EMODnet Thematic Lot n° VI Biology

EMFF/2019/1.3.1.9/Lot 6/SI2.837974 -EMODnet Biology

Start date of the project: 19/04/2021 - (24 months)

EMODnet Phase IV – Interim Report

Reporting Period: 19/04/2021 – 18/04/2022

Contents

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Executive summary

This document covers the period from 2021-04-19 to 2022-04-18, which corresponds to the first year of EMODnet Biology Phase IV. As stated in other reports, the work was performed during exceptional circumstances, not only the COVID19 pandemic which forced all partners to adopt a different style of work but also, more recently, the war taking place in the Ukraine due to Russian invasion of its sovereign territory.

In this phase, a new consortium was established, which includes two new organisations, IH Cantabria and UkrSCES, the Black Sea OBIS node. The Work Packages were reduced to five, with WP2 (access to marine data), co-led by VLIZ and HCMR, covers both recent and historical data; WP3 (data product creation) lead organisation is now the University of Sheffield and WP4 (Uptake, Outreach and communication) continues to be led by MBA. WP1 (Project coordination) and WP5 (System architecture) are led by VLIZ, similar to previous phases.

Throughout the first year, data from 138 datasets were published (including updates to 35 existing ones), corresponding to more than 4.6 million occurrence records becoming freely and openly available to users. By the end of the reporting year, 1213 datasets were available online, amounting to more than 28.9 million occurrence records.

In this Phase it was decided not to proceed with data grants, as was done in Phase III but similar budget was set aside to establish collaborations with various data providers. A data flow was agreed with INBO for the European Seabirds At Sea data, which are expected to be submitted in early 2023. This data flow is expected to continue past Phase IV.

WP3 partners have had several calls and a workshop to discuss various topics relating to data product creation, including the impact of EMODnet centralisation. It is also expected that a few products will be updated and expanded by the end of Phase IV, allowing users to make the most of the data and information available to them via a ready-made service.

The development of tools that allow users to query the various EMODnet thematic lots' webservices continued for the WFS R package and new work started towards the implementation of a similar tool for WCS services. This line of work, developing tools and/or products that are suitable not only for Biology, but all EMODnet users, is one that EMODnet Biology fosters and will continue to improve and maintain.

WP4 have not only reviewed the thematic lot static content, as it will be included in the centralised EMODnet portal, but also provided content for the monthly newsletters, produced two new use cases and a map of the network and how it connects to various other initiatives and other thematic lots. Ongoing work is being done towards a better engagement with the Regional Sea Conventions and more structure and defined engagement from the partners involved in its working groups.

1. Introduction

EMODnet Biology has, since its first implementation, worked towards freely and openly publishing marine biodiversity data that are essential to measure and study the ecosystem health of maritime basins. Additionally, the consortium has assembled individual datasets and processed them into interoperable biological data products that contribute to assessing the environmental state of overall ecosystems and complete sea basins and also engaged with various stakeholders either by hosting workshops or attending various events or meetings.

Phase IV, which runs from 2021-04-19 to 2023-04-18 continues to focus on assembling marine species data and metadata from public and private organisations resulting from water column and sea-bed surveys, to process these data into interoperable formats which includes agreed standards, common baselines or reference conditions, to create a set of gridded abundance data products for a range of marine species and to develop and operate a data portal allowing public access and viewing of the available data, metadata and data products as well as tools and project related information.

The main trophic groups covered are (macro)algae, angiosperms, benthos, birds, fish, mammals, phytoplankton, reptiles and zooplankton collected in the Baltic, Barents, Black, Mediterranean and North Seas, as well as North East Atlantic and the Caribbean Sea.

The specific objectives were divided in 11 tasks that require developing and: 1. maintaining and improving a method of access to data held in repositories, common to all thematic lots; 2. constructing products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space; 3. maintaining and improving procedures for machine-to-machine connections for all data and data products while ensuring a common approach along the different lots; 4. interacting with the administrators of the EMODnet Central Portal to ensure that the data and data products can be found, viewed and downloaded with ease from that central portal; 5. providing content for a reserved space for each thematic group within the EMODnet Central Portal; 6. ensuring coherence with efforts of regional sea conventions and other relevant local actors; 7. engaging with EU reporting mechanisms (e.g. through participation in working groups TG-DATA); 8. exploiting opportunities for interoperability with data distributed by non-EU organisations; 9. actively participating in the INSPIRE Directive27 and Digital Earth28 processes and ensuring compliance; 10. monitoring quality and performance and dealing with user feedback through a help desk service; 11. Maintaining continuity with the thematic portals for a maximum of six months from the start of the contract. The table below includes a mapping of the different tasks to each WP.

Tasks (EMFF/2019/1.3.1.9 tender specifications)	WP1	WP2	WP3	WP4	WP5
T1: Maintain and improve a common method of access to data held in repositories		X			
T2: Construct products from one or more data sources that provide users with information about the distribution and quality of parameters in time and space			X		
T3: Develop procedures for machine-to-machine connections to data and data products					X

Tasks (EMFF/2019/1.3.1.9 tender specifications)	WP1	WP2	WP3	WP4	WP5
T4: Contribute data, data products and content to a central portal that allows users to find, view and download data and data products					X
T5: Contributing content to dedicated spaces in Central Portal	X				
T6: Ensure the involvement of regional sea conventions				X	
T7: Contribute to the implementation of EU legislation and broader initiatives for open data				X	
T8: Monitor quality/performance and deal with user feedback	X				
T9: Maintain the existing thematic web portal for a maximum of six months from the start of the projects					X

A consortium of 23 government agencies (HCMR, CEFAS, ILVO, IMR, IPMA, NIMRD, OGS, SMHI, SYKE, UkrSCES), research institutes/academia (VLIZ, University of Sheffield, MBA, Aarhus University, Deltares, IEO, Ifremer, IH Cantabria, NIOZ, ULg), international organisations (ICES, IODE) and one SME (MARIS) was put in place. These partners have national and international expertise in marine biological data monitoring and data management and connections with the various regional sea commissions. With the inclusion of VLIZ, HCMR, MBA, UkrSCES it was also ensured that all European OBIS nodes as well the OBIS project office itself (hosted by IODE) were represented in the consortium.

Phase IV activities were grouped in 5 work packages: WP1- Coordination; WP2- Access to marine biological data; WP3- Data product creation; WP4- Uptake, outreach and communication; WP5- System architecture with the work divided in 26 deliverables (See table included in section 3).
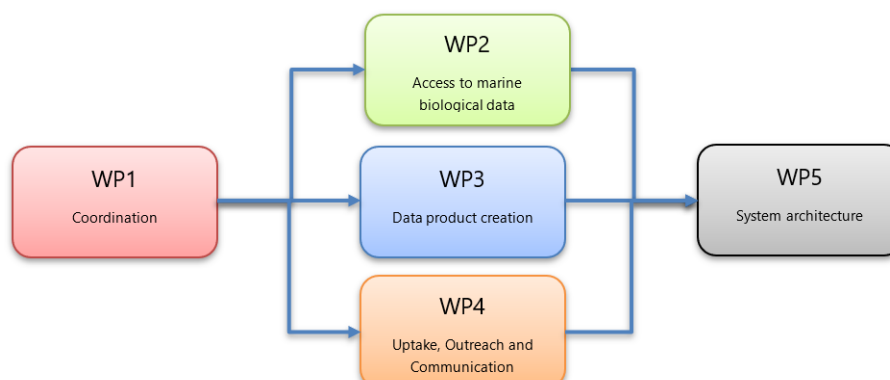
2. Update on the Tasks

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

The main WP2 objective is covered in this task, with the various activities described in detail in the section 3 under the WP2 updates. In the first year of Phase IV, 138 new datasets were added to the EMODnet Biology portal, as well as updates to 45 pre-existing datasets, this work included the publication of 6 historical and rescue datasets, details can be found in the quarterly reports published in the portal. This translated to an addition of almost 4 million occurrence records during this period. The Table in the Annexes (Task 1 section) includes a summary of the information for all datasets published during the first year. Figures 3 and 4 provide the summarised view of the records' geographic distribution, by marine region and functional group, respectively.

In addition to upgrading the content and quality of existing data and making new data available, the FAIRness of the metadata for each available dataset was assessed, the outcomes of which will result in targeted actions to improve it.

As in previous phases, a strong collaboration with the partners was ensured by frequent communication and maintenance of the previously established or newly setup data flows for new partners; additional connections with data providers and aggregators outside the project consortium were and will continue to be explored until the end of this Phase, with specific data flows pursued to increase the number of data available through the portal. The ongoing work resulted in one data flow targeting marine bird data being promoted through a sub-contract, with the overall objectives of publishing these data until the end of the Phase and ensuring that the data flow can continue after April 2023, when Phase IV is due to finish.

The link with the WoRMS remains strong, and through it, additional attribute information is being linked to the data download, allowing more targeted search functionalities by users.

As well as targeting recent data, WP2 deals with historical and rescue datasets. Within the context of this project, historical data are defined as data that have been collected at least 70 years ago (before 1950), and rescue data are those data that have been published from the 1960s to 2000s, which currently only exist on paper or digital text files. An inventory of possible historical data resources within the consortium was initiated over the Summer 2021 (July - September), requesting all partners to provide an overview of in-house historical datasets. The outcome of this inventory resulted in the identification of 18 datasets. It is worth mentioning that partners will still be able to identify historically relevant data, which can be added to this inventory at a later time. By using the temporal coverage (date coverage) as an essential factor to prioritise the list of the 18 datasets, 13 datasets were defined as Historical Data Resources (https://www.emodnet-biology.eu/sites/emodnet-biology.eu/files/public/documents/EMODnet_Biology_IV/Deliverables/D2.1.pdf)some of which will be used in the digitisation process through Citizen Science initiatives. For this work to proceed, several citizen science platforms were explored during the first year. The criteria met were relevant both to the citizen scientist's (free usage, technical support, easy-to-follow tutorials, etc) and the data manager's (data output, multiple contributors, easy-to-build workflow) perspective. Upon completion of the assessment, the [Zooniverse](#) and [DoeDat](#) platforms were selected as the most suitable for the proposed work. The comparison of the various platforms assessed is included in the following Table.

CS Platforms	Evaluation
Zooniverse	Applicable: interactive, easy to use, detailed guidelines, well-known for CS projects
DoeDat	Applicable: in 4 languages, table format for direct transcription
SciStarter	Not applicable: a project hub rather than a project builder
Citizen Cyberlab	Not applicable: a website promoting the idea of Citizen Science
Citizen Science Grid	inactive
World Community Grid	Not applicable: a platform of sharing extra computer power not a Citizen Science platform
iNaturalist	Not applicable: an observation platform rather than a transcription one
Cartoscope	Not applicable: small platform, not really interactive, suitable for Citizen Science projects with photos
Fromthepage	Not applicable: a crowdsourcing transcription platform but it comes with a cost
Transkribus	Not applicable: a transcription platform rather than a Citizen Science platform
Spotteron	Not applicable: a Citizen Science app designer, it comes with a cost
CrowdCrafting	Not applicable: a crowdsourcing transcription platform, it comes with a cost

The backbone workflow for each platform was built and internal tests were carried out in order to gain feedback on the workflows' feasibility. To this end, the contact with the platforms' technical support teams is ongoing in order to constantly improve this process. Prioritised historical datasets, identified in Deliverable D2.1 mentioned above, were selected based on their low difficulty in being curated (e.g. Report on the Danish Oceanographical expeditions 1908-1910 to the Mediterranean and adjacent seas. Vol II Biology. A.8 Lepadogaster By Frederic Guitel (1919)) and their attractiveness to non-English speaking contributors (e.g. Walter Klie (1935) V. Ostracoda. Die fischereigruende vor Alexandrien. Notes and Memoirs of the Fisheries Research Directorate of Egypt, 12).

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

Significant progress has been made, over the reporting period, in developing new data products to address this task. A major update and extension of the Phase III benthic presence-absence product has been completed (https://github.com/EMODnet/EMODnet-Biology-Benthos-European-Seas), which now provides highly quality-controlled presence and absence data for >10,000 benthic taxa throughout European seas, including the Black and Mediterranean seas. This product forms the basis of various extensions, including: preliminary work to provide benthic species lists for all polygons in the EMODnet Seabed Habitats broad scale habitat map; mapping temporal change in benthic communities at a

European scale; and seeding Machine Learning approaches to map the distribution of key taxa of interest at regional scale (e.g. a new predictive map of the occurrence of the reef-building species Sabellaria spinulosa in the North Sea; Herman & van Rees 2022). Interpolated maps of the monthly distribution of zooplankton species *Calanus finmarchicus* and *Calanus helgolandicus* have also been produced, combining DIVA modelling with expert knowledge to map distributional change over 60 years (https://github.com/gher-ulg/EMODnet-Bio-Interp-Calanus). This product also includes mapped error fields, providing a quantitative estimate of the quality of parameters in time and space. Following final testing this product will be extended to other zooplankton species. Both products will be available through the EMODnet Central Portal upon centralisation.

Other products in development and due for release in the next reporting period include predictive distribution models for non-native macroalgae species under climate change scenarios, diversity trends in phytoplankton and zooplankton in the Baltic Sea, and trait-based responses of benthic species to anthropogenic pressures including fishing.

In addition to the above-mentioned work, the EMODnetWFS: Access EMODnet Web Feature Service data through R developed during Phase III was updated and a sub-contract established to finalise the o ws4R (OGC Web Services for R) package. Both of these packages allow users to query not only the EMODnet Biology's but also other thematic lots' webservices. Continuous maintenance and improvement are foreseen in the future.

