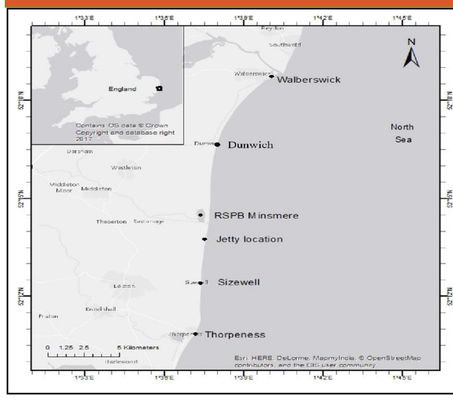
A METHODOLOGY TO PREDICT THE IMPACT OF A MARINE STRUCTURE ON LONGSHORE DYNAMICS AND SHORELINE EVOLUTION

Maria Amélia V. C. Araújo*, Steven Wallbridge, and Liam Fernand, 2024. "A Methodology to Predict the Impact of a Marine Structure on Longshore Dynamics and Shoreline Evolution"
Water 16, no. 5: 705. https://doi.org/10.3390/w16050705 ***amelia.araujo@atkinsrealis.com**

INTRODUCTION

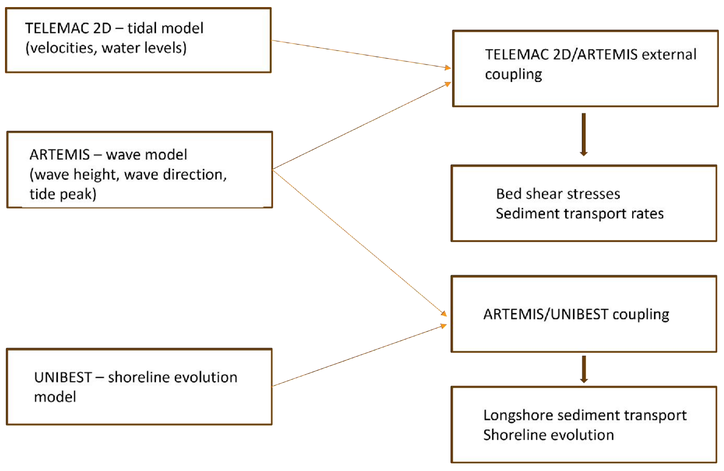
- There is an increasing requirement for a sustainable approach which considers both the effect of the marine environment on critical infrastructure and the impact of that infrastructure on the local environment.
- The objective of this study is to develop a methodology to investigate the impact of marine developments on the local environment, with an emphasis on coastal erosion.
- The methodology was applied to Sizewell Bay on the east coast of England, to assess the impact of a shore-normal jetty (640m, 510 piles) on a gently curving stretch of shoreline with relatively complex offshore geomorphology, using an external coupling of the phase-resolving ARTEMIS wave model and the shoreline evolution model UNIBEST.

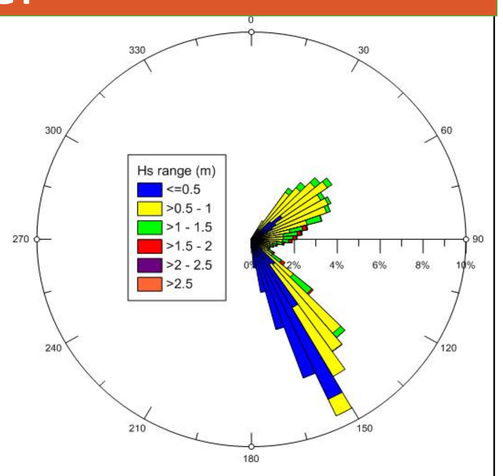
STUDY AREA



- The study area is Sizewell Bay, located on the North Sea coast in Suffolk, UK.
- It is very close (about 2km south) to the Royal Society for the Protection of Birds (RSPB) Minsmere, a nature reserve.
- Sizewell Bay consists of a mixed sand and shingle soft coast, with a mean sediment size of 408µm between the low- and high-water mark.
- The bathymetry is relatively shallow, including the Sizewell Dunwich sandbank complex within 2Km of the shore.

METHODOLOGY

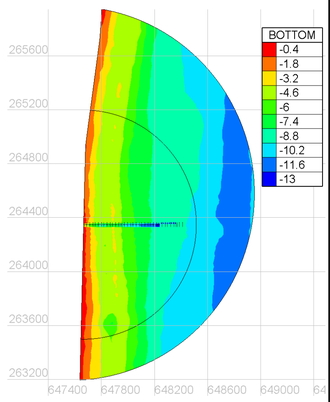




Model derived inshore waves at Sizewell for the period 1991–2012 - relationship between significant wave height and incident wave direction and occurrence.

ARTEMIS Model

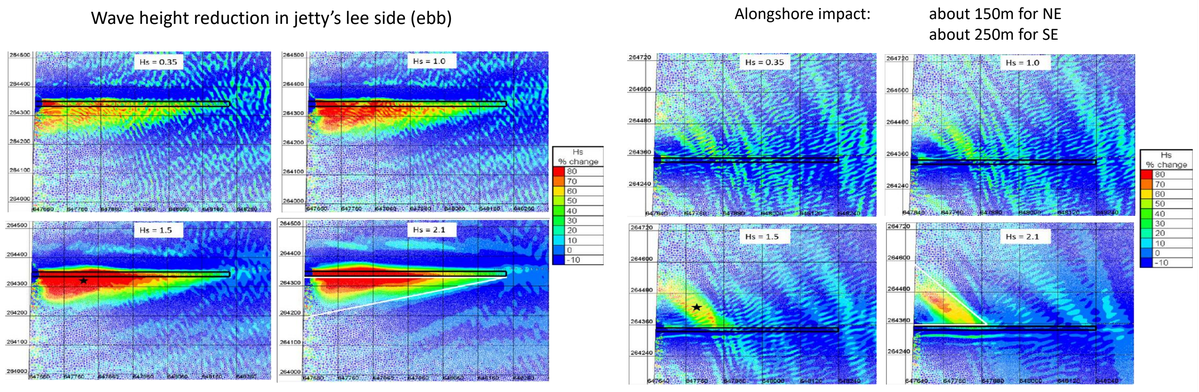
- Simulates the wave propagation towards the coast, considering multidirectional random waves.
- Computes the wave action where surface waves meet hard structures such as walls, breakwaters and coastal defence infrastructures. Includes parameters of reflection by an obstacle and diffraction behind an obstacle, combined with refraction due to bathymetric variation.
- A reflection coefficient of 0.95 was used, resulting in the absorption of 5% of the wave energy by the piles.
- The wave boundary around the jetty was designed as a semi-circle (diameter 2.7km) and a very high-resolution mesh of 650,759 elements was used, with a resolution of 20cm at the piles and 10m at the ocean boundary.
- WLs from TELEMAC2D model results at peak ebb and peak flood were used, with 4 **Hs** (0.35, 1.0, 1.5 and 2.1 m).



- Investigate the effect of the jetty on the waves coming from the two main sectors: **75°** (low-obliquity) and **157.5°**(high-obliquity) – sediment transport depends essentially on wave obliquity with respect to the shoreline.

Wave height reduction in jetty's lee side (ebb)

Alongshore impact: about 150m for NE, about 250m for SE



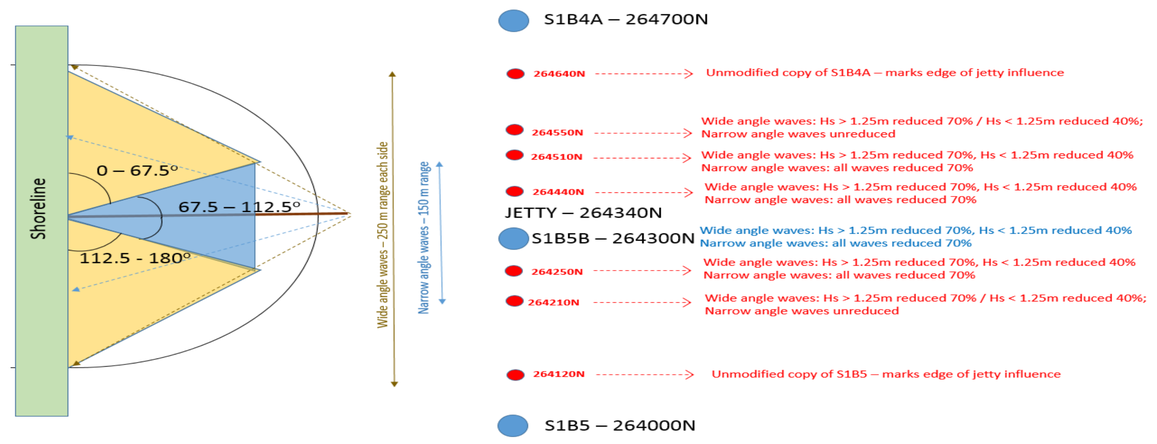
NE waves (75°)
(reduced 60–80%)

SE waves (157.5°)
(reduced 40-70% - only the larger waves (>1.5 m) being reduced by 80%)

UNIBEST Model

- Uses the angle between incident waves and the shoreline to calculate the longshore sediment transport due to the wave-induced component of current.
- Shoreline change (seaward or landward movement) is calculated from the gradients in the longshore transport rate and translated into a value for the advance or retreat of the shore-line.
- Input data (topographic profiles and hydrodynamic data) are specified at principal nodes and interpolated at intermediate nodes, with higher density around the jetty location to capture the changes to nearshore waves from ARTEMIS model.
- The impact of the jetty was tested in a model covering 10 km of the Suffolk shoreline.
- Driven using the 22-year wave climate hindcast dataset, to match available shoreline validation data.

The jetty impact is captured through the effect it has on the local nearshore waves, which ARTEMIS has shown to be limited to 250 m on each side of the structure.



RESULTS

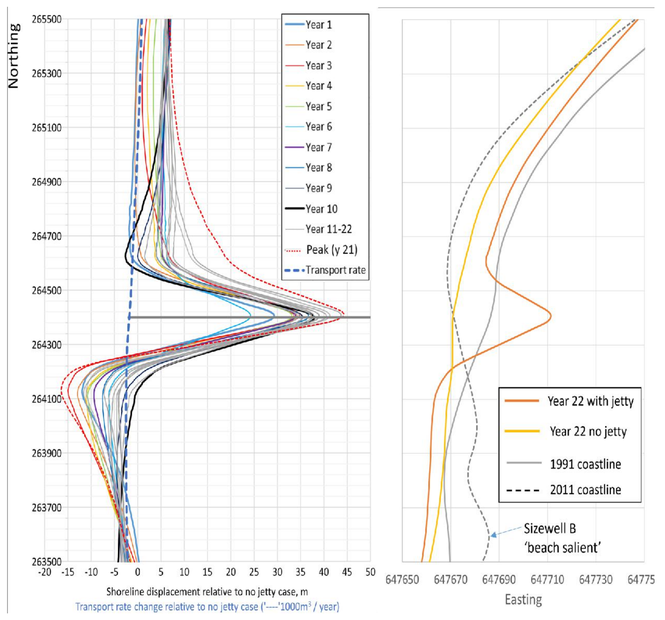
Bed Shear Stress

	Boundary Condition: 157.5°, H_s = 1.5 m			
	WL= 0.30 m (Flood)		WL = −0.62 m (Ebb)	
	Jetty	No-Jetty	Jetty	No-Jetty
H_s (m)	0.54	1.11	0.33	0.96
h (m)	4.11	4.11	3.19	3.19
$\bar{U}$ (m/s)	0.39	0.38	0.44	0.42
U_w (m/s)	0.23	0.48	0.17	0.50
τ_c (N/m²)	0.71	0.69	0.91	0.83
τ_w (N/m²)	5.85	17.03	3.80	18.22
τ_m (N/m²)	1.30	1.41	1.46	1.70
τ_{max} (N/m²)	4.67	15.74	5.17	19.80

- Critical bed shear stress =0.216 N/m²

		Boundary Condition: 75°, H_s = 1.5 m			
		WL = 0.30 m (Flood)		WL = −0.62 m (Ebb)	
		Jetty	No-Jetty	Jetty	No-Jetty
significant wave height	H_s (m)	0.13	1.42	0.12	1.32
still water depth	h (m)	4.66	4.66	3.74	3.74
depth-averaged current velocity	$\bar{U}$ (m/s)	0.46	0.44	0.49	0.49
near-bed orbital velocity	U_w (m/s)	0.05	0.56	0.06	0.61
current-only bed shear stress	τ_c (N/m²)	0.99	0.93	1.15	1.14
wave-only bed shear stress	τ_w (N/m²)	0.60	21.49	0.72	24.44
mean bed shear stress	τ_m (N/m²)	1.04	1.90	1.21	2.33
maximum bed shear stress	τ_{max} (N/m²)	1.33	22.06	1.24	23.94

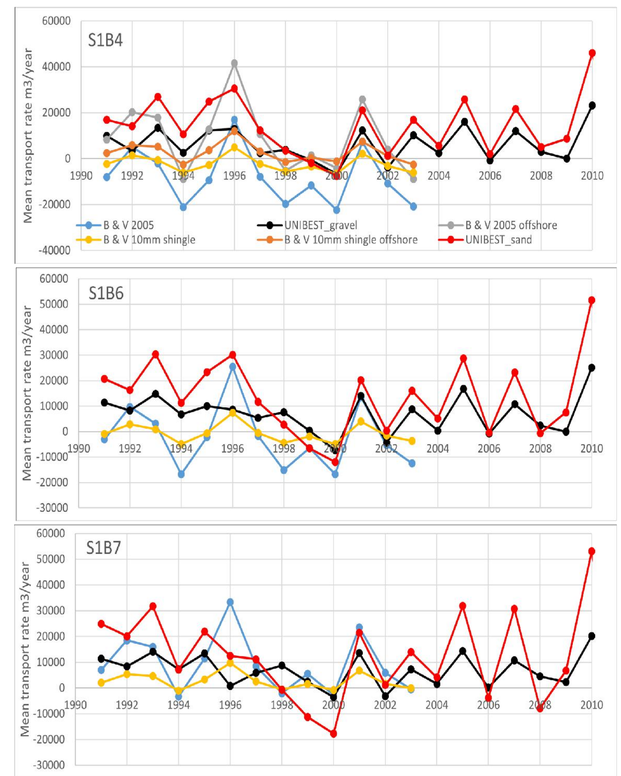
Shoreline Evolution



- The maximum year-on-year difference (for the 22 years wave hindcast) in shoreline positions between the model runs with the jetty and without is 45m (seaward) and occurs at the jetty location.
- Negative values indicate a more landward shoreline (retreat by about 15m to the south) and positive values a more seaward shoreline, with the jetty.
- Predicted and measured shorelines, showing a 20-30m shoreline perturbation due to the jetty.

Sediment Transport Rates

- The average longshore transport in the model domain, over the period 1991–2012, is in agreement with previous modelled estimates: declining from Dunwich (north) towards Thorpeness (south).
- Predicted rates agree with values reported by other researchers.
- This modelling process should not be expected to accurately reproduce all the details of shoreline variability.
- As there are some assumptions behind e.g. the wave climate applied to UNIBEST has to be derived from a limited number of modelled wave cases, as it is not possible for the wave hindcast to represent the full range of wave heights, periods and directions experienced at the Sizewell shoreline over a 22-year period.



CONCLUSIONS

- The applied methodology proves to be efficient, can provide reliable results, and allows the influence of the jetty on waves, as determined by the ARTEMIS model, to be represented within the UNIBEST model even though UNIBEST does not allow the physical representation of the jetty.
- This methodology can be applied worldwide, and can easily account for climate change conditions, including different wave climate scenarios.

Promoting Gender Equity for Wider Ocean Stewardship

Ocean Women: a project by Flossy Barraud (the Manta Trust, University of Plymouth) & Aminath Zoona (Maldives; Salted Ventures Swimmers)
& a PhD by Flossy Barraud; supervisory team: Dr Alun Morgan, Dr Sian Rees, Professor Martin Attrill (University of Plymouth), Dr Guy Stevens (the Manta Trust)

1. The Ocean Women Project

Marine experiences are key for marine citizenship. In many places, women and girls lack equal opportunities to access ocean recreation - swimming, snorkelling, diving, surfing - and get to know and love the ocean. **Ocean Women's purpose is to make the transformational benefits of the ocean available to all women and girls, all over the world, for years to come.**

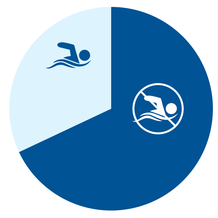
Aims:

1. Conduct transdisciplinary **research** to gain in-depth understanding of gender inequality in recreational ocean access: **barriers, enablers, impacts**.
2. Collaboratively **develop programmes** to improve ocean access.
3. Create and widely share an '**Ocean Connection Strategy**' to share learnings, providing tools to expand successful programmes.

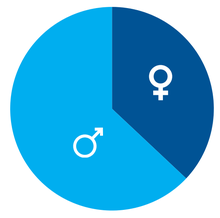
2. Why?

1 billion

people globally live **within 10km of a coastline**



68% women worldwide *cannot* swim
(compared to 43% men)



Average of **37%** ocean science personnel globally are female

'We protect what we love and we love what we know'

- **Inclusive conservation:** Effective biodiversity protection requires local leadership.
- **Women as key stewards:** Women in coastal communities play vital roles in managing biodiverse environments essential for food, livelihoods, and culture; swimming and ocean skills can amplify their contributions.
- **Marine citizenship:** Personal connections to marine environments can foster marine citizenship; expanding women's access to ocean experiences can enhance stewardship, address inequalities, and support global sustainability goals.

