NEW RESEARCH: HUGE CARBON STORES IN THE UK SEABED

BLUE CARBON

The need to protect essential stores of carbon in our seas

The Wildlife Trusts

WWF

RSPB

PAUL NAYLOR/MARINEPHOTO.CO.UK

Blue carbon:
the carbon captured and stored by marine habitats and species

PETER CAIRNS/2020VISION

Muddy habitats like this may look barren, but we now know they store huge amounts of carbon and are vitally important for wildlife

Life on Earth depends upon a healthy natural environment and a stable climate, but the world is facing accelerating climate and nature emergencies. To address these intertwined crises, urgent action is needed to safeguard ecosystems that store carbon and sustain wildlife. This isn't just an environmental choice, but an essential lifeline for the planet.

Over the past few decades, great strides have been made in recognising the importance of carbon storage in terrestrial environments, such as forests and peatlands, in regulating the climate. These land-based ecosystems have captured policy attention and are now seen as essential components of decarbonising the atmosphere. However, we've largely neglected the vast potential of 'blue carbon' found in our coastal and marine areas, which cover three times the land area of the UK. Marine habitats, including seagrass meadows, saltmarshes, and subtidal sediments like mud and sand on the seabed, act as incredible stores of carbon.

> "We must urgently and decisively act to protect UK seas, safeguard wildlife, and mitigate climate change for the well-being of future generations"

Protecting these marine carbon stores matters not just ecologically but also politically. The UK helped champion the creation and agreement of the United Nations 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 areas that are important for the continued provision of associated ecosystem functions and services. Protecting nature is not just about protecting plants and animals but also the services they provide that support all of us.

The UK domestically has so far championed marine biodiversity using its somewhat restrictive feature-led approach but is way behind in acting on associated natural services. As the UK, Devolved Administrations and Isle of Man governments raise raise ambitions for nature's recovery, a key strand of work will be to strengthen the links between what is done at a UK level and what is required through international agreement. This new groundbreaking study estimates the carbon stored within the full breadth of coastal and marine habitats in UK waters and will help governments fill a significant and priority gap in action, with its focus on natural carbon services.

Currently blue carbon remains underappreciated and largely unprotected within Marine Protected Areas (MPAs), and marine spatial planning processes have held little to no regard for the significant role our seas play in carbon storage. This, combined with ongoing human pressures that can affect the ability of our seas to effectively capture and store carbon, means that we are failing to make the most of this critical natural resource. We urgently need to speed and scale up action for existing and new MPAs alike, which if properly protected for both their carbon and biodiversity value could provide a win-win solution to help address nature and climate needs.

Protection of blue carbon stores should also be a mandatory component of seabed planning in the UK. Through effective planning that includes the protection of blue carbon habitats and important areas for biodiversity, we can support climate mitigation, protect nature and minimise the impacts of activities at sea such as bottom-towed fishing gears and offshore development. We also need investment in coastal blue carbon habitat restoration projects to increase the environment's potential to store carbon and help tackle the climate crisis. With the study we must urgently and decisively act to protect UK seas, safeguard wildlife, and mitigate climate change for the well-being of future generations.

Foreword authors

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John is an eminent marine biologist, focusing on biodiversity, climate change and conservation. Formerly Principal Marine Adviser at Scottish Natural Heritage, he holds honorary professorships, advisory and editorial roles.

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Dan is a global expert on ocean conservation, serving as Emeritus Marine Vice Chair of IUCN's World Commission on Protected Areas. He's responsible for many of the frameworks that underpin marine conservation today.

PAUL NAYLOR/MARINEPHOTO.CO.UK

This is what a carbon-rich seabed looks like close up. Many species live in it, including this red bandfish

TERRY WHITTAKER/2020VISION

Saltmarshes such as this one at Abbotts Hall in Essex are important coastal blue carbon habitats

From sky to seabed

The marine environment plays a crucial role in the carbon cycle. It has been absorbing atmospheric carbon for millions of years.

Marine ecosystems such as saltmarshes, seagrass meadows, kelp forests, biogenic reefs and seabed sediments have an incredible ability to capture and/or store what is known as "blue carbon".

