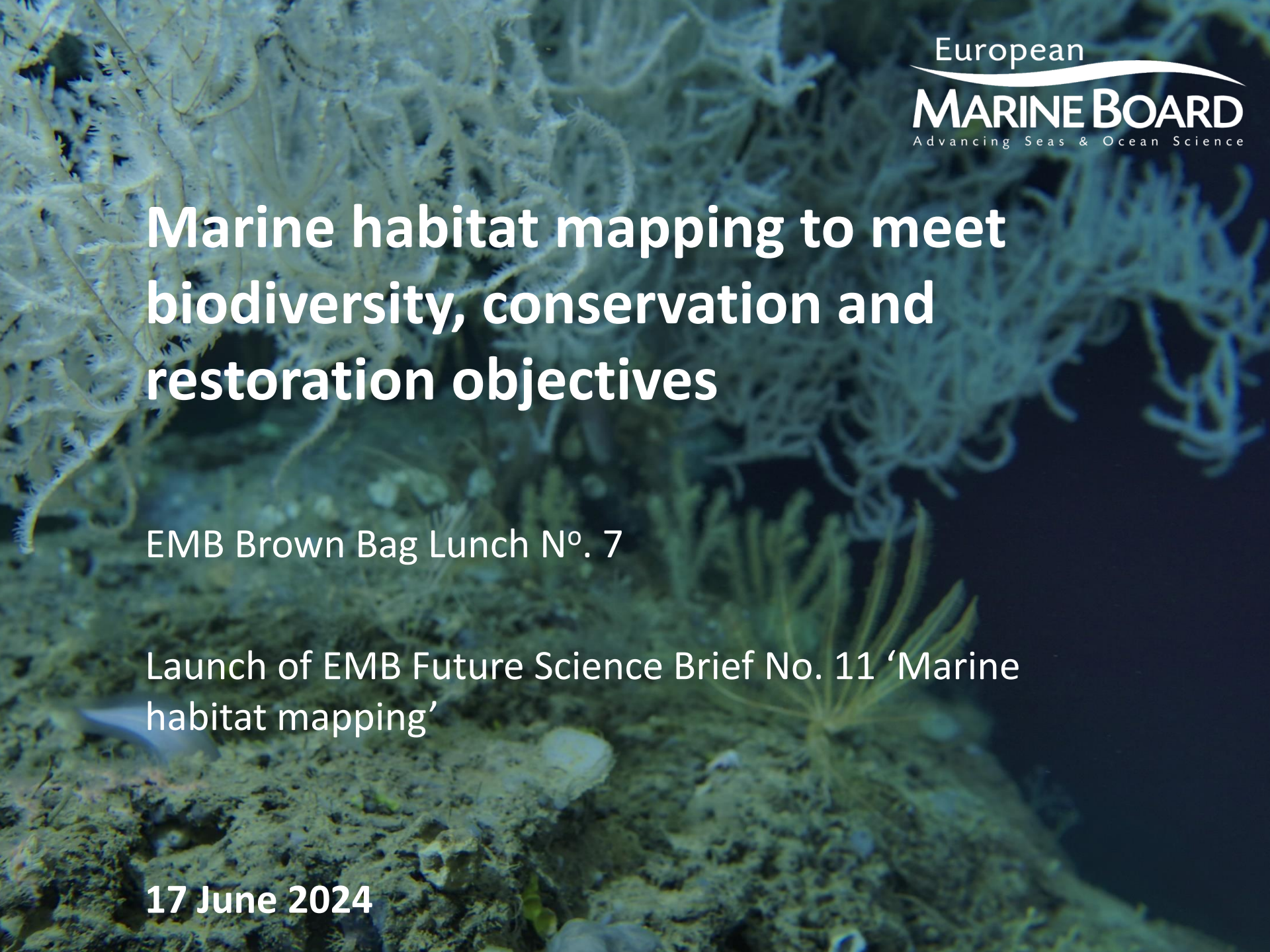

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Marine habitat mapping to meet biodiversity, conservation and restoration objectives

EMB Brown Bag Lunch Nº. 7

Launch of EMB Future Science Brief No. 11 ‘Marine habitat mapping’

17 June 2024

Agenda

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13:00 – 13:05	Welcome	**Fiona Grant** EMB Chair
13:05 – 13:20	Opening statements	**Veronica Manfredi** Director, Zero Pollution and Green Cities Directorate-General for Environment **Andrea Vettori** Head of Nature Conservation Unit, DG Environment
13:20 – 13:50	Presentation of EMB Future Science Brief No. 11 'Marine habitat mapping'	**Simonetta Fraschetti**, Professor of Ecology at University of Naples Federico II & Stazione Zoologica Anton Dohrn (SZN), Italy **James Strong**, Marine Ecologist National Oceanography Centre (NOC), UK
13:50 – 14:30	Interactive discussion	Moderated by **Sheila Heymans**