3. Global scale

Inequality in ocean access observed in >22 countries, yet no broad scale scientific research exists to evidence it or bring together solutions.

★ = FB's research conducted

4. Theory of change

Activity

Connect women to the ocean through swim, snorkel & dive training.

Output

Women drive positive change in their communities by empowering others.

Outcome

A society where women enjoying the sea is the norm. Improved conservation, gender equality, & livelihood opportunities.

5. Methodology

Transdisciplinary, feminist participatory action research approach:

a. Consultations (224pax, 20 countries) & in-depth interviews (62pax, 8 countries: ★ on above map & in 'pilot programme & case studies').
b. Door-to-door survey - baseline ocean access (700pax, Maldives)
c. Co-development of **pilot programme** (7 instructors trained, Maldives), regular mentoring

6. Pilot Programme & Case Studies

We trained 7 Maldivian people as SSI Swimming & Snorkelling Instructors & supported them to develop programmes/swim clubs for their 3 island communities.

Local Leaders Create Impact:

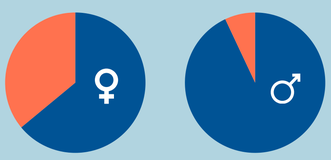
- **111** women and children taught to swim in 14 1-month programmes run by new instructors.
- **64** women and children joined environmental education and snorkelling field trips.
- **5** female instructors developed business skills & income through creation of 'Rasdhu Blue Tide' swim club.

"Letting the girls enjoy the sea, it gives them more freedom and then even this mindset of the community might change for the better: she is in the sea, she can do this, so why not a woman can do this and that? So there is no gender in any career or any activity." *Hafsa, schoolteacher*

Other Case Studies

Sea Women of Melanesia	Kauora	MORA	Love the Oceans	Daughters of the Deep	Soma
Female-led training & locally managed marine areas, **Melanesia**	Māori value-based water connection, **Aotearoa NZ**	Community women's group, **Raja Ampat**	Women's health & ocean conservation champions, **Mozambique**	Support women into marine careers, **Madagascar , Niue, Indonesia**	Surf therapy, **São Tomé**

7. Findings



In 2x Maldivian islands surveyed (n=700), 36% women cannot swim compared to 7% men.

Women are **10x** more likely than men to have never snorkelled.

Barriers
- Gender norms: societal stigmas, ocean as male space
- Lack of resources or safe spaces
- Lack of female swimming teachers/mothers that swim

Enablers:
- Local female role models & mentorship
- Family oriented & culturally relevant programmes
- Economic opportunities

Impacts:
- Improved confidence, mental and physical wellbeing
- Economic independence
- Environmental stewardship
- Female empowerment & gender equity
- Community resilience

Ocean Stewardship - by accessing the ocean more:

- Inspired females leaders as stewards & role models
- Increased community-led marine protection
- Re/connection to traditional waterways & knowledge

Key success factors for developing community programmes:

- Localised & sustained approaches
- Female leaders
- Holistic programme design
- Collaboration & partnerships

Source: 62x interviews, 8 countries; findings & sample size vary by location

"They now see the devastation the action on land have, as to what they do, what happens in the water. And you find a lot of people change their attitudes towards the environment... When you talk about climate change, they now can understand better and can relate."
Mary, St. Lucia

8. Ocean Connection Strategy

- To be created in 2026.
- **Outlines key learnings and impact case studies, enabling groups worldwide to develop culturally-relevant solutions with their communities.**
- Widely shared via document, webinars & tailored mentorship.
- Proof of concept: Maldives pilot inspired similar initiative in Madagascar, 2024.

Principal supporters

theBigGive · Enjoolata Foundation · coles-medlock foundation · COMO Foundation · Manta Trust · C4OE Open Exploration

Research partners

University of Plymouth · Universitas Padjadjaran

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Conservation, Fisheries, Trade and Management Status of CITES-Listed Sharks

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Whale shark, *Rhincodon typus*

Scalloped hammerhead shark, *Sphyrna lewini*

Great white shark, *Carcharodon carcharias*

What can we learn from CITES listing of endangered sharks?

Introduction

More than a decade ago, the IUCN Shark Specialist Group completed the first global Red List assessment of the relative risk of extinction faced by all sharks, rays and chimaeras. One-quarter of all species were found to be threatened due to overfishing (targeted and incidental). The analysis concluded that improved management of fisheries and trade was urgently needed to avoid extinctions and promote population recovery (Dulvy et al. 2014).

Ten years on and a global reassessment programme is almost complete. The status of 27 sharks and four rays has now been reassessed, and Red List assessments back-cast to 1970 to examine the 50-year population trends of 18 data-rich species (Pacoureau et al. 2021). The new analyses concluded that the global abundance of oceanic sharks and rays had declined by 71% from 1970 to 2018, at a steady rate averaging 18.2% per decade. In 1980, two-thirds of oceanic shark species were Least Concern and nine species were Threatened. Now, over three-quarters are Threatened.

Yet (in 2019) the impact of these listings on the protection of sharks in general and through the regional fishery management organisations (RFMOs) remained unchanged. In response, the German government proposed a project aimed at securing agreement for action.

Methodology

The project carried out a series of online webinars and interviews during the Covid pandemic and identified that there was a need to improve communication and cooperation at national and regional levels.

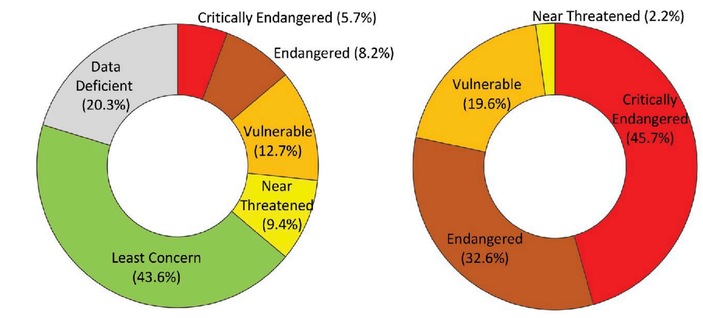

Figure 1. IUCN Red List assessments for all 1,186 chondrichthyan species (left), and 46 species listed in CITES Appendix II (right). Source: www.iucnredlist.org January 2021.

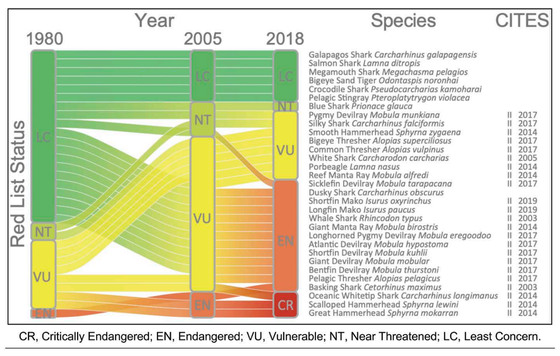

Figure 2. Change in the Red List status of oceanic sharks and rays, 1980-2018, and dates Appendix II listings entered into force. Adapted from Fig. 3b in Pacoureau et al. 2021.

Table 1. Threats to the chondrichthyan fishes. (From www.iucnredlist.org, January 2021).

Broad categories of threat	Marine species (N=1,068)		Species in freshwater (N=40)		All species (N=1,186)	
	N	%	N	%	N	%
Biological resource use	1,045	90.2%	34	85.0%	1,066	89.9%
Fishing & harvesting aquatic resources					1,063	89.6%
Logging & wood harvesting					8	0.7%
Residential & commercial development	70	6.0%	19	47.5%	82	6.9%
Pollution	34	2.9%	16	40.0%	43	3.6%
Natural system modifications (dams)	18	1.6%	16	40.0%	29	2.4%
Climate change (mainly habitat alteration)	24	2.1%	4	10.0%	25	2.1%
Aquaculture (primarily) & agriculture	20	1.7%	3	7.5%	23	1.9%
Mining; oil and gas extraction	19	1.6%	5	12.5%	22	1.9%
Human disturbance (recreational activities)	17	1.5%	0	0.0%	17	1.4%
Transport & service corridors	3	0.3%	1	2.5%	3	0.3%
Invasive & other problem species, disease	3	0.3%	0	0.0%	3	0.3%
No threats reported	86	7.4%	0	0.0%	86	7.3%

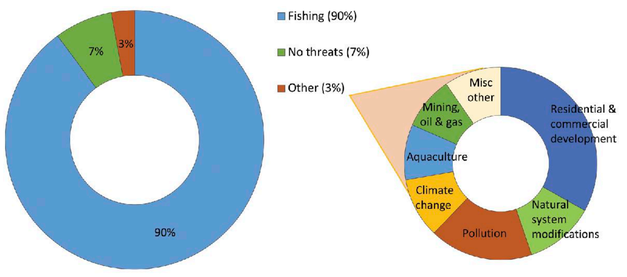

Figure 3. Major threats to chondrichthyan fishes. (www.iucnredlist.org, January 2021).

Bull shark, *Carcharhinus leucas*

Conclusions

Major findings of the study were that:

- The global conservation status of major commercial shark and ray species is poor and still deteriorating for many species, although there are some early signs of recovery for a few.
- Fishing is the most widespread threat, affecting virtually 90% of elasmobranchs and every species listed in the CITES Appendices.
- Total catches of sharks and rays reported to Food and Agriculture Organization of the United Nations (FAO) peaked in 2000, before declining slowly. The largest shark catchers are Indonesia, Spain, and India, followed by Mexico, USA, Taiwan Province of China, and Argentina. These top seven are now reporting a greater proportion of global catches (rising from 48% to 59%).
- Ten RFMOs have adopted one or more Conservation and Management Measures (CMM) for sharks and/or rays, including eight CMMs for CITES-listed species. However, there remains scope for improved data collection for and management of CITES-listed sharks taken in fisheries under the Regional Fishery Bodies (RFBs) remit.
- At national level, significant progress has been made since FAO's 2012 review of the implementation of the FAO IPOA–Sharks by the world's largest shark catchers. Additional large catchers have drafted and/or adopted National Shark Plans (NPOAs) or NPOA Guidance, and several have revised and updated their NPOAs, a few more than once. However, other important fishing countries have still not produced an NPOA or made one publicly available.

The full report for this work has been published on the website of the German Federal Agency for Nature Conservation[1].

Given that challenges in these areas are as much political as practical, it seems that significant progress will most likely come from the agreement and support of a group of countries, rather than any individual party. While potentially challenging, this wider ecosystem-based approach to species management is required to set the course for recovery. Marine species do not recognise political or geographical boundaries, and so action by an individual party will only achieve so much.

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[1]https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-607-conservation-fisheries-trade-and-management-status

Acknowledgements: This work was supported by the German Federal Agency for Nature Conservation with funds of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (no. FKZ: 3519 53 2052). Richard White, Senior Marine Ecologist, NatureBureau Ltd. (now retired) was involved in carrying out the original piece of work. All images Adobe Stock.

Mechanisms for Transformative Ocean Governance

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Introduction

Transformative ocean governance (TOG) is an approach to managing the world's oceans that aims to **balance economic development with environmental sustainability, social equity, and cultural values.** It involves a shift from the traditional top-down management style to a more **inclusive and participatory approach**.

Novel mechanisms are being developed within the framework of TOG to drive change along our coastlines. Two such mechanisms are in place and under development within the Southwest of the UK, they include the **North Devon World Surfing Reserve** (ND WSR) and the **Plymouth Sound National Marine Park** (PS NMP), both along the Devon coastline (North and south Devon respectively).

These two mechanisms, although different in their approach both have **the environment, the people and the economy at the heart** of their goals and objectives.

Research aims

- Investigate the **mechanisms of TOG** in the context of the ND WSR & PS NMP.
- Explore how community-led & participatory governance models address **environmental, social, & economic challenges** in marine & coastal management.
- Identify **barriers & enablers to transformation** that can inform the development of inclusive, adaptive, & sustainable governance frameworks.
- Provide insights & recommendations for **scaling & replicating** successful governance mechanisms across other regions in the UK and beyond.

Methods

Pluralistic approach via **focus groups & semi structured interviews** of individuals & groups, which support & manage governance within the ND WSR & the PS NMP.

Photo credit: Jay Stone

Photo credit: Lead author

Plymouth Sound National Marine Park

Key highlights:

- The UK's first NMP, Plymouth Sound is a globally significant natural harbour, recognised for its ecological, cultural, & historical importance.
- Supported by grants achieved from the National Lottery Heritage Fund, Youth Investment Fund and Plymouth City Council
- Features a mix of uses, including naval & commercial ports, marine research hubs, fishing industries, & recreational activities.

Objectives:

- Promote sustainable use of marine resources while enhancing economic, environmental, & social values.
- Engage communities in marine citizenship through learning, discovery, & conservation initiatives.
- Showcase Plymouth as a model for developing NMPs across the UK.

North Devon World Surfing Reserve

Key highlights:

- Established in March 2022, North Devon became the 12th World Surfing Reserve.
- Covers a 30 km stretch of coastline, including renowned surf spots such as Croyde, Saunton, Woolacombe, & Lynmouth.
- First cold-water World Surfing Reserve and the first in the UK.

Objectives:

- Protect surf ecosystems against threats such as coastal development, erosion, pollution, & poor water quality.
- Empower the surfing community in decision-making through a Local Stewardship Council comprising diverse stakeholders.
- Serve as a model for other UK coastal areas to establish Surfing Reserves.

Key findings so far

Barrier

Limited accessibility & inclusivity
Cost, physical infrastructure, water confidence, & awareness gaps hinder engagement with marine spaces, especially for underserved communities.

Enabler

Participatory governance models
Inclusive decision-making structures, such as the ND WSR's Local Stewardship Council & the PS NMP's Marine Park Board, ensure diverse voices are heard & integrated.

Barrier

Competing interests & priorities
Balancing the demands of environmental protection, economic activities, & recreational use creates friction among stakeholders.

Enabler

Strong community engagement
Active involvement of local stakeholders, including NGOs, businesses, and residents, fosters shared responsibility & local ownership.

Barrier

Coordination challenges
Ensuring effective collaboration & decision-making among diverse stakeholders requires overcoming logistical, cultural, & resource-related hurdles.

Enabler

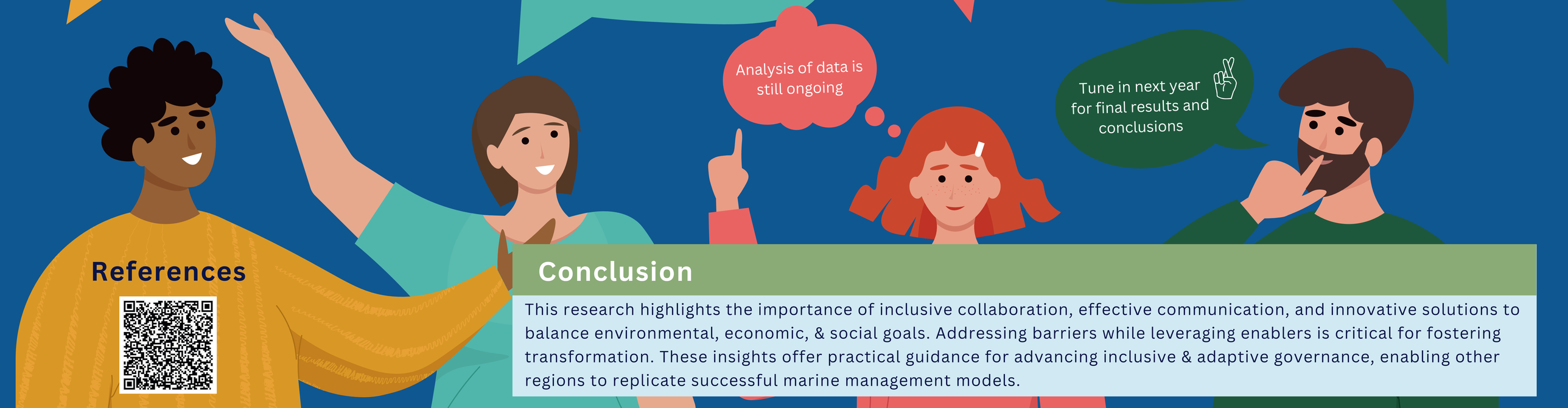
Recognition of economic & cultural Value
Acknowledging the economic & cultural significance of marine areas helps galvanise support for conservation efforts & policy innovations.

Barrier

Socioeconomic challenges & environmental disconnect
Poverty, inequality, & lack of resources often prioritise immediate human needs over environmental concerns, leading to disengagement with marine conservation.

Enabler

Innovative restoration & engagement initiatives
Habitat restoration projects and public engagement programs, like the PS NMP's Digital Marine Park & accessibility improvements, inspire connection and action.



References

Conclusion

This research highlights the importance of inclusive collaboration, effective communication, and innovative solutions to balance environmental, economic, & social goals. Addressing barriers while leveraging enablers is critical for fostering transformation. These insights offer practical guidance for advancing inclusive & adaptive governance, enabling other regions to replicate successful marine management models.

