Whole of Seabed Programme

Summary Methodology Report

July 2024

THE CROWN ESTATE

Summary

The Whole of Seabed Programme is an ongoing, iterative process of data collection, spatial analysis and stakeholder engagement. It aims to provide a highly sophisticated understanding of how the UK might utilise its marine resources to 2050, including a more detailed spatial understanding of marine resources than has ever been available in the UK before. The Programme is exploring different future-facing spatial scenarios about how the seabed might be used, to better understand the marine environment's role in achieving net zero, as well as supporting thriving marine ecosystems and economies to 2050.

Our analysis maps potential areas of opportunity across English, Welsh and Northern Irish waters for a wide range of sectors, for example, carbon capture and storage, marine aggregates, offshore wind, other marine energies, and telecommunication cables. Critically, the analysis considers the protection and restoration of nature as an activity and fundamental goal in its own right, rather than solely considering the potential future impact of other sectors on nature. The Programme represents a unique ambition to consider the diverse objectives of different sectors to 2050 and how they might interact. The scenarios we model allow us to understand the various possible interactions across our marine environment, the challenges they might pose, as well as potential enabling actions to resolve them through long-term collaborative planning.

The outputs of the Programme constitute high quality spatial evidence informed by hundreds of spatial datasets, providing a clearer understanding of the areas required to support offshore and coastal sectors, as well as the marine environment. We will look to communicate this understanding by engaging both on the spatial outputs but crucially the statistics, caveats and issues they highlight for further discussion.

The Whole of Seabed Programme is not an action plan or a static set of outputs.

Who? The Whole of Seabed Programme draws upon sectoral and analytical expertise from across The Crown Estate. We are now engaging with a wide range of external stakeholders across all sectors, activities and industries, to ensure that we can consider appropriate social, environmental and economic factors. This will help to ensure that we have tested our analytical approaches through engagement or partnered working and that we are using the best available spatial data and evidence to represent all relevant factors within our modelling.

There will be an ongoing process of validating our data and assessing how we can update and improve it on a rolling basis. We are working closely with both UK and devolved governments to ensure our approach takes account of policy and that our outputs are made available to them as a source of evidence.

Why? As managers of the seabed, we have a responsibility to manage it in the most sustainable and efficient way, to help meet our net zero and biodiversity targets whilst considering social, environmental and economic value. In doing so, we ensure that our management of the seabed supports The Crown Estate's guiding purpose of creating shared and lasting prosperity for the nation, as well as enabling Government policy and supporting UK industry.

To make the most informed decisions about how we manage the seabed, we must use the best available data and evidence. Over the last 20 years of seabed management in the UK, we have significantly advanced our spatial modelling tools and capabilities, learning valuable lessons through spatial design and analysis for the range of activities we manage.

The Whole of Seabed Programme was created both to consolidate this learning from processes such as our **Round 5 Offshore Wind Leasing**, including the engagement on the analysis used to inform it, as well as to fill a critical gap in the world of UK marine data and evidence – how to create a holistic view of our marine environment over the long-term, grounded in data. Working alongside our full range of stakeholders, we are continuing to advance our spatial data and evidence capabilities through our Whole of Seabed Programme, to ensure future sustainable use and protection of the seabed are considered in the highest possible detail, depth and clarity.

Summary

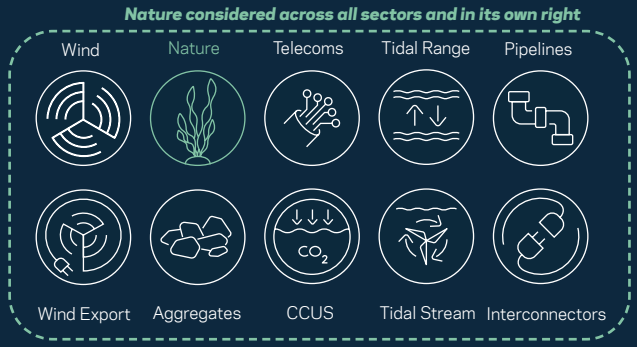
When? The Whole of Seabed Programme is a multi-year initiative of analytical capability development and evidence creation, enabling The Crown Estate in collaboration with marine stakeholders to evolve its approach to seabed management through creating cutting-edge data and evidence. Once these capabilities and holistic evidence are fully embedded into our ways of working, the Programme itself will come to a close, enabling us to take a Whole of Seabed Approach to our seabed management. As the capability will develop iteratively, we will review the Programme's progress on a yearly basis until that time. In line with this, we will equally provide an annual update on the Programme and analysis we have undertaken.