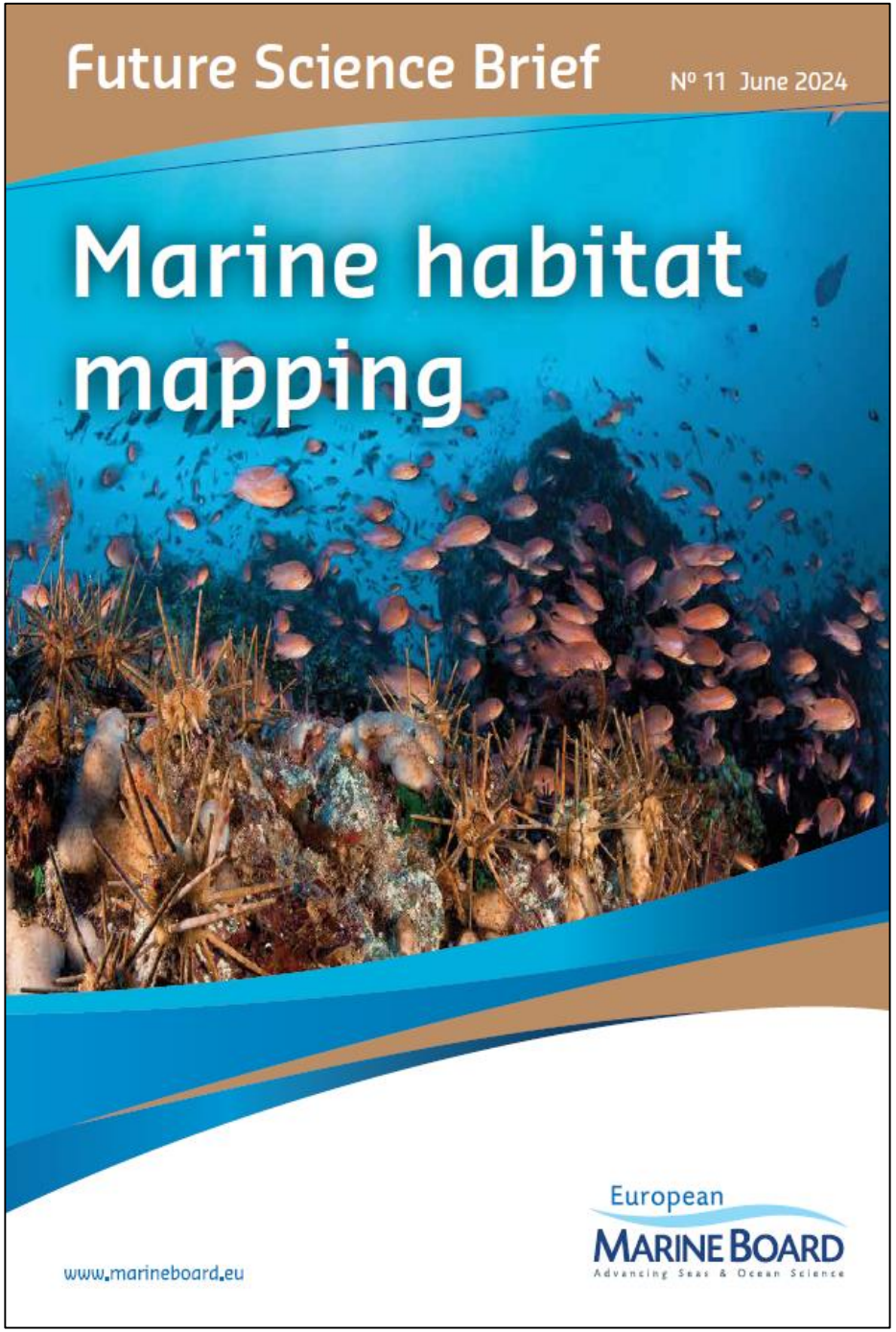

Image credit: Roberto Rinaldi

Prof. Simonetta Fraschetti

Chair of EMB Working Group on Marine Habitat Mapping

Professor of Ecology at University of Naples Federico II & Stazione Zoologica Anton Dohrn (SZN), Italy

Dr. James Strong

Co-Chair of EMB Working Group in Marine Habitat Mapping

Marine Ecologist
National Oceanography Centre (NOC), UK

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EMB Working Group: Marine Habitat Mapping

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Chair: **Simonetta Fraschetti**, University of Naples Federico II & Stazione Zoologica Anton Dohrn (SZN), Italy

Co-Chair: **James Strong**, National Oceanography Centre (NOC), UK

Eimear O'Keeffe, Marine Institute (MI), Ireland
Maria Salomidi, Hellenic Centre for Marine Research (HCMR), Greece
Timm Schoening, Helmholtz Centre for Ocean Research (GEOMAR), Germany
Federica Foglini, Institute of Marine Science (CNR-ISMAR), Italy
Helen Lillis, Joint Nature Conservation Committee (JNCC), UK
Jorge Gonçalves, Centre of Marine Sciences of the Algarve (CCMAR), Portugal
Georg Martin, Estonian Marine Institute, University of Tartu, Estonia
Mats Lindegarth, University of Gothenburg, Sweden
Lene Buhl Mortensen, Institute of Marine Research (IMR), Norway
Lenaick Menot, Ifremer, France
José Manuel González-Irusta, Spanish Institute of Oceanography (IEO), Spain
António Pascoal, Instituto Superior Técnico (IST), Portugal

Kick-off meeting April 2022

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EMB Working Group: Marine Habitat Mapping

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Future Science Brief No. 11
Overview of current state of the art, and future research and policy needs:

- **Chapter 1: Introduction**
  - What is marine habitat mapping, why is it important, key challenges

- **Chapter 2: Collecting data for marine habitat mapping**
  - Current methods and future trends in collecting remotely sensed and *in situ* data; artificial intelligence

- **Chapter 3: Combining data to produce habitat maps**
  - Physical habitat maps; biological habitat maps; distribution models; marine habitat classification schemes; assessing and communicating accuracy and confidence

- **Chapter 4: What and where to map**
  - What has been mapped; gaps in terms of sea basins and habitat types; who uses marine habitat maps and for what purpose; bespoke marine habitat maps

- **Chapter 5: Communication and dissemination**
  - Data dissemination and increasing the value of each map; getting maps into EMODnet; industry data; using marine habitat maps to improve the public understanding of the Ocean.

- **Chapter 6: Overarching recommendations to advance marine habitat mapping**

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Chapter 1: What is marine habitat mapping (MHM)?

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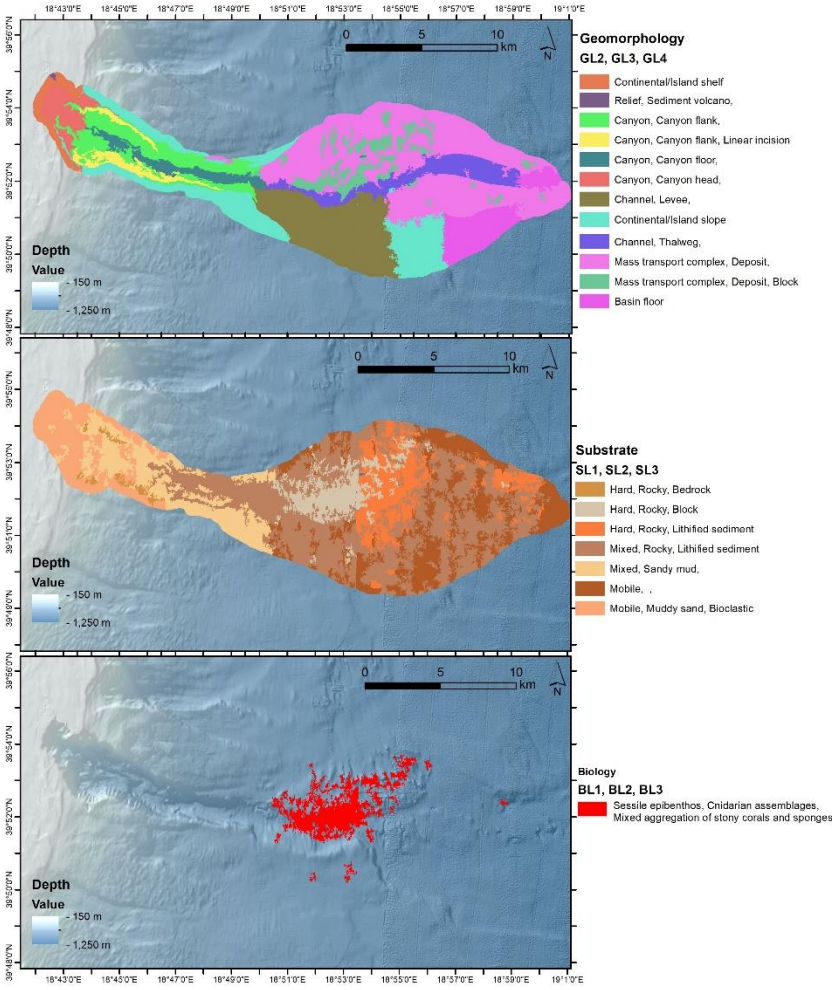
- **What is a habitat? -** A recognizable space which can be distinguished by its abiotic (i.e. physical) characteristics and associated biological assemblages, assessed at particular spatial and temporal scales