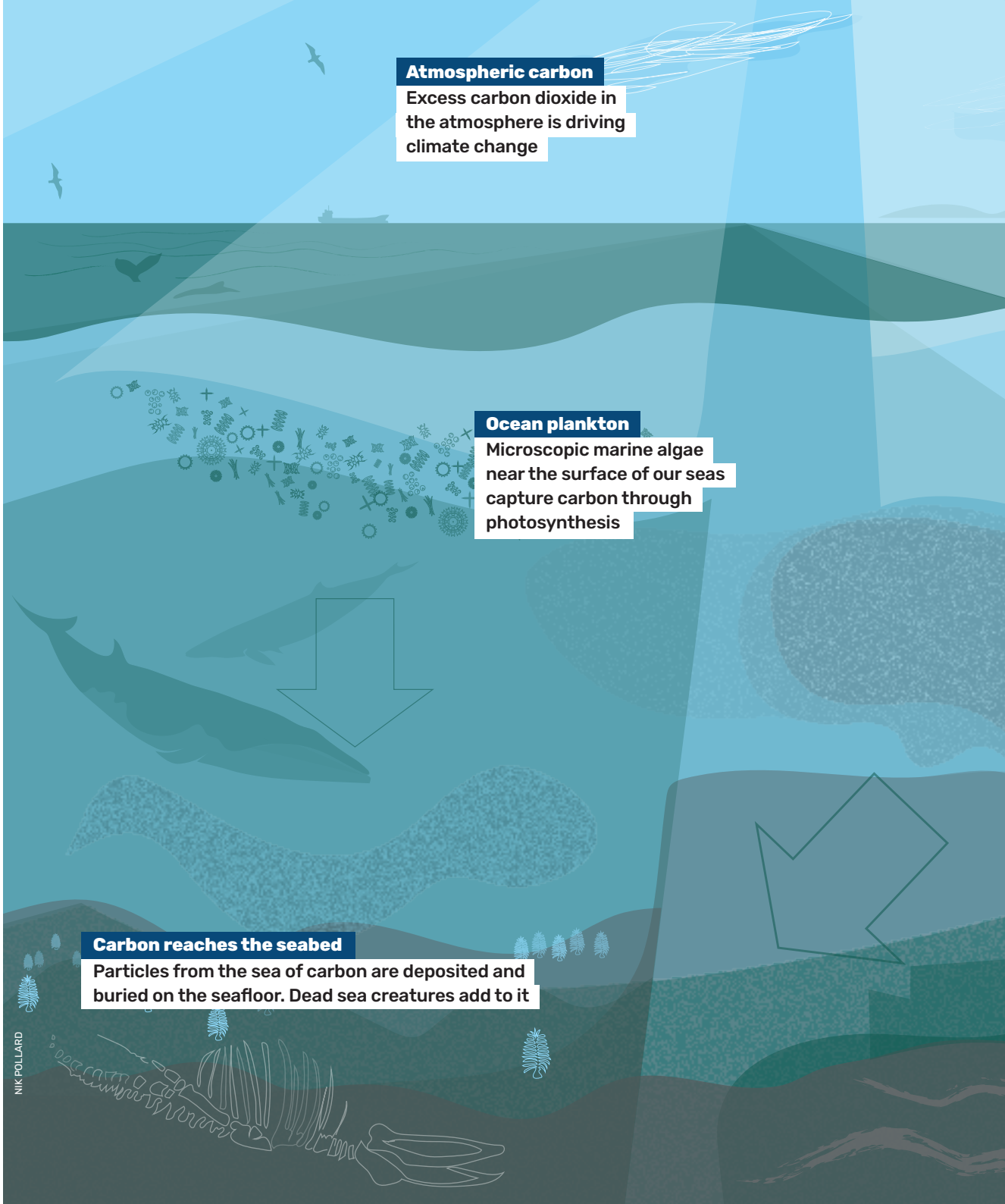
Saltmarsh and seagrass plants capture carbon directly through photosynthesis. As some of these plants decompose, a proportion of their carbon is stored in the soils underneath. They also act as a repository of carbon transported from other sources, trapping carbon which settles within the roots and rhizomes.