The Programme's first year of development has seen it progress from an ambition to an operational analytical capability, which has produced initial outputs. These include developing a refreshed spatial understanding of the seabed resources for 10 sectors based on our new methodologies (for further refinement), creating a holistic view of the resources and needs for nature and its recovery as well as building a technical capability to run multi-sector scenarios.

As more data becomes available, and as we engage with stakeholders in more depth, we will assess and evaluate how further spatial analysis and scenarios need to be run to ensure we capture the best available data and evidence.

Due to the ongoing and iterative nature of the Programme, the outputs will continue to change over time. We will engage with stakeholders throughout this process, to share our latest insights and understanding and to integrate stakeholder feedback into our approach.

How will it be used? The Whole of Seabed evidence base and analysis capability will be offered to inform external programmes we engage in such as UK Government's Marine Spatial Prioritisation Programme and National Grid ESO's Strategic Spatial Energy Plan. Whole of Seabed evidence alongside partner information will also inform a long-term delivery strategy out to 2050 for the marine space. It will underpin the Marine Delivery Routemap, a collaborative initiative convened by the The Crown Estate to coordinate action across agencies and sectors to deliver on Net Zero and Nature Recovery. Aligned to this, it will also inform the The Crown Estate's own seabed management and leasing activity for sectors that it manages.



Species as Habitats by Keith Hiscock

Underwater Photographer of the Year 2024: Plumose Pier by Billy Arthur

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Report published July 2024.

The Crown Estate. 2024. Whole of Seabed Programme - Summary Methodology Report, 2024. UK, The Crown Estate.

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Introduction

As well as being critical to the UK's energy transition, our seabed and seas support many other industries imperative to livelihoods as well as important natural habitats and wildlife.

All these activities create ever increasing demands on the seabed and competition for space. We need to take a holistic view on how we manage the seabed to ensure the right activities are brought forward in the right locations in the right way.

To enable these multiple priorities to prosper in a sustainable way, The Crown Estate invests millions of pounds to build world-class data, evidence and cutting-edge digital tools to inform how the seabed can sustain a wide variety of industries, livelihoods and natural habitats for the long-term benefit of the nation.

However, to ensure these outcomes, key questions need answering about the spatial opportunities and constraints for marine sectors needed for the UK to achieve net zero, as well as around how we can drive both nature-positive outcomes and a sustainable marine economy – answering these questions is at the heart of what we call our "Whole of Seabed Programme".

While we have undertaken some initial engagement, the Whole of Seabed Programme has largely been internal to date. As we further develop the Programme we are committed to working with industry, government, the environmental sector, organisations representing other users of the seabed and academia to work collaboratively to collate the best available data and explore the findings of our spatial analysis.

Our Whole of Seabed Programme will deliver the capability to identify potential sectoral interactions over the coming decades in greater detail than ever before. Our capability consists of a sophisticated set of geospatial tools, allowing us to analyse, compare and combine hundreds of different spatial datasets, spanning different uses of the sea, environmental data and costs. It allows us to model how future demands for seabed and overarching objectives, such as achieving net zero by 2050 and recovering the marine environment, could be met under various scenarios, underpinned with a uniquely detailed spatial understanding of seabed resources.

Generating this understanding will support our ability to plan for the long-term and derisk future activity across the seabed by providing early understanding of potential operational and environmental challenges. We are running a wide range of scenarios to capture the uncertainty in sectoral demands and analyse different objectives for how the seabed is used.

This evidence will in turn be used in our 2050 Marine Delivery Routemap which will narrow these to a small set of core pathways which best meet policy targets and sector demands, based on scenario evaluation and engagement. This evaluation process will help inform leasing, licensing and investment decisions, and our action plan for how we can achieve our net zero and biodiversity targets. We aim for the Routemap to be a rallying call and a guide for a change of approach with all partners, encouraging us to not just consider the limits of our individual sectors, but take collective responsibility for our whole system.

Underwater Photographer of the Year 2022: Swanage Pier Swarm by Paul Pettitt

The Whole of Seabed Approach

The Whole of Seabed Approach represents how The Crown Estate wants to inform its leasing and management activities going forwards with a holistic understanding of the seabed at present and far into the future.