- MHM aims to gain a **holistic representation** of the **distribution** of marine habitats in **space and time**

- Characteristics to be mapped depend on the **aims, research/management needs, scale and context** of MHM initiatives.

- Mainly refers to activities to produce maps that completely cover a specified geographical area using a combination of **remotely-sensed techniques**, **direct *in situ* observations** (also referred to as ground truthing) and/or **modelled data**.



Credit: Mariacristina Prampolini (CNR-ISMAR)

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Chapter 1: Why is MHM important?

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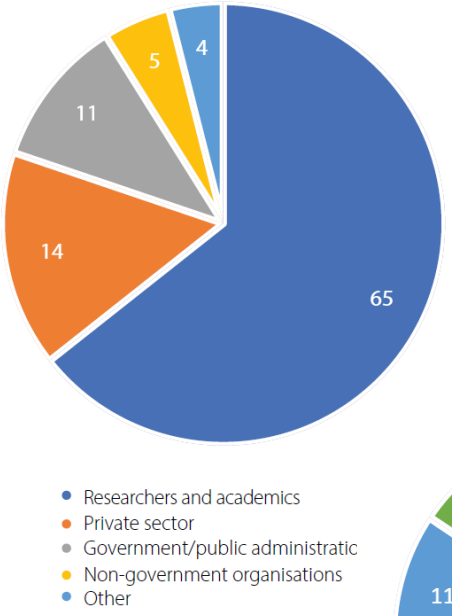
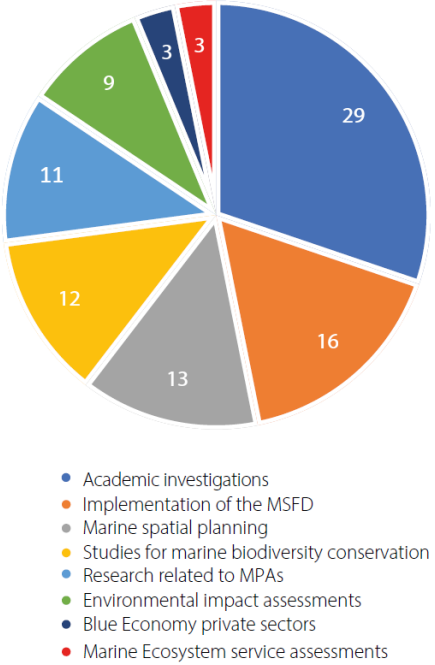
Accurate and extensive marine habitat mapss are fundamental to:

- Enable the **spatial management of human activities** in the marine environment, including Blue Economy sectors
- Provide **insight into changes in vulnerability and potential impact** of human activities
- **Plan and prioritise new areas for protection and restoration**
- **Achieve the objectives of EU Directives** (e.g. MSFD, Habitats and Birds Directives, Biodiversity Strategy, MSP, CFP, Sustainable Blue Economy Strategy, proposed Nature Restoration Law)



Data from EMODnet Seabed Habitats



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Chapter 2: Collecting data for MHM

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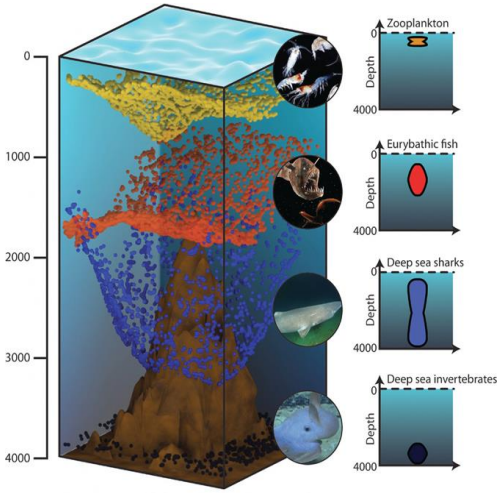
Only a very small fraction of the seabed has been mapped at comparable resolution to that on land. New technologies that increase the spatial coverage of high-resolution direct observations are emerging, and show promise for improving the quality and resolution of MHMs



Credit: Levin et al., 2018

Recommendations:

- Implement **cost-effective** mapping
- Further integrate **artificial intelligence**
- Further integrate **biological data**
- Further integrate **water column data** (currently habitat mapping is benthic)
- Support **temporal/repeat surveys** to capture changes over time/seasonality, particularly ecologically significant spatial units, i.e. hot spots of ecosystem functioning where high rates of change are expected
- Develop stronger **national and regional coordination for shared resources and facilities**.
- Support **public-private research collaboration** for the development of next-generation mapping tools

Credit: G. Castellan (CNR-ISMAR)

