



EMODnet



European Marine
Observation and
Data Network

EMODnet Thematic Lot n°3 - Seabed Habitats

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Centralisation Phase

Final Progress Report

Reporting Period: 25/09/2021 – 24/09/2023



Contents

1. Introduction.....	3
2. Update on the Tasks.....	6
3. Work Package updates.....	22
4. Identified issues: status and actions taken.....	33
5. Allocation of project resources	46
6. User feedback.....	47
7. Meetings/events held/attended & planned.....	56
8. Communication assets	74
9. Monitoring indicators.....	87
10. Recommendations for follow-up actions by the EU	90
11. Annex: Other documentation attached.....	91

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1. Introduction

This most recent phase of EMODnet Seabed Habitats began on 25 September 2021 and is led by JNCC (UK). JNCC is joined by nine partners from around Europe: GeoEcoMar (RO), IO-BAS (BG), HCMR (GR), ISPRA (IT), MI (IE), CCMAR (PT), Ifremer (FR), GEUS (DK) and SYKE (FI). Five subcontractors, the Danish Hydraulic Institute (DHI), National Institute of Aquatic Resources (DTU Aqua), Norwegian Institute for Water Research (NIVA), South Atlantic Environmental Research Institute (SAERI) and Stockholm University (SE) further bolster the consortium. This consortium assembles a complimentary set of specialists in benthic ecology, spatial habitat modelling, data collation and management, web delivery, geology, oceanography and marine policy.

The general objective of this phase of EMODnet is to further develop an operational service whereby marine data and data products built with common standards can be found, viewed and downloaded in a way that is free of charge and free of restrictions of use. The geographical scope of this phase has been expanded to include complete coverage of the Caspian Sea and jurisdictional waters of EU Member States in the Caribbean Sea. The thematic scope has also been expanded to include coastal wetlands and essential fish habitats (EFH), so that the Lot would now be more appropriately-named, simply, ‘Habitats’. Specific requirements related to Lot 3 Seabed Habitats (SHs) are listed below, with some background and a description of our practical interpretation of the requirements:

- *Data and metadata to be made available:*
 - ***benthic surveys, essential fish habitats in three regional seas, and coastal wetlands classified by type***

The collation, standardisation and publication of ground-truthing data and metadata from **benthic surveys** began in the 2019-2021 phase of EMODnet SHs. The consortium designed a data schema that was compatible with the Darwin Core Archive format that was used for species observations by EMODnet Biology, with the long-term goal of integrating the databases. We deem this to be necessary considering that a point observation of a habitat is likely to be coupled with observations of species from that same record.

Essential fish habitats (EFH) was a new sub-theme introduced in this phase. The three priority regions we selected are the Mediterranean, Baltic and Northeast Atlantic because in these regions EFH data have a history of use by decision-makers. Because it was a new sub-theme, the first requirement was to develop standard vocabularies, data schemas and protocols.

With the role of **coastal wetlands** in reducing flood damage and storing carbon we welcomed the introduction of this new sub-theme. It should be noted that the term ‘coastal wetland’ is not distinct from ‘seabed habitat’ because ‘wetlands’, particularly in the context of the Ramsar Convention, also includes categories related to shallow marine waters. ‘Coastal’, on the other hand, is distinct from ‘seabed’ – the geographical scope of ‘seabed’ is typically from the high-water mark downwards, encompassing everything from the intertidal (AKA littoral) to the abyssal zone. ‘Coastal’ tends to refer to the areas adjacent to the sea, starting from the high-water mark. Consequently, we interpret the term ‘coastal wetland’ to include both coastal habitats and coastal physiographic features such as estuaries and lagoons. As a result of the lack of a clear distinction between the meaning of seabed habitats vs coastal wetlands, we decided to adopt the same protocols and data schemas as used for seabed habitat data and maps for coastal wetlands.

The *Data and metadata* requirements are being fulfilled within WP2 Data Collation and involves all partners.

- *Data products to be made available:*
 - **a base layer of modelled habitats** at a scale of 1:100,000 or better for all sea basins using common EUNIS classification, taking into account the latest revisions
 - **access to the data products** (energy, opacity, etc.) **used to construct these modelled habitats**
 - **a library of digital habitat maps** from national and regional collections as well as from completed EU projects. Where feasible, **collections shall be combined and harmonised into single layers**

The **base layer of modelled habitats** is what we called the EMODnet broadscale seabed habitat map for Europe, or EUSeaMap. This activity began in the first phase of EMODnet SHs and the map has grown and improved in every phase. The biggest task in this phase was to expand EUSeaMap to include the new geographic regions: the Caspian Sea and territories of the Caribbean Sea. The biggest challenges here included identifying the best sources of data and data products to use as inputs to these models, producing new models of the environmental variables, understanding the ecology of the regions, and devising a new classification system that is compatible with EUNIS and the EUSeaMap method. This requirement was fulfilled in WP1 EUSeaMap.

Access to the data products used to construct the model (and, in fact, access to all data and products produced in the project) was fulfilled through the activities of WP4 Portal. But the production and gathering of input data products was covered by WP1 EUSeaMap.

The **library of digital habitat maps** has been an ongoing activity since phase 2 of EMODnet SHs. It began with maps classified to the EUNIS classification system. In the following phase we began accepting Habitats Directive Annex I maps. Subsequently we began to accept regional classification systems such as HELCOM Underwater Biotopes (Baltic). In this new phase, we have also included maps of EFH and coastal wetlands as part of this activity, which has been fulfilled in WP2 Data Collation.

The requirement for **collections to be combined and harmonised into single layers** has featured since phase 3 of EMODnet SHs. This has been fulfilled in WP3 Composite Data Products, which is the term we use to refer to these types of products. The specific data products we have produced are driven by the requirements of stakeholders such as regional sea conventions and EU Member States fulfilling MSFD reporting requirements, which were gathered as part of WP5 Communication and Outreach.

- *For the first six months of the project, a **thematic portal***

The thematic portal, www.emodnet-seabedhabitats.eu, was operational from day 1 of this phase, continuing from the previous phase. This was decommissioned in January 2023 and all pages redirected to the new central portal. This work was part of WP4 Portal.

- *Information for central portal*
 - **Metadata, data and data products through web services**
 - *Content for space on central portal including summaries of meetings, quarterly progress reports, uses cases, list of partners*

The publication of **metadata, data and data products via web services** has been a core component of EMODnet SHs since phase 1. The difference in this phase is that we were no longer required to directly

maintain and update the functionality and content of the theme-specific portal and map viewer. Now the transition to the central portal map viewer is complete, we are no longer responsible for controlling the functionality, but we maintain some responsibility over how the seabed habitat layers are presented, and which functionality improvements are prioritised.

2. Update on the Tasks

Task 1: Maintain and improve a common method of access to data held in repositories

We have developed and published an updated data exchange format (DEF) for seabed habitats that can accept coastal wetland maps (D2.03, D2.08) and a new DEF for Essential Fish Habitat (EFH) maps. We have also produced new submission guidance and confidence assessment methods (D2.11) and published two vocabularies to the NERC Vocabulary Server (D2.09) for these new map types. We have also produced the first known translation table between the Ramsar Classification System for Wetland Type and Annex I of the Habitats Directive (D2.07). We have been working to change our point data submission process so that habitat observation data is submitted to EurOBIS/EMODnet Biology. We have produced an updated data template based on the Darwin Core schema alongside a guidance document and have provided training to partners. We have submitted several datasets and are able to harvest habitat ground-truthing data from EMODnet Biology/EurOBIS via web services in conjunction with the species occurrence data. However, it is not yet possible to query and download habitat data specifically via the EMODnet viewer as this requires further development.

Task 2: Construct products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space

In the new EUSeaMap 2023 release (D1.11 and D1.12), the product was updated in all existing product regions and extended to two new regions, the Caribbean Sea and the Caspian Sea. For these new regions, environmental datasets were produced (D1.07 and D1.08) and EUNIS-compatible seabed habitat classification schemes were developed (D1.05 and D1.06). For the updated regions, progress was made in integrating new data on seabed substrate (D1.01 and D1.02), bathymetry (D1.01 and D1.02), salinity (D1.09), and waves.. Habitat descriptor class boundaries were defined for the new regions, and re-examined in some other regions (D1.10). Python scripts were also developed and published to allow anybody to use a combination of environmental data products from CMEMS (which give values at fixed depths below sea level) and the EMODnet Bathymetry DTM to calculate environmental conditions at the seabed, for any area and time period of interest (D1.14).

WP3 was dedicated to the construction of new products and updates to existing composite data products. These products, created by combining data from multiple sources, are designed to provide the best available evidence regarding the extent and distribution of specific habitats. During this phase, we updated the following products: Biogenic substrate in Europe; Essential Ocean Variable (EOV) layers: Live hard coral cover, Seagrass cover, Macroalgal canopy cover; MSFD broad habitats in the northeast Atlantic; and Coralligenous and other calcareous bioconcretions in the Mediterranean (for RAC/SPA). Additionally, we developed a new EOV product for mangrove cover and a harmonized layer for coastal wetlands in Europe.

Task 3: Develop procedures for machine-to-machine connections to data and data products

Using machine-to-machine connections, the EMODnet Central Portal is able to harvest and display all the layers provided by the EMODnet SHs web service (D4.10). Where appropriate, we use machine-to-machine connections to harvest layers directly from the source, such as the HELCOM Marine and Data Service and Finnish Environment Institution - VELMU service (D4.16). During this phase we have developed a list of point datasets, maps and models available via machine-to-machine connections (D2.16), and criteria to assess whether these should be accessed via machine-to-machine connection or downloaded and ingested into the EMODnet Seabed Habitats holdings directly. For an individual point dataset or a map that is the result of a

single survey, our preference is to access the original dataset so that the data schema and habitat classification schemes may be standardised and republished in these standard formats – making it more FAIR.

Task 4: Contribute data, data products and content to a central portal that allows users to find, view and download data and data products

During this phase we have added a significant amount of new data: 36,301 habitat point observations; 141 maps from survey including new maps of coastal wetlands in the Ramsar classification system; 20 modelled maps of specific habitats, 11 composite products, 47 essential fish habitat maps and models and seven layers showing environmental variables that influence habitat type. As a portal with a significantly large number of products on offer, we worked with the central portal team to transfer our priority layers to the central portal (CP) viewer. We continue to work with them to facilitate the optimum display of EMODnet SHs data and implement updates in response to user feedback.

Task 5: Contribute content to dedicated spaces in the Central Portal

We have worked in close collaboration with the EMODnet Secretariat to ensure that the static content, including web page text, tools and guidance, reports and use cases from the Seabed Habitats portal, was appropriately incorporated into the CP. WP5 has produced infographics and story maps relating to SHs outputs, at a basin level (D5.11) and detailing the products suite available for SHs (D5.14). Tutorials on creating new maps (D5.04) and formatting habitat maps using templates to simplify the data submission process (D5.06) were delivered. Procedural guidelines for data re-formatting were also delivered (D5.05). Identification and recording of relevant ‘Use Cases’ has been carried out using the project’s ‘Use Case’ log (D5.10).

Task 6: Ensure the involvement of regional sea conventions (RSC)

The outcomes of our engagement process with the RSCs have been summarised in a report, ‘Updated Review Of RSC Needs’ (D5.02), and influenced the development of the composite data products and EUSeaMap (D5.01). For example:

- A vital data product was provided to the OSPAR ICG-COBAM for their assessment of the extent of physical damage to the seabed. We also assisted in producing the OSPAR threatened and declining habitat 2022 dataset and published this via EMODnet SHs.
- Update of a harmonised Coralligenous and other calcareous bioconcretions data product, which will facilitate RAC/SPA activities in the Mediterranean.
- Presented EUSeaMap at the Scientific Conference On Climate Change in the Caspian Sea Region which was organised by CASPCOM and the Tehran Convention, hosted by UN Environment Programme.

Task 7: Contribute to the implementation of EU legislation and broader initiatives for open data

We have engaged with working groups and expert groups such as the MSFD Benthic Technical Group and ICES Working Group on Marine Habitat Mapping to gather feedback and requirements be used to inform Seabed Habitat deliverables. Several members of the consortium were members of the European Marine Board’s Marine Habitat Mapping Working Group, tasked with writing a ‘future science brief’ on habitat mapping in Europe. The project has delivered a translated version of the combined EUNIS habitat map for the northeast Atlantic (originally produced for OSPAR) that shows MSFD Benthic Broad Habitats so that it could also be used for EU Member States’ MSFD assessments.

Task 8: Monitor quality/performance and deal with user feedback

For monitoring and reporting web performance, we have been proactive in providing suggestions regarding reporting regions, categories and units for summarising seabed habitat data in a streamlined, logical and useful

way. We have developed a new protocol to allow a more automated, repeatable approach to summarising this information for the reports. We receive instant alerts about web performance problems and resolve them as necessary. We had one instance of prolonged downtime during March of year 2. This was due to a problem with an external Web Map Service from which we cascade several Geoserver layers. To mitigate against this issue we have made changes to the way we interact with external services to utilise more direct data ingestion rather than cascading of services. During year 2 we upgraded our Geoserver in response to a high priority critical bug raised by the central team.

Task 9: Maintain the existing thematic web portal for a maximum of 6 months from the start of the project

We maintained the old seabed habitat thematic web portal until the 23rd January 2023. Prior to this we ensured that the necessary re-directs to the central portal were in place and that all the priority content had either been transferred or was made available via the central portal.

Status of the Milestones and Deliverables listed in the workplan					
Milestone/Deliverable in numerical order	WP	Date due	Status (To do/ Delivered/ Delayed)	Date delivered	If Delayed: reason for delay and expected delivery date
D1.01: Modified substrate data product including biogenic substrate and data not possible to include in EMODnet Geology product, but which would improve the broad-scale seabed habitat map for Europe (EUSeaMap) [dependent on new product from Geology]	1	25/05/2023	Delivered	02/08/2023	
D1.02: Confidence layer for modified substrate data product published	1	25/05/2023	Delivered	02/08/2023	
D1.03: A ready-to-use DTM for EUSeaMap	1	25/05/2023	Delivered	31/03/2023	
D1.04: Confidence layer for the DTM product published	1	25/05/2023	Delivered	09/10/2023	
D1.05: EUNIS-style habitat classification in the Caspian Sea for	1	25/09/2022	Delivered	31/12/2022	

broad-scale habitat mapping					
D1.06: EUNIS-style habitat classification in the Caribbean Sea for broad-scale habitat mapping	1	25/12/2022	Delivered	31/12/2022	
D1.07: Environmental layers for the Caspian Sea ready for EUSeaMap	1	25/12/2022	Delivered	30/09/2022	
D1.08: Environmental layers for the Caribbean Sea ready for EUSeaMap	1	25/12/2022	Delivered	31/12/2022	
D1.09: Halocline layer for the Baltic Sea ready for EUSeaMap	1	25/05/2022	Delivered	25/08/2022	
D1.10: Thresholds for Caspian, Caribbean, Baltic, and Mediterranean Seas	1	25/05/2023	Delivered	31/03/2023	
D1.11: Broad-scale seabed habitat map for Europe, Caribbean Sea, and Caspian, in EUNIS 2019 and MSFD broad habitat classifications, including a column that describes the habitat descriptor classes	1	25/09/2023	Delivered	06/10/2023	
D1.12: Confidence assessment for updated broad-scale seabed habitat map in all considered classifications	1	25/09/2023	Delivered	06/10/2023	
D1.13: Confidence associated to all environmental layers published	1	25/09/2023	Delivered	06/10/2023	
D1.14: A R script automating the	1	25/09/2022	Delivered	25/10/2022	

calculation of environmental layers at the seabed from a CMEMS product archives					
D1.15: Technical report published	1	25/09/2023	Delivered	11/10/2023	
D1.16: Well-documented R code and ArcGIS models used to construct the broad-scale seabed habitat map	1	25/09/2023	Delivered	13/11/2023	
D1.17: For Swedish waters, a modelled habitat map based on Geology's novel type of seabed substrate map for habitat modelling [dependent on applicability if this new type of map to habitat modelling]	1	25/12/2022	Cancelled	NA	Cancellation of this deliverable accepted by CINEA and DG MARE on 14 September 2022.
D2.01: An expanded library of maps of communities, biocenoses, biotopes and habitats for all of Europe, Caribbean Sea and Caspian Sea ingested and converted to a standard format, with metadata for every map	2	25/2/22-25/8/23	Delivered	01/09/2023	
D2.02: An expanded collation of point records of communities, biocenoses, biotopes and habitats for all of Europe, Caribbean Sea and Caspian Sea ingested and converted to a standard format,	2	25/2/22-25/8/23	Delivered	01/09/2023	

with metadata for every dataset					
D2.03: Updated and integrated templates for habitat map data exchange formats	2	25/11/2021	Delivered	30/06/2022	
D2.04: Webinars, tutorials or other forms of training material on the EMODnet Seabed Habitats data submission process	2	25/12/2021	Delivered	31/03/2022	
D2.05: An expanded library of modelled maps of specific habitats for all of Europe ingested and converted to a standard format, with metadata for every dataset	2	25/2/22-25/8/23	Delivered	01/09/2023	
D2.06: Evidence of use of the EMODnet Ingestion and safe-keeping of marine data facility for ingesting data points, maps and models from third parties	2	25/09/2023	Delivered	22/09/2023	
D2.07: Translation tables for coastal wetland types into one or more standard classifications	2	25/01/2022	Delivered	30/09/2022	
D2.08: A data submission process and protocol for coastal wetlands types maps and points	2	25/01/2022	Delivered	30/06/2022	
D2.09: Controlled vocabulary lists for classification systems published on NERC	2	25/12/21-25/08/23	Delivered	17/08/2023	

Vocabulary Server, as required					
D2.10: A library of maps of Essential Fish habitats maps for major fish species in the Mediterranean, North East Atlantic and Baltic Sea ingested and converted to a standard format, with metadata for every map	2	25/2/22-25/8/23	Delivered	01/09/2023	
D2.11: A data submission process and protocol for Essential Fish Habitats maps	2	25/01/2022	Delivered	30/06/2022	
D2.12: Formal protocol for data sharing and identification of relevant benthic data between EMODnet Biology and EMODnet Seabed Habitats	2	25/09/2022	Delivered	03/10/2022	
D2.13: Updated data model and guidance for benthic point data	2	25/09/2023	Delivered	22/09/2023	
D2.14: A standard transformation between OSPAR T&D data schema and OBIS Schema to enable import into OBIS, including a test pilot run using the 2022 OSPAR T&D database	2	25/09/2022	Delivered	21/09/2023	
D2.15: Agree a protocol with the OSPAR commission for the continued archiving of the public database within the	2	25/09/2023	Delivered	24/09/2023	

OBIS network, pending success of D2.14					
D2.16: List of point datasets, maps and models available via machine-to-machine connections	2	25/11/21-25/8/23	Delivered	26/08/2023	
D2.17: Progress log for the ingestion of point data, maps and models	2	25/10/21-25/09/23	Delivered	31/10/2022	
D3.01: A list of products to be created or updated and product specifications	3	25/03/2022	Delivered	19/10/2022	
D3.02: A combined, harmonized data product showing the best evidence for extent and distribution of the Essential Ocean Variable "Live hard coral cover" in Europe, with metadata (updated)	3	25/08/2023	Delivered	18/09/2023	
D3.03: A combined, harmonized data product showing the best evidence for extent and distribution of the Essential Ocean Variable "Seagrass cover" in Europe, with metadata (updated)	3	25/08/2023	Delivered	21/09/2023	
D3.04: A combined, harmonized data product showing the best evidence for extent and distribution of the Essential Ocean Variable "Macroalgal canopy coral cover" in Europe, with metadata (updated)	3	25/08/2023	Delivered	18/09/2023	