It encapsulates the processes, tools and working practices across our marine business that will inform a holistic approach to the decisions and outcomes of our seabed management, led by our Marine Delivery Routemap. The Whole of Seabed Programme is an ongoing, iterative process of data collection, spatial modelling and stakeholder engagement to generate and improve the spatial evidence and data at the heart of this approach.

The Whole of Seabed Approach has been made possible by our expertise in geospatial analysis, supported by robust data and evidence developed and collated over the last 20 years and through our suite of bespoke modelling tools.

One of the key tools used to weight and analyse datasets is our world-leading spatial planning system RIO – Resource Identification and Optimisation tool. RIO enables data to be structured and prioritised to ensure all environmental, social and cultural interests are fairly represented in line with stakeholder views and provides a unique one-stop-shop of tools that deliver high quality evidence to support marine spatial planning now and into the future.

Nature is at the very core of our ambition to become the most attractive and sustainable marine economy in the world.

Therefore, as well as considering the interaction all sectors have with nature, we are also considering nature as a "sector" in itself. This is to ensure that there is spatial data and an evidence base that can support in delivering future nature restoration, recovery programmes and plan more widely for nature both within and outside of Marine Protected Areas (MPAs).

Our approach is designed to complement and add value to other workstreams including Defra's Marine Spatial Prioritisation (MSPri) Programme. We equally seek to take learnings from other programmes of work and facilitate dialogue and input around how we best develop our approach to nature.

We have a responsibility to deliver value for the nation and nature and to protect biodiversity and marine environments. Therefore, nature will continue to be considered at the very core of the Whole of Seabed Programme and across all sectors and development.

Nature is considered in all sectors and in its own right.

Shaping the Environment by Keith Hiscock

Whole of Seabed Methodology Overview

This symbol illustrates the quality assurance process (QA), conducted to ensure outputs are reliable and that only high quality datasets have been used in the modelling process.

Definition and Data Sourcing

Define constraints and source high quality UK wide datasets (social, environmental and economic).

Modelling Potential Areas of Opportunity (PAOs)

Key Resource Areas

Identify where sectors can technically be deployed.

Exclusion Modelling

Exclude locations that contain interests which prevent offshore development ("hard constraints"). These are defined as areas where development is not possible generally due to existing rights, legislation, technical factors, infrastructure or health & safety.

Constraints Modelling

Analyse remaining locations for relative level of constraint posed to offshore development by all other competing activities or interests.

Cost Modelling

Integrate cost constraints into the modelling approach, e.g. consider levelised cost of energy (LCOE) for development (where available).

Potential Area of Opportunity (PAO) outputs

Incorporate spatial insights from previous spatial exercises and region-specific requirements. The output of this step of the process is then presented as a spatial map of the Potential Area of Opportunity (PAO), per sector.

Modelling Scenarios

Scenario Modelling

The scenario modelling informs a greater understanding of the potential distribution of sectors to meet 2050 demands, according to specific spatial rules, industry projections, policy targets and priorities. This process generates a wealth of insights and information that can be used to understand the implications of the successful delivery of sectors, impacts on the environment and societal and economic benefits.

Scenario Outputs

The output is the understanding of the potential distribution of sectors and trade-offs per scenario. Results demonstrate whether a scenario has met the demand requirements as well as prioritisation and co-location implications. This process is iterative, and as more data is fed into the process, scenario outputs will change and develop over time.

Evaluation and Analysis

We generate a wealth of statistics alongside each scenario output. We use these to form insights based on individual scenarios as well as them collectively. This process consolidates our understanding of the spatial outputs, helping us to identify where challenges are being identified through the analysis as well as where we should investigate further and aim to iterate and improve aspects of the analysis.

Stakeholder Engagement

We will continue to engage with government, industry and other key marine stakeholders throughout the process, to ensure that we include the best available data, evidence and analysis rules in the Programme.

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Definition and Data Sourcing

The spatial analysis processes and modelling used to identify PAOs for each sector (such as offshore wind, nature, tidal range etc.) require the acquisition of a diverse range of data and the identification of how much resource is needed per sector.

Social, economic and environmental datasets are included, to ensure that the outputs from the Programme are as representative as real-world scenarios as possible.

We engage with government, industry and other key marine stakeholders, to ensure that we include the best available data and evidence in the Programme, and that the data that feeds into our analysis is reliable and trusted by leading experts in the field.

