THE UK'S BLUE CARBON INVENTORY

ASSESSMENT OF MARINE CARBON STORAGE AND SEQUESTRATION POTENTIAL IN UK SEAS (INCLUDING WITHIN MARINE PROTECTED AREAS)

This report was commissioned by

WWF FOR YOUR WORLD   The Wildlife Trusts   RSPB

This report summarises the findings of original analysis undertaken by the Scottish Association for Marine Science (SAMS), The University of St Andrews, and the Marine Biological Association (MBA). It has been written and edited by Professor Dan Laffoley and Professor John M Baxter, WWF, The Wildlife Trusts, and the RSPB.

TECHNICAL SUMMARY FOR FOR THE IRISH SEA AND WELSH COAST REGION

INTRODUCTION AND OBJECTIVES

Species are in decline, extinction rates are increasing, and nature is experiencing a global crisis as a result of human activities. Alongside this is the increase in the disruption caused by climate change with global atmospheric temperatures consistently above the 1.5°C benchmark. Joined-up ambitious actions are now needed at scale and speed across biodiversity and climate if the current trends are to be halted and reversed.

At the heart of this lies the ocean and its influence on the global climate system. There is a need to rapidly improve understanding of the role marine species, habitats and ecosystems play in natural carbon storage and climate regulation. Only with such an understanding can tools such as Marine Protected Areas, Marine Spatial Planning and Strategic and Environmental Impact Assessments be focused to fully play their roles in delivering restoration and recovery measures, as well as facilitating adaptation to climate change.

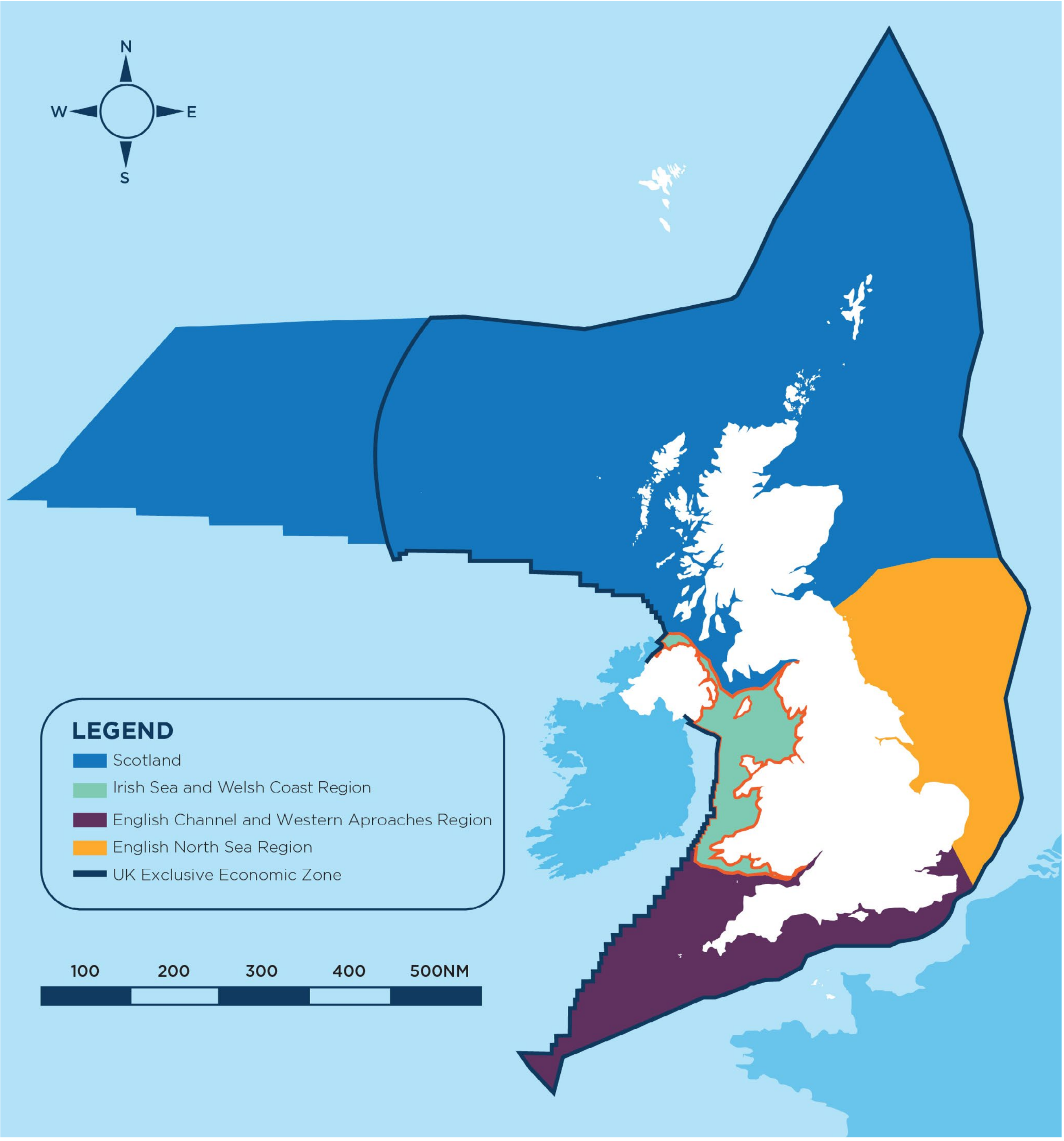
The focus of this project is to understand the character and distribution of blue carbon within the United Kingdom's (UK) Exclusive Economic Zone (EEZ). This work has developed a comprehensive inventory of existing 'blue carbon habitats' including saltmarshes, seagrass beds, kelp forests, biogenic reefs and seabed sediments and estimated their future carbon sequestration and storage potential. It has been undertaken in regional phases, each with their own report; this summary focuses on the Irish Sea and Welsh Coast region. This work builds on a pilot project that covered the English North Sea.

