



## EMODnet Thematic Lot n° 5

# Biology

## EMODnet Phase 2 – Final report

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## List of abbreviations and acronyms

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CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora

CORESET: Operationalization of HELCOM core indicators

DIVA: Data-Interpolating Variational Analysis, allows the spatial interpolation of data (analysis) in an optimal way, comparable to optimal interpolation

DwC: The Darwin Core is body of standards. It includes a glossary of terms (in other contexts these might be called properties, elements, fields, columns, attributes, or concepts) intended to facilitate the sharing of information about biological diversity by providing reference definitions, examples, and commentaries. The Darwin Core is primarily based on taxa, their occurrence in nature as documented by observations, specimens, samples, and related information

EMODnet: European Marine Observation and Data Network

ESFRI: European Strategy Forum on Research Infrastructures

EurOBIS: European Ocean Biogeographic Information System, a distributed system that allows to search multiple datasets simultaneously for biogeographic information on marine organisms in European waters

EUBON: European Biodiversity Observation Network

FAO: Food and Agriculture Organization of the United Nations

HELCOM: Baltic Marine Environment Protection Commission - Helsinki Commission

ICES: International Council for the Exploration of the Sea

ICGCOBAM: Intersessional Correspondence Group on the Coordination of Biodiversity Assessment and Monitoring, OSPAR expert group

IPT: Integrated Publishing Toolkit (IPT), a free open source software tool written in Java that is used to publish and share biodiversity datasets

IUCN: International Union for Conservation of Nature

MedOBIS: Mediterranean node of Ocean Biogeographic Information System

MoF: Measurement Or Facts, an element form the data scheme to Support generic measurements or facts as defined in Darwin Core.

MSFD: Marine Strategy Framework Directive, a European instrument aiming at Good Environmental Status (GES) of the EU's marine waters by 2020

NODC: National Oceanographic Data Centre

OBIS: Ocean Biogeographic Information System: OBIS strives to document the ocean's diversity, distribution and abundance of life. Created by the Census of Marine Life, OBIS is now part of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, under its International Oceanographic Data and Information Exchange (IODE) programme

OGC: Open Geospatial Consortium

OSPAR: Convention for the Protection of the Marine Environment of the North-East Atlantic

OOPS: Operational Oceanographic Products and Services, proposal formulated by ICES to assist in the ICES advisory process

SDN: SeaDataNet, an infrastructure linking 45 national oceanographic data centres and marine data centres

WoRMS: World Register of Marine Species, an authoritative and comprehensive list of names of marine organisms, including information on synonymy. ERMS is the European component of WoRMS

WRIMS: World Register of Introduced Marine Species,

## Executive summary

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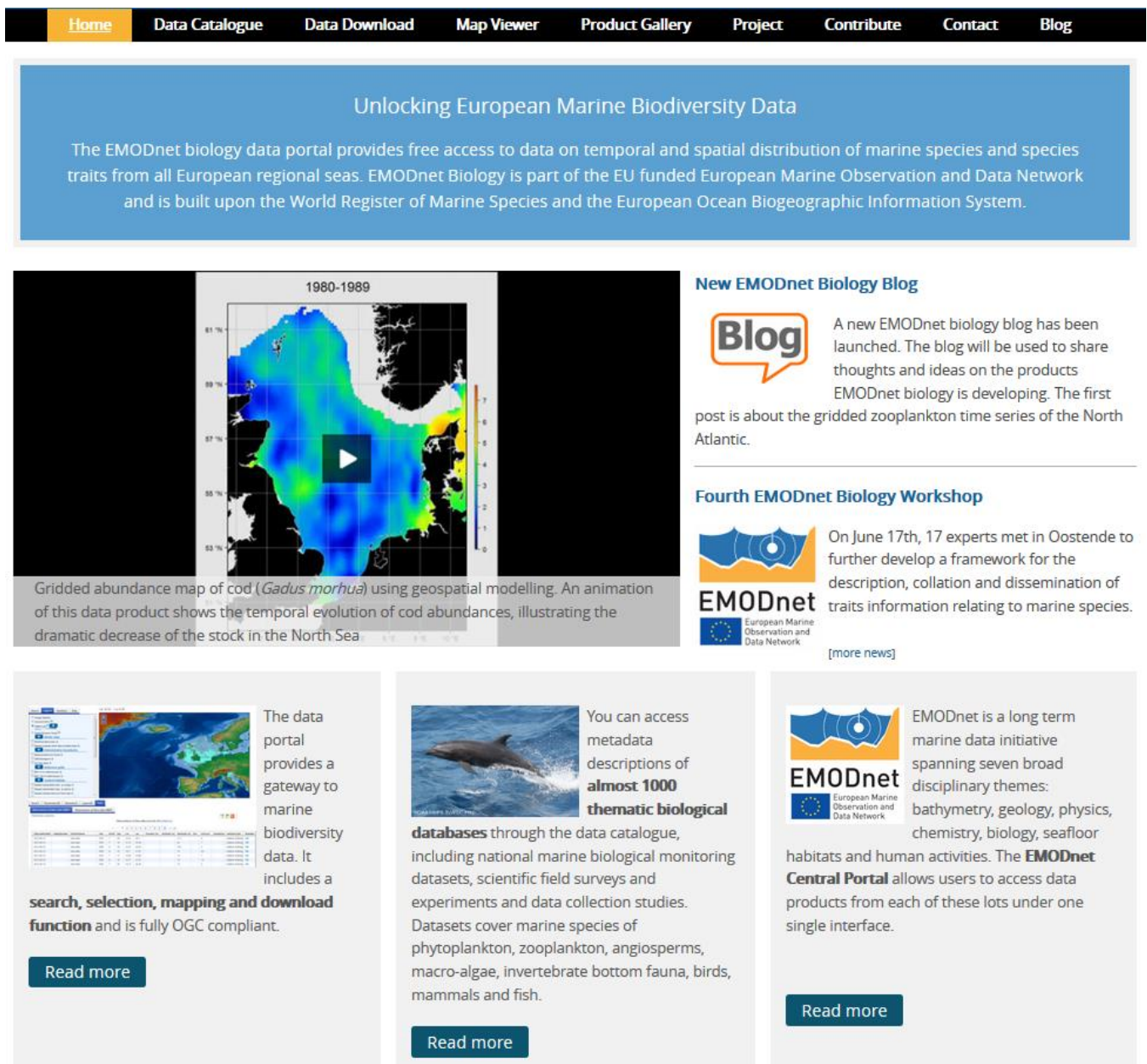
In this project a consortium of 23 institutes responsible for safeguarding and disseminating marine biological data collaborated to further develop the Biology component of the European Marine Observation and Data Network (EMODnet). The project was coordinated by the Flanders Marine Institute (VLIZ), started on September 2013 and ran for three years. Established in 1999, **VLIZ** has evolved into the central coordination and information platform for marine and coastal scientific research in Flanders and has world expertise in marine biological data management. The project consortium included the Marine Biological Association (MBA, United Kingdom), the Royal Netherlands Institute for Sea Research (NIOZ, The Netherlands), the International Council for Exploration of the Sea (ICES), the Sir Alister Hardy Foundation for Ocean Science (SAHFOS, United Kingdom), the Université de Liège, GeoHydrodynamics and Environment Research (GHER, Belgium), the Global Biodiversity Information Facility (GBIF), the University of Bremen, Centre for Marine Environmental Sciences (MARUM, Germany), the Marine Information Service (MARIS, The Netherlands), the Swedish Meteorological and Hydrological Institute (SMHI, Sweden), the Instituto Español de Oceanografía (IEO, Spain), the Havforskninginstituttet Institute of Marine Research (IMR, Norway), the Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER, France), the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Section of Oceanography (OGS, Italy), the Aarhus University, DCE-Danish Centre for Environment and Energy (Denmark), the Hellenic Centre for Marine Research (HCMR, Greece), the Institute for Agricultural and Fisheries Research (ILVO, Belgium), the Stichting Deltares (The Netherlands) and IMARES (The Netherlands). Four subcontracts were issued with the University of Auckland (New Zealand), the IMAR - DOP/UAç - Universidade dos Açores (IMAR, Portugal), the Instytut Meteorologii i Gospodarki Wodnej (IMGW, Poland) and the Institute of Biology of Southern Seas, National Academy of Sciences of Ukraine (IBSS, Ukraine) – the latter unfortunately to be cancelled.

**The partnership further built and capitalized on what have been created during the preparatory action of the European Marine Observation and Data Network (EMODnet, 2009-2011) and focussed its activities on:**

**1. Enhancement of the EMODnet Biological Data Portal allowing public access to and viewing of data, metadata and data products of marine species occurring in European marine waters**

Several updates and new functionalities on the EMODnet Biology Portal, developed under the EMODnet Biology pilot project were developed with the aim of improving the user-friendliness and intuition of the EMODnet biology data portal. A new portal concept differentiating more between data – unprocessed raw observations or measurements- and data products derived from the data has been

investigated. The data component focussing on easy, fast, performant and intuitive downloading, was implemented through the release of the data download toolbox in April 2016. The data portal now includes 4 different data sections, being the **Data Catalogue** to search through the metadata of the data and the data products, the **Data Download toolbox** to select, download and share the data, the **Map Viewer** to plot and view the georeferenced data on a webGIS and the **Data Product Gallery** that visualizes, animates and provides contextual information on the data products.



The screenshot shows the EMODnet Biology website interface. At the top is a navigation bar with links: Home, Data Catalogue, Data Download, Map Viewer, Product Gallery, Project, Contribute, Contact, and Blog. Below the navigation bar is a blue banner with the text: "Unlocking European Marine Biodiversity Data. The EMODnet biology data portal provides free access to data on temporal and spatial distribution of marine species and species traits from all European regional seas. EMODnet Biology is part of the EU funded European Marine Observation and Data Network and is built upon the World Register of Marine Species and the European Ocean Biogeographic Information System."

The main content area features several sections:

- New EMODnet Biology Blog:** A section with a "Blog" icon and text: "A new EMODnet biology blog has been launched. The blog will be used to share thoughts and ideas on the products EMODnet biology is developing. The first post is about the gridded zooplankton time series of the North Atlantic."
- Fourth EMODnet Biology Workshop:** A section with the EMODnet logo and text: "On June 17th, 17 experts met in Oostende to further develop a framework for the description, collation and dissemination of traits information relating to marine species." Below this is a "[more news]" link.
- Gridded abundance map of cod (Gadus morhua):** A section featuring a map of the North Atlantic with a color scale from 0 to 7. Below the map is a play button icon and text: "Gridded abundance map of cod (Gadus morhua) using geospatial modelling. An animation of this data product shows the temporal evolution of cod abundances, illustrating the dramatic decrease of the stock in the North Sea."
- Data Catalogue:** A section with a screenshot of the data search interface and text: "The data portal provides a gateway to marine biodiversity data. It includes a search, selection, mapping and download function and is fully OGC compliant." Below this is a "Read more" button.
- Thematic Biological Databases:** A section with a photo of a dolphin and text: "You can access metadata descriptions of almost 1000 thematic biological databases through the data catalogue, including national marine biological monitoring datasets, scientific field surveys and experiments and data collection studies. Datasets cover marine species of phytoplankton, zooplankton, angiosperms, macro-algae, invertebrate bottom fauna, birds, mammals and fish." Below this is a "Read more" button.
- EMODnet Central Portal:** A section with the EMODnet logo and text: "EMODnet is a long term marine data initiative spanning seven broad disciplinary themes: bathymetry, geology, physics, chemistry, biology, seafloor habitats and human activities. The EMODnet Central Portal allows users to access data products from each of these lots under one single interface." Below this is a "Read more" button.

Figure 1: New EMODnet biology website, launched 05 May 2015: [www.emodnet-biology.eu](http://www.emodnet-biology.eu)



## 2. Improving the interoperability of European marine biological data

EMODnet Biology is implementing international standards on the biological data and metadata it provides. The standards used are globally accepted marine biological standards, also used by the **Ocean Biogeographic Information System (OBIS), and its European node, EurOBIS**. OBIS and EurOBIS are using a data schema designed to capture data about the geographical occurrences of marine species, e.g. the collection or observation of a particular species or other taxonomic group at a particular location. It represents an extension of the **Darwin Core** schema and is designed for marine biodiversity data, specifically to record the capture or observation of a particular taxon at a particular location. The implementation of these standards makes that all biological data, including all historical datasets, that are submitted to EMODnet Biology becomes part of EurOBIS and of the Global OBIS.

The taxonomic backbone of EMODnet Biology is built on the **World Register of Marine Species (WoRMS)**. WoRMS is an authoritative taxonomic list of species occurring worldwide in the marine environment. All taxon names are matched with WoRMS to trace and rule out spelling variations and resolve frequently used synonyms. This way, all taxon names are linked to the currently accepted name, avoiding e.g. a 'double-count' of the same species under different names in diversity calculations.

EMODnet Biology can accept any data file from its data sources or data providers, but most of the datasets are harvested through the **Integrated Publishing Toolkit (IPT)**. IPT is used to publish and share local biodiversity datasets and is specifically designed for interoperability: it enables the publishing of content in databases, Microsoft Excel spreadsheets, or text files using the Darwin Core standard. Furthermore, a specific data format enabling National Oceanographic Data Centers (NODC's) to make biological data accessible using the SeaDataNet infrastructure has been set up.

## 3. Provision of access to monitoring and research data from the EMODnet biological data portal

In collaboration with the consortium partners, representing national and regional marine data networks, we further built on a detailed inventory and gap analysis of existing holdings of biological marine monitoring data that was created during the pilot project. We started with an in-depth assessment of the usability and fitness for purpose of the different data and databases that were to contribute to the project. Part of this assessment was the decision on the optimal mechanisms for linkage with the EMODnet portal, making maximal use of existing systems. After the initial data assessment, data was delivered throughout the whole duration of the project. A summary of the number of records is given in table 1, table 2 and figure 2 below. The tables provide the number of occurrence records per regional sea and per functional group before the EMODnet project, at the end



of EMODnet I and the current status at the end of the second phase of EMODnet. For a large portion of these records there is extended data such as abundances and biomass information available.

Region	# Records before EMODnet Biology	# Records at end of EMODnet Biology I	# Records at end of EMODnet Biology II
<b>Baltic Sea</b>	66,555	1,179,384	1,536,335
<b>Bay of Biscay and Iberian Coast and Macaronesia</b>	262,571	655,070	1,091,424
<b>Black Sea</b>	6,445	191,863	280,141
<b>Greater North Sea and Celtic Sea</b>	3,528,245	10,262,818	12,667,600
<b>Mediterranean Sea</b>	228,715	482,354	665,789
<b>Norwegian Sea and Arctic Ocean</b>	205,948	408,249	734,028
<b>Europe other regions</b>	1,111,021	1,527,516	1,674,460
<b>Outside Europe</b>	473,512	1,216,460	2,204,814
<b>Total</b>	<b>5,883,012</b>	<b>15,923,714</b>	<b>20,854,591</b>

Table 1. The increase of occurrence records in EMODnet Biology per region at 3 distinctive milestones: i) before EMODnet biology (status 15 May 2009) ii) at end of EMODnet Biology I (status 15 May 2012) and iii) at end of EMODnet Biology II (status 15 June 2016)

Functional group	# Records before EMODnet Biology	# Records at end of EMODnet Biology I	# Records at end of EMODnet Biology II
<b>Seagrasses</b>	2,628	3,810	6,586
<b>Seabirds</b>	25,927	1,258,543	1,659,258
<b>Benthos</b>	2,052,912	2,851,201	4,717,203
<b>Mammals</b>	551	50,006	167,018
<b>Nekton (Cephalopod)</b>	21,900	79,212	102,148

<b>Phytoplankton and other algae</b>	1,323,775	2,382,390	2,966,406
<b>Fish</b>	218,280	6,304,642	7,407,232
<b>Reptiles</b>	2,501	2,813	11,224
<b>Zooplankton</b>	1,573,660	2,090,943	2,378,943
<b>Other or Not determined</b>	660,878	900,154	1,438,573
<b>Total</b>	<b>5,883,012</b>	<b>15,923,714</b>	<b>20,854,591</b>

Table 2. The increase of occurrence records in EMODnet Biology per functional group at 3 distinctive milestones: i) before EMODnet biology (status 15 May 2009) ii) at end of EMODnet Biology I (status 15 May 2012) and iii) at end of EMODnet Biology II (status 15 June 2016)

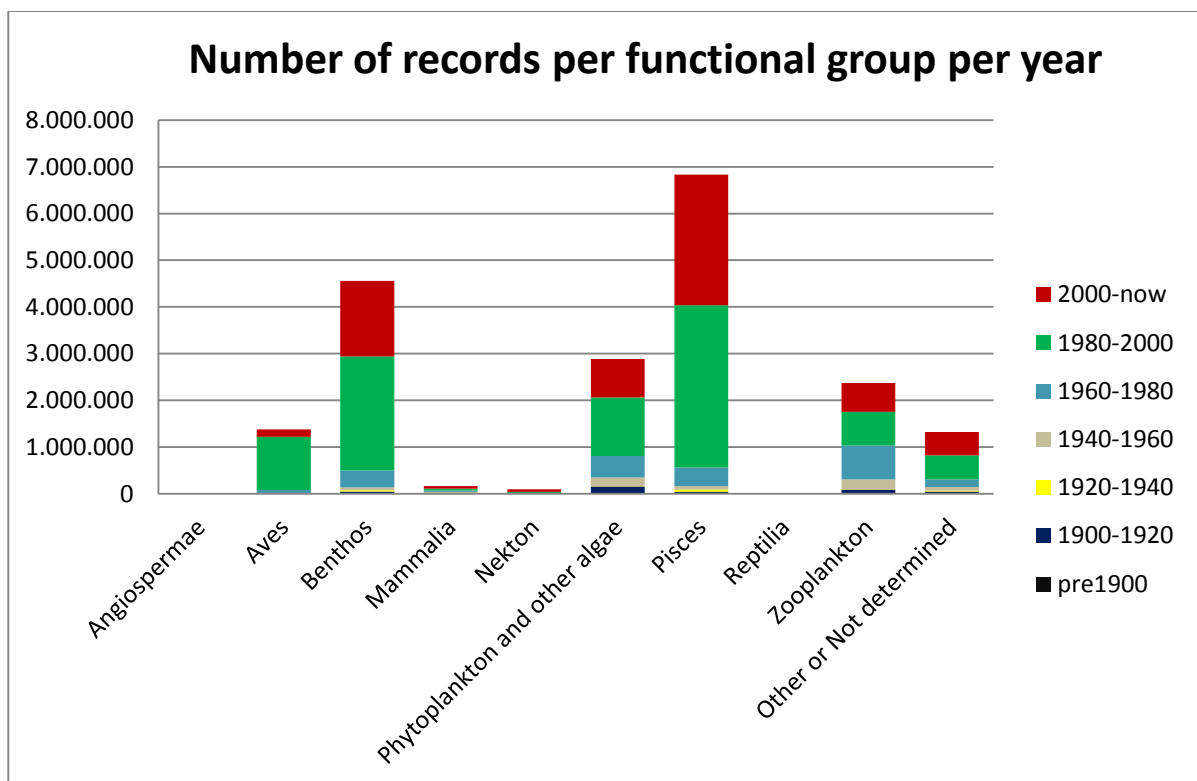


Figure 2: The number of occurrence records in EurOBIS per functional group per year class.

The data provided here should be analyzed taking into consideration the ecological reality of the region but also shows there are still gaps. Historical data (pre 1960) for all functional groups for all

regions only make up only a small portion (5.5%) of the records. This indicates that older (or historical) data is not easily mobilised and incorporated into public database systems such as EurOBIS and EMODnet. These ‘historical’ data do however represent an important component in the global representation of species distributions: these data can give scientists insights on the biodiversity of species prior to human impacts and can help establish a baseline. The loss of this valuable knowledge can be counteracted by investing in so-called ‘data-rescue’ actions, like the one included in this project.

### ***Seabirds, marine mammals and marine reptiles***

Figure 2 shows that data is mainly available for the 1980-2000 period. More recent data is only available for the Macaronesia region. In fact, most of the bird records cover the entire Greater North Sea, the Celtic Sea and the Northern part of the Bay of Biscay. For all other regions – except Macaronesia – there is very little or no bird data available. As recent marine bird, mammal and reptile data is collected by GPS trackers, (Eur)OBIS is developing a data format data which will allow it to efficiently store data obtained by GPS tracking sensors. This development may help getting more bird data into the system.

There are relatively few marine mammal and reptile records in EurOBIS. This may reflect in part the rarity of a turtle or a cetacean sighting compared to e.g. a bivalve. The absence of reptile records in the Baltic and the Norwegian Sea mainly reflects the edge of their distribution range. Real gaps occur for reptile records in the Mediterranean and for mammal records in the Baltic Sea. For the Baltic Sea, there are some cetacean sightings but almost no seal data. For the reptiles in the Mediterranean, there is actually more data available through OBIS Seemap. OBIS Seemap is a regional OBIS Node dedicated to global marine Bird, mammal and reptile data. EurOBIS cooperates with OBIS Seemap and the European data from OBIS Seemap is included in EurOBIS.

### ***Benthos***

Benthos is the second best represented functional group based on record count (4.7 million). There is a good representation of benthos records in all regions, especially for the Greater North Sea and the Celtic Sea region. For all regions there is some historical benthos data available. For the Mediterranean and Black Sea there are monitoring programmes which report data for the Turkish, Romanian, Bulgarian, Greek and Italian coasts. Benthos data for the Bulgarian and Turkish coasts are lacking in EurOBIS.

### ***Phytoplankton and Zooplankton***

Phytoplankton and zooplankton records are well represented with 2.9 million and 2.3 million records respectively. A large portion of these are provided by the SAHFOS CPR datasets (Continuous Plankton

Recorder (Phytoplankton), Continuous Plankton Recorder (Zooplankton) which mostly cover the most of the EMODnet regions except for most of the Mediterranean, the Black Sea, Baltic Sea, the Arctic Ocean, Sea of Jan Mayen and the Northern parts of the Iceland Sea. The regions which benefit from the CPR data have a quite complete geographical and a good temporal coverage for these 2 functional groups. The other regions (Mediterranean, Baltic Sea, Black Sea, the Arctic Ocean, and Sea of Jan Mayen) also do have a relatively good coverage for zooplankton and phytoplankton especially when this is compared to the data available for other functional groups. For the Mediterranean and Black Sea plankton monitoring data is reported. For the Turkish, Bulgarian and Romanian coasts little or no phyto- and zooplankton data are available.

### ***Fish***

Fish is the best represented functional group in EurOBIS based on the number of records (7.4 million). Most of these records are contributed by the ICES DATRAS monitoring surveys which results in a very good temporal and spatial coverage for all EMODnet regions except the Northern Baltic Sea, Black Sea, Mid and East Mediterranean Sea and the Arctic Ocean. For commercial fish, many countries in the Mediterranean Sea have a monitoring programme in place, but only the Spanish data are being reported. These Spanish data are in part be already included through the atlas of the Balears dataset which includes data from Spains monitoring programmes. For the entire Black Sea there is basically no fish data available, although monitoring data from Bulgaria and Romania do exist (Renzi et al. 2014).

### ***Angiospermae***

There are few Angiosperm (Seagrass) records (6,586), which results in very few data on Angiosperms for all regions except for the coasts of Great-Britain and Ireland for which there are about 3,000 records. This absence of records does not reflect the ecological reality of this group as for example *Zostera marina*, *Zostera noltii*, and *Cymodocea nodosa*, are recorded along throughout most of the European or Mediterranean coasts. A gap analysis in the Mediterranean and Black Sea (Renzi et al. 2014) showed that there is a lot of phytobenthos monitoring being carried out this region (data exists for Spanish, Corsican, Italian, Turkish, Bulgarian, Rumanian and Greek coasts), but this data has not been included to EurOBIS. In fact, EMODnet did receive GIS layers from the MediSeH project, with the Mediterranean distribution of several angiosperm and marcoalgae taxa. Most of the GIS layers were polygons not integrated in EurOBIS, and are therefore not included in figures above but are available as a data product through the EMODnet Portal.

### ***Low sampling data areas***

For are some regions there are very few data available for any functional group. The most obvious regions are the Southern (especially the Southeastern) Mediterranean and the Southern Black Sea. Particularly for the Libyan, the Egyptian and the Turkish coasts there are few data available, although

monitoring programmes that collect data along the Turkish coasts do exist (Renzi et al. 2014). The fact that for the Northern part of Black Sea data is available is largely thanks to the EMODNET 1 data grants contributed to the Ukrainian Institute of Biology of Southern Seas (IBSS). The missing data for the Southern Black Sea, as well as for some sections in the Mediterranean, may perhaps be partly explained by the bathymetry (EMODnet bathymetry). These areas are generally deep sea regions (>2000 m) which for some functional groups (especially benthos) would complicate sampling. Moreover, deep sea regions might be sampled less frequently due to an inherent lesser productivity of these waters compared to coastal waters.

### **3. The creation of gridded data products to illustrate the temporal and geographic variability of occurrences and abundances of marine phytoplankton, zooplankton, macro-algae, angiosperms, fish, reptile, benthos, bird and sea mammal species**

Therefore, the objective was to produce a set of gridded map layers showing the average abundance of at least three species per species group for different time windows (seasonal, annual or multi-annual as appropriate) using geospatial modelling.

The outputs of this activity consist of 106 gridded data products. They cover a wide taxonomic range, from the smallest organisms (e.g. bacteria, viruses) to the largest ones (e.g. fish, mammals), encompassing all trophic levels. Annex 4 displays all the products. Among the products, different data series provide relevant indicators evidencing the deleterious effects of human activities on the marine environment.

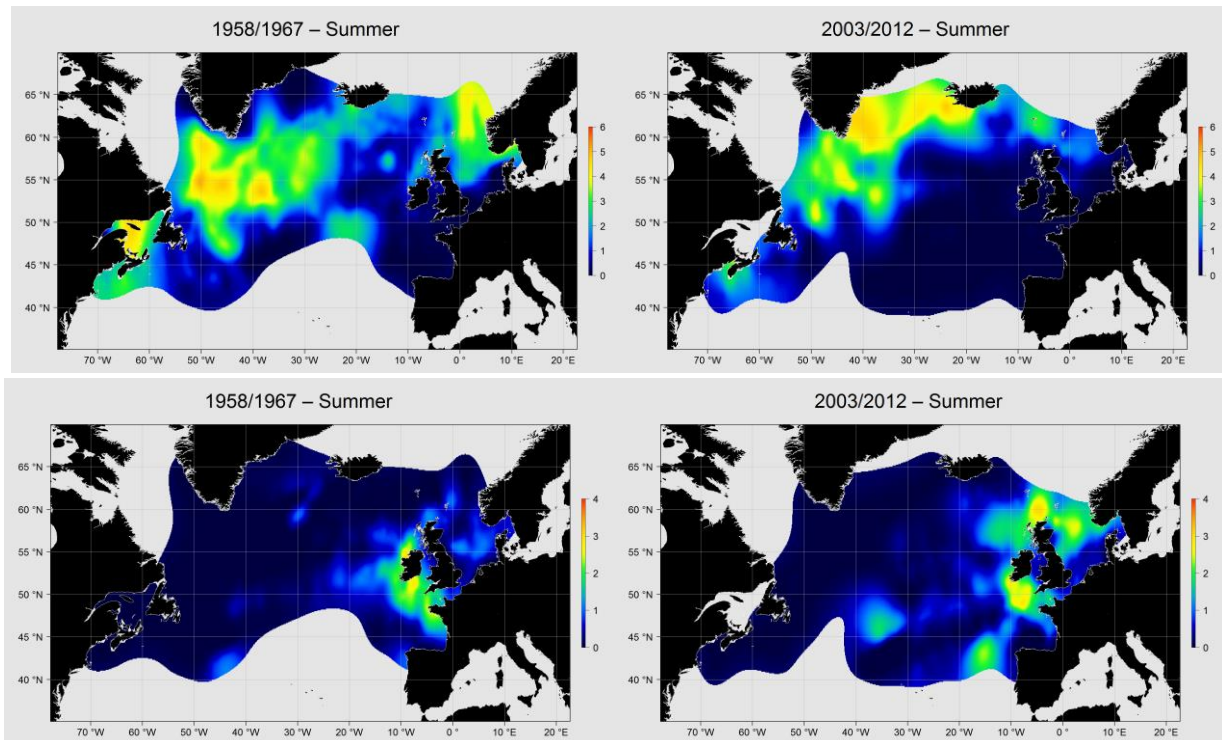


Figure 3. Distributions of *Calanus finmarchicus* (above) and *Calanus helgolandicus* (below). These distributions illustrate the evolution of sea surface temperatures over the last fifty years whereby the first species requires lower temperatures than the second one. Scale: log-transformed concentrations (nb. Ind./L).

The output of the spatial model DIVA we used for the data product calculation was compared with standard geostatistical methods. In general, the outputs were very well comparable. Both methods differ slightly in their extrapolation outside the domain of sampling. The difference is that DIVA adopts a non-linear grid-based approach. This results in considerably longer calculations times. However, the advantage of this approach in DIVA is its capacity to take natural disconnections, barriers, islands, etc. into account.

#### 4. Rescue of historical biological data that are at risk of being lost.

A total of 219 historical Black Sea datasets were identified as potential candidates for digitization mainly from logbooks covering the period 1957-1992 and 34 datasets became available. 76 Mediterranean Sea datasets matched the EMODnet scope for digitization, dating from 1841 to 2011, out of more than 220 identified as potential candidates through a search in the literature, mainly from the entire Mediterranean Sea. Among the 76 Mediterranean datasets, 5 were selected for actual digitization through a data grant program. Besides the addition of a significant number of data, we

analysed the methodology that we used. In general, main barriers were encountered to get these historical datasets digitised are the following:

- No interest on digitization (person retired, no available time)
- If interest, no willingness to share data (institution rule, personal mind-set, sensitivity of data)
- Difficulty to manage IPR (the dataset has several provider)
- Technical difficulties (no archive of raw data just summary, no metadata on fields or methods)

A workshop to propose a mechanism for the networking of the supporting community to ensure continuous inflow of datasets in the future was organised. Recommendations learned us that in general, extracting data from old literature is still a tedious process that requires a lot of visual checks. However, the experience acquired along the time by data managers facilitates the work. The software tested for a semi-automated process requires improvements before using it on a regular basis, which will be helped by feed-back of users. An important aspect to achieve a sustainable system is reward towards data managers: publishing a data paper identified as the most relevant reward. All people having taken part in the process of digitization should be co-author. The data paper is also a mean to expose the data more, and to increase the quality of data through the peer-review process.

5. Through close collaboration with the Marine Strategy Framework Directive working groups (MSFD), **data and data products relevant for the MSFD assessments and monitoring were defined.**

Work began gathering information at a Regional Seas scale i.e. identifying species that were linked to indicators that were agreed between member states through a regional process via the regional seas commissions. The OSPAR list of common and candidate indicators was used to devise a framework for gathering this information. Work was required to **resolve group indicators to species level**, for example some indicators concern seabirds, and only after correspondence with the Intersessional Correspondence Group on Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM) lead was information been gained on exactly which seabird species these indicators concerned. As a result of this inventory, it is now possible to search the EMODnet Biology Data Portal for the relevant species using the “Species importance to society” side of the emodnet-biology interface.

6. Finally, a review of the utility and availability of **biological and ecological traits** was carried out and ten traits were prioritised for inclusion within the World Register of Marine Species (WoRMS). The



traits were selected based on data availability and broad applicability across taxa and that their inclusion would lead to new management or research applications. As an example we prioritized information on the *skeleton* of marine species as this trait is crucial in monitoring the effect of ocean acidification on marine life or *diet* as this determines the position in the food web and is essential to determine the Descriptor 4: Food webs as proposed by the MSFD. The rationale and priority list was published in an Open Access Peer reviewed journal and the paper was viewed over a thousand times in the first month of publication.