Task 3: Develop a complete and robust machine to machine (M2M) interface to transfer data and products in bulk, which is easily accessible for other machines and initiatives

Throughout the first year, an update of the technical stack to support a robust M2M interface was initiated. As planned, the IPT software upgrade will be complete; this work involves setting up a new virtual machine, with the latest Ubuntu Operating System, applying the correct setting to be able to act as a server and installing the requirements to run IPT (Apache Tomcat). Once these steps are completed, the IPT war (web archive) needs to be deployed 30 times, as this server hosts several instances for other institutes or organisations for which VLIZ and the EurOBIS/EMODnet Biology team provide technical and data publication support. A final step consisted in the copying of the data folder to the new server, which has been confirmed to be working. Subsequently, the custom EurOBIS publishing script needs to be tested, to ensure that it can run on this new version of the IPT. Any issues that might arise will be promptly resolved so as not to delay or block data publication and its harvest by OBIS and GBIF (Global Biodiversity Information System).

Other M2M systems, like the Geo-Related servers will also require updates and initial steps have been taken towards this goal. More information will be included in future quarterly and the final reports.

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

The current VLIZ (Flanders Marine Institute) hosted GeoServer is used as a starting point in providing Biology data to the EMODnet Central Portal. As agreed with the CP team, a copy of this GeoServer stack, including the data will be provided to the CP, so that users can continue to query and download data upon centralisation. Investigations will also take place to assess whether the GeoServer layer can be transformed into ERDDAP, for easy sub-setting and querying via the CP viewer and webservices.

The existing, static gridded products will be provided to the CP via ERDDAP, with file transformations required to comply with the specifications provided by the CP team. This work is ongoing and also captured in WP3.

Task 5: Contributing content to dedicated spaces in Central Portal

During the first year, the thematic lot contributed not only with content for the CP monthly newsletters but also with two new use cases: [Holistic, standards-based access and interoperability for marine biodiversity data](#) and [Distribution of reef-building benthos in the North Sea](#) available since end January 2022 and mid-April 2022, respectively.

Following a first inventory created by the CP team, the static content was reviewed and the number of pages and information therein rationalised, whilst ensuring that no loss of information is lost during centralisation.

A connectivity map (Deliverable 4.2) was developed within WP4 and publication in the CP is due when centralisation is complete, in the meantime the first iteration of this map can be found via the Biology website https://www.emodnet-biology.eu/partners. Using the Commission's recommended tools (HighCharts) the connectivity map outlines the EMODnet Biology consortium's interactions with key initiatives and activities which were captured via an online questionnaire, answered by each partner organisation. The true connectivity of the partnership would be overly complex to represent in this manner, so key partnerships and initiatives were identified including, UN Ocean Decade Programmes, ICES Working Groups, Regional Sea Conventions and other EMODnet thematic lots.

Task 6: Ensure the involvement of regional sea convention

The network of stakeholders developed prior to this phase of activity identified key participants within each of the Regional Sea Conventions who have been routinely included in key communication and engagement activities at every stage, including previously help product development workshops and showcases of achievement. As mentioned in Task 5, the Regional Sea Conventions were also one of the focal areas depicted within the connectivity map. A specific deliverable on engagement Regional Sea Conventions is (D4.3) included preparatory work, such as the identification of the appropriate EMODnet Biology partner organisation who will lead the interaction, has been completed, and an engagement strategy updated. It is recognised that each RSC has specific needs and technical requirements, therefore a flexible and targeted approach is needed.

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

EMODnet Biology Work Package leads (WP2 & WP4) have coordinated with the central OBIS secretariat to better define and optimise data flow, especially with consideration to the 'Publish Once, Harvest Many Times' paradigm. This has included liaison with the GBIF to ensure the risk of data duplication is mitigated and the appropriate use of DOIs to support transparency, traceability and trust in the open data published by EMODnet Biology. The resulting data are integrated into EOV-based approaches for monitoring of ocean health and a range of globally-relevant outputs such as the IPBES Global Assessment and the UN World Ocean Assessment.

Work has also taken place to align EMODnet Biology outputs with the reporting requirements for MSFD and the upcoming OSPAR and current HELCOM Quality Status Reports, which has included the

identification of key, engaged individuals and organisations within the EMODnet partnership as mentioned above (Task 6).

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

Quality and performance are monitored throughout the project's lifetime using various tools. With GeoHealthCheck, an assessment of the OGC services are continuously performed and during the period covered in this document, EMODnet Biology's services were always within the required performance thresholds. Figure 5 of the Annexes is a screenshot of the OGC monitoring from 2021-05-16 - 2022-05-17 in which it is possible to check that the portal was always operational, with 99.5% reliability throughout the mentioned period. The OGC assessment is also included in the quarterly reports, accompanied with screenshots of the tools' output.

User monitoring, through Matomo, is also performed continuously and Figure 6 and 7 include the visits over time and the countries where users are located, including the 10 most frequent countries (Figure 8). The portal had a total of 10,121 visits amounting to 21,406 unique pageviews.

Feedback was received from users via different means, directly via email or through the website's contact form. 75% of such contacts were resolved within one working day and the remaining 15% took longer as they were sent to a specific team member during the holiday period, rather than the bio@emodnet.eu email, which is constantly monitored by various people and thus remained unread until such team member was back at work.

In this first-year changes were implemented to the marine regions used for reporting purposes. A summary of the changes can be found in the Quarterly Reports 17 and 20, but the overarching metadata record for all reporting regions can be accessed via the link https://marineregions.org/gazetteer.php?p=details&id=63392 . Note that according to the tender, the Caribbean Sea is included in the Atlantic sea, therefore we do not report separately for both regions.

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

The initial request, as stated in the tender was to maintain the Biology portal operational for six months, upon which centralisation would take place. Due to unforeseen delays, CINEA and DG MARE agreed that all thematic lots should undergo centralisation at the same, with the deadline due to the end of Summer 2022.

No major changes were made in the portal, updates to a number of pages were done, to reflect the new Phase, but tools and services, including their description, remained the same as in Phase III. Updates in the portal were limited to bug fixing or technical and content improvements following requests from the Commission, e.g. update in data privacy policy and user cookie management.

3. Work Package updates

Status of the Milestones and Deliverables listed in the workplan				
Milestone/Deliverable	WP	Date due	Status (Delivered/Delayed)	If Delayed: reason for delay and expected delivery date
D1.1: Help desk operational and contact details published online (M3)	WP1	QR17 (30 Jun 2021)	Delivered	
D1.2 Quarterly progress reports (scheduled defined in the tender) (M3-M24)	WP1	QR17 (15 Jul 2021)	Delivered	
		QR18 (15 Oct 2021)	Delivered	
		QR19 (15 Jan 2022)	Delivered	
		QR20 (15 Apr 2022)	Delivered	
		QR21 (15 Jul 2022)		
		QR22 (15 Oct 2022)		
		QR23 (15 Jan 2023)		
		QR24 (15 Apr 2023)		
D1.3 First interim report after phase (M12)	WP1	19/04/2022	Delivered	
D1.4 Final report (M24)	WP1	19/04/2023		
D1.5 Attend Steering Committee and Technical Working Group meetings (M0-M24)	WP1	Sep 2021	15th SC meeting attended / 10th WG meeting attended	
		Apr 2022	16th SC meeting attended / 11th WG meeting attended	
		TBC 2022/2023		
D2.1 Inventory of possible historical data resources within the consortium (M6)	WP2	29/10/2021	Delivered (see Task 1)	
D2.2 Technical implementation of data flows for the new project partner (M6)	WP2	29/10/2021	Delivered (see Task 1)	
D2.3 Report on efforts undertaken in rescuing historical data through citizen science (M18)	WP2	15/10/2022		

D2.4 At least 3 linkages with initiatives outside of the original Consortium, resulting in extra data/information available via the Portal (M20)	WP2	31/12/2022		
D2.5 Feasibility study for recognition of specific ecological traits and/or sampling devices/methodologies in text 8	WP2	25/02/2023		
D2.6 Report on the standardisation and integration of the proposed new and updated datasets (M24)	WP2	19/04/2023		
D3.1 Quarterly WP3 community calls; call leader or other nominated team member to produce summary report of each call for publication on EMODnet website (M3-M24)	WP3	Call QR17 (30 Jun 2021) Call QR18 (30 Sep 2021) Call QR19 (31 Dec 2021) Call QR20 (31 Mar 2022) Call QR21 (30 Jun 2022) Call QR22 (30 Sep 2022) Call QR23 (31 Dec 2022) Call QR24 (31 Mar 2023)	Delivered (see QR17 task 2) Delivered (see QR18 task 2) Delivered (see QR19 task 2) Delivered (merged with Workshop 1, See Task 2)	
D3.2 Annual intensive workshops, in person with online participation options. Workshops involve collaborative product development on one or more targeted themes derived from WP4 user needs questionnaire (M12-M22)	WP3	Workshop 1 (19 Apr 2022) Workshop 2 (28 Feb 2023)	Delivered	
D3.3 Publish R package to link EMODnet biology data with data from other EMODnet sources (M12)	WP3	19/04/2022	Delivered	This package remains in development and features will continue to be added

				over the remainder of the contract period
D3.4 Develop method to use Phase III presence-absence maps to display time series of distribution change (M12)	WP3	19/04/2022	Delayed	See WP3 section for further details
D3.5 Produce position paper outlining questions that can be addressed using EMODnet data, together with remaining gaps, and strategies for filling these (M24)	WP3	19/04/2023		
D3.6 Add/update data product metadata in the EMODnet Biology catalogue (M24)	WP3	19/04/2023		
D4.1: Questionnaire to inform cross-lot product development (M3)	WP4	30/07/2021	Delivered (see QR18 task 3)	There was a slight delay in making the questionnaire available due to the holiday period. More details in Task 3
D4.2: EMODnet Biology connectivity 'map' of projects, institutes, initiatives and networks to inform targeted engagement (M12)	WP4	19/04/2022	Delivered	Due date delayed due to COVID impact. Publication in QR20
D4.3 EMODnet Biology participation in each of the RSCs to inform and advise of available data products and mechanisms to access and influence the development of data, products, tools and services (M12)	WP4	19/04/2022	Delivered	Details included in Task 6
D4.4 "Launch" of the European MBON node (M24)	WP4	19/04/2023		
D4.5 Creation of engaging and informative use-cases for EMODnet Biology to illustrate uptake and utility of data products across a range of stakeholders across the quadruple helix of engagement (M6, M12, M18, M24)	WP4	Use case 1 (29 Oct 2021) Use case 2 (19 Apr 2022) Use case 3 (15 Oct 2022) Use case 4 (19 Apr 2023)	Delivered (see task 7) Delivered (see task 7)	

D5.1 User portal operation and maintenance (M0-M6)	WP5	19/10/2021	Delivered	
D5.2 Webservices operation and maintenance (M0-M24)	WP5	19/04/2023		
D5.3 Technology stack upgraded (M12)	WP5	19/04/2022	Delivered (see Task 3)	
D5.4 Evaluation and implementation of bulk data transfer technologies (M24)	WP5	19/04/2023		

WP1 – Coordination

WP1 is dedicated to the project coordination and includes Task 5- Contributing content to dedicated spaces in the Central Portal and Task 8- Monitor quality/performance and deal with user feedback. This WP is coordinated by VLIZ and the leads for WP2 (VLIZ and HCMR), WP3 (University of Sheffield), WP4 (MBA) and WP5 (VLIZ).

The main activities include: 1. General project coordination and supervision, 2. Budget Management, 3. Responsibility to deliver the reporting deliverables to the Commission, 4. Organisation of project meetings, 5. Liaise with external organisations on behalf of the project consortium and 6. Operate the helpdesk.

In general terms, the coordinator is responsible for:

- Act as the intermediary between the consortium and the European Commission;
- Ensure appropriate communication and, where viable, collaboration between the consortium and the remaining lots;
- Organise project meetings;
- Chair the Coordination Board meetings;
- Participate in the EMODnet Steering Committee and EMODnet Technical Coordination Group meetings;
- Participate, on behalf of the consortium, in events (workshops, webinars, discussion groups, etc.) relevant to the project;
- Liaise with the EMODnet Secretariat on behalf of the consortium.

These responsibilities are ensured via:

- Communication with consortium and contract with EU;
- Maintain cooperation and communication with the EMODnet Secretariat, Steering Committee and Technical Coordinator Group;
- Address user feedback through help desk function; Feedback from Work Packages 2, 3, 4 and 5.

The outcomes of the WP1 activities are included in Deliverables 1 to 5, more specifically:

D1.1: Maintenance of operational Helpdesk service with contact details published online (M0-M6)

D1.2: Quarterly progress reports (M3-M24)

D1.3: Interim report (M12)

D1.4: Final report (M24)

D1.5: Attend the Steering Committee and Technical Working Group meetings (M0-M24)

During the past year, deliverables D1.1, D1.2 (QR17, QR18, QR19, QR20), D1.5 (meeting held in April 2022) were submitted and/or completed. More detail on Tasks 5 and 8 are included in section 2 (Update on tasks) and sections 6 (User feedback), 7 (Meetings/events held/attended & Planned) and 8 (Communication assets) of this report.

An update to the marine regions reporting areas was initiated and concluded during this first year. This work involved costumisation of the EEA shapefile in order to include records in coastal/brackish areas and also the Caribbean Sea, more specifically the marine areas that are part of European countries' overseas territories.