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Chapter 2: MHM costs

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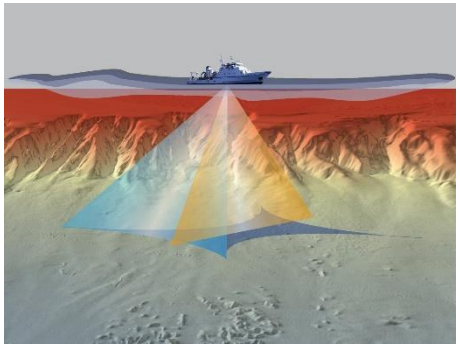
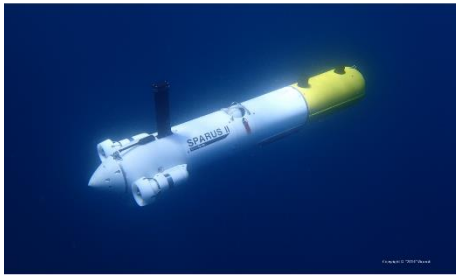
Platform	Data type	EUNIS level achievable (see section 3.3)	Fit-for purpose uses	Potential Extent [km²]	Resolution [m]	Cost [€k/km²]
Satellite	Gravity data to measure bathymetry/ Images	Up to 4	Large-scale/low-resolution inferences on physical/biological habitats, predictive modelling	10 trillion	1000	0.5
Ship >1000m water depth	MBES/SSS	Up to 3	Large-scale/low-resolution inferences on physical habitats, predictive modelling	1000	100	5.1
AUV	MBES/SSS and images	Up to 3	Small-scale/high-resolution inferences on physical habitats, predictive modelling, ground truthing	10	1	3.2
UAV/drone <10 m water depth	Images	Up to 6	Mapping of biological habitats, predictive modelling, ground truthing	0.1	1	0.5
ROV	Images	Up to 6	Mapping of biological habitats	0.1	<0.01	4.3
Small boat <20 m water depth	Images from drop cameras	Up to 6	Mapping of biological habitats, predictive modelling	1	10	1.6
SCUBA diving	Images and *in situ* observations (e.g. species lists)	Up to 6	Mapping of biological habitats, direct mapping of features	1	10	4
Sampling (grabs, dredges cores, etc. using small/big vessels	Sediment and faunal sample	Up to 6	Mapping of biological habitats, predictive modelling	0.1	1	8



Credit: Elisabetta Campiani (CNR-ISMAR)



Credit: Pere Ridao (University of Girona)

Credit: Searover

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Chapter 3: Combining data to produce marine habitat maps

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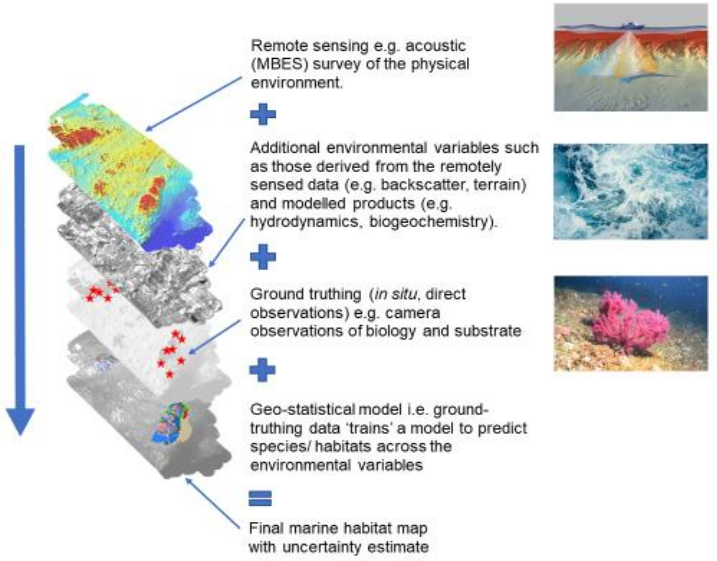
Remotely-sensed data and habitat distribution models are often used to **extrapolate ground truthing observations** across a mapped area.

Recommendation to advance **habitat distribution models** include:

- **Improve datasets** (i.e. training data of species assemblages, finer-scale environmental data)
- **Standardise** the production and validation of spatial models
- Better assess, communicate and standardise **map accuracy and confidence.**



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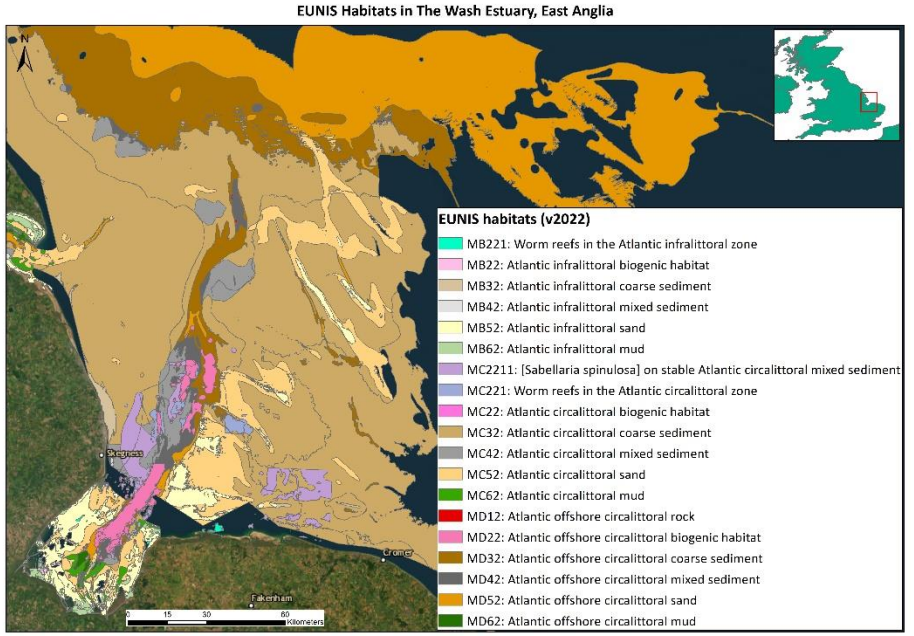
Chapter 3: Habitat Classification Schemes (HCSs)

HCSs are sets of instructions that **identify, delimit and describe habitats** of distinct species and communities by categorising them into “classes”. They are important tools to **compare/combine maps** and **translate into other HCSs** to allow their use for different purposes.

Recommendations for the improvement of HCSs:

- Develop **quantitative definitions of classes within and between habitat classification schemes** for consistent classification and representation of habitats, and in the use of maps to monitor change over time
- **Improve process of revision and future development** of habitat classification schemes.
- Include additional attributes: **sensitivity, conservation value, habitat condition, ecosystem service provision.**



Credit: EMODnet Seabed Habitats

Chapter 4: What has been mapped?