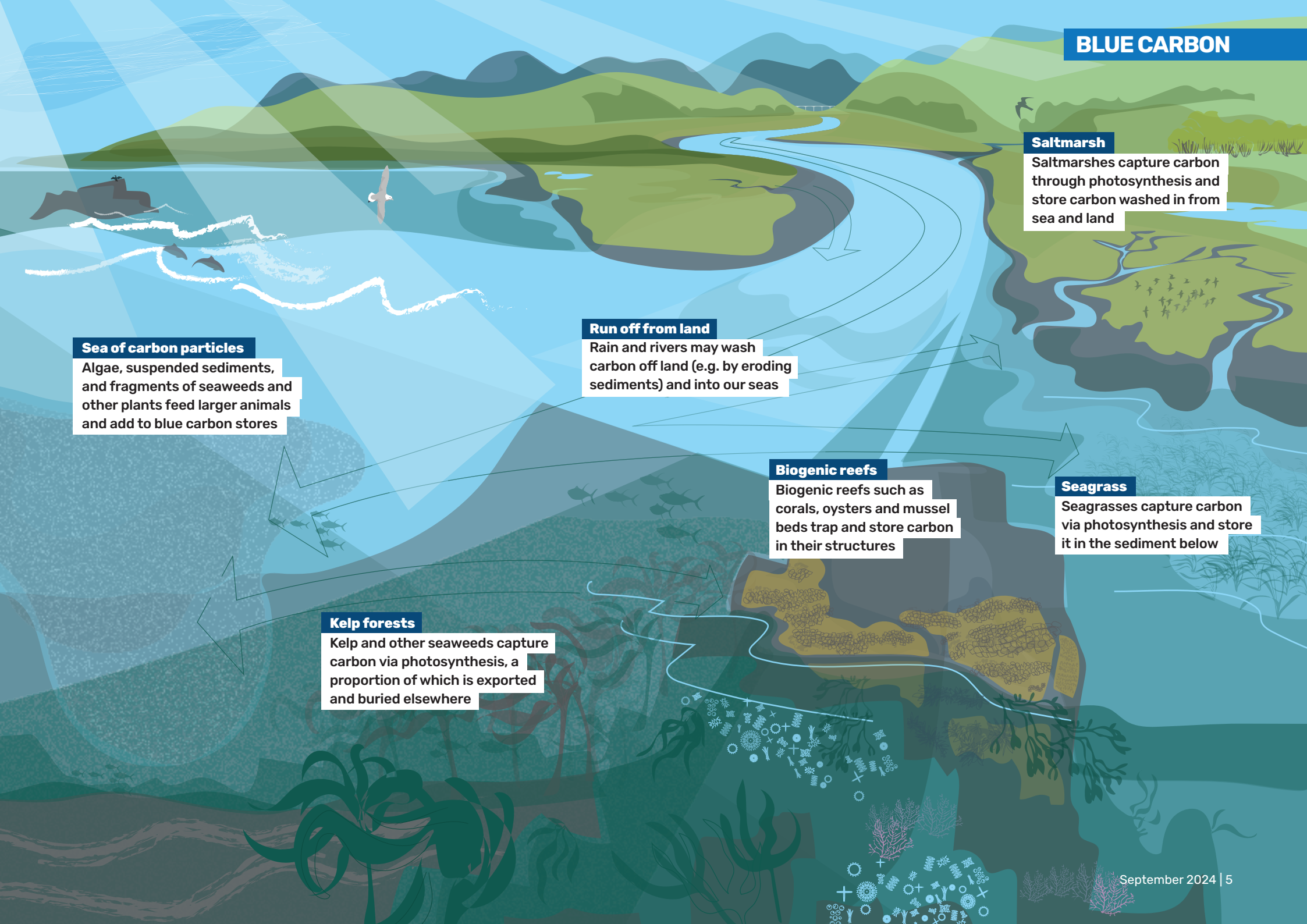
Biogenic reefs are natural structures formed by living organisms, such as corals, oysters or mussels, that build up over time to create hard, reef-like habitats. These reefs trap carbon from other sources in the structures they create.

Kelp forests and other seaweeds capture carbon through photosynthesis. The seas around our coasts transport carbon particles throughout the marine environment. They come from microscopic marine algae, known as phytoplankton, bits of seaweed and plants which have broken off in the water, and sediments eroded from land. Seabed sediments (mainly mud) store vast amounts of this carbon.

Across the ocean, seabed sediments act as the world's largest repository of carbon, extending over 360 million km^2 of the Earth's surface and going thousands of metres deep in places.

> "Seabed sediments are the world's largest repository of carbon, extending over 360 million km^2 of the Earth's surface."




BLUE CARBON
Saltmarsh
Saltmarshes capture carbon through photosynthesis and store carbon washed in from sea and land
Run off from land
Rain and rivers may wash carbon off land (e.g. by eroding sediments) and into our seas
Sea of carbon particles
Algae, suspended sediments, and fragments of seaweeds and other plants feed larger animals and add to blue carbon stores
Biogenic reefs
Biogenic reefs such as corals, oysters and mussel beds trap and store carbon in their structures
Seagrass
Seagrasses capture carbon via photosynthesis and store it in the sediment below
Kelp forests
Kelp and other seaweeds capture carbon via photosynthesis, a proportion of which is exported and buried elsewhere

How much is down there?

The carbon within just the top 10 cm of seabed sediments has been estimated.

A pioneering review led by the Scottish Association for Marine Science and commissioned by WWF, The Wildlife Trusts and the RSPB has been published. It estimates that 244 million tonnes of organic carbon are stored within the top 10 cm of blue carbon habitats around the UK and Isle of Man.

The vast majority (98%) of this carbon is found within sediments such as mud on the seafloor. The remainder is in the sediment and plants/algae of saltmarshes, seagrass beds, kelp forests and intertidal seaweeds. Together, these cover just 1% of UK and Isle of Man seas, but contain 1.7% of the total organic carbon. Saltmarshes alone are responsible for 60% of the carbon stored within these coastal vegetated habitats.

The review has only looked at the carbon within the top 10 cm of sediments. They can extend thousands of metres in some places. It is the top layers of sediment, however which are the most recently deposited and the most at risk to disturbance by human activities.