D3.05: A combined, harmonized data product showing the best evidence for the extent of wetland type in Europe, Caspian Sea and the Caribbean, with metadata (new)	3	25/04/2023	Delivered	23/05/2023	
D3.06: Data contributed to a harmonized data product showing the best evidence for extent and distribution of the Essential Ocean Variable "Mangrove cover and composition", with metadata (new, if required)	3	25/08/2023	Delivered	19/08/2023	
D3.07: Evaluation of EFH approaches to determine map suitability to combine into products useful for fisheries management and biodiversity conservation	3	25/05/2023	Delivered	30/06/2023	
D3.08: Combined, harmonized data products showing the best evidence for extent and distribution of habitats defined in other classifications in all regions, with metadata, depending on stakeholder needs (new)	3	25/08/2023	Delivered	18/9/2023	
D3.09: An updated combined, harmonized data product showing the best evidence for the extent of biogenic substrate in all regions,	3	31/05/2023	Delivered	12/06/2023	

with metadata (updated)					
D3.09: An updated combined, harmonized data product showing the best evidence for the extent of biogenic substrate in all regions, with metadata (updated)	3	25/01/2023	Delivered	12/06/2023	
D3.10: Report detailing the construction of the biogenic habitat data product (updated)	3	25/05/2023	Delivered	30/09/2023	
D3.11: Report(s) detailing the construction of the data products defined by stakeholder needs (new)	3	25/09/2023	Delivered	30/09/2023	
D3.12: Report detailing the construction of the Essential Ocean Variable data products (updated)	3	25/09/2023	Delivered	25/09/2023	
D4.01: A web portal including a digital map, facilities for downloading data, metadata search and technical information	4	25/09/2021	Delivered	25/09/2021	
D4.02: Contribute to EMODnet Technical Working Group as necessary	4	As necessary	Delivered	04/05/2023	
D4.03: Minutes & actions from Technical Working Group within 1 month of meeting	4	Within 1 month of each meeting	Delivered	05/05/2023	
D4.04: Ad hoc changes to website and visual identity, as requested by Secretariat	4	25/10/21-25/03/22	Delivered	30/09/2022	

D4.05: A set of data schema standards for the provision of habitat data, built upon international standard.	4	25/09/2021	Delivered	25/09/2021	
D4.06: Method for indirect cascading of problematic external services prior to onward publication	4	25/12/2022	Delivered	11/11/2022	
D4.07: Habitat ground-truthing data from EurOBIS extracted via web services	4	25/12/2021	Delivered	16/11/2023	We are technically able to harvest habitat ground-truthing data from EMODnet Biology/EurOBIS via web services in conjunction with the species occurrence data. However, It is not yet possible to query and download habitat data specifically via the EMODnet viewer as this requires further development to expand the API filter which cannot occur until the last 2023 viewer version is complete, a work that requires the intervention of Bilbomatica. Full delivery will be in the next phase.
D4.08: IPT (or alternative) infrastructure for the publication of habitat data into EurOBIS	4	25/08/2023	Delivered	30/09/2022	

D4.09: Internal database of unpublishable habitat data for use in WP1 and to aid public discoverability	4	25/09/2021	Delivered	25/09/2021	
D4.10: A GeoServer web-server for the provision of OGC spatial web-services (WMS, WFS, WCS)	4	25/09/2021	Delivered	25/09/2021	
D4.11: A plan of action for the provision of key habitat datasets as attributed raster data	4	25/08/2022	Delivered	26/09/2022	
D4.12: A GeoNetwork INSPIRE-compliant metadata instance with OGC CSW capabilities	4	25/09/2021	Delivered	25/09/2021	
D4.13: Publication to the central portal of relevant data and products collected and created under WP1 and WP2	4	25/03/22 with updates at least every 6 months	Delivered	22/09/2023	
D4.14: Website liaison and training node between lot partners/content creators and central portal team.	4	25/09/2021	Delivered	25/09/2021	
D4.15: Transfer of key habitat mapping resources from the thematic portal to the central portal	4	25/09/2022	Delivered	25/09/2022	
D4.16: Direct link to the HELCOM Mapping and Data Service, and similar services from other Regional Sea Conventions where feasible	4	25/03/2022	Delivered	30/06/2022	

D4.17: A direct data link to the ICES VME database, providing access to vulnerable marine ecosystem data	4	25/03/2022	Delivered	31/03/2022	
D4.18: Tracked issues and suggestions regarding the portal and services, and improvements made as a result.	4	25/09/2021	Delivered	25/09/2021	
D4.19: Abstracts submitted for annual INSPIRE conference and participation in community forum where relevant.	4	depends on conference dates	Cancelled		Cancellation of this deliverable accepted by CINEA and DG MARE on 23 August 2022.
D4.20: Publication of relevant products, datasets and services through EOSC and EUODP	4	25/12/2022	Delivered	30/06/2023	
D4.21: Live operation of help desk 9-5, Mon-Fri	4	25/10/2021	Delivered	25/09/2021	
D4.22: Collated anonymous questions and answers published on the portal and through RSS (or alternative mechanism after portal retirement).	4	25/10/2021	Cancelled	NA	It was agreed with CINEA in the previous phase that this was no longer required
D4.23: Provision of Matomo (or similar as steered by secretariat) web analytics information to secretariat for reporting	4	25/09/2021	Delivered	25/09/2021	
D4.24: Statistics from OGC webservice usage - to be guided by secretariat.	4	25/12/2021	Delivered	30/09/2021	

D5.01: Evidence of efforts to ensure maximum coherence with data delivery to and from regional sea conventions	5	25/09/2023	Delivered	25/09/2023	
D5.02: Updated review of RSC needs	5	25/01/2022	Delivered	16/12/2022	
D5.03: Liaise with ICES in advance of annual WG meetings to ascertain products they require for reporting on ToRs	5	25/05/2022, 25/05/2023	Delivered	31/08/2022	
D5.04: Tutorials for creating new maps from existing data	5	25/03/2023	Delivered	26/03/2023	
D5.05: Promotion of simple procedural guidelines for creating alternative data formats from existing data formats	5	25/03/2023	Delivered	26/03/2023	
D5.06: Tutorial on how to format habitat maps using templates and to simplify the data submission process.	5	25/03/2023	Delivered	31/03/2022	
D5.07: Evidence of engagement with relevant working groups and expert groups to gather feedback and needs of habitat data requirements and products that will help Member States to fulfil reporting obligations	5	25/01/22- 25/09/23	Delivered	30/09/2022	
D5.08: Minutes of meeting(s) with EMODnet biology	5	25/03/2022	Delivered	31/03/2022	

D5.09: Communications plan	5	25/01/2022	Delivered	31/03/2022	
D5.10: New use cases on the EMODnet central portal	5	25/10/21-25/09/23	Delivered	25/09/2023	
D5.11: A prominent summary of the data and data products available from EMODnet seabed Habitats web services	5	25/09/2022	Delivered	22/09/2023	
D5.12: Co-ordinated and sustained online presence: news stories, blogs, tweets, etc.	5	25/10/21-25/09/23	Delivered	25/09/2023	
D5.13: Presentations and posters at conferences and cross-cutting meetings	5	25/10/21-25/09/23	Delivered	25/09/2023	
D5.14: ESRI story maps / Infographics	5	25/03/2022	Delivered	31/12/2021	
D5.15: Record of all promotion and outreach activities	5	25/10/21-25/09/23	Delivered	25/09/2023	
D6.01: Project management plan and project initiation document	6	25/10/2021	Delivered	30/11/2021	
D6.02: Project quality management plan and project audit document	6	25/10/2021	Delivered	30/06/2022	
D6.03: Consortium Agreement	6	25/10/2021	Delivered	31/03/2022	
D6.04: Participation in EMODnet SC meetings as necessary	6	As necessary	Delivered	23/05/2023	
D6.05: Minutes & actions from Steering Committee meetings within 1 month of meeting	6	Within 1 month of each meeting	Delivered	23/06/2023	

D6.06: Progress meeting 1 - WP leads	6	25/03/2022	Delivered	31/03/2022	
D6.07: Minutes & actions from progress meeting 1	6	Within 1 month of meeting	Delivered	31/03/2022	
D6.08: Progress meeting 2 - whole consortium	6	25/03/2023	Delivered	14/12/2022	
D6.09: Minutes & actions from progress meeting 2	6	Within 1 month of meeting	Delivered	14/12/2022	
D6.10: Quarterly progress report to EASME, DG-MARE and EMODnet Secretariat	6	15 Jan, 15 Apr, 15 Jul & 15 Oct each year	Delivered	14/10/2023	
D6.11: Interim report	6	25/09/2022	Delivered	24/10/2022	
D6.12: Submission of the invoice for the interim payment	6	25/09/2022	Delivered	23/11/2022	
D6.13: Final report	6	25/09/2023	Delivered	24/11/2023	
D6.14: Submission of the invoice for the final payment	6	25/09/2023	Delayed		As per the formal request from CINEA we are delaying sending the invoice until January 2024.

3. Work Package updates

WP1 – Improving and expanding the base layer of modelled habitats (EUSeaMap)

Covering Task(s): 2 - Construct products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space

In the 2023 release, EUSeaMap has been extended to two regions, the Caribbean Sea and the Caspian Sea. In the Caribbean, the area covered is the area known as the Lesser Antilles, which includes EU and UK Overseas Territories. For continental Europe, Macaronesia, Iceland and the Arctic, progress has been made in integrating new data on seabed substrate and some environmental variables. The following is a summary of the work carried out and the results obtained. More details can be found in the EUSeaMap 2023 Technical Report (D1.15)¹.

1 - Preparing input datasets and associated confidence datasets

The seabed substrate used as input to EUSeaMap (D1.01 and D1.02) is the result of combining multiple datasets at varying scales into a single dataset containing the best scale available at each location. Of these datasets, those produced by EMODnet Geology are by far the main source. Other data sources have been used locally, including the biogenic substrate data product developed as part of WP3 (see deliverable D3.09).

Bathymetry (D1.03 and D1.04) is the most fundamental layer used to construct the biological zone dataset, which is one of the habitat descriptor layers of EUSeaMap. In EUSeaMap 2023 the bathymetry has been updated using the DTM 2022 produced as part of EMODnet Bathymetry, except in the Caspian Sea, which is not covered by EMODnet Bathymetry, where the GEBCO 2021 DTM has been used instead.

There are several environmental datasets in use in EUSeaMap, most of which are used to construct the biological zone dataset. The progress made for EUSeaMap 2023 is described below. A confidence assessment grid has been developed for each dataset produced (D1.13).

Light at the seabed in the Caspian Sea and the Caribbean Sea (D1.07 and D1.08): the amount of light on the seabed, estimated from PAR and KdPAR variables, is a parameter used in EUSeaMap to construct the biological zone habitat descriptor layer, specifically for the boundary between the infralittoral and circalittoral zones. In the Caspian Sea data was compiled from the MERIS Full Resolution (250m) image archive. In the Caribbean Sea, data was compiled from SENTINEL-3 OLCI A and B images (300m).

Probability that the seafloor is below the halocline in the Baltic Sea (D1.09): a probability grid of the seafloor being below the halocline is required as input to EUSeaMap to construct the biological zone habitat descriptor layer in the Baltic Sea, specifically for the boundary between the circalittoral and the offshore circalittoral. For EUSeaMap 2023 the dataset has been updated. Based on the results of runs of the DHI hydrographic model MIKE III a grid representing 20-year probability average values have been calculated.

¹ EUSeaMap 2023, A European broad-scale seabed habitat map, Technical Report <https://doi.org/10.13155/97116>

Wave-induced energy at the seabed and wave wavelength in Northwest Europe (not initially planned): In 2022, the RESOURCECODE² project released a hindcast database of high-resolution ocean energy resource parameters for European waters (extending from the north of Scotland to the Iberian Peninsula. This was seen by EMODnet Seabed Habitats as an opportunity to improve on the wave data previously used in EUSeaMap in the area covered. A seabed kinetic energy grid and a wave base ratio grid were calculated. In these grids, the values are averaged over the period 2000-2005.

Seabed salinity in the Baltic Sea (not initially planned): seabed salinity is an important input for EUSeaMap in the Baltic, as seabed salinity levels (euhaline, polyhaline, mesohaline, and oligohaline) are a habitat descriptor dataset and determine the variable and the thresholds used to model the biological zones. An update has been produced using CMEMS product Baltic Sea Physical Reanalysis³ (BALTICSEA_MULTIYEAR_PHY_003_011). Annual mean values of the variable 'Bottom Salinity' covering the period 2017-2021 have been downloaded and averaged.

2 - Preparing habitat classifications for the new regions covered (D1.05 and D1.06)

EUSeaMap describes habitats according to European classifications (EUNIS and MSFD broad habitat types) and regional classifications (Helcom Hub in the Baltic and Mediterranean habitat types). In the Caribbean and the Caspian Seas, where EUNIS is not applicable, a specific habitat list has been defined.

In the Caribbean Sea, the classification used for EUSeaMap 2023 (D1.06) is largely based on that published in June 2022 by the MNHN (French Museum of Natural History) for the island of Martinique (Andres et al., 2022⁴). In the document, the infralittoral is home to seagrass beds, algae and shallow coral reefs. Unlike EUNIS, the circalittoral is not subdivided into circalittoral and deep circalittoral due to the lack of knowledge on community changes within the circalittoral. The other zones are the bathyal and the abyssal zones. Seabed substrates include rock, sand, muddy sand, mud, coarse substrate, and the biogenic substrate coral reef.

Defining habitats in the Caspian Sea (D1.05) has been challenging. In contrast with the Caribbean, no existing classification has been found in the literature. The habitats were defined during two workshops in which Ifremer and GeoEcomar participated. In the broad habitat types classification that was developed, biological zones include infralittoral, circalittoral, offshore circalittoral, bathyal and abyssal. Seabed substrate types include rock, sand, mud, coarse substrate and mixed sediment. Two mussel species were identified as biogenic substrate builders: *Mytilaster lineatus*, which occurs in the infralittoral, and *Dreissena grimmi*, which occurs in the circalittoral.

3 - Defining habitat descriptor class boundaries (D1.10)

In the EUSeaMap method, boundaries between two adjacent habitat descriptor classes (e.g. between infralittoral and circalittoral, between high and moderate energy, etc.) are mostly defined by thresholds used to classify a continuous grid of a given variable into one habitat descriptor class or its adjacent class. In some cases, the boundaries are defined manually, for example, for the bathyal/abyssal boundary, which is defined as a slope change in some regions (e.g. Mediterranean Sea). Both in the Caribbean Sea and the Caspian Sea, a

² <https://resourcecode.ifremer.fr>

³ <https://doi.org/10.48670/moi-00013>

⁴ Andres S., Ferry R., Gaudillat V., Dirberg G. 2022. Typologie des habitats benthiques de la Martinique. Patrinat (OFB-CNRS MNHN). 207 pp. <https://inpn.mnhn.fr/docs-web/docs/download/408199>

seabed PAR threshold was used for the separation between infralittoral and circalittoral zones. The boundaries between the circalittoral/bathyal and the bathyal/abyssal, defined by changes in slope, were delineated using a semi-automatic approach. In the Caspian Sea, the circalittoral and the offshore circalittoral were separated using a depth threshold. In the other regions, the thresholds were re-examined where grid datasets have been updated. In the Mediterranean, the bathyal zone was subdivided into upper and lower bathyal zones to be consistent with the EUNIS 2022 classification.

4 - Producing EUSeaMap (D1.11 and D1.12)

EUSeaMap 2023 was released in early October 2023. It is a major update, with new regions explored and significant updates to regions already covered. In the Caspian and the Caribbean Seas, the product provides full coverage of the broad benthic habitat types for the first time in these regions. In other regions, EUSeaMap has been significantly improved in terms of seabed substrate and, thanks to the integration of new bathymetry and other physical variables, in terms of biological zone.

5 - Other tasks

The R scripts used to construct EUSeaMap⁵ has been updated to use the R package ‘terra’ instead of ‘raster’ (D1.16). User-friendly Python scripts⁶ have been developed and published to automate the calculation of environmental variables from CMEMS products, including time integration and shifting values at the seabed using the EMODnet Bathymetry DTM, for an area and time of interest (D1.14).

WP2 – Data collation

Covering Task(s):

- **1 – Maintain and improve a common method of access to data held in repositories**
- **2 – Construct products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space**
- **3 – Develop procedures for machine-to-machine connections to data and data products**
- **7 – Contribute to the implementation of EU legislation and broader initiatives for open data**

The overall aim of this WP, which involves all consortium members, is to ingest, standardise and publish each habitat map and dataset that we listed in Appendix 3 of the tender proposal. During this phase we have developed and updated several of our protocols, trackers, templates and guidance. To support partners and help track and report progress we:

- Created tutorial videos to help users: format habitat maps, format point datasets, carry out confidence assessments and create INSPIRE-compliant metadata (part of D2.04).
- Held an instructional webinar for partners on these topics and produced an internal guidance document that brought together all the steps and provided additional detail, such as within-project deadlines, roles and responsibilities (part of D2.04).
- Developed a new public guidance document for habitat maps to replace the step-by-step instructional pages on the now de-commissioned thematic portal (part of D2.04).

⁵ https://github.com/emodnetseabedhabitats/EUSeaMap_creation

⁶ <https://github.com/emodnetseabedhabitats/seabottom-statistics>

- Designed a new data collation tracker, which allows us to track data acquisition status, data preparation status and data upload status for each of the habitat maps and datasets that we listed in Appendix 3 of the tender proposal (D2.17). The tracker was formatted in such a way as to make it straightforward and efficient to report against indicator 3 (data providers) in the quarterly reports.
- Have agreed a new process for the storage and publication of seabed habitat point data through EMODnet Biology/EurOBIS. This will facilitate the submission and use of datasets containing both species and habitat observation data. We have developed a new guidance document detailing the steps involved to enable partners to format and submit their habitat point data via the VLIZ Integrated Publishing Toolkit (IPT) (D2.13). The guidance has been designed to use an updated version of the habitat point template spreadsheet to enable a smooth transition for partners when submitting data. In 2023 we held an instructional webinar for partners to walk them through the guidance and steps involved.

Before this phase of EMODnet SH there was no standard approach or common format for sharing EFH maps. Therefore, we developed and published:

- a new data exchange format customised for EFH maps (part of D2.11)
- a confidence assessment method, based on the MESH confidence assessment for seabed habitat maps but customised for EFH maps (part of D2.11)
- a guidance document for EFH maps, including a simple EFH type classification scheme (part of D2.11).
- the EMODnet Seabed Habitats Essential Fish Habitat (EFH) vocabulary, which was submitted to the NERC Vocabulary Server and has now been published as collection [EF1](#) (D2.09).

Also, before this phase there was no standard approach or common format for sharing coastal wetlands maps. Therefore, we:

- developed and published an updated data exchange format for seabed habitats that can accept coastal wetland maps and is generally more flexible about which classification systems are accepted. It also consolidates three separate data exchange formats that previously existing into a single format that will be easier to understand (D2.03, D2.08).
- produced an internal guidance document that clarifies what is within the scope of 'coastal wetlands' for the purposes of this contract, including which classification schemes to use. This will ensure that consortium members can more easily recognise whether a dataset is within the scope of EMODnet Seabed Habitats or not (D2.08).
- submitted the global Ramsar Classification System for Wetland Type to the NERC Vocabulary Server, which has now been published as collection M28 and M29 (D2.09). Before now, the Ramsar classification was only available to view online in Word and PDF documents but is now available in both human- and machine-readable formats.
- produced the first known translation table between the Ramsar Classification System for Wetland Type and Annex I of the Habitats Directive (D2.07), which will ensure that data classified according to one scheme may be reused for other purposes.