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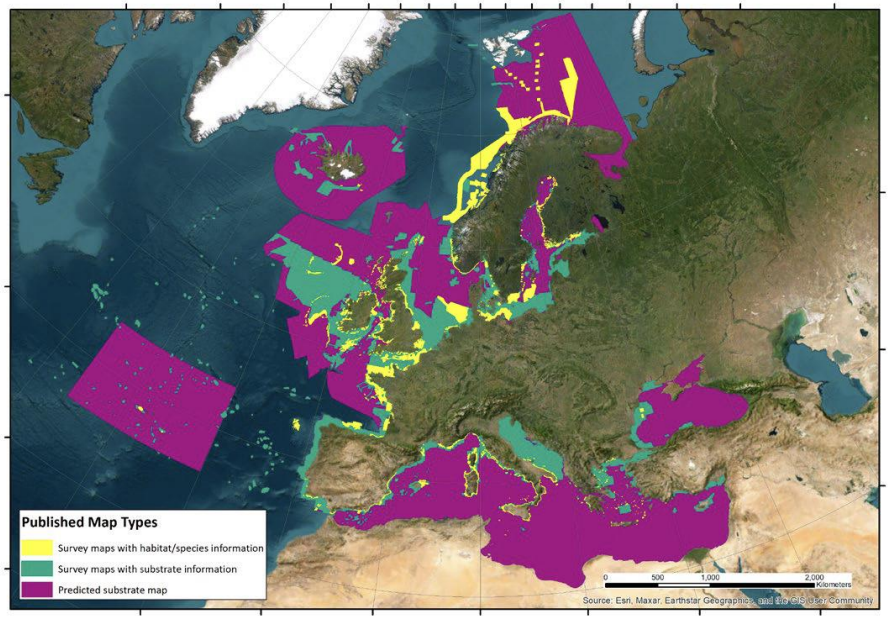
- **EMODnet Seabed Habitats** collate and publish MHM of European waters. Since 2009, almost **1,000 MHMs have been made publicly available**
- **Norway, Republic of Ireland** have **ongoing national programmes seeking to map their entire seabed,** leading to the OSPAR area having the highest percentage map coverage in Europe
- The **North-East Atlantic**, **Mediterranean** and **North Sea** are the **best mapped regional seas** in terms of numbers of available maps
- **Biological habitat maps** generally cover **small areas**, mostly confined to **coastal regions**



Data from EMODnet Seabed Habitats

Recommendations

- **Increase the spatial extent and resolution of biological information in marine habitat maps**
- **Develop specifications for specific types of MHMs**, including required spatial resolution and scale, habitat types, resolution of biological information, accuracy and reporting format
- **Strengthen national, regional, European and international strategic coordination mechanisms for interdisciplinary mapping efforts -** enhanced cooperation on standards, the submission of data into national and European data centres and services, the prioritisation of mapping efforts to fill gaps

MHM and the MSFD

- MHMs are required to facilitate the reporting of **GES status assessments** across the 22 Benthic Broad Habitat Types (BBHT) via the indicators that are used to evaluate the spatial coverage or extent of features or habitats.

- The development of **reliable biological habitat maps covering large spatial scales** is a prerequisite for reliable MSFD assessments.

- The challenge for the 2022 version of the **EUNIS** HCS (and associated BBHT), which uses common terms at level 2 in an endeavour for consistency for all regions, is to **strike a balance between consistent definitions and biologically-relevant definitions across regions**.

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Bespoke MHMs
MHM accuracy and confidence

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Member States often have their own local expert knowledge of habitats and additional available data to **build maps at the scale, extent and level of confidence** that they require for different purposes (e.g. for MSFD reporting).

<u>Recommendation:</u>

- EMODnet Seabed Habitats to work towards producing and promoting best practice guidelines and tools to support Member States in producing **bespoke maps** using MHMs that better answer stakeholders' needs.

- **Consistently and accurately assess and communicate the accuracy of MHMs** so they can be used effectively by end-users who should be able to understand their limitations.

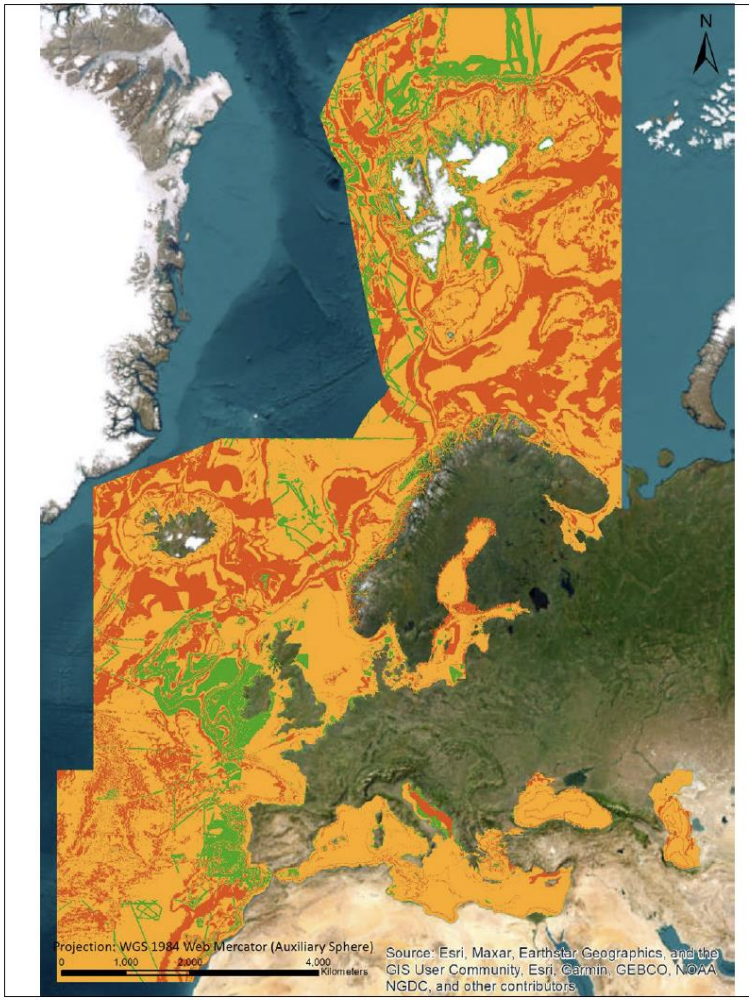

Figure 3.8 The 'confidence' map associated with EUSeaMap (v2023) giving an idication of the quality of the data sources and methods used to create the map. Red = low, orange = moderate and green = high confidence (Vasquez *et al.*, 2023).

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The Habitats and Birds Directives

- MHMs needed for **representative and sufficient implementation of the Natura 2000 network** of protected areas and for assessment of favourable conservation status to account for **changes in areal extent and condition of habitats and species**

- **EUNIS** is used to facilitate Article 17 reporting of the Habitats Directive, which includes reporting the extent of Annex I habitats that Member States must designate, protect and manage

- The Habitats Directive **Annex I habitat types** include **very broad and not very detailed typologies** and more effort is needed to align these with HCSs.