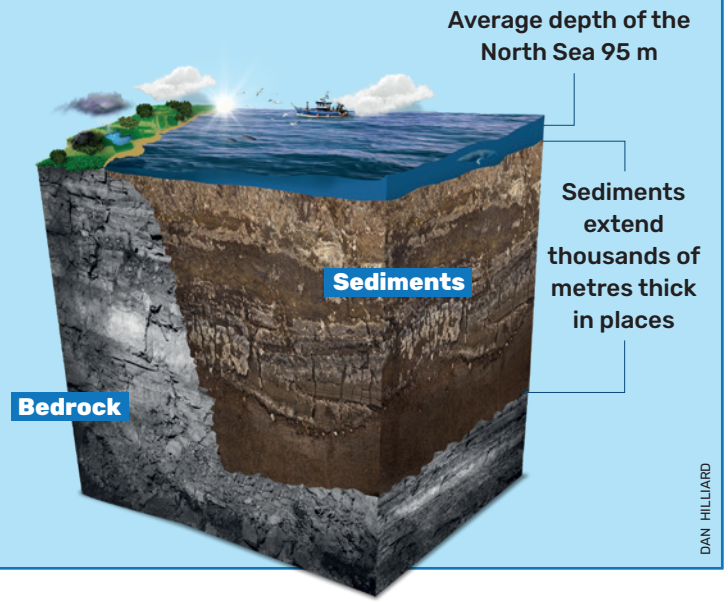
The review has also highlighted long-term stores and short-term stocks in these natural systems. The sediments in the seabed, saltmarshes and seagrass meadows lock carbon away from the atmosphere for extended periods (generally over 100 years). Kelp forests and intertidal seaweeds also contain carbon within their tissues but are continually being eroded and grazed. Many also shed the previous year's growth at the end of the annual growing season. They are therefore considered as short-term stocks. It's estimated 10% of the seaweed which is broken off is transported by waves and ocean currents and eventually added to seabed sediments. If left undisturbed, this carbon can be stored long-term.

MPAs with mapped blue carbon habitats are estimated to contain 43% of the total organic carbon (105 million tonnes of organic carbon). Offshore MPAs contain the most carbon as they are often larger and thus contain a greater extent of seabed sediments. However, inshore MPAs have the highest densities and rates of organic carbon accumulation per unit area in their coastal muds, saltmarshes and seagrass beds. MPAs with predominantly rocky habitats have less organic carbon in long-term stores and lower accumulation rates but do support kelp beds that contribute carbon to seabed sediments.

> "Sediments, saltmarshes and seagrass beds lock carbon away from the atmosphere long-term – over 100 years"

We have estimated the tip of the iceberg

Seabed sediments in UK waters are thousands of metres thick in some places. It is the top layers that are the most at risk from the impacts of human activities.



DAN HILLIARD

Just in the top 10 cm of the UK and Isle of Man seabed

244 million tonnes locked away

Broken down into long-term stores:

Seabed sediments
240 million tonnes

Saltmarsh habitats
2.4 million tonnes

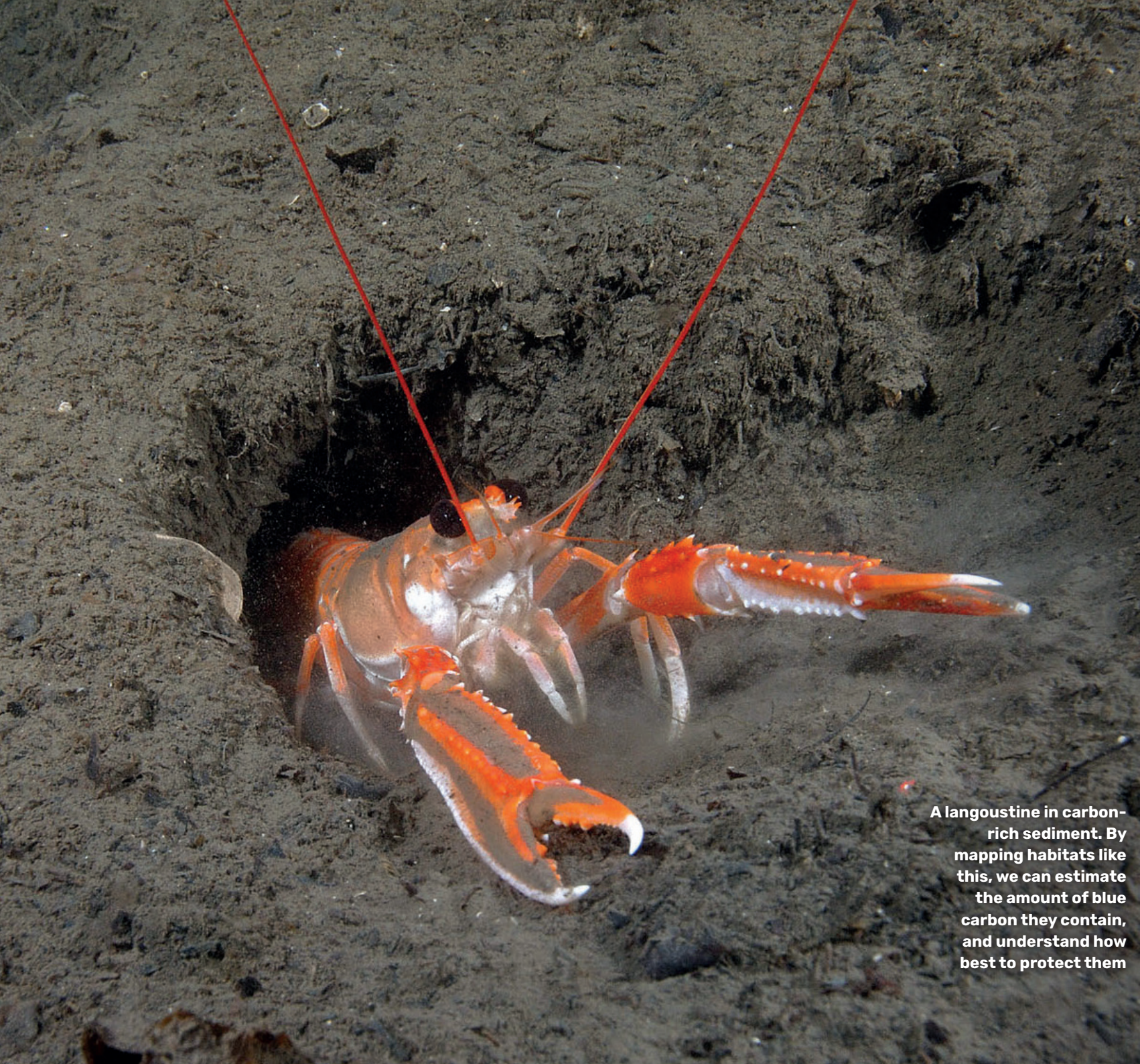
Seagrass meadows
139,000 tonnes

Short-term stocks:

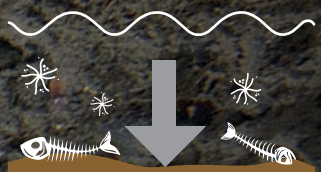
Kelp forests
1.4 million tonnes

Intertidal seaweeds
67,000 tonnes

PAUL NAYLOR/MARINEPHOTO.CO.UK



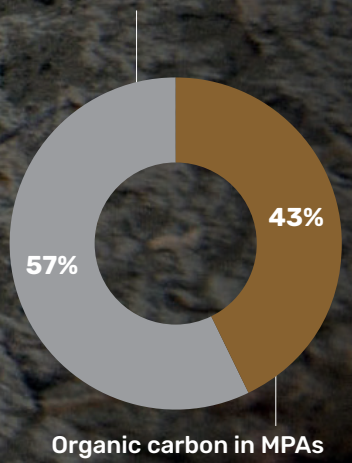
A langoustine in carbon-rich sediment. By mapping habitats like this, we can estimate the amount of blue carbon they contain, and understand how best to protect them