The project demonstrates the importance of blue carbon in the marine environment, and the value and role that a network of well-managed Marine Protected Areas (MPAs) can play in protecting such stores. This work is of direct and immediate policy relevance, as it supports better implementation of international and national policy imperatives in tackling the dual challenges of biodiversity loss and climate change impacts.

Key amongst these is the Convention on Biological Diversity. The UK governments helped champion the creation and agreement of the Convention on Biodiversity's Global Biodiversity Framework, which drives the 30x30 commitments to both protect at least 30% and to restore at least 30% of nature by 2030. This agreement specifies that action should be directed to protect areas of particular importance for biodiversity, and also areas that are important for the continued provision of ecosystem functions and services, and that the protection of such areas should be prioritised in reaching the targets. The UK countries domestically have so far championed the marine biodiversity aspects using its somewhat restrictive feature-led approach but is way behind in acknowledging and acting on associated marine biodiversity functions and services. This work helps fill a significant and priority gap in such action with its focus on natural carbon services.

The passing of the EU Restoration Regulation in June 2024 places added pressure on UK governments to ensure that there is proper protection of carbon stores throughout the EEZ, rather than the current piecemeal feature-led approach to the implementation of management measures within existing MPAs, which effectively result in some activities being able to continue unabated, causing widespread damage and destruction to marine biodiversity functions and services. UK governments now have the opportunity to quickly update policy. This study provides the evidence to do this, highlighting the role and importance of carbon services when managing activities at sea and the designation and future management of MPAs, building on the climate smart MPA work undertaken by JNCC - taking 'theory' to practice. The methodology and approach that this work has devised can also be replicated on a wider, international scale, if the UK governments so wished to provide such global leadership.

By creating an Irish Sea and Welsh Coast regional blue carbon inventory, this research is of direct relevance to policy advisers and decision makers when forming a view on the management of activities at sea and the role and management of existing MPAs and Other Effective area-based Conservation Measures (OECMs) in protecting, managing and restoring natural carbon processes.



BACKGROUND

Marine ecosystems, including habitats such as saltmarshes, seagrass meadows, seaweeds (including kelp forests), biogenic reefs and seabed sediments, as well as phytoplankton, all contribute to the capture and/or storage of carbon. Saltmarsh plants, seagrass and seaweeds all capture carbon through photosynthesis in the form of organic material. Saltmarsh and seagrass sediments also act as a store of carbon whereas a proportion of the carbon captured by seaweeds is eroded and transported elsewhere as detritus, with some subsequently buried and stored in seabed sediments. Biogenic reefs and seabed sediments act principally as depositories for carbon derived from other sources, both marine and terrestrial. These natural carbon stores are vulnerable to a variety of human activities which can cause them to be disturbed, damaged, or destroyed, which then hinders or eliminates their ability to store and/or capture carbon and potentially lose carbon to the water column and atmosphere.

Working with nature and implementing 'nature-based solutions' not only makes environmental and socio-economic sense but is essential for tackling both the climate and biodiversity crises. The protection and restoration of marine habitats represents a long-term strategy for natural carbon storage and provides additional benefits from nursery grounds for fish, to the protection of coastal towns and cities and essential infrastructure. Long-term carbon storage in the sea depends on protecting carbon-rich habitats from disturbance and damage. The first step is understanding the scale and distribution of carbon stores and capture rates in the different habitats.

This report provides the best available estimate of the size of carbon stores within the top 10 cm of seabed sediments in the Irish Sea and Welsh Coast Region and highlights the scale and distribution of such stores within the existing MPAs, as well as identifying key areas falling outside of these.