Credit: George Stoyle © NatureScot

What are the gaps?

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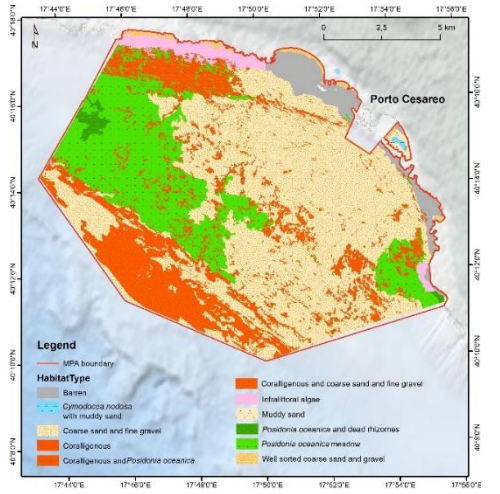
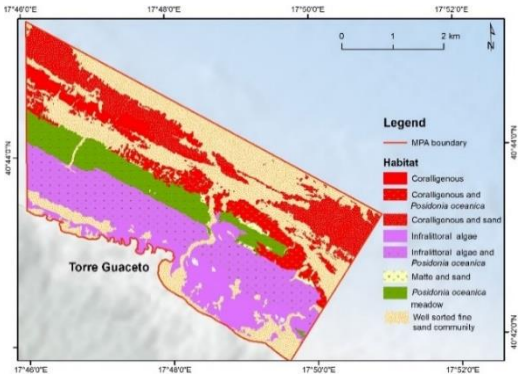
- **Habitat gaps, including the deep sea**
- **Geographical gaps:** the **Mediterranean Sea** (e.g. large areas off North Africa) and **Black Sea** maps have **very low biological coverage**.
- **Gaps in collation of already existing information:** the **consistency and resolution** of coverage for both **common habitats** and those of **conservation importance**
- Habitat **condition** and **degradation** to guide restoration efforts and policies
- In **MPAs** knowledge about biodiversity distribution and status is often incomplete, also in **Natura 2000 sites**





Credit: Mariacristina Prampolini & Simonetta Fraschetti (AMare project)

Recommendations:

- **Increase and improve map coverage across habitat types** (including the water column and processes) **and spatial extent** through national mapping programmes
- **Capture habitat condition (health) in MHMs**
- Additional attributes: **human pressures** and **ecosystem services**

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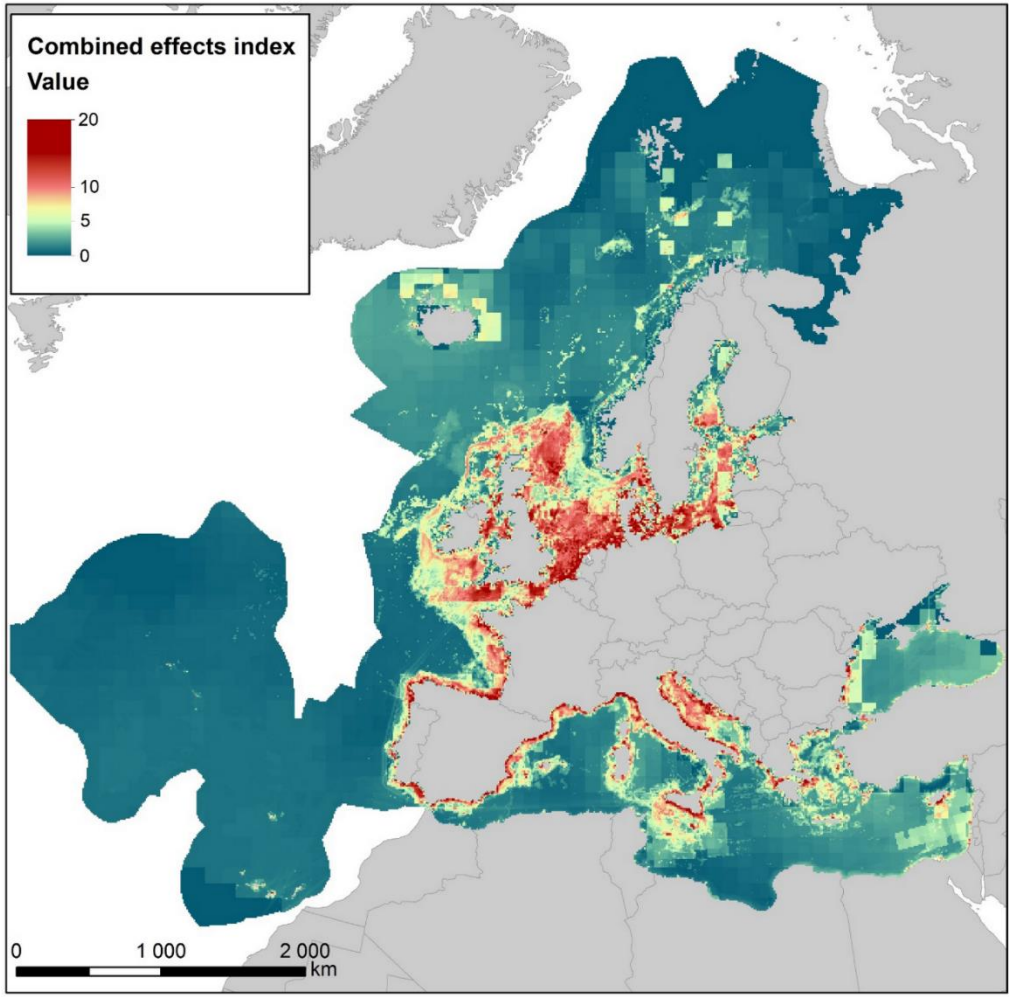
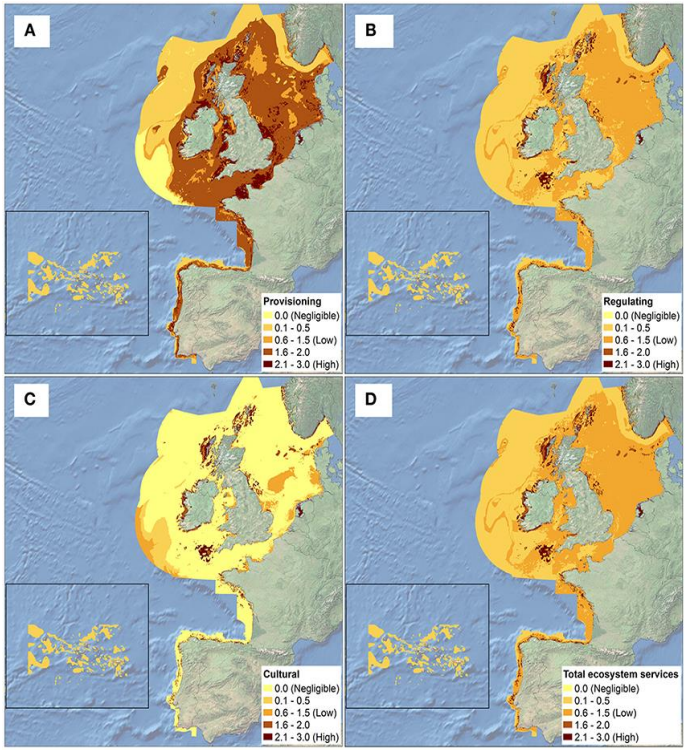
Human pressures and ecosystem services