WP2 – Access to marine biological data

The main objective for WP2 is covered in Task 1: Maintain and improve a common method of access to data held in repositories. The data primarily include the following groups, (macro)algae, angiosperms, benthos, birds, fish, mammals, phytoplankton and zooplankton in six European seas, more specifically: Arctic, Atlantic, Baltic Sea, Black Sea, Mediterranean Sea and North Sea, including their coastal and estuarine zones as well as the Caribbean Seas (where EU countries have overseas territories). Data from other regions are also ingested when available, even though it is not the main focus of the proposed work. WP2 also includes the processing and publication of historical datasets, defined as data that have been collected at least 70 years ago.

The data management activities focus on further automatisation of the data flow, compared to what was accomplished in previous phases. This will be suitable for all partners and sub-contractor that already generate DarwinCore files in a (semi-)automated way based on their local structured and maintained databases. All partners/sub-contractor are required to adhere to the DarwinCore EventCore format, which was introduced in the previous phase. When partners/sub-contractor have absence data available for datasets that were submitted in previous phases, they are encouraged to update their data with this additional information, which has a high value for the creation of data products describing time evolution and migration.

WP2 continues to use the standards, vocabularies and data formats from the previous phases, thereby providing consistency and ensuring interoperability for providers and users, more specifically:

- The OBIS-ENV Darwin Core (DwC) format, not only allowing the inclusion of presence/absence data of marine biodiversity data, but also the storage of additional measurements or facts sampled alongside with the biological sampling
- The World Register of Marine Species, the authoritative and comprehensive list of names of marine organisms worldwide
- The Marine Regions Gazetteer, a standard list of marine georeferenced place names and areas
- The BODC controlled vocabularies, lists of standardised terms that cover a broad spectrum of disciplines of relevance to the oceanographic and wider community

Adhering to the above standards, formats and vocabularies allows interoperability with other systems such as e.g. OBIS and GBIF as well as with other types of data, while allowing for an unambiguous description of the various parameters, taxa and localities. Within the single task of WP2, several deliverables (6 in total) are clearly defined and will be discussed below, with specific details on their status and general progress.

Deliverable 2.1 (Inventory of possible historical data resources within the consortium) and **Deliverable 2.3** (Report on efforts undertaken in rescuing historical data through citizen science) are closely related. The inventory of possible historical data resources within the consortium (D2.1) was initiated over the Summer of 2021 (July - September) and published shortly after. With this inventory, all partners were requested to provide an overview of in-house historical datasets. The list of the proposed resources contains 18 datasets in total and documented - among others - information on the current file format, the type of data, the geographical, taxonomic, and temporal scope. Within this list of datasets, a prioritisation was made, resulting in 5 datasets that will be used as example datasets for the testing of the user-friendliness and effectiveness of citizen science platforms – both from the data manager and citizen volunteers' perspective - through which these datasets can potentially be digitised and standardised. Once this work is complete, the data will be included in the EurOBIS database and published via EMODnet Biology. A report of the findings of working through citizen science platforms and with citizen volunteers (D2.3) will be available later this year.

The digitisation work will be done via two citizen science platforms that were targeted for full-scale testing: Zooniverse and DoeDat. Both have a proven track of being successful in this line of work, and the WP2 team is in the process of creating small projects available, whilst keeping track of both advantages and disadvantages for each of them. If one or both are evaluated positively by the end of 2022, the remainder of the available time within Phase IV can be used to digitise additional historical datasets.

Since the start of Phase IV, close and regular contacts are kept with all partners involved in WP2. Early into this Phase, the existing data flow mechanisms were re-evaluated for existing partners, while data flow mechanisms for new partners were discussed in detail and implemented. **Deliverable 2.2** - Technical implementation of data flows for the new project partners/sub-contractor – describes all the details on data flow mechanisms, as well as a table overview of datasets that are expected to be delivered by each partner within Phase IV of the project. As the project moves forward, so does the data delivery of the partners and by the end, a full report on the standardisation and integration of the proposed new and updated datasets will be made available as **Deliverable 2.6**. In the meantime, the Data Management Team is also investing time in making all available metadata more FAIR. To improve the FAIRness of the EurOBIS dataset collection, including all datasets available through the EMODnet Biology portal, the record's metadata completeness was evaluated, using the VLIZ FAIR Checker, an in-house developed tool. A first exploration of FAIRness of the available datasets revealed that 81% are complete, 91% are findable by their standardised identifier and 78% have a Marine Data Archive (MDA) repository, which means that the data are registered in a searchable resource. Currently, the partially incomplete records are being investigated in more detail, and action will be taken towards improving the full FAIR specifications of all datasets.

Deliverable 2.4 defines that EMODnet Biology should have at least 3 linkages with databases/initiatives outside of the original Consortium, resulting in extra data/information available via the Portal. Good progress is being made towards this target. An ongoing collaboration with the OPI has been established, resulting in a data flow of historical research data, from a global perspective, into the EurOBIS database and subsequent publication in the EMODnet Biology portal. In addition, a collaboration was initiated with the INBO (Belgium), to establish a continuous data flow of the ESAS database, currently being maintained and managed by ICES. Several other potential data flows are being explored and negotiated (e.g. PANGAEA, GBIF nodes within Europe). In parallel, connections and collaborations are being initiated or taken further in link with WoRMS. An example of this is the integration of specific traits for European macro-algal species, e.g. information on their blooming behaviour and their modes of reproduction. More generally, the traits information in WoRMS is gradually being expanded, in collaboration with the wide and diverse network of its taxonomic and thematic editors. One of the aims is, for example to reach >90% completeness for the trait 'functional group' - which defines whether a species is benthic or pelagic – and a roughly 80% completeness for an indication of the qualitative body size of each species in WoRMS (micro-, meio-, macro-, …).

A dedicated deliverable, **Deliverable 2.5:** Feasibility study for recognition of specific ecological traits and/or sampling devices/methodologies in text is envisaged in this Phase. Traits are considered the morphological, anatomical, physiological, biochemical and phenological characteristics of species. Physiologists, taxonomists and morphologists use them to describe the characteristics of the taxa they study. Traits are closely related with the EBVs and with ecosystem function. Due to their vast diversity and long history, traits have multiple meanings and are used inconsistently in literature. To address this issue, traits' databases have been curated for many taxonomic groups, such as plants, polychaetes, corals, fish, copepods and birds, among others. Going a step further, the ETS vocabulary and PATO can be used to standardise traits terms usage. It is worth mentioning that basic trait information is already been collected within the WoRMS.

Text mining tools identify terms in free form text and can assist curators and/or perform large-scale automated knowledge discovery of multiple documents. Text mining is built upon standardised knowledge and well-defined terms. In addition, training and evaluation of these tools require curated corpora. Many text mining tools have been successful in identifying species names, a task that many tools perform well, like gnfinder, EXTRACT etc. There are multiple methodologies to implement a text-mining tool, such as using dictionary-based approaches (https://github.com/larsjuhljensen/tagger) or training deep neural networks (e.g. https://spacy.io). The aforementioned advances regarding traits, call for an attempt to examine which ones are more feasible to mine from text and which methods are most promising for the task. Hence, the result of the D.2.5. could be a proposal of a strategy for setting up a text mining prototype; the steps required regarding building a curated corpus (e.g., with http://brat.nlplab.org/) and the subsequent text mining tasks to retrieve traits from documents. Furthermore, an examination of whether the current data and tools are adequate for a full-scale development of such a system will be facilitated. The focus of this initiative should be on marine distribution/species traits, more specifically, this study will focus on ecological traits, life stages and body length extraction with text mining and will build upon previous work on traits and text mining of EMODnet Biology.

WP3 – Data product creation

WP3 has four primary aims:

- Develop methodologies to robustly visualise and assess changes in species abundance and extent over time and space
- Increase the linkages between different data sources, providing products which fetch and process data required to address a set of specific user questions
- Expand the geographical scope where possible beyond North Sea and Baltic
- Expand the taxonomic scope to include key taxa of interest

Each of these contributes towards 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, which includes six Deliverables. Over the reporting period, we have successfully completed five scheduled community calls (D3.1) and we held our first intensive WP3 workshop (D3.2) fully online, in March 2022, due to ongoing COVID-related uncertainty about international travel. These have together helped to strengthen the community within the WP3 team, including the establishment of new collaborations between project partners to develop new products. They have also provided an opportunity to share best practice and we have had masterclasses in reproducible computational methods, and in improving meta-data documentation (D3.6).

Aim 1 links directly to D3.4, to develop methods to use Phase III presence-absence maps to display time series of distribution change. This has proved to be both a technical and a scientific challenge, and delivery of products addressing this has been delayed beyond the anticipated month 12 target. The fundamental challenge is how best to deal with uneven data coverage through time - a feature of the data in the EurOBIS database (and, indeed, of all similar aggregations of biodiversity data). We have adopted different approaches to displaying time series of distributional change, for different major groups of taxa, and products building on Phase III are in development for benthos, zooplankton, phytoplankton, and macroalgae. One approach is to use the spatial products from Phase III to map distributional change through time for an assemblage at the community level. To this end, the University of Sheffield team have used the Phase III product of [presence and absence of benthos in the greater North Sea](#) from Deltares to provisionally map time series of change at community level (Figure 9A in the Annexes). This method will now be applied to the new benthos presence-absence product to produce a European-wide time series product, with an anticipated delivery date of M18. Where this product will use data at the European level to present broad temporal comparisons, more detailed time series will be made available in some regions. The SMHI team are developing indices of temporal change in zooplankton and phytoplankton diversity, starting by using high-quality data from the Baltic Sea: trends in plankton diversity, while Cefas and NIOZ are using finer resolution benthic data, combining information on distribution and biological traits to model the response of benthos to selected pressures including fishing intensity.

An alternative way to display temporal change is to consider individual species. A new collaboration is linking the computational expertise at University of Liège with detailed knowledge of zooplankton biology and ecology from the MBA, to improve previous phase DIVA maps of plankton distribution, focusing initially on key species where biology and environmental affinities are well known. Because of the excellent time series data available for zooplankton, monthly distribution maps have been created for the years 1960-2018, with predicted density (and associated error field) available at 0.5°, 1°, and 2° resolution ([https://github.com/gher-ulg/EMODnet-Bio-Interp-Calanus;](https://github.com/gher-ulg/EMODnet-Bio-Interp-Calanus) Figure 9B in the Annexes). This methodology will be applied to a wider range of taxa once is has been fully tested on the key taxa *Calanus finmarchicus* and *C. helgolandicus*.

Another species-level product, again resulting from a new collaboration (between IH Cantabria and VLIZ), considers temporal change in distribution into the future, using environmental niche modelling to predict future distribution change in non-native species of macroalgae.

Aim 2 has been addressed via the R package EMODnetWFS (D3.3) which is available to users via https://github.com/EMODnet/EMODnetWFS. As such it is already effectively published (meeting D3.3), however it will be submitted to ROpenSci review and continued development over the remainder of this Phase. There has already been extensive development of this package during the reporting period, led by Sheffield and VLIZ with significant input from subcontracted external consultant Maëlle Salmon. The package now provides access to data from across EMODnet lots, with a range of filtering options including selecting specific data layers and querying by geographical region. A limitation identified was that the package, as originally conceived, allowed access via WFS only, so gridded data (common in other lots) were not accessible. We have addressed this by subcontracting another external consultant, Emmanuel Blondel, to fully develop the ows4R package (https://github.com/eblondel/ows4R) to provide native R support for accessing data served via WCS, which will open up all gridded EMODnet data products. The eurobis package (https://github.com/lifewatch/eurobis) has also been updated - this uses EMODnetWFS as a backbone to access EurOBIS/EMODnet Biology occurrence data, further contributing to our aim to increase the linkages between different data sources. The eurobis package now allows querying on taxon, dataset, time, location (any polygon), marine region, and some biological traits.

Aim 3 has been addressed by a major update and expansion of the Phase III benthos presence-absence product, which now covers all European seas. Efficiently serving products of this size (many thousands of taxa across many thousands of sampling locations) presents challenges to any web portal, and the best protocol is being agreed with the CP team and the product with >10,000 benthic taxa will be available in the CP later this year. A real strength of this product is how it can be used to develop other products (such as the benthic trends product described above) and use cases (e.g. a new predictive map of *Sabellaria spinulosa* occurrence in the North Sea built by applying random forest Machine Learning methods to the product; Figure 9C in the Annexes, Herman & van Rees 2022).

This product exemplifies what EMODnet Biology data are best for: synthetic products that are spatially and temporally extensive, aggregating multiple individual datasets to document distributional patterns and trends in taxa for which dedicated surveys at equivalent scale do not exist. This contrasts somewhat with Aim 4, which requested a focus on key taxa including marine mammals and seabirds. We have not focused on these taxa because we judge (based in part on recent master projects run in the University of Sheffield that were designed to test this) that the data currently available within the EurOBIS database are not sufficiently robust to allow for useful products to be built without very substantial additional researcher effort on quality control and methods' development. We are working with other teams to incorporate existing data products on distribution and distributional change of key species (Waggitt et al. 2018, https://doi.org/10.1111/1365-2664.13525) into EMODnet - these maps are higher quality than any we could produce directly. We also note ongoing efforts within WP2 to incorporate more seabird data into the database, and the very recent publication of the Joint Cetacean Data Programme (JCDP) via project partner ICES (https://cetaceans.ices.dk) which has greatly expanded the availability of cetacean data via a different platform and which may be useful for future product development.

WP4 – Uptake, outreach and communication

The adoption of data, products and services and their operational integration represents a significant measure of success for the EMODnet Biology project. As such this dedicated Work Package is committed to understanding the reach, level and engagement and proactively work to ensure uptake by the wider community and key stakeholders. Particular attention has been paid to engagement across key sectors represented by the quadruple helix (Figure 10 in the Annexes).