A key objective in this phase was to access habitat data using machine-to-machine connections, where possible, to avoid duplicating data and metadata on the web. In this phase we have developed a list of point datasets, maps and models available via machine-to-machine connections (D2.16), and criteria to assess whether these should be accessed via machine-to-machine connection or downloaded and ingested into the EMODnet Seabed Habitats holdings directly. The criteria consider key areas such as: which web services are

available, data permissions, update frequency, how comprehensive/user-friendly the data is and downstream use cases. We have applied these criteria in WP4 when deciding how best to publish datasets.

We have been working with EMODnet Biology on the process for the storage and publication of seabed habitat point data through EMODnet Biology/EurOBIS. We have produced an updated data template based on the Darwin Core schema alongside a guidance document and have provided training to partners. This has allowed us to submit a subset of datasets during this phase and we will aim to transfer all existing data during the next phase. We have also mapped the OSPAR Threatened & Declining data to the OBIS Darwin Core schema (D2.14) however since OBIS will not accept datasets without species occurrence data, OBIS is not a suitable long term storage solution for this dataset. It has therefore been agreed that the OSPAR datasets will continue to be made available through EMODnet Seabed Habitats instead (D2.15).

According to Appendix 3 of the technical proposal that we submitted in 2020, 186 map, model and point datasets were expected to be made available via the EMODnet Seabed Habitats portal by the end of the contract (D2.01, D2.02, D2.05). Some of the listed datasets actually represented “sets of maps” and/or “sets of point data”, i.e. not single datasets, as a result, the actual number of proposed datasets was 309. As of the end of this phase we have published a total of 335 datasets, maps and models, which is 25 more originally planned. It should be noted that due to factors beyond our control, 49 of the originally-listed datasets were not possible to acquire or publish, however we subsequently identified and published 75 other datasets. The main reasons for datasets not being available included: data licensing restrictions, difficulties establishing contact with data owners, and data not ready for dissemination due to ongoing analysis or sign-off. For datasets that are still undergoing analysis and/or sign-off we will continue to work with the data owners to ensure they are acquired in future phases once finalised.

Data collated, prepared and published during this phase, complete with metadata in the catalogue:

- Individual habitat maps from surveys (essential fish habitats): 20 classified maps and 27 models (part of D2.10)
- Individual habitat maps from surveys (seabed habitats and coastal wetland): 141 new and two updated (part of D2.01)
- Survey sample points: 61 new and three updated datasets – 36,301 points (part of D2.02)
- Modelled maps of specific habitats: 20 models (part of D2.05)
- Seven datasets of environmental variables that influence habitat type
- Eight externally created composite products.

Of these datasets two new datasets were submitted via EMODnet Ingestion and a further 8 updated following EMODnet Ingestions updates (D2.06). A notable new area for data collation this phase was in areas of the Caribbean Sea. During this phase we have prepared and published over 50 individual habitat maps from survey in the Caribbean Sea region. Some of these datasets were submitted by consortium partners but the majority were prepared and submitted via our Caribbean subcontractor SAERI.

WP3 – Building composite data products (points and polygons)

Covering Task(s):

- **2 – Construct products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space**
- **6 –Ensure the involvement of regional sea conventions**

The growing collection of European seabed habitat maps and point data (WP2) means the update of products demonstrating the current state of knowledge on the extent and distribution of priority marine habitats is an ongoing progress. As such we used the EMODnet SHs library of individual habitat maps and point data to update several composite products created in previous phases of the project and created new composite products of European, regional, and international interest. We first created a list of composite products to be created or updated and their product specifications (D3.01). Below is a summary of the products created and updated in WP3:

1. Three existing Essential Ocean Variables (EOV) data products in Europe were updated: live hard coral cover, seagrass cover and macroalgal canopy cover, using the EMODnet Seabed Habitats library of individual habitat maps and point data (D3.02, D3.03, D3.04). A key task in this phase was to evaluate the viability of extending these products into the Caribbean Sea region and where feasible extend the geographic extent of these products. We extended the seagrass and live hard coral cover EOV data products to the Caribbean Sea region using a combination of the EMODnet Seabed Habitats data and external data from UNEP-WCMC⁷
2. The EU Biodiversity Strategy 2030 highlights the importance of coastal wetlands in mitigating flood damage and sequestering carbon. Therefore, coastal wetland maps are now included in the EMODnet SHs habitat maps from survey dataset alongside our seabed habitat maps. A new combined, harmonized data product showing the best evidence for the extent of wetland type in Europe and the Caribbean, with metadata, was created using the EMODnet SHs collection and external data from CORINE Land Cover⁸ (Coordination of Information on the Environment) (D3.05).
3. A new EOV product for mangrove cover in the Caribbean Sea was created using the EMODnet SHs collection of point data and maps (D3.06). This new composite product was created using the EMODnet SHs library of habitat maps and external data from Global Mangrove Watch⁹.
4. Managing the ocean with an Ecosystem Approach that recognizes the complexity of the marine ecosystems is an essential objective followed by the European Union. To achieve this objective, Essential Fish Habitats (EFHs), defined as “habitats identified as essential to the ecological and biological requirements for critical life history stages of exploited fish species”, have been viewed as an important fisheries management tool. In WP3 the feasibility of combining the new EFH datasets into a new composite product useful for fisheries management and biodiversity conservation has been evaluated (D3.07).
5. The biogenic substrate layer for Europe was updated and extended to the Caribbean Sea region. This layer was first created in the previous phase to allow EUSeaMap to be translated into the EUNIS 2019 classification scheme. We used the EMODnet SHs library of habitat maps from surveys to update the data product that shows the best available evidence for the extent of biogenic substrates in Europe

⁷ UN Environment Programme World Conservation Monitoring Centre - <https://www.unep-wcmc.org/>

⁸ CORINE Land Cover 2018 - <https://land.copernicus.eu/en/products/corine-land-cover/clc2018>

⁹ Global Mangrove Watch (1996 - 2020) data - <https://data.unep-wcmc.org/datasets/45>

(D3.08). This was inserted into the grain-size-based substrate layer and this combined product (D1.01) was used as the source of seabed substrate data for EUSeaMap.

For the following new and updated composite data products: EFH, coastal wetlands, biogenic substrate, coralligenous and EOVs, we have produced reports describing the method of production and/or update, the data sources, the rationale behind the creation of the product and some discussion about limitations and future improvements (D3.10, D3.11, D3.12).

The requirement for two of the composite products came out of our review of stakeholder needs for new data products (D3.07).

1. Coralligenous and other calcareous bioconcretions habitats in the Mediterranean (D3.08). The need for this product arose from our assessment of stakeholder requirements for new data products, which led us to conclude that it would be a beneficial product for the RAC/SPA – Barcelona Convention. This composite product was an update of the distribution of Coralligenous and other calcareous bioconcretions in the Mediterranean, first created in the previous phase using the EMODnet Seabed Habitats library of habitat maps from surveys and point observations.
2. In the previous phase a composite product showing the distribution and extent of EUNIS habitats in the Northeast Atlantic (D3.08) was created. This was in response to a request from OSPAR for a product they could use in their assessment of the extent of physical damage to seabed habitats (BH3). In this phase we produced a version of this product that was translated into MSFD benthic broad habitat types for use in the assessment.

WP4 – Web services and FAIR data access

Covering Task(s):

- **1 – Maintain and improve a common method of access to data held in repositories**
- **3 – Develop procedures for machine-to-machine connections to data and data products**
- **4 – Contribute data, data products and content to a central portal that allows users to find, view and download data and data products**
- **5 – Contribute content to dedicated spaces in the Central Portal**
- **7 – Contribute to the implementation of EU legislation and broader initiatives for open data**
- **8– Monitor quality/performance and deal with user feedback**
- **9 – Maintain the existing thematic web portal for a maximum of six months from the start of the projects**

The thematic web portal and all associated functionality was hosted and maintained until the 23rd January 2023 (D4.01). Whilst the thematic portal was live issues and potential improvements were tracked and discussed within the GitHub platform and solutions implemented when within the scope and constraints of the project (D4.18). This included updates to:

- static content such as project information and data submission guidance
- functionality, e.g. the data download page to provide additional groupings for: separate regions of EUSeaMap, new categories of habitat maps from surveys i.e. Barcelona Convention and HELCOM underwater biotope maps and EFH maps and models. Developments to the download page were carried out through a small subcontract with CarbonSix Digital in conjunction with in-house staff.

Prior to the thematic portal shut down we implemented re-direct links to the central portal, set up a new download filestore and updated our metadata links to ensure a seamless user experience.

The content of the portal has been updated at six-monthly intervals to make data and data products from work packages 1, 2 and 3 available through the thematic OGC-compliant web-services (D4.10, D4.13) in GeoServer. A summary of the maps, points and models collated and uploaded to the portal (D4.13) was included in the WP2 section above. In addition, we have published:

- WP1 data layers including environmental variables that influence habitat type: seven new models for the Caspian Sea – two of which have been used to update Europe-wide layers (part of D4.13). The EUSeaMap 2023 data had also been published including new regional products for the Caribbean and Caspian Seas (See WP1 for details).
- WP3: updated Essential Ocean Variable (EOV), coralligenous and other calcareous bioconcretions in the Mediterranean, and biogenic substrate products as well as two new composite products: EOV for Mangrove cover, coastal wetlands in European waters and the EUNIS habitats in the northeast Atlantic (for OSPAR) composite product that was created in the previous phase.

All of these datasets were supported by INSPIRE compliant metadata. This metadata is harvested from our GeoNetwork INSPIRE-compliant metadata instance (D4.12) and published by the central portal data product catalog and by the European Union Open Data Portal (D4.08). Additionally, several new external products are now provided directly by machine-to-machine connections, including Vulnerable Marine Ecosystems records from ICES (D4.17), and Habitats Directive Annex I habitat layers sourced directly from the HELCOM Map and Data Service via WMS (D4.16). Where direct cascading of external services isn't possible, we are using an indirect acquire, format and upload methodology to ensure the data is still available for onward use (D4.06).

We have been making updates to improve our data infrastructure including:

- Following the update of the Data Exchange Format (DEF) in WP2 we updated the data schema for our library of habitat maps (D4.05) to utilise a single combined habitat maps table integrating all seabed habitat and coastal wetland maps. This process also involved checks for attribute data consistency. This streamlined approach facilitates the downstream use and integration of the individual habitat map data e.g. for the creation of our composite products under WP3.
- A new data schema and infrastructure has been created to allow the inclusion of the new Essential Fish Habitat maps and model data.
- Making changes to Geoserver to improve our response times and overall uptime to provide the best user experience. These changes included: implementing more rigorous data cleaning, increased layer caching, and implementing changes to the way we interact with external services and applying stricter criteria before utilising machine-to-machine connections. We have also upgraded our Geoserver in response to a high priority critical bug.

During this phase we also planned to move to utilising an Integrated Publishing Toolkit (IPT) infrastructure (D4.08) and web service harvesting (D4.07) for the publication of habitat point data via EurOBIS/EMODnet Biology. We have successfully submitted point data using the existing “data providers” IPT and we are able to harvest habitat ground-truthing data from EMODnet Biology/EurOBIS via web services in conjunction with the species occurrence data. However, It is not yet possible to query and download habitat data specifically via the EMODnet viewer as this requires further development to expand the API filter which cannot occur until the last 2023 viewer versions is complete, a work that requires the intervention of Bilbomatica.

We are active and attentive members of the EMODnet Technical Working Group, having attended all meetings and addressing actions via JIRA tickets in a timely manner (D4.02, D4.03, D4.04). We offer help to users via our support team who are available Monday to Friday 09:00-17:00 (D4.21) to respond to queries and any feedback received. Prior to thematic portal shutdown help queries arrived via the Contact Us form on the website, or by direct email. Post centralisation queries are managed centrally, and we respond via JIRA. We have received several pieces of feedback through these means and always respond and resolve any issues promptly (see User Feedback table). We also receive instant alerts about web performance problems and resolve them as necessary. During this phase we developed a plan of action for the provision of key habitat datasets as attributed raster data (D4.11). This was in direct response to user feedback received in a previous phase. The plan was trialled using rasterised EUSeaMap layers during the Open Sea Lab 3.0 Hackathon in March 2023.

Performance and quality metrics on web-site usage are already automated and accessible to the EMODnet secretariat through Matomo/Europa Analytics (D4.23). For monitoring and reporting, we have been proactive in providing suggestions regarding updates to the data monitoring process including ideas on reporting regions, categories, and units for summarising seabed habitat data in a streamlined, logical, and useful way. Once the new reporting templates and categories were finalised we developed a new protocol to allow a more automated, repeatable approach to summarising this information for the reports. This includes:

- A system of GeoServer labelling via keywords and vocabularies using the terminology and categories required by the quarterly reports (e.g. themes, sub-themes, data vs data product, sea-basin, etc.)
- Python scripts to read these labels and summarise the information in a consistent manner (D4.24).

Since the beginning of the phase, we have formed a good working relationship with and collaborated closely with the centralisation team, to make the process as frictionless and successful as possible. This collaborative work has so far proven very successful and led to two key successes. The first success is in the completion of migration of static content from the existing portal to the central website (D4.15). The second success is in centralisation of the mapping functionalities, datasets and services provided by the existing thematic mapper and GeoServer. In the migration of layers to the central portal map viewer, the thematic lot has several nuances that set it apart from the other lots: large number of data products served (>900), high complexity of EUSeaMap vector dataset preventing realistic use of existing OGC WFS services and the existence of composite datasets including confidence sub-layers.

As such, we worked closely with the centralisation team to prioritise layers into “must haves” for the initial soft release, and layers to migrate after this time. Layers have also been reconfigured, grouped and regenerated to ease the work of the central portal team, aggregating split layers into groups with additional filters to allow the original intention to remain viewable, redefining cascaded layer sources to use WFS where possible, and improving the display of information when the user clicks on features of the map. Based on our feedback the central team have implemented a third level menu option on the viewer and are working on developing the filter functionality to meet the needs of Seabed Habitats users. Further additional functionality suggestions have been made; however the functionality is not critical, and we will continue to work with the centralisation team to prioritise these requirements.

WP5 – Communication and outreach

Covering Task(s):

- **5 – Contributing content to dedicated spaces in Central Portal**
- **6 – Ensure the involvement of regional sea conventions**

- **7 – Contribute to the implementation of EU legislation and broader initiatives for open data**

This WP was responsible for ensuring communication of Seabed Habitats deliverables and outputs, and engagement with stakeholders to ensure that their needs were met by the activities of the project. This was facilitated through delivery and updating of a communications plan (D5.09). This included a schedule for co-ordinated information dissemination, via news items/social media in co-ordination with EMODnet Secretariat Comms (D5.12). A record of all promotion and outreach activities was maintained to reflect this (D5.15). A significant component of this outreach has been delivery of presentations and posters at conferences and cross-cutting meetings. All materials published and presented have been collated by the project (D5.13).

Communication across the EMODNet thematic lots is essential. Seabed Habitats have engaged regularly with Geology, Physics and Biology in this phase to identify output alignments and to facilitate more effective deliverables (D5.08).

This WP has produced infographics and storymaps relating to Seabed Habitats outputs, at a basin level (D5.11) and detailing the products suite available for Seabed Habitats (D5.14). Tutorials on creating new maps (D5.04) and formatting habitat maps using templates to simplify the data submission process (D5.06) were delivered. Procedural guidelines for data re-formatting were also delivered (D5.05). Identification and recording of relevant 'Use Cases' has been carried out using the projects 'Use Case' log (D5.10).

The project management team have worked in close collaboration with the EMODnet Secretariat to ensure that the static content of the Seabed Habitats portal was appropriately incorporated into the central portal. This has involved meetings as well as interactions via the JIRA system.

Through WP5, the project has engaged with all RSCs. A structured approach to RSC outreach and engagement was developed. This comprised tasking dedicated partners with RSC liaison in their regions and producing an internal document outlining how to approach the RSCs and what issues to discuss with each of them. The RSC liaison partners engaged with their relevant RSC to gain feedback about existing products and services, and discussed options for new products and ways of working that could benefit the RSCs. The outcomes of this were summarised in a public report, 'Updated Review Of RSC Needs' (D5.02), and influenced the development of composite data products (WP3) and EUSeaMap 2023 (WP1). This, and the proposed use of ESH products as baseline datasets for RSC activities, demonstrates interaction with, and data delivery to/from RSCs (D5.01).

The project has pursued engagement with relevant working groups and expert groups to gather feedback and requirements be used to inform Seabed Habitat deliverables. Seabed Habitats has participation in the European Marine Board Working Group on Marine Habitat Mapping, which will produce a Future Science Brief in 2023, outlining recommendations on the future of habitat mapping in Europe. EUSeaMap and its underlying sediment classification was presented and discussed by the JNCC at a meeting of TGSeabed in order to facilitate an improved transboundary approach for broad scale maps (D5.07). The project has delivered a translated version of the combined EUNIS habitat map for the northeast Atlantic that shows MSFD Benthic Broad Habitats.

Through WP5, the project has entered structured engagement with ICES Working Groups (Marine Habitat Mapping, Deep-water Ecology, Benthos Ecology and Biodiversity Science). All indicated willingness to participate in the review of stakeholders needs (D5.03), however, feedback was limited from these groups. It is anticipated that an enhanced approach will be required in the next phase. EUSeaMap was presented at the ICES Annual Science Conference (2022) in order to generate engagement with ICES groups on proposed developmental pathways for this, and other Seabed Habitats products.

The consortium submitted a pledge to the Make EU Blue campaign to "continue to improve & expand the coverage of the broadscale seabed habitat map for Europe, EUSeaMap, which serves as a base map for national, regional & global assessments".

As part of our work in the Caribbean Sea region this phase, our subcontractor SAERI carried out a stakeholder mapping exercise to identify relevant stakeholders in the region and held in person meetings with some of these stakeholders in Anguilla in August 2023 to raise awareness of the EMODnet Seabed Habitats project. They also conducted in person training courses in September 2023 to try and build capacity with a focus on data management, processing, metadata and submission to EMODnet Seabed Habitats.

WP6 – Coordination and formal reporting

Covering Task(s): management of all tasks

Project management

At the start of the project a Project Steering Group was formed, chaired by the Project Coordinator (Helen Lillis, JNCC), and made up of one person from each partner organisation. The Project Steering Group provided strategic guidance for the project and ensured the project was managed correctly. The Project Steering Group was responsible for financial decisions, for agreeing remediation actions to resolve any project issues and for taking decisions on priorities. It met virtually in January 2022 and in person, in December 2022 in Manchester, UK (D6.08, D6.09). A large focus of the first meeting was WP2 Data Collation and at the second meeting, the progress of all WPs was discussed and plans made to ensure the effective delivery of all remaining deliverables in the final nine months of the project.

Separately, the Project Management Team, comprised of the six WP leaders and chaired by the Technical Manager (Mickaël Vasquez, Ifremer), implemented the scientific and technical activities necessary to achieve the project objectives. It was responsible for operational decision making. This group met regularly throughout the project phase with 3 virtual meetings: February 2022 (D6.06, D6.07), September 2022 and March 2023 and 3 in person meetings: Lisbon, Portugal, in May 2022, Manchester, UK in December 2022 and Faro, Portugal in May 2023.