Combined effects of anthropogenic pressures in Europe's seas (Korpinen et al., 2021)



Maps of ecosystem services: (A) provisioning services; (B) regulating services; (C) cultural services; and (D) total ecosystem services (Galparsoro et al., 2014)

Where to map first? The need for spatial prioritisation

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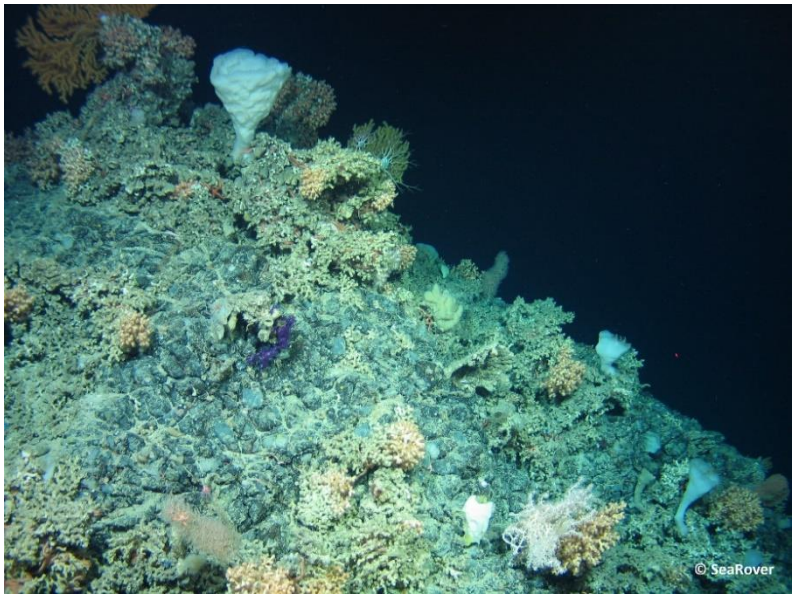
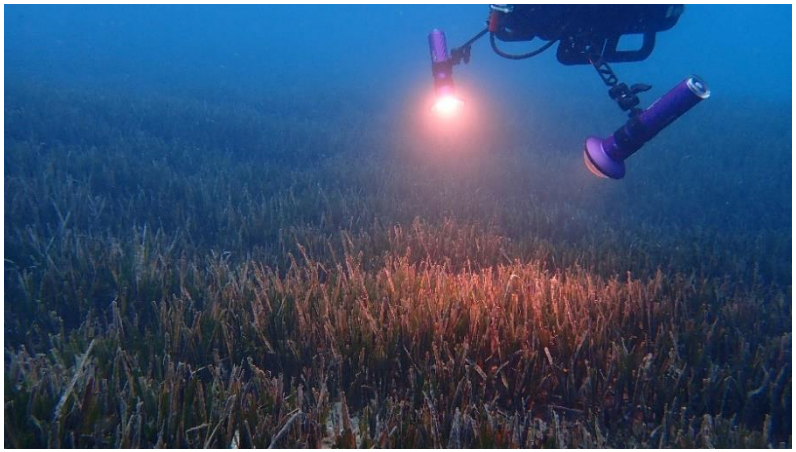
- Use of **decision-support tools** based on scientific knowledge and considering socio-economic constraints. Currently being used in marine spatial planning and systematic conservation planning
- **Spatial prioritisation** to guide the selection of priority areas for MHM. This is currently done on a use-case specific basis
- **Hot spots of ecosystem functioning,** to support the implementation of ecologically relevant, coherent networks of MPAs
- Mapping areas **known to be affected most by human impacts** (e.g. bottom trawling)
- Sites for the **installation of Blue Economy activities**.





Credit: Plan Blue

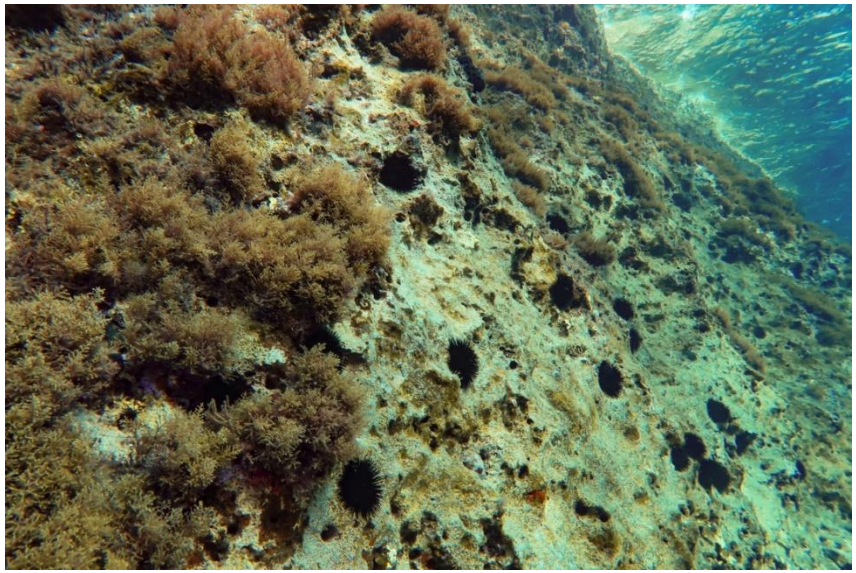
<u>Recommendations:</u>

- **Develop guidelines for the prioritisation of MHM activities** at an international level.