### Main challenges & lessons learned

1. Barriers to share biological data is a sensitive and complex issue. Although these barriers were not so numerous, and the data products comprise a large diversity of ecosystem components, Atlantic and north western shelves were dominantly represented. The main gaps among European basins concern the Mediterranean Sea where data were either not existing, not accessible or coverages were spatially very restricted and the Black Sea where data sets were extremely limited and none covers exhaustively the whole basin.
2. Products resulting from temporal series were built through sliding series. However, spatial gaps in early periods prevented in some cases complete spatio-temporal coverages. This can be explained by the fact that historical data for all functional groups for all regions only makes up a small portion of the records. This indicates that older (or historical) data is not easily mobilised and incorporated into public database systems such as EurOBIS and EMODnet.
3. When data sets of a same ecosystem component were available, the most difficult issue in comparing base layers for complete sea regions was the sampling compatibility. Data is often poorly exploitable mainly due to different sampling gears (e.g. grab vs. box-core) to which benthic communities for example respond differently in density and species richness.
4. The interpolation methodology used in the project requires the availability of zero observations: a list of stations where a species or taxonomic group could have been found, but was absent. In many datasets that we tested it was relatively easy to reconstruct the zeroes, even if only presences were recorded in the database. From the overview of sampling effort, or from the complete list of presences, it can be deduced where sampling took place. Meanwhile, a large part of available species distribution data is presence-only, with little opportunity to reconstruct the zero observations, because basic information on sampling effort is lacking. The DIVA methodology used is unable to use these data sets.
5. The identification of species that will comprise indicators or components of indicators for the MSFD is a large and complex task. The majority of challenges faced in the successful completion of this task related to the different approaches taken by the regional seas in the implementation of their respective indicators. Alongside this, within each regional sea, some descriptors progress was

more rapid than others, typically with NIS (Descriptor 2) and Food webs (Descriptor 4) being the least evolved.

6. There were delays in the delivery of datasets through the SeaDataNet protocol due to the development of the ODV-biology format (which was finalised only during the in January 2015) and the development and subsequent testing of the SeaDataNet EMODnet Biology exchange buffer. The technical developments are now finalized, but the effort to create multiple, repetitive metadata records is high.
7. The small grants for data digitization, standardization and quality control learned us that data occurrence digitization is not straightforward even for researchers; the training is difficult, and not cost-efficient if the person trained does not perform regular data entry after the training. Such data entry is better performed by experienced data managers in the domain of biodiversity in collaboration with the researcher, as well as the quality control. If the goal is to have massive occurrence data entry, institutes have to seriously consider increasing the number of data manager permanent positions.
8. The user analysis highlighted that the vast majority of organisations using the data portal are either Universities or Research institutes, but there are also representatives from civil society, governments and industry (WWF, Ministry of Environment, Ramboll, Deltares...). There is a great interest in benthos data with more than double the downloads of the second most searched dataset - mammals. There is a great variety of data purposes, which have been categorised as follows: Research, Testing, Training, Modelling, Data Validation, PhD / Master, Undisclosed, NGO, Sampling, Industrial, MSFD. Research is the primary reason for downloading biological data.

### **Top 10 recommendations**

1. Trust and fear of republication of data by others hampers data exchange. We believe therefore it is urgent that international organizations (ICSU, IBSU, UNESCO, RDA) propose new mechanisms to evaluate scientific research, so data can be shared without affecting these evaluations.
2. When providers are retired or have lost contact after moving in another institute, data might perish. This problem, certainly general, happens when the institute does not have a proper repository of the datasets that its researchers generate. This should be taken into account for the management of IPR and plan the possible change of license when the contact is lost, allowing the aggregator to continue the dissemination of the data.
3. A clear, professional EMODnet data policy might help to trust the network and convince providers to contribute.
4. In order to create consistent data products at sea regional scale, international coordination is required to ensure sampling consistency at large spatio-temporal scales. Therefore, standard monitoring efforts are needed at the European scale and better rules as to which minimum data

should be made available at European level could fill the presently observed gaps in data availability. Therefore, in order to create consistent data products at sea regional scale, an overall long term sampling strategy should be designed for the future.

5. None of the EMODnet projects (Biology, Human activities, Geology, Chemistry, Bathymetry, Physics, Habitats) can be neglected to promote future developments of robust European indicators.
6. Other modelling approaches, e.g. MaxEnt modelling, can probably be used when only presence data are available, but the quality of the estimates is highly dependent on the availability of appropriate environmental predictors. However, for data-sparse areas such as the Mediterranean Sea it could be considered to use alternatives based on modelling presence-only data as a temporary solution.
7. It is essential that a flagging system to assess the quality of a dataset is developed. This flag should indicate the reliability of the record, and is best established by the providers who know their dataset the best.
8. Help data managers at the very beginning of the data encoding process to establish a schema that will 1) minimize the repetition of identical data; 2) fits as closely as possible to the layout of the raw data.
9. The governance model to maintain data access should be based on an open access community and data sharing attitude A mechanism to include all stakeholders should include 1) financial resources to manage, format and quality control the marine data 2) create an open community that recognized the advantages and 3) have national support to collaborate in the pan-European initiatives.
10. From the recommendations discussed during several EMODnet Biology workshops and the experience in the data management, there is one logical conclusion: the number of professional data manager permanent positions should be increased.

# 1. Introduction

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Marine biodiversity data are essential to measure and study the ecosystem health of maritime basins. These data are often collected with limited spatial and temporal scope and are scattered over different organizations in small datasets for a specific species group or habitat. Therefore, there is a continuous need to assemble these individual datasets, and process them into interoperable biological data products for assessing the environmental state of overall ecosystems and complete sea basins.

The main goals of the this three-year project, running from 2013 till 2016 were thus to assemble existing data and metadata from public and private organisations on water column and on the sea-bed surveys of marine species belonging to different trophic groups (phytoplankton, zooplankton, fish, benthos, birds, mammals and reptiles), 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.

For this tender, a consortium of 23 government agencies and research institutes (VLIZ, MBA, HCMR, NIOZ, ILVO, IMARES, Deltares, Aarhus University, SMHI, University Bremen, GBIF, University Auckland, IEO, Ifremer, IMAR, IMGW, OGS, IMR, MARIS, ULg, SAHFOS, ICES) with national and international expertise in marine biological data monitoring and data management built further upon the work carried out during the biological preparatory action of EMODnet.

The standards and data formats used within this project to integrate the scattered marine biological datasets are based on the World Register of Marine Species (WoRMS), the authoritative and comprehensive list of names of marine organisms worldwide and the Darwin Core Archive, an internationally recognised biodiversity informatics data standard that simplifies the publication of biodiversity data. Through the implementation of the European Ocean Biogeographic Information System (EurOBIS) as marine biological data infrastructure, this project has a strong collaboration, with OBIS, an evolving global strategic alliance of people and organizations sharing a vision to make marine biogeographic data, from all over the world, freely available over the World Wide Web.

A methodology using existing datasets to create gridded data products indicating the abundance of different marine species, based on geospatial modelling was investigated. The calculated products cover a wide taxonomic range, from the smallest organisms (e.g. bacteria, viruses) to the largest ones (e.g. fish, mammals), encompassing all trophic levels. Special attention was given to species which are protected by EU Directives and international conventions, and those to be used as indicators for Marine Strategy Framework Directive. The online data portal providing free access to European marine biological data, developed under the preparatory phase was used as main online data access point. Throughout to project new functionalities to improve the user friendliness, data accessibility and interoperability have been developed. This was done in close collaboration with different data networks and organisation (TDWG, GBIF, INSPIRE, SEADATANET, WoRMS, OBIS, OGC, Lifewatch).

## 2. Highlights of the project

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- A new interface, including a new data download toolbox has been developed and implemented for [www.emodnet-biology.eu](http://www.emodnet-biology.eu) with the aim of improving the user-friendliness and intuitiveness of the EMODnet biology data portal.
- A total of 713 datasets representing 20,854,591 quality controlled data records are now available through the EMODnet biology data portal, including several long-term national marine biological monitoring data collections. Some of these datasets were collected within the framework of ongoing activities of the European Ocean Biogeographic Information System (EurOBIS).
- An EU-wide assessment of those species and communities identified as indicators for descriptors 1, 2, 3, 4 and 6 of the Marine Strategy Framework Directive was performed. The indicators were resolved to target species level and it is now possible to search the EMODnet Biology Data Portal for the relevant species and observations using the “Species importance to society” selection. A review of the utility and availability of biological and ecological traits for marine species so as to prioritise the development of a world database on marine species traits has been performed and published in peer review. In addition, a proposed standard trait vocabulary has been published and is online available as an ontology.
- Creation of the ‘World Register of Introduced Marine Species (WRIMS). The aim is to provide a global dataset of all marine introduced, cryptic and previously considered alien species. The data system integrates data and information from different databases and allows users to select per regional sea, lists of alien and or invasive species. WRIMS hopes to become an important tool for the descriptor 2 of the MSFD.
- Data archaeology activities identified more than 220 datasets through literature research of which 76 were suitable for digitization/rescue within the scope of EMODnet. A framework to run small grants for their digitization, standardization and quality control was launched and set up.
- Over 60 data products indicating the abundance of different marine species are available (5 microorganisms products, 6 phytoplankton products, 11 zooplankton products, 19 benthos products, 6 fish products, 10 bird products, 8 mammal products, 1 reptile product, 10 angiosperm products, 6 macroalgae products). They cover a wide taxonomic range, from the smallest organisms (e.g. bacteria, viruses) to the largest ones (e.g. fish, mammals), encompassing all trophic levels.
- The EMODnet zooplankton data products are since 2015 produced as Operational Oceanographic Products and Services to facilitate ICES’ Ecosystem Overviews which describe the trends in pressures and state of regional ecosystems.
- Between 01/09/2014 and 01/07/2016, 3225 data downloads have been registered; most common purpose was for research purposes, but users also indicated training, marine planning and data management purposes. A good example of the fit for purpose of the data portal is the published Science article: ‘Assemblage Time Series Reveal Biodiversity Change but Not Systematic Loss’, where the authors reused several datasets retrieved from the EMODnet Biology portal to come to these conclusions.

## 3. Description of the work done

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### ***WP1: Project Management***

The objective of the project management work package was to ensure timely delivery and quality of results and products, to monitor, facilitate and effectively manage the project's technical, scientific and managerial work and to communicate and provide accurate information to the project members, the Commission, the other EMODnet lots and the general public.

A consortium agreement between VLIZ and 18 project partners to define the terms and conditions under which the Project partners shall cooperate was composed and sent out on November, 19, 2013 to all project partners. The document was signed by the 19 project partner representatives on 01 March 2014. Four additional subcontracts were composed of which three were accepted and signed in 2013. The subcontractors to the EMODnet Biology project are IMAR - Institute of Marine Research, represented by Centre of IMAR of the University of the Azores, the Institute of Meteorology and Water Management – National Research Institute, Poland and Auckland UniServices Limited, representing the University of Auckland. Due to the unplanned situation in Crimea, it was impossible for the subcontractor Institute of Biology of the Southern Seas, NAS of Ukraine (IBSS) to perform its activities as foreseen. Therefore, IBSS decided to withdraw from the project

The prefinancing sum of 30%, a first interim payment (15%), and a second interim payment (15%) according to the consortium agreement was transferred to all partners and to the three subcontractors. Bimonthly, first interim and second interim reports have been sent to the EMODnet Secretariat and the EU Commission throughout the project. All the reports were accepted and are publicly available both on the Maritime Forum and on the EMODnet Biology website.

During this reporting period 3 general meetings were organised. The first general meeting took place in Oostende, the Second General Meeting took place 17-18 September 2014 at the Institute of Marine Research (IMAR) in the Azores and the third general meeting took place in Oostende during the Jamboree meeting. EMODnet biology organised 6 work package related workshops. EMODnet biology participated in all EMODnet steering committee meetings and in the EMODnet-MSFD meetings. As a direct result EMODnet biology was invited and attended the OSPAR ICG COBAM & CORESET, HELCOM meeting and attended the workshop on Options for reporting of MSFD biodiversity indicators, organised by the EEA. These meetings explored possible collaboration between EMODnet biology and the MSFD process. Furthermore, the EMODnet biology project was represented during several European marine and maritime conferences.

## ***WP2: Identification and collection of species, species attributes and species indicator information***

Work Package 2 focussed on the collation of legislative and biological traits and attributes for species, and the development of tools and resources to link these traits to existing taxonomic and data infrastructures. The WP was split into two distinct tasks with specific deliverables: the Identification of species and species attributes information (Task 2.1), and the Collection of species attribute information (Task 2.2).

### **Identification of species and species attributes information**

#### ***Species important to society***

This task involved the identification of species which are protected by EU Directives and international conventions, and also those to be used as indicators of relevant MSFD descriptors. The focus of the activity was on the MSFD element of this work, as the Pan-European Species Directories Infrastructure (PESI) project (<http://www.eu-nomen.eu/portal/search.php?search=adv>) already contained much of this information for other legislation, including; CITES, Habitats Directive, Birds Directive, OSPAR, and IUCN. However, identification of species that will comprise indicators or components of indicators for the MSFD was a large and complex task. The MSFD has 11 descriptors however only the biodiversity descriptors together with commercial fish and non-indigenous species are relevant to EMODNET Biology. Thus the descriptors addressed in this task were:

- Descriptor 1: biological diversity;
- Descriptor 2: Non –indigenous species;
- Descriptor 3: Population of commercial fish and shellfish;
- Descriptor 4: Elements of marine food webs
- Descriptor 6: Sea floor integrity.

The initial emphasis was on Descriptors 1, 4 and 6 with subsequent work focussing on Descriptors 2 and 3. Work began gathering information at a Regional Seas scale i.e. identifying species that were linked to indicators that were agreed between member states through a regional process via the regional seas commissions. The OSPAR list of common and candidate indicators was used to devise a framework for gathering this information. Work was required (and is still needed in some cases) to resolve group indicators to species level, for example some indicators concern seabirds, and only after correspondence with the Intersessional Correspondence Group on Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM) lead was information been gained on exactly which seabird species these indicators concerned.

The North Atlantic and Mediterranean regional seas are further divided into sub regions, however the Baltic and Black Seas are not (Figure 3).



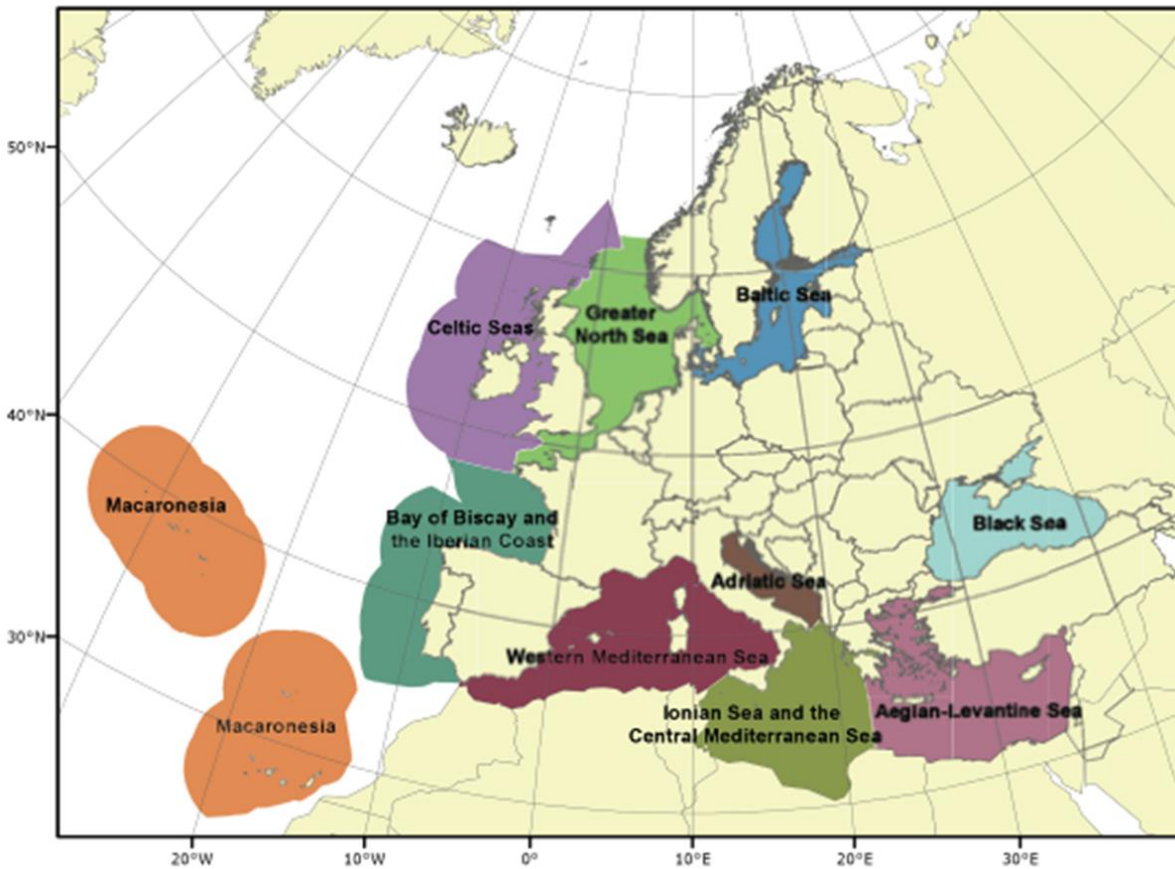


Figure 4. Map of the regional seas and sub regions defined within the MSFD.

Through the process of information collation, it became clear that the OSPAR region was the most advanced, with a greater amount of effort needed for the other regional seas to identify at what stage in the process they are and ask for lists of agreed indicators. A rapid response was received from HELCOM providing their HELCOM Core Indicators report, UNEP-MAP sent a draft decision document outlining their approach but indicators will not be agreed until 2015, while efforts to contact the Black Sea Commission have been unsuccessful. This likely reflects the stages each regional sea is at in terms of the MSFD indicator process.

Each member state selected indicators and submitted these to the European Commission in July 2012. However, many of these indicators have not been adopted at the regional level but are still used by the member state to assess Good Environmental Status within their respective EEZs. Indicators from all member states, along with other nationally developed indicators had been collated by the EU FP7 DEVOTES project. In order to formalize cooperation and the transfer of knowledge, an agreement of collaboration between AZTI-Tecnalia, as coordinator of FP7 DEVOTES project and Vlaams Instituut voor de Zee, as coordinator of EMODnet Biology was signed. The agreement made it possible to access the DEVOTool database, providing information on a wide range of indicators. developed for the Marine Strategy Framework Directive and other purposes.

As a result of this inventory, it is now possible to search the EMODnet Biology Data Portal for the relevant species using the “Species importance to society” side of the interface.

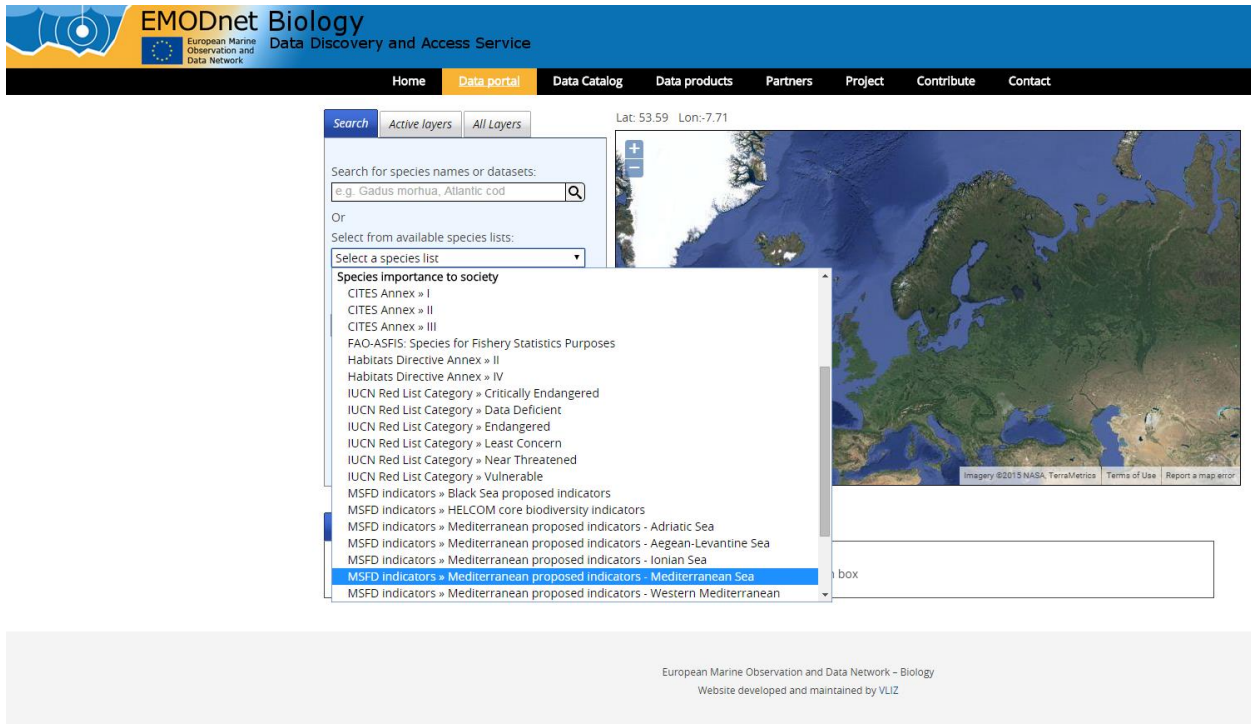


Figure 5. “Importance” search interface on the EMODnet Biology Portal

### Collection of species attribute information

The starting point for the collation of the traits information was to harmonise existing databases and sources of traits information, and engage with relevant experts to agree a standard set of terms and structures. The terms from the Biological Traits Information Catalogue (BIOTIC) which contains information on over 40 biological trait categories on selected benthic species, alongside trait terms from PolyTrait, FishBase and pilot projects funded through the preparatory phase of EMODnet contributed to the initial list of terms and definitions. These approaches were all presented at an initial biological traits workshop held in Paris in February 2014. Attended by 24 experts from 16 global organisations including GBIF and the Encyclopaedia of Life, the outputs included a refined hierarchy of trait terms and definitions. The hierarchy was initially populated and further developed within an online Google spreadsheet. However, limitations with version control and planned expanded future functionality led to the migration of all terms into a semantically-enabled MediaWiki installation, hosted by VLIZ.

The Wiki format provided a platform for discussion as the trait groups, terms and related definitions evolved. The semantic extension allowed terms to be related, and the resulting vocabulary to be published in standard, open formats including SKOS and RDF. One key step in the publication of the vocabulary was the development of a namespace and associated Universal Resource Identifiers (URI's).

The most important consideration with the namespace and URI’s was that they were persistent and did not change, this was being possible using a redirection service such as [www.purl.org](http://www.purl.org). The published namespace would, for example, remain as <http://purl.org/mst/terms> whilst the actual location could change to account for server migrations and changes in governance.

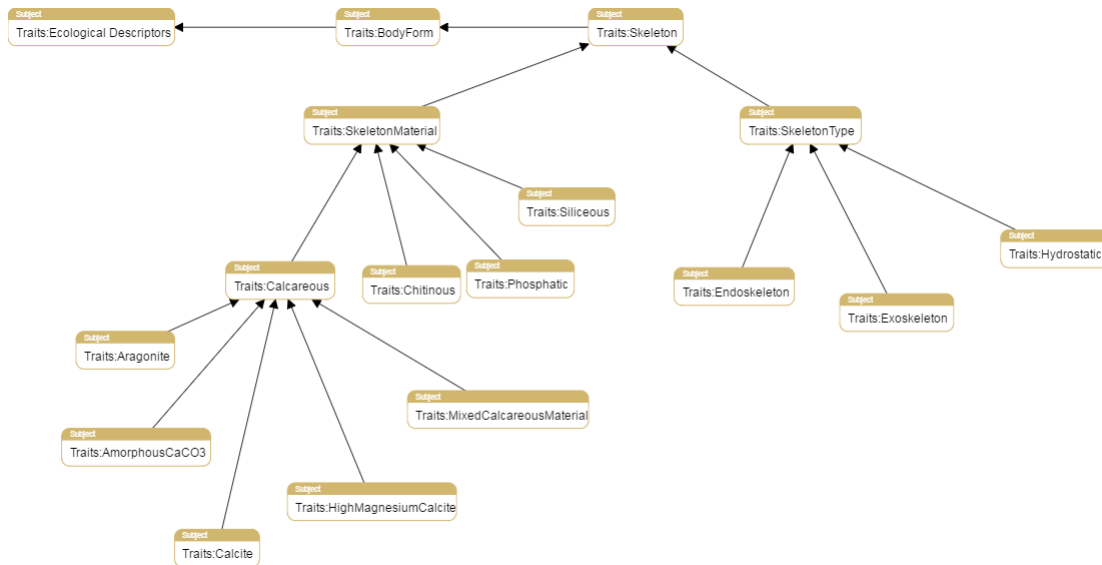


Figure 6. Visualisation of RDF output of the functional biological trait: skeleton

In parallel, a peer-reviewed publication in PeerJ carried out a review of the utility and availability of biological and ecological traits, and prioritised ten of the traits from the hierarchy for inclusion within the World Register of Marine Species (WoRMS). The traits were selected based on data availability, broad applicability across taxa and that their inclusion would lead to new management or research applications. The paper was viewed over a thousand times in the first month of publication.

Trait	Relevance	Categories	Numerical
<b>1. Taxonomic</b>	Related species have similar traits so taxonomic relationships predict traits of related species	Kingdom to genus	Not applicable
<b>2. Environment</b>	Most studies are confined to a particular environment so this trait allows users to quickly isolate species of interest for their purpose.	Marine, brackish, freshwater, terrestrial, pelagic, benthic	Not applicable
<b>3. Geography</b>	Distribution is the most	Locality name	Latitude-longitude

Trait	Relevance	Categories	Numerical
	sought after information on species after its taxonomy.		coordinates (in OBIS)
<b>4. Depth</b>	The most widely available variable to distinguish species' habitat.	Intertidal, subtidal (epipelagic) deep-sea (>500 m)	Deepest and shallowest depth recorded in (1) literature and (2) in OBIS, above and below Chart datum ( $\pm$ m).
<b>5. Body-size</b>	Related to position in food web, species abundance, metabolic rates, and dispersal.	–	Maximum body length in mm excluding appendages. Maximum total body weight of individual.
<b>6. Substratum</b>	A key physical factor determining species habitat.	Sediment, hard, biological	Not applicable
<b>7. Mobility</b>	Indicates the dispersal potential of the life-stage.	Mobile, immobile (sessile)	Potential metres in life-time
<b>8. Skeleton</b>	Calcareous important for ocean acidification and fossil record. Gelatinous important due to sampling difficulties, role as predators, and hazard to humans.	Calcareous (aragonite, calcite), chitinous, silicious, exoskeleton, endoskeleton, plant cell wall	Not applicable
<b>9. Diet</b>	Influence on abundance of other species, determines position in food web.	Carnivore, herbivore, parasite, detritivore, phototrophic, chemoautotrophic	Isotopic signature Trophic level
<b>10. Reproduction</b>	May relate to the ability of a population to recover from reduced abundance or invisibility.	Sexual, asexual	

Table 3. The 10 selected traits from the PeerJ paper. DOI: 10.7717/peerj.1201/table-4

To increase the awareness of the traits hierarchy work, and to engage with individuals and groups undertaking related activities two follow up workshops were organised in June 2015 and 2016. Participants included representatives from the WoRMS Steering Committee, Encyclopaedia of Life,

Lifewatch, FishBase, EUBON and EMODnet Biology WP4 (Data Archaeology), ensuring the activities of WP2 were communicated and relevant to a wider user-group. Following feedback from taxonomic experts, work progressed on refining and realigning the terms and definitions within the hierarchy to ensure the broadest applicability was attained. In addition, the harvesting of traits values from literature and online sources continued with an ongoing focus on body length and skeleton as priorities.

### ***WP3: Access to marine biological data***

The general objective for WP3 was to provide data and metadata on surveys in the water column and on the seabed from the different groups of marine species (phytoplankton, zooplankton, macro-algae, benthos, angiosperms, birds, reptiles, fish and mammals). The specific objectives of this work package were to

- Analyse and assess in-depth the usability and fitness for purpose of the different data and databases that will contribute to the project;
- Decide on the optimal mechanisms for linkage with the EMODnet portal, making maximal use of existing systems;
- Format the data and perform taxonomic and data standardizations to allow interoperability with the EMODnet Biology Portal;
- determine the suitability of the data for the creation of the data products and validate the produced data products.

#### **General data management**

The first objective of WP3 corresponded to deliverable D3.1: assessment of data and databases, which was due in Month 6 of the project. The work on this deliverable already started during the EMODnet Biology II kick-off meeting where the initial overview of datasets that would contribute to EMODnet Biology II was fine-tuned. Through the inventory, additional datasets were identified, of which the majority was already described in the metadata catalogue (<http://www.EMODnet-biology.eu/data-catalog>), and all of which will become accessible through the Portal. Part of the assessment included the data transfer protocol that would be used to transfer the data. The following overview illustrates which protocols were used by how many partners:

<b>Data transfer protocol</b>	<b># Partners</b>
IPT	7
SeaDataNet format	4
OGC (WFS)	2
Own web services	2

*Table 4. The number of partners using the different data transfer protocols*

The majority of the partners is using the IPT (Integrated Publishing Toolkit), to publish their biological data. IPT is used to publish and share biodiversity datasets online – through uploading the data on a publically available instance of IPT - and is specifically designed for interoperability: it enables the publishing of content in databases, Microsoft Excel spreadsheets, or text files using open standards namely the Darwin Core. Partners have been offered the possibility to either set up their own IPT, or

make use of an IPT hosted by VLIZ. There has been extensive communication through email and physical meetings with different partners to get accustomed to using IPT and the Darwin Core data format that goes with it. Making data available from the different partners and keeping track of updated data was an ongoing task during the project. Once the data are available through IPT or any of the other data exchange mechanisms, taxonomic and data standardizations are performed, allowing the interoperability within the EMODnet Biology Portal. Once this has been done, quality control procedures run on all the data and the results of these can help to determine the suitability of the data in the creation of data products.

When a dataset was reported by a partner as ‘ready to be harvested by EMODnet’, it was first generally checked if the dataset is comprehensible and consistent with the metadata provided (e.g. does the sampling protocol match what is expected, based on the assessed functional group, do the dates and coordinates fall within the range described by the metadata, etc.).

Other checks include:

- Checking that the required data fields are present and the values are possible.
- That all data fields contain the appropriate data.
- Database relational integrity for datasets which have Measurements or Facts measurements
- That abundances are provided for the datasets for which they were promised
- There are no 0 (‘zero’) values in the abundance and that the unit is known
- That when biomasses are provided, it is clear whether they are wet weight or dry weight
- When codes are provided for certain data (e.g. sex, lifestage, sampling gear,), they are explained.
- Duplicate records. This check proved valuable not only to limit actual data duplication, but also to assess whether relevant sampling descriptors (different subsamples) or biotic measurements (e.g. life stages, size measurements) were omitted.

After uploading data to the EurOBIS database, automated QC procedures are run. These procedures check whether:

- a taxon is matched with World Register of Marine Species (WoRMS)
- taxon is at genus or (sub)species level
- latitude & longitude are different from zero
- latitude & longitude are within possible boundaries  
( $-90 < \text{latitude} < +90$  &  $-180 < \text{longitude} < +180$ )

For each record in the EurOBIS database, a Quality Control (QC) value is calculated based on which of these steps are passed. These QC values are available through the EMODnet Portal. For more details on the calculation of the QC values see Vandepitte et al. 2015.