A Consortium Agreement between the partners was signed by all members of the Project Steering Group in the early months of the project (D6.03). The Consortium Agreement included details on governance structure, the budget distribution and allocation of effort, and the management of risk.

The Project Coordinator, and usually also the Technical Manager, attended and participated in all EMODnet Steering Committee meetings and other meetings as requested by the EMODnet Secretariat (D6.04). Relevant information and actions are cascaded to consortium members (D6.05). In January 2023, the original Project Coordinator, Helen Lillis, went on maternity leave and was replaced by Helen Woods (JNCC).

Subcontracting

As part of the tender proposal, we named three subcontractors: Stockholm University, Norwegian Institute for Water Research and Anguilla Community College (ACC) (in their capacity as lead organisation in the Mid-Atlantic Environment Research Institute (MAERI) partnership). A further two subcontractors: Danish Hydraulic Institute (DHI), National Institute of Aquatic Resources (DTU Aqua) were also used.

The Stockholm University, Danish Hydraulic Institute (DHI), National Institute of Aquatic Resources (DTU Aqua) contracts were established and managed by our partner GEUS, and were targeted towards WP1 and WP2. The NIVA contract focused on WP2 and was established in year 2 and successfully completed by the end of the phase. The establishment of the ACC contract encountered some issues during year 1, as described in the following 'Identified issues: status and actions taken' section. In summary, the establishment of MAERI as a

standalone, operational entity has been delayed and was not as far along as expected at the time of writing the tender proposal. This, in turn, meant that ACC did not have the expected capacity to fulfil the requirements of the project. During year 2, following approval from CINEA we contracted the South Atlantic Environmental Research Institute (SAERI) who are another MAERI partner to carry out the Caribbean data collation work for the project. The work carried out within this subcontract primarily related to WP2 and WP5 and is described in the sections above.

We had intended to utilise additional data provider subcontracts to collate data from areas with data gaps and from other countries not represented by partners in the consortium for example in the Caspian Sea. We explored various options and utilised the contacts of the consortia, however our efforts were hindered by a lack of data in some areas and a lack of capacity to engage under the specified project timeframes. We will continue to engage across our networks and encourage participation and data submission via EMODnet ingestion going forward.

Reporting

All quarterly reports and the year one interim report were completed and submitted on time, and accepted with only minor queries from CINEA and/or the Secretariat.

For reporting web performance, we were proactive in providing suggestions regarding reporting regions, categories and units for summarising seabed habitat data in a streamlined, logical and useful way. Once the new reporting templates and categories were finalised, we developed a new protocol to allow a more automated, repeatable approach to summarising this information for the reports, as described in WP4.

4. Identified issues: status and actions taken

A. Priority issue(s) identified and communicated by CINEA/ DG MARE/ SECRETARIAT				
Priority issue	Status (Pending/ Resolved)	Action(s) taken/ remaining actions planned	Date due	Date resolved
EM-88 (Sub-task) Seabed Habitats - Web Services MetadataUrl and DataUrl fields	pending	All metadata url issues resolved. No current outstanding problems but issue remains open as regular checks occur	none	
EM-146 (Sub-task) Seabed Habitats Quality of Service Monitoring: Several of the services did not meet the 99% availability this quarter, and one of the WMS didn't meet the performance requirement of 5 sec.	pending	substantial work has gone into investigating the causes of the performance issues and the development of a solution (the so-called 'self-healing' GeoServer. However, this solution is relatively novel as has come across several	none	

		hurdles. Our next steps are to instigate a data cleansing process to find and eliminate any geometry issues and to add an additional Geoserver instance to help share the load.		
EM-339 (Sub-task) Collect names of Portal editors	resolved		none	29/11/2021
EM-347 (Sub-task) Collect fields/forms used on Seabed Habitats Thematic Portal	resolved		none	26/01/2022
EM-350 (Bug) Missing attribute in eusm2019_full_800 layer of Seabed Habitat WMS service	resolved		none	07/10/2021
EM-363 (Sub-task) Seabed Habitats to report on number and volume of downloaded data and data products by 29th of October 2021	resolved		none	21/01/2022
EM-383 (Task) SBH Grafana dashboard stopped tracking webpage Search Metadata	resolved		none	14/02/2022
EM-384 (Sub-task) SBH to produce an inventory of products	resolved		none	21/06/2022
EM-391 (Sub-task) SBH review of the new CP Map Viewer	pending	tasks complete to date but this issue remains open for future requests for SBH to review the CP	none	
EM-422 (Sub-task) Log4jshell Update from SBH	resolved		none	07/11/2022
EM-495 (Sub-task) Seabed Habitats to report on number and volume of downloaded data and data products	resolved		09/02/2022	09/02/2022

EM-531 (Sub-task) SBH - EMODnet Catalogue Tags	resolved	we provided the requested feedback so consider this issue resolved. status according to JIRA: In Review	none	26/04/2022
EM-539 (Task) Seabed Habitats products' centralisation	resolved		none	16/03/2023
EM-543 (Task) Adding Seabed Habitats' layers to metaGIS	resolved		06/05/2022	29/09/2022
EM-558 (Bug) Seabed Habitats Catalogue no longer has any public records	resolved		none	03/05/2022
EM-570 (Sub-task) Feedback on CP Main Menu	resolved		30/06/2022	27/04/2022
EM-591 (Task) SBH Layers in the Map Viewer Content Management System	resolved		04/07/2022	02/06/2023
EM-611 (Task) Centralisation Checklist for review	resolved		none	02/12/2022
EM-639 (Sub-task) Standardise the navigation menu on left hand side of page	resolved		none	24/04/2023
EM-644 (Sub-task) Seabed Habitats to provide input to the Tools & Guidelines section	pending	Tools and guidelines have been added to the central portal. Report uploads are in progress	none	
EM-652 (Sub-task) Seabed Habitats to review layer legends and add units where they are missing	resolved		none	11/10/2022
EM-664 (Task) TWG12-SBH to report on which filters are still required	resolved		none	16/03/2023
EM-665 (Task) TWG12 - CP & SBH to investigate if CP viewer can deal with layer group styles	pending	we have investigated this but it does not resolve the duplicated legend issue for group	none	

		layers in the central portal. A temporary solution has been proposed and work is underway.		
EM-708 (Bug) Download Broken for Several Seabed Habitats Layers	resolved		none	24/01/2023
EM-713 (Epic) Switch on URL redirects on Monday the 23rd of January	resolved		23/01/2023	20/04/2023
EM-717 (Task) EMDOnet Seabed Habitats URL direct to new EMODnet portal	resolved		23/01/2023	25/01/2023
EM-773 (Bug) Critical - Geoserver Remote Code Execution - CVE-2022-24816 & CVE-2023-25157	resolved		none	16/05/2023
EM-88 (Sub-task) Seabed Habitats - Web Services MetadataUrl and DataUrl fields	pending	All metadata url issues resolved. No current outstanding problems but issue remains open as regular checks occur	none	
EM-146 (Sub-task) Seabed Habitats Quality of Service Monitoring: Several of the services did not meet the 99% availability this quarter, and one of the WMS didn't meet the performance requirement of 5 sec.	pending	substantial work has gone into investigating the causes of the performance issues and the development of a solution (the so-called 'self-healing' GeoServer. However, this solution is relatively novel as has come across several hurdles. Our next steps are to instigate a data cleansing process to find and eliminate any geometry issues and to add an additional Geoserver instance to help share the load.	none	
EM-339 (Sub-task) Collect names of Portal editors	resolved		none	29/11/2021

EM-347 (Sub-task) Collect fields/forms used on Seabed Habitats Thematic Portal	resolved		none	26/01/2022
EM-350 (Bug) Missing attribute in eusm2019_full_800 layer of Seabed Habitat WMS service	resolved		none	07/10/2021
EM-363 (Sub-task) Seabed Habitats to report on number and volume of downloaded data and data products by 29th of October 2021	resolved		none	21/01/2022
EM-383 (Task) SBH Grafana dashboard stopped tracking webpage Search Metadata	resolved		none	14/02/2022
EM-384 (Sub-task) SBH to produce an inventory of products	resolved		none	21/06/2022
EM-391 (Sub-task) SBH review of the new CP Map Viewer	pending	tasks complete to date but this issue remains open for future requests for SBH to review the CP	none	
EM-422 (Sub-task) Log4jshell Update from SBH	resolved		none	07/11/2022
EM-495 (Sub-task) Seabed Habitats to report on number and volume of downloaded data and data products	resolved		09/02/2022	09/02/2022
EM-531 (Sub-task) SBH - EMODnet Catalogue Tags	resolved	we provided the requested feedback so consider this issue resolved. status according to JIRA: In Review	none	26/04/2022
EM-539 (Task) Seabed Habitats products' centralisation	resolved		none	16/03/2023

EM-543 (Task) Adding Seabed Habitats' layers to metaGIS	resolved		06/05/2022	29/09/2022
EM-558 (Bug) Seabed Habitats Catalogue no longer has any public records	resolved		none	03/05/2022
EM-570 (Sub-task) Feedback on CP Main Menu	resolved		30/06/2022	27/04/2022
EM-591 (Task) SBH Layers in the Map Viewer Content Management System	resolved		04/07/2022	02/06/2023
EM-611 (Task) Centralisation Checklist for review	resolved		none	02/12/2022
EM-639 (Sub-task) Standardise the navigation menu on left hand side of page	resolved		none	24/04/2023
EM-644 (Sub-task) Seabed Habitats to provide input to the Tools & Guidelines section	pending	Tools and guidelines have been added to the central portal. Report uploads are in progress	none	
EM-652 (Sub-task) Seabed Habitats to review layer legends and add units where they are missing	resolved		none	11/10/2022
EM-664 (Task) TWG12-SBH to report on which filters are still required	resolved		none	16/03/2023
EM-665 (Task) TWG12 - CP & SBH to investigate if CP viewer can dealwith layer group styles	pending	we have investigated this but it does not resolve the duplicated legend issue for group layers in the central portal. A temporary solution has been proposed and work is underway.	none	
EM-708 (Bug) Download Broken for Several Seabed Habitats Layers	resolved		none	24/01/2023

EM-713 (Epic) Switch on URL redirects on Monday the 23rd of January	resolved		23/01/2023	20/04/2023
EM-717 (Task) EMDOnet Seabed Habitats URL direct to new EMODnet portal	resolved		23/01/2023	25/01/2023
EM-773 (Bug) Critical - Geoserver Remote Code Execution - CVE-2022-24816 & CVE-2023-25157	resolved		none	16/05/2023

B. Issues / challenges identified by the thematic assembly group itself

Priority issue / challenge	Status (Pending/ Resolved)	Action(s) taken / remaining actions planned	Date due	Date resolved
EM-316 (Improvement) reorder EMODnet Themes on Reports page to force the 'active' themes to the top of the list	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP	none	16/09/2021
EM-317 (Improvement) 'Seabed Habitats' missing from list of Topics on Newsroom	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP	none	20/20/2022
EM-412 (New Feature) In the layer catalogue on new central portal, indicate which layer groups contain active layers	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-513 (New Feature) In the layer catalogue, add the ability toggle entire layer groups on or off	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-514 (Improvement) Return custom feature/pixel information when user clicks on a feature/pixel in the map	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP	none	15/09/2022
EM-515 (New Feature) Ability to filter habitat layers by habitat type or map ID	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	

EM-620 (Improvement) Introduce text wrapping in Catalogue pane	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP. This specific suggestion has not been implemented but instead the layer pane can be extended to allow users to see more of the name	none	01/03/2023
EM-621 (Improvement) manual sorting of layers, rather than alphabetically	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-622 (Task) correct layer information, metadata and download links for some SH layers	resolved	This is a issue/suggestion that SBH flagged with some of our layers on the central portal viewer. These have now been corrected	none	17/11/2022
EM-623 (Improvement) improve access to metadata and download	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-688 (Improvement) correction to a use case	resolved	This is a issue that SBH flagged with one of the use cases which had been reported by a user. CP have corrected so just needs to be reviewed by us	none	30/09/2023
EM-723 (Task) Updated download links needed for EMODnet Seabed Habitats layers on central	resolved	Post thematic shut down updates were needed for some central viewer layers to ensure the downloads links were correct	none	25/01/2023
EM-796 (Task) Viewer third level menu options for Seabed Habitats	resolved	Additional third level menu option implemented for relevent SBHs layers		13/06/2023
EM-798 (Task) Products catalogue - metadata not updated	pending	Issue flagged by SBHs whereby changes we implement to our		

		metadata are not being carried through to the products catalogue. We have provided some examples for the central team to look at		
EM-802 (Task) New Ramsar and EFH layers for CP viewer	resolved	Mostly complete just awaiting SBHs review		10/07/2023
EM-316 (Improvement) reorder EMODnet Themes on Reports page to force the 'active' themes to the top of the list	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP	none	16/09/2021
EM-317 (Improvement) 'Seabed Habitats' missing from list of Topics on Newsroom	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-412 (New Feature) In the layer catalogue on new central portal, indicate which layer groups contain active layers	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-513 (New Feature) In the layer catalogue, add the ability toggle entire layer groups on or off	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-514 (Improvement) Return custom feature/pixel information when user clicks on a feature/pixel in the map	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP	none	15/09/2022
EM-515 (New Feature) Ability to filter habitat layers by habitat type or map ID	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-620 (Improvement) Introduce text wrapping in Catalogue pane	resolved	This is a issue/suggestion that SBH made related to the functionality of the CP. This specific suggestion has not been implemented but instead the layer pane can be extended to allow	none	01/03/2023

		users to see more of the name		
EM-621 (Improvement) manual sorting of layers, rather than alphabetically	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-622 (Task) correct layer information, metadata and download links for some SH layers	resolved	This is a issue/suggestion that SBH flagged with some of our layers on the central portal viewer. These have now been corrected	none	17/11/2022
EM-623 (Improvement) improve access to metadata and download	pending	This is a issue/suggestion that SBH made related to the functionality of the CP	none	
EM-688 (Improvement) correction to a use case	resolved	This is a issue that SBH flagged with one of the use cases which had been reported by a user. CP have corrected so just needs to be reviewed by us	none	30/09/2023
EM-723 (Task) Updated download links needed for EMODnet Seabed Habitats layers on central	resolved	Post thematic shut down updates were needed for some central viewer layers to ensure the downloads links were correct	none	25/01/2023
EM-796 (Task) Viewer third level menu options for Seabed Habitats	resolved	Additional third level menu option implemented for relevent SBHs layers		13/06/2023
EM-798 (Task) Products catalogue - metadata not updated	pending	Issue flagged by SBHs whereby changes we implement to our metadata are not being carried through to the products catalogue. We have provided some examples for the central team to look at		

EM-802 (Task) New Ramsar and EFH layers for CP viewer	resolved	Mostly complete just awaiting SBHs review		10/07/2023
In the project proposal we proposed that we subcontract the 'Mid Atlantic Environmental Research Institute' (MAERI) to carry out data collation, preparation and outreach in the Caribbean. At the time of bidding MAERI was not an operational entity but a partnership between Anguilla Community College (ACC), Department of Natural Resources (Anguilla), South Atlantic Environmental Research Institute (SAERI) and JNCC. However, the intention was to establish MAERI as a standalone entity. Developments were hindered by the pandemic and, as such, MAERI still only exists as a partnership between these organisations. In the bid, we proposed that ACC be the official subcontractor representing MAERI and throughout year 1 of the project we have had many exchanges with both ACC and DNR about how to arrange this subcontract. Over the summer it became apparent that there were going to be too many administrative obstacles to be able to set up a contract with ACC and get any meaningful input from them before the end of the	resolved	CINEA approved the subcontracting of another MAERI partner, SAERI, who were better set up for contracts such as these - both with the financial mechanisms in place and personnel.	31/10/2022	01/02/2023

contract and so we realised we needed another option.				
Lack of an EMODnet DEM in the Caspian Sea for broad-scale habitat mapping. It is well known that a vital input layer into the broad-scale habitat map (EUSeaMap) is a digital elevation model provided by EMODnet Bathymetry. However, in this phase of the project Seabed Habitats has been asked to produce a broad-scale habitat map for the Caspian Sea, while Bathymetry were not asked to produce a DEM for that sea. As a result, we are forced to use GEBCO, which is of low resolution and quality in the Caspian Sea. We will be able to deliver the deliverable of a broad-scale habitat map for the Caspian Sea, but its quality will not be high.	resolved	raised at the April Steering Committee meeting. It was confirmed with Bathymetry and CINEA that Bathymetry would not be producing a DEM and that ESH should use GEBCO.	none	30/09/2022
We have found a problem with the new version of the EMODnet DTM. There are areas, typically bays and estuaries, with depth values that are too high to a sometimes surprising degree. It appears that in all these areas GEBCO 2022 is used. This problem will lead to classification errors in EUSeaMap, and we cannot publish EUSeaMap with such classification errors (they cover too large an area).	pending	We have reported the problem to EMODnet Bathymetry and discussed it with them. Their view is that the problem should be solved by GEBCO first, and as a result future versions of the EMODnet DTM will de facto be corrected. Therefore, we will have to manually correct the classification errors of EUSeaMap in a post-processing step. This will take some time. However, we do not expect this to delay in		

		the delivery of EUSeaMap.		
We are able to harvest habitat ground-truthing data from EMODnet Biology/EurOBIS via web services in conjunction with the species occurrence data. However, it is not yet possible to query and download habitat data specifically via the EMODnet viewer as this requires further development to expand the API filter which cannot occur until the last 2023 viewer versions is complete, a work that requires the intervention of Bilbomatica.	pending	Once the 2023 viewer updates are successfully completed we will pick up this work with EMODnet biology in the next phase.		
We had planned to use a small proportion of the funds in this phase to run targeted data provider contracts – for example in the Caspian. For the Caspian Sea, in particular, we have discovered a significant lack of classified habitat data and maps of any kind. It was hoped we could utilise the Caspian funds for other subcontracts however despite the consortia reaching out to their contacts we were unable to find suitable contractors with capacity to collate and submit their data under the required time frames.	Resolved	Reported the issue to CINEA and agreed that the unused subcontracting amount will be excluded from the end of phase invoice. We will continue to work with our network of contacts to try and fill any remaining data gaps and will encourage the use of EMODnet Ingestion for submitting data as this is less resource intensive for potential submitters.		23/08/2023

5. Allocation of project resources

Information on the allocation of project resources	
Categories	Resource usage ¹⁰ (%)
Making data and metadata interoperable and available	35%
Preparing data products	38%
Preparing web-pages, viewing or search facilities	3%
Managing user feedback	<1%
Project management	9%
Outreach and communication activities	6%
Others	1%

¹⁰ Provide the workings of your calculations, *i.e.* percentage allocation of the total amount awarded.