A number of deliverables were defined in the proposed work. Below is a brief summary of the outputs and conclusions.

D4.1: Questionnaire to inform cross-lot product development (M3)

Using the Alchemer tool, an online questionnaire management service, and in collaboration with EMODnet Seabed Habitats, we sought to capture key stakeholder requirements and drivers. The resulting questionnaire was shared throughout our network of stakeholders and the wider marine biological community. The questionnaire remained open for four weeks and we received 24 responses. Selected responses (Questions 1, 4 and 5) are included in Figure 11 in the Annexes. The results of the questionnaire have been shared with the wider partnership and specifically with WP3 to inform future product development and also with EMODnet Seabed Habitats to help drive greater cross-lot collaboration.

D4.2: EMODnet Biology connectivity 'map' of projects, institutes, initiatives and networks to inform targeted engagement (M12)

In order to better understand the landscape within which EMODnet Biology sits and the complexity of the range of project, initiatives and institutes, a further questionnaire was prepared using the Alchemer application. This instance, targeted EMODnet Biology partners, and specifically the staff that form the EMODnet Biology consortium and their interactions with other areas. The full extent of the partnerships interactions would result in an overly complex network map, so the decision was taken to simplify and focus on key, strategic engagements including ICES Working Groups, Regional Sea Conventions, UN Ocean Decade Programmes and the other EMODnet thematic lots (see Figure 12 in the Annexes). Future iterations will further develop the map to highlight the nature and directionality of the engagement activity.

D4.3: EMODnet Biology participation in each of the RSC's to inform and advise of available data products and mechanisms to access and influence the development of data, products, tools and services (M12)

Leveraging the outputs of D4.2 we have identified relevant EMODnet Biology partners to engage with each of the Regional Sea Conventions, in order to better understand their requirements. It is recognised that each of the RSC's have differing requirements, a range of technical support available to them and that the relevant point of contact will vary, from specific working groups to the main RSC secretariat. Following initial engagement, the EMODnet Biology partnership will then be well positioned to ensure operational adoption of key data products and services to support RSC activities.

D.4.4: "Launch" of the European MBON node (M24)

During the annual meeting WP4 partners discussed the best way forward to implement a European MBON node. Updates on progress will be included in future quarterly reports.

D4.5: Creation of engaging and informative use-cases for EMODnet Biology to illustrate uptake and utility of data products across a range of stakeholders across the quadruple helix of engagement (M6, M12, M18, M24)

Four use cases were planned for Phase IV. Two of them were published in January and April 2022 in the Central Portal, whilst the remaining two will be published in October 2022 and April 2023. The published use cases are based on the collaboration with the EMODnet Seabed Habitats team to produce guidelines to submit habitat data to EMODnet Biology (Holistic, standards-based access and interoperability for marine biodiversity data) and the second one on a specific work done by one of our partner on mapping the Distribution of reef-building benthos in the North Sea.

WP5 – System architecture

WP5 is dedicated to the technical infrastructure that supports the data publication and M2M services. It is defined by three tasks, more specifically Task 3: Develop procedures for machine-to-machine connections to data and data products, Task 4: Contribute data, data products and content to a central portal that allows users to find, view and download data and data products and Task 9: Maintain the existing thematic web portal for a maximum of six months from the start of the projects.

All tasks were initiated at the start of the Phase and will continue until the end of the Phase in April 2023.

In order to fulfil Task 3, a number of updates was proposed for the technology stack:

- PostgreSQL (raw occurrence records and data products)
- Geoserver (OGC webservices, monitoring plugin)
- GeoNetwork (ISO19115 metadata, DCAT-AP)
- IPT update

From these, the GeoNetwork, which allows not only the metadata harvest by the EMODnet Central Portal but also by the EU Open Data Portal has been completed, while the remaining updates have been initiated and will be concluded in the coming months. Details of the ongoing progress will be given in future quarterly reports.

The GeoNetwork update process followed from the required update for the EMODnet central Portal (hosted by VLIZ). In order to better manage the several instances used within the institution, it was decided that the use of docker containers was the one that presented the best results. The work proceeded with the installation of a version obtained through a Belgian organisation and subsequent costumisation fit for the CP and Biology portals. This work was severely underestimated and took much longer than initially envisaged, mainly due to the fact that the version did have the required DCAT support to comply with the EU Open Data Portal, but also had specific functionalities not applicable for EMODnet, which had to be reverted.

As part of the ongoing activities to improve the internal data publication process there were various meetings to assess the best way forward. The technical infrastructure (EurOBIS database and associated publishing procedures) is more than 15 years old and was initially designed for the publication of biodiversity occurrence presence records and has been, over the past few years, pushed to its limits, not only due the amount of data held, but also the need to manage of new types of data (e.g. habitats, images, -omics) but also the need to expose biodiversity absence data, which is valuable for e.g. data product creation as well as ecological modelling, or data that are not linked to biological occurrences. This line of work is ongoing and the meetings focused on looking at existing initiatives, e.g. OBIS, GBIF, ALA, assessing the workload required for fundamental changes to the infrastructure, as well as pros and cons, whilst at the meantime implementing incremental updates whenever required (e.g. publication of habitat data). It is envisaged that significant technical changes, to the internal data management infrastructure, will begin within Phase IV.

Additionally, the IPT instances require an update from version 2.3.4 to version 2.5.7 so that new data can be included in the output files and be harvested by both OBIS and GBIF. This process is quite complex, not only because VLIZ hosts 30 instances, EurOBIS (which supports the EMODnet Biology data publication), but also for several other organisations to whom technical and data management support is provided, including but not limited to OBIS Canada, IndOBIS, Caribbean OBIS, AfrOBIS, OBIS China, ILVO, IEO and may others. A detailed list of all instances can be found via http://ipt.vliz.be/. The updating process needs to consider the EurOBIS data publication procedures (which are the base for EMODnet Biology) and might

require some adjustments in order to not break/block the data flow to the IPT and, subsequently, to OBIS and GBIF.

Linked to the work described in WP2, on improving the FAIRness of the metadata records, several updates to the Ecological Metadata Language (EML) standard used for the metadata records, was also done: fixing of field mapping issues, automatic calculation of dataset's BBOX, automatic calculation of the dataset's time range and discussions started to implement the best procedures to automatically update the dataset's taxonomic coverage.

Within the centralisation work, the team has had several meetings with the CP team in order to discuss how Biology's products and data should be exposed in the CP viewer. It is acknowledged by all that these products and data are more complex than other lot's products and require costumised functionalities in order for users to be able to search and download the correct information. On the products side, it was agreed to attempt the exposure via NetCDF to ERDDAP. The gridded products developed in the renewal stage of Phase III were therefore converted to this format, CF-Compliant, however technical constraints with ERDDAP (e.g. JAVA arrays size limitations and presence of string and char variables and the inability of ERDDAP in dealing with them) has delayed their seamless integration. Due to the lack of resource within the CP team to improve the ERDDAP technology, it was decided that the best way forward would be to build an API that allows users to query the taxon via their name, which is translated, in the background, to their AphiaID, allowing the files to be interrogated and the correct data displayed on the viewer. The viewer itself will also require costumised filter functionalities that will include, as a minimum set of filters available upon centralisation, taxa and traits (as well as BBOX and date/time). Once the first version of the centralised viewer is operational, work will continue to ensure that all filters, as currently included in the EMODnet Biology's download toolbox (https://www.emodnet-biology.eu/toolbox), will be available, thus allowing users to explore the data through its various facets.

As mentioned in Task 9, the thematic lot's portal has been maintained in operation throughout the current Phase and minor technical interventions have been required.

4. Identified issues: status and actions taken

A. Priority issue(s) identified and communicated by EASME/ DG MARE/ SECRETARIAT				
Priority issue	Status (Pending/ Resolved)	Action(s) taken / remaining actions planned	Date due	Date resolved
Including in metadata records online resources	Pending	More information from the Secretariat is needed on what the expected end result should be		
Including data and metadata URL in web services of data products	Ongoing	Formats in the metadataURL's of the newest layers have been updated and verified by the EMODnet Secretariat. Remaining issue is caused by a bug in the current GeoNetwork version (undergoing an update to a more recent version, implementation is expected during QR18)	QR18	
Assessment of performance				
A recent questionnaire (D4.1) used a commercial survey tool called Alchemer. The Secretariat is looking forward to the results, and recommends that in future surveys should be run via the EU Survey tool (https://ec.europa.eu/eusurvey/home/welcome)	Resolved	The Alchemer tool is used by MBA and complies with GDPR regulation, while also allowing for a simple way to create a results report. Future EMODnet Biology surveys will use the EU survey tool instead	QR19	
Portal specifies the schedule for publication of the products	Resolved	Provisional dates will be agreed for the publication of Phase IV products and will be shared with the EMODnet Secretariat in order to agree on the communication strategy for each product. Similar procedure to what was done for Phase III products		
It is recommended that the new delivery dates for the 'delayed datasets' would be listed in the Biology Final Report, so that these can be known as they are part of Phase III (and the Biology lot is now in Phase IV), so as to ensure delivery in the near future	Resolved	All Phase III data will be referred to as such in future reports	QR17	
There was not update provided on this task in the report. As indicated in the previous assessment report, Secretariat recommends to have a discussion	Resolved	This refers to Phase III Task 5 and Phase IV Task 6. An update was provided in the final report and will always be included in future reports under the appropriate task.	QR17	

between CINEA/DG MARE and all thematic coordinators at the next Steering Committee meeting in September 2021 to formulate guidance and to understand the objectives of the collaboration (per RSC if possible and per thematic node), and so gain a priority perspective and targeted way forward.				27
Observations in view of Section 1.7 of the Tender Specifications on Performance and Quality Requirements				
Indicator 5: The Secretariat noted some data entry errors in the excel table, i.e., 206 users giving information, vs. 23 total users for quarterly period. It was therefore not possible to interpret the results and perhaps clarify this in the final report which is still due.	Resolved	This was most likely a typo and should read 206 total users for the quarterly period		
Summary of the data and data products available should be included in the portal	Resolved	The portal was updated with the publication of all Phase III products (e.g. https://www.emodnet-biology.eu/blog). Summary of data and products can be done within the context of the centralisation	QR17	
Implementing Marine-ID	Resolved	~~Review of potential alternatives (QR10 report feedback)~~ With the ongoing work towards the centralisation of all thematic lots in the Central Portal, it has been established that Marine-ID cannot be used as an authentication means. If any is required in the Central Portal, it will be the EU login		
Including data and metadata URL in web services of data products	Ongoing	No changes since the last QR	QR18	
Report compliance, completeness and quality				
Update Spreadsheet progress indicators	Resolved	The spreadsheet used for QR17 was the last version as sent by the Secretariat. Unclear what errors (links to external sources) were detected. No action was taken by the thematic lot.		
Assessment of performance				
In the previous reporting period, a survey was done and it was reported that a brief summary would be included in this quarterly report. However, no details on the survey results were provided	Resolved	There was no mention of a survey done in the previous report (QR19). An internal survey was done to capture all partner's involvement with different RSC's, international initiatives, EU Working Groups, the outcome of which will be made available via a connectivity map of the network, included in D4.2	QR20	QR20

Indicator 2: Status/Volume and coverage of total number of products.	Resolved	The indicator units is correct as we monitor the products that are downloaded, each download equates to one request	QR20	QR20
Indicator 3: The thematic lots should not provide an exhausting list of their contributing partners	Resolved	This indicator only includes the partners that have in fact contributed with data during the reporting period. Data providers (internal or external) have always been listed in the QR when their data were published within the period in consideration	QR20	QR20
Status of the archaeological data part	Resolved	Archaeological data (phase III WP3) is now included in WP2. Whenever archaeological data are harvested they will be highlighted in the quarterly report. For QR17, 4 NIMRD datasets fit this category		
The use of the term "archaeological data" is incorrect	Resolved	This term is not incorrect, as it is also used for old data that are not available in digital format. The term was also used in Phase III and Phase IV proposals, therefore, for consistency's sake, will continue to be used throughout this phase.		
European Marine Regions shapefile	Resolved	Shapefile is fully implemented and will continue to be used throughout Phase IV unless new requirements are published		
Progress solving identified issues				
EM-83 - Biology - Web Services MetadataUrl and DataUrl	Pending	Resolution is planned to take place in the second half of 2021 or early 2022		
EM-78 - Biology to report on status or plans to support INSPIRE Compliant CSW	Ongoing	Customised GeoNetwork (DCAT and INSPIRE compliant) upgrade in progress. Fixing and debugging is almost complete, however the Log4j bug that was identified worldwide at the end of 2021 also needs to be addressed for this piece of software		