SEA THE VALUE

MARINE BIODIVERSITY BENEFITS FOR A SUSTAINABLE SOCIETY

Authors: Broszeit, S., Rendon O., Watson, S.C.L., Guillen-Onate, K., Tillin, H., Szostek, C.L., Van Der Schatte Olivier, A., Burdon, D., Watson, G., Dickie, I., Preston, J., Collar, M., Barham, P., Potts, T., Anbleyth-Evans, J., Tinch, R., Paxton, V., Watts, A., Chan, Y.Y., Chung, P., Lockett, J., Rodriguez-Vargas, L., White, J., Beaumont, N. (PI)*
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SEA THE VALUE

VISION

To determine novel and policy relevant diverse values for marine biodiversity
To apply these values in the co-development of green investment options for restoration and conservation
To transform our understanding and utilisation of the economics of biodiversity

BENEFIT FOCUS

Carbon sequestration and storage (CCS)

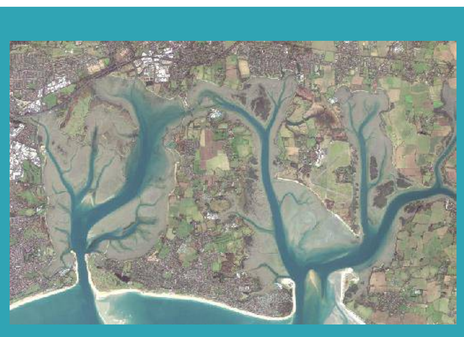
Bioremediation of waste

Biodiversity

TWO CASE STUDY SITES

CROMARTY FIRTH
Minimal environmental data available

THE SOLENT
Rich in biodiversity, habitat and condition data



Langstone Harbour Chichester Harbour

IMPACT DRIVEN INTERDISCIPLINARY APPROACH

CO-DEVELOPMENT AND CAPACITY BUILDING TO DELIVER IMPACT

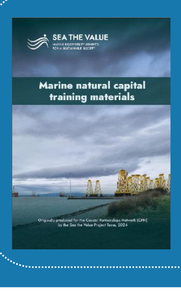
Equitable partnerships between policy makers, managers, academics, industry, and NGOs developed and sustained.

Upskilling of the team and broader practitioner and policy communities in natural capital approaches and green financing options. Expertise shared through 4 tailored workshops, empowering 24 coastal managers with practical skills, as part of the Coastal Partnership Network.

Programme Steering Group of international experts, from a range of sectors and disciplines, provided advice and guidance.

Project webpages and social media used to share project information and updates reaching a global audience. Key outputs, such as the training materials, have been made freely available online.

Comments from attendees:
'I found it extremely interesting and useful to attend.'
'Very useful, really thought provoking'
'Absolutely brilliant session, really interesting and I can see how this would fit in clearly with our work.'



Training materials are available to download. Scan to visit our webpage

INTERDISCIPLINARY COLLABORATION RESULTING IN ENRICHED DATA, IMPROVED METHODS AND IMPACTFUL OUTPUTS

The project fostered deep interdisciplinary connections within the team and with project partners, for example:

Habitat maps were developed using both standard and participatory methods. The participatory maps were evidenced to be a cost-effective solution in poor data scenarios.

Embedding of environmental data in economic valuation, improving understanding of the range of, and reasons for variation in, economic values for marine ecosystem services

New understanding of beneficiaries to contextualise potential financial mechanisms.

Disciplines engaged: Environmental and ecological economics / Marine ecology / Human geography / Governance / Finance / Impact/ Communications / Extensive research users & interested parties

OUTPUTS

Participatory mapping

Coastal communities were engaged to generate maps linking natural features, benefits and beneficiaries. These maps have improved community access to, and understanding of, their local environment.

The maps have been made freely available, and actively shared with 30 stakeholder groups, 6 schools, 12 community councils and Cromarty museum, and have supported local decisions on planning and restoration activities.

Figure 1: A series of 3 well attended participatory workshops were held at both case study sites

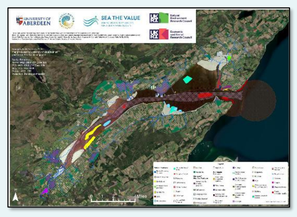


Figure 2: Participatory map created for Cromarty Firth

Quantifying linkages between Biodiversity, Natural Capital and Ecosystem Services

UK policy-ready representations of how marine biodiversity provides climate regulation and bioremediation have been developed, including how this provision varies with habitat condition (quantity, quality, resilience and biodiversity status).

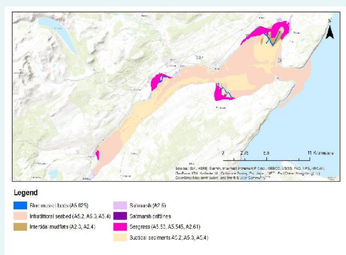


Figure 3: Habitat maps were developed for both the data rich Solent and data poor Cromarty Firth

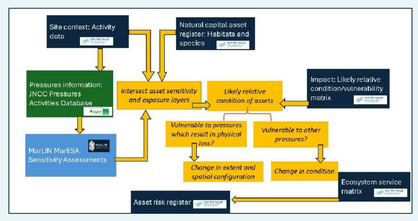


Figure 4: An asset-risk natural capital approach was applied at both case study sites evidencing the ecosystem services delivered and also the pressures and risks to these

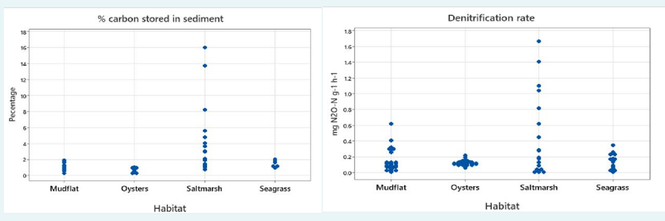


Figure 5: Fieldwork filled gaps on how habitat quality and biodiversity shape ecosystem services provided by seagrass, saltmarsh, mudflats and oysters.

Robust, Ecologically Sensitive Economic Valuation

Inputs from the interdisciplinary team enabled the development of valuation approaches which consider how external factors determine the level of ecosystem function and the condition of the assets providing the ecosystem service, and thus influence their value.

This provides better understanding of uncertainties and improves valuation data for use in the UK ONS Natural Capital Accounts, decision-making, economic appraisal, policy-developments, natural capital assessments, and the design of innovative green investment options.

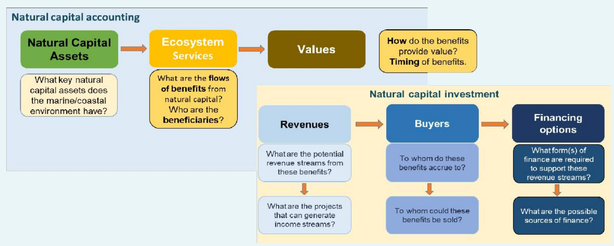


Figure 6: Linking natural capital information (including information from participatory mapping, ecosystem service science, and economic valuation) to natural capital investment options

OUTCOMES

Connecting values to decision-making through green investment

Finance Mechanisms are needed to connect funding to restoration projects, potentially through selling credits from ecosystem service benefits

Monetary values of ecosystem services were integrated with ecosystem restoration science (e.g. timing, extent and uncertainty of habitat recovery) and information on beneficiaries developed in the participatory research, to contextualise potential financial mechanisms to support marine habitat restoration.

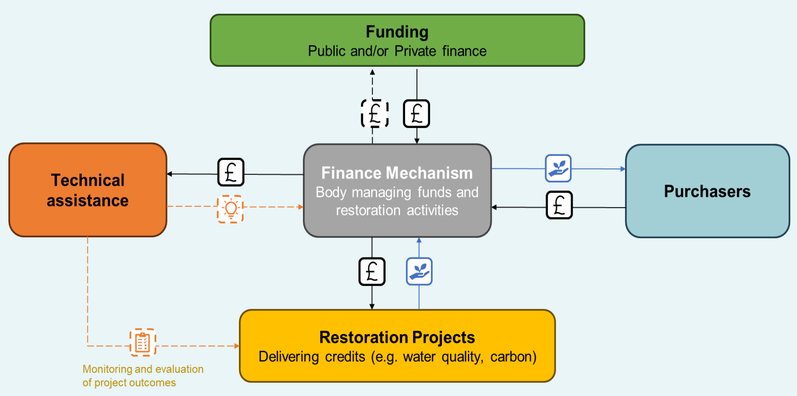


Figure 7: Finance Mechanisms Connect Funding to Projects (source: Coastal Partnership Network Training): Illustrative investment model as the mechanisms are currently in co-design with a range of interested stakeholders

This research was supported by UK Research and Innovation (UKRI) under Natural Environment Research Council award NE/X002357/1

www.pml.ac.uk/projects/sea-the-value

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Natural Environment Research Council

Economic and Social Research Council

PML Plymouth Marine Laboratory

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UNIVERSITY OF PORTSMOUTH

THE SOLENT FORUM Working in partnership for the future

DB Daryl Burdon Ltd. Marine Research, Teaching & Consultancy

MORAY FIRTH COASTAL PARTNERSHIP

Coastal Partnerships Network

eftec economics for the environment

Supporting coastal communities '*Sea the Value*' of marine restoration initiatives using participatory mapping approaches

D. Burdon[1*], T. Potts[2], A. Van Der Schatte Olivier[3], K. Gormley[2], J. Anbleyth-Evans[2], A. Ndah[4], V. Paxton[5], J. Preston[3], G. Watson[3] & S. Watson[4]

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SEA THE VALUE

MARINE BIODIVERSITY BENEFITS FOR A SUSTAINABLE SOCIETY

Project Aims and Objectives:

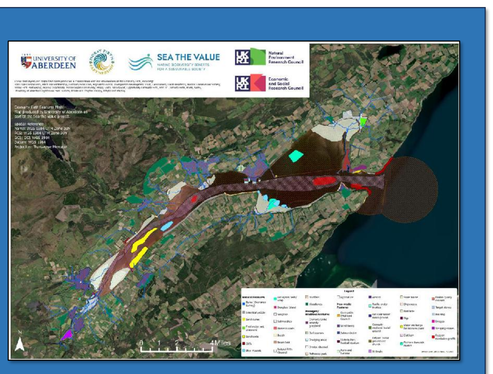
- **Quantify the interlinkages** between marine biodiversity, natural capital, and ecosystem services, **considering quantity & quality**.
- **Determine the economic and social values** associated with benefits of carbon sequestration and bioremediation of waste and apply to support natural capital accounting and community benefits.
- **Connect the ecological, economic, and social values of biodiversity to decision-making** through co-design and supporting of green investment to enhance biodiversity.
- **Two case studies**: Cromarty Firth (Scotland) and the Solent (England).

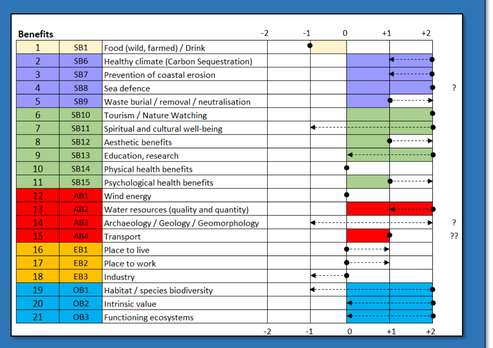
Why use a Participatory Mapping Approach?

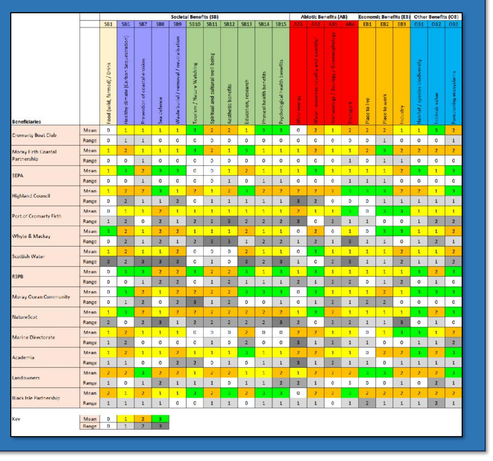
- **Driven by stakeholders** at all stages.
- Creates a **shared common language**.
- **Improves understanding** of the links between natural features and benefits.
- **Captures local knowledge**.
- Generates **outputs for communities**.
- **Supports organisations** to assess their own reliance on natural capital features.
- **Identifies shared reliance** on natural capital features and the benefits they deliver for society.

Workshop Series

- **Workshop 1**: Identifies and maps the natural capital features and the benefits they deliver for society.
- **Workshop 2**: Explores the trade-offs between benefit provision under future management scenarios (e.g. managed realignment or native oyster restoration).
- **Workshop 3**: Identifies and scores the relative importance of linkages between the beneficiaries and the benefits delivered by the natural capital features.

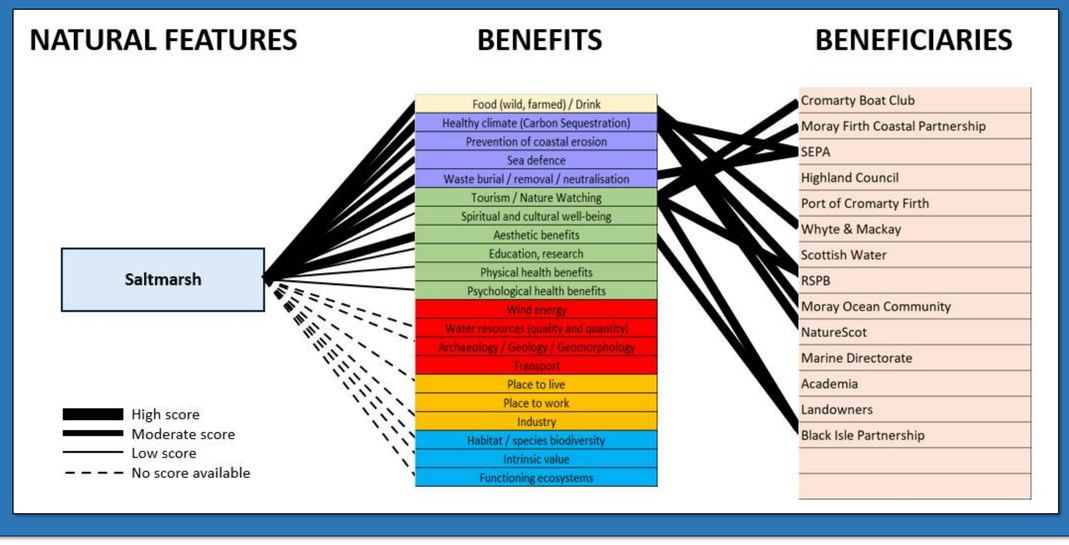






Workshop Outputs for Coastal Communities

- **Features maps** in hard copy and digital format for use by local stakeholders and in the wider community (e.g. schools, libraries).
- **Interactive pdf** which illustrates the links between natural capital features and the benefits they deliver for society.
- **Online maps** which visualise the features and benefits.
- **New stakeholder networks** who can talk in a common language.



Acknowledgements: This research was supported by the UK Research Councils under Natural Environment Research Council award NE/X002357/1 Title: Sea the Value. The participatory mapping methods follow that outlined by Burdon et al. (2022) Linking natural capital, benefits and beneficiaries: The role of participatory mapping and logic chains for community engagement. *Environmental Science & Policy*, 134, pp. 85-99. https://doi.org/10.1016/j.envsci.2022.04.003

Habitat Compensation and Restoration Programme (HCRP)

20 Years of Managed Realignments and Counting

Environment Agency

START **How much do you know about the Habitat Compensation and Restoration Programme (HCRP) and managed realignment in England?**

Without reading on just yet… Please take a few minutes to scan the QR Code and complete this short survey.

2 Flood and Coastal Erosion Risk Management (FCERM)

The National FCERM Strategy[1] vision is "**A nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100**".

Shoreline Management Plans (SMPs) and FCERM Strategies ('Strategic Plans'), provide the planning framework to support FCERM activities that achieve this vision.

SMPs are contiguous around the English and Welsh coast, with the boundaries based on physical coastal processes, approximating natural sediment cells (**Fig. 1**).

Visit SMP Explorer[2] online to check your local SMP management approaches…

Fig 1

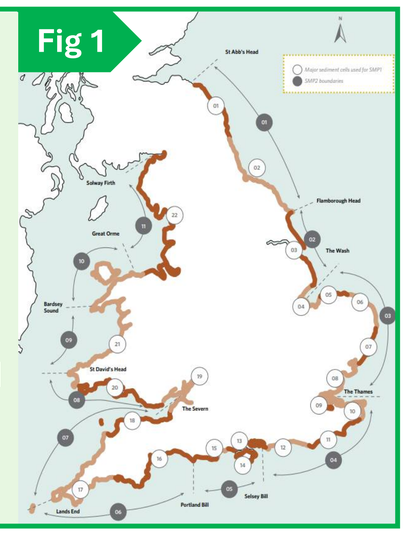
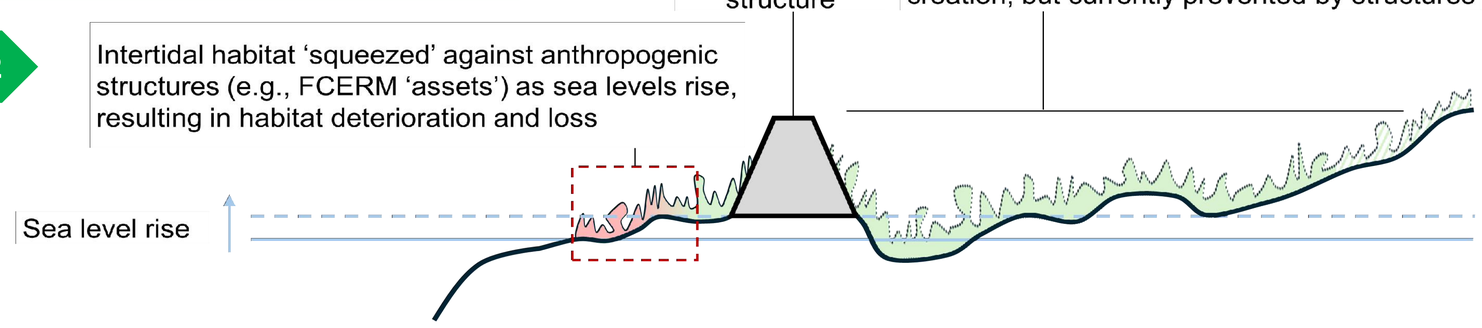


Fig 2



3 Coastal Squeeze

Coastal Squeeze[3] (Fig. 2) is defined as:

"The loss of natural habitats or deterioration of their quality arising from anthropogenic structures or actions, preventing the landward transgression of those habitats that would otherwise naturally occur in response to sea level rise in conjunction with other coastal processes. Coastal squeeze affects habitat on the seaward side of existing structures".