6. User feedback

Overview of user feedback and/or requests received in this project phase							
Date	Organisation	Type of user feedback (e.g. technical, case study, etc.) and short description of the feedback received	Means of contact	Response time	Status of user query (Resolved/ Pending)	Measures taken to resolve the query	Status: if not (yet) resolved/ pending, explain reason why and expected timeline
02/11/2021	French Museum	technical - Would like to implement a model with substrate data so downloaded C20211108_EUSeaMap_2021_Arctic_Atlantic.gdb but does not know : 1- How to read the data 2- How to extract the data to use them with R Is there a tutorial?	web form	4 hours	resolved	replied via email. Sent a R script to read ArcGIS geodatabase format in R using the rgdal package	
09/11/2021	Cornwall IFCA	technical - trying to find/ download biotope distribution data to produce the same maps that marlin have used for each of their biotopes for the seagrass habitat. Is there a layer which contains this information?	web form	4 hours	resolved	replied via email	
23/11/2021	Not disclosed	technical - Is undertaking a project developing essential fish habitat maps and is relying heavily on our data as information on confidence is available. However, has not been able to download the quality index data for our bathymetry layer (2020). Is it possible to download this? The dtm tiles I need this for are C2, C3, C4, C5, D2, D3, D4, D5, E2, E3, E4, E5	web form	10 minutes	resolved	replied via email EMODnet bathymetry is in charge of the information she's looking for	
01/12/2021	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	technical - Current work involves the use of the EMODnet KdPAR and Seabed PAR datasets in Northern Germany. As such, would like to cite this dataset in my manuscript. What is the correct ref?	email	10 minutes	resolved	replied via email	
08/12/2021	JNCC	technical - I wanted to add the windfarm data (point and polys) from EMODnet Human Activities to the ESH mapper, but when I select Add external layers and try to get layers from HA, I get 'No	web form	10 minutes	resolved	replied via email to explain that this is an issue at EHA's end (CORS issue) and	

		layers available from this source'. Is this a bug at our end or theirs?				notified EHA of the issue. EHA has now resolved the issue and it is now working.	
09/12/2021	DG-ENV	request for analysis - Would you have values for the extent (km2) of each MSFD broad habitat type per country (and per subregion if several for a country)? ... I need to do some calculations in relation to seabed trawling. Calculation made and sent the 11/01/2022. Lots of work, especially to find a shapefile on the marine waters used by the Member States for the MSFD assessment and then to fix the many issues found in the shapefile	email	1 month	resolved	Calculated values for the extent (km2 and percentage) of each MSFD broad habitat type per country and per subregion. Accepted by DG-ENV and plan to publish them online, and keep them updated	
10/12/2021	Not disclosed	technical - Would need the data for the probability of coralligenous, maerl and posidonia habitats in Greece. Tried to download the three datasets from the map viewer but did not work.	web form	6 days	resolved	replied via email. There has been a change in the permissions associated with this data and that they are not available for download. Suggested to contact the owner	
02/01/2022	Arcadis	technical - Attempted to download the probability of coralligenous and maerl habitats in the Mediterranean but the links were broken.	web form	1 hour	resolved	sent correct link with an hour. Then set about correcting the links online	
12/01/2022	Not disclosed	technical - broken link on bulgarian wave data	email		resolved	modified erroneous data driving underlying webpage	
02/02/2022	DG-ENV	request for analysis - The 11/01/2022 we sent to the EEA an excel spreadsheet with values for the extent (km2) of each MSFD broad habitat type per country (and per subregion if several for a country), a request made by the EEA in December	email	10 days	resolved	calculations remade	

		2021. in the spreadsheet, there were some significant differences between these figures and those they expected, due to projection issues. The calculations were remade using the expected projection (LAEA)					
03/03/2022	Jersey Marine Conservation	concern about data ownership - There was concern that the data owner was not given enough recognition in the case of data owned by Jersey Marine Conservation. This relates to the Survey sample points data layer.	web form	1 hour	resolved	a phone conversation helped to identify that the main source of the issue was that the data custodian needs to amend the data owner information before it is submitted to the national UK database, Marine Recorder, which is subsequently aggregated into the EMODnet collection. Furthermore, we will consider a new web page that lists all data providers and what they have contributed.	
04/03/2022	ABPMER	technical - 'habitat point observations - all' download not working	web form	1 day	pending	Issue investigated, download is over the 2 GB WFS limit. Alternate solutions offered to user to allow access to the data whilst the technical issue is resolved.	

14/03/2022	Ifremer	technical - Would need to know what the habitat is at a specific location. What is the data layer I should look at on the webGIS?	Live Chat	2h	resolved	Live guidance	
23/03/2022	CGR	technical - Broken links in a metadata record	email	15 minutes	resolved	corrected the metadata record	
01/04/2022	Aqualicence	technical - The user was enquiring about some missing data in the EMODnet seabed substrate layer, which they were accessing via WMS.	web form	3 hours	resolved	it transpired that they were viewing an old version of the layer, which is still available via WMS but not on the map viewer. I directly her to the latest version, which she was happy to see had the gaps filled. I also promised to rename the WMS layers to make it clear if they were not the most recent version. This has been added to our internal technical issues log	
08/04/2022	SHOM	technical - The user was confused about the fact that there are EUSeaMap confidence layers on the map viewer, but when they clicked the download link they were taken to a link to download the EUSeaMap map package.	web form	3 hours	resolved	explained that the confidence layer is not available to download on its own via the download page, it is zipped up with the EUSeaMap habitat map.	
16/05/2022	Havochvatten - Swedish Agency for Marine and Water Management	technical - ICES metadata catalogue was down.	web form	1 hour	resolved	contacted ICES data centre to check status. They confirmed that the service was down	

						temporarily due to system maintenance.	
09/08/2022	Archipelagos Institute of Marine Conservation	technical - Their organisation has some habitat maps they would like to contribute to EMODnet and were asking a question about unique identifiers.	web form	1 day	resolved	Responded with the required information and reached out to understand more about the data they have to submit.	
03/09/2022	University of Aberdeen	technical - Is looking to use the Light (PAR) at seabed data layer (accessible from EMODnet Seabed Habitat data portal) however is struggling to find the resolution of the layer and can only find information on the scale in ICES Metadata Catalogue. Ask to confirm the layer's resolution	email	15 minutes	resolved	replied that the resolution of the grid is 0.0010416667 decimal degrees, corresponding to approx. 100m.	
05/09/2022	Natural Power	technical - They had a question about WMS legend	web form	1 hour	resolved	Responded to explained how to see the legend	
22/09/2022	Red Electrica	technical - The description of attributes in the EUSeaMap download did not exactly match the attributes present in the attribute table. They requested an updated description of attributes.	web form	1 day	resolved	Responded with questions to better understand the problem and offer some potential solutions. They responded to say they have resolved their problem.	
16/06/2022	University of St Andrews	technical - The user was asking why there was substrate information missing from some coastal areas (e.g. Orkney Islands) in EUSeaMap 2021 when it was present in EUSeaMap 2016.	web form	2 hours	resolved	Responded to explain that this information disappeared from the EMODnet Geology seabed substrate layer and that JNCC were planning to discuss the issue with BGS	

21/06/2022	Intertek	technical - The user informing us that the OSPAR points layer doesn't have a symbology in the legend for Oceanic Ridges	web form	1 day	resolved	The legend graphic was updated to show the missing habitat	
20/09/2022	nationalpark authority in Schleswig Holstein	technical - A bit surprised that in German North Sea there are many differences with respect sediment in EUSeaMap 2021 compared to version 2016	email	7 days	resolved	Gave a contact at EMODnet Geology	
03/10/2022	Instituto Espanol de Oceanografia (IEO)	technical - They were responding to an offer from ESH to provide data formatting assistance to members of OSPAR who were preparing data submissions for the 2022 data call for OSPAR threatened and/or declining habitats.	email	2 days	resolved	Explained that the deadline for OSPAR data submissions had passed but that we welcome data submissions to EMODnet at any time and enquired about the volume of data available.	
13/10/2022	Envision	technical - There was a problem download the Habitat point observations dataset from the download page.	web form	1 day	resolved	Sent them an alternative link and promised to resolve the problem on the download page.	
11/11/2022	Plymouth Marine Laboratory	technical - Metadata catalogue was temporarily down	web form	1 hour	resolved	None needed - the issues resolved itself	
23/11/2022	Central Statistics Office, Ireland	technical - request for previous versions of EUSeaMap	web form	1 hour	resolved	Provided information and data	
23/11/2022	French Office for Biodiversity	case study - Incorrect user attribution in a use case	web form	1 hour	resolved	Corrected the use case on thematic portal and submitted JIRA ticket for correction on central portal	
23/01/2023	Not disclosed	technical - unable to access the Mediterranean EUSeaMap data and biological zone information via the central portal download by area	email	4 hours	resolved	Broken links were during the switchover from thematic to central	

						portal. Whilst we were waiting on the links to be fixed we provided the data directly to the user via e-mail.	
24/01/2023	Bangor University, UK	technical - unable to access EUSeaMap 2021 EUNIS 2007 data and biological zone information via the central portal download links	JIRA ticket/CP help desk	2 days	resolved	Broken links were during the switchover from thematic to central portal. Whilst we were waiting on the links to be fixed we provided the data directly to the user via e-mail.	
01/02/2023	Envision Marine	technical - request for RGB mapping colours for the EUNIS EUSeaMap map and EUNIS individual habitat maps as well as both the EUNIS 2007-2011 or EUNIS 2019 classification scheme	email	1 day	resolved	Provided them with spreadsheet containing the requested HEX/RGB codes	
13/02/2023	Institute for Agricultural and Fisheries Research - Oostende, Belgium	technical - request for an updated EUSeaMap layer	email	1 hour	resolved	Highlighted the new centralised marine data service portal and provided them with a link to the EUSeaMap 2021 broadscale Habitat Map dataset	
08/03/2023	Marine Biological Association	contact - request for contact details for a member of JNCC staff who deals with marine habitat maps and specifically EMODnet	email	1 day	resolved	Provided them with Helen Woods contact details	
20/03/2023	Marine Biological Association	technical - request for access to particular attribute information for point data	email	2 days	resolved	Clarified where they could find point information through the new central portal	

27/03/2023	Natural England	technical - request for a link to the Seabed Habitats Data Exchange Format documentation on the new central portal	Central helpdesk - JIRA ticket 1566	2 hours	resolved	Provided the new link on the central portal	
28/03/2023	Université de Montpellier	technical - request for seabed typology data at the Mediterranean scale	Central helpdesk - JIRA ticket 1554	12 days	resolved	advised on the relevant datasets available under Seabed Habitats and where these could be found	
30/03/2023	Individual	technical - One of the download links from EMODnet Map Viewer doesn't work, requested a link to the EUSeaMap download	Central helpdesk - JIRA ticket 1575	4 hours	resolved	Provided them with a download link and directed them towards the layers in the catalogue for future data downloads	
12/04/2023	Individual	technical - request for all seabed individual habitat maps	Central helpdesk - JIRA ticket 1585	1 day	resolved	provided links to download all datasets	
13/04/2023	Individual	contact - advise sought on reporting of deceased dog fish in the UK	Central helpdesk - JIRA ticket 1586	1 day	resolved	provided contact information	
14/04/2023	Individual	technical - feedback provided on the individual seabed habitat maps suggesting that versioning information would be a useful addition.	Central helpdesk - JIRA ticket 1588	3 hours	resolved	logged the feedback for future development	
14/04/2023	Individual	technical - flagged missing habitat map from download	Central helpdesk - JIRA ticket 1589	3 hours	resolved	corrected the download to include the missing files	
14/04/2023	Individual	technical - flagged that some of the download shortcuts in the seabed habitat map download packages were broken	Central helpdesk - JIRA ticket 1590	3 hours	resolved	provided a temporary solution to the user and then corrected the broken	

						metadata links in the download package	
14/04/2023	Individual	technical - flagged that the Seabed Habitat metadata on Geonetwork wasn't working	Central helpdesk - JIRA ticket 1591	4 days	resolved	issues was due to a temporary server update so resolved on it's own once server was restarted	
30/05/2023	University of A Coruña	technical - request for advise on what software to use to access downloaded data	Central helpdesk - JIRA ticket 1616	3 days	resolved	advised on the file type and the appropriate software to use to access the file	
20/07/2023	Plymouth University	technical - flagged that some layers accessed by WFS service are returning errors	Central helpdesk - JIRA ticket 1647	5 days	pending	fixed the requested layers	
22/08/2023	Royal Belgian Institute of Natural Sciences	technical - Need EUSeaMap 2023 for MSFD assessment. Replied that would be available end of September.	email	1 hour	resolved	Replied that EUSeaMap 2023 would be available end of September.	
27/09/2023	Royal Belgian Institute of Natural Sciences	technical - Wanted to inform wheter EUSeaMap is now available (see request 22/08/2023). Is is not ready yet for that area but biozone 2023 and seabed substrate 2023 were ready so made a bespoke layer for Belgium	email	3 hours	resolved	made a bespoke layer for Belgium	

7. Meetings/events held/attended & planned

A. Meetings/events organised and attended in this project phase					
Date	Location	Type event (internal or external meeting; training/workshop)	Was a presentation given? (yes/no + short description)	Meeting attended (A) / organised (O)	Short description and main results (# participants, agreements made, etc.)
15/10/2021	Web	Internal Meeting	No	O	WP5 planning, including JNCC handing over responsibility for this WP to MI. 4 participants. MI now prepared to manage WP5.
27/10/2021	Web	External Conference	Yes - on the challenges of delivering EUSeaMap in the Caspian Sea	A	Conference on Climate Change in the Caspian Sea Region (27-28 October). ~200 participants. Promotion of EMODnet Seabed Habitats Phase 4 extension of EUSeaMap into the Caspian Region. Initial identification of primary research contacts for this region. 6 recommendations submitted for inclusion into the Conference Summary Report.
28/10/2021	Web	External Meeting	No	A	EMODnet Central Portal Technical team meeting with Seabed Habitats - meeting 1. ~15 participants. Central Portal team gained a better understanding of steps needed to incorporate the contents and functionality of the Seabed Habitat portal into the Central Portal.
11/11/2021	Web	Internal Meeting	No	O	WP2 planning, including ISPRA handing over responsibility for this WP to JNCC. 5 participants. JNCC now prepared to manage WP2.
23/11/2021	Web	External Workshop	Yes - on data standards and useful EMODnet Seabed Habitats data products (prepared as part of a	A	Workshop: Towards a Coordinated European Observing System for Marine Macroalgae. 53 participants. Awareness of EMODnet Seabed Habitats data standards and existing data products relevant to marine macroalgae.

			wider EMODnet presentation delivered by Biology)		
30/11/2021	Web	Internal Meeting	No	O	Caspian Climate Conference - Presentation Debrief. 4 participants. MI described the 27/10 conference to other partners, with some suggested next steps
30/11/2021	Web	Internal Meeting	No	O	WP1 and WP6 planning. 2 participants. Agreement on division of responsibilities between Project Coordinator (at JNCC) and Technical Project Manager (at Ifremer), who together with the Project Administrator (at JNCC), form the 'Project Office'. Ifremer now prepared to manage WP1.
30/11/2021	Web	Internal Meeting	No	O	WP3 planning and essential fish habitats. 4 participants. CCMAR now prepared to manage WP3.
01/12/2021	Web	External Meeting	No	A	EMODnet Central Portal Technical team meeting with Seabed Habitats - meeting 2. ~15 participants. Central Portal team gained a better understanding of steps needed to incorporate the contents and functionality of the Seabed Habitat portal into the Central Portal.
02/12/2021	Peterborough	Internal Meeting	No	O	WP4 planning. 2 participants. JNCC now prepared to manage WP4.
19/01/2022	Web	Internal Meeting	Yes	O	EMODnet Seabed Habitats kick-off. ~20 participants. We expect that all consortium members will gain a greater understanding of what is required in the project.
01/02/2022	Web	External Meeting	No	A	Stakeholder discussion for the "Urbanization and Climate Change Adaptation in the Caspian Sea Region" project. 50 participants. Identified the person who will be collating the spatial data for the Caspian for this UN Habitat project and reached out to her and suggested we liaise on dataset discovery in the region.
02/02/2022	Web	External Meeting	No	A	EMODnet Central Portal Technical team meeting with Seabed Habitats - meeting 3. 15 participants. Central Portal team gained a better understanding of steps needed to incorporate the

					contents and functionality of the Seabed Habitat portal into the Central Portal.
08/02/2022	Web	External Meeting	No	A	Meeting with EMODnet Biology to discuss future collaboration. 6 participants. A better understanding of outputs from each programme and any commonalities or future collaborations.
10/02/2022	Web	Internal Meeting	No	O	WP2 coastal wetlands. 3 participants. Progress meeting and discuss next steps regarding coastal wetland data and classification
10/02/2022	Web	Internal Meeting	Yes - progress updates	O	Project Management Team meeting. 5 participants. Progress meeting among WP leaders, and to discuss any issues
14/02/2022	Web	External Conference	Yes - "EMODnet Seabed Habitats: collecting habitat maps once, using many times"	A	International Ocean Data Conference 2022 - The Data We Need for the Ocean We Want. More awareness of the sorts of products that EMODnet Seabed Habitats has and can produce
15/02/2022	Web	Internal Meeting	No	O	WP1 EUSeaMap in the Caspian Sea. 3 participants. Discuss possible input layers for the Caspian Sea
21/02/2022	Dublin, Ireland	External Conference	Yes - EMODNet Seabed Habitats participation & alignments with INFOMAR	O	INFOMAR National Seabed Mapping Conference. 70 participants. Seabed Mapping community in Ireland get an overview of the products and improvements planned in the next phase of EMODnet SH
03/03/2022	Web	External Conference	Yes - "How following the FAIR principles has allowed EMODnet Seabed Habitats to aggregate and combine disparate data into new products for the benefit of many"	A	MEDIN Open Meeting. 100 participants. Raise awareness of EMODnet SH among the marine data community in the UK and show its commitment to FAIR data principles.