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
Re-definition of Phase IV Marine Regions as specified in the tender	Resolved	EEA shapefile was adapted for Biology purposes. More details can be found in Task 8	QR17	QR17
GeoNetwork update	Pending	New version has been updated and is being tested before being made operational	QR18	
Change of staff at HCMR	Resolved	Handover was done so that co-lead responsibilities and overall workplan were	QR18	QR18

		shared with the HCMR team. No delays or constraints occurred		
EML metadata mapping between IMIS (metadata catalogue) and IPT had some transformation issues	Resolved	Improved the mapping and made the contact/author fall back mechanisms work as intended	QR19	30/11/2021
Inclusion of dataset bounding box in metadata records. **This need was identified by a different project but also affects EMODnet Biology's metadata records as they are being harvested by this third project**	Resolved	For all the datasets, the geographical bounding box is being calculated based on the occurrence records in the dataset. This information is stored in the IPT metadata as the 'EurOBIS calculated BBOX. See https://www.emodnet-biology.eu/data-catalog?module=dataset&dasid=5076 as an example	QR19	11/11/2021
Updates to EMODnet reporting regions polygons	Resolved	Update included in QR20 document	QR20	2022-01-18
QC tool updates	Resolved	Updates included: ● Documentation added to About tab (error messages explanation and tutorials) ● Debugging (account for non resolving BODC terms, non-numerical coordinates, dependencies management) ● Addition of BODC S09 collection to the checks and harvest of new BODC terms	QR19	QR19
Users do not have access to absent occurrences	Ongoing	Absence of specimens in surveys can provide invaluable information for data product creation and overall ecosystem knowledge. Within the thematic lot there are a number of datasets where data providers have reported real absences (species were looked for but not found) or inferred absences (i.e a list of species was defined for the project and sistematically used throughout. When absent from the data submitted, we know that this is because such individuals were absent from the samples). Work is underway to allow for these data to be available to users in the near future	QR22	
Delays due to situation in the Ukraine	Ongoing	The partner in question, UkrSCES is based in Odessa and contributes to WP2. Situation is being monitored within the project. The ongoing conflict might mean that the partner is unable to supply the data within the project's deadlines, as initially agreed		
Updates to Webservices to allow users to	Ongoing	The inclusion of ingestion of habitats data, that resulted from a collaboration between Seabed	QR24	

download habitat data that are not linked to biological occurrences		Habitats and Biology, was successful. A constraint in accessing the data was identified for those records that are not linked to biological records. Ongoing work is being done to allow for all data to be available to users via Web Services.		30
EMODnet Biology products added to CP viewer	Ongoing	The complexity of the Biology product structure needs special attention not only from the thematic lot (ie assess and implement the best way to structure the product files) but also on the CP technical team as, from initial tests, it's not clear that Biology products will be made available in the same way as for the other lots.	QR22	

5. Allocation of project resources

Information on the allocation of project resources	
Categories	**Resource usage (%)**
Making data and metadata interoperable and available	52%
Preparing data products	15%
Preparing web-pages, viewing or search facilities	1%
Managing user feedback	3%
Project management	7%
Outreach and communication activities	19%
Others	NA

6. User feedback (Contact us form, online chat & other communication means)

Overview of user feedback and/or requests received in this quarter							
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
11/02/2022	RWS	Government Request to provide a presentation at the NCK open day	email	1 working day	Resolved	Invitation received on March 2nd, presentation will be given on QR21	
14/02/2022	MNCN-CSIC	Government Access to Mediseh Posidonie shapefile	email	1 working day	Resolved	Directed user to the downloadable files	
17/02/2022	DFMR	Government Information on how to share data	email	1 working day	Resolved	User asked about registration to share data. All information provided, no response received	
11/03/2022	UGent	Academia/Research EMODnet Biology aanleveren datalayers- bivalve reefs	email	1 working day	Resolved	Request forwarded by EMODnet Secretariat. Data Products seem to be a better fit for Seabed Habitats, however the user was encourage to submit the data behind the maps to Biology as well	

23/03/2022	CSIC	Government IPT credentials – associatedMedia field missing	email	1 working day	Resolved	Informed user that this is a known issue with missing fields in files available to users. This is part of our infrastructure updates for Phase IV	
2021-08-18	Sustainable Digital Finance	Making Oceans Count in the Nordic financial system - initiative	email (forwarded by the EMODnet secretariat)	1 working day	Resolved	Provided information on how user can query our holdings (catalogue and data)	
2021-08-04	IMBRSEA	EMODNET Data Access	email	2 weeks (email received during the holiday period and send to an individual, not the team's email)	Resolved	Directed user to the WFS R package GitHub and the EMODnet Biology WebServices documentation	
2021-08-04	UCSD	Pulling metadata from VLIZ	email	5 days (email received during the	Resolved	Directed user to the EMODnet Biology API documentation	

				holiday period and send to an individual, not the team's email)				
2021-07-14	IPMA	Request for Dead planktonic foraminifera faunal data from NE Atlantic multinet hauls dataset to be added to EMODnet Biology	Submission form	1 working day	Resolved	Emailed user to inform that data would be added to the database in due time	
2021-11-25	UCC	Academia	CP helpdesk form	1 working day	Resolved	Email sent to user requesting more information on the problem experienced. User did not reply	
2021-12-09	UDG	Academia	email	1 working day	Resolved	Directed user to Seabed Habitats as query was not within Biology's remit	
07/05/2021	SeaBed Habitats	Enquiry about data grants	email	1 working day	Resolved	Reply informing the user that no data grants are expected during Phase IV	
09/06/2021	Ifremer	Enquiry about JERICO datasets data downloads	email	1 working day	Resolved	EMODnet Biology does not collate this information at dataset/data provider level. Pointed to OBIS stats as a proxy of EMODnet Biology downloads. Also noted that EMODnet Biology downloads are approximately 1% of those observed in OBIS (for datasets that flow via EurOBIS)	

7. Meetings/events held/attended & planned

A. Meetings/events organised and attended					
Date	Location	Type event (internal or external meeting, training/workshop)	Indicate if a ppt was given (yes/no + short description)	Meeting attended (A) / organised (O)	Short description and main results (# participants, agreements made, etc.)
12-14/04/2021	Online	External/ Conference	Yes (poster titled 10 Years of EMODnet Biology: Past, Present and Future)	A	IMDIS
19/04/2021	Online	Internal/Meeting	Yes	A	EMODnet Steering Committee meeting
20-21/04/2021	Online	Internal/Meeting	Yes	A/O	EMODnet Technical Working Group meeting
17/05/2021	Online	Internal/Meeting	Yes	O	EMODnet Biology end of Phase III meeting
18/05/2021	Online	Internal/Meeting	No	A/O	Meeting with EMODnet Seabed Habitats lot Discussed the recent ingestion of habitat data to EMODnet Biology and future steps, including collaboration in drafting guidance to data providers, in drafting a use case and showcasing this work to the wider network
18-21/05/2021	Online	Internal/Meeting	Yes	O	EMODnet Biology Phase IV kick off meeting
19/05/2021	Online	Internal/Meeting	No	O	Meeting with EMODnet Central Portal technical team

26-28/05/2021	Online	External/Workshop	No	A	EuropaBON First Stakeholder Workshop: Biodiversity Data User, Provider & Policy Needs Initiative is mainly terrestrial focused and there was an acknowledgement that the marine environment was not as well addressed. Several working groups met and discussed various topics. EMODnet Biology highlighted the need for better collaboration with existing marine initiatives and clarified several aspects related not only with the marine topic (e.g. EU directives) but also the role of the EMODnet network and how we (especially the Biology lot) could better support/collaborate with EuropaBON
31/05/2021 and 03/06/2021	Online	External/Conference	No	A	⌷OBJ⌷⌷OBJ⌷⌷OBJ⌷All-Atlantic DATA & POLICY Forum
14-6/06/2021	Online	External/Conference	Yes (EMODnet Biology presentation and poster titled: A decade of EMODnet Biology-What the future entails)	A	EMODnet Open Conference
02/07/2021	Online	External/Conference	No	A	All-Atlantic2021-MBON Side Event Descriptions and use-cases of how MBON has brought together communities of practice in support of an all-Atlantic solution, aligned with the aims and actions within the UN Ocean Decade. Examples from the Caribbean, Western Atlantic and African coast were given, and particular mention given to how EMODnet

					Biology represents a successful mechanism for the promotion of standards and engagement with stakeholders.
17-18/06/2021	Online	External/Workshop	No	A	EMODnet Jamboree Ocean Best Practices and Citizen Science Sessions
18/06/2021	Online	External	No	A	EC European Ocean Observation event 98 participants
12/07/2021	Online	Meeting	No	A	BRIDGES-BS kick off meeting. Project title "Advancing Black Sea Research and Innovation to Co-Develop Blue Growth within Resilient Ecosystems" >150 participants Assess where/how EMODnet Biology (who is not a partner) can provide support to data management
14/07/2021	Online	Meeting	Yes	A	ODIN Black Sea (IODE) SG IX Attended by a partner
02/09/2021	Online	Meeting	No	A	UNEP/MAP on the 2023 Mediterranean Quality Status Report (QSR) Attended by a partner, where the interest to strengthen dialogue between EMODnet Biology and various stakeholders was highlighted.
13/09/2021	Online	External training	No	A	Interview for the micro-credential course based on MOOC (Innovative methods for assessment of marine ecosystems distribution) ran by

					University of Cantabria, University of Bologna, University of Coimbra and the Spanish Co Telefonica Educacion Digital
8-9/09/2021	Hybrid	EMODnet Steering Committee meeting	Yes	A	Meeting held to discuss progress within EMODnet, with the presence of the MKEG group, DG MARE and CINEA
9-10/09/2021	Hybrid	EMODnet Technical Working Group meeting	Yes	A/O	Meeting held to discuss technical details related with the different thematic lots, EMDOnet Ingestion and EMODnet Central Portal
07/10/2021	Online	External Webinar	No	A	Best Practice Webinar & Study Launch: Offshore Biodiversity Data and Monitoring - What have we yet to learn?
08/10/2021	Online	External Workshop	No	A	4OCeans Project Workshop. Exploring the availability and use of historic data, with a focus on fisheries and whaling records.
12/10/2021	Online	External Webinar	No	A	Webinar 1: IBAT and ENCORE: 2 key biodiversity data sources for screening purposes
19/10/2021	Online	External Webinar	No	A	EU Biodiversity: The use of remote sensing as a specific source of biodiversity data. The webinar series "Biodiversity data for corporate biodiversity measurement" organised by the EU Business @Biodiversity platform aims to integrate the concept of biodiversity conservation into business policies, with one of the main topics being the "use of remote sensing as a specific source of biodiversity data".

					With the aim of monitoring the environment, i.e. ecosystems and populations among others, for the prevention or mitigation of the human impact on them, remote sensing applications based on satellites, radar and artificial intelligence technologies were presented. The main interest focused on natural forests deforestation and degradation as well as animal population decline, while tools such as large scale - real time land use maps of high resolution and accuracy and hi-tech smart collars respectively were suggested as monitoring solutions. Marine (protected) areas were also mentioned, though not analysed, as possible fields of monitoring.
20-21/10/2021	Brussels, Belgium	External Hackathon	No	A	Hack4Oceans Hackathon EMODnet Biology was present to provide support to the student participants in the development of their ideas. The overall group was quite heterogenous in terms of knowledge as some participants were at university entry level whereas others were at Post-Doc level.
26/10/2021	Online	External Webinar	No	A	Webinar 3: Innovative developments in the field of biodiversity data collection
28/10/2021	Online	External Webinar	No	A	Webinar 4: Looking ahead: Future developments in the biodiversity data landscape
28/10/2021	Online	External Webinar	No	A	OBIS Genetic Data Webinar Organised to inform the wider community of the recent developments and implementation for genetic data.

03/11/2021	Online	External meeting	No	A	ODYSSEA conference:
					The purpose of this conference was to present the results of the ODYSSEA project to key target audiences: partners, the scientific community, marine-based industry (including SMEs), policymakers, public authorities, media, consumer organisations and the public. The conference had around 120 participants.
					The conference has been arranged into 6 specific areas of focus:
					1. Capacity-building around the Mediterranean (with emphasis in North Africa)
					2. Marinomica – the data visualisation platform
					3. Development of Marinomica products and services.
					4. Observatories – the new Med observatories.
					5. End user services and contribution to policy processes
					6. Impacts and the future
					Most interesting was the presentation of Marinomica platform, which is an application focused on decision making in the marine environment. Marinomica platform provides state of the art on-demand data services and forecasts to a wide range of users managing and mitigating challenges arising from changes in the water. The Marinomica Platform vision is to provide a single portal by applying advanced algorithms to organise, homogenise and fuse the large quantities of data in common standard

					type. It is foreseen as an ideal tool for all parties that are engaged in mitigating pollution hazards and untreated waste; offshore maritime renewable energy (currents, wind, waves, solar); MetOcean hind, now and forecasts; fishery and aquaculture; biodiversity; oil and gas exploitation; tourism; and marine traffic and harbours. Answering my question what the source of the data is, they replied: Present Datasets: CMEMS, HYCOM, AVISO+, CLS models, Sentinels, ECMWF, NOAA, EMODnet habitats and Upcoming Datasets: OneGeology, Fishbase, UNEP-WCMC, CORDEX CC, e-Hype.
12/11/2021	Online	External	No	A	Networking Fridays - MarineLife 2030 & OKAN. Live participants + delayed views: 272 The AIR (Atlantic International Research) Centre, organises 'networking Fridays': short webinars on several topics, aiming for an international collaborative framework to address global challenges and local priorities in the Atlantic Ocean. The webinar of Friday 12 November was aimed at introducing the Ocean Decade Programme MarineLife 2030 and the Ocean Knowledge Action Network (OKAN). Full webinar available through YouTube: https://www.youtube.com/watch?v=j8-V9t11-OY
23/11/2021	Online	External Workshop	Yes	A	Macroalgae Workshop 50 participants

