to map the relationships between entities working in the offshore wind consenting space. This tool illustrates the interconnections and key stakeholders across government, SNCBs, industry, developers, working groups, programs of work, and more.⁹⁸
- ECOWINGS StrathE2E enables users to run ‘what if’ experiments to simulate the effects of different management and climate scenarios.⁹⁹
- ECOWINGS the seabird prey mapper tool that generates maps of estimated seabird prey consumption by chick-rearing seabirds.¹⁰⁰

⁸⁶ <https://www.marinedataexchange.co.uk/>

⁸⁷ <https://designatedsites.naturalengland.org.uk/>

⁸⁸ <https://jncc.gov.uk/our-work/seabird-monitoring/>

⁸⁹ <https://jncc.gov.uk/our-work/marine-mammals-and-noise-mitigation/>

⁹⁰ <https://medin.org.uk/>

⁹¹ https://rconnect.cefas.co.uk/onebenthic_portal/

⁹² <https://www.marlin.ac.uk/data-extract>

⁹³ <https://opendata-thecrownestate.opendata.arcgis.com/>

⁹⁴ <https://www.gov.uk/guidance/explore-marine-plans>

⁹⁵ <https://marine.gov.scot/maps/nmpi>

⁹⁶ <https://beta.marinedataexchange.co.uk/details/TCE-3480/2021-jncc-offshore-wind-evidence-and-change-programme-offshore-wind-environmental-evidence-register-summary>

⁹⁷ <https://mnr.jncc.gov.uk/>

⁹⁸ <https://www.owic.org.uk/resources/offshore-wind-consenting-stakeholder-mapping/>

⁹⁹ <https://rshiny.science.strath.ac.uk/apps/StrathE2EApp/>

¹⁰⁰ <https://nerc-ceh.github.io/spmapper-pkg/index.html>

Appendix A: Research Project Contacts

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