4 Managed Realignment (MR)

MR is the process whereby existing FCERM structures are 'breached', allowing tidal waters to inundate areas of the hinterland behind, as they would have prior to previous land claim of intertidal areas. If needed (e.g., due to low lying ground), a new set back FCERM structure may be built before the breach.

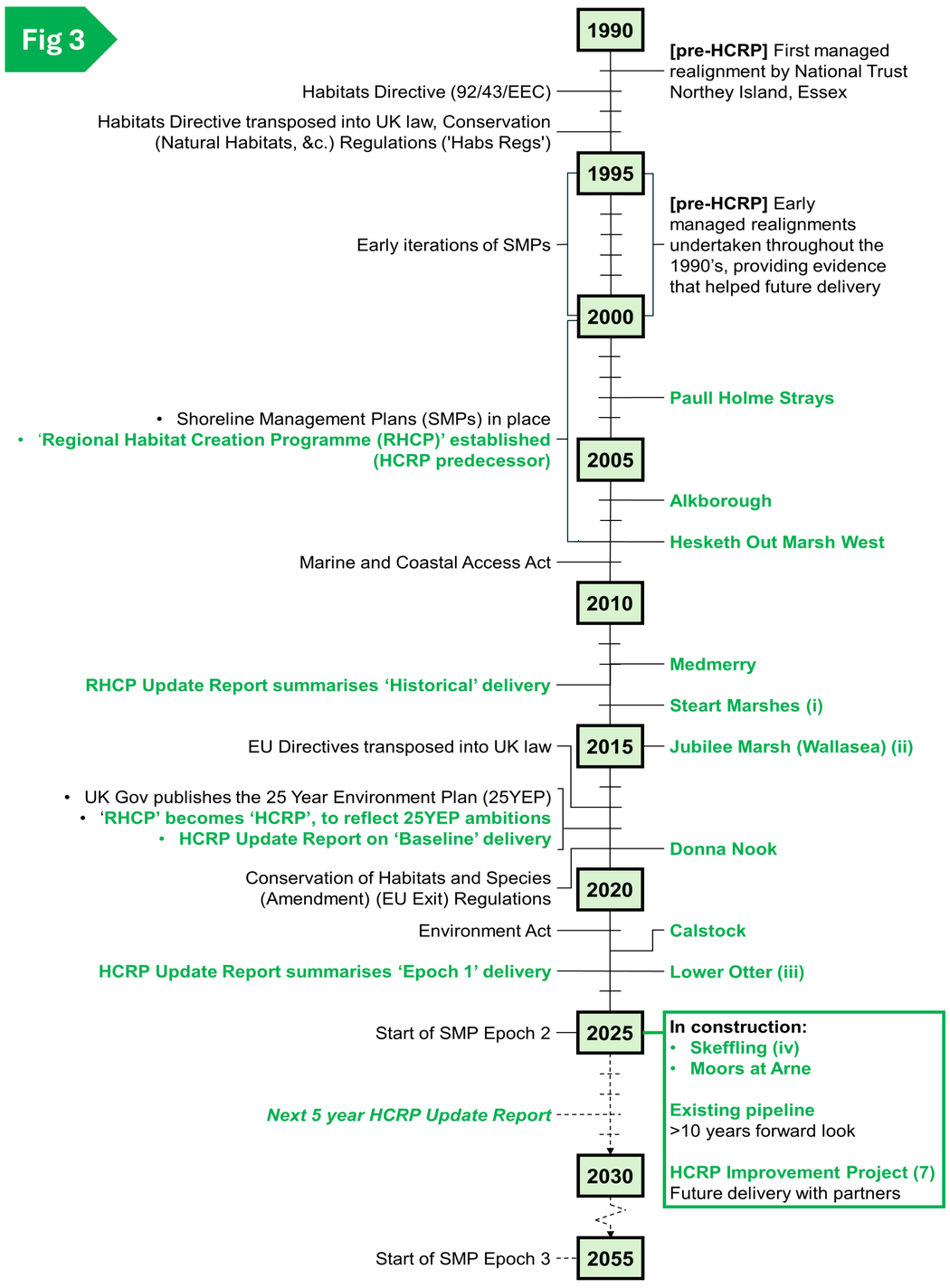
In the context of climate change and sea level rise, **MR is an important coastal management tool** for creating intertidal habitats and increasing their resilience by alleviating coastal squeeze pressures, whilst also improving the sustainability of FCERM assets and society's use of the coastal zone.

5 HCRP: Strategic Delivery Vehicle

The HCRP is the national 'strategic delivery vehicle' for **creating compensatory habitat, for the loss of designated sites, predicted to occur due to FCERM activity at the coast. The majority of losses are due to coastal squeeze**.

Area teams lead delivery with national oversight and support, working in partnership with Natural England, landowners, conservation partners and contractors. Development and delivery of the HCRP Pipeline provides Defra with confidence that coastal FCERM activities meet legal obligations in accordance with the 'Habs Regs' – the **HCRP is therefore a 'critical enabler' of FCERM**.

Fig 3



6 HCRP: Timeline and Delivery

The timeline in **Fig. 3** illustrates historical MR delivery and key legislation and planning milestones in England. Key HCRP milestones, reports and *just a few examples* of MR delivery are in **green** and imagery below (**i – iv**). **In terms of delivery, to date, over SMP Epoch 1 (c.2005 to 2025), the HCRP has created…**

… 1,600 ha of intertidal mudflat and saltmarsh

… 470 ha of freshwater grazing marsh

… 290 ha of other coastal habitats

7 HCRP: Improvement Project

Following 20+ years of successful delivery, the HCRP has initiated the '**HCRP Improvement' Project**'. From now to March 2027 and comprised of 10x Workstreams, the Project aims to:

"**Create the tools, guidance, data and governance needed to support and improve development, delivery and strategic oversight of the HCRP, to fulfil FCERM compensation legal obligations and where possible, support wider estuarine and coastal restoration ambitions for the EA and UK Gov**".

As we enter the SMP medium term (Epoch 2, 2025 – 2055), with new legislative drivers for environmental recovery beyond legal compensation, alongside existing and emerging risks, issues and opportunities, the project is timely.

Running in tandem with and feeding into the wider Programme, it provides an opportunity for the next evolution of the HCRP to ensure that it is best placed to work with and support partners in **delivering coastal adaptation for both people and nature**.

END

Resources

[1] Environment Agency (2020) *National Flood and Coastal Erosion Risk Management Strategy for England*.
[2] Environment Agency (2023) Shoreline Management Plan Explorer. *https://environment.data.gov.uk/shoreline-planning*.
[3] Defra et al (2021) *What is Coastal Squeeze (WICS)?*. Project FRS17187.

Contact Details

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Senior Advisor, Coastal Resilience | HCRP National contact | Environment Agency (EA)
For more information, please contact: hcrp@environment-agency.com

CORNWALL & ISLES OF SCILLY MARINE & COASTAL PARTNERSHIP

Cornwall & Isles of Scilly Marine & Coastal Partnership

VISION

By working collaboratively, the Cornwall and Isles of Scilly Marine and Coastal Partnership (MCP) will support the delivery of resilient marine and coastal communities and ecosystems, fostering sustainable growth in the blue economy, through joint solutions, and community-based capacity building.

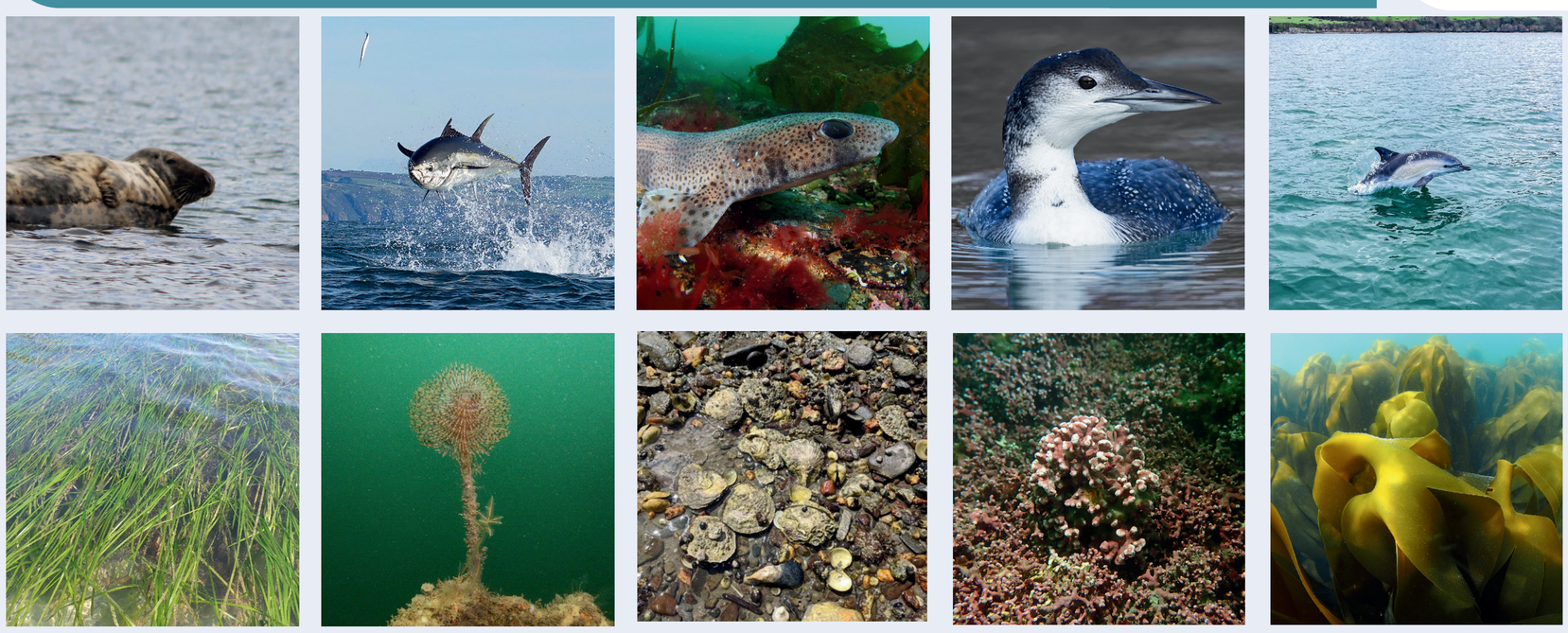
STRATEGIC THEMES & OBJECTIVES

Working across our coast	Investing in our coast	Supporting marine-aware communities & businesses
Use the partnership to drive a coordinated and collaborative approach. Maintain oversight, drive collaboration across the sectors for coastal and marine resilience and share information across the Partners' stakeholder networks.	Utilise all available public, private and blended funding sources to ensure maximum benefits for a coordinated marine and coastal community throughout Cornwall & Isles of Scilly. Explore options relating to the Environmental, Social and Governance (ESG) agenda as well as any new funding for net environmental gain in the marine and coastal areas.	Deliver engagement with marine, estuarine and coastal communities including an education programme to increase marine literacy amongst community members, businesses, and industry, with the aim for them to support blue-environmental growth and the blue-economy.
Supporting resilient coastal communities	**Restoring our coast**	**Understanding our coast**
Work with partners and communities to develop a combination of mitigation and adaptation strategies to address climate change and other challenges faced by our coastal areas.	Develop a framework for marine nature recovery. Work without boundaries across the land/sea divide, ensuring effective and meaningful engagement in relation to the delivery of the 30 by 30 marine nature recovery targets.	Share data to support effective decision-making, evaluation, and monitoring. Make best use of the natural capital approach.

COASTAL DATA HUB

The aim of the data hub is to act as a central location for exploring marine based digital map data for Cornwall and The Isles of Scilly.

MARINE NATURE RECOVERY FRAMEWORK



To help nature at sea to recover, Cornwall Council are working to develop an evidence-based, voluntary Marine Nature Recovery Framework (MNRF) with support from Cornwall and Isles of Scilly Local Nature Partnership (CIOSLNP) and the MCP, building on all the feedback from local people about the importance of our marine and coastal wildlife. This new Framework will align with and compliment the statutory terrestrial Local Nature Recovery Strategy.

FUTURE PLANS

- **Project Pipeline:**
  - Developing a framework to identify and deliver collaborative projects that align with MCP's strategic themes.
- **Expanding Membership:**
  - Growing our diverse network with the launch of a new membership prospectus.
- **Collaborative Events:**
  - Hosting more events, including an annual conference, to strengthen connections, share knowledge, and drive collective action.
- **Inspiring Resilience:**
  - Promoting cooperative approaches to marine stewardship to foster healthier communities and ecosystems.

Cornwall Wildlife Trust

CORNWALL COUNCIL one and all • onen hag oll

Environment Agency

Photo credits: Matt Slater, Adrian Langdon, Seal Research Trust, Alicia Shephard, Susan Scott

Marine Management Organisation

Scan the QR code to **find out more about MPAs**

© Natural England/Tim Allsop

Safeguarding our seas:

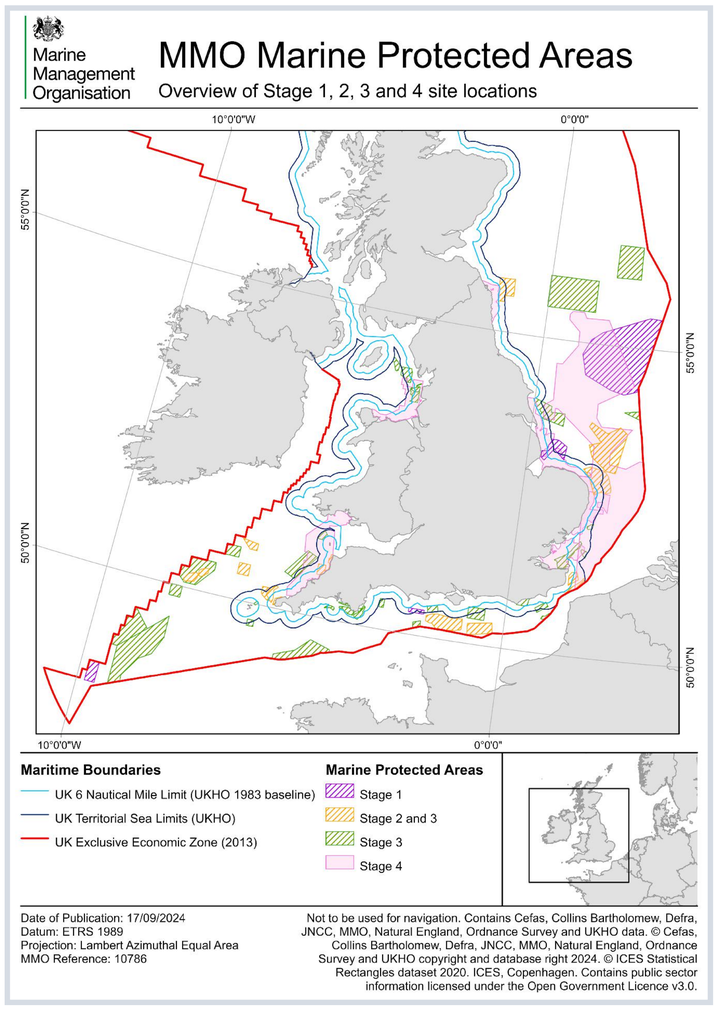
Managing fishing in England’s Offshore Marine Protected Areas (MPAs)

© Natural England/Ross Bullimore

© Natural England/Keith Hiscock

Scope of protection

- MMO is delivering an ambitious programme to protect all English offshore MPAs from harmful fishing activity.
- MPAs are areas of the ocean established to protect habitats, species and processes essential for healthy, functioning marine ecosystems. These marine ecosystems are essential to the supply of ecosystem services that benefit wider society.
- There are 181 MPAs, including 4 highly protected marine areas, covering over 40% of England’s waters.
- It’s MMO’s responsibility to assess and manage fishing in England’s MPAs offshore of 6 nm to ensure their conservation objects are met and they can recover to a more natural state.
- There are around 50 offshore sites covering more than 74,000km² of seas.
- MMO has made significant progress in protecting rare and threatened habitats and species from damaging fishing activities since 2020.



Impact of protection

- Preservation of marine biodiversity.
- Recovery of vital ecosystems.
- Supporting sustainable fisheries.
- High levels of compliance to date.

Significant milestones

- Stage 1: Protection put in place in first four MPAs including Dogger Bank, the largest sandbank habitat in the North Sea, and protecting deep sea coral reefs in The Canyons MPA in the far South West of UK waters in 2022.
- Stage 2: New measures introduced in 2024, banning bottom-towed fishing gear in 13 offshore MPAs, protecting nearly 4,000 km² of critical marine habitats.
- Total protected area now spans 18,000 km² — larger than Yorkshire and Norfolk combined.
- Calls for evidence to assess the impacts of fishing in Stage 3 and Stage 4 sites have taken place in offshore MPAs not already protected by MMO byelaws. These have provided us with the most up to date evidence of the impacts of fishing in MPAs.