16/03/2022	Web	External Meeting	No	A	EMODnet Central Portal - static content. 4 participants. Discuss static content transfer to central portal
17/03/2022	Web	External Meeting	No	A	EMODnet Central Portal Technical team meeting with Seabed Habitats - meeting 4. 11 participants. Central Portal team gained a better understanding of steps needed to incorporate the data and functionality of the Seabed Habitat portal into the Central Portal.
23/03/2022	Web	Internal Meeting	No	O	RSC Engagement - Black Sea. 4 participants. Discussed and agreed the approach for engagement of the ESH RSC rep with the RSC for the Black Sea. Template letter drafted and reviewed.
30/03/2022	Web	Internal Meeting	No	O	RSC Engagement - Tehran Convention. 3 participants. Discussed and agreed the approach for engagement of the ESH RSC rep with the RSC for the Caspian Sea.
03/04/2022	Web	External Meeting	No - Live Portal Demo	O	ESH Outputs demonstrated to Ecosystem Accounts Division of Centre Statistics Office Ireland. 2 participants. ESH Outputs demonstrated to Ecosystem Accounts Division of Centre Statistics Office Ireland. ESH Resources / EUSeamap will be used by Ecosystem Accounts Division in the CSO, (Ireland) in compiling Ecosystem Accounts at national level for Ireland.
07/04/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping - kick-off meeting. ~15 participants. The EMB WG on Marine Habitat Mapping should aim to highlight the science and policies needed to advance marine habitat mapping to fulfil the objectives of the European Green Deal, the EU Biodiversity Strategy for 2030, and international commitments on biodiversity and climate. The WG should also make links to the societal outcomes of the UN Decade of Ocean Science for Sustainable Development.
12/04/2022	Online	External Meeting	Yes - our partnerships, key thematic focus, users, a technical overview of the	A	EMODnet meet and greet - Introducing MARE A1 Deputy Head of Unit. 10 participants. DG MARE A1 welcomed recently its new Deputy Head of Unit, Remy DENOS. Aiming to give him the gist of EMODnet as fast and as efficiently as possible, DG MARE

			thematic portals as they currently stand, before the centralisation.		considered that it would be beneficial to have short meetings with each Thematic lot
14/04/2022	Web	Internal Meeting	No	O	Meeting on "D1.05 EUNIS-style habitat classification in the Caspian Sea for broad-scale habitat mapping". 3 participants. Discussions on Impact of the war on our work. Review of the list of environmental variables collated. Review of sample point data projects.
26/04/2022	Web	External Meeting	Yes - Seabed Habitats portal update	A	EMODnet TWG. ~20 participants. https://maritime-forum.ec.europa.eu/en/node/7266
27/04/2022	Web	External Meeting	Yes - Seabed Habitats general update	A	EMODnet Steering Committee. ~25 participants. https://maritime-forum.ec.europa.eu/en/node/7203
06/05/2022	Web	External Meeting	No	A	EMODnet Central Portal Technical team meeting with Seabed Habitats - meeting 5. 11 participants. Central Portal team gained a better understanding of steps needed to incorporate the data and functionality of the Seabed Habitat portal into the Central Portal.
09/05/2022	Lisbon, PT	Internal Meeting	Yes - WP updates	O	EMODnet Seabed Habitats Project Management Group Meeting. 9 participants. Updates from each WP on the current phase and identification of issues regarding the deliverables. Planning commencement for potential next phase which will include a new project co-ordinator due to JNCC/UK status.
11/05/2022	Web	External Conference	Yes - OSPAR use case	A	EU Marine Data Services All-Atlantic Workshop - satellite event to the Ocean Decade Laboratory on the Outcome "An Accessible Ocean". 150 participants. This 2-hour webinar discussed how a future All-Atlantic Ocean Data Space could be realized by building on existing initiatives such as the two EU operational marine data services, i.e. Copernicus Marine Service and EMODnet.
16/05/2022	Venice, Italy	External Conference	No	A	GeoHab. 150 participants. GEOHAB is an international association of marine scientists studying and mapping

					geophysical, biophysical, and geomorphic indicators of benthic communities, species diversity, and distribution. Enhancing Visibility of ESH outputs.
23/05/2022	Web	Internal Meeting	No	O	Making progress on setting up the subcontract with Anguilla Community College. 5 participants. Anguilla Community College/Government of Anguilla gaining a better understanding of the requirements so they can recruit a new member of staff to work on the project.
25/05/2022	Web	Internal Meeting	Yes - summary of WP2 progress, guidance, templates	A	WP2 progress meeting (Europe region). 10 participants. To make sure everyone understood what was required for preparing habitat maps and point datasets for submission as part of WP2.
31/05/2022	Constanta, Romania	Internal Meeting	No	O	Workshop on "D1.05 EUNIS-style habitat classification in the Caspian Sea for broad-scale habitat mapping". 3 participants. A draft habitat classification for Caspian Sea
15/06/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping . ~15 participants. The EMB WG on Marine Habitat Mapping should aim to highlight the science and policies needed to advance marine habitat mapping to fulfil the objectives of the European Green Deal, the EU Biodiversity Strategy for 2030, and international commitments on biodiversity and climate. The WG should also make links to the societal outcomes of the UN Decade of Ocean Science for Sustainable Development.
20/06/2022	Web	Internal Meeting	No	O	Making progress on setting up the subcontract with Anguilla Community College. 5 participants. Anguilla Community College/Government of Anguilla gaining a better understanding of the requirements so they can recruit a new member of staff to work on the project.
22/06/2022	Web	External Meeting	No	A	EMODnet Vision for the future, governance and business model. 15 participants.
29/06/2022	Web	External Meeting	No	A	EMODnet Central Portal Technical team meeting with Seabed Habitats - meeting 6. 11 participants. Central Portal team gained a better understanding of steps needed to incorporate the data

					and functionality of the Seabed Habitat portal into the Central Portal.
12/07/2022	Web	External Meeting	No	A	Ifremer was invited at a meeting organised by people in charge of MSFD assessment in France to provide guidance on the use of EUSeaMap. 6 participants.
13/07/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping . 9 participants. Catch-up on the drafting of a Future Science Brief on Marine Habitat Mapping in Europe
13/07/2022	Web	External Meeting	No	A	Meeting with new chair of MSFD EU TG Seabed about EUSeaMap. 5 participants. For TG Seabed to understand why the definition of mud and sand differs between EUNIS and EUSeaMap and for a general introduction
14/07/2022	Web	External Meeting	No	O	Meeting with the hosts of the NERC Vocabulary Server, BODC, to discuss to addition of new vocabularies for habitat classification systems. 4 participants. The get a better understand of how the NERC Vocabulary Server works and the process for adding new vocabularies.
18/07/2022	Web	External Meeting	Yes (latest highlights)	A	DG/MARE invited thematic coordinators to a meeting directly after the submission of the thematic quarterly reports, to check altogether the state of play of EMODnet's centralisation and the overall progress of our common work. ~15 participants.
09/08/2022	Web	External Meeting	No	A	Habitat Mapping products available on ESH Mapper. 2 participants. Provide an overview of ESH habitat mapping products and identify best available data for MSFD reporting to Department of Housing (RP for OSPAR and MSFD Reporting)
16/08/2022	Aalborg Univ./Denmark	External Conference	Yes, GEUS seabed mapping in North Sea and how that improved the EMODnet EUNIS and Broad scale habitats in that area.	A	Meeting with all marine researcher in Denmark, presenting the results of the habitata mapping in the North Sea including the EUNIS / Broad habitat map using the model developed by Seabed Habitat Lot in 2019. In Danish/English.

29/08/2022	Reykjavik, IS / Web	External Meeting	No	A	ICES Working Group on Marine Habitat Mapping. 15 participants. To investigate the applicable uses of Habitat maps in policy / MSFD.
05/09/2022	Web	Internal Meeting	Yes - WP updates	O	EMODnet Seabed Habitats Project Management Group Meeting. 6 participants. Updates from each WP on the current phase and identification of issues regarding the deliverables.
13/09/2022	Cork, IE	External Meeting	No	A	IE OSPAR delegation meeting . 30 participants. To promote EUSeaMap and enhance engagement of ICES WGS/ EGS with ESH
14/09/2022	Web	External Meeting	Yes - EUSeaMap and EUNIS	A	Technical Group on seabed habitats and sea-floor integrity (TG SEABED). ~30 participants. To present and answer questions on EUSeaMap and EUNIS so that Member States understand how to use EMODnet seabed habitat maps for MSFD reporting and assessment.
15/09/2022	Web	External Meeting	No	A	How best to use EUSeaMap for MSFD reporting. 3 participants. Combine best available data from ESH library of maps and models (with EUSeaMap as a base) to create a new map covering the extent of the Marine Reporting Unit used in Irish MSFD assessments.
19/09/2022	Genova, IT	External Conference	No	A	Marine Key Habitats and Non-indigenous Species Symposia. The main objective of Symposia is to gather available knowledge on Marine Key Habitats at Mediterranean level.
19/09/2022	Dublin, IE	External Conference	Yes - EUSeaMap	A	ICES Annual Science Conference. 500 participants. To promote EUSeaMap and enhance engagement of ICES WGS/ EGS with ESH
21/09/2022	Web	External Meeting	Yes - Seabed Habitats portal update	A	EMODnet Technical Working Group. ~20 participants. https://maritime-forum.ec.europa.eu/en/node/7402
26/09/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping . ~10 participants. The group is tasked with writing a Future Science Brief to highlight the science and policies needed to advance marine habitat mapping to fulfil the objectives of the European Green Deal, the EU Biodiversity Strategy for 2030, and international commitments on biodiversity and climate. The WG

					also make links to the societal outcomes of the UN Decade of Ocean Science for Sustainable Development.
26/09/2022	Web	Internal Meeting	Yes - EMODnet overview	O	Making progress on setting up the subcontract with the South Atlantic Environmental Research Institute. 4 participants.
03/10/2022	Brussels, BE	External Meeting	No	O	Seabed Habitats-Biology common topics. 2 participants. Discuss progress on common work areas between the two projects
03/10/2022	Brussels, BE	External Workshop	No	A	EU-Canada Ocean Partnership Forum. 30 participants. Supporting a Healthy and Sustainable Ocean through International Collaboration to Enhance Knowledge and Data Sharing
06/10/2022	Dingle, IE	External Vessel Launch	No	A	Commissioning of RV Tom Crean. 2000 participants. EMODNet Seabed Habitat MSFD Maps displayed / Explained to minister & delegation
11/10/2022	Web	External Workshop	Yes - How EMODnet biodiversity assets can contribute to coastal ecosystems' protection	O	Copernicus Biodiversity and coastal ecosystems workshop. Unknown participants. Promote EMODnet (SH+Biological) data and products of use for coastal biodiversity protection. Overall goals of the workshop: Describe the landscape in terms of biodiversity at stake, European and international policy development in a context of climate change as well sustainable development goals, practices and needs at Member State level. Showcase examples of research, development and best practices to develop blue economy or support territorial development, implement EU policies (CFP, MSPD, MSFD, etc.) along coasts while protecting and fostering biodiversity, based on the use of space technologies combined with science and digital intelligence.
20/10/2022	Web	External Workshop	Yes	A	EMODnet for Business workshop: offshore renewable energy sector (Med & Black Sea). Unknown participants. Ensure visibility of ESH outputs and products and establishment of contacts
21/10/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping . ~10 participants. The group is tasked with writing a Future Science Brief to highlight the science and policies needed to advance marine habitat mapping to fulfil the objectives of the European Green Deal, the EU Biodiversity Strategy for 2030, and

					international commitments on biodiversity and climate. The WG also make links to the societal outcomes of the UN Decade of Ocean Science for Sustainable Development.
24/10/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping . ~10 participants. The group is tasked with writing a Future Science Brief to highlight the science and policies needed to advance marine habitat mapping to fulfil the objectives of the European Green Deal, the EU Biodiversity Strategy for 2030, and international commitments on biodiversity and climate. The WG also make links to the societal outcomes of the UN Decade of Ocean Science for Sustainable Development.
26-27/10/2022	Constanta, Romania	External Conference	No	A	The aim of the conference is to contribute to the protection of the Black Sea by supporting the sustainable development in a multi-disciplinary way.
2-3/11/2022	Bucharest, RO	Internal Meeting	No	O	Workshop on "D1.05 EUNIS-style habitat classification in the Caspian Sea for broad-scale habitat mapping". 3 participants. Workshop on "D1.05 EUNIS-style habitat classification in the Caspian Sea for broad-scale habitat mapping". 3 participants. A classification of seabed broad habitat types for Caspian Sea, a list of environmental variables that explain their occurrence and thresholds values that allow to the classify environmental variables in habitat descriptor classes
18/11/2022	Aarhus, Denmark	External meeting	No	O	The theme of this year's event is "Coastal and Marine Reefs – True or False?" – a topic which attracts a lot of interest among planners and managers, but at the same time is a field where lack of knowledge of their function (as habitat and potential coastal protection) is evident and where no apparent consensus exists with regard to designing and management.
24/11/2022	Web	External Meeting	No	A	European Marine Board Working Group on Marine Habitat Mapping . ~10 participants. The group is tasked with writing a Future Science Brief to highlight the science and policies needed to advance marine habitat mapping to fulfil the objectives of the

					European Green Deal, the EU Biodiversity Strategy for 2030, and international commitments on biodiversity and climate. The WG also make links to the societal outcomes of the UN Decade of Ocean Science for Sustainable Development.
29/11/2022	Web	External meeting	Yes, short run through of the iterations of EUSeaMap and reasons for differences.	A	Central Statistic Office. 3 participants. Ecosystems Accounts division of the Central Statistics Office are working on a marine ecosystem typology for Eurostat - European Commission for Ecosystem Extent Accounts.
02/12/2022	Dublin, IE	External Meeting	Yes	A	Hydrographic Society UK& Ireland - Ireland Branch Winter Meeting. 15 participants. EMODnet Seabed habitats Products presented including the development pathways for EUSeaMap. Access via the CP discussed.
12/12/2022	Manchester, UK	Internal Meeting	Yes - WP updates	O	EMODnet Seabed Habitats Project Management Group Meeting. 5 participants. Updates from each WP on the current phase and identification of issues regarding the deliverables.
12/12/2022	Manchester, UK	Internal Meeting	Yes	O	EMODnet Seabed Habitats WP3 planning and knowledge exchange. 7 participants. A more concrete plan for delivering composite data products under WP3, and transfer of knowledge/processes/scripts from JNCC to CCMAR
13/12/2022	Manchester, UK	Internal Meeting	Yes - WP updates	O	EMODnet Seabed Habitats Whole Consortium Meeting. ~20 participants. Relationship-building, better understanding of procedures and purposes, ideas for next phase
18/01/2023	Web	External Meeting	No	A	EMODnet Central Portal Communication Processes Meeting. ~20 participants. To discuss and finalise procedures concerning all communication actions around the EMODnet centralisation in preparation for the thematic portals going offline. Additionally, an overview of the communication campaign and actions supporting the portal unification will be presented.
23/01/2023	Web	External Meeting	No	A	EMODnet: achievements & way forward. ~20 participants. Meeting with DG MARE, CINEA and thematic coordinators to

					discuss a request for feedback and reflections on the current phase and how best to gather this information from each theme.
26/01/2023	Web	External Meeting	Yes - Assessing the progress on EMODnet data adequacy - Panel discussion with EMODnet thematic Coordinators (25') - 2' reflection per Coordinator on EMODnet data adequacy and related initiatives	A	EMODnet Sea-basin Checkpoint (SBCP) online workshop. ~100 participants. A Panel discussion for short reflections on the progress in EMODnet data adequacy from 2018 (end of Sea-basin Checkpoints) to 2022
08/02/2023	Brussels, BE	External Meeting	No	A	Open Sea Lab Hackathon training event. 2 participants. Training & Networking Day for the Coaching & Mentoring Team of OSL Hackathon 3.0. This day will be an opportunity to provide coaches and mentors with all the information that they might need to support the delivery of their role in the hackathon, including a Guide to all available resources. Also, to gear them up with useful tips & suggestions, based on past hackathon experiences.
16/02/2023	Web	External Webinar	No	A	EMODnet Public Webinar "EMODnet Centralisation: One Ocean, One EMODnet". 50+ participants. To share thoughts on the benefits of centralisation including reflections on the achievements of EMODnet Centralisation from the perspective the themes and answer questions from the audience.
01/03/2023	Bodo, NO	External Meeting	Yes - EMODnet and Seabed Habitats overview	A	MPA Europe kick-off meeting. ~60 participants. Profile of EMODnet and Seabed Habitats raised within the MPA Europe project. Better understanding of the data available and how project data can feed into it.

13-16/03/2023	Copenhagen, DK	External Meeting	No	A	ICES SCICOM Spring Meeting. ~40 participants. Identified ESH efforts to engage with RSCs / ICES EGS & WGS and enhance profile of ESH holdings and outputs on the CP.
20-21/03/2023	Paris, FR	External Conference	No	A	IODC-II - Ocean Data Conference. 180 participants. Communication of EMODnet CP centralisation process and enhance profile of ESH holdings and outputs on the CP.
22-24/03/2023	Paris, FR	External Meeting	No	A	IODE - XXVII - International Oceanographic Data And Information Exchange meeting. 150 participants. Engages with Secretariat, EMODnet Geology and enhanced profile of ESH holdings and outputs on the CP. Reviewed current progress of OBIS /ODIS
26-27/03/2023	Online	External Hackathon	No	A	Open Sea Lab Hackathon Event. 200+ participants. Online OSL Hackathon 3.0 event bringing together data and multidisciplinary scientists, software developers, social innovators, students, and businesses in Europe and around the world to harness the wealth of open-source, marine data offered by EMODnet to develop solutions to Ocean challenges.
31/03/2023	Online	Internal Meeting	Yes - updates on each WP	O	EMODnet Seabed Habitats Project Management Group Meeting. 4 participants. Updates from each WP on the current phase and identification of issues regarding the deliverables.
04-05/04/2023	Online	Internal Meeting	Yes - Seabed Habitats update	A	EMODnet Technical Working Group. 23 participants. https://maritime-forum.ec.europa.eu/en/node/10328
06/04/2023	Constanta, Romania	External Workshop	Yes - overview of EMODnet and Seabed Habitats	A	`Workshop on mobilization and mutual learning` in the framework of H2020 DOORS project `Developing Optimal and Open Research Support for the Black Sea`. ~20 participants. Promoting the EMODnet Seabed Habitat achievements and outcomes at regional Black Sea level and encourage of external players to access and use the data/products stored on the central portal
12 - 13/04/2023	Lanarca, CY	External Meeting	Yes	A	EMODnet Ingestion annual meeting. ~50 participants. Updates from all partners and updated information on progress in the project

14/04/2023	Online	Internal Meeting	Yes - overview of EMODnet and Seabed Habitats	O	JNCC/SAERI kick-off meeting. 6 participants. Kick-off of the EMODnet Seabed Habitats Caribbean subcontract with SAERI
25/04/2023	Online	Internal Meeting	No	O	JNCC/SAERI habitat map Q&A. 3 participants. Information sharing to help SAERI format the Caribbean habitat maps appropriately
26/04/2023	Online	Internal Meeting	No	O	Emodnet WP3 coastal wetlands composite products. 5 participants. Discuss progress in creating the new coastal wetlands and mangroves composite products
03/05/2023	Online	External Meeting	Yes - Seabed Habitats overview and subcontract plans	O	EMODnet Seabed Habitats Caribbean kick-off meeting with Anguilla Government. 7 participants. Keep MAERI informed of how the EMODnet Seabed Habitats project is going and a plan for on island training to be delivered later in the phase
8-10/05/2023	Donostia, ES	External Workshop	No	A	Development of research strategy for deep water ecosystems of Bay of Biscay - EPROCAN Project (AZTI). 45 participants. Facilitate visibility and availability of EMODnet holdings for development of a strategy for deep sea ecosystems research in the bay of Biscay by the EPROCAN project
12/05/2023	Online	Internal Meeting	No	O	MI/IFREMER /SAERI WP1 & 5 Q&A. 5 participants. Briefing on the progress and outputs from WP1 & 5 to ensure SAERI appropriately informed
14-17/05/2023	Jurilovca, Romania	External Workshop	Yes - overview of EMODnet and Seabed Habitats	O	Highlighting environmental and biotic changes in past and current aquatic systems - Ambiacva Project - Excellence Research. ~25 participants. EMODnet Seabed Habitats – support platform for benthic habitats and marine products offered in the context of open data access at European level
16/05/2023	Online	Internal Meeting	No	O	EMODnet WP3 coastal wetlands and mangroves. 5 participants. Discuss progress in creating the new coastal wetlands and mangroves composite products
17/05/2023	Online	External Workshop	No	A	UN Global Compact Working Meeting on Net Biodiversity Positive Offshore Renewables. ~75 participants. Consensus

					around what best practice looks like for ORE action on creating biodiversity positive outcomes
17/05/2023	Dublin, IE	External Conference	No	O	Offshore Wind Energy . 500 participants. Ensure EMODnet Holdings are visible and available to ORE sector / developers / policy makers
23/05/2023	Brest, FR	Internal Meeting	Yes - Seabed Habitats general update	A	EMODnet Steering Committee. ~25 participants. https://maritime-forum.ec.europa.eu/en/node/10412
24 - 25/05/2023	Brest, FR	External Conference	No	A	European Maritime Day Event. 1600+ participants. Two-day event during which Europe's maritime community meet to network, discuss and outline joint action on maritime affairs and sustainable blue economy
02/06/2023	Online	External Meeting	No	A	EMODnet for Ocean Decade Co-ordination and Implementation Group. ~20 participants. Ensure support of the Ocean Decade by EMODnet Seabed Habitats, potential alignment of outputs and further integration of EMODnet thematic lots
05-09/06/2023	Online	External Workshop	Yes - overview of EMODnet and Seabed Habitats	A	BIOCONTAM “Marine food webs and biological mechanisms of CONTAMINANT transfer. BENTHIC HABITATS – BLACK SEA Modern approach to the biozonation and habitats designation through EMODnet Seabed Habitats platform as support offered in the context of free access to data at European level
06-08/06/2023	Limerick, IE	External Conference	Poster - EMODnet Seabed Habitats Outputs	A	OCEANS 2023. 750 participants. Poster display of ESH products / Networking with Policy Makers and Researchers / Promotion of EMODnet CP to access marine habitat mapping products.
07/06/2023	Online	External Meeting	Y - EMODnet and Seabed habitats overview	O	EMODnet Seabed Habitats: Caribbean kick-off meeting. 6 participants. Meeting with MAERI partners to introduce the Seabed Habitats work that SAERI are doing in the Caribbean and start planning for the in island visit
12/06/2023	Online	Internal Meeting	No	O	EMODnet SH WP3 coastal wetlands and mangroves. 6 participants. Discuss progress in creating the new coastal wetlands and mangroves composite products
21/06/2023	Online	External Meeting	No	A	CINEA / EMODnet Seabed habitats Meeting to review ESH achievements and outputs. ~10 participants. To clarify Seabed