KEY REPORT FINDINGS

- The Irish Sea and Welsh Coast Region covers an area of 43,112 km^2 of which 31,177 km^2 (72%) are designated as MPAs (MCZs, MNRs, SACs, SPAs and marine areas of SSSIs and ASSIs).

- In total, there are an estimated 15.7 million tonnes (Mt) of long-term stores of organic carbon, with 93.7% of that total (~14.7 Mt) and 15.4 Mt of inorganic carbon stored within just the top 10 cm of sublittoral mud and sand/mud seabed sediments. This estimate therefore represents only a fraction of the overall carbon stored in the full thickness of these sediments. It is the top layers of sediments however which are the most recently deposited and the most at risk to disturbance by human activities.

- An estimated 0.94 Mt of organic carbon are stored in the top 10 cm of soils in coastal saltmarshes and 0.06 Mt in seagrass bed sediments.

- Living kelp biomass contains an estimated 204,000 t organic carbon with a further 8,800 t contained in intertidal macroalgae.

- Blue carbon habitats within MPAs are estimated to hold 10.4 Mt of organic carbon and 7.6 Mt of inorganic carbon, respectively accounting for 70% of the total organic carbon and 49% of the total inorganic carbon stored in the top 10 cm of sediments in the area assessed by this study. Sublittoral MCZs and SACs contain the largest proportion of organic and inorganic carbon (6.4 MtC), but inshore, littoral MPAs, and notably the smaller marine portions of SSSIs, have the highest densities (SSSIs: 0.49 C kg/m^2) and rates of organic carbon accumulation per unit area in their coastal muds, saltmarshes and seagrass beds (SSSIs: 45.5 gC kg/m^2/yr). MPAs with predominantly rocky habitats have less organic carbon long-term stores and lower accumulation rates but do support extensive kelp beds that contribute carbon to neighbouring areas of sediment through the erosion and transport of kelp detritus.

Mudflats and feeding waders

PETER CAIRNS/2020VISION

• Annually, it is estimated that up to 1.3 Mt of organic carbon are added to long-term sediment stores across the region, predominantly within mud and sand/mud seabed sediments. Saltmarshes and seagrass beds store a relatively small proportion of this organic carbon (123,000 tC/yr), albeit at a higher rate per unit area, with saltmarsh soils accounting for the majority of this contribution (98%).

• Growth and reproduction of algae and plants (i.e. all primary producers), with subsequent losses and transport to long-term stores in the seabed, are the primary mechanism for removal of carbon dioxide (CO_2) by the marine ecosystem in the region. Unlike rates of algal and plant growth, the proportion of algal and plant detritus that reaches long-term stores is poorly known. Based on an estimate of 10% of algal and plant material produced to predict the fraction of organic carbon transported from living biomass and stored within seabed sediments results in 0.4 MtC/yr being added to the particulate organic carbon (POC) pool for transport and incorporation into stores. Production of organic carbon by algae and plants in the region is dominated by phytoplankton (0.35 MtC/yr), with much smaller fractions by kelp (49,000 tC/yr), saltmarshes (2,900 tC/yr), intertidal macroalgae (2,200 tC/yr) and seagrass beds (700 tC/yr).

• Additionally, biogenic reefs (e.g. horse mussel, blue mussel, native oyster, cold-water coral, tubeworm reefs, and maerl) are similar to surrounding sediments in their ability to store carbon by trapping particulate material, but such positive contributions to organic carbon storage are in part at least offset by CO_2 released during calcification of reef building material.

• Integrating the understanding of carbon storage provided by marine habitats into decisions relating to marine management would improve the protection provided to these habitats and enhance their capacity to act as carbon sinks. In some cases, where blue carbon habitats are covered by an existing MPA designation, management measures that have the specific objective of protecting or restoring habitats containing carbon in long-term stores can be considered alongside primary biodiversity considerations as potential nature-based solutions to mitigate the impacts of climate change.

• The most widespread threat to long-term organic carbon stores is physical disturbance of the seabed (surface abrasion and subsurface penetration and disturbance), which arises from a range of human and natural activities. The predominant anthropogenic source of physical disturbance is demersal fishing activities which occur throughout the seas of the UK, but offshore development also disturbs the seabed and this should be considered as part of marine spatial planning.

• While the analysis here has been based on the best information available at the time of writing, it must be understood that values presented for sizes of carbon stores and rates of accumulation are built on critical assumptions and caveats. Carbon in seabed sediments has been considered here for only the top 10 cm of marine deposits. This has been driven by the sampling of such sediments using surface grabs and very shallow sediment cores. The full depth of coastal sediments has not been assessed and represents a much larger store of carbon. Carbon in surface sediments is however the most recently deposited and most vulnerable to the effects of physical disturbance. Information on rates of seabed sediment accumulation is much more limited, especially compared to such rates in coastal vegetated habitats – the focus of much recent research. There are persistent evidence gaps which mean more data is required to effectively quantify carbon stores and sequestration rates between habitats and across varying UK geographies.