Looking ahead

- Upcoming initiatives to expand protection will include consultations on proposed management measures for remaining MPAs not already protected by MMO byelaws.
- Stakeholders will play an important role in shaping future policies, through the supply of views, evidence and data.

...ambitious for our seas and coasts

Contact us: conservation@marinemanagement.org.uk

Assessing The Effects Of Offshore Wind Farms & Climate Change In The North Sea

Michela De Dominicis, National Oceanography Centre, micdom@noc.ac.uk

Additional Authors:
R. O'Hara Murray[2], A. Gallego[2], J. Jardine[1], W. MacDonald[2], M. Palmer[3], T. Smyth[3], J. Wihsgott[3], C. Williams[1], A. Zampollo[2,4] & B. Scott[4]
(1) National Oceanography Centre, (2) Scottish Government Marine Directorate, (3) Plymouth Marine Laboratory, (4) University of Aberdeen

THE WHY

The UK is committed to delivering up to 50GW of offshore wind by 2030. There are still gaps in our knowledge of the **cumulative effects on marine life of a massive expansion of offshore wind farms** (OWFs) – especially in combination with factors, such as climate change and other human activities.

The expansion of OWFs is **moving into deeper waters**, where there is the potential for OWFs to perturb the natural ocean mixing, and as a result **alter the timing and magnitude of seasonal stratification that underpin the seasonal cycle of primary production**. This potential impact has not previously been a concern for OWFs installed in coastal waters, which are typically tidally mixed, but it represents an additional stressor to ecosystems in deeper waters.

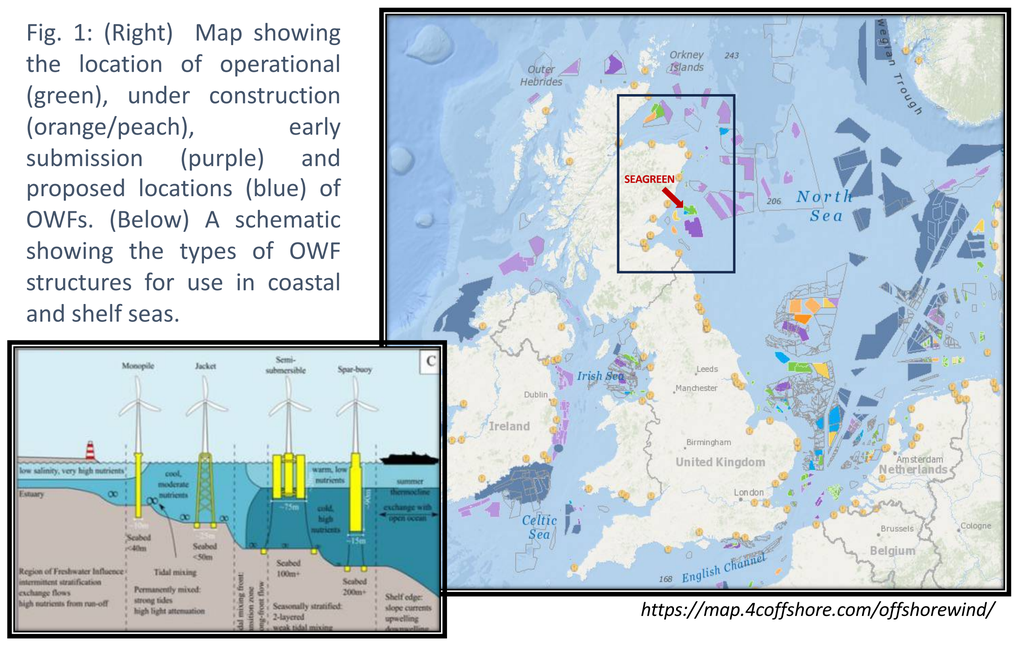


Fig. 1: (Right) Map showing the location of operational (green), under construction (orange/peach), early submission (purple) and proposed locations (blue) of OWFs. (Below) A schematic showing the types of OWF structures for use in coastal and shelf seas.

https://map.4coffshore.com/offshorewind/

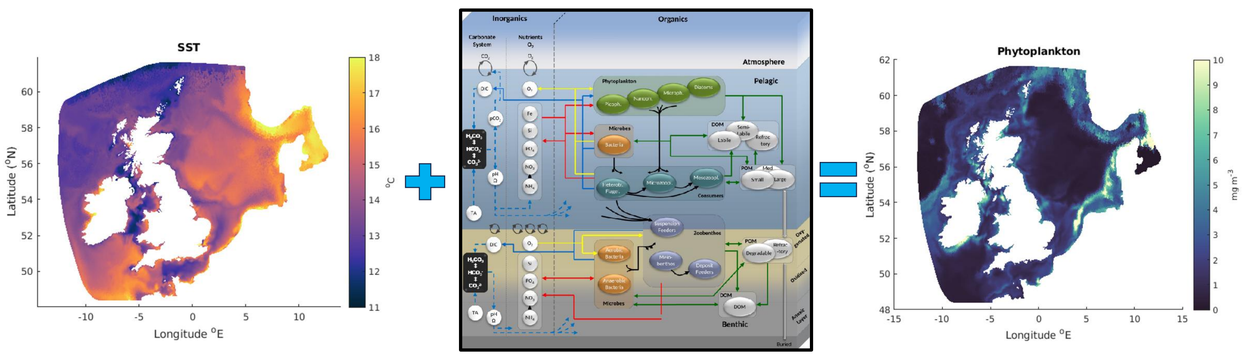


Fig. 2: Example physics output from the Scottish Shelf Model (Sea Surface Temperature, SST) from the FVCOM model grid (left), coupled with the ERSEM model (as shown by the schematic, middle), to produce example biogeochemistry (in this case, total phytoplankton) across the FVCOM model grid (right).

THE HOW

In the **P**hysics-to-**E**cosystem **L**evel **A**ssessment of **I**mpacts of **O**ffshore wind farms (**PELAgIO**), we are building an ocean and biogeochemical modelling system (FVCOM-GOTM-ERSEM) of the UK shelf to simulate how OWFs could perturb the physical environment in the whole North Sea.

By incorporating a wind turbine parameterisation that includes drag and mixing effects from the underwater structure and wind reduction in the wake of the turbines, **we can model impacts of OWF on stratification, and the consequent changes in nutrients, oxygen and plankton distribution**. In PELAgIO we will also study how fish, marine mammals and sea birds will respond to those changes.

THE WHAT

Preliminary results indicate a significant change in the physical structure of the water column inside of and downstream of the Seagreen OWF site. However, more multi-year simulations with/without OWFs are needed to disentangle these effects from natural variability and climate change.

The wind turbine parameterisations are being currently validated with data collected during the 2023 & 2024 PELAgIO surveys (CTDs, gliders, ADCPs).

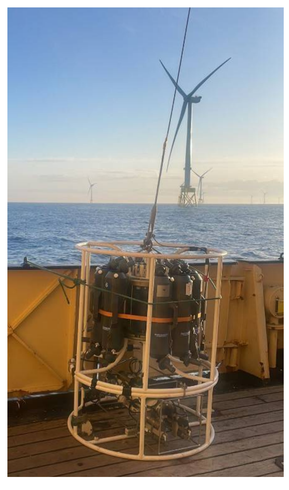


Fig. 3: CTD deployed in the vicinity of the Seagreen OWF

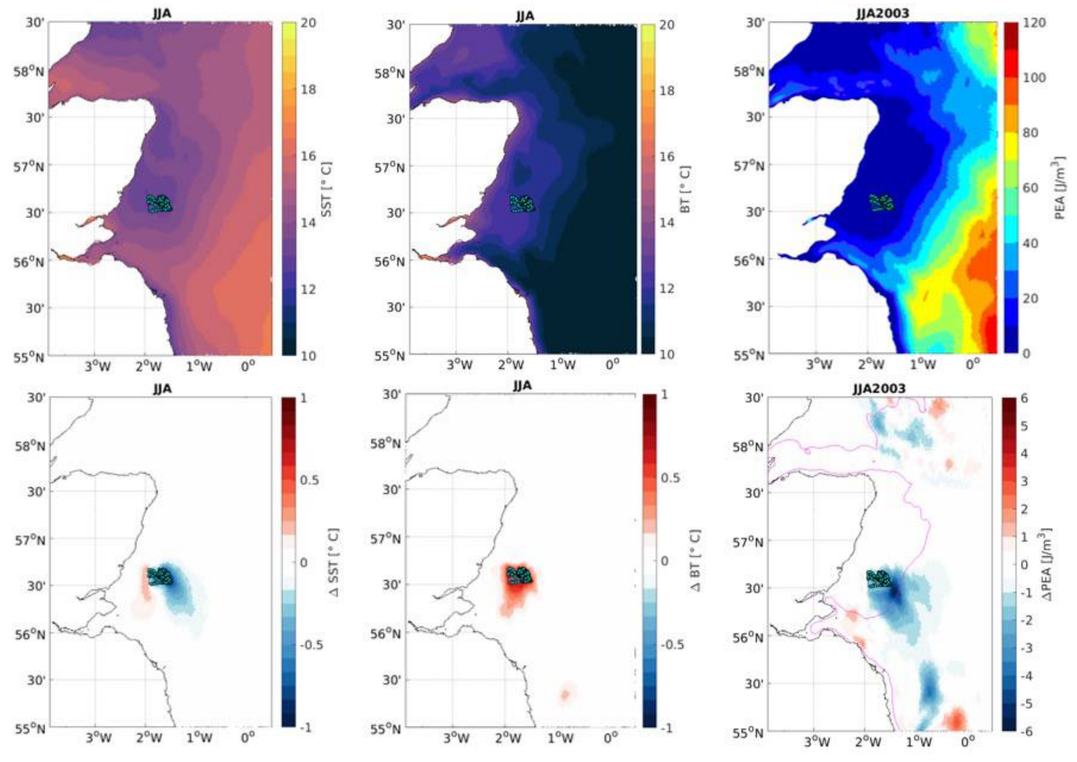


Fig. 3: (Top) Seasonal changes in Sea Surface Temperature (left), bottom temperature (middle) and stratification (as seen in the potential energy anomaly, right) off the east coast of Scotland. The Seagreen OWF site is marked. (Bottom) Preliminary results showing the changes in SST, BT and PEA due to the added modelled wind farm parameterisation for the Seagreen site.

THE FUTURE

Stratification is expected to change in the future across the Northwest European shelf with significant knock-on effects on spring bloom initiation and primary production.

It is unclear whether OWFs will exacerbate or mitigate these effects. FVCOM-ERSEM climate runs, under a "business as usual" scenario (RCP8.5) and including all proposed OWFs up to 2050, will address these questions and help inform the future direction of the UK marine energy strategy.

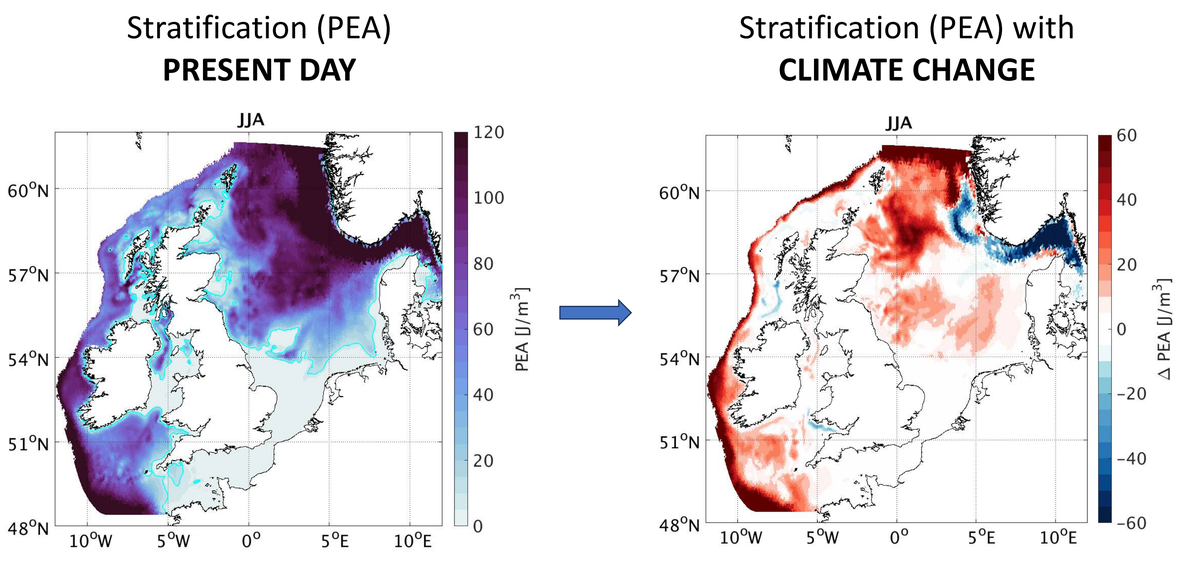


Fig.4: (Left) Seasonal summer climatology of the stratification across the NW European Shelf. (Right) The projected change in stratification (2100) under a RCP8.5 climate scenario.

A Coastal Health framework to support sustainable coastal ecosystems and resilient coastal communities

Marie Hanin, Craig Baker-Austin, & David Bass (Cefas), Constanza Toro Valdivieso (Defra)

Under the Coastal Health, Livelihoods and Environment pilot programme, we trialled the adoption of a One Health systems approach to better understand and tackle complex health events affecting animal and plant populations in coastal zones. We seek a cross-organisational framework to improve data flow and analysis and suggest exploring the role of participatory science to better understand the variability of life around our coasts.

THE COASTAL HEALTH, LIVELIHOODS AND ENVIRONMENT PROGRAMME

The programme is funded by HM's Treasury and so far involves 12 England-based partner organisations across government, academia and NGOs. It aims to develop a coastal monitoring framework to improve our understanding of coastal ecosystem health and ability to manage unexplained adverse coastal health events, and support government to respond quickly, effectively and robustly to such events.

The pilot phase, running until March 2025, will make recommendations for a cross-agency coastal health monitoring framework, and 4 England-based case-studies to test innovative environmental monitoring tools and consider how to improve cross-agency data sharing and analysis.

DEFINING COASTAL HEALTH

Marine ecosystems are crucial for human populations, providing food, livelihoods, coastal resilience, recreational opportunities, and biodiversity conservation.

We define "coastal health" as the overall condition and functionality of coastal ecosystems with particular focus on the health of their constituent animals and plants, recognising their inter-dependence with environmental sustainability and human well-being in coastal zones.

We emphasise the need to better understand the baseline health of these ecosystems and its numerous stressors, including climate change, pollution and anthropogenic activities. Improving our understanding of coastal health and enabling cross-organisational collaboration can help us better target our collective efforts to manage and respond to adverse coastal health events, support healthy coastal ecosystems and resilient coastal communities.

A SYSTEMS "ONE HEALTH" APPROACH TO COASTAL HEALTH

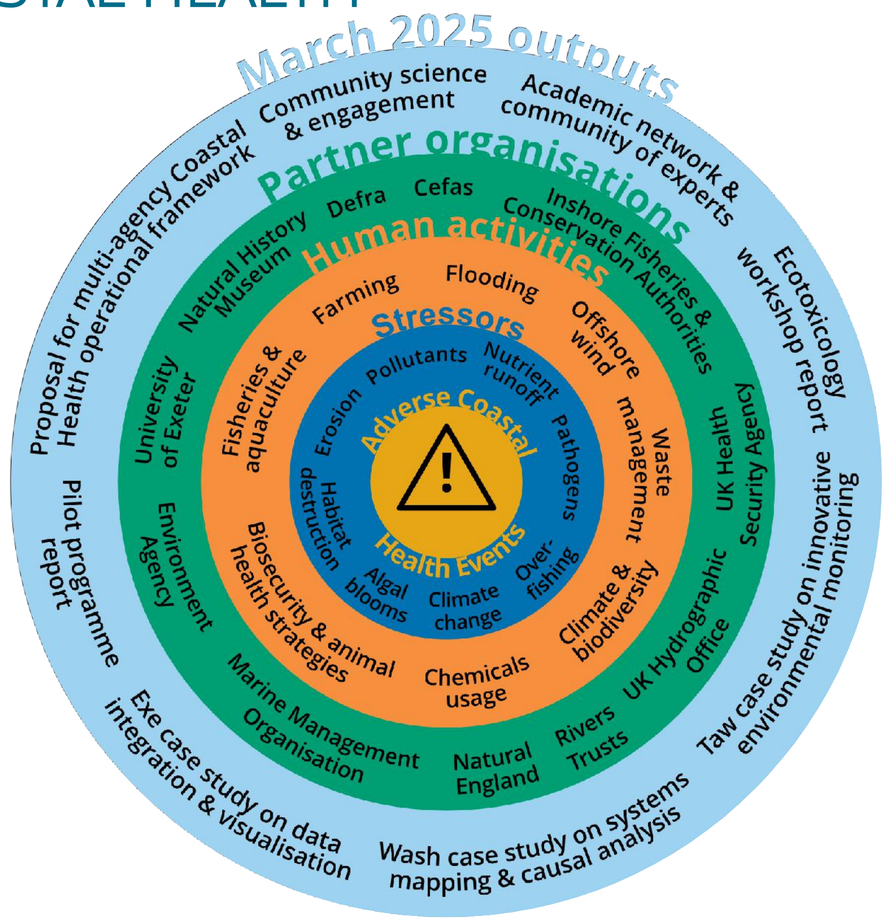


Figure 1. The Coastal Health wheel provides a visual representation of the systems and One Health approach adopted in the programme, bringing together a range of disciplines, skills and expertise to tackle complex coastal health problems.