Spatial Modelling and Analysis

Our team of geospatial experts process UK wide marine datasets using our RIO tool, creating models that produce a simplified spatial representation of real-world systems, using data, evidence, and mathematical and computational techniques.

Utilising these data and techniques we are able to create our PAOs and through further geoprocessing and analysis of these PAOs, we create our spatial scenarios. Through this process, we develop evidence and build understanding of future resources and how they might be used based on the best information available at a given point in time.

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Potential Areas of Opportunity (PAOs)

The creation of a PAO includes the analysis and processing of 4 key elements: a Key Resource Area (KRA), Exclusion Model, Restriction Model and Cost.

Key Resource Areas (KRAs):

A Key Resource Area (KRA) defines areas of seabed suitable for a sector's development (for example offshore wind), based on technology viability over a given timeframe. It is not intended to capture other factors that are vital to assessing suitability for development (e.g. other seabed uses, environmental interests, etc.). These additional sensitivities are considered in successive stages through further analysis by The Crown Estate, building upon the identified KRA.

KRAs are identified through analysing spatial datasets of geophysical and "metocean" (meteorological and oceanographic conditions) drivers which describe where a technology or sector can feasibly be delivered. For example, fixed offshore wind is only feasible within a given water depth due to the type of turbine foundations. Therefore, datasets that describe the depth of the seabed are used in building the KRA for offshore wind.

Exclusion Models:

Exclusion Models, built using RIO, identify and remove areas from the spatial model that are not suitable for development due to other marine uses or interests, known as "hard constraints."

Features are considered hard constraints to development based on any of the following reasons:

- There is existing infrastructure in place that would preclude development.
- Safety reasons would inhibit development (e.g. International Maritime Organisation shipping routes and oil and gas safety zones).
- Existing rights have been granted over the seabed which preclude granting development rights.

Restriction Models:

Following the Exclusion Model, a RIO Restriction Model is run to analyse all other existing activities which represent spatial constraints ('soft constraints'), for which it is assumed there is some potential for co-existence with the modelled sector.

These constraints are weighted in terms of the risk they present to the deployment of the sector and the potential risk of displacement of existing activities.

Constraints are processed in a multi-criteria analysis methodology known as Analytical Hierarchical Processing (AHP).

The weight of the datasets to be included within AHP are informed by discussions with industry experts and stakeholders and learnings from previous spatial design work, to ensure that the weight of the dataset is appropriate and in line with risk to the sector.

Nature is considered in ALL of the sector analyses.

For all sectors, nature-related datasets have been used to highlight areas that should be considered as sensitive areas for development, due to various different environmental considerations relating to habitats and species.

These sensitivities are analysed alongside other sectoral constraints (both as exclusions and restrictions). For example, data around MPAs, fish spawning and nursery areas, and other environmental sensitivities are fed into the modelling.

The Whole of Seabed Approach is an iterative process and PAOs will be subject to further refinement and engagement prior to leasing activities. As new nature datasets and information emerge they will be fed into the programme, both into the PAO for nature and to inform how nature should be considered by other sectors.

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Potential Areas of Opportunity (PAOs)

Cost:

Cost is an important consideration to make when exploring the opportunities for future developments. The UK has a diverse range of characteristics in terms of wind, metocean and seabed geology which makes it important to understand how the cost of deployment varies spatially. For example, a given area may be less constrained by the presence of other activities but significantly more expensive to develop in based on a variety of factors, and therefore unviable.

To date we have used a variety of cost metrics in our Whole of Seabed analysis, specific to each sector. Notably we have developed an industry-leading suite of techno-economic models to calculate Levelised Cost of Energy (LCOE) for offshore wind, using a consistent set of spatial data and commercial assumptions. Our offshore wind LCOE model incorporates machine learning-based sub-structure and operations and maintenance strategy optimisation, consideration of energy system costs and inter-array wake effects.

A key priority for the Programme in the coming years is to continue adding further sectors and functionality to this capability, improving the cost proxies we have used to date for other sectors in our Whole of Seabed work.

We will look to test the outcomes of this with industry stakeholders to build understanding of industry-specific costs and how this impacts creating PAOs.

PAO Outputs:

Once we have completed the analysis of the KRA, Exclusion Model, Restriction Model and Cost, we can draw these elements together to create a PAO. This represents a sector's resources based on our current knowledge of technical factors, other marine users and costs. We also make sure to include consideration of the given sector's existing infrastructure, lease agreements and interests in its PAO.