## Marine biological data in EMODnet Biology – general assessment



### Increase in available datasets and distribution records

On 15 June 2016 when this rapport was drafted **713** datasets and **20,854,591** occurrence records which have an LSID associated to them are available through the EMODnet Biology data portal. For a large portion of these records there is extended data such as abundances and biomass information available.

<b>Data types</b>	<b># Datasets</b>	<b># Records</b>
Occurrence data only	252	10,122,402
Abundance	455	10,697,499
Biomass	34	996,870
Other MoF measurements	53	762,669

Table 5. Number of occurrence records and number of datasets with abundance, biomass or other measurements stored in the Measurement or Facts table.

A little over 50% of the occurrence records in EurOBIS provide abundance data while a little under 50% of the occurrence records are “occurrence only” and as such do not provide any additional information like abundance, biomass, size classes or environmental readings associated to the occurrence. EurOBIS only recently (from 2014 on) opened up to additional biotic and environmental measurements with the measurement or facts extension to the occurrence table. For many datasets which were harvested before 2014, additional information is available and an effort is undertaken include these measurements in EurOBIS as well. So although the percentage of records with other MoF measurements is still very low at the moment (<4 %), it will increase in near the future.

WoRMS stores the functional group information to which different taxa at the different stages of development belong. Using this information occurrence records can be divided according to these different species groups. During this exercise an error is made for the number of zooplankton, nekton and benthos records as the life stages of the occurrence records are not taken into account, but instead all occurrence records in EurOBIS are treated as if they were adult specimens. As fish records are listed in a separate group, they are not recorded as nekton, which therefore mainly consist of Cephalopoda and certain Malacostraca taxa. All functional groups mentioned in this section of this report were derived in this manner.

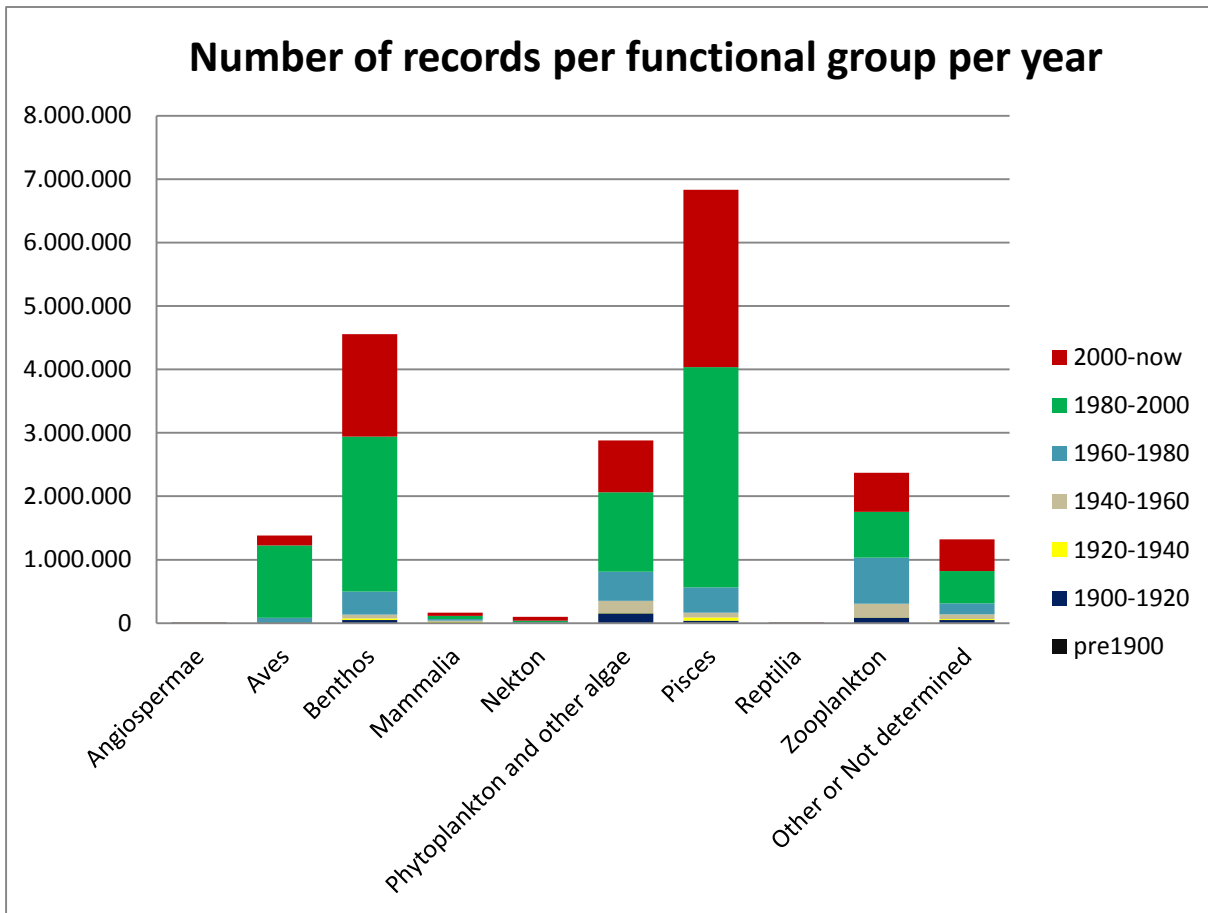


Figure 7. The number of occurrence records in EurOBIS per functional group per year class

About 3,8 million occurrence records are situated outside the regional seas discussed in the following section and are therefore excluded from further analyses. These records are either located in Europe but outside the boundaries set for the regional seas (1.6 million records) or outside Europe (2.2 million records).

**Marine biological data in EMODnet Biology – per regional sea**  
**Baltic Sea - Assessment of the data in this region**

EMODnet Biology provides access to **62** datasets which contribute data for the Baltic Sea with a total of **1,536,335** occurrence records. For a large portion of these records there is extended data such as abundances and biomass information available as is illustrated by the table below. Figure 7 t and the distribution maps for this region in appendix 3 provide insight on the temporal and spatial distribution of the available data per functional group in this region.

Data types	# Datasets	# Records
Occurrence only	34	500,598
Abundance	24	1,019,712
Biomass	9	299,660
Other MoF	8	158,074

Table 6. Baltic Sea: number of occurrence records and number of datasets with occurrences in this region. Also provided are Figure 8. The number of occurrence records in the Bay of Biscay, Iberian Coast and Macaronesia per functional group per year class

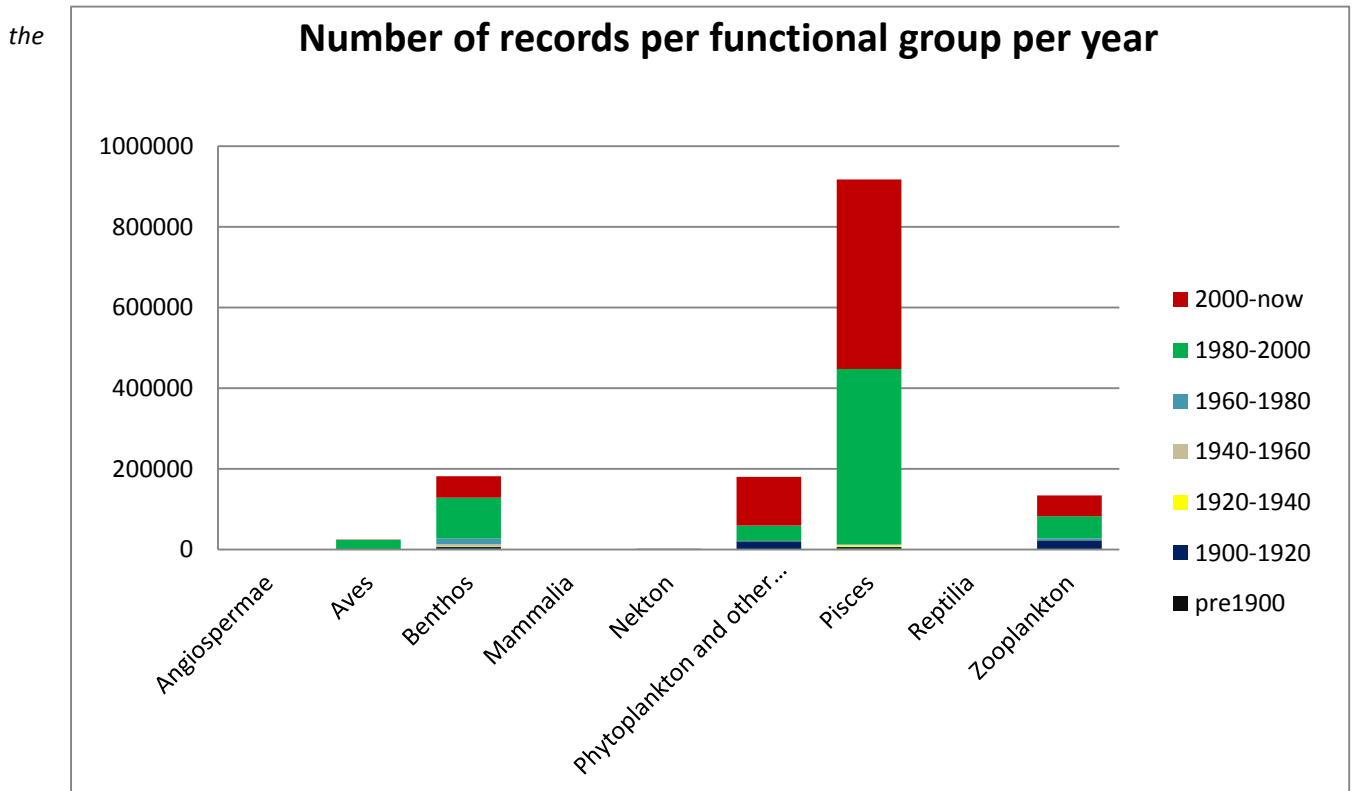


Figure 8. The number of records per functional group per year from the Baltic Sea

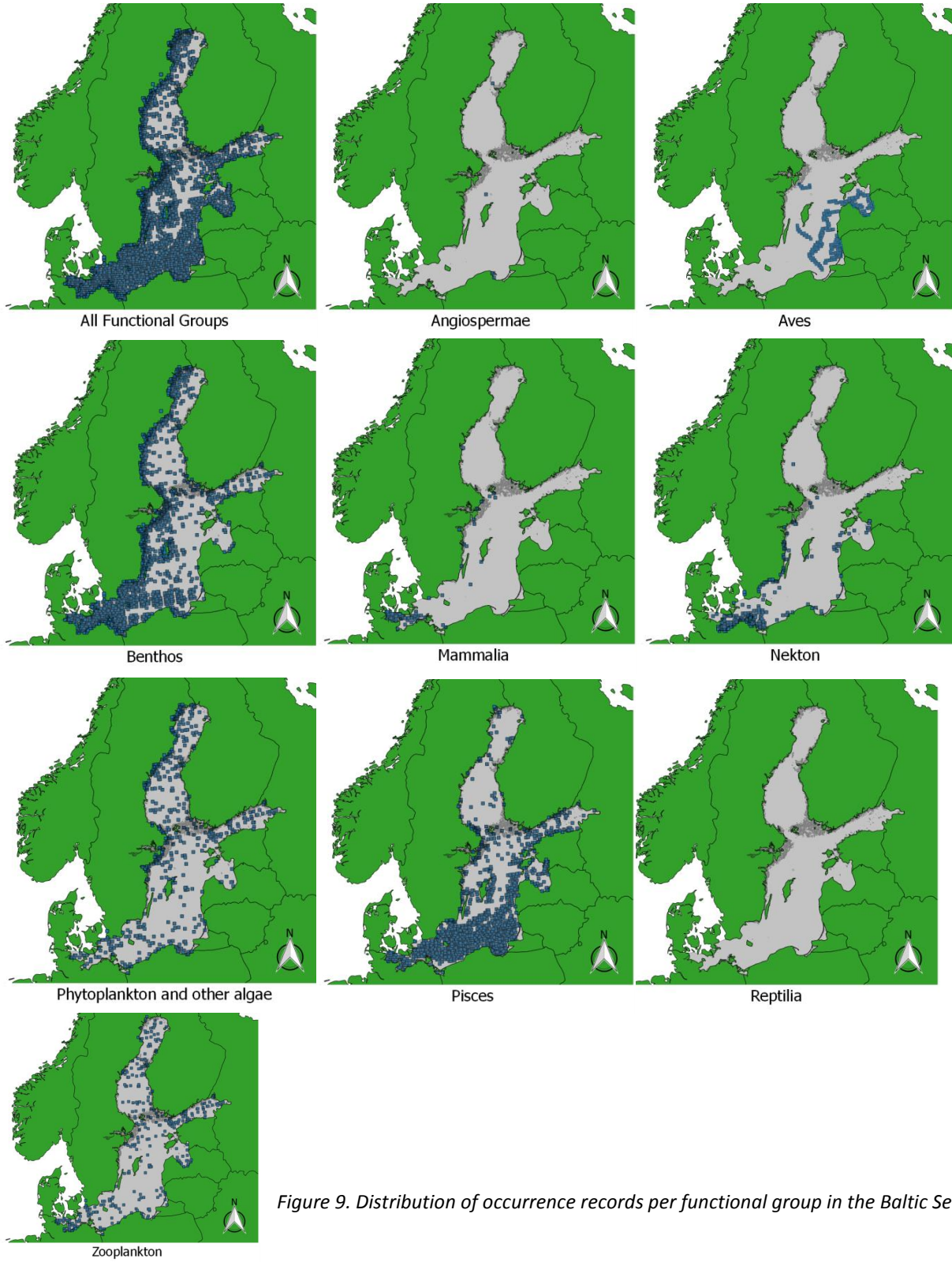


Figure 9. Distribution of occurrence records per functional group in the Baltic Sea.

### Bay of Biscay, Iberian Coast and Macaronesia

EMODnet Biology provides access to **153** datasets which contribute data for the Bay of Biscay, Iberian Coast and Macaronesia with a total of **1,091,424** occurrence records. For some of these records there is extended data such as abundances available as is illustrated by the table below. Figure 8 and the distribution maps for this region in Annex 3 provide insight on the temporal and spatial distribution of the available data per functional group in this region.

Data types	# Datasets	# Records
Occurrence Only	94	828,283
Abundance	57	263,141
Biomass	0	0
Other measurements MoF	7	26,332

*Table 7. Bay of Biscay, Iberian Coast and Macaronesia: number of occurrence records and number of datasets with occurrences in this region. Also provided are the number of records and datasets with abundance, biomass or other measurements stored in the Measurement or Facts table*

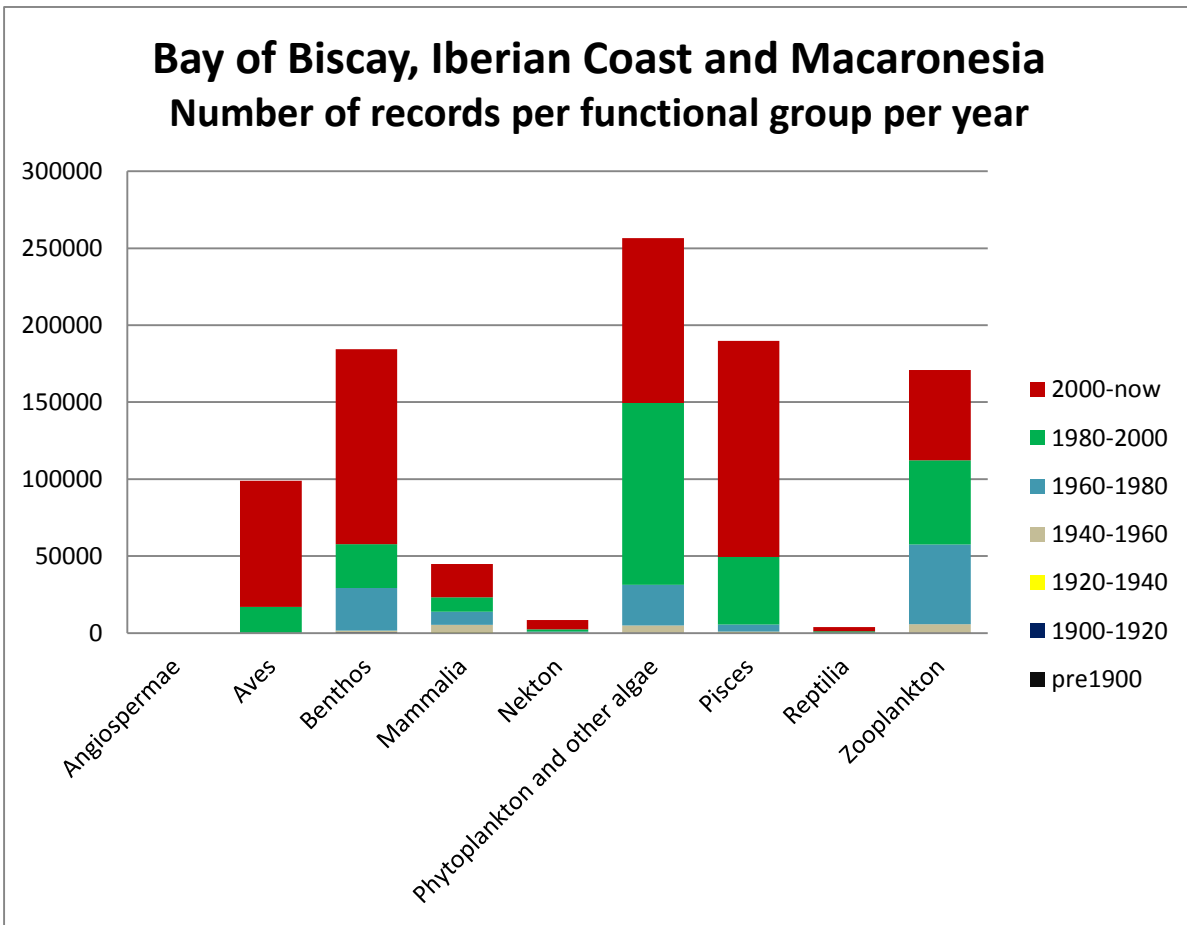


Figure 10. The number of occurrence records in the Bay of Biscay, Iberian Coast and Macaronesia per functional group per year class

### Black Sea and Sea of Azov

EMODnet Biology provides access to **105** datasets which contribute data for the Black Sea and Sea of Azov with a total of **280,141** occurrence records. For a large portion of these records there is extended data such as abundances and biomass information available as is illustrated by the table below. Figure 9 and the distribution maps for this region in Annex 3 provide insight on the temporal and spatial distribution of the available data per functional group in this region. We see that fish data is almost not represented for the Black Sea.

Data types	# Datasets	# Records
Occurrence Only	20	79,872

Abundance	84	200,261
Biomass	6	8,220
Other measurements	MoF 8	16,093

Table 8. Black Sea and Sea of Azov: number of occurrence records and number of datasets with occurrences in this region. Also provided are the number of records and datasets with abundance, biomass or other measurements stored in the Measurement or Facts table

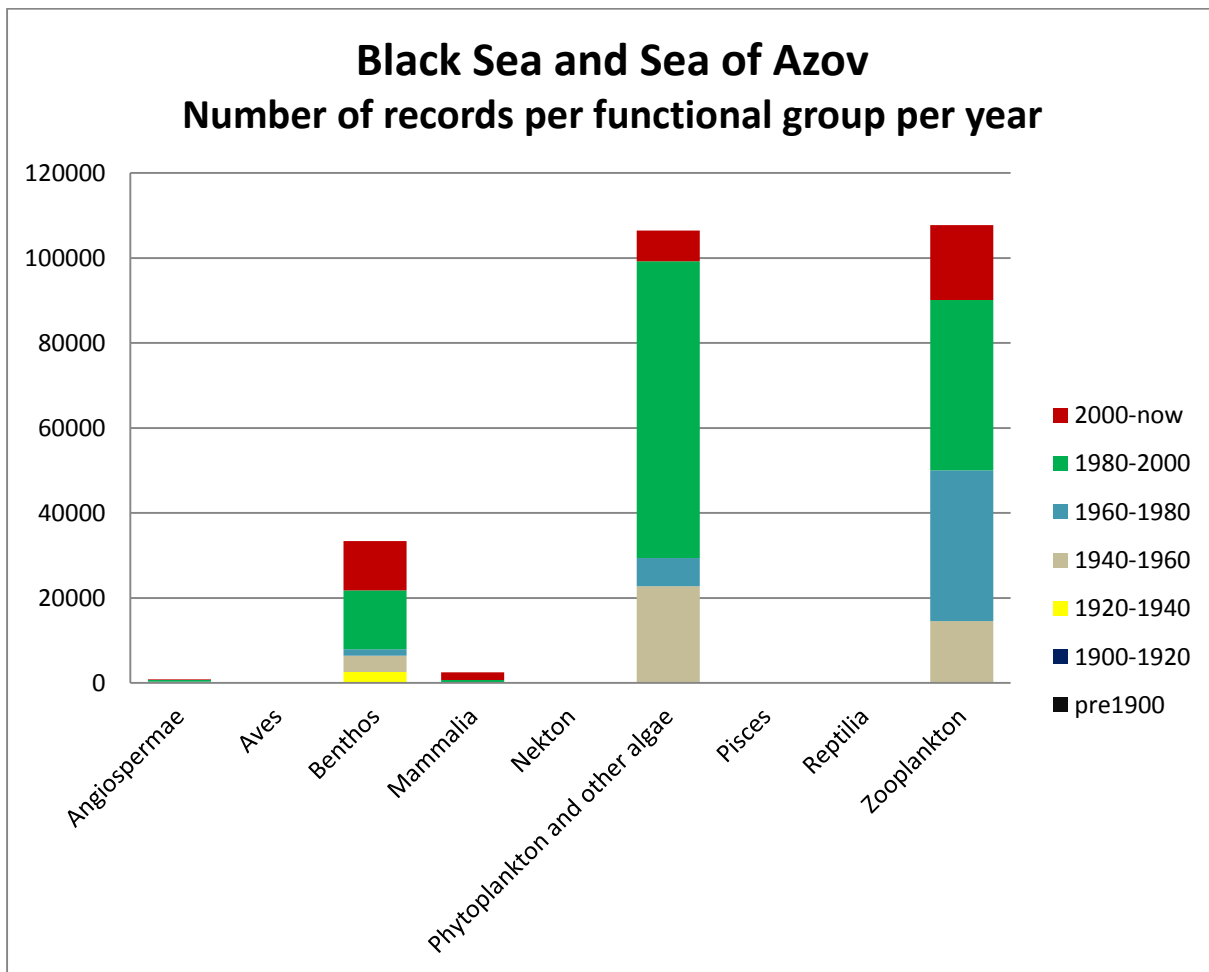


Figure 11. The number of occurrence records in the Black Sea and Sea of Azov per functional group per year class

### Greater North Sea and Celtic Sea

EMODnet Biology provides access to **295** datasets which contribute data for the Greater North Sea and Celtic Sea with a total of **12,667,600** occurrence records. For a large portion of these records there is extended data such as abundances and biomass information available as is illustrated by the table



below. Figure 10 and the distribution maps for this region in Annex 3 provide insight on the temporal and spatial distribution of the available data per functional group in this region.

Data types	# Datasets	# Records
Occurrence Only	140	4,781,654
Abundance	153	7,872,072
Biomass	7	642,175
Other measurements	MoF 27	532,899

Table 9. Greater North Sea and Celtic Sea: number of occurrence records and number of datasets with occurrences in this region. Also provided are the number of records and datasets with abundance, biomass or other measurements stored in the Measurement or Facts table

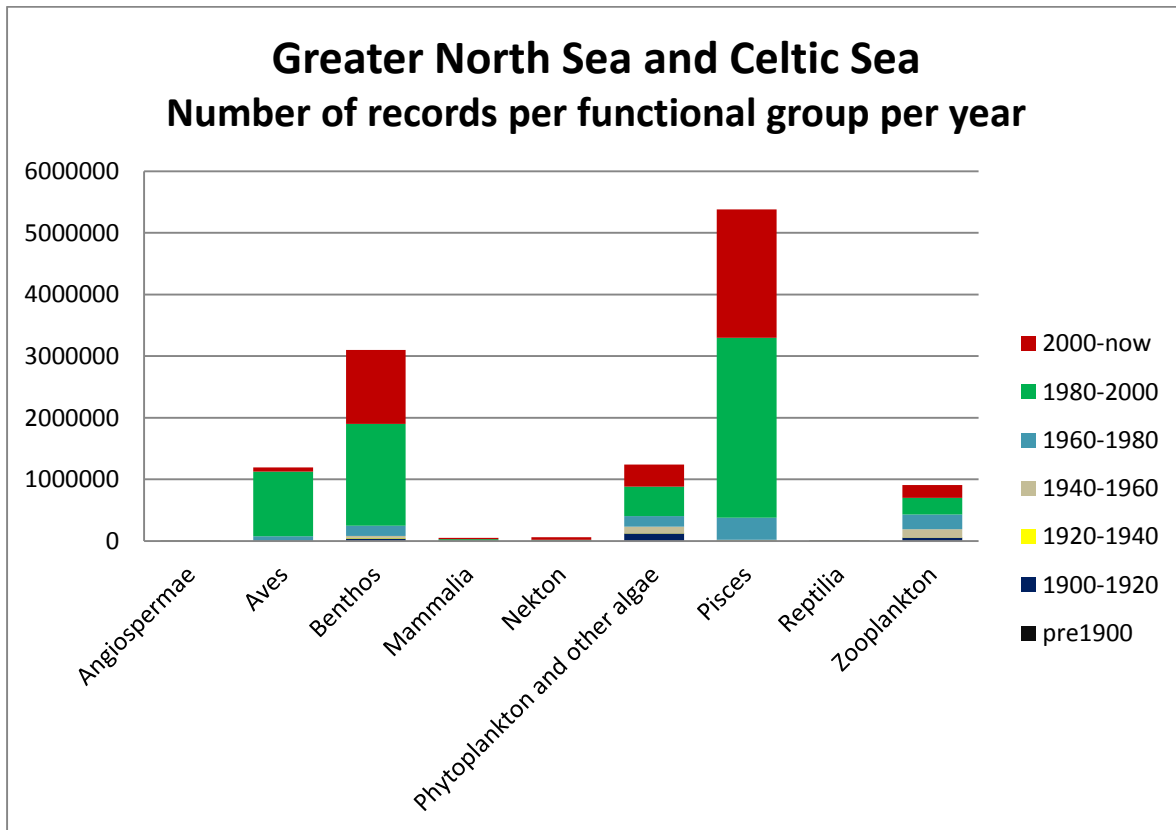


Figure 12. The number of occurrence records in the Greater North Sea and Celtic Sea per functional group per year class

## Mediterranean Sea

EMODnet Biology provides access to **210** datasets which contribute data for the Mediterranean Sea with a total of **665,789** occurrence records. We observe thus a relative high number of small datasets. For a large portion of these records there is extended data such as abundances and biomass information available as is illustrated by the table below. The chart and maps provide insight on the temporal and spatial distribution of the available data per functional group in this region.

Data types	# Datasets	# Records
Occurrence Only	71	344,615
Abundance	132	316,479
Biomass	12	19,747
Other measurements MoF	6	10,057

*Table 10. Mediterranean Sea: number of occurrence records and number of datasets with occurrences in this region. Also provided are the number of records and datasets with abundance, biomass or other measurements stored in the Measurement or Facts table*

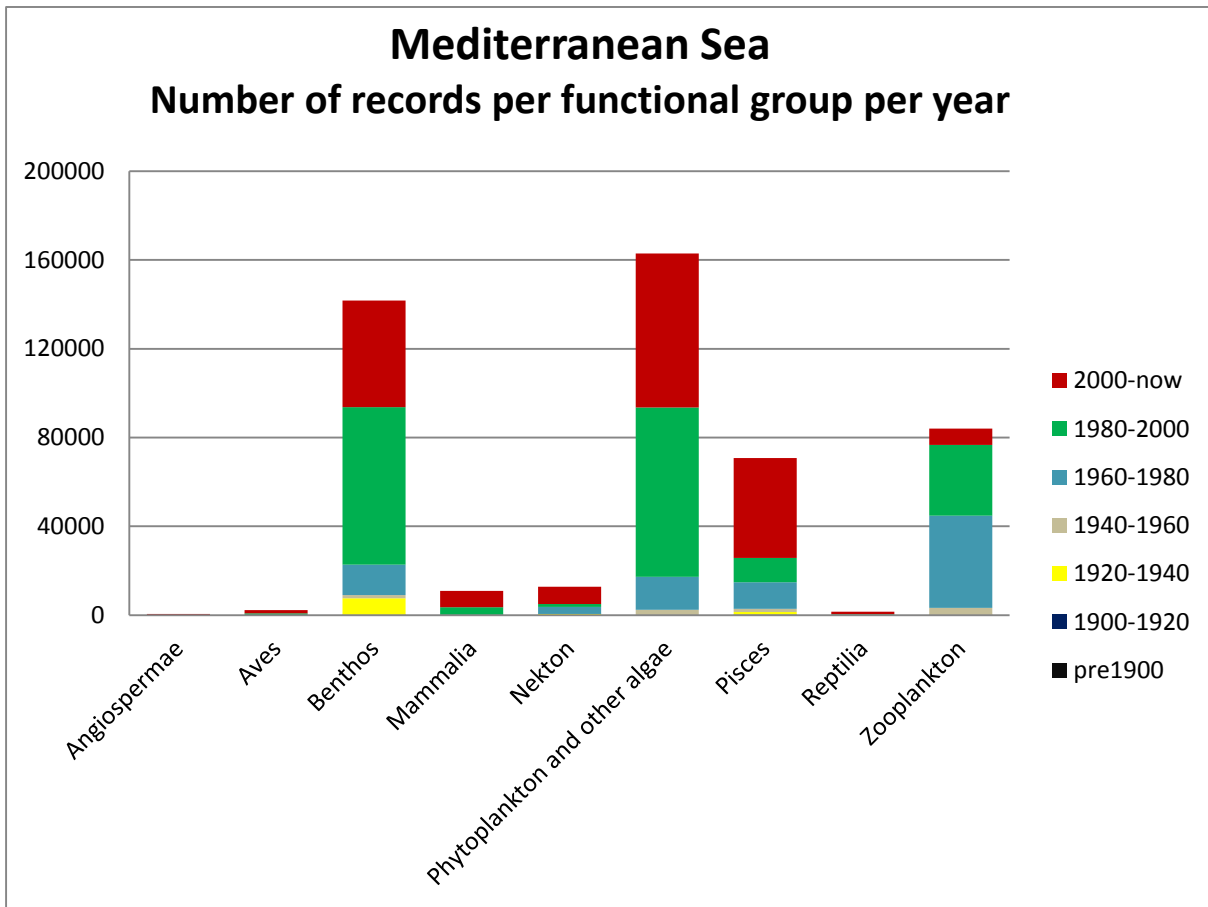


Figure 13. The number of occurrence records in the Mediterranean Sea per functional group per year class

## Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen

EMODnet Biology provides access to **126** datasets which contribute data for the Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen with a total of **734,028** occurrence records. The chart and maps provide insight on the temporal and spatial distribution of the available data per functional group in this region.