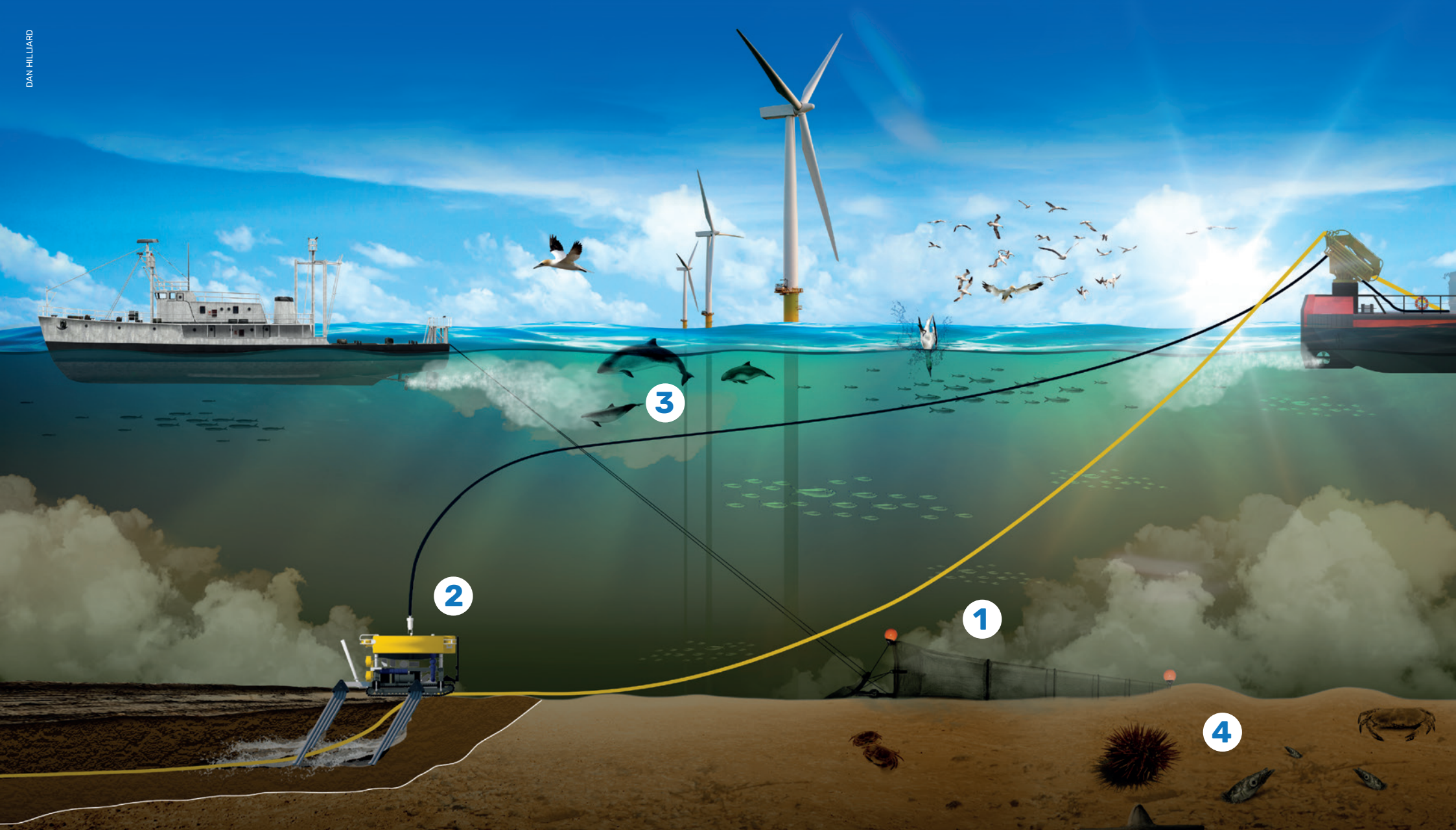


How much carbon accumulates each year?

It's estimated up to 13.5 million tonnes of organic carbon could be added annually to sediment stores – more than by all the UK's forests

How much carbon is in MPAs?





What are we doing now?

In short, digging up the seabed. This disturbance risks damaging blue carbon habitats and releasing carbon.

The problems you don't see

1. Bottom-towed fishing gears can penetrate the seafloor, disturbing carbon-rich sediments and potentially releasing carbon to the atmosphere, worsening climate change.

2. Developments at sea result in as yet unquantified disturbance and/or loss of carbon rich sediments.

3. Multiple activities threaten marine wildlife and blue carbon. Marine planning fails to prioritise nature and climate, and there is currently no incentive for activities to minimise their impacts on blue carbon habitats.

4. Many of our MPAs do not have adequate management measures in place, leaving the blue carbon within them at risk from damaging activities.

Without being effectively recognised in policy, these essential blue carbon habitats and the services they offer are at risk. Failure to recognise, protect and manage blue carbon habitats leaves these areas at risk from activities which disturb, damage or entirely destroy these habitats, and could not only release precious carbon stores but hinder their ability to capture and/or store carbon in the future.

The world is experiencing the effects of climate change including elevated temperatures, extreme weather events, water shortages and food production issues. By integrating the importance of blue carbon habitats into marine management and policy, we can help safeguard the carbon capturing capability of these valuable ecosystems and prevent the release of additional carbon.

The review highlights that the most widespread threat to blue carbon stores is the physical disturbance of the seabed by activities at sea (e.g. bottom-towed fishing and offshore developments). Our current marine planning systems do not work. The lack of prioritisation of nature and climate and no strategic spatial plan of activities is leading to conflicts, and nature and blue carbon are being damaged or destroyed. We currently have no mechanism for actively restoring seabed sediments – their protection relies on spatially managing activities to avoid disturbing these sediments.