PAOs focus on the future opportunity for their given sector alone, meaning they do not take account of areas of future resource potential for other sectors. These PAOs still represent an area with significant optionality for a sector's future development, and more space than a given sector could ever feasibly need, even under the most extreme scenarios.

The Nature PAO:

Reflecting the diversity of opportunities and ambitions for nature protection and restoration around the UK is a key challenge in this work. We believe that we are taking a new approach to tackling this challenge at a strategic level in attempting to draw together many different sources and categories of data and evidence in one analytical process.

In addition, while we seek to give the opportunities and ambitions for nature parity with traditional industrial sectors in the sense of representing them proactively alongside each other, we need to acknowledge in the analysis process that nature cannot be represented with an identical method.

The Nature PAO is not built up from one simple demand target or one driver, there are multiple targets, drivers and policies.

The integration of spatial datasets that support our understanding of the areas of opportunity and constraint for nature are complex. We need to further investigate the interplay of these diverse datasets and address evidence gaps to allow greater confidence in the Programme's spatial outputs. As with all the PAOs, we recognise that further iterations will be necessary to ensure we are drawing on the best available evidence and we will continue to work collaboratively to fill any critical gaps.

The aim of the Nature PAO is to account for the anticipated need for nature across these different demand targets and drivers, whilst understanding that there are still gaps in knowledge.

To address these knowledge gaps, we will continue to engage with stakeholders and invest in programmes and initiatives that will help to increase our understanding of the marine environment. The PAO does not consider how other sectors may interact with nature. **However, nature is considered in the modelling for all other sector's PAOs.**

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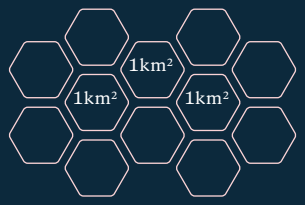
Scenarios

Each PAO gives us a detailed spatial understanding of a sector's future resources. The next step of our analysis poses questions about how these sectoral resources overlap and where demand for sectors could be most and least prominent. We investigate this by running scenarios around how those resources could be used according to different overarching objectives and views of where may be most optimal for each sector.

Hex Grid

We have created a layer of 1km^2 hexagonal cells in our GIS software which covers UK waters. We then attribute different datasets, including PAOs, to this uniform net of cells, allowing us to understand the characteristics and presence of activities in any given 1km^2 of seabed. This hex grid provides us with the foundations to run different spatial scenarios.



Scenario Objectives

Using the hex grid and its attributes we then run multi-sector spatial scenarios to 2050 based on:

1. Different objectives on spatial prioritisation between and within sectors (e.g. minimise cost, minimise impact on other users, maximise co-location).

2. Different sector demand profiles to capture the uncertainty (e.g. GWs of offshore wind needed by 2050 to meet net zero).

Deployment Modelling

Running scenarios across 10+ sectors requires a large amount of computational power. To make this possible we use an in-house deployment model to optimise where different sectors will locate, taking into account the cost, constraints and configuration of sites needed to meet demand profiles.

This is a flexible and evolving tool which we will continue to develop over the coming years, streamlining the time it takes to run scenarios as well as facilitate increasingly complex analysis (for example, by including further variables of time, which represent a need for further computational power).

Scenario Outputs

The outputs from the scenario analysis constitute an integrated understanding of potential future spatial configurations of offshore sectors and the different sectoral interactions which are created through modelling each scenario. We can use this understanding, as well as a wealth of statistics associated with scenario outputs, to evaluate whether each sector has met its demand requirements, as well as whether any overarching scenario objectives were achieved (e.g. meeting specific regional deployment targets).

Some scenarios meet their objectives and some do not.

There is value in understanding all scenario outcomes however, as the scenarios themselves do not represent plans for development, simply evidence on where, why and how different opportunities and challenges could arise across UK waters to 2050.

By understanding the reasons why scenarios have or have not achieved their objectives, we can build an evidence base to unlock key questions about delivering effective management of the marine environment over the long-term. This can accelerate our work with Government and industry to unblock challenges earlier in development and inform how we deliver best value for the UK.

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Evaluation and Analysis

We generate a wealth of statistics alongside each scenario output. We use these to form insights based on individual scenarios as well as them collectively. This process consolidates our understanding of the spatial outputs, helping us to identify where challenges are being identified through the analysis as well as where we should investigate further and aim to iterate and improve aspects of it.