Data types	# Datasets	# Records
Occurrence Only	76	622,915
Abundance	50	111,113
Biomass	3	25,172
Other measurements MoF	2	211

*Table 11. Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen: number of occurrence records and number of datasets with occurrences in this region. Also provided are the number of records and datasets with abundance, biomass or other measurements stored in the Measurement or Facts table*

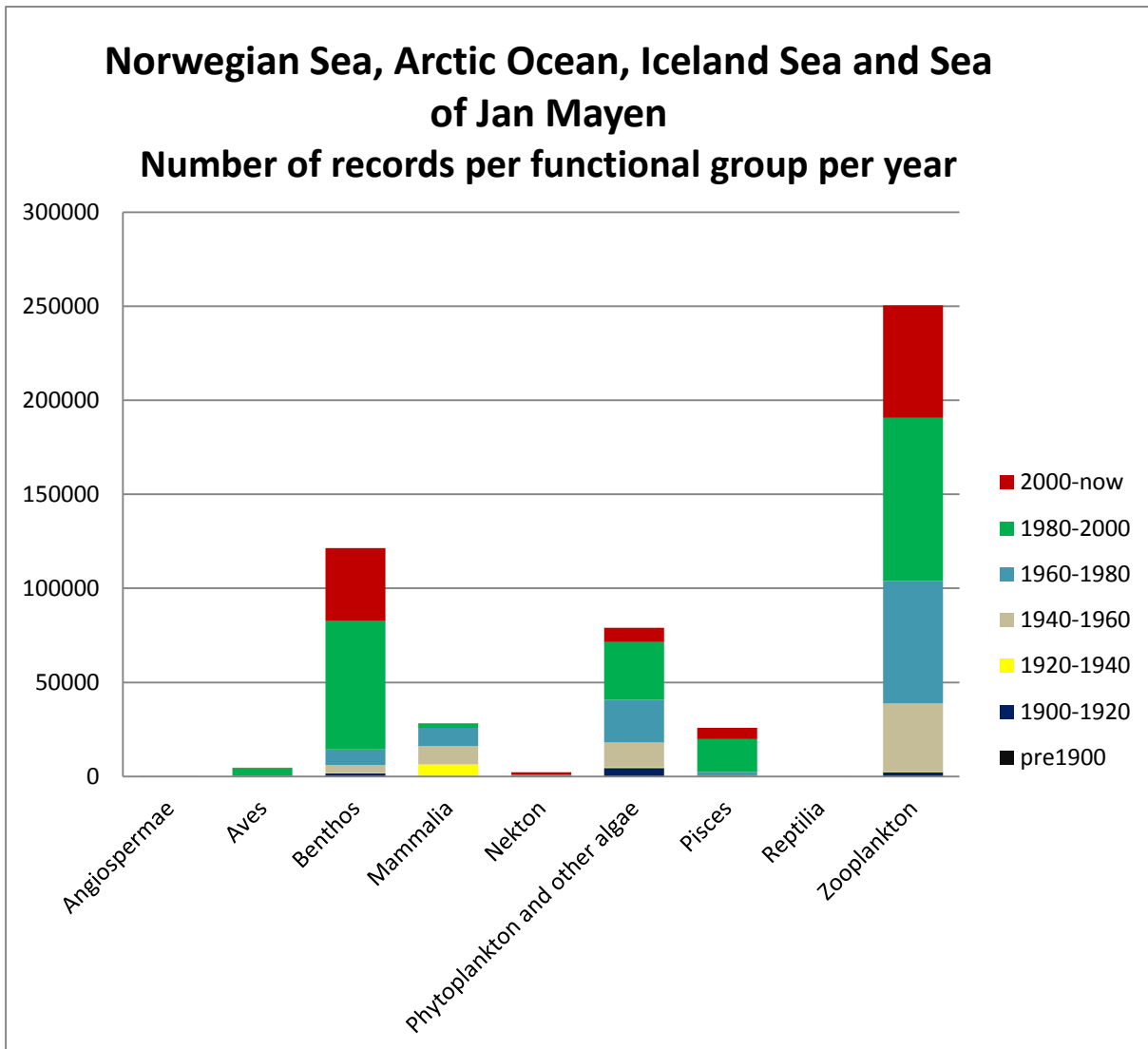


Figure 14. The number of occurrence records in the Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen per functional group per year class

## Discussion data assessments

### Historical data

Historical data (pre 1960) for all functional groups for all regions only make up only a small portion (5.5%) of the records in EurOBIS. This indicates that older (or historical) data is not easily mobilised and incorporated into public database systems such as EurOBIS and EMODnet. These ‘historical’ data do however represent an important component in the global representation of species distributions: these data can give scientists insights on the biodiversity of species prior to human impacts and can

help establish a baseline. The loss of this valuable knowledge can be counteracted by investing in so-called ‘data-rescue’ actions, which focus on tracing and identifying historical paper-based datasets and providing the possibility to digitize them. The result of the data-rescue activities carried out during EMODnet 1 shows nicely in the temporal chart of the Black Sea (Figure 9).

## Angiospermae

There are very few Angiosperm records (6,586) in the EurOBIS, which results in very few data on angiosperms for all regions except for the coasts of Great-Britain and Ireland for which there are about 3,000 records. This absence of records does not reflect the ecological reality of this group as for example *Zostera marina* ([Short et al 2010](#)), *Zostera noltii* ([Short et al 2010](#)) and *Cymodocea nodosa* ([Short et al 2010](#)) are recorded along throughout most of the European or Mediterranean coasts. A gap analysis in the Mediterranean and Black Sea ([Renzi et al. 2014](#)) showed that there is a lot of phytobenthos monitoring being carried out this region (data exists for Spanish, Corsican, Italian, Turkish, Bulgarian, Rumanian and Greek coasts), but this data has not been included to EurOBIS yet. Possibly these data are kept in a format which makes them unsuitable for EurOBIS. In fact, EMODnet did receive GIS layers from the MediSeH project, with the Mediterranean distribution of several angiosperm and macroalgae taxa. However, most of the GIS layers were polygons and could therefore not be harvested as EurOBIS stores point records.

EurOBIS will need to focus more on harvesting data from angiosperm and macroalgae as these 2 groups are usually analysed together. In fact, EMODnet 3 anticipates a Danish and a Croatian macroalgae dataset from Aarhus University and Ruđer Bošković Institute respectively, and a Swedish macrophyte dataset from the Swedish Meteorological and Hydrological Institute. However, more datasets will be needed in order to bridge this gap completely.

## Aves, Mammalia and Reptilian

Figure 6, which features the temporal distribution per functional group, shows that data is mainly available for the 1980-2000 period. More recent data is only available for the Macaronesia region. In fact most of the bird records come from a [single dataset](#) with 1.1 Million records covering the entire Greater North Sea, the Celtic Sea and the Northern part of the Bay of Biscay. For all other regions – except Macaronesia – there is very little or no bird data available. Like with Mammalia and Reptilia, it’s reported that they are commonly monitored but that the spatial and temporal scales of data collection may not be suited for EurOBIS purposes ([Renzi et al. 2014](#)). (Eur)OBIS is developing a format data which will allow it to efficiently store data obtained by GPS tracking sensors. As recent marine bird,

mammal and reptile data is collected by such trackers, this develop may help getting more bird data in EurOBIS.

There are relatively few marine mammal and reptile records in EurOBIS. This may reflect in part the rarity of a turtle or a cetacean sighting compared to e.g. a bivalve. The absence of reptile records in the Baltic and the Norwegian Sea mainly reflects the edge of their distribution range ([Rasmussen et al. 2011](#)). Real gaps occur for reptile records in the Mediterranean and for mammal records in the Baltic Sea. For the Baltic Sea, there are some cetacean sightings but almost no seal data. EMODnet 3 anticipates delivery of 3 Swedish seal datasets provided by the Swedish Meteorological and Hydrological which would help with that. For the reptiles in the Mediterranean, there is actually more data available through OBIS Seemap. OBIS Seemap is a regional OBIS Node dedicated to global marine Bird, mammal and reptile data. EurOBIS cooperates with OBIS Seemap and the European data from OBIS Seemap is included in EurOBIS and bird, reptile and mammal data from EurOBIS gets included in OBIS Seemap. The synchronization process takes some time, but these missing datasets for the Mediterranean will become available through EurOBIS too.

### **Benthos**

Benthos is the second best represented functional group in EurOBIS based on record count (4.7 million). There is a good representation of benthos records in all regions, especially for the Greater North Sea and Celtic Sea region. For all regions there is some historical benthos data available, although the amount is quite low. For the Mediterranean and Black Sea there are monitoring programs which report data for the Turkish, Romanian, Bulgarian, Greek and Italian coasts ([Renzi et al. 2014](#)). Benthos data for the Bulgarian and Turkish coasts are lacking in EurOBIS.

### **Phytoplankton and Zooplankton**

Phytoplankton and zooplankton records are well represented in the EurOBIS database with 2.9 million and 2.3 million records respectively. A large portion of these are provided by the SAHFOS CPR datasets ([Continuous Plankton Recorder \(Phytoplankton\)](#), [Continuous Plankton Recorder \(Zooplankton\)](#)) which mostly cover the most of the EMODnet regions except for most of the Mediterranean, the Black Sea, Baltic Sea, the Arctic Ocean, Sea of Jan Mayen and the Northern parts of the Iceland Sea. The regions which benefit from the CPR data have a quite complete geographical and a good temporal coverage for these 2 functional groups. However, SAHFOS's data policy does not allow them to make the abundance data public (although they are available to EMODnet by request) which means that a for small portion of the zooplankton and phytoplankton records, abundances are available. The other regions (Mediterranean, Baltic Sea, Black Sea, the Arctic Ocean, and Sea of Jan Mayen) also do have a relatively good coverage for zooplankton and phytoplankton especially when this is compared to the



data available for other functional groups. For the Mediterranean and Black Sea plankton monitoring data is reported for the Turkish, Romanian, Bulgarian, Greek, Lebanese, Israeli, French, Corsican and Italian coasts ([Renzi et al. 2014](#)). For the Turkish, Bulgarian and Romanian coasts little or no phyto- and zooplankton data are available.

## Pisces

Pisces is the best represented functional group in EurOBIS based on the number of records (7.4 million). Most of these records are contributed by the ICES DATRAS monitoring surveys which results in a very good temporal and spatial coverage for all EMODnet regions except the Northern Baltic Sea, Black Sea, Mid and East Mediterranean Sea and the Arctic Ocean. For commercial fish, many countries in the Mediterranean Sea have a monitoring programme in place, but only the Spanish data are being reported ([Renzi et al. 2014](#)). These Spanish data are in part already included in EurOBIS through the atlas of the Balears dataset which includes data from Spain's monitoring programs. For the entire Black Sea there is basically no fish data at all available in EurOBIS, although monitoring data from Bulgaria and Romania do exist ([Renzi et al. 2014](#)).

## Low sampling data areas

For are some regions there are very few data available for any functional group. The most obvious regions are the Southern (especially the Southeastern) Mediterranean and the Southern Black Sea. Particularly for the Libyan, the Egyptian and the Turkish coasts there are few data available in EurOBIS, although monitoring programs that collect data along the Turkish coasts do exist ([Renzi et al. 2014](#)). The fact that for the Northern part of Black Sea data is available is largely thanks to the EMODNET 1 data grants contributed to the Ukrainian Institute of Biology of Southern Seas (IBSS). The missing data for the Southern Black Sea, as well as for some sections in the Mediterranean, may perhaps be partly explained by the bathymetry ([EMODnet bathymetry](#)). These areas are generally deep sea regions (>2000 m) which for some functional groups (especially benthos) would complicate sampling. Moreover, deep sea regions might be sampled less frequently due to an inherent lesser productivity of these waters compared to coastal waters.

## Marine biological data in EMODnet Biology – per data partner

Transferring or sharing data with EurOBIS - the data infrastructure behind EMODnet Biology - can be done in several ways. As the project aimed at regular updating of existing datasets – and sharing these updates regularly with EMODnet Biology – the proposed transfer protocols could easily be managed by

the data partners themselves, leaving the responsibility for keeping the data online with the partners, including a regular transfer to EMODnet Biology through the chosen protocol.

Based on the chosen data transfer protocol, partners were contacted on an individual basis early in the project, to discuss the details on the data transfer and a tentative time-line for the data delivery.

The majority of the partners is using the Integrated Publishing Toolkit (IPT), to transfer their biological data. Partners have been offered to set up their own IPT or to make use of an IPT hosted by the Flanders Marine Institute (VLIZ). During the project, there has been detailed communication through email and physical meetings with these partners to get accustomed to using IPT and the Darwin Core format that goes with it.

Other partners are part of SeaDataNet and preferred to use the Biological Data Exchange Format (BIODEF) of SeaDataNet. An alteration of the ODV format (the ODV-B format) was developed and disseminated to these partners by December 2014. This format allows the partners to efficiently store the biological data in SeaDataNet and also allows easy integration into EurOBIS. Afterwards, detailed communication through email took place to assure the correct use of the format.

Some partners already had data exchange mechanisms in place (e.g. web services) and opted to use those. Extensive communication between VLIZ and these partners has led to a successful mapping of the used terminologies and structures and the following integration.

<b>Partner</b>	<b>Protocol</b>	<b># datasets promised</b>	<b># datasets reharvested</b>	<b># currently available distribution records</b>
<b>AU</b>	SeaDataNet	1	1	794,717
<b>Deltares</b>	SeaDataNet & OGS (WFS)	3	3	46,026
<b>ICES</b>	Custom Services Web	15 (+ 2 Historical datasets)	5 (+ 2 Historical datasets)	5,811,889
<b>IEO</b>	IPT	12	12	54,704
<b>IFREMER</b>	SeaDataNet	3	0	285,562
<b>IMGW</b>	SeaDataNet	5	5	51,224
<b>MBA</b>	IPT	1	1	314,317
<b>OGS</b>	IPT	20	20	71,312

<b>ILVO</b>	IPT	10	10	70,103
<b>SAHFOS</b>	IPT	4	3	3,007,802
<b>SMHI</b>	Custom Web Services	4	4	648,498
<b>IMR</b>	IPT	11	11	152,346
<b>IMARES</b>	SeaDataNet	2	0	0
<b>IMAR</b>	IPT	20	18	332,414
<b>HCMR</b>	IPT	19	13	23,267

Table 12. Number of datasets and total number of distribution records harvested by 2016-06-15 per partner and protocol

Most partners decided to provide the data through the IPT protocol which has as great benefit that it mirrors the EurOBIS format almost exactly. When data is provided through IPT, a minimal of data transformation is required for it to be included in EurOBIS. As a script was developed to allow semi-automated harvesting of datasets published through IPT, the effort needed to harvest the data at the EurOBIS side is further reduced. IPT also has the additional advantage that it is the tool used by OBIS nodes to disseminate their data to OBIS, so even though IPT was initially a tool for terrestrial biodiversity data, good guidelines on how to submit marine data were already available.

In contrast, data provided by web services or WFS are not able to mimic the EurOBIS format exactly as they are either not exclusively developed for harvesting by EurOBIS and/or they are unable to produce a MeasurementsOrFacts table for the available, non-standardized measurements. Preparing the WFS data to be harvested by EurOBIS can be done manually, while for other web services EurOBIS needed to develop a dedicated script to read and harvest the data. On the upside, once such a harvest script is developed, the effort needed for harvesting updates is greatly reduced.

Regardless of the protocol used, quite some effort is needed to ensure the provided data was formatted correctly and to harvest the data. The effort and time needed to transform the data from the SeaDataNet format to the format used in EurOBIS far exceeds that of the other 3 protocols (IPT, Custom Web Services, WFS). In the WP6 section of this report, the workflow for data delivery through SeaDataNet is explained in some detail. Both the complexity of the format and the need to (re)transform the data from the SeaDataNet format to the EurOBIS format may make it more prone to errors. It was planned to develop a tool to (semi-)automate the data transfer from a SeaDataNet buffer dedicated to EMODnet Biology to the EurOBIS database. To this date however (15 June 2016), only a single dataset has been made available through this buffer, although 7 datasets provided in the SeaDataNet format have been harvested by EurOBIS. Due to the complexity of the SeaDataNet format, a lot of time and attention to detail is needed to successfully submit a dataset to SeaDataNet. For 5

datasets, the data themselves were already perfectly useable for EMODnet by April 2016, however due to minor formatting issues with the SeaDataNet semantic header and CDI files they are still not available through SeaDataNet at the time this draft was completed. Another complication of the SeaDataNet format which causes delay in data delivery is that SeaDataNet allows the data provider to make data available “by negotiation” only, while EMODnet Biology requires data to be freely downloadable. For one dataset this led to discussion and confusion about whether the data can actually be included in EMODnet Biology or not. After a 3-month delay, explicit permission was granted and the dataset was harvested by EMODnet, although to date the dataset is still not yet included in the buffer.

## **WP4: Data archaeology and rescue**

The overall objective of the work package was to fill the historical spatial and temporal gaps in EMODnet data availability by implementing data archaeology and rescue activities. This was a two-step process of (a) identifying and locating data, and (b) implementing the pre-designed methodology required to merge them into a digital database, which will be further distributed through the EurOBIS node and the EMODnet data portal. The work focussed on the Black Sea and Eastern Mediterranean Seas, but it was not limited to these regions only.

The main challenge in the implementation of the work was caused by the change of the leadership of the work package. The former WP Leader, IBSS, was rendered unable to continue its activities within the project after the first year, due to the political situation in Ukraine. It was subsequently decided that HCMR will take over on the lead of the WP4 activities starting October 2014, for the two remaining years. The detailed plan of deliverables was reviewed to cope with this situation at that time.

Three main tasks were identified in the context of WP4:

- To identify historical data that are at risk of being lost and mobilize the human resources for their archaeology and rescue. *D4.1. planned and delivered M12, and D4.2 postponed from M12 to M18 and delivered on M18.*
- To run a framework of small grants for their digitization, standardization and quality control. *Main activity during the year 2 and. D4.3 postponed from M24 to M30 and delivered M30.*
- To propose a mechanism for the networking of the supporting community to ensure continuous inflow of datasets in the future. *D4.4: The workshop activities were conducted in June 2015 together and/or back to back with WP2 workshop, and with EU-BON meeting, M21.*

### **Report on data availability and gap analyses for the Black Sea**

The deliverable contains a detailed description of all the Black Sea Datasets accessible through the EMODnet Biology Portal, originating from the largest organizations of the Former Soviet Union countries that have carried out (and still continue for most of them) research on marine biology in the Black Sea and Eastern Mediterranean and a preliminary list of identified datasets that were proposed for digitization at IBSS NASU. Priority was given to IBSS NASU which is the largest and oldest marine biological research organization in the Black Sea region.

Only 3 out of 18 scientists who were identified as potential key actors for the WP4 in Russia, Ukraine and Georgia, accepted to participate. Refusals to participate were due to several reasons such as:

- Some datasets have several providers, which creates uncertainty on whether the data holder has the rights to digitize or distribute dataset through the EMODnet portal.
- The activity is quite time consuming and could interfere with the main work tasks of the data holder.
- There was no interest in digitizing historical datasets (especially for retired professionals).
- There was no willingness to distribute them within the scientific community.
- The data policy of the institute of the data holder does not allow the distribution of raw data (regardless the time coverage).

The work with the archives of IBSS NASU revealed the following problems that are common for all Former Soviet Countries:

- No database on archive materials exists – only lists of holding, in most of the cases, just on paper.
- The description of the items included in the dataset does not always give a clear understanding of contents (temporal, geographic, taxonomic coverage etc.). Additional analyses of the content are required.
- For the datasets over the period 1940-1950, the dates and coordinates of sampling are not always available due to the restricted use of this information.
- No standard format for biological sample processing and recording were used. In some case the understanding of the methodology and as a consequence the calculation of abundance/biomass values is not possible.

A total of 219 datasets were identified in IBSS NASU as potential candidates for digitization mainly from logbooks covering the period 1957-1992. A database was developed for a NATO project in Black Sea that contains 34 datasets. See details in deliverable 4.1: Report on data availability and gap analyses for the Black Sea.

### **Description of identified historical datasets**

The search for datasets was extended to the whole Mediterranean Sea and other countries than those originally targeted in D4.1. Reports of expeditions were particularly targeted due to their historical importance, e.g., the scientific cruises of Prince Albert I de Monaco.

In total, more than 220 datasets were proposed or identified through the literature research. Not all of these are suitable for digitization, either because they do not fall within the scope of EMODnet (no biogeographical data or not in European waters) or because the information contained is not sufficient for the creation of a high-quality dataset.

The final list of datasets identified for digitization/rescue contains 76 datasets dating from 1841 to 2011. For five of these datasets, four grants were allocated to ensure their digitization, quality control and integration into the EMODnet system. In addition, datasets were digitized from historical literature as an in-house contribution of the LifeWatchGreece Research Infrastructure (ESFRI). These are annotated with extensive metadata and are being made available via the MedOBIS IPT installation.

### **Report describing the datasets that are digitized, standardized and mobilized into system including dataset documentation and QC procedures applied**

The digitization of the dataset of the 4 contracts were achieved in time end were integrated either in MedOBIS or EurOBIS. The dataset titles, as well as some taxonomic information is listed below:

- Temporal evolution of zooplankton from 1898-1917 and 1966 onwards in the north-western Mediterranean Sea
- Romanian Black Sea Phytoplankton data from 1956 to 1960
- Historical data on benthic macrofauna, demersal fish, and fish stomach content from the North Sea and the Baltic Sea
- Quantitative data on benthos and zooplankton from the NW Black Sea, sampled from 1954 to 1968 and macrobenthos sampled from 1997 to 2011

The datasets on Black Sea are temporarily hosted in MedOBIS but they will be moved to the Black Sea node, as soon as the appropriate infrastructure is operational. In addition, a number of datasets for the Mediterranean listed in the deliverable 4.2 are being digitized under the LifeWatchGreece project. These datasets are available through the MedOBIS IPT.

### **Process – Digitization and Quality Control**

Data providers were first requested to register a list of mandatory metadata and then to map their data to DwC standards, by using a spreadsheet. This spreadsheet had a common structure containing DwC terms, such as Dataset Name, Sampling Protocol, Individual Count, etc. (<http://rs.tdwg.org/dwc/terms/>). Data providers were also recommended to follow the guide of OBIS RON (Regional OBIS Node).



They were assisted on case by case basis by email, in particular for defining the name of the source, how establishing the code of stations and sampling, and the count of individuals. For the latter, the providers sometimes enter abundance values. This was a key point to double-check with them the accuracy of the data. Also a difficult part was to conclude to the correct structure of stations and samplings and unify the units used.

The same quality controlled procedures as described in WP3 were implemented for the historical datasets. A special attention was given to the scientific names and the attribution of the AphiaID. All scientific names were cross-checked and taxonomically updated using the Taxon Match tool of the World Register of Marine Species (WoRMS) (<http://www.marinespecies.org/aphia.php?p=match>). In the case of scientific names which were not listed in any authoritative taxonomic database, extensive literature research was made in order to find related information. As outcome of this procedure, a manual was produced together with LifeWatchGreece. It is worth mentioning that three providers out of the four contracted agreed to publish a data paper, but the work has not started yet.

### **Description of mechanisms and guidelines on mobilization of historical data into the systems**

A workshop was conducted 8 and 9 June 2015 in HCMR. During the HCMR's workshop the GoldenGATE-Imagine software was demonstrated and participating data managers received training on how to semi-automate the previously mentioned tedious process. Different types of legacy literature were explored such as expedition results, protocol logbooks and more biodiversity research articles. GoldenGATE-Imagine was used both for digital born files and for scanned image PDF files. Via hands-on sessions the complete process was studied: starting from how to scan a document, to import it into GoldenGATE-Imagine, to mark different document sections as well as entities of interests (e.g. taxonomic mentions and location names), to upload the mark-up in the PLAZI server and from there to retrieve the auto-generated Darwin Core Archives. Finally, in addition to the hands-on sessions, extensive discussions among the data managers and the information technology experts resulted in the compilation reward-via-publication suggestions.

The report contains a guide of best practices for extracting of data from the literature.

Recommendations:

- In general, extracting data from old literature is a tedious process that requires a lot of visual check. However, the experience acquired along the time by data manager facilitates the work.
- Technical recommendations for OCR: Scanning mode: RGB colour; Scanning resolution: 400 ppi (at 100% of objects size); Output image format: TIFF; Colour depth: 48 bit.
- The software tested for a semi-automated process requires improvements before using it on a regular basis, which will be helped by feed-back of users.

- Reward for data managers: Publishing a data paper is the most relevant reward. All people having taken part in the process of digitization should be co-author.
- The data paper is also a mean to expose the data more, and to increase the quality of data through the peer-review process.

The notes and comments are also available at:

[https://docs.google.com/document/d/1BL0AgWtRH77Ptb90mTuJ02qqO\\_HHz-1Jk32nqDo-rYc/edit?pli=1](https://docs.google.com/document/d/1BL0AgWtRH77Ptb90mTuJ02qqO_HHz-1Jk32nqDo-rYc/edit?pli=1)

The report will be shortly submitted to the Research Ideas and Outcomes in a slightly modified version that fits the journal format.

## ***WP5: Creation of gridded abundance data products***

The objective of WP5 was to produce a set of gridded map layers showing the average abundance of at least three species per species group for different time windows (seasonal, annual or multi-annual as appropriate) using geospatial modelling. The work for WP 5 was initiated by a workshop on January 2014 at the Netherlands Institute for Sea Research (NIOZ, Yerseke, Netherlands). The discussions concerned first data availability in the different European seas and the selection of well-known and published cases as key ecosystem components from diverse data sources; second, technical aspects of the DIVA software (Data-Interpolating Variational Analysis; Beckers et al., 2014) were detailed and use was exemplified through several study cases (benthic invertebrates and fish) with both density and presence/absence data. The workshop was concluded with the elaboration of a planning of tasks attributed to the different partners of the WP.

On 11<sup>th</sup> June 2014, a follow up meeting was held in NIOZ Yerseke to discuss progresses regarding WP 5 (gridded abundance products) and specific issues of product elaboration. Some technical constraints induced by data gaps were highlighted. Data selection was then chosen based on both time and space so that products, although spatially restricted, be more reliable. Product elaboration was more intensive and results were presented and discussed at the EMODnet Biology second general meeting in Horta (Azores) on 17<sup>th</sup>-18<sup>th</sup> September 2014.

The strategy followed while selecting data products was first to look at the data availability - we analysed the data bases and looked into datasets with quantitative data; secondly we looked at the Data quality - we assessed the data quality, including the spatial and temporal distribution of the dataset and the consistency of the used methodology, finally we prioritized by relevance of biological species or indicators - we focussed on species that have an important role in the ecosystem (e.a. Cod), or are relevant indicator species within the framework of the MSFD (e.a. Non indigenous species). We finally also assessed if it was possible to apply the used methodology for datasets with only qualitative data (presence only). Responding to a call for expressions of interest launched in 2014 by ICES, options to develop Operational oceanographic products and services (OOPS) were assessed and implemented. A specific workshop was held in Oostende (VLIZ) on 11<sup>th</sup>-12<sup>th</sup> March 2015 for discussing additional products mainly related to zooplankton and the status of the current data products and products to deliver before year II.

### **Products**

#### **Products in 2, 3 and 4 dimensions**

The outputs of the WP consist of 106 products. They cover a wide taxonomic range, from the smallest organisms (e.g. bacteria, viruses) to the largest ones (e.g. fish, mammals), encompassing all trophic

levels; Annex 4 displays all the products. Among the products, different data series provide relevant indicators evidencing the deleterious effects of human activities on the marine environment; for instance, the case of Cod (*Gadus morhua*) illustrates fishing pressure and stock depletion (Greenstreet et al., 2012) (Figure 13).

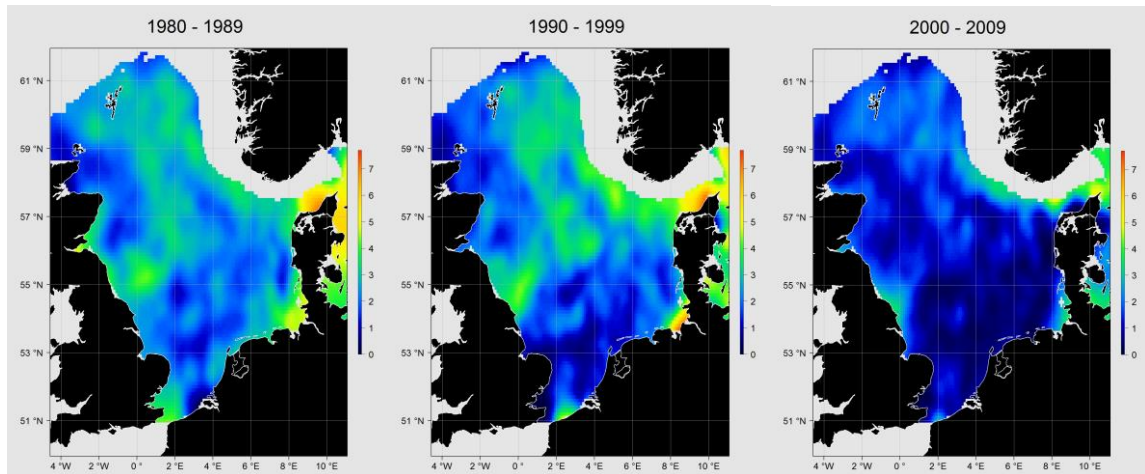
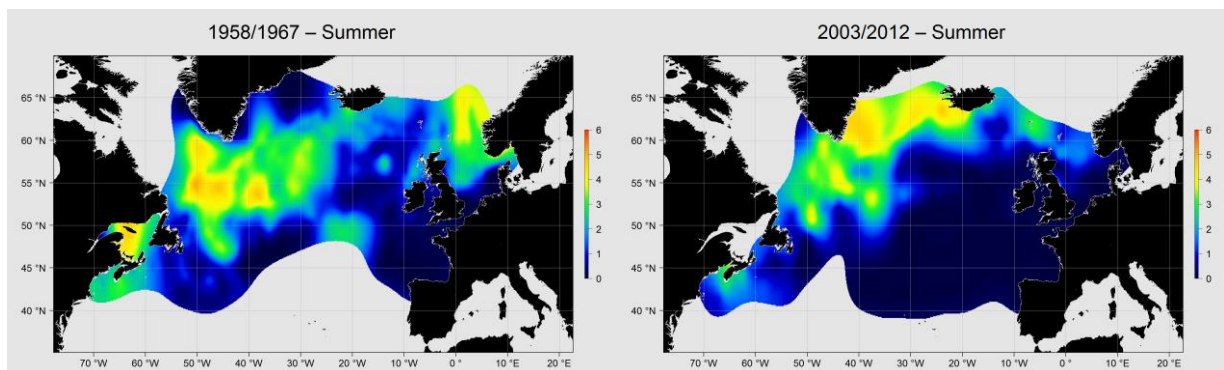


Figure 15. Three distant slices of the spatio-temporal distribution of Cod (*Gadus morhua*) in the North Sea showing stock depletion. Scale: log-transformed CPUE.

The distributions of the copepods *Calanus* spp. (Beaugrand et al., 2002) reflect the evolution of sea surface temperatures over the last fifty years and potential modifications of local food web structures (Figure 14).



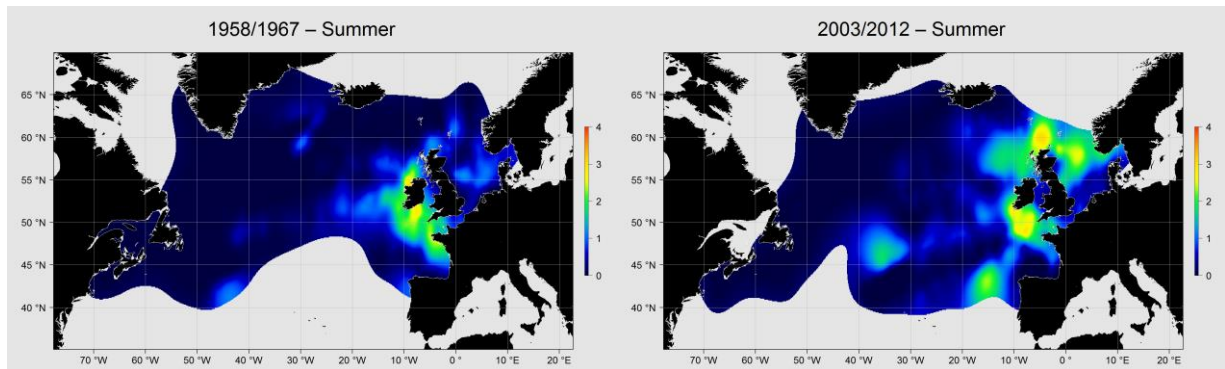


Figure 16. Distributions of *Calanus finmarchicus* (above) and *Calanus helgolandicus* (below). These distributions illustrate the evolution of sea surface temperatures over the last fifty years whereby the first species requires lower temperatures than the second one. Scale: log-transformed concentrations (nb. Ind./L).