					Eurosea organised workshop where EMODnet Biology was invited to present not only our holdings and products with respect to macroalgae, the data flow and connections with global initiatives like OBIS and GBIF, but also provided a brief overview of EMODnet Seabed Habitats and Human Activities as other sources of information that could be relevant to this community
07/12/2021	Online	External Workshop	No	A	iNaturalist Steering Group. This global Citizen Science initiative collects biodiversity data and images via an app and website. Work is underway to investigate the development of workflows and process to capture iNaturalist data and integrate it into EMODnet Biology.
13/12/2021	Online	External Workshop	Yes	A	Scientific Workshop on White Sea Benthic Datasets. Exploring the availability and utility of data in the White Sea region, including the opportunities for EMODnet Biology supporting data digitisation and rescue.
17/12/2021	Online	External Workshop	No	A	A virtual Marine Stakeholder Conference entitled "Future of our Seas". Highlighting the current state of EU waters in the context of MSFD. Breakout sessions included attended included: A Coherent Framework - looking at the interaction between MSFD and other EU legislation Implementing the Directive - Working Together. This session looked at how, through engagement and interaction we can improve

					coordination and implementation of the directive.
14/01/2022	Online	External Webinar	No	A	Marine Biodiversity Networking Fridays: Marine indicators for the Convention on Biological Diversity Permanent link: https://www.aircentre.org/netfridays-marine-biodiversity-02/
14/01/2022	Online	External Meeting	No	A	Meeting with Central Portal Technical team Discuss centralisation workplan and work required by thematic lot to comply with CP requirements
26/01/2022	Online	External Meeting	No	A	JERICO Image data management follow up Aim was to share JERICO updates and discuss the best way forward in implementing a solution for image data management that fits not only JERICO's but also EMODnet Biology's objectives
02/02/2022	Online	External Workshop	No	A	Black Sea CONNECT Innovation Workshop Aim was feature successful stories and best practices from different blue economy sectors, allowing the meeting of nascent maritime and innovation clusters in the Black Sea with more developed European counterparts and driving their collaborative development of blue innovations for the region

04/02/2022	Online	External Meeting	No	A	MarineLife2030 Co-design and Stakeholder Engagement Meeting Initial meeting to discuss previous activities and potential roles in developing engagement activities around the MarineLife2030 UN Decade programme.
09-11/02/2022	Online	External Conference	No	A	One Ocean Summit Commission initiative to promote a cleaner, healthier and safer ocean
11/02/2022	Online	Internal meeting	No	O	EMODnet Biology Coordination Board meeting Progress updates, project information exchanged within all WPs through their leads
14-16/02/2022	Hybrid (Sopot, Poland)	External Conference	Yes	A	Ocean Data Conference > 200 participants Oral presentation titled 'EMODnet Biology: A European initiative with global influence' and partner poster titled 'Dive into MedOBIS: an Open and FAIR Biogeographic Information System for the Mediterranean Sea'
17/02/2022	Online	External Meeting	No	A	Meeting with Trans Europe Marinas and European Boating Industry Follow up of a request forwarded by the EMODnet Secretariat. Discussion on how these organisations can foster ocean outreach within its members but also contribute with data and use EMODnet's data/products. Colleagues from

					EMODnet Ingestion and Physics were also present
28/02/2022	Online	External Meeting	No	A	Meeting with Central Portal Technical Team Discuss centralisation workplan and work required by thematic lot to comply with CP requirements
28/02-03/03/2022	Online	Internal WP3 workshop	Yes	O	WP3 data product workshop Internal workshop to discuss, organise Phase IV Biological data product creation
02/03/2022	Online	External Meeting	No	A	MarineLife2030 Capacity Building and Citizen Science Volunteers Introductory meeting to develop the MarineLife2030 UN Decade programme activities related to Citizen Science and associated data flows.
11/03/2022	Online	External Meeting	No	A	Marine Biodiversity Networking Fridays Ocean Observation: strengthening collaboration among the marine biodiversity Ocean Decade Actions Range of presentations highlighting UN Decade actions

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
12-13/07/2021	Online	Meeting	A	BRIDGES-BS kick off meeting. Project title "Advancing BlackSea Research and Innovation to Co-Develop Blue Growth within Resilient Ecosystems" Assess where/how EMODnet Biology can provide support to data management
15/07/2021	Online	Meeting	A/O	Meeting with Central Portal Technical team to discuss aspects related with centralisation
7-9/09/2021	Online/In Presence?	Meeting	A/O	EMODnet Steering Committee and Technical Working Group meetings
19/10/2021	Online	Webinar	A	EU Biodiversity: The use of remote sensing as a specific source of biodiversity data
20-21/10/2021	Hybrid	Workshop	A	Hack4Oceans
26/10/2021	Online	Webinar	A	EU Biodiversity: Innovative developments in the field of biodiversity data collection
28/10/2021	Online	Webinar	A	EU Biodiversity: Looking ahead: Future developments in the biodiversity data landscape

28/10/2021	Online	Webinar	A	Genetic Data and OBIS
23/11/2021	Online	Workshop	A	Towards a Coordinated European Observing System for Marine Macroalgae EMODnet Biology invited to give a presentation of macroalgae data and products, plans for the future.
Feb 2022	Poland/online	Conference	A	International Ocean Data Conference
March 2022	Online	Workshop	O	WP3 data product workshop
05-04-2022	Online	Workshop	A	EATiP-OBPS Best Practises in Aquaculture workshop
11-04-2022	Online	Webinar	A	NCK Data Day
20 to 21-04-2022	Hybrid/Paris	Conference	A	Digital Ocean Forum
26 to 28-04-2022	Hybrid/Oostende	Meeting	A/O	EMODnet Steering Committee and Technical Working Group Meetings
04 to 05-05-2022	Hybrid/Oostende	Meeting	O	Annual project meeting
19 to 20-05-2022	Ravena, Italy	Conference	A	European Maritime Day

06 to 10 June 2022	New York, USA	Meeting	A	22nd United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea

8. Communication assets

	A. Communication assets			
Date	Communication material	Short description (of the material, title, …) and/or link to the asset	Main results	Name of event at which material was disseminated (if applicable)
QR17	Tweets	79 tweets Online dataset, Product publication, Events attended, etc	Increase in # followers	NA
QR17	News	Data harvest results, meetings, deliverables published, etc	10 items	NA
Sep 2021	Video	Interview on the topic: Challenges in sharing marine ecosystem information	Awareness/Outreach/Education	The video is part of the MOOC "Sustainable Marine Ecosystems" delivered by the Universities of Bologna, Coimbra, Cantabria and the Spanish Co Telefonica Educacion Digital. All content and materials will be open source
QR18	Tweets	49 tweets about published datasets and project related information	Awareness/Outreach/Education	
QR18	News 16/07/2021 02/09/2021 06/09/2021 10/09/2021	https://www.emodnet-biology.eu/news?p=show&id=8833 https://www.emodnet-biology.eu/news?p=show&id=8857 https://www.emodnet-biology.eu/news?p=show&id=8862 https://www.emodnet-biology.eu/news?p=show&id=8866	Awareness/Outreach/Education	EMODnet Biology Website
QR19	Tweets	68tweets	Increase visibility Outreach Follower engagement	NA
QR19	News	https://www.emodnet-biology.eu/news?p=show&id=8886	New Data harvest announcement	NA

		https://www.emodnet-biology.eu/news?p=show&id=8918	Deliverables published		51
		https://www.emodnet-biology.eu/news?p=show&id=8921	Deliverables published		
QR20	Tweets	58 Tweets	Increase visibility Outreach Follower engagement	NA	
QR20	Use Cases	Holistic, standards-based access and interoperability for marine biodiversity data Distribution of reef-building benthos in the North Sea	Increase visibility Outreach	NA	
QR20	News	New Use case- combining species and habitats data WP3 Data Product Workshop complete			

B. Planned communication assets			
Date	Communication material	Short description (of the material, title, …) and/or link to the asset	Main results expected
	Tweets	Tweets on published datasets, project information, participation in meetings/events	Increase visibility Outreach Follower engagement
	News	Published deliverables Project information	Increase visibility Outreach
	Use cases		Increase visibility Outreach
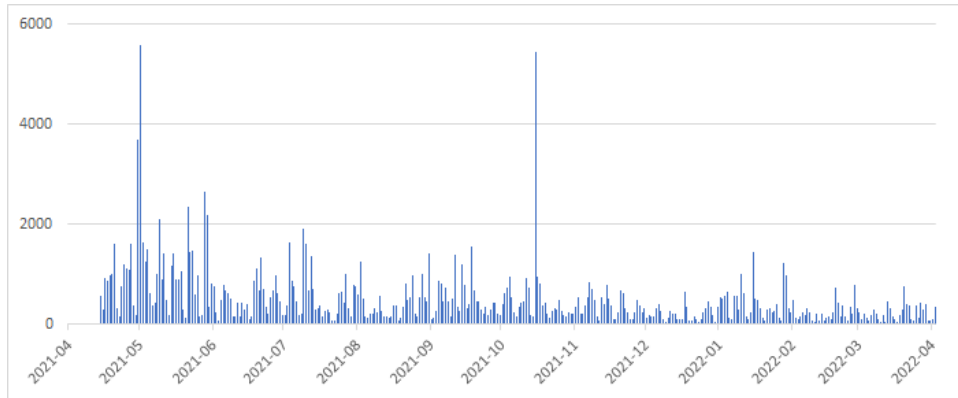
Figure 1. Twitter impressions for the EurOBIS account for the first year of Phase IV
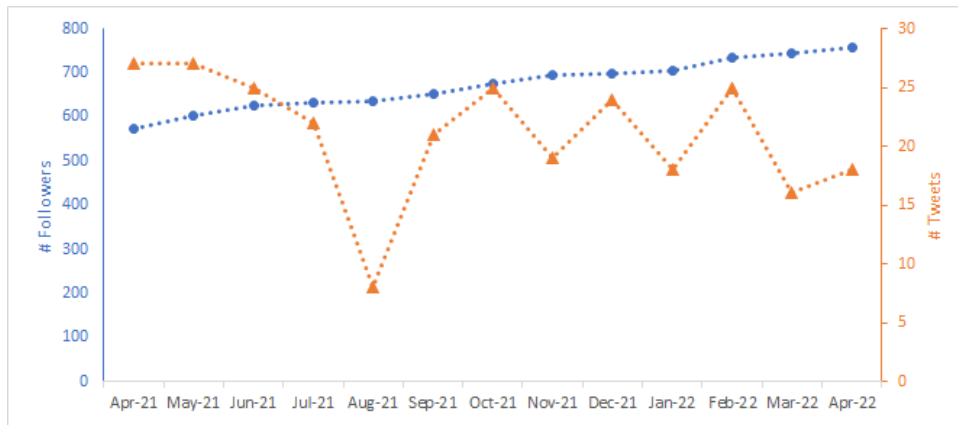
Figure 2. Twitter followers and tweets for the EurOBIS account for the first year of Phase IV

List of known publications using EMODnet data or data products				
Date	Type and name of journal, conference, …	Publication title	Author(s)	Organisation(s)
QR17	IMDIS 2021	Wake up, safeguard & share your marine data with EMODnet-Ingestion.EU	Schlesse Marianne[1], Strobbe Francis[2], Schaap Dick[3], Iona Sissy[4] and Beja Joana[5]	1. Belgian Marine Data Center, OD Nature, Royal Belgian Institute of Natural Sciences, Vautierstraat 29, 1000 Brussel, Belgium 2.EMODnet Secretariat, InnovOcean site, Wandelaarkaai 7, 8400 Oostende, Belgium 3. MARIS, Gildeweg 7 A, 2632 BD Nootdorp, Netherlands 4. Hellenic Centre for Marine Research–HCMR, Institute of Oceanography, P.O. Box 712, 190 13 Anavyssos, Greece 5. Flanders Marine Institute (VLIZ), InnovOcean site, Wandelaarkaai 7, 8400 Oostende, Belgium
QR17	IMDIS2021	10 years of EMODnet Biology: past, present & future	Joana Beja[1], Leen Vandepitte[1], Ruben Perez Perez[1], Gizem Poffyn[1], Dan Lear[2], Vasilis Gerovasileiou[3], Peter Herman[4], Bart Vanhoorne[1], Lennert Tyberghein[1], EMODnet Biology consortia	1. Flanders Marine Institute (Belgium) 2. Marine Biological Association (UK) 3. Hellenic Centre for Marine Research (Greece) 4. Deltares (The Netherlands)

Oct 2021	Report	A Review of Biodiversity Data Needs and Monitoring Protocols for the Offshore Wind Energy Sector in the Baltic Sea and North Sea	PJ Stephenson	Consultant for Renewables Grid Initiative
02/10/2021	Book	Ocean Science Data (Paperback ISBN: 9780128234273)	Chapter 2: Joana Beja[1], Leen Vandepitte[1], Abigail Benson[12], Anton Van de Putte[2,3], Dan Lear[4], Daphnis De Pooter[5], Gwenaëlle Moncoiffé[6], John Nicholls[7], Nina Wambiji[8], Patricia Miloslavich[9,10], Vasilis Gerovasileiou[11]	1 Flanders Marine Institute (VLIZ), Oostende, Belgium 2 Royal Belgian Institute for Natural Sciences, Brussels, Belgium 3 UniversitØ Libre de Bruxelles, Brussels, Belgium 4 Marine Biological Association, Plymouth, United Kingdom 5 Commission for the Conservation of Antarctic Marine Living Resources, (CCAMLR), Hobart, TAS, Australia 6 British Oceanographic Data Centre, National Oceanography Centre, Liverpool, United Kingdom 7 Norfish Project, Centre for Environmental Humanities, Trinity College Dublin, Dublin, Ireland 8 Kenya Marine and Fisheries Research Institute, Mombasa, Kenya