Saltmarsh

TERRY WHITTAKER/2020VISION

CHALLENGES AND OPPORTUNITIES

The report highlights the importance of the Irish Sea and Welsh Coast Region's seabed as a substantial carbon store and the significant contribution the marine environment makes to carbon sequestration. It has also identified the most valuable areas for blue carbon based on best available data. The results of this report should be used to inform policy and management decisions and identify opportunities to enhance recovery and protection of the seabed and its associated natural carbon storage and sequestration potential. The report can also be used to implement measures which would support the delivery of existing policy commitments such as achieving Good Environmental Status under the UK Marine Strategy and meeting the Climate Change Objective of the Fisheries Act 2020. In the case of Northern Ireland, other policy instruments these results should feed into include the Blue Carbon Action Plan, the MPA Strategy Review and the Northern Ireland Marine Plan. In Wales, the results should be used to incorporate consideration of blue carbon in the delivery of commitments under the Biodiversity Deep Dive, including the completion of the MPA network, the restoration of seagrass and saltmarsh habitats, and the development of a more spatial and strategic approach to marine planning.

The importance and vulnerability of marine carbon needs to be recognised.

In comparison with terrestrial carbon stocks, far less attention has been paid to understanding and improving our knowledge relating to blue carbon stores and their value in helping reduce global atmospheric CO_2 levels. Recognition needs to be given to habitats that act as long-term stores of carbon such as seabed sediments (i.e. mud and sand) and those that are important parts of the carbon cycle (i.e. kelp), all of which are currently excluded from national carbon assessments. This is alongside already recognised blue carbon habitats that both capture and store carbon (i.e. saltmarsh and seagrass beds). All of these should be quantified within policy as far as possible, such as through inclusion in the UK's Greenhouse Gas Inventory to track and monitor emissions and removals. More research and monitoring of blue carbon habitats is generally needed to increase our knowledge of these vital areas, the role they play in the carbon cycle and how best to protect them.

Raising public awareness of blue carbon's role is crucial.

Efforts should focus on increasing public understanding of the importance of marine habitats in natural carbon capture and/or storage, emphasising the need to protect these ecosystems. Greater awareness of the enormous contributions healthy seas make to protecting nature, capturing and locking away carbon and supporting our economy, health and wellbeing can help drive policy changes and promote sustainable practices that safeguard their role in regulating the climate.

Improved strategic planning of activities is needed in UK seas.

An imperfect evidence base should not be used as an excuse to delay taking decisive action and protecting important blue carbon habitats. Blue carbon should be integrated into marine plans, and activities should be strategically and spatially planned to avoid especially important areas for blue carbon and wildlife. Nature and climate must be the top priorities in marine planning. Damaging activities cannot be allowed to continue unabated and sea users must demonstrate their activities do not have significant impacts on carbon stores. Including blue carbon in environmental impact assessments will incentivise industries to avoid and minimise their impacts to blue carbon habitats and wildlife.

Blue carbon needs to be better protected in MPAs

Carbon storage as a key service provided by marine biodiversity, needs to be properly protected in MPAs. Significant quantities of stored carbon already occur in MPAs, but these stores are not currently the focus of any management measures designed to protect them. In this region, given that existing MPAs already contain 70% of the total organic carbon stores, a key focus needs to be on improving management measures for these designated sites as many remain vulnerable to damaging activities within their boundaries. Modest expansion of MPAs could also be considered to increase the level of protection afforded to seabed carbon in this region. High and full levels of protection are needed, rather than continuing to allow damaging activities such as bottom towed fishing gears in all or parts of MPAs. As part of this, governments should support fishers to move away from using bottom-towed fishing gears to more sustainable and selective methods.

Climate and biodiversity policy need to be implemented in a coherent and integrated way.

Measures to protect biodiversity and ecosystem services, including carbon storage, through conservation tools such as MPAs should be implemented. UK governments have championed key international agreements (such as the Convention on Biological Diversity's Global Biodiversity Framework) where protection of nature and its services are specified for national implementation. A shift to whole-site protection of MPAs (rather than the current feature-led approach), and the consideration of blue carbon in marine planning, would ensure that the natural carbon capture and storage processes are safeguarded and/or restored by managing damaging activities. At the same time, this would help to increase the resilience of the natural environment while contributing to meeting Net Zero targets.


Blue mussel bed

PAUL NAYLOR