Other products provide species distributions and taxon richness, and additional products were built to represent more specifically some ecological processes such as toxic algal blooms along the French coasts (Figure 15).

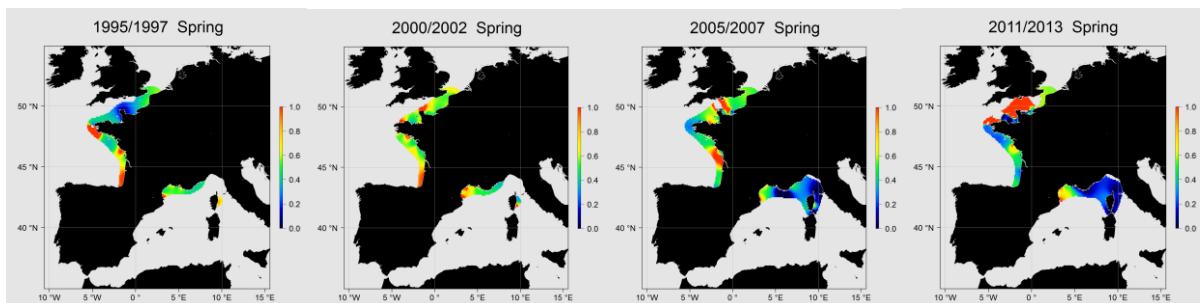


Figure 17. Algal toxicity along the French coasts. Taxa were documented for their potential toxicity and a ratio was built by dividing the concentration of harmful planktonic cells by the sum Harmful + Harmless.

Furthermore, different data products on historical and current data of seagrass beds, coralligenous and määrl beds in the Mediterranean Sea, developed within the Mediseh project became available through the data portal. During the project, the data products were presented to different stakeholders in order to review their relevance for policy support within the context of integrated ecosystem assessments and for the Marine Strategy Framework Directive. As a result, the zooplankton data products are since 2015 produced as Operational Oceanographic Products and Services to facilitate ICES' Ecosystem Overviews which describe the trends in pressures and state of regional ecosystems. These advice processes require regular inputs of monitoring information on the oceanography and

hydrology of the regions. As such, the EMODnet zooplankton data products will contribute directly to this process.

The data products were also presented to OSPAR ICG-COBAM group to discuss how these products could be used within the framework of the MSFD. The experts expressed there is potential that appropriate products could be developed, but this would require dialogue with the expert groups in the design and planning of any future products to ensure that they meet the specific requirements of the indicators in question.

### Products in 1 dimension

Some products consist in a single data temporal series recorded at one location. They were built with shiny (Chang et al., 2016) under Rstudio (RStudio Team, 2015), an R package that makes easy building interactive web applications straight from R. Temporal series are simply represented by curves or boxplots over time. For instance, the product of the Copepod *Acartia* sp. On the Faroer Island waters appears as follows:

OOPS zooplankton abundance timeseries

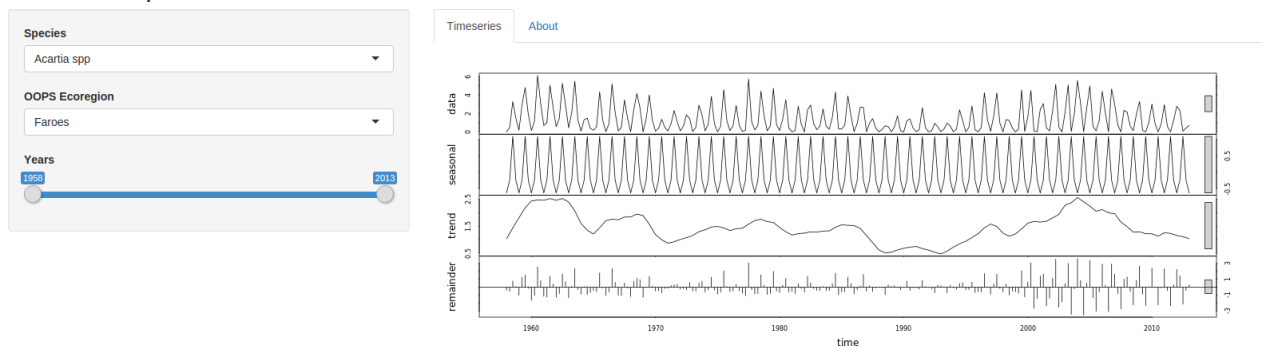


Figure 18. 1 Dimensional abundance trend of Copepod species per regional seas available at <http://rshiny.emodnet-biology.eu/>

### DIVA processing

#### Representation of temporal dynamics



Depending on data availability, we have used different methods to represent temporal changes in the gridded variables. For some applications, e.g. the cod example shown in Figure 13 that constitutes a very long series with considerable year-to-year variation, the data were grouped in decades to represent the major long-term changes. In other applications with shorter time series or less year-to-year variation, we have used sliding time windows. With a three-year sliding window, subsequent maps represent the combined data of years 1-3, 2-4, 3-5 etc. This ‘running average’ approach avoids strong jumps between maps, while retaining high temporal resolution. The problem of seasonality further complicates the picture. In many data sets containing several surveys per year, strong seasonal effects were noted. In these cases, seasons were delineated in line with the biology of the species, and it was avoided to mix data from different seasons, even in the mapping of the long-term development.

### Comparison with standard geostatistical models

DIVA output was compared with a standard geostatistical method, isotropic kriging based on a standard (spherical) variogram. The output of the two methods is compared in Figure 17. In general, the outputs are very well comparable. The correlation length used in DIVA seems to be a bit smaller than that chosen in the kriging algorithm. As a consequence, the DIVA interpolation follows the data somewhat more closely. Both methods also differ slightly in their extrapolation outside the domain of sampling. In general, however, the similarity between both dominates the picture. This results are expected based on theoretical considerations, because both methods share the same basic approach to spatial interpolation. The difference is in the solution algorithm, where DIVA adopts a non-linear grid-based approach. This results in considerably longer calculations times. However, the advantage of this approach in DIVA is its capacity to take natural disconnections, barriers, islands, etc. into account, because the finite-element grid only covers the real domain of interest (Troupin et al., 2010).

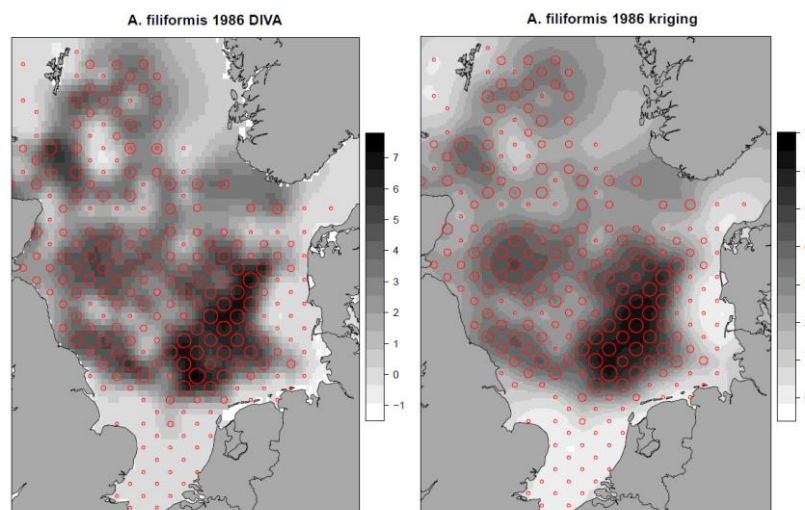




Figure 19. Distribution of *Amphiura filiformis* in the 1986 North Sea Benthos Survey (NSBS). Red circles are proportional to observed density. Shades of gray produced by DIVA interpolation (left) and ordinary kriging (right). Scale: log-transformed density (nb. ind./m<sup>2</sup>).

### Uncertainty analysis of the interpolation results

An important feature of the DIVA interpolations is the formal derivation of uncertainty measures of the interpolated values (Beckers et al. 2014). These results are standard included in the (netCDF) output file of the analysis. These estimates of uncertainty have been used in the data products, as masks for the output shown in the maps: areas with too high uncertainty have been excluded from the representation. It is possible to produce separate maps of the uncertainty, but this has not been done as a standard procedure. In case the statistical reliability of results for specific areas would be needed, the feature could be added to products on request.

### Presence-absence data

DIVA was originally devised for gridding based on quantitative data, such as concentrations or abundance density. However, many biological data are only available as presence/absence data. The DIVA methodology has been extended to produce maps of probability of occurrence using presence/absence data. The method has been applied to different data sets, including comparisons with full numeric data that had been reduced to presence/absence. It has been shown to work well in all test cases.

### Incorporation of environmental variables into DIVA interpolation maps

DIVA is essentially an interpolation software that cannot be used for species distribution modelling outside the range and scope of available data. Thus, a DIVA map cannot incorporate regression-type models for extrapolation. However, DIVA is able to restrict interpolation to areas of expected spatial covariance. Wherever barriers in the environment occur, e.g. sudden change of depth or substrate, or strong currents that limit exchange across streamlines, DIVA can be programmed so as not to interpolate across these gradients. This is achieved by spatially specifying the correlation length. Essentially, the correlation length expresses the spatial scale over which a significant spatial correlation can be expected, and thus information flows exist in the interpolation. It is estimated based on the spatial autocorrelation in the available data, but can be amended based on external information. This feature may help to improve interpolations with knowledge of environmental variables. During the project, we applied this method on the example case of *A. filiformis* in the North-East Atlantic. Based on a strong relation between occurrence of the species and water depth (the species being restricted to intermediate depth) we have limited the correlation length along strong depth gradients. This avoids spurious interpolations that would otherwise predict (limited) presence in the deep troughs of the North Sea, clearly an undesirable feature of the maps. The modulation of the interpolation procedure using environmental variables requires the (external) evaluation of basic species

distribution models using available environmental data, and is difficult to automate for multiple species and cases. We have not included this feature in most products, as it would require extensive documentation for each case and would make the products highly dependent on the accuracy of the models. Specific studies of certain groups (e.g. macrobenthos in the North Sea) could however make use of the feature to improve the correctness of the interpolation, provided common factors (barriers for correlation length) across species can be discovered.

### **Automation of workflow using R scripts**

The workflow of DIVA contains a large number of steps, including the preparation of a topography, preparation of data files, preparation of a parameter file that is consistent with the topography and data files, running the analysis and post-processing the output. While the versatility of DIVA almost excludes the complete automation of all possible workflows, in specific applications it is possible to script out the treatment. The biggest advantage of this procedure is that the workflow is fully documented and any errors can easily be corrected. Moreover, it offers the possibility to easily extend the script to new applications. All scripts are applied under Linux. Basically, the scripts prepare system commands that are sent to the operating systems. Output of the DIVA analyses are stored as files, usually with fixed names, that are subsequently used in other analyses. The scripts regulate the directory structure of input and output files. The main script `doMARdiva_direct.R` (Listing 1) first defines the directory structure, sets default parameters and defines a number of constants used in the processing. It calls required R packages, cleans up the DIVA working directory (with backup) and then calls the script `prepgebco.R` (Listing 2), which is used to prepare the topography based on `gebco` output. The script `prepinp.R` (Listing 3) reads in the basic data file, and prepares the sliding time windows of observations, to be written in a series of DIVA input files that will be processed one by one. Subsequently, the DIVA analysis is called for each data input file. A function is defined for this purpose, and called in a loop over the input files. The script `plotrstanddat.R` (Listing 4) defines a number of plotting parameters, and a function that is used to plot observed point data on the background of the interpolated grid. This function is subsequently called for all DIVA results, to produce both a pdf and an animated gif output.

### **Computational adjustments**

In ecological data analysis, asymmetric distributions are frequently encountered. This is typically the case with species abundances where a few high values can result from spatio-temporal aggregative distributions due to either peculiar environmental conditions, insufficient numbers of samples, or anomalies in sampling/recording/conversions in data bases. In modelling, species relationships with environmental descriptors or between species may be strongly affected; this is visible on graphical representations especially on maps where a few locations from a given area are over represented, masking the nature of the gradients over the whole area. To overcome such a constraint, variables are

usually transformed with the natural logarithm function ( $\ln$ ); to cope with absences for which values equal 0, the following transformation is applied:  $\ln(x + 1)$ . This transformation normalises distributions and hence lowers the influence of extrema; it was systematically applied for building the products based on quantitative variables, except, of course, in the case presence/absence (1/0).

### Finalization

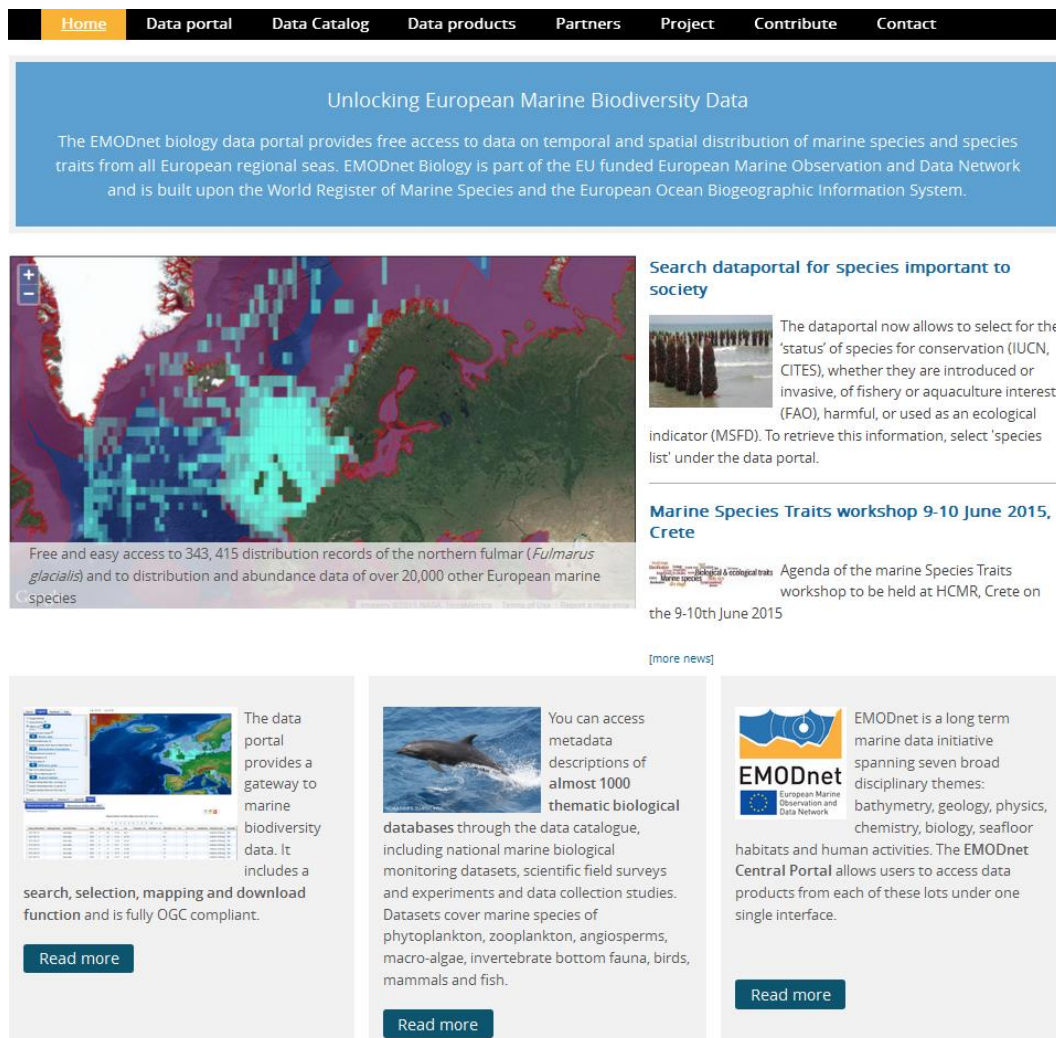
DIVA returns output interpolated maps under netcdf files. Final maps were built with the open-source platform R (R Core Team, 2015) and netcdf files were imported using the package “netcdf4” (<http://dwpierce.com/software>). The packages “maps” (Becker and Wilks, 1993) and “mapdata” (Becker and Wilks, 1993) were used for coastlines. Sliding series animations were built with the package “animation” (Xie, 2013). The code is available on the website (please complete this part with your outputs).

## WP6: Technical update EMODnet Biology portal & link to other portals

The objectives of WP6 is to develop and maintain the EMODnet biological portal and portal services and to make the data, metadata and data products that are created and mobilized during the project available.

### Improved functionality of the EMODnet Biology Portal

Several updates and new functionalities on the EMODnet Biology Portal, developed under the EMODnet Biology Pilot Project were developed with the aim of improving the user-friendliness and intuitively of the of the EMODnet biology data portal.



The screenshot shows the EMODnet Biology website homepage. At the top is a navigation bar with links: Home, Data portal, Data Catalog, Data products, Partners, Project, Contribute, and Contact. Below the navigation bar is a blue banner with the text: "Unlocking European Marine Biodiversity Data. The EMODnet biology data portal provides free access to data on temporal and spatial distribution of marine species and species traits from all European regional seas. EMODnet Biology is part of the EU funded European Marine Observation and Data Network and is built upon the World Register of Marine Species and the European Ocean Biogeographic Information System."

The main content area features a large map of Europe with a heatmap overlay showing species distribution. To the right of the map is a section titled "Search dataportal for species important to society". Below this is a text box: "The dataportal now allows to select for the 'status' of species for conservation (IUCN, CITES), whether they are introduced or invasive, of fishery or aquaculture interest (FAO), harmful, or used as an ecological indicator (MSFD). To retrieve this information, select 'species list' under the data portal."

Below the map is a text box: "Free and easy access to 343,415 distribution records of the northern fulmar (*Fulmarus glacialis*) and to distribution and abundance data of over 20,000 other European marine species". To the right of this is a section titled "Marine Species Traits workshop 9-10 June 2015, Crete" with a small image of a workshop and text: "Agenda of the marine Species Traits workshop to be held at HCMR, Crete on the 9-10th June 2015".

At the bottom of the page are three columns of featured content, each with a "Read more" button:

- Column 1:** "The data portal provides a gateway to marine biodiversity data. It includes a search, selection, mapping and download function and is fully OGC compliant." (Accompanied by a small image of the portal interface).
- Column 2:** "You can access metadata descriptions of almost 1000 thematic biological databases through the data catalogue, including national marine biological monitoring datasets, scientific field surveys and experiments and data collection studies. Datasets cover marine species of phytoplankton, zooplankton, angiosperms, macro-algae, invertebrate bottom fauna, birds, mammals and fish." (Accompanied by an image of a dolphin).
- Column 3:** "EMODnet is a long term marine data initiative spanning seven broad disciplinary themes: bathymetry, geology, physics, chemistry, biology, seafloor habitats and human activities. The EMODnet Central Portal allows users to access data products from each of these lots under one single interface." (Accompanied by the EMODnet logo).

Figure 20. New EMODnet biology website, launched 05 May 2015: [www.emodnet-biology.eu](http://www.emodnet-biology.eu)

Main new features include:

- The home menu is redesigned, to draw the attention to specific new products and news items and to allow the user to enter the data system in one click and to allow the user to enter the data system in one click
- The home page generates a list of newly added datasets – including a direct link to the metadata and data
- The data portal is now fully integrated into EMODnet Biology website.
- There are direct links to animated temporal data products.
- The data portal menu is divided into ‘Active layers’ and ‘All layers’, which allows you to add and navigate more easily between the data layers
- You can select by different species list (species functional group, regional MSFD indicators, protection status, commercial importance).
- You can now download and add to the data attribute table (Hide/show columns) abundance and biomass data that have been provided through the ‘MeasurmentorFacts’ extension.
- The EMODnet biology website has been made responsive. Responsive design means that the layout will adapt according to the device (smartphone, tablet...) that is used to visit the site.

### **New conceptual design EMODnet data Portal**

In parallel, a detailed user analysis and functional analysis of the current EMODnet data portal has been performed. The user analysis provided an analysis of the use of the current EMODnet data portal and reports on the new user requirements of the EMODnet Data Portals. The identification of the different user-requirements feeds into the functional analysis of the Data Portals. A new concept that differentiates more between data – unprocessed raw observations or measurements- and data products derived from the data has been formulated. The data component should focus on its easy and intuitive downloading, while the focus of the data products component focuses on a good visualization, a better overview of existing data and a quick understanding of the data. Based on both documents, the technical implementation of the new data portal started in the second year of the project, where a data download toolbox was released in the in April 2016.

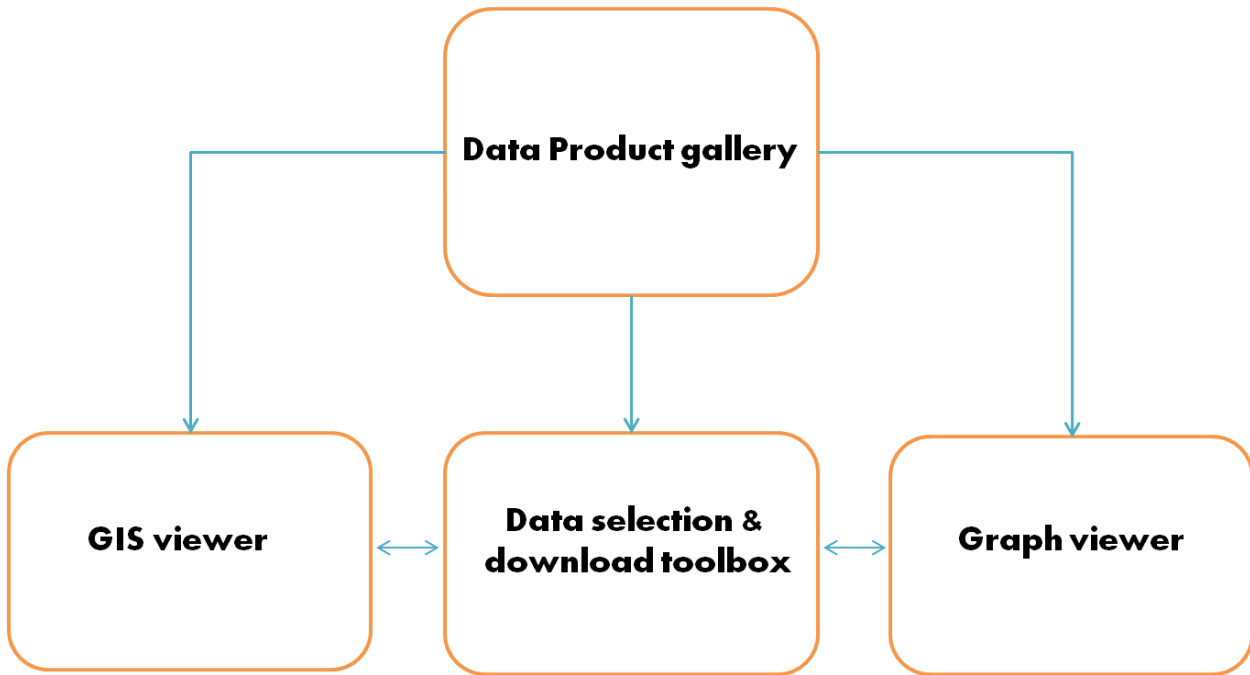


Figure 21. Conceptual representation of new concept EMODnet Biology data portal

### Data selection and download toolbox

The download toolbox will guide the user through a step-wise workflow where one can select datasets, perform predefined geographic and temporal selection, can add specific taxonomic or functional filters, and select for data with a certain quality and precision. At any time, the user will have a clear overview of the specific performed filters and queries through a selection overview. This component was launched in April 2016 (Figure 20).

Home / Occurrence Data / Explore

Select Datasources
(optional)

Free text

Datasource:

Data origin:

Dataset Name	+
BfG - Estuary Monitoring Programme Macrozoobenthos	+
Cetacean sightings in the north western mediterranean Sea by écoOcéan Institut and partners 1994-2011	+
Checklist of benthic marine algae and cyanobacteria of northern Portugal	+
Danish benthic marine monitoring data from ODAM	+
Epibenthos and demersal fish monitoring at long-term monitoring stations	+
Epibenthos and demersal fish monitoring data in function of wind energy development	+
European Seabirds at Sea - data collected by the Research Institute for Nature and Forest (INBO), Belgium	+
IMR Capelin larvae monitoring	+
IMR Herring larvae monitoring	+
IMR Juvenile fish monitoring	+

Previous 1 2 3 4 5 6 Next

Select the geographical area
(optional)

Select the time period
(optional)

Selection overview

- 1 Datasources 🗑️
- Danish benthic marine monitorin... ✖️
- ∞ Spatial 🗑️
- ∞ Temporal 🗑️

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# Records: 20250139 🗑️

Figure 22. Data selection and download toolbox at [www.emodnet-biology.eu/toolbox](http://www.emodnet-biology.eu/toolbox)

### Improved interoperability

A tool was developed to allow semi-automated harvesting of datasets published through IPT by February 2016. From a single IPT installation a selection of datasets is transferred automatically from the IPT installation to a harvesting environment in the EurOBIS database where QC procedures are run. Typically, at the end of each month data is moved to the production environment and a harvest cycle is completed.



Some partners already provide oceanographic data through the SeaDataNet infrastructure and preferred to exchange their biological data to EMODnet Biology the same way. For this purpose, the Biological Data Exchange Format (BIODEF) of SeaDataNet was developed. The BIODEF format deviates from the classical ODV format as the data is stored semantically as is the case in Darwin Core and EurOBIS. In fact, as the format was developed with integration into EurOBIS, most of the mandatory parameters are based on Darwin Core and EurOBIS terms. The SeaDataNet program Ocean Data View (ODV) was modified to be to cope with the new format. This format tested thoroughly and guidelines finalized and distributed to the project partners by December 2014.

Since then project partners can use the SeaDataNet infrastructure to disseminate data to EMODnet Biology. First the partner needs to use SeaDataNet software such Download Manager to map the data from his database to the BIODEF format. All partners were invited to submit early drafts of their data in this format to assure the correct use. If additional parameters were required VLIZ would help with the mandatory registration in the BODC P01 parameter vocabulary. Secondly MIKADO (or similar) software is used to create a distinct CDI metadata record for each sampling event. These CDI records are to be submitted to MARIS as they provide the discovery metadata in the SeaDataNet portal and link to the actual data which is physically stored at the data providing institute.

After the CDI's are checked and placed by MARIS in the production environment, the project partner needs to request that their data are also made available through a buffer dedicated to EMODnet Biology. For this MARIS requires that the CDI files belonging to the same dataset have the same dataset title or can easily be identified some other way. It's also a requirement that data in the buffer are freely available through the SeaDataNet license.

Through this buffer EMODnet Biology can easily identify which data(sets) should be included to EMODnet biology. A machine-to-machine interface is to be developed to (semi-)automate the transfer of the data from the SeaDataNet buffer to EMODNet Biology. However, to date (15 June 2016) only a single dataset has been made available through the buffer. It was therefore concluded at the time that the effort needed to build and QC the tool would greatly outweigh the effort of transforming the format of the single dataset manually. The development of this tool is thus postponed until enough biological datasets are available in SeaDataNet to justify the development effort.

For now, data are transferred manually from the buffer to the EMODnet biology by (i) downloading the data through the buffer (ii) use the ODV software to group all data files which belong to the same dataset (iii) use MS Access to format the data according to EurOBIS guidelines (iv) upload the data to EurOBIS. To date, 7 datasets have been processed in this manner, although only a single dataset is available through the buffer. The SeaDataNet format is quite complex and a lot of time and attention to detail is needed to successfully submit a dataset. For 5 of the 7 datasets mentioned the data themselves were already perfectly useable for EMODnet by April 2016, however due to issues with the

semantic headers and CDI files they are still not available through SeaDataNet at the time this draft was completed. The 6th dataset actually has been available through SeaDataNet since March but due to discussions regarding the license is still to be included in the buffer.

### **Interaction with EMODNET central portal**

The current interaction between the EMODnet Biology portal and the EMODnet central portal is arranged through a number of predefined OGC compliant Web Feature Services (WFS) services.

Two specific services are available from the EMODnet Central query tool:

- Taxon observations within a radius of 1000 meter: Gives the number of observations per taxon from the OBIS and EurOBIS databases within a radius of 1000 meter around a coordinate point.
- Taxon observations within a grid cell (6 minutes' resolution): Gives the number of observations per taxon from the grid cell (6 minutes' c-square) where the coordinate point is located based on the OBIS and EurOBIS databases

The WFS calls are designed to include a specific YearCollected, MonthCollected, DayCollected, bounding box and AphiaID. Current setup and possibilities for improvement were discussed during the EMODnet Technical Working Group meeting that was organized during the EMODNet Jamboree on the 23th of October 2015 at the InnovOcean site in Ostend, Belgium.

## 4. Challenges encountered during the project

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### Change of WP4 leadership

Due to the unplanned situation in Crimea, it was impossible for the subcontractor Institute of Biology of the Southern Seas, NAS of Ukraine (IBSS) to perform its activities as foreseen. Therefore, IBSS decided to withdraw from the project. IBSS was replaced at the end of the first year by HCMR. This choice was justified by the skills and experience with MedOBIS, and the recent start LifeWatchGreece that supported the upgrade of MedOBIS.

### Link with MSFD process - indicator species identification:

The identification of species that will comprise indicators or components of indicators for the MSFD is a large and complex task. The majority of challenges faced in the successful completion of this task related to the different approaches taken by the regional seas in the implementation of their respective indicators. Alongside this, within each regional sea, some descriptors progress was more rapid than others, typically with NIS (Descriptor 2) and Food webs (Descriptor 4) being the least evolved. This variable approach meant a great deal of time was used in iterations with regional and national MSFD leads to identify the appropriate contact and establish the degree of progress.

The MSFD requires reporting across regions and sub-regions that encompass waters of different member states, with varying levels of coordination in the past to address marine environmental issues. The North East Atlantic and the Baltic Sea have long histories of cooperation through their respective regional seas commissions, whereas weaker trans-boundary governance arrangements in the Mediterranean and Black Seas, which are also surrounded by non-EU states. In addition, some taxa have long histories of monitoring, for example certain species groups such as birds and cetaceans, while there have been few comprehensive monitoring surveys of benthic habitats, especially at the spatio-temporal scales required for reporting. Finally, some of the indicators proposed are complex indices that are not possible (or fairly meaningless) to resolve to individual species; for example, multi-metric indices are being used to assess benthic habitats or the plankton life form indicators for water column habitats that use all the species in the Continuous Plankton Recorder Database.

### Data availability:

Although the data products comprise a large diversity of ecosystem components, Atlantic and north western shelves were dominantly represented. The main gaps among European basins concern the Mediterranean Sea where data were either not existing, not accessible or coverages were spatially very restricted (Renzi et al., 2015). Besides, Black Sea data sets were limited and none covers exhaustively the whole basin.