				9 Scientific Committee on Oceanic Research (SCOR), University of Delaware, College of Earth, Ocean and Environment, Newark, DE, United States
				10 Departamento de Estudios Ambientales, Universidad Simon Bolívar, Caracas, Miranda, Venezuela
				11 Hellenic Centre for Marine Research (HCMR), Institute of Marine Biology, Biotechnology and Aquaculture (IMBBC), Heraklion, Greece
				12 U.S. Geological Survey, Lakewood, CO, United States
20/01/2022	Paper	Benthic synecology in a soft sediment shelf: habitat contrasts and assembly rules of life strategies. Mar Ecol Prog Ser 682:31-50. Online ISSN: 1616-1599 https://doi.org/10.3354/meps13928	Beauchard O, Mestdagh S, Koop L, Ysebaert T, Herman PMJ	
2022	Report	Working Group on Fisheries Benthic Impact and Trade-Offs (WGFBIT; outputs from 2021 meeting). http://doi.org/10.17895/ices.pub.10042	Pierucci A et al	

9. Monitoring indicators

Comments on the progress indicators in the excel template		
Progress indicator	Means of collecting figures	Comment
1. Current status and coverage of total available thematic data A) Volume and coverage of available data **If you don't use the provided sea-basin figures, please indicate why you do not use them, as from when, and what do you use instead and why?**	Internal system	There was an increase in the amount of data available as well as the regional sea coverage. In some themes and areas, this increase was quite substantial and reflects also the publication of datasets submitted through the Phase III data grants. Note that as per tender requirements, data in the Caribbean seas are included in the Atlantic EEA. Despite ongoing efforts, the data coverage for the Arctic, Baltic and Black Seas is still quite low. For some sub-themes, the existing data doesn't reach 1% coverage. This is a situation that the thematic lot is constantly trying to improve but despite our efforts, events as the war in the Ukraine prevent our partners and other organisations from performing their day-to-day jobs, which, as a consequence, will delay or even halt data submission. In addition to the organisations in the consortium, we are establishing contacts with other data providers which can hopefully help us in closing the data gap for the above-mentioned regions. More details are included in the Task 1 and WP2 sections and further progress will be summarised in the quarterly reports.
B) Usage of data since the start of the project phase	Download form	Note that the trend is negative as it is being compared to the numbers given in the final report, which covered a two-year period, whereas this report covers only a one year period.
2. Current status and coverage of total number of data products A) Volume and coverage of available data products **If you don't use the provided sea-basin figures, please indicate why you do not use them, as from when, and what do you use instead and why?**	Internal system	Two external products were submitted and are hosted by EMODnet Biology. The coverage has not changed significantly with these two additions

B) Usage of data products since the start of the project phase	Matomo	Note that the negative trend can in part explained by the fact that the value from the previous report covers a two year period. The uptake of products by users has been discussed internally, one conclusion is that they present complex information that, even though is quite valuable, might not be easily understandable by users.
3. Organisations supplying/ approached to supply data and data products since the start of the project phase	Download form	During the period covered, there was a mix of data providers, from Phase III data grant holders that incurred delays due to the COVID pandemic, to providers that voluntarily submitted data as well as our partners. It is also worth notting that effort was done to update existing datasets and improve their interoperability and overall quality through the use of controlled vocabularies
4. Online 'Web' interfaces to access or view data		There are no changes to report for this indicator
6. Statistics on information volunteered through download forms	Download form	Following the same trends as previous years, the majority of users are from research/academia. This first year we say an increase in usage by individual citizens/NGOs and a slight decrease from businesses and private companies. The main purpose for data was to conduct research
7. Published use cases	Grafana/Matomo	Two new use cases have been published during the first year and the viewing numbers are comparable to some of the older use cases. Two more use cases will be published until the end of Phase IV, which is hoped will contribute to a better understanding of what we can offer in terms of data and products
9.1. Technical monitoring	Grafana/Matomo	EMODnet Biology's response time is within defined limits and has maintained a 100% uptime during the reporting period
9.2. Visual Harmonisation score	Grafana/Matomo	
10. Visibility & analytics for web pages	Grafana/Matomo	The quarterly figure indicates that there's been a decrease in this indicator since the last quarter. Various reasons could be presented, e.g COVID impacts delaying research activities, users opting to search and download the data via the OBIS portal
11. Visibility & analytics for web sections	Grafana/Matomo	As with the previous indicator, a decrease is also visible in the quarterly numbers.
12. Average visit duration for web pages	Grafana/Matomo	The quarterly stats indicate a light decrease in average visit duration for specific pages

The monitoring numbers reported as part of the progress monitoring of EMODnet performance are collected through Matomo. In some cases, numbers from other monitoring systems may also be reported (e.g. Awstats, Google Analytics). Each system uses different technical approaches and therefore has its strengths and shortcomings. Therefore, results are indicative and care should be taken with interpreting absolute numbers or comparing results from different tools. It is often more sensible to consider trends over time collected by the same monitoring tool.

10. Recommendations for follow-up actions by the EU

[Give a list of recommendations and suggestions for the EU to consider and take action. Max 1 page.]

The main concern this Phase is the ongoing was in the Ukraine, which affects our partners. Although we understand that ongoing discussions are taking place at EU level, we urge the EU to facilitate the efforts to finding a quick end to the war.

As mentioned in WP3, after an initial assessment, the partners concluded that it will be extremely difficult to fulfil the requirements relating to documenting distributional patterns and trends for mammals and seabirds due to not only lack of expertise but also insufficient data. The thematic lot is attempting contacts with experts that work in this line of work, but it is unclear at this point, whether our efforts will be successful in publishing products that meet the tender requirements. We requests further insights and suggestions from the EU relating to this topic.

11. Annex: Other documentation attached

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

The Table below includes a summary of the available data between start (April 2021) and end (April 2022) of the reporting phase. For a full – detailed – overview of delivered datasets, we refer to the quarterly reports from April 2021 to April 2022 published in the EMODnet Biology and Central Portal websites. Note that the number of accepted species names has slightly decreased as, through continued quality control and updates on the content of pre-existing datasets in EurOBIS, some previously accepted species names were dropped or merged with others, based on the available information in the World Register of Marine Species, which is a dynamic system as it keeps up with the current taxonomic status of names.

	April 2021	April 2022
# Datasets	1.077	1.215
# Occurrence records	25.5 million	29 million
Quality controlled records	86%	85%
EMoF records	30.7 million	36.9 million
Species names	98.024	101.894
Accepted species names	75.658	71.729*
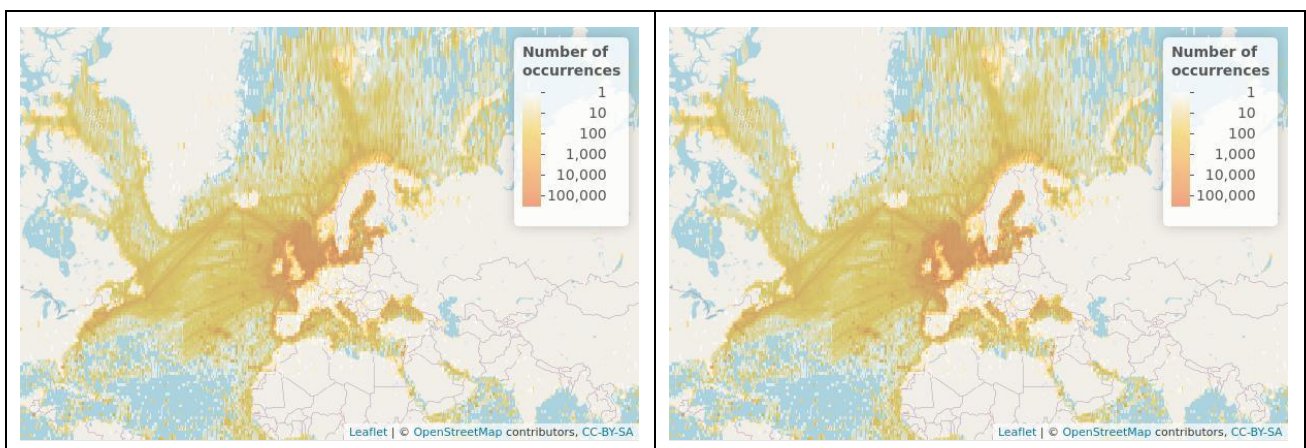
Figure 3: Comparison in available occurrence records from a geographical perspective. Situation April 2021 (left) versus situation April 2022 (right).
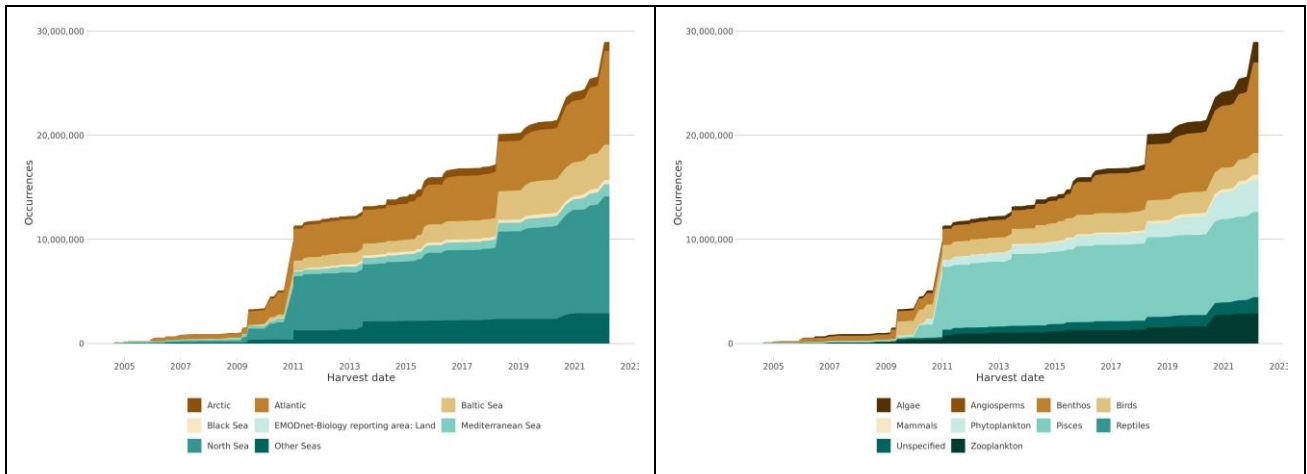
Figure 4: Overall growth in number of available occurrence records in the EurOBIS database. Left: from a geographical perspective; Right: from a functional group perspective.

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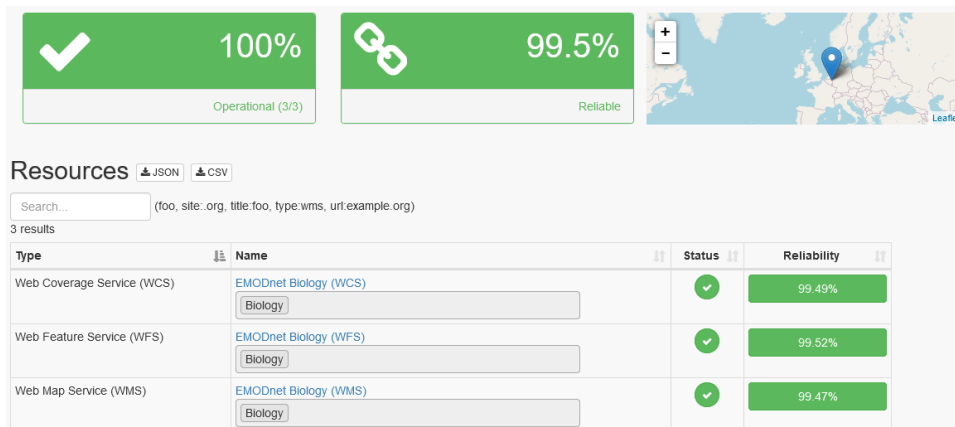

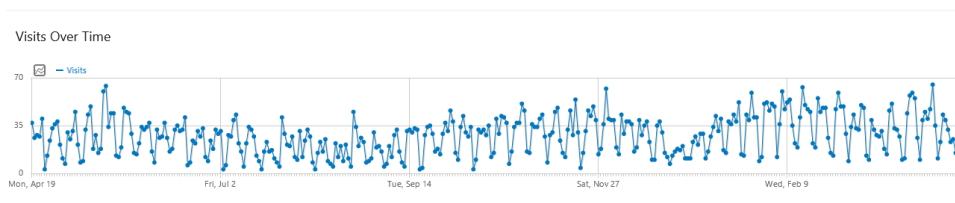Figure 5. Summary of the OGC services monitoring covering most of the reporting period

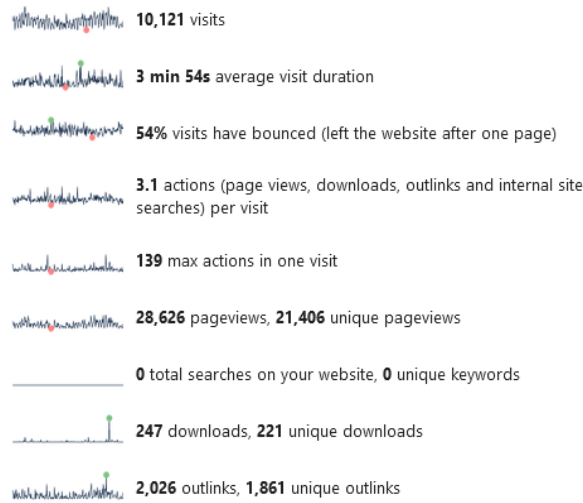Figure 6. Visits over time for the report period as extracted from Matomo

Figure 7. Visits overview for the report period as extracted from Matomo

Figure 8. Map with all EMODnet Biology portal visitors and table with 10 most frequent countries and overall visit percentage, as extracted from Matomo