PARTICIPATORY SCIENCE INITIATIVES AROUND THE COAST

Figure 2. This map shows a subset of participatory science initiatives collecting data on coastal ecosystems across England. These were identified through stakeholder mapping exercises and are categorised by coverage with blue dots showing the headquarters of nation-wide studies, white dots showing regional initiatives and orange dots showing local initiatives.

A MODEL FOR A MULTI-AGENCY COASTAL HEALTH FRAMEWORK

Working with partners across government, we developed a proposal for a coastal heath framework which can be adapted to suit individual countries' needs and existing structures. This framework, inspired from the intelligence management of the college of policing, advocates better utilisation and integration of existing data, improved communication and intelligence sharing with local initiatives and preparation of national coordination and response plans to deal with coastal health incidents of unknown cause.

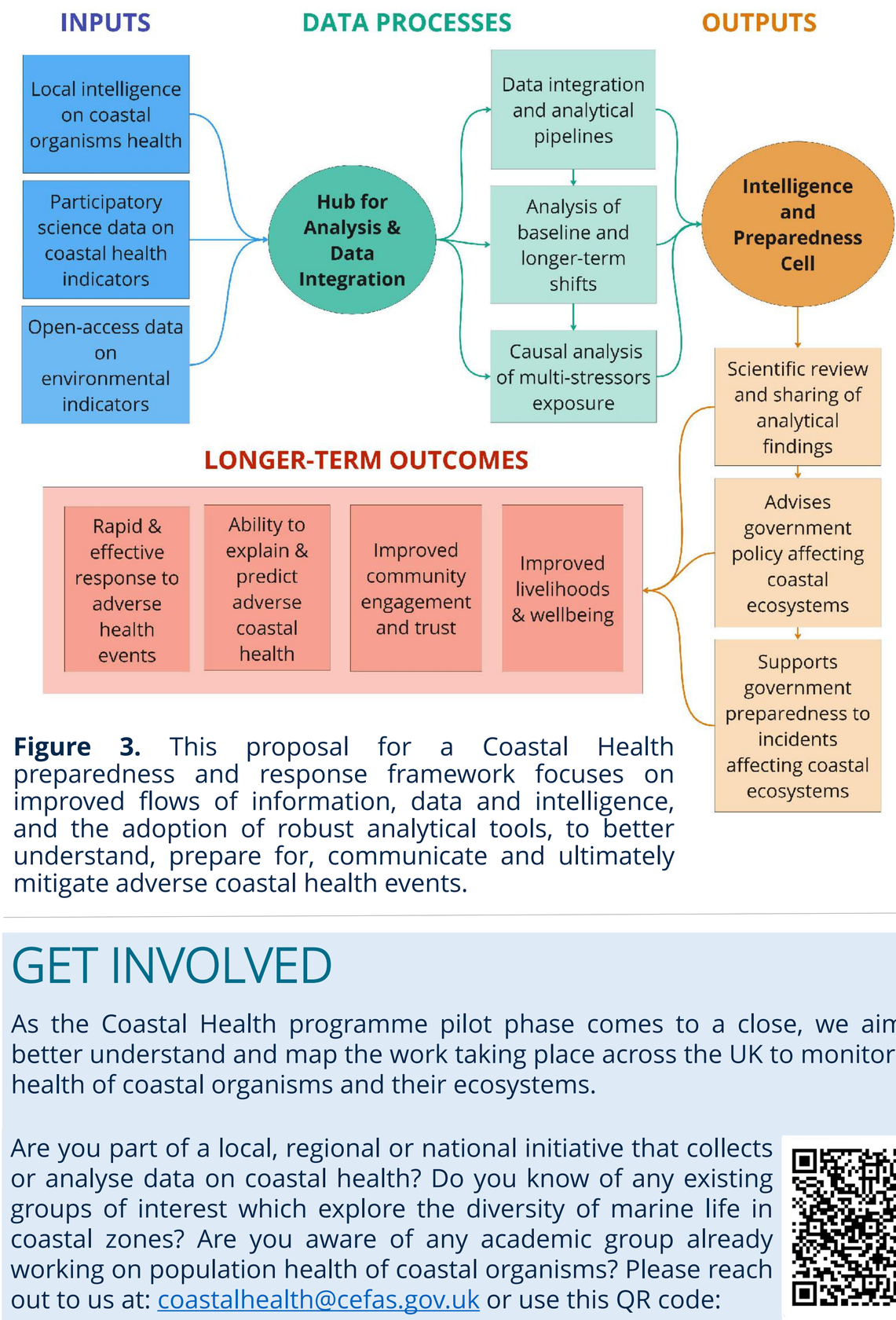


Figure 3. This proposal for a Coastal Health preparedness and response framework focuses on improved flows of information, data and intelligence, and the adoption of robust analytical tools, to better understand, prepare for, communicate and ultimately mitigate adverse coastal health events.

GET INVOLVED

As the Coastal Health programme pilot phase comes to a close, we aim to better understand and map the work taking place across the UK to monitor the health of coastal organisms and their ecosystems.

Are you part of a local, regional or national initiative that collects or analyse data on coastal health? Do you know of any existing groups of interest which explore the diversity of marine life in coastal zones? Are you aware of any academic group already working on population health of coastal organisms? Please reach out to us at: coastalhealth@cefas.gov.uk or use this QR code:

HM Treasury · Cefas · Environment Agency · Department for Environment Food & Rural Affairs · Association of IFCA · Natural History Museum · UK Health Security Agency · United Kingdom Hydrographic Office · Westcountry Rivers Trust · University of Exeter · Marine Management Organisation · Natural England · The Rivers Trust

NATIONAL TRAILS.UK

Coastal Wildbelt - Unlocking the potential of England's dynamic coast

Coastal Wildbelt is a once-in-a-generation opportunity to develop a new national initiative for people and nature along our dynamic coastline.

At an incredible 2,700 miles, the King Charles III England Coast Path is set to become the longest, managed coastal path in the world. But this extraordinary project is about more than creating an accessible path for people, it's about transforming how we connect with, care for, and enhance our unique coastline.

Our coastal margin, designated from the Marine and Coastal Access Act 2009, is generally the area that falls between the coastal path and mean, low water. This area is designated Open Access Land and has huge potential for nature recovery.

Coastal Wildbelt is uncovering how we unlock the potential of the coastal margin to create **a thriving, nature-rich coastline which benefits everyone**.

Why is the coastal margin important?

943 square miles in size – larger than the Lake District National Park

86.5% of the Coastal Margin has the potential to contribute to 30x30 (1.6% of England's land area)

79% falls outside of a National Park or National Landscape (key role in providing connectivity)

81% is designated for nature

71% is made up of priority habitats

There were over 150 million visits to the beach in the past month – that's as if every person in England made at least two trips

Almost 1 in 5 people in England live within 5km of the Coastal Margin

3.6 million people live within walking distance of the Coastal Margin

The Coastal Margin is within 21 Protected Landscapes, 4 World Heritage Sites & 32 Heritage Coasts

The beach is one of children's favourite outdoor places – but only a quarter visited in the previous week and less than 10% of children can easily walk from their home.

"We can't wait any longer. Our ever-evolving coastline is changing before our eyes. The time for a new, national initiative that is as dynamic as our vibrant coastline is now. Coastal Wildlbelt is a champion for successful projects and partnerships, a convener for innovation, collaboration and future opportunities, and a collective voice to unlock the potential of this invaluable national asset."

Kate Jury, Coastal Wildbelt Project Officer

To find out more, reach out to Kate on kate@nationaltrails.uk

Coastal Wildbelt is funded through the Protected Landscapes Partnership, supported by Defra

We are the Protected Landscapes Partnership

National Landscapes Association · National Parks England · NATIONAL TRAILS.UK · NATURAL ENGLAND

Coast-R Network

Coastal Communities and Seas Together for Resilience

Project Lead: Prof. Briony McDonagh, University of Hull

The Coast-R Network is an inclusive and collaborative community of practice, working to build knowledge, action and resilience for UK coastal communities and seas.

Part of the ReCCS Programme

The Resilient UK Coastal Communities and Seas Programme is a £14.8M investment from UKRI and Defra

ReCCS consists of four large research grants and a Network Plus (the Coast-R Network)

Coast-R will champion and coordinate the programme as well as develop further transdisciplinary research projects, training and capacity via a Flexible Fund

Coast-R Network aims

1. Champion and coordinate research and knowledge exchange across and beyond the ReCCS Programme
2. Develop and support transdisciplinary research capacity around coastal and marine resilience, including via a Flexible Fund
3. Scale and embed effective place-based interventions into policy, practice and knowledge mobilisation

Our objectives

1. Sharing learnings and good practice across disciplines to build coastal resilience
2. Co-designing and hosting events, training and mentoring to improve partnership working
3. Working in partnership with coastal communities to identify and respond to priority needs using our Flexible Fund
4. Collating key insights, case studies and resources via our website, policy briefs and events
5. Building ongoing practitioner and community-led evaluation and reflection

Get involved

Our programme of online and in-person events include workshops, training, seminars and secondments

Coast-R Network Year 2 Event

11-12 September 2025, University of Glasgow.

Save the date for our engaging 1.5-day event, focussed on building resilience for coastal communities and seas.

Together we will explore how we can work better to co-create resilient coastal futures.

ukcoastalresilience.org/events

ReCCS large grants

Transitions in Energy for Coastal Communities over Time & Space (**TRANSECTS**).
PI: Karen Alexander, Heriot-Watt University

Advancing Resilience & Innovation for a Sustainable Environment (**ARISE**).
PI: Gina Reinhardt, University of Essex

Resilience of Anthropocene Coasts & Communities: Assessing & responding to urban & post-industrial coastal risks (**RACC**).
PI: Kate Spencer, Queen Mary University of London

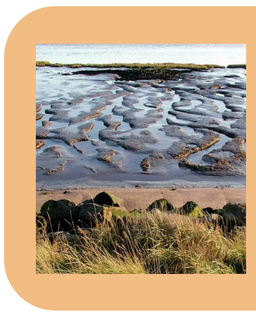
Transformative Research Actions for Resilient Coastal Communities (**TRACC**).
PI: Tim Acott, University of Greenwich

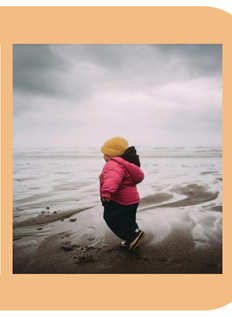
Cross-cutting themes

People, places and participation

Living with coastal (un)certainties

Working together at interfaces





We're a growing network anyone can join

Join up via ukcoastalresilience.org or email COASTR@hull.ac.uk

ukcoastalresilience.org

Coastal Communities And Seas Together for Resilience Network Plus

UK Research and Innovation · Arts and Humanities Research Council · Economic and Social Research Council · Natural Environment Research Council · Department for Environment Food & Rural Affairs · NCEA Natural Capital and Ecosystem Assessment

University of Hull · Prifysgol Aberystwyth University · University of Glasgow · University of Liverpool · University of Southampton · University of Leeds

Co-Creation for strengthening locally led coastal management: advancing equitable solutions to coastal risks

Marta Meschini [1], Elina Apine [2], Leonie Robinson [1, 3]

1 University of Liverpool, School of Environmental Sciences, Liverpool L69 3GP, UK

2 Marine and Coastal Environment Team, School of Geography & Sustainable Development, University of St Andrews, St Andrews, UK

3 Evidence and Evaluation team, Marine Management Organisation, Lancaster House, Newcastle upon Tyne, NE4 7YH

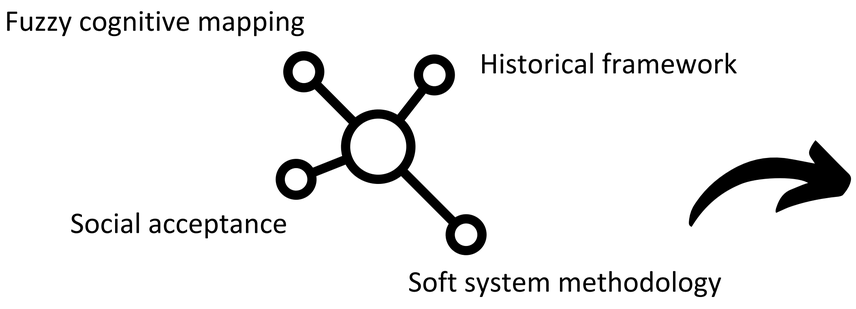
CO-OPT
Resilient Coasts:
Optimising Co-Benefit Solutions

1. WHAT IS THIS POSTER ABOUT?

In the " Resilient Coasts: Optimising co-benefit solutions" project we are interested in transitions to nature-based solutions (NbS) to manage flooding and erosion risk. We wanted to understand what affects the decision-making around putting in place coastal defences as part of a coastal scheme, and what might be needed to increase the use of NbS, where this would optimise benefits to people and nature. Within the project, we brought together experts from several disciplines and communities to explore a range of different perspectives and to create and/or increase shared understanding of the issues. We used diverse methodologies that brought us to the development of an enhanced DPSIR framework (see section 2.2) to support co-creation processes, strengthening locally led coastal management initiatives.

2. HOW DID WE DO THAT?

2.1 MULTI METHODS APPROACH TO UNDERSTAND THE SYSTEM



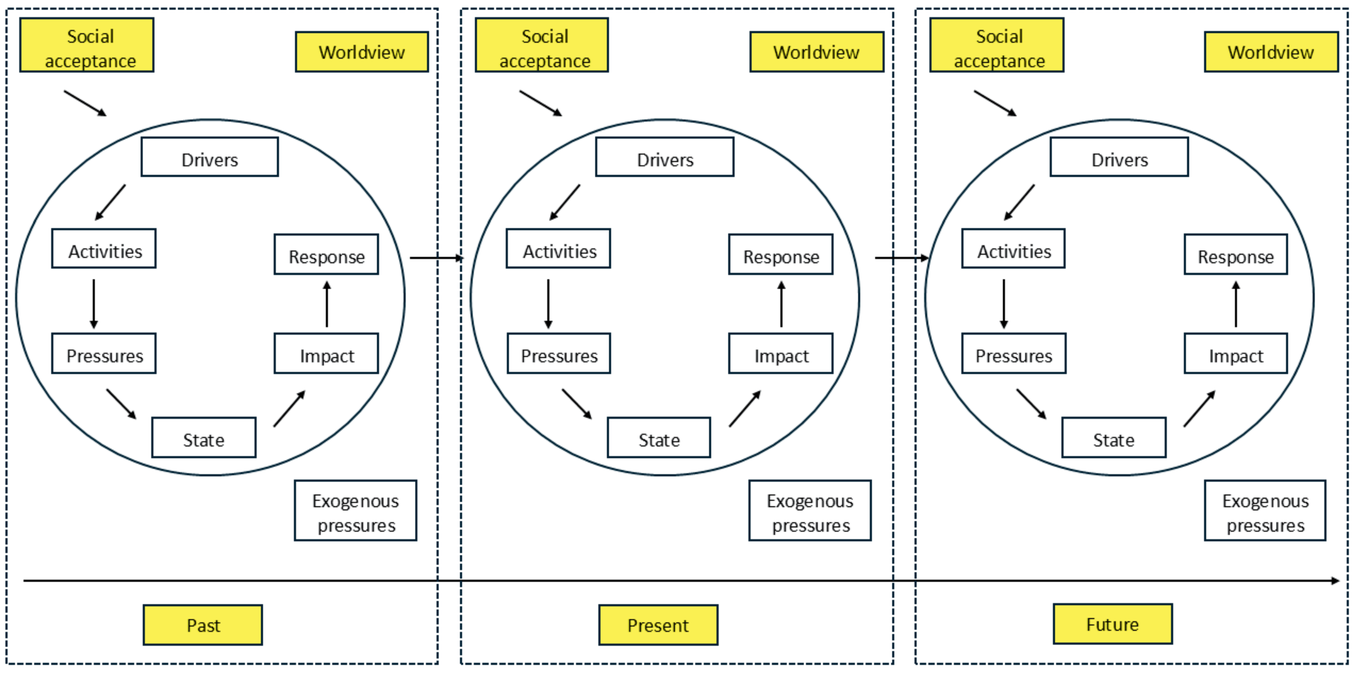
<u>Fuzzy cognitive mapping methodology</u> helped us to co-develop a fuzzy map of the components of the socio-ecological system (humans and nature) that affect how we manage flooding and erosion risk.

<u>Social acceptance</u> was studied by engaging communities to assess their perceptions of coastal management schemes and trust in risk management authorities used for flood and erosion management.

<u>Historical frameworks</u> were developed to better contextualise the current situation and to learn how past decisions could have informed the current and future acceptance and implementation of coastal schemes.