### Data access:

There were delays in the delivery of datasets through the SeaDataNet protocol due to the development of the ODV-biology format (which was finalised and communicated to the EMODnet partners in January 2015) and the development and subsequent testing of the SeaDataNet EMODnet Biology exchange buffer. Other delays occurred due to the development of web services and data quality issues. It's expected that by November 2016 all except 6 of the new datasets will be available through the EMODnet portal. The dataset "RSL: Lagoon Monitoring Network..." from IFREMER had been postponed to be delivered through EMODnet 3. The 2 datasets from IMARES, two datasets from IMAR and the dataset "Black Sea Mnemiopsis leidyi and Beroe ovata database" from IBSS have not been delivered.

Despite the fact that all partners have been continuously asked about the status of data delivery throughout the project, many datasets (25 of 131 = almost 20%) were delivered during the final month and some are still to be delivered. Possibly shifting the deadline of delivery of the datasets might improve this situation but this activity is probably the most labour intensive and subject to specific data policies and embargo periods, so specific delays can always be the case.

#### **Data products:**

Products resulting from temporal series were built through sliding series. However, spatial gaps in early periods prevented complete spatio-temporal coverages

Interpolation using DIVA requires the availability of zero observations: a list of stations where a species or taxonomic group could have been found, but was absent. In many datasets that we tested it was relatively easy to reconstruct the zeroes, even if only presences were recorded in the database. From the overview of sampling effort, or from the complete list of presences, it can be deduced where sampling took place. Meanwhile, a large part of available species distribution data is presence-only, with little opportunity to reconstruct the zero observations, because basic information on sampling effort is lacking. The DIVA methodology used is unable to use these data sets. Other approaches, e.g. MaxEnt modelling, can probably be used for this purpose, but the quality of the estimates is highly dependent on the availability of appropriate environmental predictors. However, for data-sparse areas such as the Mediterranean Sea it could be considered to use alternatives based on modelling presence-only data as a temporary solution.

Among the occurrences from a same data set, the taxonomic resolution was either at the species level or at higher levels. Therefore, higher taxonomic levels were preferred in some cases; for instance, organisms were considered either at the genus level when a large proportion of occurrences of this genus was not documented at the species level, or family if genus were not identified, etc. This was especially the case for mammals from the North Sea where seals were considered at the family level (Phocidae) and "whales" as the non-dolphin species within the order Cetacea; moreover, the scarcity of these taxa prevented a seasonal mapping.

## 5. Analysis of performance and lessons learned

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### Reluctance to share data

Barriers to share biological data is a sensitive issue. Although these barriers were not so numerous, data access would have substantially enabled to increase the geographical coverage in EMODnet Biology, notably the deep seas beyond shelves where overfishing is reported and in the Mediterranean Sea, a largely absent area from the project. Such a barrier is difficult to overcome as it requires political authority. In the Mediterranean, contact persons/institutions for accessing such data were difficult to find; anyway, possible existing data sets were not ready for dissemination as an ongoing project, IRIS-SES (IRIS-SES, 2013), aiming to compile meta-data sets in the Mediterranean and the Black seas, was only starting.

In the case of Russia and two other former USSR Republics, 15 colleagues over 18 refused to participate for institutional, personal or technical reasons. For those who personally do not want, we can infer from other experiences that these colleagues are afraid that other colleagues publish results with their data and before them. Unfortunately, this not something that can be solved easily because it is related to evaluation of teams and careers of staff. It is urgent that international organizations (ICSU, IBSU, UNESCO, RDA) propose new mechanism so data can be shared without affecting these evaluations.

In the case of IBSS NASU, it was often the lack of metadata that prevents more data to exposed. In other words, they are some fields where nobody knows what it contains in terms of unit, protocols of data acquisition and treatment. This case is both the responsibility of institutes to organize correctly the archiving of datasets, and researchers themselves to support the conditions of archiving after a project is finished: curate the data properly, detailed documentation, and release in the institute repository.

At the start of the project it was specified which data could be shared and which couldn't. Despite this, for some datasets discussion arose about making (part of) the data only available by negotiation. For example, some datasets were initially delivered without the promised abundance data. When the responsible partners were confronted with this, in some cases the abundance data was delivered afterwards. In other cases, the abundance data was provided but processed in a way which would make it less useful than the original data. The general feeling is that data delivery might go smoother if funding would be more closely related to the actual delivery of the promised datasets.

### Registration and ownership

When providers are retired or have lost contact after moving in another institute, the institute in some cases does not follow up. This problem, certainly general, happens when the institute does not have a proper repository of the datasets that its researchers generate. This should be taken into account for the management of IPR and plan the possible change of license when the contact is lost, allowing the aggregator to continue the dissemination of the data. This is a point of serious concern.

### **(2) The challenges to rendering data interoperable including different measurement techniques, different baselines, different standards, different nomenclature etc.**

Extending data sets with different data holders can be envisaged if holders/managers are involved in a same process. International monitoring should be developed in order to improve interoperability and to standardize data recording from European seas. Currently, the national and regional monitoring approaches vary within Europe and some aspects need to be harmonized in the light of the Marine Strategy Framework Directive (MSFD): the ecosystem-based approach, the development of benthic indicators, the definition of “pristine” or sustainable conditions, the detection of pressures and the development of common monitoring programs among EU members (van Hoey et al., 2010). Such initiative warrants equitable benefits among participants and enable data access/exchanges.

Standardizing units of measurements was challenging, requiring numerous exchanges with providers to be sure to understand what the unit was. For example, the dataset of Villefranche-sur-Mer is a long time series of daily sampling, but the samples are mixed per week. However, for some week, due to sea conditions, holidays, etc., the number of days is not the same. Correct indication of the unit was difficult to choose. In this cases, metadata are extremely important.

About nomenclature, the older the dataset is, the more they are names that do not match with WoRMS. This is specially the case of combinations that are not in use anymore since 1950s. The WoRMS Data Management Team has always been helping in asking the relevant taxonomic editor to enter those missing, although there is a legitimate reluctance to enter names in WoRMS that were used only once. In that case, we have adopted the AphiaID the closest to the indicated name. For example, in the case of missing name Genus1 (Genus2) species1 was use, Genus2 as a subgenus, we have used the AphiaID of the existing name Genus2 species1. But we indicated in remarks the name as used in the publication. However, there are discussions on WoRMS to store these names separately just for matching purposes. Obviously, it requires experienced persons well aware of the taxonomy and nomenclature to perform thorough quality control in general when the dataset comprises several taxonomic groups. For current databases still active, they must manage their own taxonomy with a joint table with the taxon of the lowest inclusive rank. For example, we had to deal with such things as “Brown turf algae”, that we associated with Phaeophyceae. It adds much more flexibility to ecological studies, where usually, a mix of scientific name, temporary names (sp.1, sp.A) for potential new species or unidentified species, uncertain names, ecological group names, ... are used.

The use of different data transfer protocols was promoted above exchange through simple .txt or excel format as the development of a data exchange protocols at the partner institutes would make it more efficient for them to provide updates of their monitoring datasets, and allows EurOBIS to write data harvesting protocols which would reduce the effort at the EurOBIS side as well. For the IPT such a script is currently in use, as is for certain web services. It was intended to create a script to automate data transfer from the buffer which SeaDataNet installed for EMODnet Biology, however as most datasets were actually harvested before they became available through the buffer it was considered that at the moment the effort needed to create this (very complex) script would greatly outweigh the effort needed to harvest the datasets manually. When more dataset become available through the buffer and partners start updating their datasets, this situation will change and a more automated harvesting procedure will be developed.

**(3) The challenges to producing contiguous data over a maritime basin from fragmented, non-homogeneous data and how to overcome these challenges.**

During the project, when data sets of a same ecosystem component were available, the most difficult was the sampling compatibility. For instance, the Swedish SHARK and Danish ODAM data sets (benthic macroinvertebrates from the Baltic Sea) comprise a high number of yearly samples and both extend over many years. However, only certain years and months were in common so that a large number of data were not exploitable. Another example is the North Sea Benthos Project (NSBP) which integrates macrobenthic infaunal data available from various sources extending from 1992 to 2002, including national monitoring surveys, in North Sea soft bottom sediments. Although its spatial sampling density and its species richness exceed the previous NSBS (1986), this data set is poorly exploitable mainly due to different sampling gears (e.g. grab vs. box-core) to which benthic communities respond differently in density and species richness. Again, international coordination is required to ensure consistency at large spatio-temporal scales.

**(4) The fitness for purpose of the data for measuring ecosystem health of the maritime basin and what might be done to overcome any shortcomings.**

The elaboration of indicators of environmental health requires to define a reference state (or boundary conditions) of an ecosystem component in the absence of human-mediated stress/disturbance. Every ecosystem component (plankton, fishes, birds, mammals, invertebrates...) can exhibit spatial and temporal variations in abundance/biomass due to non-human-mediated environmental variability, often called “natural”. Hence, in the presence of human activities deleterious to the ecosystem, human-mediated environmental variability can be confounded with the natural one: this is typically the case when comparing beam-trawl fishing and natural water velocity and wave energy observed in extreme natural conditions such as extreme bottom water velocities and storms abrading the seafloor; effects can be similar on benthic macroinvertebrates (Kenchington et al., 2001; Lindegarth et al., 2000; Queirós et al., 2006). Although statistical techniques to disentangle these confounding effects are available, monitoring the different human activities is crucial to 1) identify true



correlations and 2) to reconstruct a reference state (Beauchard et al., 2016). Centralising high quality data on human pressures like on the EMODnet Human activities portal will encourage the development of ecological indicators as required by the MSFD.

Additionally, with the relevance of the previous points concerning the need of international coordination, a perfect complementarity between WP2 (biological traits) and WP5 within EMODnet Biology can also support a sound development of indicators of environmental health. Incorporation of biological traits indicator development is an approach initially developed for terrestrial ecosystem studies, in freshwater and terrestrial vegetation (Bonada et al., 2006; Stutzner and Bêche, 2010). After nearly 20 years of works on this aspect in freshwaters, Stutzner and Bêche (2010) concluded that biological traits present the undeniable advantage to link theory and application in different ecosystems, and highlight the potential of using multiple biological traits to predict the effects of multiple anthropogenic stressors (page 110):

*“...resolving the effects of multiple human-caused stressors on ecosystems requires a high diversity of response variables that react mechanistically to specific stressors so that their responses can be a priori predicted. Currently, we do not see any other approach than the use of multiple biological traits that meets these requirements.”*

Species distributions are patterns and patterns are phenomena without mechanisms, a mechanism being the interplay between variables (Rosenzweig and Ziv, 1999). This is why that the use of multiple traits, as variables describing species performances, can enable to generate laws, patterns with mechanisms, and hence theoretically-sound indicator developments. For fifteen years, the use of biological traits has received a growing interest in marine ecology, but the development of indicators derived from biological traits have been curbed by the lack of biological data compilation and the lack of simultaneous data recording on biota (i.e. species distributions as mapped in WP5) and human pressures at the large scale (Beauchard et al., 2016). Therefore, standard monitoring efforts are, again, needed at the European scale and that any of the EMODnet projects (Biology, Human activities, Geology, Chemistry, Bathymetry, Physics, Habitats) can be neglected to promote future developments of robust European indicators.

Thus, **an overall long term sampling strategy should be designed for the future**. But when it comes to visit the past, we have to cope with patchy data, both in time, in space and in taxonomic group. Any type of occurrence should be recorded and databased. But not all can be used for all purposes depending on their precision, their frequency in space and time. When one constitutes a data, one has to filter the data.

If fragmented dataset are integrated, the parameters measured must be the same, but differences in the frequency of space and time must be managed with some statistics. If not, or if one tries to infer the status of biodiversity in more or less remote areas from a unique dataset, it requires some datasets



from these areas, at least to calibrate the correlations between the variations of the different area. For instance, the data off Villefranche-sur-Mer Bay from 1959 to 2010 (and from 1898 to 1917) corresponds to one station only, Point B, where zooplankton is sampled every working day. It is a nice long term series to study changes over years and over seasons. In fact, the first analyses allowed to refine the protocol: it was shown that daily variations are not significant. Rather the daily samples are mixed together over one week, which eliminate stochastic daily variations. But additional data from a larger area around Villefranche should be gathered to analyze to which extent the results of point B represent the same variations in Nice, Cannes, Toulon or Marseille westwards, and Monaco, Menton, Vintimiglia or Genova eastwards.

The Villefranche Point B series illustrates the necessity of good metadata. At one point in time of the series, the type of plankton net changed, which must be taken into account when analyzing data before and after that event. Another change in the protocol more recently occurred: the specialists in charge of the identification of planktonic species are now all retired, which affects the taxonomic precision, and consequently the results of some analyses. Depending on the biodiversity indicators that are computed, we may conclude to false degradation of plankton biodiversity.

**(5) The priorities and effort required for improving the accuracy, precision and coverage of the data collated including a description of how an appropriate data quality assurance and control system can be established.**

On our experience, in EMODnet and other projects, a dataset of significant size (ca.5000 records, 20 fields) that has been reasonably quality controlled by the owner contains 20% of records where there is at least one error, minor or major. About 10% are usually corrected easily and semi manually (e.g., by queries); for the last 10%, we are in the plateau part of the sigmoid that represent the level of quality in function of time. Here, usually it requires to go back to the source of data. And it takes 10 times more than checking the 90%. If the error is in the source is not a result of the data entry, it is always sensitive to take the decision to “correct” the data.

If the time of a project is limited, one decision can be taken to flag this 10% records as unreliable than spending much time correcting for an uncertain result. Or to limit the time that one can spend. It is in general not a good idea to delete these records because the next user may question why obviously there are records missing. Rather keeping the record but flagging as unreliable is better.

Therefore, it is essential that a flagging system developed. This was the conclusion of a workshop held during ENBI (European Biodiversity Information Network) project. This flag should indicate the reliability of the record, and is best established by the providers who know their dataset the best.

On the other hand, there could be another type of indicator, this time set up by the aggregators, indicating how a record fits for what type of analyses (the most common).

A number of error detections can be implemented through automatic procedures carried out by computers, and corrections applied by data managers. But more errors can be detected by experimented people. These errors are semantic and requires a good knowledge of geography, taxonomy, oceanography, etc. It can be performed only by specialist who unfortunately do not have time for such activities. There should be a small project that studies how to involve specialists, and how to reward them.

## **(6) The performance of the chosen portal technology in terms of speed of response, user-friendliness.**

### **IPT**

During the timeframe of EMODnet, a new version of IPT was released. In addition, at the same time the new schema for environmental data was set up by OBIS. To do that, it was necessary to define the EventID, and to properly relink the tables. It still unclear if the star schema set up by GBIF can be matched to the OBIS, this is still under investigation between OBIS and GBIF. Some of these technological changes during the lifetime of the project delayed the release of the datasets.

### **Data encoding schema**

On the one hand, the DwC schema was the proposed data encoding format to data managers. However, DwC is a data exchange format that theoretically should be generated and read only by computers; only the matching phase should be performed by a human. This schema forces data managers to repeat the same information sometimes in thousands of rows.

The issue that we encountered at quality control level is that despite all the care that data managers can take, we discovered inconsistencies in these repeated lines, especially in long text fields like the name of the source and the reference citation. The most common is the extension in the spreadsheet of a cell down the rows generating a +1 increase if the last character in the cell is a digit (e.g., for authorship, the consecutive rows for the same scientific name is Linnaeus, 1758 / Linnaeus, 1759 / Linnaeus, 1760, etc.). It means that these types of check have to be performed systematically for all records, which lengthens significantly the quality control process.

On the other hand, while performing a semantic analysis of the MedOBIS database schema (Allocca et al., not publ.), we discovered that each data structure extracted from a paper is a subset of a very complete and complex schema of sampling events taking into account various gears, various parameters, various depths with possible replicates (and subsampling). This complexity is now reflected in the OBIS Environment data schema (in prep.). Our experience showed that data managers have some difficulties to manage the coding (= affecting a unique ID to station, sampling and replicate codes), because the data schema they encounter in papers never fits strictly with the complete and complex schema or with the DwC. In many cases, we had to help data managers, or to review the dataset during the quality control phase.

From the two issues listed above, our recommendation is to help data managers at the very beginning of the data encoding process to establish a schema that will 1) minimize the repetition of identical data; 2) fits as closely as possible to the layout of data in papers. Then, the standardization to fit the final database (here MedOBIS) should be done by its (team of) professional manager, over which the final and minimal quality control can be performed. The DwC is then generated by the IPT.

The work is less generic for the final database managers, but in the end, the quality control is much more straightforward (e.g., compare the same data layout in the paper and in the encoding file) and the quality of the dataset is higher.

### **Training data managers**

Training data managers is very challenging, especially when they are not accustomed to the database mind-set. In addition, the investment in training is costly, and would rather target data managers that will continue to encode data long after the end of the project or training.

## 6. Analysis of sustainability

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### **The governance model: an open access community and data sharing attitude**

In general, we can say that biological data accessibility has grown a lot since the EMODnet project started 7 year ago. For a large portion of the data there is extended data such as abundances and biomass information available and a network of data sharing organisations has been established. However, barriers to share biological data remains a sensitive issue and the European network of biological data producing institutes is large. A mechanism to include all stakeholders is therefore not trivial and should include 1) financial resources to manage, format and quality control the marine data 2) create an open community that recognized the advantages and 3) have national support to collaborate in the pan-European initiatives.

### **Resources needed: A plea for professional data manager position in research institutes**

From the recommendations about the data schema and the training workshops, and the experience in the data management, there is one logical conclusion: **the number of professional data manager permanent positions should be increased.**

Training data managers during 3-years projects, both occasional or professional, is not efficient in the long-terms in terms of data encoding speed, and data quality. In particular, a thorough quality control requires much experience. Large data aggregators such as GBIF, OBIS, DATRAS and FishBase, and others are often criticized by colleagues to deliver data with a quality level lower than what they expect, in a few papers and many oral remarks during conferences. However, the origin of errors is much less at the aggregator level than at the source data themselves. The feed-back loop between the aggregator and the provider must be improved, although it is often difficult for the provider to integrate corrections. And indeed, using data from these large aggregators still requires a critical review each time, and applying filters.

In the era of Big Data in biodiversity domain, and if the targeted goals are to aggregate, share and publish as many of good quality data as possible, each biodiversity research institute should have one or several professional data managers, helping researchers and technicians to create good quality datasets, well curated and documented, for sharing and publication including through large aggregators. This has been proven by the success of WoRMS and FishBase cases among others, where some data managers are employed for more than 10 and 25 years resp.

## 7. User Feedback

Date	Organization	Type of user feedback (e.g. technical, case study etc.)	Response time to address user request
May 2014	EMODNet Secretariat User feedback	Detailed user feedback report from the EMODnet Secretariat regarding search and visualization, data download, documentation, QA/QC issues	The simple requests were directly implemented on the EMODnet Biology Website, including an updated manual, change of order, page with deliverables. The requested functional adaptations, such as improved geographic selection, qc selection, and improved performance were included in the user and functional analysis of the update of the portal.
February 2014	Finnish Environmental agency	Request for cooperation, data provision to EMODNet biology	Institute collaborating with EMODnet Biology.
May 2014	BONUS	Possible collaboration with EMODnet Biology	Ongoing
June 2014	ICES	Provide EMODnet gridded abundance data products based on monitoring data from the CPR dataset as Operational Oceanographic Products (OOP) to ICES	OOPS products are served to ICES and taken up for the Ecosystem assessments
June 2015	OSPAR Secretariat	A document (ICG-COBAM (1) 15/3/2) was submitted to ICG-COBAM to indicate the products that EMODnet biology is currently developing that were considered to be of potential interest to ICG-COBAM.	It was expressed there is potential that appropriate products could be developed, but this would require dialogue with the expert groups in the

			design and planning of any
June 2016	JNCC	Searching for a unique sample identifier, i.e. a code that links together all species records obtained from the same sample	Referred to the EVENTID
June 2016	CEFAS	Looking for collaboration	Under discussion
2014-2016	Numerous	Several requests for specific data & datasets	All replied within 1-2 days.

Table 13. Overview of the user feedback

## 8. Allocation of project resources

Please provide information about the effort (percentage of project resources) spent during the whole project on the following groups of activities: (i) collecting, harmonising and giving access to data; (ii) creating data products; (iii) developing and overview of the user feedback and training IT; (iv) management and reporting; and (v) answering questions and other communication activities.

<b>Tasks</b>	<b>Percent of total budget spent</b>
Project management (cfr IV)	7,4 %
Identification and collection of species, species attributes and species indicator information	14,7 %
Data access to marine biological data (cfr I)	31,2 %
Data archaeology and rescue (cfr I)	8,2 %
Creation of gridded abundance data products (cfr II)	19,6 %
Technical development (cfr III)	10,6 %
Organisation scientific workshops and meetings (cfr IV)	8,2 %
<b>Total</b>	<b>100 %</b>

Table 14. Overview of allocation of project resources

## 9. Outreach and communication activities

Please list up all the relevant communication activities or products you have developed/executed during this period (preferable in a table) and highlight the 5 most important ones. This can include presentations, lectures, trainings, demonstrations and development of communication materials such as brochures, videos etc. This can also include scientific papers and/or popular articles you know have been published using/referring to the work developed in EMODnet.

Date	Media	Title	Short description and/or link to the activity
17-20 September 2013	Oral presentation	Status EMODnet biology	The EMODnet Biology project was presented at the MARES 2020 Meeting in Varna, Bulgaria.
10 January 2014	Oral presentation	EMODnet biology project	Presentation at Innovocean site (VLIZ, IODE-IOC-Marine Board) about EMODnet biology
19-20 February 2014	Oral presentation	Status EMODnet biology	Presentation of EMODnet biology at MODEG meeting
<b>04 March 2014</b>	<b>Oral presentation</b>	<b>EMODnet Biology</b>	<b>Speed-pitching presentation at high level HOPE conference</b> <a href="http://ec.europa.eu/environment/marine/hope-conference/pdf/SP2.%20EMODNet%20Biology%20Claus.pdf">http://ec.europa.eu/environment/marine/hope-conference/pdf/SP2.%20EMODNet%20Biology%20Claus.pdf</a>
07 March	Oral presentation and demonstration	EMODnet	At VLIZ Young Scientists Day, short presentation and demonstration on EMODnet central portal
09 May 2014	Presentation	BONUS-EMODnet Meeting	Meeting with EMODnet Secretariat and BONUS, presenting the activities of EMODnet Biology
13 May 2014	Presentation	Capturing fossil information in the Aphia database	In framework of a WoRMS related workshop, the EMODnet activities



			on species traits were explained, including how the WoRMS editor community could contribute to the documentation of species traits through the planned traits portal.
26 May 2014	Presentation	Alien Species @ VLIZ	Presentation on all VLIZ activities related to alien species, including the activities of EMODnet WP2, where the documentation of alien species is part of the species traits activities. Data products of WP5 were briefly mentioned to show the possibilities of these products
26-28 May 2014	Presentation	WG DIG Meeting	Presentation on EMODnet and EMODnet Biology at yearly DIG (Data and Information Group) Meeting. Explore opportunities to organize EMODnet Biology Year three meeting back to back with ICES Annual Science conference (2015).
3 June 2014	Presentation	QC, SDM and data products.	Short overview of WP5 data products at LifeWatch Technical workshop. High quality species observation data (OBIS QC), species distribution modelling pipeline and expected applications and data products.
14-20 June 2014	Presentation and training	JERICO summer school	Presentation and exercise on marine biological data given in joint session with ICES datacentre
9/09/2014	Presentation	EMODnet biology	Meeting with regional sea commissions, EEA and ICES on cooperation within framework of MSFD
02/10/2014	Presentation	EMODnet Biology	Presentation of EMODnet biology, and the data products currently developed to ICG-COBAM expert group of OSPAR

06/10/2014	Presentation	EMODnet biology	Speed pitching presentation of EMODnet biology at EMODnet pre-event at Eurocean meeting
20-21/11/2014	Presentation	Data exchange mechanisms developed under EMODnet biology	Presentation at EEA workshop: Options for reporting of MSFD biodiversity indicator.
20/02/2015	Presentation	EMODnet regional gridded abundance products: a tool to facilitate ecosystem assessments	Presentation on EMODnet biology data products during the VLIZ Young Marine Scientists' day (> 300 participants)
20/02/2015	Demonstration	EMODnet biology	Demonstration of the EMODnet biology data portal during the VLIZ Young Marine Scientists' day (> 300 participants)
<b>02/07/2015</b>	<b>Presentation</b>	<b>EMODnet</b>	<b>Presentation EMODnet at the European Parliament Intergroup – Seas, Rivers, Islands and Coastal Areas “Marine Data: What role for Europe?” – with focus on MSFD related data</b>
02/07/2015	Presentation	EMODnet biology	EMODnet-JRC seminar
29/05/2015	Digital news item	Renewed emodnet-biology.eu for an even better unlocking of European marine biodiversity data	News item on VLIZ website and in VLIZ digital newsletter <a href="http://vliz.be/en/news?p=show&amp;id=4174">http://vliz.be/en/news?p=show&amp;id=4174</a> <a href="http://www.vliz.be/docs/vlizine/vl_16_5.htm#2.2">http://www.vliz.be/docs/vlizine/vl_16_5.htm#2.2</a>
22/09/2016	Blog Page	An interactive place where readers can come to share their thoughts on the products EMODnet biology is developing. The blog will contain short descriptions of the methodology, outcome and impact of the data products of marine species and can include	First Blog, an operational zooplankton data service, retweeted 30 times. <a href="http://www.emodnet-biology.eu/blog/oops">http://www.emodnet-biology.eu/blog/oops</a>

		data driven applications. Feedback can be posted using #emodnetbiology in Twitter.	
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Table 15. Overview of the communication activities

Date	Location	Topic	Short Description
11-12 September 2013	VLIZ, Oostende, Belgium	Kick Off Meeting	General meeting, with 39 people, representing 23 institutes
16-17 December, 2013	JPI, Brussels, Belgium	EMODnet Steering Committee Meeting	Overview EMODnet biology activities at steering committee meeting
23-24 January 2014	Yerzeke, Netherlands (NIOZ)	WP 5 Workshop	Technical workshop on the creation of data products
12- 13 February 2014	Paris, France (Ifremer)	EMODNET Biology: Species Traits Vocabulary Workshop (WP2)	The aim of the workshop was to progress the development of a unified vocabulary for species traits information, and to ensure engagement with the scientific community.
2 March 2014	Oostende, ILVO	WP 3	Meeting with ILVO on data transfer to EMODnet
26-27 May 2014	Ispra, Italy	WP2	Meeting with EASIN to discuss collaborations on species traits, more specifically related to alien species
4-5 June 2014	CNR, Rome	EMODnet Steering Committee Meeting	Overview EMODnet biology activities at steering committee meeting
11 June 2014	NIOZ, Yerzeke	WP5 Meeting	Discuss progress regarding WP5 (Gridded abundance)

			products)
26 June 2014	Oostende, VLIZ	WP3 Meeting	Meeting with ILVO on data transfer to EMODnet
09 September 2014	DG MARE, Brussels	EMODNET-MSFD Meeting	A meeting was held at DG-MARE to discuss the possibilities of EMODNET for the MSFD. EMODnet Biology was invited to attend a joint OSPAR-HELCOM COBAM meeting, presenting the results to the experts.
1. 17-18 September 2014	IMAR, Horta, Azores	EMODnet Biology Second general Meeting	The second general meeting was organized by IMAR. 33 participants discussed the current status and second years' activities of the EMODnet biology project.
<b>2. 1-2 October 2014</b>	<b>OSPAR-ICG-COBAM Meeting, Sweden</b>	<b>OSPAR ICG COBAM &amp; CORESET, HELCOM Meeting</b>	<b>Attending CORESET and ICG-COBAM Meeting on MSFD biodiversity indicators, and presenting activities EMODnet biology.</b>
<b>3. 6-8 October 2014</b>	<b>CNR, Rome</b>	<b>Eurocean Meeting and EMODnet pre-session</b>	<b>Presenting EMODnet biology at EMODnet session.</b>
4. 20-21 November 2014	EEA-Copenhagen	Options for reporting of MSFD biodiversity indicators	The aim of the workshop was to further explore and develop the collective understanding regarding biodiversity information flows and associated reporting requirements under the MSFD art 19.3

5.	9-10 December 2014	DGMARE-Brussels	Steering Committee Meeting	EMODnet Steering Committee meeting
6.	03-04 February 2015	PANGAEA , Bremen	Meeting dataflow PANGAEA and EMODnet biology	Current state of the dataflow between PANGAEA and EMODnet biology. Review how EMODNet displays and serves data and metadata from PANGAEA.
7.	27 February 2015	DGMARE-Brussels	EMODnet-MSFD Meeting	The objectives of the MSFD-EMODnet coordination meetings is to identify opportunities and issues of common importance between MSFD and EMODnet
8.	11-12 March 2015	Oostende, VLIZ	WP5 Workshop	WP5 Workshop on data product generation
9.	1-2 April 2015	Oostende, VLIZ	WP5 Workshop	Hands on workshop to create EMODnet biology and OOPS data products
10.	08-11 June 2015	Crete, HCMR	EMODNET WP4 Workshop: Mechanisms and guidelines to mobilize legacy biodiversity data	The presentation of tools and state-of-art approaches in mobilizing of historical data, a hands-on evaluation of these tools by a group of data managers, a discussion on further improvements of such tools and downstream integration into literature and data repositories – participation of WP4 partners and partners from EU-GEOBON project.

11. 09-10 June 2015	Crete, HCMR	EMODNET Biology: Marine Species Traits Workshop	This two-day workshop developed further a framework for the description, collation and dissemination of traits information relating to marine species.
12. 30 June-2 July 2015	ISPRA, JRC	EMODnet-INSPIRE workshop EMODnet Steering Committee Meeting	Workshop on information exchange between INSPIRE and EMODNet. Presentation result EMODnet Biology at Steering Committee Meeting
13. 29 July 2015	Oostende, VLIZ	WP5 Meeting	Discussion with NIOZ-VLIZ on deliverables for WP5 before next reporting.
<b>October 2015</b>	<b>Oostende, VLIZ</b>	<b>Jamboree</b>	<b>EMODnet Biology general meeting as part of the Jamboree Organisation</b>
June 2016	Oostende, VLIZ	WP2 Meeting	Workshop on marine species traits, linked back to back with the WoRMS Steering Committee Meeting

Table 16. Overview of the meetings and workshops

## 10. Evolution of Progress Indicators

### *Indicator 1. Volume of data made available through the portal*

On 15 June 2016 when this rapport was drafted, 21,328,561 occurrence records. In the EurOBIS database the scientific names are quality controlled by linking with an LSID to the World Register of Marine Species (WoRMS). There are currently **20,854,591** occurrence records with have such a LSID associated to them. For the non-matching names, actions are undertaken to sort these out. Unless stated otherwise, only these records are used in the data assessments in this report. See Annex 1 for the full list of datasets and records made available.