The Nature Restoration Law

- **High-quality data** (i.e. products with a high level of spatial resolution and classification accuracy) on the **distribution of habitats that need to be restored** and the **distribution of human pressures** are important to demonstrate the feasibility of restoration actions, to **inform prioritisation** and to **guide the allocation of the restoration targets**

- An **assessment is needed of how to close the gap** between efforts to describe habitats for GES assessment for the MSFD; the Habitats and Birds Directives; the 30x30 target under the EU Biodiversity Strategy 2030; and prioritisation under the proposed EU Nature Restoration Law.



Credit: Alberto Colletti

Chapter 5: Communication and dissemination

Recommendations:

- Facilitate and incentivise map producers to **publish their maps according to the FAIR principles** and submit data to EMODnet
- Develop **partnerships with wider stakeholders on open data** - to incorporate industry and citizen science data it needs to adhere to the same standards as data acquired for environmental assessments and research purposes
- **Develop accessible mapping products** for Ocean literacy and support citizen science initiatives.

Credit: NOAA Ocean Exploration

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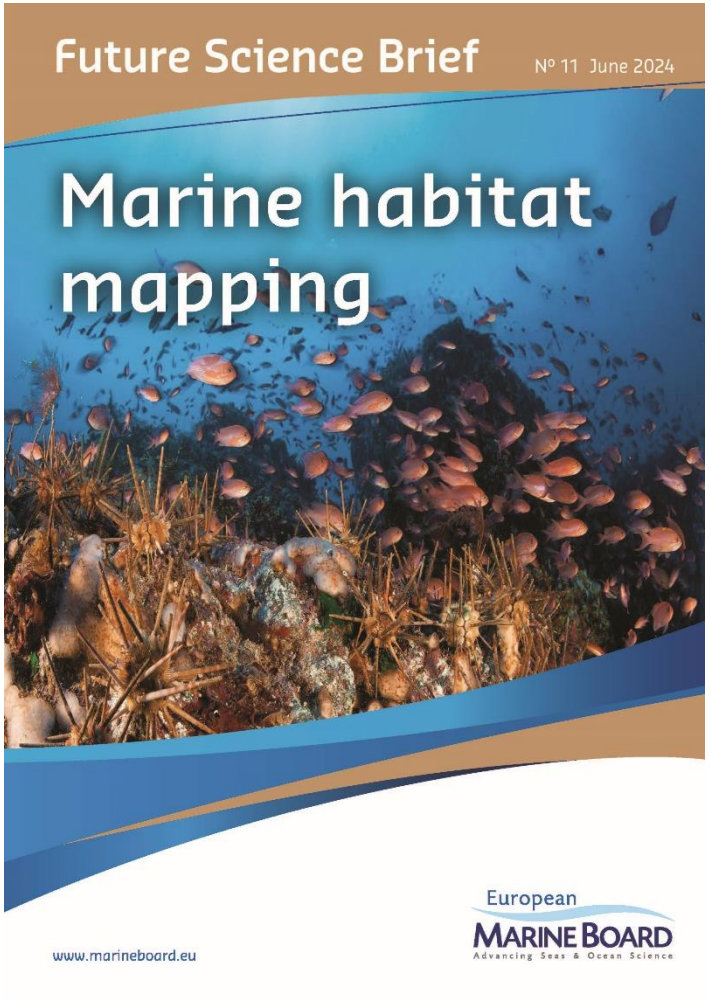

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Interactive Discussion

Not live-streamed/recorded!

Housekeeping rules for online participants:

- Please make sure **your name and institution** is clearly entered so when you ask questions we know who you are.

- To ask questions:

  ⇒ **Post in the Q&A** and the online facilitator will ask your question to the panel.

  ⇒ If you would like to **verbally intervene**, **please raise your hand** and the online facilitor will upgrade you to a panelist.

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Panelists

In-person

- **Simonetta Fraschetti,** University of Naples Federico II & Stazione Zoologica Anton Dohrn (SZN), Italy
- **James Strong,** National Oceanography Centre (NOC), UK
- **Eimear O'Keeffe,** Marine Institute (MI), Ireland

Online

- **Federica Foglini,** Institute of Marine Science (CNR-ISMAR), Italy
- **José Manuel González-Irusta,** Spanish Institute of Oceanography (IEO), Spain
- **Jorge Manuel Dos Santos Gonçalves**, Centre of Marine Sciences of the Algarve (CCMAR), Portugal
- **Mats Lindegarth**, University of Gothenburg, Sweden

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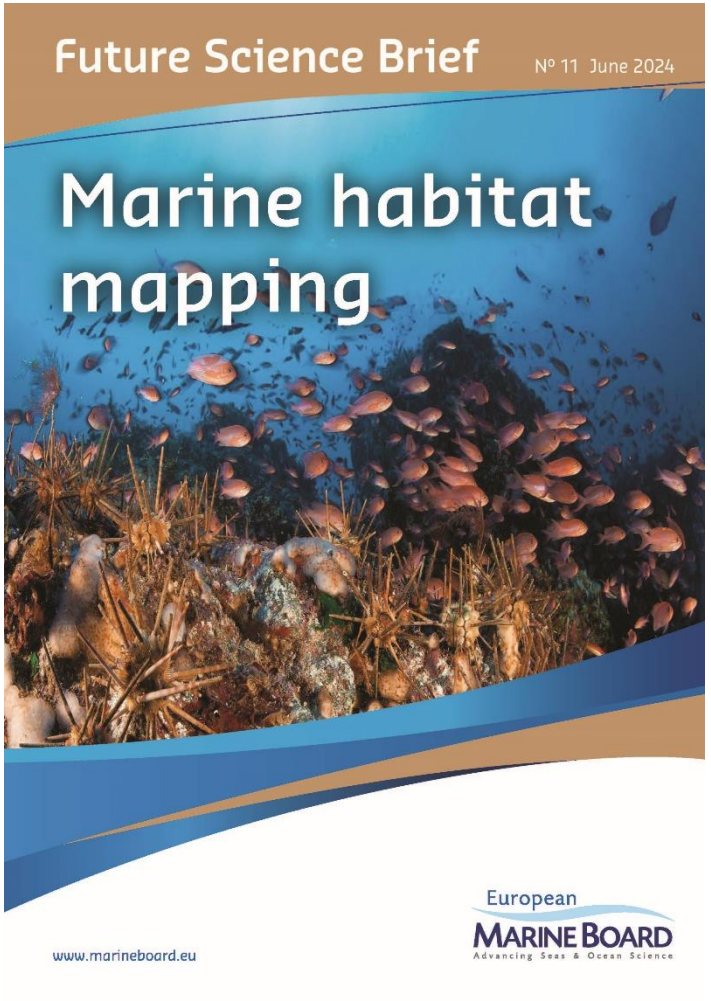

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