<u>Soft systems methodology</u> was used to understand the decision making process for coastal schemes put in place to manage flooding and erosion risk on UK coasts, exploring both current approaches and "the ideal approach"

2.2 ENHANCED DPSIR FRAMEWORK TO IDENTIFY CHANGES IN THE SYSTEM OVER TIME



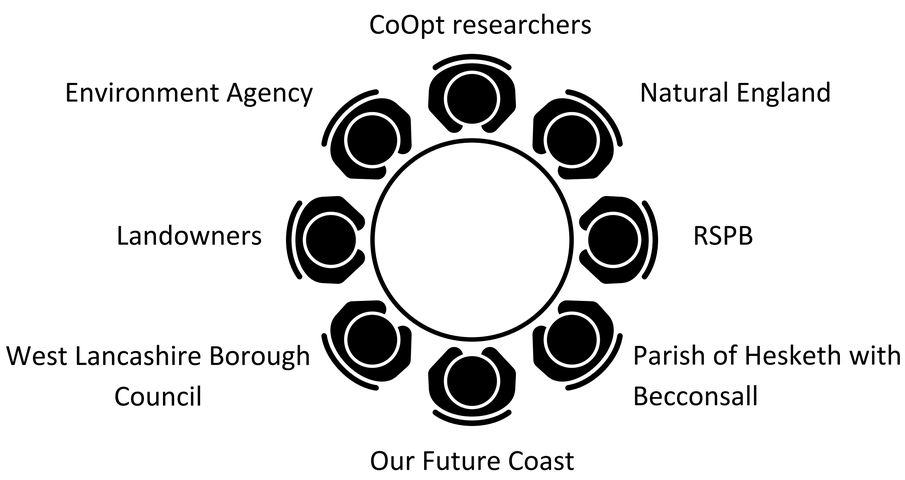
The DPSIR framework (Drivers-Pressures-State-Impacts-Responses) is a widely recognized tool in environmental science, policy, and management that helps identify causal relationships and feedback loops between human activities and ecological or socio-economic outcomes within socio-ecological systems (SES).

We adapted this framework from Elliott et al., 2017*, to incorporate insights gained from our multi-method approach (yellow boxes show components we added). In particular, the **social acceptance** of different management solutions (**responses**) can change over time and affect decisions, as can the **worldview** regarding specific **drivers** and **activities**. These drivers and activities can produce **pressures** on the system, leading to observable changes in the natural environment (**state**) as a consequence of the pressures. The resulting **impacts** are related to changes in the state of the natural system, which in turn affect both natural and human systems. These impacts, in turn, will necessitate a new response, initiating the next cycle of events. We found that the **historical context** and influence of **exogenous pressures** (such as extreme events, funding cuts, and other factors that cannot be foreseen) also influence the likelihood of different **responses** being implemented.

*Elliott, M., et al. "'"And DPSIR begat DAPSI (W) R (M)!"-a unifying framework for marine environmental management." Marine Pollution Bulletin 118.1-2 (2017): 27-40.

3. OUR TEST CASE STUDY: HESKETH OUT MARSH

We applied our enhanced DPSIR framework to a case study at Hesketh Out Marsh (HOM). This site was reclaimed for agricultural purposes in the 1980s and was subsequently transformed back into saltmarshes through managed realignment between 2006 and 2017. The workshop aimed to facilitate the exchange of knowledge and perspectives among participants, fostering a shared understanding of the current challenges facing Hesketh Out Marsh within the broader socio-ecological system, as well as exploring potential solutions.



DPSIR framework developed by participants bringing together all the different points of view about the current challenges in Hesketh Out Marsh and potential solutions.

4. HIGHLIGHTS

- **Through trying out applying our enhanced DPSIR framework to the Hesketh Out Marsh managed realignment (MR) scheme**, we learnt valuable lessons about whether or not Nature-based Solutions (NbS) will be chosen and implemented in coastal protection schemes:
- **The past**: Initiated in the early 2000s at a time when NbS were not widely recognized (their utility was not a commonly shared **worldview**), the project aimed to compensate for habitat loss due to an urgent flood alleviation programme in Morecambe, while benefiting wintering birds. The community and farming sector also supported the scheme at that time (high degree of **social acceptance**), anticipating enhanced flood protection. Some of the **state** changes anticipated were achieved, including increases in suitable habitat for wintering birds, with positive impacts.
- **The present:** Whilst the **worldview** has increased in supporting NbS, locally, **social acceptance** in the scheme has reduced due to unanticipated **impacts** resulting from **exogenous pressures.** Challenges emerged post-completion due to reduced resources available to the regulators to maintain the realigned area, combined with factors like the low-lying terrain, natural estuary accretion, and unexpected increases in drainage pressures from nearby housing developments. These additional **pressures** resulted in issues such as siltation in outfalls and farmland flooding. Unclear responsibility for these problems further eroded community trust in the project's effectiveness, and ultimately the acceptance that managed realignment was a suitable and appropriate **response**.
- **The future**: The issues highlighted around the current situation are reducing appetite (**acceptance**) for increasing the areas of managed realignment in the local area. This case highlights that sustained funding, clear accountability, and effective management are critical for the ongoing benefits of this kind of **response** to be seen. Comprehensive planning, ongoing community engagement, and empowering local stakeholders were also seen as essential for ensuring sustainable and resilient NbS outcomes.

SCAN ME TO DISCOVER ALL PROJECT OUTPUTS

Acknowledgements: We thank our funders and all participants of the various project activities that contributed to the development of this work. We extend our gratitude to our colleagues from the CoOpt project for their invaluable support in organizing and facilitating these activities.

Project funded by SMMR Sustainable Management of UK Marine Resources

Project partners University of Liverpool; University of St Andrews, Founded 1413; National Oceanography Centre; Cranfield University

FISHERIES IMPROVEMENT FUND

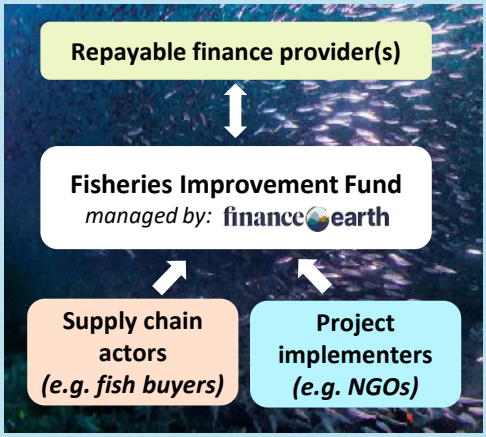
Supporting gear and tech to improve the sustainability of UK fisheries

Finance Earth partnered with World Wildlife Fund to launch the Fisheries Improvement Fund (FIF) in April 2023 : a new funding model to finance the transition to more sustainable fisheries worldwide, with the ambition to catalyse $100 million in investment by 2030.

Fisheries Improvement Fund

FIF model

- Sustainability projects fully funded to completion
- Builds sustainability into product cost
- Range of supply chain participation options including equitable volume-based fee mechanism
- Impact assurance for funders
- Impact investment to cover up-front project costs
- Unlocks finance at scale for fisheries transition



Piloting the FIF in Chile

- Launched April 2024
- **Aim:** support the transition to sustainable marine ingredients in the anchoveta and araucanian herring (common sardine) fishery in the Central-Southern Region of Chile.

Supported by:

Walton Family Foundation, Cargill, Skretting, Mars, Walmart.org, sodexo, giant eagle, Costco Wholesale

Adapting FIF model to support gear / tech

Project to explore how the FIF's volume-based fee model could be adapted to **accelerate the roll-out of gear/technology** to improve the **sustainability of UK fisheries,** targeting solutions that**:**

- ✓ Address social / environmental issues
- ✓ Provide value for money
- ✓ Are ready for commercialisation
- ✓ Align to UK government priorities
- ✓ Have industry support for implementation

Esmée Fairbairn Foundation

Opportunities for supply chain engagement

- Contributing through a **volume-based contribution or fixed amount** to accelerate gear / tech upgrades and FIPs
- Contributing to the **development of new FIPs or gear / tech upgrades** in priority fisheries
- **Working with company suppliers** to encourage engagement with FIPs or gear / tech upgrades through the FIF

For more information please contact: fif@finance.earth or visit https://finance.earth/FIF

World Wildlife Fund | 1250 24th Street NW | Washington, DC 20037 | worldwildlife.org/initiatives/oceans | oceanmarkets@wwfus.org

Is English Estuarine Environmental Management fit for purpose?

Exploring transformative governance for England's estuaries.

Dr Toni Scarr - Birkbeck, University of London / Head of Ecology and Geomorphology at Environment Agency

This study provides a vision for: *collaborative, adaptive, equitable estuarine environmental management system that delivers a change in the provision of benefits for the environment, economy and society, based on evidence and accountability*.

English estuaries are **unique, complex systems** that are vital for ecological, cultural, and economic reasons.

They provide:

- A wide range of regulating benefits, ecosystem services, cultural goods and benefits[1].
- Valuable habitats for wildlife.
- Resilience to climate change.

This study used a mixed-methods analysis to analyse estuarine management including a:

- **Literature review,**
- **Expert interviews and**
- **a citizens' jury**.

The **literature review** revealed substantial research on historical environmental pressures, but with limited focus on estuarine environments compared to marine and freshwater systems.

Figure 1 The many different organisations involved in estuarine management.

The **expert interviewees** discussed siloed and ineffective management approaches, along with global economic pressure and climate changes have resulted in many estuaries becoming environmentally degraded. They thought that organisational collaboration, adaptive management and accessible evidence was important.

They discussed best practice including **Estuary Partnerships** who provide a framework for multiple partners with a material interest in maintaining a healthy environment collaborating to provide better decision making, drive investment and deliver multiple benefits including environmental recovery.

They discussed **Complexity.** The systems map below shows how interdependent and dynamic the relationships within and feeding into an estuary, highlighting the need for a holistic approach to estuarine management. Understanding these complexities helps identify leverage points for positive interventions and areas where mitigation of negative impacts is necessary.

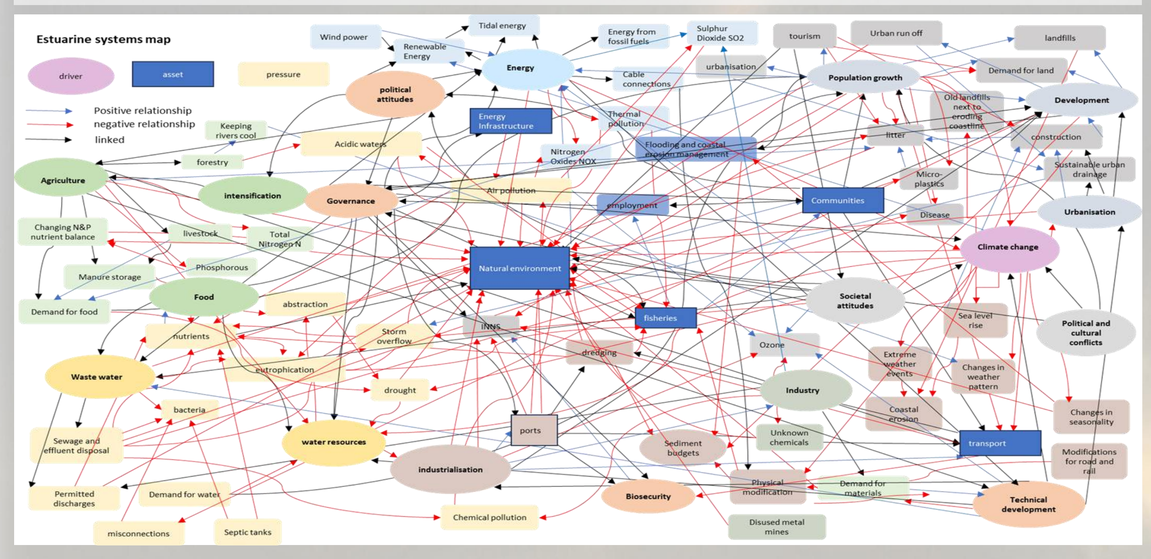


Figure 2 A systems map for an English estuary, to illustrate the estuarine governance and pressure complexities discussed by experts and the literature.

The experts felt that a systems view allows for **strategic planning** across sectors and adaptive decision making to ensure the sustainability and resilience of estuarine environments.

The **Citizens' Jury** explores the concerns of communities living alongside the Thames Estuary. It found that deliberative engagement enabled the participants to comment on complex evidence and provide their own recommendations for management of the estuary.

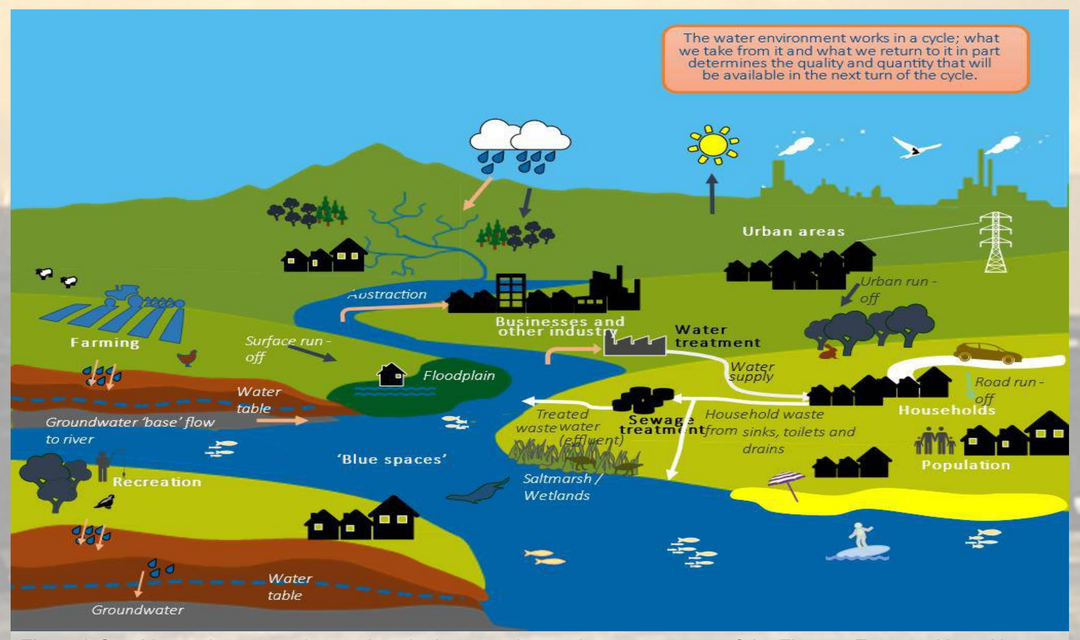


Figure 3 Graphic used to set out interactions in the estuarine environment as part of the Thames Estuary citizens' jury discussed in this study[2].

Thames Estuary Citizens' Jury Six Recommendations

. **Public Education**, more public education to help communities understand their influence and responsibilities.
. **Access for all**, improving public access to the river.
. **Natural Flood Defences**, and climate change mitigation measures need to be front and centre in all planning and urban development considerations.
. **Biodiversity Net Gain**, connecting net gain with wildlife and flood prevention.
. **Coordinated River Management**, having a single body which represents key stakeholder groups for the whole Tidal River Thames.
. **Enforcement of Environmental Standards**, taking a much stronger stance on environmental enforcement.

The recommendations, in the form of a video recorded by the jurors - https://www.youtube.com/watch?v=pRkRNohrMO4 or QR code:

One of the insights of this work is its demonstration that **deliberative engagement** with **communities** not only further the discussion on estuarine management but also have the potential to shift political priorities[3]. By combining diverse forms of knowledge ranging from local residents living alongside the Thames Estuary with academic, practitioners and industry experts this research fills a vital gap in the literature.

This mixture of methods found that despite recent trends, systemic changes are needed to environmental management to protect and improve the **natural function** of our estuarine environments[3]. Restoring estuaries requires

- **collaboration and deliberative engagement**, **strategic catchment planning** to plan holistically for environmental infrastructure, and **strong environmental legislation**.
- **Community engagement**, to gain social accountability for future management and **evidence-sharing** are essential.
- Changes to **culture and policy** within organisations to better enable **adaptive management,** aligning **organisational objectives** to better adapt organisation's approaches to face future threats[4].
- **Biosecurity** measures need to be taken more seriously as the threat from invasive non-native species can be irreversible;
- while **funding** should prioritise environmental enhancements and **green finance** tools to drive sustainable development and ecosystem protection.

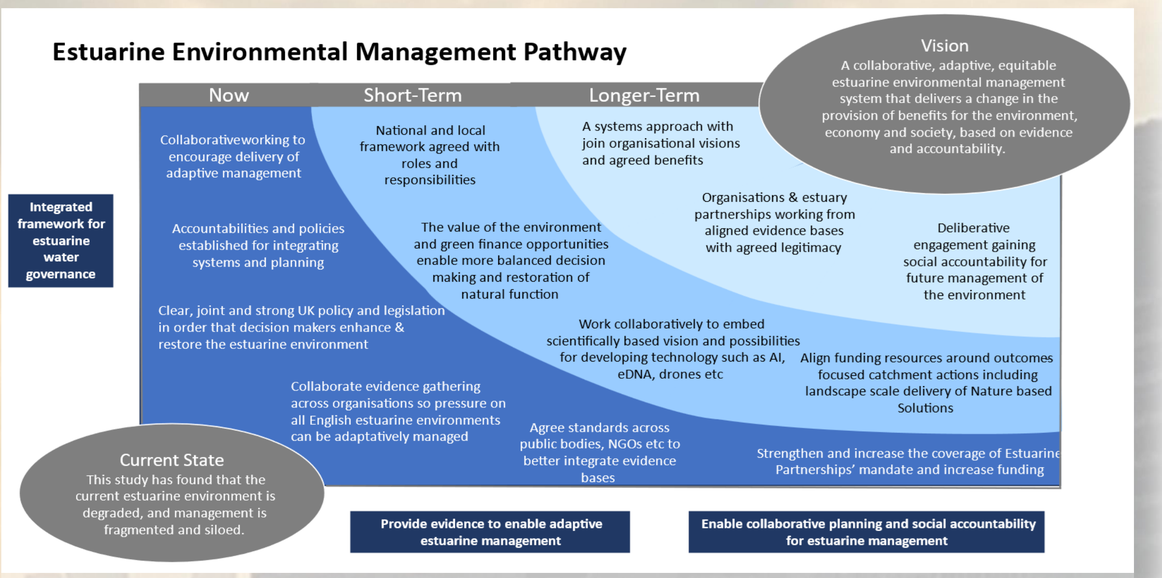


Figure 4 The estuarine environmental management pathway that this study has found is needed to improve estuary management in England.