Bottom-trawling repeatedly disturbs carbon-rich sediments

TOBY ROXBURGH/2020VISION

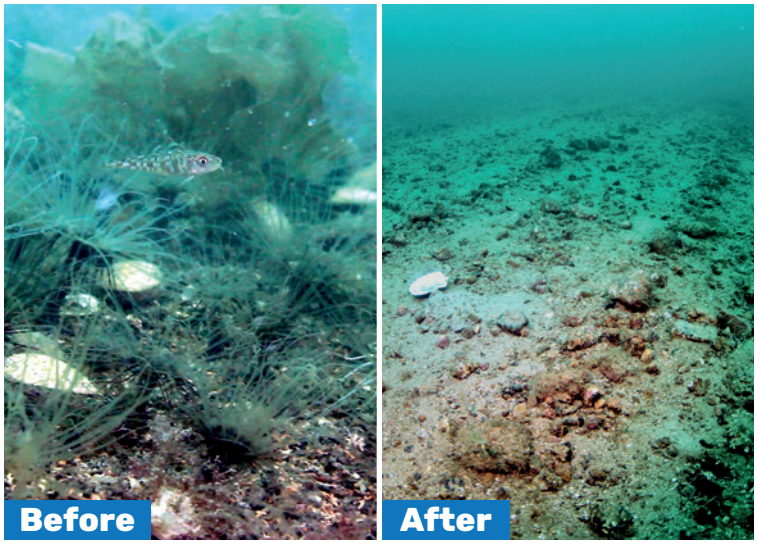
Widespread pressure from the repeated use of bottom-towed fishing gears puts blue carbon stores at risk. Bottom-towed fishing gears can penetrate 2 to 16 cm into the seabed, potentially releasing carbon and impacting both target and non-target marine life.

As offshore developments continue to expand, we must also consider the impacts this will have on blue carbon, which are as yet unquantified. Effective planning should consider how best to minimise impacts during installation and maintenance.

Collectively, the MPAs in the UK and Isle of Man seas are estimated to contain 105 million tonnes of organic carbon in the top 10 cm of the seabed, 43% of the total. Yet these MPAs lack adequate management measures and often still allow damaging activities to take place within them.

There are also significant blue carbon stores beyond our existing protected areas which remain unprotected. Blue carbon stores must be considered in spatial planning and the future designation of MPAs, to minimise any further damage or loss.

To protect valuable carbon stored in the seabed we need to reduce and remove pressure from damaging activities. In recent years, bottom-towed fishing gears have been prohibited within a number of MPAs and closures to industrial sandeel fishing have been announced. Such decisions are steps in the right direction, but we need to do more.



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A healthy seabed in its natural state

A seabed destroyed by bottom-trawling

> "The most widespread threat to blue carbon stores is physical disturbance of the seabed by activities at sea."

What needs to change?

Despite scientists' warnings decades ago, we are now experiencing the consequences of the joint climate and nature crises. We know enough to act and we must do so now. There is no time to lose.

1 Recognise the importance of blue carbon

For too long our seas have been overlooked. We must recognise the enormous contributions healthy seas make to protecting nature, capturing and storing carbon and supporting our economy, health and wellbeing.

We must recognise blue carbon habitats that act as long-term stores of carbon (e.g. seabed sediments, saltmarshes and seagrass beds), and those that capture carbon (e.g. kelp forests) within policy and, where possible, within the Greenhouse Gas Inventory. Such recognition would support measuring the UK's progress towards achieving existing national and international goals.

ALEXANDER MUSTARD/2020VISION

Kelp forest off Lundy Island

ANDY ROUSE/2020VISION

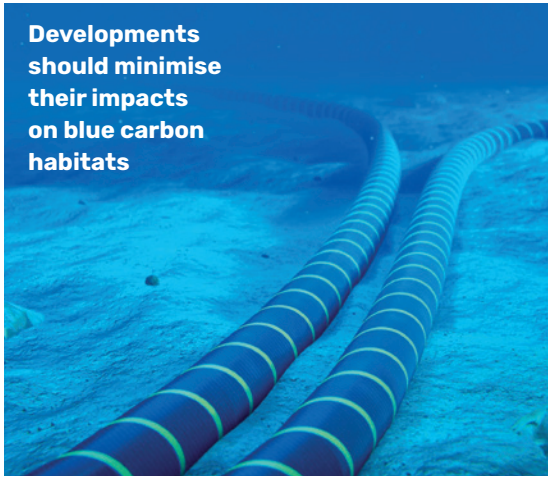
2 Strategically plan activities at sea

Blue carbon must be embedded within marine spatial planning. All activities should be strategically planned to avoid disturbance to areas of blue carbon, and where this is not possible minimise their impact on these important habitats. Nature and climate must be the top priorities in marine planning.

3 Mandate all activities to undertake blue carbon impact assessments

The impacts that all activities have on blue carbon habitats should be assessed. Including blue carbon in environmental impact assessments will incentivise industries to avoid and minimise their impacts to blue carbon habitats and wildlife.

Innovative solutions should be found to minimise the unavoidable impacts of developments on blue carbon habitats and wildlife.



Developments should minimise their impacts on blue carbon habitats

SHUTTERSTOCK

Scallop diving has a minimal impact on the seabed

ALEXANDER MUSTARD/2020VISION

4 Ensure a just transition for fisheries

Bottom-trawling fishing gears can damage blue carbon habitats and harm marine wildlife. Targeted research must be undertaken to fully understand these interactions and account for them within marine spatial planning. Governments should support the fishing industry to transition away from activities that damage the seabed.