WP3 – Data product creation
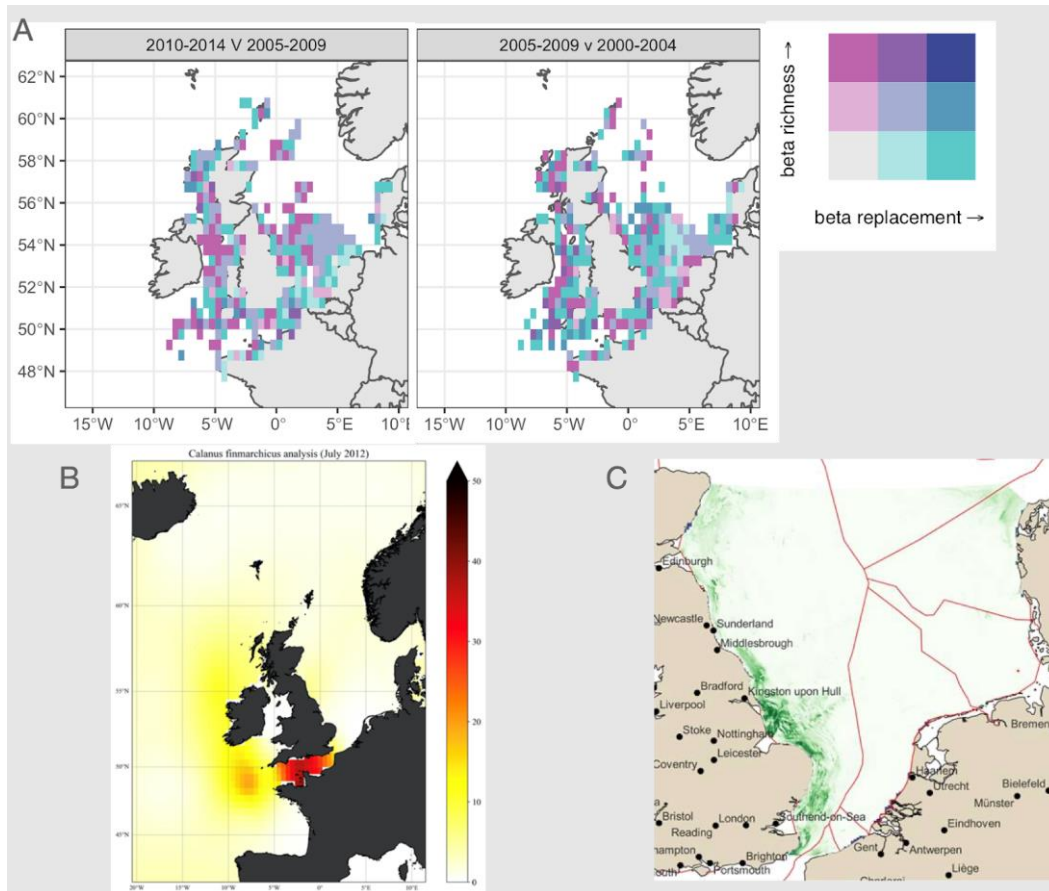
Figure 9. **A**. Prototype product built using the North Sea benthic presence-absence product, showing turnover in benthic communities between time periods (2010-2014 versus 2005-2009, and 2005-2009 versus 2000-2004). Turnover (beta diversity) is partitioned into changes in species richness and changes in species identity (replacement). **B**. Example output from the zooplankton trends product, showing predicted abundance for a single month for *Calanus finmarchicus*. Similar maps, and accompanying error fields, are available monthly from 1960-2018 for *C. finmarchicus* and *C. helgolandicus*. **C.** Use case of the benthic presence-absence product, showing interpolated occurrence probability of the reef-forming species *Sabellaria spinulosa* in the North Sea, modelled using random forests applied to the presence-absence product.

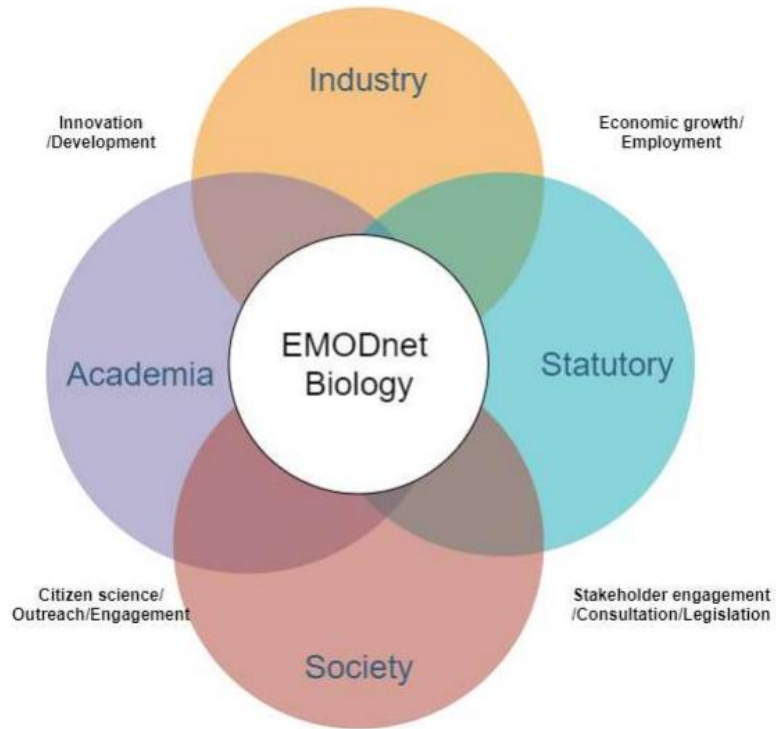## *WP4 – Uptake, outreach and communication*

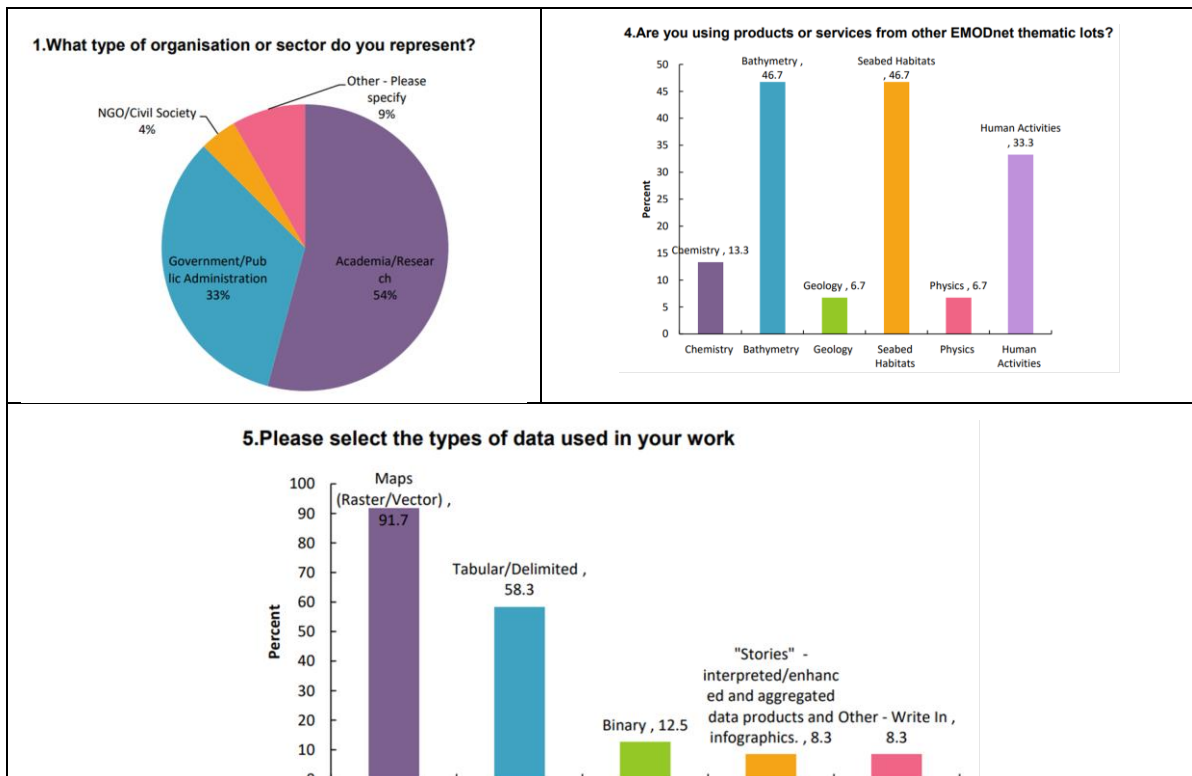Figure 10. Scheme of the quadruple helix defined in EMODnet Biology

Figure 11. Selected answers from the D4.1: Questionnaire to inform cross-lot product development
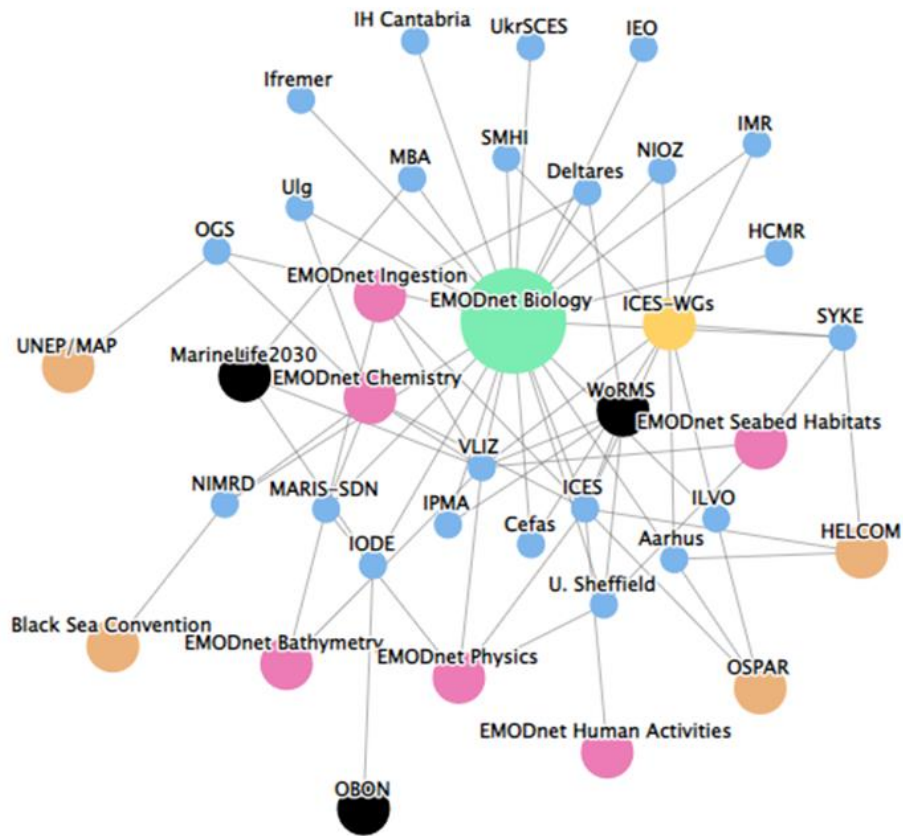

Figure 12. Selected answers from the D4.1: Questionnaire to inform cross-lot product development

12. List of abbreviations and acronyms

ALA: Atlas of Living Australia

API: Application Programming Interface

BODC: British Oceanographic Data Centre

CEFAS: Centre for Environment, Fisheries and Aquaculture Science

CP: (EMODnet) Central Portal

DCAT: Data Catalogue Vocabulary

DOI: Digital Object Identifiers

GBIF: Global Biodiversity Information System

HCMR: Hellenic Centre for Marine Research

HELCOM: Helsinki Commission

EBV: Essential Biodiversity Variables

EEA: European Environment Agency

EMoF: Extended Measurements or Facts

EOV: Ecosystem Oceanographic Variables

ESAS: European Seabirds At Sea

ETS: Ecological Trait-data Standard

EU: European Union

FAIR: Findability, Accessibility, Interoperability and Reproducibility

GDPR: General Data Protection Regulation

ICES: International Council for the Exploration of the Sea

IH Cantabria: Instituto de Hidráulica Ambiental Cantabria

IEO: Instituto Español de Oceanografia

ILVO: Flanders Research Institute for Agriculture, Fisheries and Food

IMR: Institute of Marine Research

INBO: Instituut Natuur en Bosonderzoek

IODE: International Oceanographic and Data

IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPMA: Instituto Português do Mar e da Atmosfera

IPT: Integrated Publishing Toolkit

M2M: Machine to Machine

MARIS: Marine Information Service

MBA: Marine Biological Association

MSFD: Marine Strategic Framework Directive

NIMRD: National Institute for Marine Research and Development "Grigore Antipa"

NIOZ: Royal Netherlands Institute for Sea Research

OBIS: Ocean Biodiversity Information System

OGC: Open Geospatial Consortium

OGS: National Institute of Oceanography and Experimental Geophysics

OPI: Oceans Past Initiative

OSPAR:

PATO: Phenotype And Trait Ontology

QSR: Quality Status Reports

RSC: Regional Sea Conventions

SMHI: Sweden's Meteorological and Hydrological Institute

SYKE: Finnish Environment Institute

UkrSCES: Ukrainian Scientific Centre of Ecology of the Sea

ULg: University of Liège

UN: United Nations

VLIZ: Vlaams Instituut voor de Zee

WCS: Web Coverage Services

WFS: Web Feature Services

WoRMS: World Register of Marine Species