Transformative changes in English governance are needed to manage estuaries and their catchments as a system. Systems thinking, strategic planning, collaboration, strong legislation, adaptive management, a cultural shift, and accessible evidence are key to balancing human use with nature recovery and supporting estuarine environmental recovery.

References and Acknowledgments

I would like to express my gratitude to my supervisors Dr. Simon Pooley, Professor Mike Elliott and my original supervisor Dr. Diane Horn, whose unwavering support and dedication have been vital throughout this journey. Thank you to all the experts who gave me their time and the participants of the citizen jury who were so engaged during the process and taught me about the value of listening to communities.

1 Elliott, M. (2023). Marine Ecosystem Services and Integrated Management: "There's a crack, a crack in everything, that's how the light gets in"! Marine Pollution Bulletin, 193: 115177. doi: 10.1016/j.marpolbul.2023.115177.
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3 Capstick S, Demski C, Cherry C, Verfuerth C, Steentjes K. (2020). CAST briefing paper 03: Climate change citizens' assemblies. https://cast.ac.uk/wp-content/uploads/2020/03/CAST-Briefing-03-Climate-Change-Citizens-Assemblies.pdf.
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CONCEPTUALISING MARINE SOCIAL-ECOLOGICAL SYSTEM GOVERNANCE CHALLENGES: A SYSTEMIC EXPLORATION OF MANAGEMENT PRIORITIES

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1. SUMMARY

This poster details a multimethodological approach for the construction of a 'Marine Management Impediments System' through conceptual mapping, analysing marine manager priorities via Q-Methodology, and validating findings using the Delphi technique.

Focus: Understanding the interconnectedness of social and ecological priorities in marine management. using Systems Thinking.

2. A 'SYSTEMIC LENS'

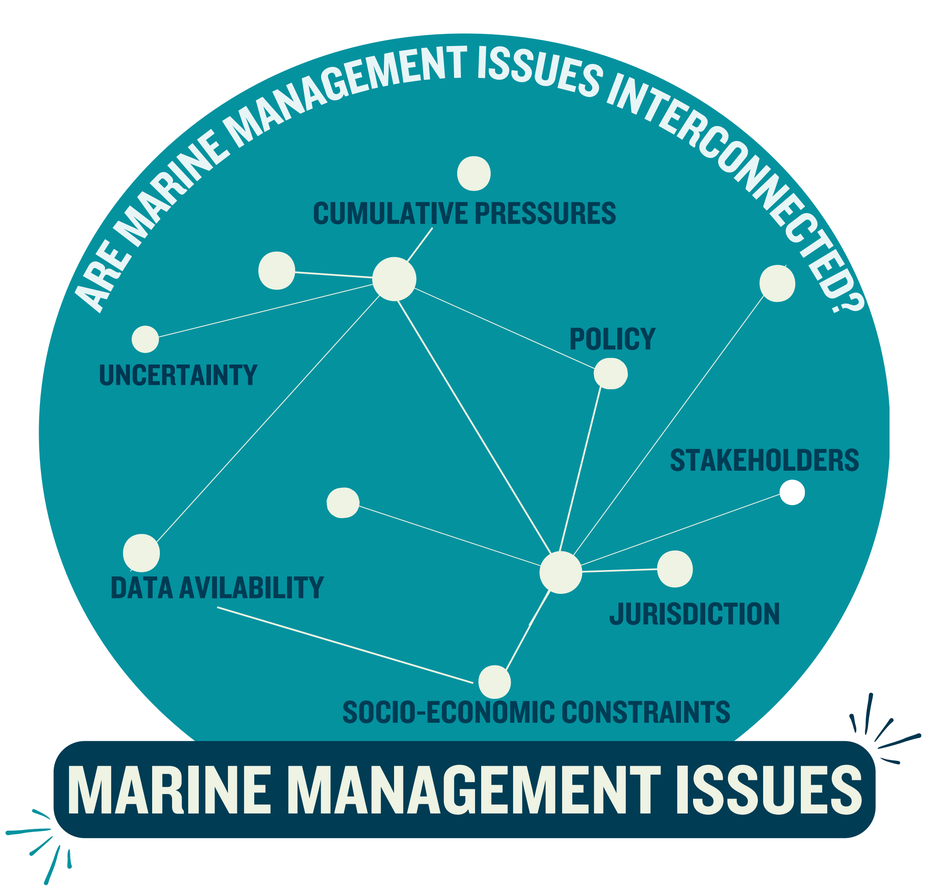
A systemic lens enables the identification of patterns and trends within a study, facilitating a comprehensive understanding of how issues within marine management systems influence one another and the system as a whole. Recognising the interconnections between these issues through a systemic lens offers a novel way to explore and contribute to the implementation of EBM.

"Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing 'patterns of change' rather than static snapshots."

- Peter Senge (2006)

3. RATIONALE

- Social-Ecological Systems, are composed of direct and indirect interacting agents, such as humans and organisms, and their environment (Ostrom, 2009).
- Marine Ecosystem Based Management (EBM) issues are often understood in relation to the overarching goal of successful marine management. Various elements such as governance, stakeholders, and uncertainty are often treated as separate elements within the larger picture.
- There is a need to systemically unpack marine management issues and priorities to explore how EBM uptake can be actioned.



4. RESEARCH QUESTIONS

*1. What are the **priorities** of management facets identified by marine managers?*

2. How can marine management impediments in the European context be **systemically mapped**?

3. Based on management priorities, what criteria are appropriate for identifying best practices in managing marine SESs?

*4. How can these priorities inform **recommendations** to improve uptake of EBM with consideration of the diverse perspectives?*

5. MULTIMETHODOLOGICAL APPROACH

Stakeholder Mapping: Identifying and analysing individuals or groups who are responsible for the management of marine resources, including academics and practitioners who influence decisions on the marine environment

Gathering Perspectives: Using Q-methodology to explore and prioritise the challenges faced by marine managers in implementing EBM.

Systemic Mapping: Using Causal Loop Diagrams (CLDs) to visualise the interconnections between EBM issues.

Qualitative Validation: Using the Delphi technique to validate findings and ensure robustness of results.

Systemic Analysis: Employing the "ten tenets" framework to analyse how management priorities align with social-ecological system facets.

6. Q-STUDY

The Q-method is a research approach used to understand various viewpoints (Webler et al., 2009). In this study it will be used to gather and analyse perspectives on marine management impediments. It differs from a typical survey or interview. Instead of asking participants to agree or disagree with statements, the approach asks participants to sort a set of statements into a grid as illustrated below.

Low Priority ***High Priority***

Examples of statements:

"Stakeholders are to be incorporated at every stage of management"

"Management decisions can be delayed to gather more data if there is a lack of"

"Cumulative Pressures should be considered in every instance"

"Uncertainties should be communicated for every management action"

The results of this methodological element will be analysed to explore how participants sort the statements; this will identify patterns and clusters of viewpoints. Not only does this inform upon understanding the range of perspectives, but also how they relate to each other. This part of the research seeks to evaluate the points of agreement, neutrality, and consensus of managers, and further inform the causal loop diagramming process below.

7. SYSTEMIC MAPPING

Causal Loop Diagrams (CLDs) are a Systems Thinking tool which will be employed in this study to visualise the interconnections between marine management issues, highlighting feedback loops and potential leverage points (Sterman, 2002).

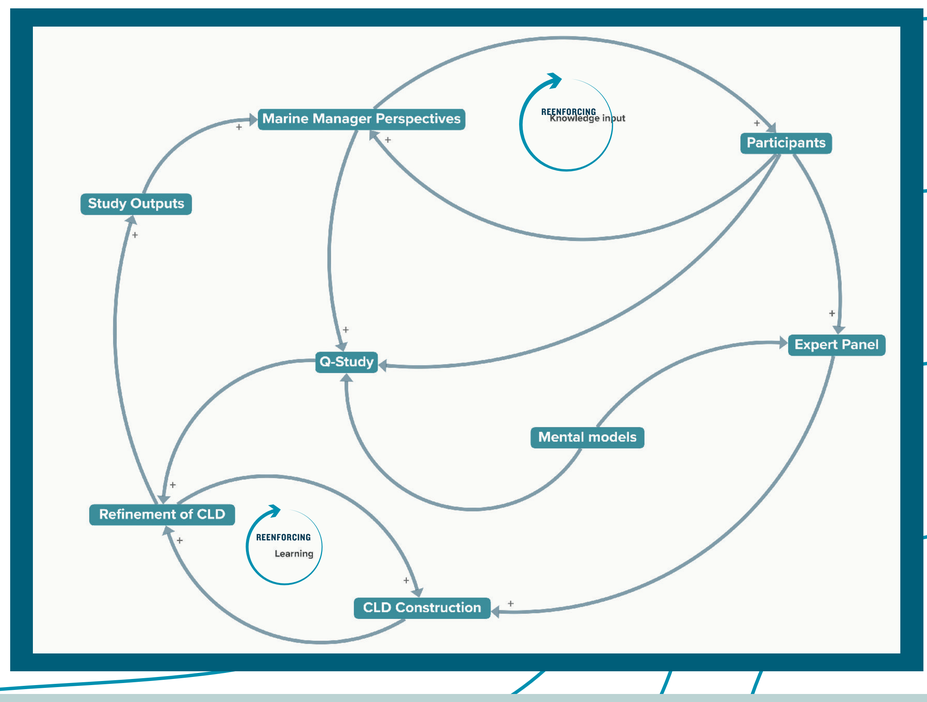
Marine managers, as stakeholders, will be central in the process of constructing the CLDs, providing their expertise and perspectives on the relationships between EBM challenges.

The CLDs will be refined and updated based on the knowledge and feedback gained in other stages of the research, such as the Q-study.

A Causal Loop Diagram (CLD) of the current research design. →

The diagram illustrates the intended process where perspectives from marine managers are used to construct and refine the CLD. A Q-study is employed to gather and analyse subjective viewpoints, further informing the refinement process. The entire process is iterative, with learning occurring throughout, ultimately leading to study outputs.

The diagram emphasises the cyclical and interconnected nature of knowledge gathering, analysis, and synthesis in developing a robust understanding of a complex system related to the perceptions of marine management.



FIND OUT MORE AND EXPRESS YOUR INTEREST TO PARTICIPATE IN THIS STUDY HERE:

8. EXPECTED RESULTS

By conceptualising marine management challenges as a system, this research aims to provide informed recommendations for improving EBM implementation. The findings will contribute to a deeper understanding of the complex interrelationships between EBM issues and offer pathways for fostering resilience and sustainability in marine social-ecological system management.

REFERENCES.

Marine Management Organisation

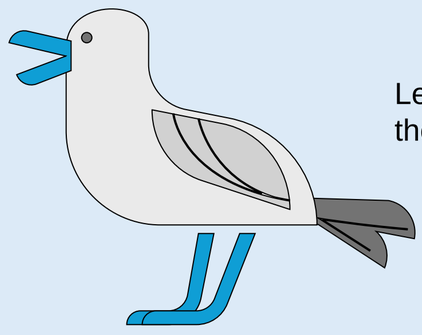
Climate and nature: sustainable offshore wind deployment for 2030 targets

UK Government Target: *50GW of offshore wind by 2030* -The MMO's Strategic Renewables Unit (SRU), working with our licensing and planning colleagues, is ensuring offshore wind (OFW) deployment is sustainable, protecting the marine environment. This is vital given the ongoing climate and nature crises and international targets including the United Nations Sustainable Development Goals.

Setting new standards for monitoring:

- Across 6 environmental receptors, SRU is standardising post consent OFW monitoring requirements.
- **Aim**: a standardised process for reporting of environmental monitoring data, presented in a comparable and accessible format.
- **Project:** SRU reviewed literature and post-consent monitoring data to create a list of standardisation recommendations which were taken to a workshop with government departments, SNCBs and RenewableUK.
- **Output:** monitoring reports meet the recommended standards, enabling easier data sharing and access.
- **Next steps:** feedback from contractors and developers to facilitate implementation.

UN Sustainable Development Goal



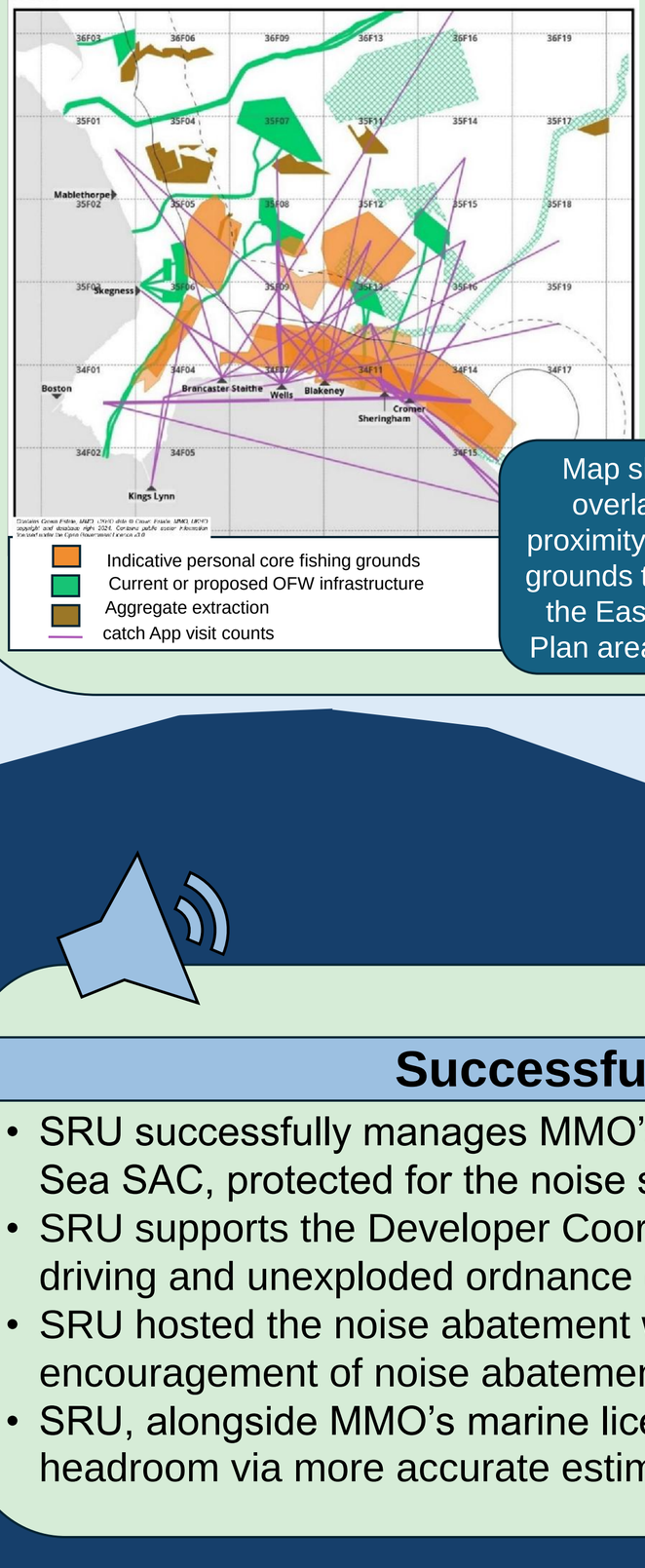
Learn more about these projects here

New project on cable protection:

- **Aim:** To identify and map where external cable protection has been used and consider this against underlying spatial factors to identify any trends in the need for hard protection.
- **Project:** extensive hard protection data collation and creation of 5 data rich case studies, being reviewed to allow better understanding of cable protection requirement and remedial works and impacts.
- **Output:** Publicly available regularly updated geospatial database hosted by MMO.

Mapping the sensitivity of the <12m fishing fleet to OFW:

Figure 10: Potting for crabs and lobster (n=9) in The Wash and north Norfolk coasts



Map showing overlap and proximity of fishing grounds to OFW in the East Marine Plan area (MMO, 2024)

- **Aim:** to understand the spatial distribution of fishing activity and fishery-specific sensitivity of <12m fleet to fill outstanding evidence gaps regarding sustainable OFW deployment.
- **Project:** fisher led participatory mapping of fishing grounds compared to OFW grounds and how sensitive different gear types are to different OFW stages.
- **Results:** fisheries and OWF occur alongside or near each other in the same area or at the same time, but the reality is much more nuanced (full report linked in QR code).

Outcomes:

1. high-resolution data: can be used in environmental statements and development consent orders.
2. Filled knowledge gap on OFW coexistence with fishers.
3. Pilot methodology that can be used in other marine plan areas.

Successfully tackling underwater noise:

- SRU successfully manages MMO's noise tracker, ensuring noise thresholds in the Southern North Sea SAC, protected for the noise sensitive harbour porpoise, aren't breached.
- SRU supports the Developer Coordination Forum to track noisy activity across industry, such as pile driving and unexploded ordnance (UXO) clearance, ensuring cooperation to reduce noise levels.
- SRU hosted the noise abatement workshop to discuss efficacy of various techniques, concluding in encouragement of noise abatement systems.
- SRU, alongside MMO's marine licensing team, implemented a UXO 2-license approach to create headroom via more accurate estimations of UXOs to clear and encouraged low order clearance.

UN Sustainable Development Goal