5 Use Marine Protected Areas as a tool to protect carbon and biodiversity

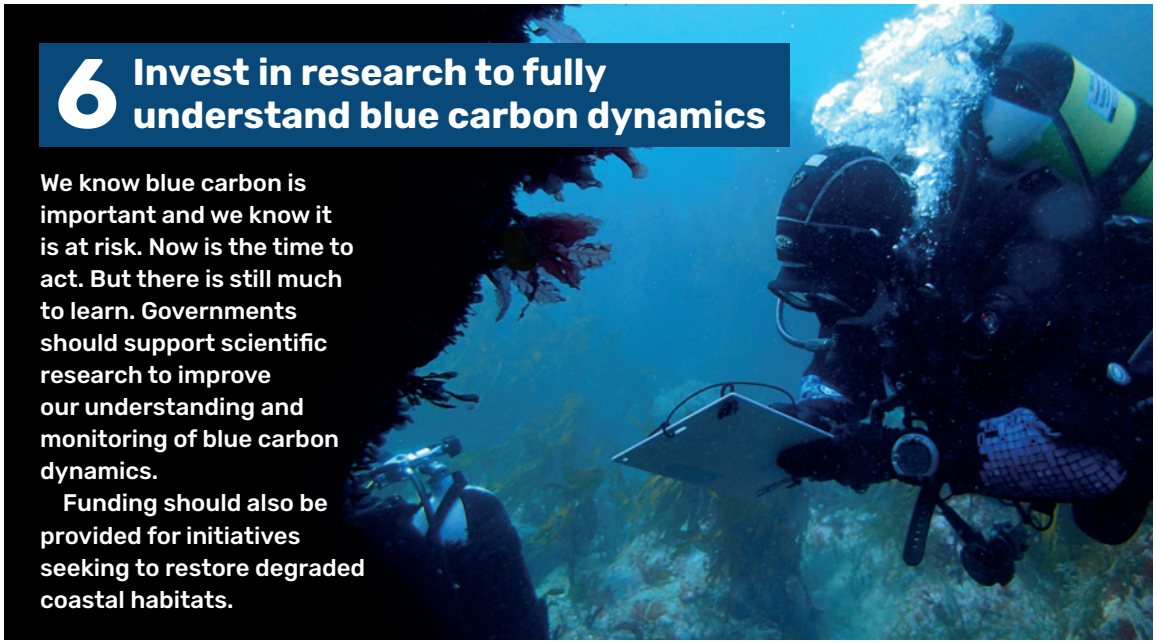
Seagrass meadow off Helford, Cornwall

PAUL NAYLOR/MARINEPHOTO.CO.UK

By implementing effective management measures to stop damaging activities within the whole area of MPAs, these can be used as a tool to protect both blue carbon and wildlife, providing a win-win for the climate and nature crises.

More widely, accounting for both carbon and biodiversity in the designation and objectives of new protected areas would help safeguard the role our seas play in climate mitigation and support marine ecosystem resilience.

6 Invest in research to fully understand blue carbon dynamics



We know blue carbon is important and we know it is at risk. Now is the time to act. But there is still much to learn. Governments should support scientific research to improve our understanding and monitoring of blue carbon dynamics.

Funding should also be provided for initiatives seeking to restore degraded coastal habitats.

MATT SLATER/CORNWALL WILDLIFE TRUST

Ocean action is climate action

This is an opportunity to be transformative

The UK, Devolved Administrations, and the Isle of Man governments could become world leaders in marine management. But they will not do so by ignoring the essential role our seas play in storing carbon, protecting wildlife, supporting our economy, and our very own health and wellbeing.

Previous governments have failed to reverse declines in nature, achieve international targets and address the climate emergency. Our seas have been overlooked and overburdened, and we are now seeing the consequences. The poor planning of activities at sea is resulting in the loss of carbon and wildlife. Marine Protected Areas (MPAs) are failing to do the job they were designed for due to a lack of protection from damaging activities. Declining marine life and the impacts of climate change are affecting our daily lives and the UK's economy.

We have an opportunity to be transformative. But we cannot do so by maintaining the status quo. Recognising the value of blue carbon ecosystems and effectively considering them in marine management would help reverse the declining state of nature, address the climate emergency and build healthy seas that support people and the planet.

We must recognise the connected nature of our environment and our impacts upon it. By effectively managing activities at sea in a way that minimises negative impacts on blue carbon and wildlife, and ensuring blue carbon ecosystems are protected from damaging activities in well-managed MPAs, the UK and Isle of Man governments could lead the way in ocean conservation and a sustainable blue economy. We know what we need to do, and we must do it now.

MARK HAMBLIN/2020VISION

The Wildlife Trusts WWF RSPB

wildlifetrusts.org/blue-carbon

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