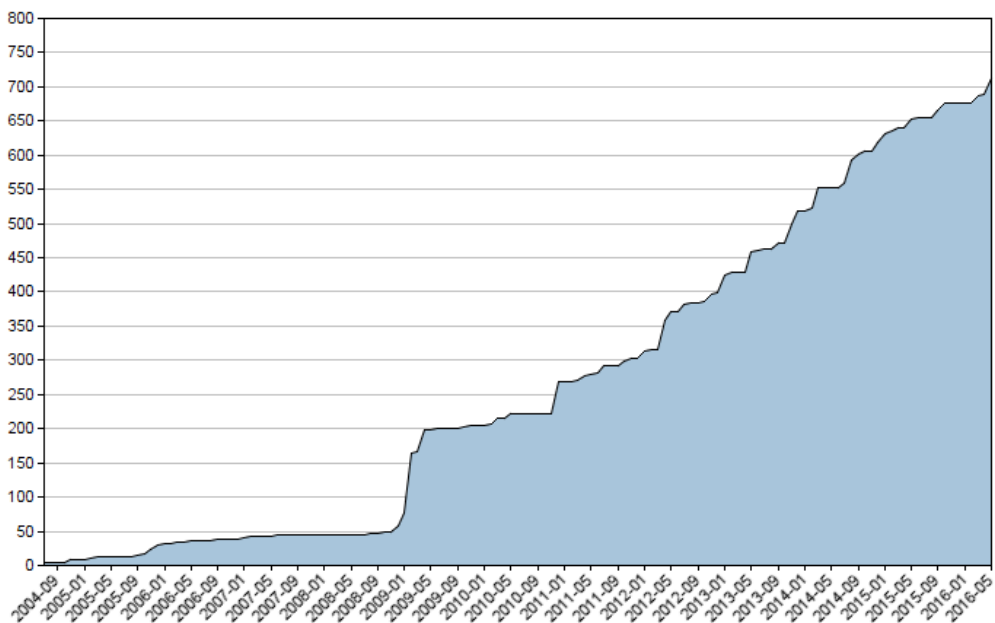


Figure 23. Evolution of datasets available through EMODnet Biology Data portal

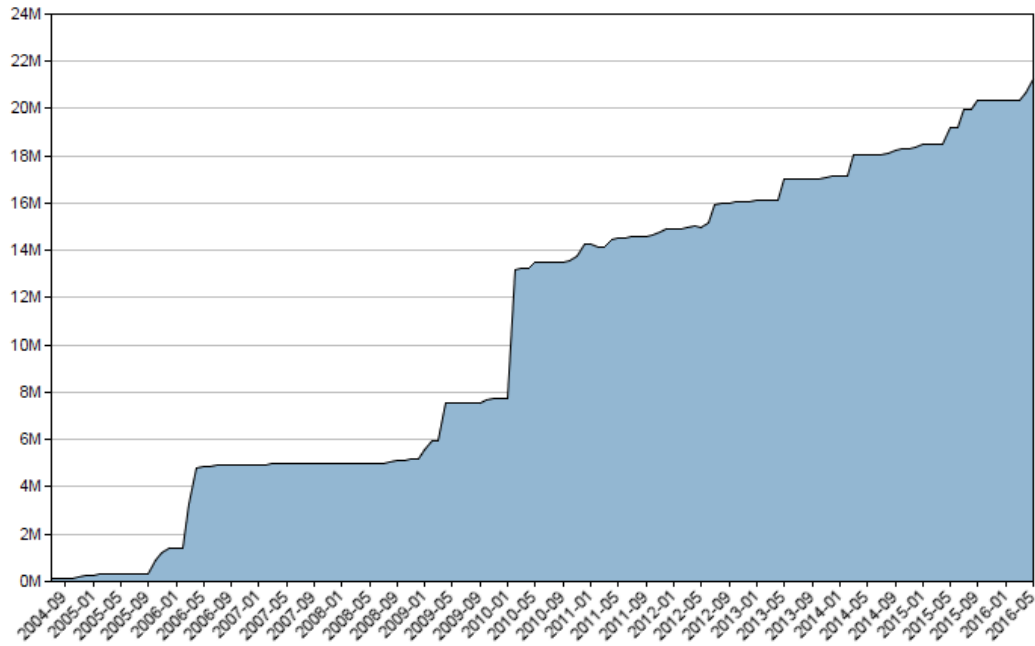


Figure 24. Evolution of the available distribution records (M=million) through EMODnet Biology Data portal



*Indicator 2. Organisations supplying each type of data based on (formal) sharing agreements and broken down into country and organisation type (e.g. government, industry, science).*

Annex 2 lists the data providing institutes, including the datasets that have been made accessible. We note her the number of data providing institutes per country during the reporting period:

BE	8
DE	5
DK	2
EE	1
EG	1
ES	5
FR	5
GB	11
GR	4
IE	2
IT	4
ME	1
NL	7
NO	4
PL	3
PT	2
RO	2
RU	3
SE	3
UA	1
US	1
TOTAL	75

*Table 17. Overview of number of data providing institutes per country*

*Indicator 3. Organisations that have been approached to supply data with no result, including type of data sought and reason why it has not been supplied.*

*MEDITS: The MEDITS survey programme (International bottom trawl survey in the Mediterranean) intends to produce basic information on benthic and demersal species in term of population distribution as well as demographic structure, on the continental shelves and along the upper slopes at a global scale in the Mediterranean Sea, through systematic bottom trawl surveys.*

*We contacted MEDITS but received no feedback. No reason was given.*

*ASCOBAMS: The Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area.*

*We had contact with ASCOBAMS, initially there was willingness to collaborate but finally no replies were given.*

*ESAS: European Seabirds at Seas:*

*Some stakeholders did not considered providing data to EMODnet as an added value for the organisation.*

*Indicator 4. Volume of each type of data and of each data product downloaded from the portal*

The table and graphic below show the number of downloads per data type per year.

The use of the different file formats may hint at how the users of EMODnet Biology use the downloaded data. The most preferred files formats .txt and .xls. KMZ is used to visualize and interact with the data set on a map viewer, html provides a web-based table while xml is the structured Darwin Core standard for describing the geographic occurrence of species.

Count of format Row Labels	Column Labels					Grand Total
	xml	htm	kmz	xls	txt	
2013	1	5	4	329	66	405
2014	3	6	25	168	196	398
2015	15	12	9	370	1233	1639
2016	2	10	11	687	71	781
<b>Grand Total</b>	<b>21</b>	<b>33</b>	<b>49</b>	<b>1554</b>	<b>1566</b>	<b>3223</b>

Table 18. Number of downloads per data type per year

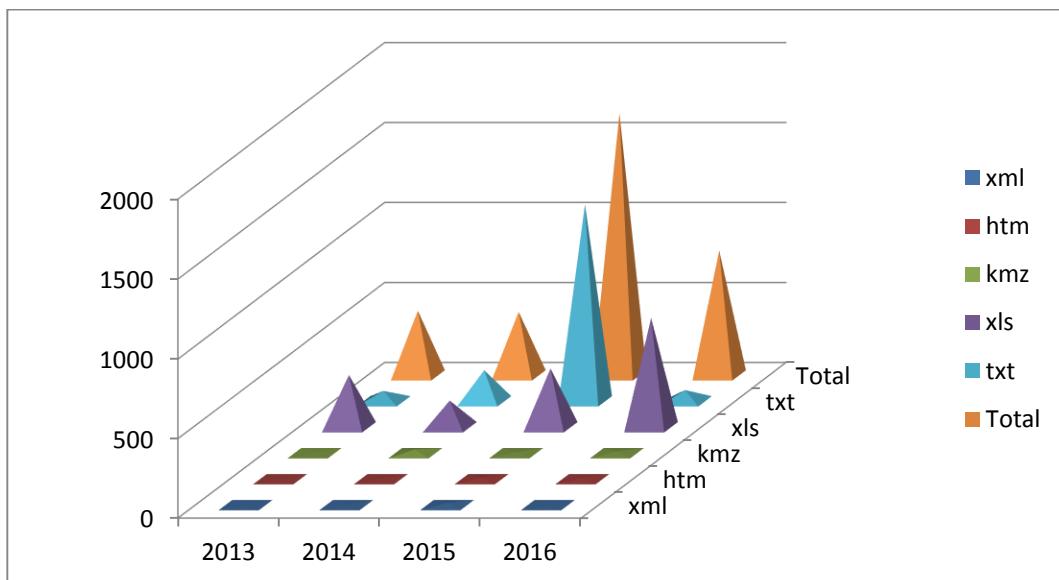


Figure 25. Overview of the number of downloads per data type per year

The table below shows the top 25 most recurring downloaded datasets. The diversity of data sets was further categorised into the species groups made available for selection on the website. There is a great interest in benthos with more than double the downloads of the second most searched dataset - mammals. It is also interesting to mention that the second to last entry on the table correspond to the download of all datasets available from the Data Download facility (shown on the graphic under category “all”.

Row Labels	Count of data
Dataset: North Sea Benthos Survey	33
Dataset: Marine Nature Conservation Review (MNCR) and associated benthic marine data held and managed by JNCC	15
Observations of <i>Caretta caretta</i>	13
Dataset: SHARK - Marine zooplankton monitoring in Sweden since 1979	11
Dataset: Phytoplankton North Adriatic-Gulf of Trieste LTER time-series	11
Observations of <i>Chondrus crispus</i> , including synonyms	9
Dataset: Macrozoobenthos data from the southeastern North Sea in 2000	9
Observations of <i>Alca torda</i>	8
Dataset: SHARK - Marine soft bottom macrozoobenthos monitoring in Sweden since 1971	8
Dataset: First satellite tracking of sea turtles in Albania	7
Dataset: Zooplankton monitoring in the Belgian Part of the North Sea between 2009 and 2010	7
Dataset: Phytoplankton North Adriatic-ALPE ADRIA Project	7
Observations of Mammalia, including child taxa	7
Dataset: SHARK - Marine phytoplankton monitoring in Sweden since 1983	7
Observations of <i>Delphinus delphis</i>	7
Dataset: Phytoplankton monitoring RADIALES - Section off Vigo (NW Spain, Galicia)	6
Dataset: Macrobenthos North Adriatic-ALPE ADRIA Project	6
Dataset: Mesozooplankton North Adriatic-Gulf of Trieste LTER time-series	6
Dataset: Small Cetaceans in the European Atlantic and North Sea (SCANS II) - 2005	6
Dataset: Microzooplankton North Adriatic-ALPE ADRIA Project	5
Observations of <i>Gadus morhua</i> , including synonyms	5
Observations of <i>Abra alba</i>	5
Observations of <i>Ziphius cavirostris</i>	5
Observations of <i>Meganyctiphanes norvegica</i>	4
Dataset: Network Monitoring phytoplankton	4

Table 19. Most popular datasets (\*VLIZ downloads have been removed)

Row Labels	Sum of Species Group
Benthos	76
Phytoplankton	35
Zooplankton	33
Mammals	25
Reptiles	20
Algae	9
Birds	8
Fish	5
<b>Grand Total</b>	<b>211</b>

Table 20. Most popular datasets by species group of the top 25 most downloaded datasets

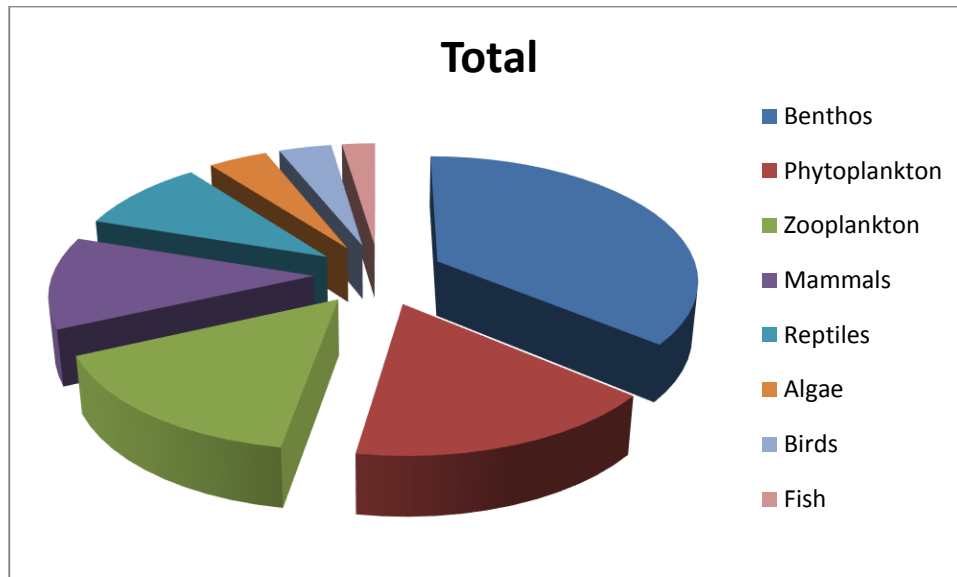


Figure 26. Distribution of downloaded datasets per species group

*Indicator 5. Organisations that have downloaded each data type*

The table below shows the top 20 organisations most frequently downloading datasets from EMODnet Biology. The vast majority of organisation are either Universities or Research institutes, but there are also representatives from NGOs (WWF), Government (Ministry of Environment - Peru), Industry (Ramboll, Deltares). It is also worth mentioning the presence of Organisations not affiliated with EMODnet.

<b>Row Labels</b>	<b>Count of organisation</b>
OGS	73
Ghent University	34
UTH	31
Muséum National D'Histoire Naturelle	30
Yale University	24
University of Hamburg	15
NIOZ	13
Ministry of Environment - Peru	12
Hellenic Centre For Marine Research	12
WWF	12
CNR-ISMAR Institute of Marine Sciences	11
SMHI	10
University of Sheffield	9
ILVO	9
Ramboll	8
Harvard	8
Deltares	8
University of the Aegean	7
Ifremer	7

*Table 21. Most frequent organisations downloading datasets (VLIZ downloads have been removed)*

*Indicator 6. Using user statistics to determine the main pages utilised and to identify preferred user navigations routes*

Year	Pages					Grand Total
	Data Products	Contribute	Data Catalog	Portal	Home	
2013		54	78	2944	3819	6895
2014		419	5309	6732	6955	19415
2015	306	212	7246	7442	10472	25678
2016	195	90	3292	3341	4152	11070
<b>Grand Total</b>	<b>501</b>	<b>775</b>	<b>15925</b>	<b>20459</b>	<b>25398</b>	<b>63058</b>

Table 22. Number of page visits per webpage per year

The table and graphic in this section refer to the number of page visits. The development pages, i.e., the pages not available to users yet with a high number of hits, have been removed to better illustrate the preferences of the users. The graphic below indicates that while the number of unique visitors as remained stable for the last year and a half of the project, there was a noticeable increase in the bandwidth. This increase is probably due to the efforts of EMODnet Biology in improving the usability of the website, for instance, by developing a new data download facility.

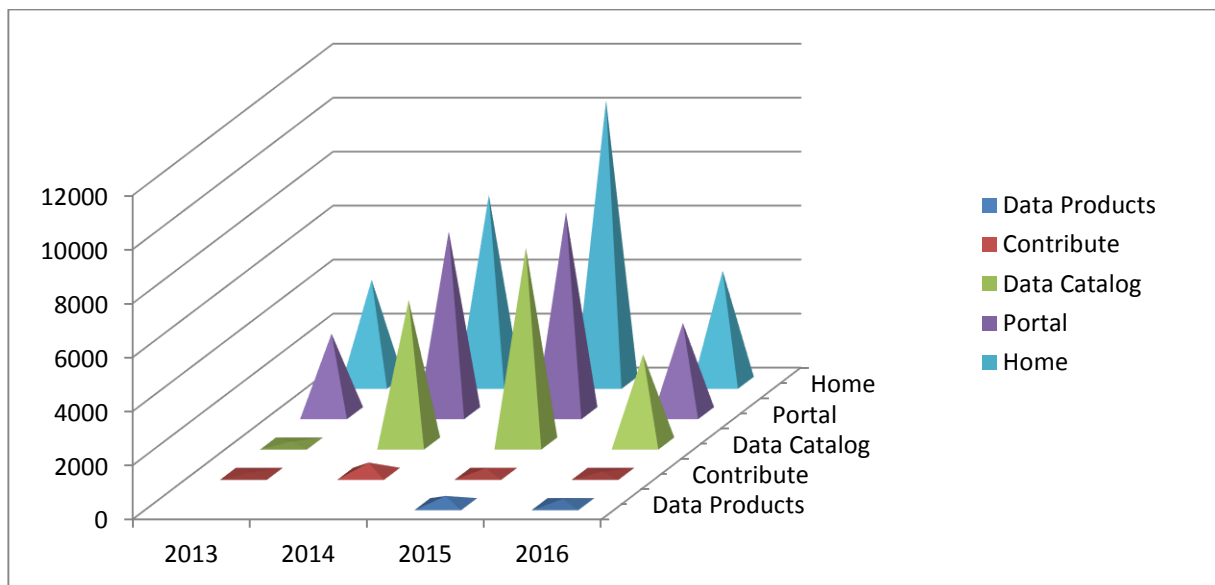


Figure 27. Number of unique visits per page of the emodnet-biology.eu website

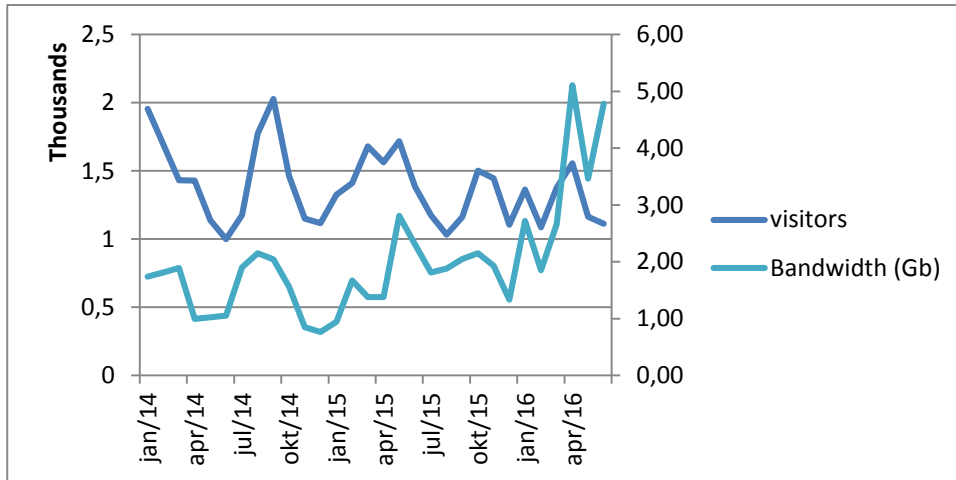


Figure 28. Evolution of number of visitors and bandwidth of the emodnet-biology.eu website



*Indicator 7. List of what the downloaded data has been used for (divided into categories e.g. Government planning, pollution assessment and (commercial) environmental assessment, etc.)*

One of the field in the Data Download form is “Data Purpose”. This field is a mandatory free text field, therefore there is a great variety of answers which have been categorised as follows:

Category	Keywords
Research	Research, science, study, compare, analyse
Testing	Test-
Training	Student, class, assignment, workshop, course
Modelling	Model-, script, package
Data Validation	Validate-, check, calibration
PhD / Master	Thesis, PhD, Doctorate, Master-
Undisclosed	NULL
NGO	Awareness, NGO, outreach
Pre Sampling	Planning, survey,
Industrial	Cable, project,
MSFD	MSFD

Table 23. Definition of download categories

The answers categorisations allow for a more comprehensive approach to assess the purpose for downloading data. Not surprisingly, Research is the primary reason for downloading biological data. “Testing” category accounts for users that answered “test” or “testing” as in a first try of the download tool. The value of the EMODnet Biology dataset for use in workshops, courses, and classes is highlighted by the 84 downloads in the category “Training”, as it its use in modelling and development of new products such as R packages.

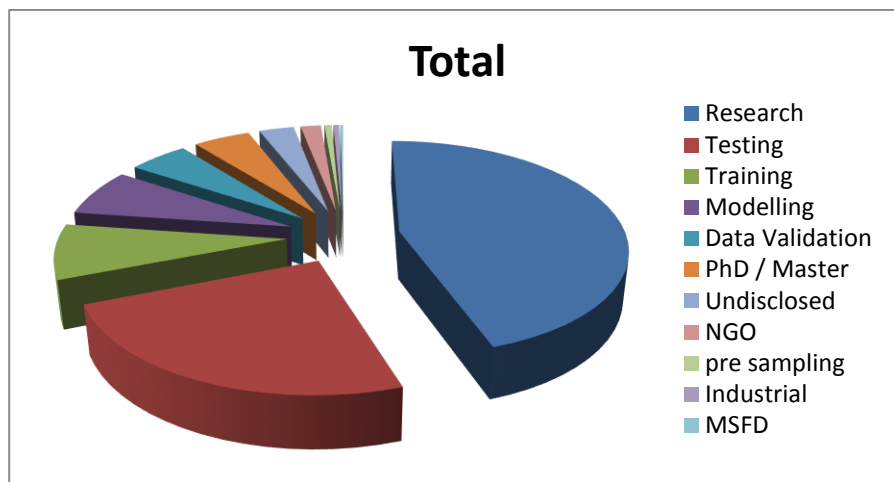


Figure 29. Distribution of the purpose of data downloads

*Indicator 8. List of web-services made available and user organisations connected through these web-services*

*WMS & WFS Services of qualitative and quantitative species observations – client EMODnet Central Portal*

*WMS request (GetMap):*

*Taxon observations within a radius of 1000 meter*

*[http://geo.vliz.be/geoserver/Eurobis/wms?service=WMS&version=1.1.0&request=GetMap&layers=Eurobis:eurobis\\_points&styles=&bbox=-10.2767171859741,45.5488891601562,14.0799999237061,62.2492446899414&width=512&height=351&srs=EPSG:4326&format=application/openlayers](http://geo.vliz.be/geoserver/Eurobis/wms?service=WMS&version=1.1.0&request=GetMap&layers=Eurobis:eurobis_points&styles=&bbox=-10.2767171859741,45.5488891601562,14.0799999237061,62.2492446899414&width=512&height=351&srs=EPSG:4326&format=application/openlayers)*

*WMS request (GetFeatureInfo):*

*[http://geo.vliz.be/geoserver/wms?TRANSPARENT=true&LAYERS=Eurobis:eurobis\\_points&VIEWPARAMS=AphiaID:141433&STYLES=Points\\_orange&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetFeatureInfo&FORMAT=image/png&SRS=EPSG:900913&EXCEPTIONS=application/vnd.ogc.se\\_xml&BBOX=-3711.442373,6579201.245941,225599.642451,6709144.194007&X=276&Y=108&INFO\\_FORMAT=text/html&QUERY\\_LAYERS=Eurobis:eurobis\\_points&FEATURE\\_COUNT=50&WIDTH=750&HEIGHT=425&server=geo](http://geo.vliz.be/geoserver/wms?TRANSPARENT=true&LAYERS=Eurobis:eurobis_points&VIEWPARAMS=AphiaID:141433&STYLES=Points_orange&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetFeatureInfo&FORMAT=image/png&SRS=EPSG:900913&EXCEPTIONS=application/vnd.ogc.se_xml&BBOX=-3711.442373,6579201.245941,225599.642451,6709144.194007&X=276&Y=108&INFO_FORMAT=text/html&QUERY_LAYERS=Eurobis:eurobis_points&FEATURE_COUNT=50&WIDTH=750&HEIGHT=425&server=geo)*

*WMS request (GetMap)*

*Taxon observations within a grid cell (6 minutes resolution)*

*[http://geo.vliz.be/geoserver/Eurobis/wms?service=WMS&version=1.1.0&request=GetMap&layers=Eurobis:eurobis\\_grid&styles=&bbox=-10.0,45.0,15.0,63.0&width=512&height=368&srs=EPSG:4326&format=application/openlayers](http://geo.vliz.be/geoserver/Eurobis/wms?service=WMS&version=1.1.0&request=GetMap&layers=Eurobis:eurobis_grid&styles=&bbox=-10.0,45.0,15.0,63.0&width=512&height=368&srs=EPSG:4326&format=application/openlayers)*

*WFS request (GetFeature):*

*[http://geo.vliz.be/geoserver/wfs?service=wfs&version=2.0.0&request=GetFeature&typeName=Eurobis:eurobis\\_points&count=10&VIEWPARAMS=AphiaID:141433](http://geo.vliz.be/geoserver/wfs?service=wfs&version=2.0.0&request=GetFeature&typeName=Eurobis:eurobis_points&count=10&VIEWPARAMS=AphiaID:141433)*

*Note: You can use 'viewparams' to select taxa eg.: VIEWPARAMS=AphiaID:141433.*

*WMS and WFS services of gridded data products of zooplankton abundances– client ICES - OOPS*

OOPS product per region. All data for OOPS are available in one layer: Emodnetbio:OOPS\_products

[http://geo.vliz.be/geoserver/Emodnetbio/wms?service=WMS&version=1.1.0&request=GetMap&layers=Emodnetbio:OOPS\\_products&styles=&bbox=-4.95,48.05,12.25,60.75&width=512&height=378&srs=EPSG:4326&format=application/openlayers&viewparams=scientificName:Large%20copepods;season:1;AphiaID:1080;startYearCollection:1958;endYearCollection:1967](http://geo.vliz.be/geoserver/Emodnetbio/wms?service=WMS&version=1.1.0&request=GetMap&layers=Emodnetbio:OOPS_products&styles=&bbox=-4.95,48.05,12.25,60.75&width=512&height=378&srs=EPSG:4326&format=application/openlayers&viewparams=scientificName:Large%20copepods;season:1;AphiaID:1080;startYearCollection:1958;endYearCollection:1967)

OOPS summaries: Average abundance (and standard deviation) for each oops region per timeframe.  
WFS (geojson, csv, ...)

[http://geo.vliz.be/geoserver/Emodnetbio/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=Emodnetbio:OOPS\\_summaries&outputFormat=csv](http://geo.vliz.be/geoserver/Emodnetbio/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=Emodnetbio:OOPS_summaries&outputFormat=csv)

## Annexes

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### ***Annex 1: Marine biological data in EMODnet Biology – new datasets made available during EMODnet II: 01/09/2013 – 01/09/2016***

No	Dataset Name	Records	Date harvested
1	Monthly variation in the macrozoobenthic community structure in Laki Lagoon (Evros Delta, N. Aegean Sea)	123	2013-10-11
2	Monthly variation in the macrozoobenthic community structure in Monolimni Lagoon (Evros Delta, N. Aegean Sea)	314	2013-10-11
3	Spatial distribution of the macrobenthic fauna in Laki Lagoon (Evros Delta, N. Aegean Sea)	35	2013-10-11
4	Syllidae, Magelonidae and Maldanidae from the Northwestern Coast of Egypt	40	2013-10-11
5	Polychaete Study in Northeastern Mediterranean Coast of Egypt	182	2013-10-11
6	Syllidae (Polychaeta) from the North Mediterranean Coast of Egypt	9	2013-10-11
7	Polychaeta from the Eastern Harbour of Alexandria	12	2013-10-11
8	Phytoplankton data from the Black Sea collected on R/V Professor Vodyanitskij in November 1991 (pv35)	2,298	2013-12-09
9	Phytoplankton samples collected near Sochi, Black Sea, in 1974-1975 (sochi_1974-1975)	2,034	2013-12-09
10	Phytoplankton data of Sevastopol Bay of the Black Sea during 1972	3,906	2013-12-09
11	Phytoplankton data collected in the Black Sea along the	771	2013-12-09

	Tuapse transect in August 1951		
12	Phytoplankton data collected in the Black Sea in February 1957	550	2013-12-09
13	Phytoplankton data collected during R/V Issledovatel cruise in September 1948	630	2013-12-09
14	Phytoplankton data collected during a cruise in the Black Sea in May 1957	677	2013-12-09
15	Zoobenthos data from different sources (collected and extracted from literature), personal archive of G.V. Murina (IBSS)	629	2013-12-09
16	Phytoplankton data collected during cruise 25 of R/V Skif (January 1990) in the Indian sector of the Southern Ocean	488	2013-12-09
17	Phytoplankton data collected during cruise 24 of R/V Skif (February - March 1989) in the Indian sector of the Southern Ocean	2,414	2013-12-09
18	Phytoplankton data collected during Second Ukrainian Antarctic Expedition (March-April 1998) on board of R/V Krenkel	2,345	2013-12-09
19	Microzooplankton data (Tintinnida) collected during First Ukrainian Antarctic Expedition (March-April 1997) on board of R/V Krenkel	165	2013-12-09
20	Microzooplankton data (Tintinnida) collected during 7-th Ukrainian Antarctic Expedition (March, 2002) on board of R/V Horizont (Bransfield Strait)	526	2013-12-09
21	Phytoplankton data collected during cruise 43 (February - April 1989) of R/V Dmitriy Mendeleev	186	2013-12-09
22	Phytoplankton data collected during cruise 38 (December 1986 - April 1987) on board of R/V Dmitriy Mendeleev	5,535	2013-12-09
23	Phytoplankton data collected during cruise 37 (second joint Soviet-American expedition) of R/V Akademik Korolev (July 1984) in the Bering Sea	3,049	2013-12-09

24	Phytoplankton data collected during cruise 22 of R/V Fiolent (December 1987 – April 1988) in the Indian sector of the Southern Ocean	3,072	2013-12-09
25	Phytoplankton data collected during First Ukrainian Antarctic Expedition (March 1997) on board of R/V Krenkel in Bransfield strait and region of Ukrainian Antarctic Station	787	2013-12-09
26	Environmental impact assessment of oil pollution accident in Gialova lagoon and Navarino Bay	1,312	2013-12-10
27	Zooplankton data collected during cruises on the R/V Knipovich in April 1950	774	2013-12-10
28	Phytoplankton data collected near Yalta, Black Sea, in June 1950	989	2013-12-10
29	Phytoplankton data collected during cruises on the R/V Knipovich in 1948 and 1950	1,132	2013-12-10
30	Phytoplankton data collected in deep waters of the halistatic region of the Black Sea in September 1948	808	2013-12-10
31	Phytoplankton data from the Sukhumi region, Black Sea, collected in November 1948	418	2013-12-10
32	Phytoplankton data collected during R/V Issledovatel cruise in October 1948	716	2013-12-10
33	Zooplankton collected in the Black Sea during Cruise 5 in February 1957	957	2013-12-10
34	Zooplankton collected in the Black Sea along the Yalta-Batumi transect in February 1951	1,230	2013-12-10
35	Zooplankton collected in the Northwestern Black Sea in 1952	2,846	2013-12-10
36	Epi- and hyperbenthic communities of Belgian sandy beaches	4,285	2014-01-17
37	Metabolism, reproduction and moulting as endpoints to study endocrine disruption of <i>Neomysis integer</i>	2	2014-01-17

38	BEWREMABI dataset: Belgian Shipwreck - hotspots for Marine Biodiversity: Macrofauna on shipwrecks	3,439	2014-01-17
39	Linking pelagic food web and its top predators: bird and prey fish sampling - Westbanks	490	2014-01-17
40	Trophic interactions at the sediment-water interface: effect of beam-trawling on <i>Lanice</i> and associated fauna - partly Westbanks	402	2014-01-17
41	Spatial and temporal epibenthos and hyperbenthos variations at the Belgian Continental Shelf monitoring stations	463	2014-01-17
42	BEWREMABI dataset: Belgian Shipwreck - hotspots for Marine Biodiversity: Macrofauna in vicinity of shipwrecks	342	2014-01-17
43	BEWREMABI dataset: Belgian Shipwreck - hotspots for Marine Biodiversity: Meiofauna	222	2014-01-17
44	Spatial distribution in sediment characteristics and benthic activity on the northwestern Black Sea shelf: macrobenthos	1,036	2014-01-17
45	Survey dataset on <i>Pomatoschistus minutus</i> (Pallas, 1770) and other gobies at the Belgian Coast, Oosterschelde, Westerschelde and at nuclear plants near Doel & Borssele	974	2014-01-17
46	Ecological hyperbenthic data of the Scheldt estuary: ENDIS-RISKS data (2002-2005)	1,808	2014-01-17
47	Ecological hyperbenthic data of the Scheldt estuary: historical data (1988-2001)	37,801	2014-01-17
48	INRAM benthic fauna monitoring	1,102	2014-01-17
49	Hyperbenthic communities of the North Sea	4,040	2014-01-17
50	Dispersal of pelagic organisms of the Belgian Continental Shelf	999	2014-01-17
51	The hyperbenthos of subtidal sandbanks on the Belgian Continental Shelf: habitats and indicator species	894	2014-01-17
52	TROPHOS/PODO-I work-database II	3,692	2014-01-17