Engagement

As we develop the Programme further, we are expanding our work with stakeholders to build and validate the underlying data and evidence used in the analysis, as well as identify knowledge gaps that can be filled to improve our understanding going forwards.

We are committed to working collaboratively with industry, government, the environmental sector, organisations representing other users of the seabed and academia, to collate the best available data and explore spatial analysis scenarios that will support the UK in accelerating nature-positive offshore development.

In parallel, we are using the Whole of Seabed evidence base to help coordinate actions amongst delivery bodies for net zero and nature recovery, bridging policy to delivery.

This includes co-developing a **Marine Delivery Routemap** with our partners, including government bodies and delivery agencies, which will inform future leasing, licensing, sector plans, and identify where enabling investment needs and opportunities are.

Underwater Photographer of the Year 2022: Freediving freedom by Dan Bolt

The Whole of Seabed Programme is used as an evidence base to inform Marine Delivery Routemap

Whole of Seabed Programme

- Ongoing, iterative process of data collection, spatial modelling and stakeholder engagement
- Holistic data and evidence base
- Spatial modelling tools and outputs: PAOs and Scenarios.

Marine Delivery Routemap:

Using this Whole of Seabed evidence base, the Routemap will co-develop, with stakeholders, a forward strategy for the marine space. This includes:

- **Spatial pathways.** Using Whole of Seabed scenarios, identifying how we can best use the marine space in the period to 2050, to deliver across policy goals and meet the needs of all sectors and users of the seabed.
- **Seabed and coastal management.** Informed by these, developing forward plans which align the needs of both sectors and the natural environment. For The Crown Estate, this means a timeline of leasing activity and investment sectors which it manages.
- **Enabling investment.** Providing forward visibility on where and when key enabling investments are needed (e.g. ports, supply chain, grid, nature).

Photograph by Ben Barden

The Whole of Seabed

Iterative Development

Proof of concept

To date:

Over the past 18 months we have transformed the Whole of Seabed Programme from an ambition to revolutionise the world of marine evidence, to a highly sophisticated set of analytical tools and processes, which is changing how the UK can understand the future of its marine environment. We have analysed 10 sectors to date, including nature, creating an initial evidence base of where their future resources lie and how they could be used.

10 sectors

Refine processes and definition of programme cycles

Next Steps:

Going forwards we will continue to work iteratively to improve this evidence base and the capability which underpins it. Working with Governments, industries and wider stakeholders will be crucial to this – please visit the marine section of our website to find out more about our sectoral work and relevant points of contact for our individual sectors.

Having developed an operational capability, the next year will see us evolve the processes around how we use this, developing a clear cycle of data integration, modelling and stakeholder engagement.

Engagement will be guided by which elements of the analysis we focus on improving in a given year, a process we are currently working on and gathering feedback around. In general, the Programme will explore demand and creating PAOs for other offshore sectors we have not yet analysed, as well as look to improve our work on sectors we have run initial analysis on, for example, nature. We further plan to provide an annual update on the Whole of Seabed analysis, summarising developments to the capability and evidence base over the past year.

10+ sectors

Visit our website at:

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The Whole of Seabed

Key Learnings

Our Whole of Seabed analysis is an ongoing process which we will continue to develop iteratively. Nevertheless, our proof of concept analysis to date represents a significant amount of work, in which we have analysed 10 sectors, run a wide range of scenarios, and produced large amounts of data and statistics. We have outlined some of the key takeaways from this process:

1. Cross-system evidence	It is critical we do not look at individual sectors and nature in isolation when making decisions around seabed use. We have built an internationally renowned analytical capability which allows us to investigate questions about future use of the seabed in more detail than ever before and we will continue to develop this and use it to catalyse action around net zero and nature recovery.
2. Demand Increases	While there are significant uncertainties around future predictions of the demand for UK sea space, both for individual sectors and cumulative activities, our analysis points towards there being a manyfold increase in the demand for sea space between now and 2050. We must continue working to increase our understanding of this demand for space.
3. Nature Throughout	By representing nature as a sector in its own right as well as a sensitivity which other sectors should seek to avoid, we have begun a process which should see the range and diversity of nature considerations better represented as part of a national scale evidence base. We will continue to make this a core focus of the Programme, collaborating with partners to improve upon our work to date.
4. Managing Pressures	Even by giving nature greater visibility and weight in this analysis, speculative sector demand forecasts point towards significant amounts of offshore development which could place increasing pressure on the marine environment. Therefore, assessing the potential scale of impact and any subsequent need for strategic compensation associated with different scenario outputs is a vitally important activity, which we will bring focus to over the coming year.
5. Engagement is critical	Engagement with experts across different sectors, environmental bodies, governments and academic projects will be integral to improving the evidence base over time. Now we have an initial set of outputs and established process we can start to collaborate in greater depth to refine and iterate the work over the coming years.