					Habitats feedback and ensure visibility of EMODnet Seabed Habitats outputs, developments and engagements and to highlight potential development pathways for ESH products
19/07/2023	Online	External Meeting	No	A	MAERI/EMODnet meeting. 5 participants. Updates from SAERI on how the Caribbean work within EMODnet Seabed Habitats and planning for SAERIs trip to Anguilla including in person meetings, training and workshops.
26-27/07/2023	Faro, PT	Internal Meeting	Yes - updates on each WP	O	EMODnet Seabed Habitats Project Management Team meeting. 5 participants. Updates from each WP on the current phase and identification of issues regarding the deliverables.
21/08/2023	Anguilla	External Meeting	No	O	EMODnet Seabed Habitats phase 4 project manager from SAERI met with Anguilla National Trust. 4 participants. Informed of project and invited ANT to training.
24/08/2023	Anguilla	External Meeting	No	O	EMODnet Seabed Habitats phase 4 project manager from SAERI met with DNR Fisheries and Marine Management Unit. Introduced project and invited to training.
29/08/2023	Online	Internal Meeting	No	O	EMODnet Seabed Habitats SYKE & Project Management Team meeting. 6 participants. Planning for the next phase, EMODnet Jamboree and Open Conference and future Project Management Team meetings
29/08/2023	Online	Internal Meeting	No	A	EMODnet Conference/Jamboree & Strategy meeting. TBC participants. Jamboree/open conference programme finalisation and EMODnet Strategy discussions
08/09/2023	Online	External Meeting	No	A	EMODnet for Ocean Decade Co-ordination and Implementation Group. ~20 participants. Ensure support of the Ocean Decade by EMODnet Seabed Habitats, potential alignment of outputs and further integration of EMODnet thematic lots
09/10/2023	Online	External Meeting	No	A	ICES SCICOM ASC Meeting. ~40 participants. National Update (Ireland) included update on next phase of ESH.
04-15/09/2023	Anguilla	External Training Course	Yes – data management, data	O	6 day data submission and training course for marine habitat data in the Caribbean. 6 participants. Build MAERI's capacity in spatial data management

			processing/formatting, metadata		
SUM				O	Total # of meetings organised = 45
SUM				A	Total # of meetings attended = 70

B. Meetings/events planned in the future					
Date	Location	Type event (meeting, training (workshop), etc.)	Meeting to be attended (A) / organised (O)	Short description and main expected outcomes	
16/10/2023	Online	Internal Meeting	O	Phase 5 – 1st Project Management Team Meeting	
18/10/2023	Online	External Meeting	A	EMODnet Technical Working Group (14th)	
07-09/11/2023	Genoa, Italy	External Conference	A	Hydro 23, Hydrographic conference. EMODNet Seabed Habitats Poster to be presented to inform stakeholders of availability of, and access to, ESH products and outputs.	
21/11/2023	Online	Internal Meeting	O	EMODnet Thematic Session / Jamboree Planning	
26-28/11/2023	Brussels, Belgium	Internal Meeting	O	EMODnet Seabed Habitats phase V kick-off meeting and EMODnet jamboree	
29-30/11/2023	Brussels, Belgium	External Conference	A	EMODnet Open Conference	

06-10/05/2024	Arendal, Norway	External Conference	A	GeoHab 2024
27-29/05/2024	Bergen, Norway	External Conference	A	IMDIS 2024

8. Communication assets

A. Communication products developed				
Date	Communication material	Short description (of the material, title, ...) of the asset	Main results	Name of event at which material was disseminated (if applicable)
29/10/2021	News article	EMODnet Central news article entitled "EUSeaMap 2021: EMODnet broad-scale seabed habitat map for Europe"	Greater awareness of the existence of an updated EUSeaMap so that the latest version of this product is used.	NA
11/11/2021	Newsletter item	EMODnet newsletter item entitled New release of EMODnet broad-scale seabed habitat map for Europe (EUSeaMap)"	Readers see that there is an update to EUSeaMap, and their attention is drawn to the longer news article on this topic.	NA
11/11/2021	News article	EMODnet Seabed Habitats news article entitled "Official Release of EUSeaMap 2021"	Greater awareness of the existence of an updated EUSeaMap so that the latest version of this product is used.	NA
12/11/2021	News article	EMODnet Seabed Habitats news article entitled "EMODnet Seabed Habitats - Phase 4"	Awareness that the new phase of EMODnet Seabed Habitats has begun, with some new objectives and partners	NA
23/11/2021	Online pledge	A pledge: "EMODnet Seabed Habitats will continue to improve & expand the coverage of the broadscale seabed habitat map for Europe, EUSeaMap, which serves as a base map for national, regional & global assessments"	Greater awareness of EMODnet as a contributor to marine environmental protection in Europe.	NA
30/11/2021	News article	EMODnet Central news article entitled "Conference on Climate Change in the Caspian Sea 2021"	Awareness that the geographic scope has expanded to the Caspian Sea	NA
30/11/2021	Newsletter item	EMODnet news item entitled "Conference on Climate Change in the Caspian Sea 2021"	Readers see that the geographic scope has expanded to the Caspian Sea and their attention is drawn to the longer news article on this topic.	NA
30/11/2021	News article	EMODnet news item entitled "EMODnet Seabed Habitats Phase IV"	Awareness that the new phase of EMODnet Seabed Habitats has begun, with	NA

			some new objectives and partners	
30/11/2021	Newsletter item	EMODnet newsletter item entitled "EMODnet Seabed Habitats Phase IV"	Readers see that a new phase has begun, with some new objectives, and their attention is drawn to the longer news article on this topic.	NA
31/01/2022	News article	EMODnet newsletter item entitled "Holistic, standards-based access and interoperability for marine biodiversity data"	Awareness that a new use case on the collaboration between EMODnet SH and Biology Lots to produce a standardised approach to Habitat point data submission has been published.	NA
31/01/2022	Newsletter item	EMODnet newsletter item entitled "Holistic, standards-based access and interoperability for marine biodiversity data"	Readers see that the thematic lots are working together and not alone.	NA
31/01/2022	News article	2022: marking the start of a new phase	Awareness on the progress made by EMODnet SH during the last phase.	NA
31/01/2022	Newsletter item	2022: marking the start of a new phase	Readers see the outputs and milestones achieved by all of the thematic lots in 2021.	NA
15/02/2022	Tweet	Tweet promoting EMODnet SH	Promoting work of EMODnet SH on delivering standardised habitat mapping data products.	N/A
17/02/2022	Newsletter item	EMODnet news item entitled "EMODnet Seabed Habitats Phase IV"	Awareness that the new phase of EMODnet Seabed Habitats has begun, with some new objectives and partners	NA
28/02/2022	News article	EMODnet news item entitled "OSPAR Threatened and/or Declining Habitat Dataset"	Awareness that the OSPAR spatial database has been updated.	NA
28/02/2022	Newsletter item	EMODnet newsletter item entitled "OSPAR Threatened and/or Declining Habitat Spatial Dataset"	Readers see that there has been a significant update to the number of records hosted in the OSPAR spatial database on Threatened and/or Declining Habitats.	NA
08/04/2023	News article	EMODnet news item entitled "EMODnet Seabed Habitats Story Map"		

29/04/2022	Newsletter item	EMODnet newsletter item entitled "EMODnet Seabed Habitats Story Map"	EMODnet Seabed Habitats have published a story map describing the extensive suite of habitat mapping products currently available to view and download from the project's web mapping viewer.	NA
19/05/2022	Tweet	EMODnet Seabed Habitats participation in Geohab	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA
17/05/2022	News article	EMODnet news item entitled "Summarising the extents of MSFD benthic broad habitats per sub-region and country"	Promotion of new EMODnet Seabed Habitats tool to facilitate Member States with MSFD reporting requirements on D6 Seafloor Integrity.	NA
31/05/2022	Newsletter item	EMODnet newsletter item entitled "Summarising the extents of MSFD benthic broad habitats per sub-region and country"	Promotion of new EMODnet Seabed Habitats tool to facilitate Member States with MSFD reporting requirements on D6 Seafloor Integrity and links to the spreadsheet resource with metrics.	NA
08/06/2022	Tweet	EMODnet Seabed Habitats on World Ocean Day	Promotion of ESH products	NA
30/06/2022	News article	EMODnet Seabed Habitats participation in Geohab	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA
05/07/2022	Newsletter item	EMODnet Seabed Habitats participation in Geohab	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA
20/09/2022	News article	EMODnet Seabed Habitats Modelled Map Collection	Promotion of ESH Library of Habitat Maps and availability	NA
30/9/2022	Newsletter item	EMODnet Seabed Habitats Modelled Map Collection	Promotion of ESH Library of Habitat Maps and availability	NA
21/09/2022	Tweet	EUSeaMap Evolution Talk promotion	Engagement with EUSeaMap presentation at ICES ASC 2022 and engagement with RSC	ICES ASC 2022
26/01/2023	News article	EMODnet Seabed Habitats participation in development of EUNIS 2022	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA

31/01/2023	Newsletter item	EMODnet Seabed Habitats participation in development of EUNIS 2022	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA
21/02/2023	News article	Application of EUSeaMap in MSFD D6 reporting	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA
28/02/2023	Newsletter item	Application of EUSeaMap in MSFD D6 reporting	Promotion of ESH products and relevance of EMODnet to the wider EU research community	NA
07/06/2023	Tweet	ESH products	Promotion of ESH products to policy makers and the global marine research community	OCEANS 2023
21/09/2023	Newsletter item	Summary of SAERI's work in EMODnet Seabed Habitats project phase 4	Brief overview of work completed and acknowledgements to partners	NA

B. Planned communication products

Date	Communication material	Short description (of the material, title, ...) and/or link to the asset	Main results expected
30/10/23	Article in EMODnet Newsletter	Introduction of Phase V and new thematic lead.	Promote EMODnet Seabed Habitats Activities
07/11/23	Tweet	ESH Presence at Hydro 2023	Promote EMODnet Seabed Habitats Activities
26/11/23	Tweet	ESH Thematic Session at Jamboree	Promote EMODnet Seabed Habitats Activities
28/11/23	Tweet	ESH Co-Chairs EU Policy Townhall at Jamboree	Promote EMODnet Seabed Habitats Activities
15/12/23	Article in EMODnet Newsletter	Promoting EMODnet Seabed Habitats providing support to Caribbean partners on data submission process.	Promote EMODnet Seabed Habitats Activities
15/01/24	EMODnet Central Protocol for promoting new datasets.	Release of new EUSeaMap including data layers and technical report	Promote EMODnet Seabed Habitats Products
15/01/24	Tweet	Release of new EUSeaMap including data layers and technical report	Promote EMODnet Seabed Habitats Products
15/01/24	Article in EMODnet Newsletter	Release of new EUSeaMap including data layers and technical report	Promote EMODnet Seabed Habitats Products
15/02/24	Tweet	New ESH data products on the Portal (EFH, Wetlands)	Promote EMODnet Seabed Habitats Products
15/02/24	Article in EMODnet Newsletter	New ESH data products on the Portal (EFH, Wetlands)	Promote EMODnet Seabed Habitats Products
15/03/24	Tweet	Caspian Habitat Map	Promote EMODnet Seabed Habitats Products

15/03/24	Article in EMODnet Newsletter	Caspian Habitat Map	Promote EMODnet Seabed Habitats Products
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A. (Co-)Authored peer-reviewed publications					
Date of publication	Type of publication	Full reference	ISBN	DOI	Is it open access? Yes/No
January 2022	Chapter	Larkin Kate E., Marsan Andrée-Anne, Tonné Nathalie, Van Isacker Nathalie, Collart Tim, Delaney Conor, Vasquez Mickael, Manca Eleonora, Lillis Helen , Calewaert Jan-Bart (2022). Connecting marine data to society . In Ocean Science Data. Collection, Management, Networking and Services. 2022. Manzella, G, Novellino, A (Eds). ISBN 978-0-12-823427-3. Chap.5, pp.283-317 (Elsevier BV) .	978-0-12-823427-3	https://doi.org/10.1016/B978-0-12-823427-3.00003-7	Yes
12/02/2022	Paper	Manolis Tsapakis, Ioanna Kalantzi, Alexandra Pavlidou, Nomiki Simboura, Konstantinos Tsiaras, Nikolaos Katsiaras & Maria Louiza Petre (2022). The Coastal Environmental Status of Argolikos Gulf. In: The Handbook of Environmental Chemistry. Springer, Berlin, Heidelberg.		https://doi.org/10.1007/698_2021_838	Yes
14/07/2022	Journal	Panayotidis, Panayiotis & Papathanasiou, Vasillis & Gerakaris, Vasilis & Fakiris, Elias & Orfanidis, Sotiris & Papatheodorou, George & Kosmidou, Maria & Georgiou, Nikos & Drakopoulou, Paraskevi & Loukaidi, Valia . (2022). Seagrass meadows in the Greek Seas: presence, abundance and spatial distribution. Botanica Marina. 65. 289-299.		http://dx.doi.org/10.1515/bot-2022-0011	No

20/09/2022	Journal	Borja, Angel & Pouso, Sarai & Galparsoro Iza, Ibon & Manca, Eleonora & Vasquez, Mickaël & Lu, Wenhai & Yang, Lu & Uriarte, Ainhize. (2022). Applying the China's marine resource-environment carrying capacity and spatial development suitability approach to the Bay of Biscay (North-East Atlantic). 9. 10.3389/fmars.2022.972448.		http://dx.doi.org/10.3389/fmars.2022.972448	Yes
September 2022	Journal	Horta e Costa, Barbara & Gonçalves, Jorge & Gonçalves, Emanuel. (2022). UN Ocean Conference needs transparent and science-based leadership on ocean conservation. Marine Policy. 143. 105197. 10.1016/j.marpol.2022.105197.		10.1016/j.marpol.2022.105197	Yes
October 2022	Journal	Adao, A.C.; Bosch, N.E.;Bentes, L.; Coelho, R.; Lino, P.G.;Monteiro, P.; Gonçalves, J.M.S.;Erzini, K. Complementary SamplingMethods to Improve the Monitoringof Coastal Lagoons. Diversity 2022,14, 849		http://dx.doi.org/10.3390/d14100849	Yes
October 2022	Journal	Mureșan, M.; Motoc, R.; Menabit, S.; Teacă, A.; Begun, T. A New Species of Free-Living Nematodes (Desmodorida, Desmodoridae) in the Romanian Black Sea Waters. Diversity 2022, 14, 933.		https://doi.org/10.3390/d1410933	Yes
November 2022	Journal	Mariana Cardoso-Andrade, Frederico Cruz-Jesus, Jesus Souza Troncoso, Henrique Queiroga, Jorge M. S. Gonçalves, Understanding technological, cultural, and environmental motivators explaining the adoption of citizen science apps for coastal environment monitoring, Global Environmental Change, volume 77, 2022, 102606		http://dx.doi.org/10.1016/j.gloenvcha.2022.102606	Yes
November 2022	Journal	Horta e Costa B, Guimarães MH,Rangel M, Ressurreição A, Monteiro P,Oliveira F, Bentes L, Sales Henriques N,Sousa I, Alexandre S, Pontes J,Afonso CML, Belackova A, Marçalo A,Cardoso-Andrade M, Correia AJ,Lobo V, Gonçalves EJ, Pitta e Cunha Tand Gonçalves JMS (2022)		http://dx.doi.org/10.3389/fmars.2022.969234	Yes

		Co-design of a marine protected area zoning and the lessons learned from it. <i>Front. Mar. Sci.</i> 9:969234			
November 2022	Journal	Hansen, S.S.; Ernstsén, V.B.; Andersen, M.S.; Al-Hamdani, Z.; Baran, R.; Niederwieser, M.; Steinbacher, F.; Kroon, A. Evaluation of Boulder Characteristics for Improved Boulder Detection Based on Machine Learning Techniques. <i>Geosciences</i> 2022, 12, 421.		http://dx.doi.org/10.3390/geosciences12110421	Yes
December 2022	Journal	rzini, Filipe Parreira, Zineb Sadat, Margarida Castro, Luís Bentes, Rui Coelho, Jorge M.S. Gonçalves, Pedro G. Lino, Begoña Martínez-Crego, Pedro Monteiro, Frederico Oliveira, Joaquim Ribeiro, Carmen B. de los Santos, Rui Santos, Influence of seagrass meadows on nursery and fish provisioning ecosystem services delivered by Ria Formosa, a coastal lagoon in Portugal, <i>Ecosystem Services</i> , Volume 58, 12-0416		http://dx.doi.org/10.1016/j.ecoser.2022.101490	Yes
October 2022	Workshop report	Mediterranean–Black Sea Gateway Exchange: Scientific Drilling Workshop on the BlackGate Project Wout Krijgsman, Iuliana Vasiliev, Anouk Beniest, Timothy Lyons, Johanna Lofi, Gabor Tari, Caroline P. Slomp, Namik Cagatay, Maria Triantaphyllou, Rachel Flecker, Dan Palcu, Cecilia McHugh, Helge Arz, Pierre Henry, Karen Lloyd, Gunay Cifci, Özgür Sipahioglu, Dimitris Sakellariou, and the BlackGate workshop participants.		http://dx.doi.org/10.5194/sd-31-93-2022	Yes
October 2022	Conference paper	Assessment of the effect of Posidonia Banquettes on shoreline changes: Preliminary results from the case of Schinias-Marathon National Park, Attica, Greece. I. Kourliافتis, D. Vandarakis, V. Gerakaris, Y. Issaris, V. Kapsimalis, I. Panagiotopoulos, M. Salomidi			Yes