6. Shared evidence base

The evidence base and capability we have developed will be of interest to other national initiatives considering the use, prioritisation, protection and development of the marine environment. We will also make our evidence base available as appropriate to governments and delivery bodies, and via our **Marine Delivery Routemap**, sharing our expertise and insights to help inform how we can deliver value and prosperity for the UK.

7. Long-term data strategy

The type and quality of data used in this process determines how we must caveat and contextualise the outputs of it. The long-term development of this evidence base will be reliant on a coherent strategy to update and procure new data in areas where we have lower confidence in the quality of currently available datasets.

8. Regionality

We have focused on the use of national scale datasets to provide a consistency of scale across sectors. We will continue to consider what role regional datasets should play in relation to the analytical process, whether as inputs or review layers. This exercise will never include every available spatial dataset as an input, and the outputs of this process should be contextualised amongst other data and evidence - as with all projects.

9. Scale

Our work covers English, Welsh and Northern Irish waters. It is our intention to increasingly build in a UK and international context to our work as we iterate, engaging with other nations to understand how we can build a joint understanding of cross-boundary issues with our data, evidence and tools.

10. Digital innovation

The work to date has only been possible by investing significantly in digital tools capable of handling advanced computational processes. We need to continue to advance our tools to analyse complex datasets in parallel (for example, climate change, ecosystems, decommissioning, and repowering datasets).

To contact the Whole of Seabed Programme Team, please email:

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Underwater Photographer of the Year 2023: Edible Crab Under Portencross Pier by Mark Kirkland

Glossary

Key Resource Area (KRA)	An area where it is understood to be technically feasible to develop a given sector based on geological and metocean factors.
Levelised Cost of Energy (LCOE)	A measure of the average cost of energy generation over the generator's lifetime, based on assessing the total cost of building and operating the energy generation asset.
Marine Delivery Routemap	The Marine Delivery Routemap is a collaborative initiative to develop a long-term strategy for the marine space. It will help coordinate action across agencies and sectors to deliver on net zero and nature recovery policy; build a thriving marine economy; and support onshore communities.
Marine Protected Area (MPA)	MPAs are areas of the ocean established to protect habitats, species and processes essential for healthy, functioning marine ecosystems.
Nature Potential Area of Opportunity	A Potential Area of Opportunity designed to provide a way of considering nature in its own right alongside other sectors. In summary, this consists of mapping opportunities for nature recovery, protection and enhancement, giving us a way of representing the diversity of demands from nature. To date it does not consider the cost of any of these activities in order to define the spatial output.
Potential Area of Opportunity (PAO)	A Potential Area of Opportunity for an individual sector, identified through consideration of cost and existing marine users and interests. A PAO does not take into consideration areas of potential opportunity for other sectors or co-location of future activities, but are used as inputs to spatial scenarios which model all future activities to provide a deconflicted view of development out to 2050.
Resource Identification and Optimisation tool (RIO)	An in-house digital tool developed by The Crown Estate to analyse spatial data in a structured and prioritised way.
Sector	For the purposes of our analysis this consists of a range of activities which The Crown Estate plays a role in leasing or managing. It is therefore used to represent activities from the protection of nature, to tidal energy generation, to the laying of telecommunications cables.
Strategic compensation	Strategic compensation is the delivery of compensatory measures required under the Habitats Regulations to ensure the coherence of the UK National Site Network, that goes beyond individual project by project delivery and takes a more coordinated and/or proactive, strategic approach to their identification and delivery.
Whole of Seabed Approach	How The Crown Estate wants to inform its leasing and management activities going forwards with a holistic understanding of the seabed at present and far into the future.
Whole of Seabed Programme	An ongoing, iterative process of data collection, spatial modelling and stakeholder engagement to generate and improve the spatial evidence and data at the heart of this approach.

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