December 2022	Project report	Manca Eleonora (2022), contributing author Vasquez Mickaël. Broad-scale habitat mapping in the Beibu Gulf, South China Sea. Final methodology report . Work-Package 4: Comparison of European and Chinese models for seabed habitat and ecosystem vulnerability. Deliverable D4.4 -M30 report .		https://emodnet.ec.europa.eu/sites/emodnet.ec.europa.eu/files/public/EMODPACE/20221208_EMODPACE_Deliverable4.4_v2.pdf	yes
06/01/2023	Paper	Ragkousis M et al. (2023) <i>Unpublished Mediterranean and Black Sea records of marine alien, cryptogenic, and nonative species</i> . <i>BiolInvasions Records</i> 12 (in press)		https://www.researchgate.net/publication/366950850_Unpublished_Mediterranean_and_Black_Sea_records_of_marine_alien_cryptogenic_and_nonative_species	Yes
20/02/2023	Paper	Bekkby T, Torstensen RRG, Grünfeld LAH, Gundersen H, Fredriksen S, Rinde E, Christie H, Walday M, Andersen GS, Brkljacic MS, Neves L and Hancke K (2023) <i>'Hanging gardens'—comparing fauna communities in kelp farms and wild kelp forests</i> .		http://dx.doi.org/10.3389/fmars.2023.1066101	Yes
31/01/2023	Paper	Close HL, Barry PJ, Mcllwaine PSO, Marzloff MP, Folliot B, Vasquez M, Laffargue P, Tan SH (2023). <i>Distolambrus maltzami (Miers, 1881) (Brachyura: Parthenopidae) with observed and modelled distribution in the North-east Atlantic</i> . <i>Journal of the Marine Biological Association of the United Kingdom</i> 103, e23, 1–10		http://dx.doi.org/10.1017/S0025315423000127	Yes
April 2023	Paper	Evangelia Stroglyoudi, Evangelia Krasakopoulou, Antonia Giannakourou, Sofia Galinou-Mitsoudi, Vasiliki-Angelique Catsiki, Paraskevi Drakopoulou, Chara Kyriakidou, Evangelos Papathanassiou, Michael O. Angelidis,		https://doi.org/10.1016/j.rsm.a.2022.102806	Yes

		How environmental factors determine mussel metal concentrations? A comparative study between areas facing different pressures, Regional Studies in Marine Science, Volume 59, 2023.			
April 2023	Paper	GIULIA MO, SABRINA AGNESI, PIETRO LO CASCIO & BRUNO MASSA. Historical and recent data on the occurrence of the Mediterranean monk seal in the Aeolian Islands (southern Tyrrhenian Sea, Sicily).		https://doi.org/10.5281/zenodo.7657458	Yes
13/05/2023	Paper	Müller, C., Erzini, K., Dudeck, T. et al. Variability of prey preferences and uptake of anthropogenic particles by juvenile white seabream in a coastal lagoon nursery ground. Environ Biol Fish 106, 1383–1404 (2023).		https://doi.org/10.1007/s10641-023-01423-z	Yes
31/05/2023	Paper	Svedäng Henrik, Thunell Viktor, Pålsson Ale, Wikström Sofia A., Whitehouse Martin J. Compensatory feeding in Eastern Baltic cod (<i>Gadus morhua</i>): recent shifts in otolith growth and nitrogen content suggest unprecedented metabolic changes. Front. Mar. Sci., 31 May 2023. Sec. Marine Fisheries, Aquaculture and Living Resources.		https://doi.org/10.3389/fmars.2023.1154309	Yes
June 2023	Paper	Kirsty A. McQuaid, Amelia E.H. Bridges, Kerry L. Howell, Tiago B.R. Gandra, Vitor de Souza, Jock C. Currie, Oliver T. Hogg, Tabitha R.R. Pearman, James B. Bell, Lara J. Atkinson, Diane Baum, Jarbas Bonetti, Alvar Carranza, Omar Defeo, Thomas Furey, Maria A. Gasalla, Neil Golding, Shannon L. Hampton, Sebastián Horta, Daniel O.B. Jones, Amanda T. Lombard, Eleonora Manca, Yamandú Marin, Stephanie Martin, Pål Mortensen, Cecilia Passadore, Nils Piechaud, Kerry J. Sink,		https://doi.org/10.1016/j.poc.2023.103016	Yes

		Andrew Yool, Broad-scale benthic habitat classification of the South Atlantic, Progress in Oceanography, Volume 214, 2023.			
01/06/2023	Paper	Christopher J. Smith, Nadia K. Papadopoulou, Irida Maina, Stefanos Kavadas, P. Daniel van Denderen, Nikolaos Katsiaras, Sofia Reizopoulou, Ioannis Karakassis, Anastasios Tselepidis, Irini Tsikopoulou, Relating benthic sensitivity and status to spatial distribution and intensity of trawling in the Eastern Mediterranean, Ecological Indicators, Volume 150, 2023.		https://doi.org/10.1016/j.ecolind.2023.110286	Yes
July 2023	Paper	Angiolillo, M.; Bertasi, F.; Grossi, L.; Loia, M.; Vani, D.; Rende, S.F.; Giusti, M.; Tunesi, L. Deep Aggregations of the Polychaete <i>Amage adspersa</i> (Grube, 1863) in the Ionian Sea (Central Mediterranean Sea) as Revealed via ROV Observations. Diversity 2023, 15, 906.		http://dx.doi.org/10.3390/d15080906	Yes
August 2023	Paper	Enrichetti, F.; Bavestrello, G.; Cappanera, V.; Mariotti, M.; Massa, F.; Merotto, L.; Povero, P.; Rigo, I.; Toma, M.; Tunesi, L.; et al. High Megabenthic Complexity and Vulnerability of a Mesophotic Rocky Shoal Support Its Inclusion in a Mediterranean MPA. Diversity 2023,15, 933.		http://dx.doi.org/10.3390/d15080933	Yes
August 2023	Paper	Andersen, J.H., Al-Hamdani, Z., Carstensen, J. et al. Are European Blue Economy ambitions in conflict with European environmental visions? AMBIO A Journal of the Human Environment (2023).		http://dx.doi.org/10.1007/s13280-023-01896-3	Yes
September 2023	Paper	Cross-Comparison of the “BathySent” Coastal Bathymetry to Sonar Measurements and Ratio Model Technique: Pilot Sites in the Aegean Sea (Greece). Paraskevi Drakopoulou, Ioannis P. Panagiotopoulos, Marcello de Michele, Vassilios Kapsimalis, Daniel Raucoules, Michael Foumelis, Ioannis Morfis, Isidoros Livanos, Dimitris Sakellariou and Dimitrios Vandarakis. Water 15(18):3168. 2023.		https://doi.org/10.3390/w15183168	Yes

September 2023	Paper	M Rodriguez, D Sakellariou, C Gorini, A Janin, E D'Acremont, L Le Pourhiet, N Chamot-Rooke, K Tsampouraki-Kraounaki, I Morfis, G Rousakis, P Henry, A Lurin, M Delescluse, P Briole, A Rigo, S Arsenikos, C Bulois, D Fernández-Blanco, A Beniést, C Grall, F Chanier, F Caroir, J-X Dessa, D Oregioni, A Nercessian, Evolution of the North Anatolian Fault from a diffuse to a localized shear zone in the North Aegean Sea during the Plio-Pleistocene, Geophysical Journal International, 2023.		https://doi.org/10.1093/gji/ggad364	Yes
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B. Other/non-peer reviewed types of publications (co-)authored

Date of publication	Type of publication	Full reference	ISBN	DOI	Is it open access? Yes/No
September 2021	Ecological Indicators	Karin J.van der Reijden, Laura L. Govers, Leo Koop, Johan H. Damveld, Peter M. J. Herman, Sebastiaan Mestdagh, Gerjan Pieth, Adriaan D. Rijnsdorph, Grete E. Dinesen, Mirjam Snellen and H an Olf. Beyond connecting the dots: A multi-scale, multi-resolution approach to marine habitat mapping.		http://dx.doi.org/10.1016/j.ecolind.2021.107849	Yes
December 2021	Marine Policy	Oihana Solaun Yolanda Sagarminaga , Iratxe Menchaca , Ibon Galparsoro. Spatial overlap between human activities and seabed habitats in European Seas: Insights into EMODnet's data for management purposes.		https://doi.org/10.1016/j.marpol.2021.104551	Yes
December 2021	Marine Pollution Bulletin	Angela G. Bartolo, Konstantinos Tsiamis, Frithjof C. Küpper. Identifying hotspots of non-indigenous species' high impact in the Maltese islands (Central Mediterranean Sea).		https://doi.org/10.1016/j.marpolbul.2021.112016	Yes
01/05/2022	Spreadsheet	Vasquez, M. (2022). Summary of extents of MSFD benthic broad habitats per sub-region based on EUSeaMap 2021.		https://www.emodnet-	Yes

				seabedhabitats.eu/resources/documents-and-outreach	
September 2022	Conference Paper	Todorova, Valentina & Panayotova, Marina & Doncheva, Valentina & Zlateva, Ivelina. (2022). ASSESSING THE PHYSICAL DISTURBANCE ON THE SEABED FROM FISHERIES IN THE BULGARIAN BLACK SEA AREA WITH REFERENCE TO BENTHIC HABITATS STATUS. 10.5593/sgem2021/3.1/s15.83.		http://dx.doi.org/10.5593/sgem2021/3.1/s15.83	Yes
September 2022	Conference Paper	Todorova, Valentina & Doncheva, Valentina. (2022). BENTHIC HABITATS BIODIVERSITY STATUS IN THE BULGARIAN BLACK SEA IN 2019 - CLASSIFICATION AND SPATIAL ASSESSMENT UNDER THE MARINE STRATEGY FRAMEWORK DIRECTIVE. 10.5593/sgem2021/3.1/s15.86.		http://dx.doi.org/10.5593/sgem2021/3.1/s15.86	Yes
August 2023	Supplementary Material	Jesper H. Andersen, Ziyad Al-Hamdani, Jacob Carstensen, Karen Edelvang, Josefine Egekvist, Berit C. Kaae, Kathrine J. Hammer, Eva Therese Harvey, Jørgen O. Leth, Will McClintock, Ciarán Murray, Anton S. Olafsson, Jeppe Olsen, Signe Sveegaard, Jakob Tougaard. Electronic Supplementary Material: Are European Blue Economy ambitions in conflict with European environmental visions?		https://www.researchgate.net/publication/373492132_EC_OMAR_Supplementary_Material_Final_pdf	Yes
September 2023	Conference abstract	Salomidi, M. et al. Remarkable Sponge Communities in Coralligenous Banks Of The North Aegean Sea. 5th International Workshop on Taxonomy of Atlanto-Mediterranean Deep-Sea & Cave Sponges (Rapallo, Italy).		http://dx.doi.org/10.13140/RG.2.2.19258.36804	Yes

For a comprehensive overview of publications referring to/making use of EMODnet data and/or data products, please consult Google Scholar.

9. Monitoring indicators

Comments on the progress indicators in the indicators spreadsheet		
Progress indicator	Means of collecting figures	Comment
<p>1. Current status and coverage of total available thematic data</p> <p>A) Volume and coverage of available data</p>	Custom postgresql views and geoserver layers including vocabulary keyword tagging) with python scripting	A good addition of habitat data, especially in underrepresented regions such as the Black Sea and Arctic. Percentage increase of 8% is good considering the initial large volume of point data extant in the database.
<p>What is your opinion on the data coverage within EMODnet for your thematic?</p>		Point data coverage is concentrated in the EEZs of countries where project partners are based. There is likely to be much more data to be found in countries like Spain, Poland, Croatia, etc. and we will look to improve the coverage in these areas and others such as the Caribbean during the next phase.
<p>B) Usage of data since the start of the project phase</p>	Custom geoserver layers (including vocabulary keyword tagging), with python scripting, geoserver server-side logging and data download logging	Consistent volume of point data downloads throughout the phase with particularly high numbers in the later half of 2022 . Number of map visualisations and WFS requests have significantly increased, however WMS requests have declined perhaps because people were choosing to use the thematic/central portal viewer or WFS service instead.
<p>2. Current status and coverage of total number of data products</p> <p>A) Volume and coverage of available data products</p>	Custom postgresql views and geoserver layers including vocabulary keyword tagging) with python scripting	Compared to the previous version, EUSeaMap 2023 has been extended geographically into the Caspian Sea and Caribbean Sea regions and updated for all other areas. Essential fish habitat maps and models and a new internal composite product for mangrove cover are new additions this phase. Increases in almost all other sub-theme categories, including data in new geographic areas e.g. Caribbean and Caspian seas and increased machine to machine connections.

B) Usage of data products since the start of the project phase	Custom geoserver layers (including vocabulary keyword tagging), with python scripting, geoserver server-side logging and and data download logging	Although not all the values are directly comparable there has in general been an increase in downloads of all products this phase, particularly for EUSeaMap and our modelled datasets. Possibly due to better publication through both the thematic portal and subsequently through the central portal. Individual maps from surveys remain the most popular dataset, though high numbers are impacted by high numbers of datasets offered. Numbers of map visualisations has significantly increase although the WMS requests have declined over the same period, perhaps as people utilise the viewer rather than their own GI systems. WFS requests show a more mixed picture however this may in part be due to changes in how the statistics have been calculated.
3. Internal and external organisations supplying/approached to supply data and data products since start of the project phase	Tracking tables in sharepoint.	During this phase we have acquired data from over 50 different providers. Overall a good amount of data has been acquired, predominantly from Government/public bodies, followed by academia with low representation from industry and NGOs.
4. Online ‘Web’ interfaces to access or view data	N/A	No major change this phase, just the addition of new sub-themes utilising the existing infrastructure.
6. Statistics on information volunteered through download forms	Download data forms along with python scripting and geoserver layer tagging.	Around 48% of users provided some statistics (the portal did not enforce statistics collection to remain a truly open data portal), mainly around sector of use. Around 50% of users did not report a country or region, but from those that did, as expected a large proportion are European, which the largest country share the United Kingdom, followed by Italy, Spain, France, Belgium Portugal and Ireland. This ties closely with partners, suggesting that promotion of the site within partner countries is very effective. Please note these statistics are only valid up to January 2023 when the thematic portal was decommissioned.
7. Published use cases	Grafana dashboard	Most of the use cases are viewed consistently highly. The most viewed use cases relate to mapping the risk of cumulative effects on benthic habitats, standards-based access and interoperability for marine biodiversity data and assessing ecosystem services richness and exposure to anthropogenic treats in Lithuania. Please note these statistics are only valid up to January 2023 when the thematic portal was decommissioned.
9. Technical monitoring	Grafana dashboard	Response time is acceptable, though towards the higher end. Uptime of site was 100%

10. Visibility & Analytics for web pages	Grafana dashboard	Generally consistent page views whilst the thematic portal was live, with the most popular pages being those themed on data access, which is expected but welcome. Interactive map has a higher viewership than the homepage, suggesting that the interactive map had a core base of repeat customers (e.g. through bookmarking), again showing success of the interactive map. Please note these statistics are only valid up to January 2023 when the thematic portal was decommissioned.
11. Visibility & Analytics for web sections	Grafana dashboard	Fairly consistent throughout the phase. Please note these statistics are only valid up to January 2023 when the thematic portal was decommissioned.
12. Average visit duration for web pages	Grafana dashboard	Highest visit duration was to data submission, data downloads and interactive map pages, which is to be expected. Low time spent on homepage suggested that users were easily finding the route that they needed to pages. Please note these statistics are only valid up to January 2023 when the thematic portal was decommissioned.
5.1 NEW. Daily number of page views of EMODnet Thematic entry page since the start of the contract	Europa Analytics	Fairly consistent pattern emerging, usually over 35 views a day on week days. Slightly reduced peaks compared to the first quarter of 2023, but early numbers may were likely abnormally high as the central portal had just been launched.
5.2 NEW. Total number of visitors, page views, unique page views and percentage of returning visitors, since the start of the contract	Europa Analytics	Visitor numbers and page views (including unique) have all followed a similar pattern since central portal launch in January 2023. Numbers peaked in Feb/March 2023 and then have slowly dropped to more consistent monthly values. The % of returning visitors has stayed fairly constant indicating a core set of visitors who regularly use the Seabed habitat information.

The monitoring numbers reported as part of the progress monitoring of EMODnet performance are collected through Matomo and/or Europa Analytics, unless reported otherwise.

10. Recommendations for follow-up actions by the EU

Standard definitions in EUNIS and MSFD benthic broad habitat types

The transformation of the EUNIS classification in 2019 led to standardised naming across basins of broad habitat types which was widely welcomed and seen as a significant improvement. However, the classification scheme still has major issues. A recent user feedback from the MSFD TG Seabed illustrates one of the main issues, which is the lack of specific, quantitative definitions of the broad seabed habitat types.

The last published manual for the EUNIS classification was released in 2004 (Davies et al, 2004). We have been informed that the manual to accompany the latest version of EUNIS is still not close to publication. As a result, the new version of EUNIS is little more than a set of terms, each with a brief description, without any quantitative definition. Commission Decision (EU) 2017/848 (laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment) lists the habitat types that Member States must refer to for the purposes of the MSFD – the Benthic Broad Habitat Types. This list does not include definitions but appears to assume that the (new version of) EUNIS classification scheme would include standard consistent definitions that reflect the standard, consistent terminology. Further discrepancies between maps are likely to occur until EUNIS sediment types are clearly defined in terms of Folk classification metrics. Considering how fundamental it is to MSFD implementation, precise definitions of broad habitat types are imperative for all Europe.

Therefore, we would recommend that the EU considers the creation of EUNIS regional working groups, the terms of reference of which would be to 1) define precisely the broad habitat types in all marine regions, and 2) review and update the EUNIS classification at biotope levels, i.e. levels 4-6. This would be needed in all regions, but more particularly in the Black Sea, where there is no consensus. There are also substantial gaps in the Arctic section, which currently only comprises these biotopes from the Atlantic section that are acknowledged to occur in the Arctic. This could lead to consistency within regions at least, if not between regions. These should be accompanied by a timely update mechanism for all changes to be published by the European Environment Agency.

Seabed habitat classification in the Caribbean Sea

If the longer-term goal of EMODnet is to produce a seabed habitat map that is meaningful for the entire Caribbean Sea, we would recommend that the EU considers the creation of a EUNIS regional working group that would include experts from the EU Overseas Countries and Territories, the UK Overseas Territories, existing holders or users of seabed habitat data (e.g. NOAA) and CARICOM (Caribbean Community). This would increase the chances that a standardised system such as EUNIS would be widely adopted by stakeholders in the region.

EUSeaMap update frequency

Since 2017, EUSeaMap has been updated every two years at the request of the Contracting Parties, and the next update will be in two years. We recommend reducing the update frequency, and proposed that an update frequency modelled on the update frequency of the MSFD assessments, i.e. every 6 years, would be more appropriate and would not negatively impact users. This would allow EMODnet Seabed Habitats to devote more effort to methodologies and the production of improved inputs to EUSeaMap.

11. Annex: Other documentation attached

Annex I – Declaration of pre-existing rights

Please see separate Annex I document.

Annex II - Legacy strategy

As the managers of the EMODnet Seabed Habitats data infrastructure, JNCC will enable a smooth transition to CINEA (or a party designated by CINEA). The following technical characteristics of the data infrastructure mean that transfer to another party is a relatively simple process:

1. The current data infrastructure is fully open-source (PostgreSQL (with PostGIS) and GeoServer). These are well-established, mainstream open-source tools, with an active developer community providing a high level of support. GeoServer is cloud hosted on Amazon Web Services, with a scripted infrastructure and configuration, and as such the transfer would be relatively simple to achieve by providing the config file and data to EASME or another party, assuming that they are well versed in the programming language (Terraform) and services (Amazon Web Services). Data contained within the underlying PostGIS database would be extracted and transferred for re-initialisation by EASME or another party.
2. In addition to using open-source tools to create many of our EMODnet Seabed Habitat products (GRASS, R, Python), JNCC use open-source tools to prepare habitat maps for upload to the portal (Quantum GIS, Python, R), including the semi-automated tools developed for portal and data management. This will further ease the transition for another party to manage the portal, removing the need for proprietary GIS.

We assume that any staff time to make the transfer would fall outside the scope of this contract (EASME/2020/OP/0006). However, we guarantee our cooperation for transition meetings; staff would be made available to EASME as a priority for data and knowledge transfer.