53	Macrobenthos: temporal patterns for BCS stations 115b and 330	204	2014-01-17
54	Characterisation of the habitat of the Flemish banks, the maritime country banks and of the hinder banks on the basis of the hyper benthos communities	1,155	2014-01-17
55	Benthos collected in the Azov Sea during several expeditions in 1934-1935	1,258	2014-03-04
56	Zooplankton collected in the Mediterranean Sea in 1959 on board the R/V Akademik S. Vavilov.	3,333	2014-03-04
57	Benthos collected in the Azov Sea in 1935 on board the R/V N. Danilevskiy	1,829	2014-03-04
58	Phytoplankton data collected in the NW Black Sea along the Tarkhankut transect in April 1952	658	2014-03-04
59	Phytoplankton collected in the Mediterranean Sea in 1959 on board the R/V Akademik S. Vavilov	1,006	2014-03-04
60	Marine Intertidal Phase 1 species dataset from the Countryside Council for Wales 1996-2005	38,998	2014-04-16
61	Marine records from Skomer Marine Nature Reserve (MNR) Marine Monitoring Programme	15,597	2014-04-16
62	Marine flora and fauna records from the North-east Atlantic	3,526	2014-04-16
63	RISC and ALERT Marine Non-Native Species (Chinese Mitten Crab, Wakame and Carpet Sea Squirt) Records	181	2014-04-16
64	Twaité Shad ( <i>Alosa fallax</i> ) distribution for Scotland, historical to present	367	2014-04-16
65	RECORD Cetacean data up to current day	250	2014-04-16
66	IOW Natural History & Archaeological Society Marine Invertebrate Records 1853- 2011	1,262	2014-04-16
67	Marine data from Natural Resources Wales (NRW) Technical	139,641	2014-04-30



	Support (Research & Monitoring) Contracts, Wales		
68	Marine Sightings & Miscellaneous species records from Natural resources Wales (NRW), 2008 onwards	9	2014-04-30
69	Wildbook for Whale Sharks	3,607	2014-04-30
70	Colección de Crustáceos Decápodos y Estomatópodos del Centro Oceanográfico de Cádiz: CCDE-IEOCD	370	2014-04-30
71	Porpoises (NRM)	371	2014-04-30
72	Tauchen und Meer	24	2014-04-30
73	Tauchen und Meer 02	21	2014-04-30
74	Colección de referencia de otolitos, Instituto de Ciencias del Mar-CSIC	2,874	2014-04-30
75	ESAS cetacean sightings from 1980 to 2003	3,045	2014-04-30
76	NPWS Seal Database	1,210	2014-04-30
77	Marine species distributions in Irish coastal waters	31,232	2014-04-30
78	Naturalis National Natural History Museum (NL) – Invertebrate specimens from marine expeditions	939	2014-04-30
79	Zoological Museum Amsterdam, University of Amsterdam (NL) – Benthos monitoring of the North Sea_ research database	29,691	2014-04-30
80	SEAPOP NINA	282,975	2014-04-30
81	Colección de Fauna Marina del Centro Oceanográfico de Málaga (I.E.O.): CFM_IEOMA	453	2014-04-30
82	RAVON (NL) - Fish observations extracted from Redeke (1907)	1,654	2014-04-30
83	RAVON (NL) - Fish observations extracted from Hoek (1888) and Hoek (1897)	1,287	2014-04-30
84	Inventaire National du Patrimoine Naturel : Observations d'hippocampes et syngnathes de France métropolitaine:	190	2014-04-30

	Programme Hippo-ATLAS		
85	Inventaire National du Patrimoine Naturel : Données des campagnes de Suivi Aérien de la Mégafaune Marine (SAMM) de France métropolitaine	16,568	2014-04-30
86	Inventaire National du Patrimoine Naturel : Données Benthos du Réseau des Stations et Observatoires Marins	8,760	2014-04-30
87	Distribution of Harpacticoida in the Chernaya River estuary (White Sea)	56	2014-08-28
88	Harpacticoida diversity in littoral zone of Kandalaksha Bay (White Sea)	30	2014-08-28
89	Harpacticoida from a field survey in the White Sea in 2000	15	2014-08-28
90	Harpacticoida from a monitoring survey in the Black Sea in 2000-2001	143	2014-08-29
91	Harpacticoida from a seasonal field survey in the White Sea	149	2014-08-29
92	Harpacticoida from an intertidal flat in the Chernaya River estuary (White Sea)	36	2014-08-29
93	Occasional sampling of Harpacticoida in Gulf of Kandalaksha (White Sea)	13	2014-09-01
94	Harpacticoida from a scientific cruise of the R. "Akademik" in the western part of the Black Sea	120	2014-09-01
95	Meiobenthos North Adriatic-INTERREG-FVG-Projects*	362	2014-09-03
96	IMR Capelin larvae monitoring*	2,899	2014-09-03
97	Picoplankton Adriatic-SESAME Project*	320	2014-09-05
98	IMR Herring larvae monitoring*	4,497	2014-09-08
99	Observations of three Idotea species ( <i>I. balthica</i> , <i>I. chelipes</i> and <i>I. granulosa</i> ) in Northern Europe, including the Baltic Sea - data derived from museum collections	320	2014-09-09

100	Observations of three <i>Idotea</i> species ( <i>I. balthica</i> , <i>I. chelipes</i> and <i>I. granulosa</i> ) in Northern Europe, including the Baltic Sea - field data	21	2014-09-09
101	Collection Echinodermata SMF	338	2014-09-09
102	Collection Cnidaria SMF	2,339	2014-09-09
103	Collection Polychaeta SMF	664	2014-09-09
104	Collection Bryozoa SMF	7,474	2014-09-09
105	University of Málaga: MGC - Algae	628	2014-09-09
106	Allis Shad ( <i>Alosa alosa</i> ) distribution for Scotland, historical to present	234	2014-09-09
107	Polish Monitoring Programme - Monitoring of the Baltic Sea: zooplankton*	14,222	2014-09-11
108	IMR Zooplankton Barents Sea*	21,193	2014-10-16
109	IMR Zooplankton North Sea*	8,048	2014-10-16
110	IMR Zooplankton Norwegian Sea*	78,689	2014-10-16
111	Diveboard - Scuba diving citizen science observations	22,628	2014-11-27
112	Cetacean sightings along the central Catalan coast made during surveys of the Associació Cetàcea	11	2015-01-06
113	Data collected during the expeditions of the e-learning projects Expeditie Zeeleeuw and Planeet Zee	416	2015-01-07
114	Picoplankton North Adriatic-Gulf of Trieste LTER time-series*	1,087	2015-01-12
115	Mesozooplankton North Adriatic-Gulf of Trieste LTER time-series*	4,228	2015-01-13
116	Macrobenthos North Adriatic-ALPE ADRIA Project *	3,118	2015-01-13
117	Microphytobenthos North Adriatic-INTERREG Project*	1,386	2015-01-14
118	Mesozooplankton South Adriatic-PRISMA1-Flussi Project*	680	2015-01-14

119	Netplankton North Adriatic-ALPE ADRIA Project*	3,146	2015-01-16
120	Monitoring of birds in the Voordelta *	15,191	2015-01-19
121	Microzooplankton North Adriatic-INTERREG Project*	5,562	2015-01-27
122	Demersals survey in the Azores between 1996 and 2013*	9,837	2015-01-27
123	Epibenthos and demersal fish monitoring in function of wind energy development*	2,184	2015-01-30
124	Macrobenthos monitoring in function of the Water Framework Directive in the period 2007-2009*	3,455	2015-01-30
125	IMR Juvenile fish monitoring *	5,615	2015-02-10
126	POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores tuna fishery from 1998 to 2013: during the capture of live bait*	50	2015-02-13
127	POPA- Fisheries Observer Program of the Azores: Seabird sightings in the Azores tuna fishery from 1998 to 2013: while fishing*	33,616	2015-02-13
128	POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores tuna fishery from 1998 to 2013: while fishing*	1,583	2015-02-13
129	POPA- Fisheries Observer Program of the Azores: Tuna species caught in the Azores tuna fishery from 1998 to 2013*	27,024	2015-02-13
130	POPA- Fisheries Observer Program of the Azores: Sea bird sightings in the Azores between 2004 and 2013 recorded by Biosphere Expedition *	357	2015-02-13
131	POPA- Fisheries Observer Program of the Azores: Sea turtle sightings in the Azores between 2004 and 2013 recorded by Biosphere Expedition*	97	2015-02-13
132	POPA- Fisheries Observer Program of the Azores: Seabird sightings in the Azores tuna fishery from 1998 to 2013: during the capture of live bait *	3,261	2015-02-13

133	POPA- Fisheries Observer Program of the Azores: Fish caught to be used as bait in the Azores tuna fishery from 1998 to 2013 *	5,747	2015-02-13
134	POPA- Fisheries Observer Program of the Azores: Discards in the Azores tuna fishery from 1998 to 2013 *	728	2015-02-13
135	POPA- Fisheries Observer Program of the Azores: Accessory species caught in the Azores tuna fishery between 2000 and 2013 *	381	2015-02-13
136	POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores between 2004 and 2013 recorded by Biosphere Expedition *	600	2015-02-13
137	Microzooplankton North Adriatic-ALPE ADRIA Project*	495	2015-03-02
138	MAREANO - Base-line mapping of epifauna obtained with Beamtrawl*	7,338	2015-03-02
139	MAREANO - Base-line mapping of fauna obtained with grab*	11,760	2015-03-02
140	MAREANO - Base-line mapping of hyperbenthic crustacea fauna obtained with RP-sledge*	6,074	2015-03-02
141	Zooplankton monitoring in the Belgian Part of the North Sea between 2009 and 2010*	3,708	2015-03-03
142	COLETA - IMAR/DOP-UAc Reference Collection from 1977 to 2012*	7,270	2015-03-27
143	Phytoplankton monitoring RADIALES - Section off Vigo (NW Spain, Galicia); coastal (station depth 39m); sampling depths 0, 5, 10 and 30m *	7,419	2015-04-27
144	Phytoplankton monitoring RADIALES - Section off Vigo (NW Spain, Galicia); mid-shelf (station depth 97m); sampling depths 0, 5, 10, 20 and 30m *	7,503	2015-04-27
145	Phytoplankton monitoring RADIALES - Section off Cudillero (N Spain, Cantabrian Sea); mid-shelf (station depth 130m); sampling depths 0, 5, 10,30, 40 and 70m*	5,465	2015-04-27

146	Phytoplankton monitoring RADIALES - Section off Gijón (N Spain, Cantabrian Sea); mid-shelf (station depth 108m); sampling depths 0, 35 and 70m*	1,371	2015-04-27
147	Phytoplankton Adriatic-SESAME Project *	1,181	2015-04-27
148	SHARK - Marine bacterioplankton monitoring in Sweden since 1989*	11,756	2015-06-01
149	SHARK - Marine phytoplankton monitoring in Sweden since 1983*	342,647	2015-06-01
150	SHARK - Marine soft bottom macrozoobenthos monitoring in Sweden since 1971*	233,584	2015-06-01
151	SHARK - Marine zooplankton monitoring in Sweden since 1979*	60,511	2015-06-01
152	Zooplankton monitoring RADIALES - section off Vigo (NW Spain, Galicia); coastal (station depth 39m)*	3,866	2015-06-15
153	Zooplankton monitoring RADIALES - section off Vigo (NW Spain, Galicia); mid-shelf (station depth 97 m)*	3,608	2015-06-15
154	Zooplankton monitoring RADIALES - section off Santander (N Spain, Cantabrian Sea); coastal (station depth 30m)*	1,842	2015-06-15
155	Zooplankton monitoring RADIALES - section off Santander (N Spain, Cantabrian Sea); mid-shelf (station depth 110m)*	2,031	2015-06-15
156	Zooplankton monitoring RADIALES - section off Santander (N Spain, Cantabrian Sea); oceanic (station depth 850m)*	1,631	2015-06-15
157	Zooplankton monitoring RADIALES - section off Gijón (N Spain, Cantabrian Sea); mid-shelf (station depth 130m)*	315	2015-06-15
158	Zooplankton monitoring RADIALES - section off A Coruña (NW Spain, Galicia); inner-shelf (station depth 77m)*	4,903	2015-06-15
159	Echinodermata of Montenegro (South Adriatic)	308	2015-06-29
160	Epibenthos and demersal fish monitoring at long-term	6,729	2015-07-22

	monitoring stations in the Belgian part of the North Sea*		
161	Benthos Cretan Continental Shelf*	2,670	2015-08-27
162	Macrobenthos from the Norwegian waters	14,891	2015-08-27
163	Macrozoobenthos from the Belgian Continental Shelf, collected in 2000	636	2015-08-27
164	Macrobenthos samples collected in the Scottish waters in 2001	4,681	2015-08-27
165	Macrobenthos data from the Doggerbank - 2000	566	2015-08-27
166	Macrobenthos data from the Norwegian Skagerrak coast	1,918	2015-08-27
167	macrobenthos in the Dutch Sector of the North Sea 1991-2001	4,663	2015-08-27
168	Macrobenthos from Copale - Authie	1,073	2015-08-27
169	Eastern Channel dataset	493	2015-08-27
170	BfG - Estuary Monitoring Programme Macrozoobenhos	286	2015-08-27
171	Macrobenthos from English waters between 2000-2002	3,999	2015-08-27
172	Aegean macrobenthic fauna	7,277	2015-08-27
173	Laspibay-Black Sea	689	2015-08-27
174	Macrofauna Bahia de Blanes	3,748	2015-08-27
175	Strelbay	297	2015-08-27
176	SARONIKOS	2,050	2015-08-27
177	Mytilini	4,634	2015-08-27
178	MegFeod-Black Sea	169	2015-08-27
179	Kalamitsi	2,037	2015-08-27
180	Jalta-Black Sea	308	2015-08-27
181	Aegean Polychaetes	2,215	2015-08-27

182	Fauna Bentonica	2,418	2015-08-27
183	REDIT 1	5,642	2015-08-27
184	LBMRev	9,321	2015-08-27
185	Occhipinti dataset	963	2015-08-27
186	Gulf of Gdansk	87	2015-08-27
187	Biomôr 1 dataset. Benthic data from the Southern Irish Sea from 1989-1991	5,166	2015-08-27
188	Bay of Puck dataset	537	2015-08-27
189	Polish Arctic Marine Programme	603	2015-08-27
190	70 samples data of Kiel Bay	1,144	2015-08-27
191	Arctic soft-sediment macrobenthos	1,005	2015-08-27
192	Macrozoobenthos data from the southeastern North Sea in 2000	10,280	2015-08-27
193	Amrum Bank and inner German Bight Benthos	1,026	2015-08-27
194	National Marine Monitoring Programme data set	1,161	2015-08-27
195	Benthos Gironde Estuary	3,019	2015-08-27
196	Plymouth Sound macrofauna	1,343	2015-08-27
197	Kongsfjorden/Spitsbergen - soft bottom fauna	210	2015-08-27
198	Danish benthic marine monitoring data from ODAM*	794,717	2015-08-27
199	Antipatharia distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	29	2015-08-27
200	Mackerel and horse mackerel eggs*	42,878	2015-10-14
201	North Sea cod and plaice egg surveys (2004, 2009)*	75,713	2015-10-14



202	Atlantic Anguilla surveys (1862-2007)*	15,700	2015-10-14
203	The International Herring Larvae Surveys*	195,983	2015-10-14
204	IMR Fish eggs survey*	891	2015-10-14
205	Gulf of Riga Larval Fish Survey*	2,011	2015-10-14
206	Ascidacea distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	559	2015-10-14
207	Aplacophora distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe.	202	2015-10-14
208	Phytoplankton North Adriatic-INTERREG-FVG Project *	3,732	2015-11-25
209	Microzooplankton South Adriatic-PRISMA1-Flussi Project *	2,025	2015-11-25
210	Phytoplankton South Adriatic-PRISMA1-Flussi Project*	955	2015-11-25
211	Bivalvia distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	2,103	2015-11-26
212	Brachiopoda distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	77	2015-11-26
213	Bryozoa distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	100	2015-11-26
214	Ceriantharia distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	5	2015-11-26
215	Cirripedia distribution data from: Deep-sea fauna of European	138	2015-11-26

	seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe		
216	Crinoidea distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	94	2015-11-26
217	Echinoidea distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	255	2015-11-26
218	IMR Macroplankton surveys *	5,342	2015-12-01
219	Microzooplankton North Adriatic-Gulf of Trieste LTER time-series*	3,943	2015-12-01
220	Microphytobenthos North Adriatic-Gulf of Trieste LTER time-series*	1,665	2015-12-01
221	Macrobenthos North Adriatic-INTERREG-FVG Project*	2,367	2015-12-01
222	Eastern Mediterranean Syllidae from three locations in Crete and Israel*	997	2015-12-01
223	Polychaetes from two subtidal rocky shores of the North coast of Crete, collected for the NaGISA project 2007-2008*	1,359	2015-12-01
224	Records of fish species in coastal lagoons and sea shore that belong to Municipality of Preveza, for the period 2002-2011*	249	2015-12-01
225	Records of fish species in coastal lagoons that belong to Municipality of Arta, for the period 1999-2011*	409	2015-12-01
226	Benthic communities in Amvrakikos Wetlands: Mazoma, Tsopeli, Tsoukalio, Rodia and Logarou lagoons (September 2010 – July 2011)*	1,482	2015-12-01
227	Asteroidea distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	679	2015-12-01

228	Phytoplankton North Adriatic-Gulf of Trieste LTER time-series *	28,604	2016-02-03
229	Kyklades	898	2016-02-03
230	Kerkyra	1,189	2016-02-03
231	Echiura distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	19	2016-02-03
232	Phytoplankton North Adriatic-ALPE ADRIA Project*	6,030	2016-04-11
233	Mesozooplankton North Adriatic-INTERREG Project*	426	2016-04-11
234	Rare marine fishes taken in Irish waters from 1786 to 2008	1,135	2016-04-11
235	Irish Marine Turtle Database	1,022	2016-04-11
236	Ostracoda distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	223	2016-04-15
237	Holothuroidea distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	882	2016-04-15
238	Pycnogonida distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	150	2016-04-15
239	Gastropoda distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	1,074	2016-04-15
240	Mysida and Lophogastrida distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	150	2016-04-15

241	Porifera distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	72	2016-04-15
242	Scleractinia distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	93	2016-04-15
243	Monoplacophora distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	1	2016-04-15
244	Xenophyophores distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	39	2016-04-15
245	Ophiuroidea distribution data from: Deep-sea fauna of European seas - an annotated species check-list of benthic invertebrates living deeper than 2000 m in the seas bordering Europe	861	2016-04-15
246	DASSH: The UK Archive for Marine Species and Habitats Data*	314,317	2016-05-02
247	COMARGIS: Information System on Continental Margin Ecosystems	6,209	2016-05-02
248	Biocean	32,485	2016-05-02
249	Type locality distributions from the World Register of Marine Species	6,587	2016-05-22
250	Continuous Plankton Recorder Dataset (SAHFOS) - Zooplankton*	2,057,411	2016-06-15
251	Polish Monitoring Programme - Monitoring of the Baltic Sea: phytoplankton*	30,677	2016-06-15
252	Polish Monitoring Programme - Monitoring of the Baltic Sea:	1,046	2016-06-15

	phytobenthos*		
253	Polish Monitoring Programme - Monitoring of the Baltic Sea: zoobenthos*	3,551	2016-06-15
254	National ferrybox project - discrete sampling by IMWM*	1,728	2016-06-15
255	Continuous Plankton Recorder Dataset (SAHFOS) - Pacific Zooplankton*	57,292	2016-06-15
256	Continuous Plankton Recorder Dataset (SAHFOS) - Pacific Phytoplankton*	23,852	2016-06-15
257	Phytoplankton monitoring RADIALES: Section off A Coruña (NW Spain, Galicia); inner-shelf (station depth 77m); sampling depths 0, 5, 10, 20 and 30m*	14,750	2016-06-15
258	Epibenthos and demersal fish monitoring in function of aggregate extraction*	3,093	2016-06-15
259	Epibenthos and demersal fish monitoring in function of dredge disposal monitoring*	3,578	2016-06-15
260	Macrobenthos monitoring in function of aggregate extraction activities in the Belgian part of the North Sea*	18,089	2016-06-15
261	Macrobenthos monitoring in function of dredge disposal monitoring in the Belgian part of the North Sea*	7,120	2016-06-15
262	Macrobenthos monitoring at long-term monitoring stations in the Belgian part of the North Sea between 1979 and 1999*	4,658	2016-06-15
263	Monitoring of fish in the Voordelta*	16,225	2016-06-15
264	Monitoring of macrozoobenthos in the Voordelta *	14,610	2016-06-15
265	Romanian Black Sea Phytoplankton data from 1956 to 1960*	6,118	2016-06-15
266	POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores tuna fishery from 1998 on: during navigation or search mode *	26,520	2016-06-15
267	POPA- Fisheries Observer Program of the Azores: Seabird	57,804	2016-06-15

	sightings in the Azores tuna fishery from 2000 on: during navigation or search mode *		
268	POPA- Fisheries Observer Program of the Azores: Turtle sightings in the Azores tuna fishery from 2000 on: during navigation or search mode*	3,621	2016-06-15
269	Historic data (1908-1963) of benthic macrofauna from the Limfjord, Denmark*	11,737	2016-06-15
270	Historic fish data (1921-1953) from the Limfjord, Denmark*	2,664	2016-06-15
271	Macrobenthos data from the Romanian part of the Black Sea between 2003 and 2011*	5,656	2016-06-15
272	Historical benthos data from the Romanian Black Sea Coast between 1954 and 1968*	2,007	2016-06-15
273	Historical benthos data from the Romanian Black Sea Coast between 1959 and 1961*	1,033	2016-06-15
274	Historical benthos data from the Pre-deltaic Romanian Black Sea Coast in 1960*	834	2016-06-15
275	Benthos data collected in the Black Sea during the Leg 2 EROS Cruise in 1997*	341	2016-06-15
276	Benthos data collected in the Black Sea during the IAEA Cruise in 1998*	112	2016-06-15
277	ImagDOP Benthic Video Annotations in the Faial-Pico Channel in 2011*	148,143	2016-06-15
278	Macrobenthos monitoring at long-term monitoring stations in the Belgian part of the North Sea from 2001 on*	17,489	2016-06-15
279	Underwater fish visual census in the Azores from 1997 to 2015*	5,775	2016-06-15

Table 24. List of datasets newly harvested or updated since 2013-09-01. The datasets marked with a \* were provided in the framework of EMODnet II.

***Annex 2: Institutes making available marine biological datasets during EMODnet II: 01/09/2013 – 01/09/2016***

<b>Country Code</b>	<b>Data providing Institute</b>	<b>Number of datasets provided</b>
BE	Diveboard	1
BE	Institute for Agricultural and Fisheries Research (ILVO)	11
BE	Katholieke Universiteit Leuven; Departement Biologie; Afdeling Dierenecologie en -systematiek; Laboratorium voor Aquatische Ecologie	1
BE	Koninklijk Belgisch Instituut voor Natuurwetenschappen; Operationele Directie Taxonomie en Fylogenie; Afdeling Malacologie	1
BE	Research Institute for Nature and Forest (INBO)	1
BE	Universiteit Gent; Faculteit Bio-ingenieurswetenschappen; Vakgroep Toegepaste ecologie en milieubiologie; Laboratorium voor Milieutoxicologie en aquatische ecologie; Onderzoeksgroep voor Milieutoxicologie (ECOTOX)	1
BE	Universiteit Gent; Faculteit Wetenschappen; Vakgroep Biologie; Onderzoeksgroep Mariene Biologie (MARBIOL)	14
BE	Vlaams Instituut voor de Zee (VLIZ)	1
BE	WoRMS Steering Committee	1
DE	Alfred Wegener Institute for Polar- and Marine Research (AWI)	2
DE	Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences (IFM-GEOMAR)	2
DE	Federal Institute of Hydrology (BfG)	1
DE	GEO-Tag der Artenvielfalt	2

DE	Senckenberg Nature Research Society; Research Institute and Natural History Museum	5
DK	International Council for the Exploration of the Sea (ICES)	6
DK	University of Aarhus; Department of Bioscience (BIOS)	1
EE	University of Tartu; Estonian Marine Institute (EMI)	1
EG	National Institute of Oceanography and Fisheries (NIOF)	4
ES	Associació Cetàcea	1
ES	Consejo Superior de Investigaciones Científicas; Institute of Marine Sciences (ICM)	1
ES	Instituto Español de Oceanografía (IEO)	14
ES	Spanish Council for Scientific Research (CSIC)	1
ES	University of Málaga; Faculty of Sciences; Departamento de Biología Vegetal	1
FR	Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER)	2
FR	National Natural History Museum Paris; Service du Patrimoine naturel (SPN)	3
FR	Observatoire Océanologique de Banyuls-Sur-Mer; Laboratoire d'Océanographie Biologique (LOBB)	1
FR	Université Bordeaux 1; Station Marine d'Arcachon; Laboratoire d'Océanographie Biologique (LOB)	1
FR	Université des Sciences et Technologies de Lille; Station Marine de Wimereux (INSU/CNRS)	2
GB	Biosphere Expeditions	3
GB	Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	2
GB	Clyde River Foundation	2
GB	Fisheries Research Service; Marine Laboratory (FRS)	1
GB	Marine Biological Association of the UK (MBA)	2



GB	National Biodiversity Network Trust (NBN)	2
GB	National Museums and Galleries of Wales; Department of Zoology	1
GB	Natural Resources Wales (NRW)	4
GB	Plymouth Marine Laboratory (PML)	2
GB	Porcupine Marine Natural History Society	1
GB	The Sir Alister Hardy Foundation for Ocean Science; The Laboratory	3
GR	Aristotle University of Thessaloniki (ATh)	1
GR	Democritus University of Thrace; Department of Primary Education	3
GR	Hellenic Centre for Marine Research (HCMR)	12
GR	Preveza Fisheries Department	1
IE	National Biodiversity Data Centre	4
IE	The Irish Whale and Dolphin Group (IWDG)	1
IT	Istituto Di Biologia Marina Per L'Adriatico	1
IT	National Institute of Oceanography and Experimental Geophysics (OGS)	20
IT	Università degli Studi di Pavia; Laboratoria di Ecologia	1
IT	University of Trieste; Marine Biology Laboratory	1
ME	University of Montenegro; Institute of Marine Biology	1
NL	Bureau Waardenburg bv - Consultancy for Ecology & Environment	1
NL	Deltares	1
NL	Koninklijk Nederlands Instituut voor Onderzoek der Zee (NIOZ)	2
NL	Netherlands Centre for Biodiversity Naturalis; National Museum of Natural History - Naturalis (Naturalis)	1
NL	Reptielen Amfibieën Vissen Onderzoek Nederland (RAVON)	2

NL	Universiteit van Amsterdam; Faculteit der Natuurwetenschappen, Wiskunde en Informatica; Zoologisch Museum Amsterdam (UVA-ZMA)	1
NL	Wageningen University and Research Centre; Institute for Marine Resources and Ecosystem Studies (IMARES)	2
NO	Institute of Marine Research (IMR)	11
NO	Norwegian Institute for Nature Research (NINA)	1
NO	Norwegian Institute for Water Research (NIVA)	1
NO	Polar Environmental Centre: Akvaplan-niva; Biodiversity Group	1
PL	Institute of Meteorology and Water Management (IMGW)	5
PL	Polish Academy of Sciences; Institute of Oceanology (IOPAN)	2
PL	University of Gdansk; Institute of Oceanography; Department of Marine Biology and Ecology; Marine Invertebrates Ecophysiology Laboratory	1
PT	Institute of Marine Research (IMAR)	13
PT	University of the Azores; Department of Oceanography and Fisheries (DOP)	2
RO	National Institute for Marine Research and Development "Grigore Antipa" (NIMRD)	1
RO	National Institute of Marine Geology and Ecology (GeoEcoMar)	6
RU	Lomonosov Moscow State University; Zoological Museum	2
RU	Moscow State University; Department of Hydrobiology	8
RU	Russian Academy of Sciences (RAS)	18
SE	Swedish Meteorological and Hydrological Institute (SMHI)	4
SE	Swedish Museum of Natural History (NRM)	1
SE	University of Gothenburg; Faculty of Science; Department of Biological and Environmental Sciences	2
UA	National Academy of Sciences of Ukraine; Institute of Biology of the Southern	37

	Seas (IBSS)	
US	ECOCEAN USA	1

*Table 25. List of data providing organisations and number of datasets provided*

### ***Annex 3: Detailed overview of data providing organisations of EMODnet II per regional sea***

#### **Baltic Sea**

##### *Partners that have provided data for this region*

#### **Polish Institute of Meteorology and Water Management (IMGW)**

The Maritime Branch of the IMGW agreed to open up the data from the Polish Monitoring Programme to EMODnet. Biological data originates from the Polish Exclusive Economic Zone of the Baltic Sea including shallow water lagoons. Data has been collected in framework of the Polish Monitoring Programme of the Baltic Sea as part of the contract with Chief Inspectorate for Environmental Protection. That monitoring program has started in 1999, however not all the data has been included into existing data base due to lack of some meta data information as required by HELCOM data base. Zoobenthos data will be available for the time series of 1979-2012. Instantly available data regards phytoplankton, zooplankton, zoobenthos and phytobentos individual species, abundance, biomass (wet and dry) in accordance with HELCOM COMBINE Manual. Samples were collected for a number of sampling stations visited usually 5 times a year. Two of them are high frequency stations visited 12 times a year. Zoobenthos and phytobentos data are collected once and twice a year respectively. Station data include geographical coordinates and sampling dates, sampling water depth, layer, bottom substrate coverage etc. Some of the phytoplankton data have been collected along a Ferry-Box route at 6-5 discrete sampling stations.

NO	Dataset	Number of occurrence records	Dataset Focus	
64	<a href="#">Polish Monitoring Programme - Monitoring of the Baltic Sea: zoobenthos</a>	3,551	Benthos	<b>new</b> (harvested)

65	<a href="#">National ferrybox project - discrete sampling by IMWM</a>	1,728	phytoplankton	<b>new</b> (harvested)
66	<a href="#">Polish Monitoring Programme - Monitoring of the Baltic Sea: phytoplankton</a>	30,677	phytoplankton	<b>new</b> (harvested)
67	<a href="#">Polish Monitoring Programme - Monitoring of the Baltic Sea: zooplankton</a>	14,222	zooplankton	<b>new</b> (harvested)
68	<a href="#">Polish Monitoring Programme - Monitoring of the Baltic Sea: phytobenthos</a>	1,046	macroalgae	<b>new</b> (harvested)

Table 26. list of datasets included by IMGW in the assessment inventory. All 5 datasets listed were new for EMODnet and harvested by 15 June 2016

### Swedish Meteorological and Hydrological Institute (SMHI)

SMHI is a government agency under the Ministry of the Environment. SMHI manages and develops information on weather, water and climate that provides knowledge and advanced information for public services, the private sector and the general public. SMHI's national and international co-operation is extensive. The management system of SMHI has been assessed by SEMKO Certification AB and found to be in accordance with the requirements of the quality standard ISO 9001:2000 and the environmental standard. SMHI is the Swedish national data host for marine biological monitoring data.

SMHI agreed to share the data from the SHARK (Svenskt HavsARKiv or Swedish Ocean Archive) database. Its data originate from the waters around the Swedish coast, including the Baltic Sea and the Skagerrak region. The over 212 different individual local data contributors are responsible for the accuracy and quality of their respective sub-sets of data that together constitute the aggregated data set that SMHI keeps. Thus, the national data host has made few quality checks (such as e.g. taxonomic validity). The SHARK database contains phytoplankton, zooplankton, bacterioplankton, phytobenthos, zoobenthos, seals, primary production, sedimentation and chlorophyll measurements. In this first phase SMHI contributed the zooplankton, phytoplankton, macrobenthos and bacterioplankton data.

NO	Dataset	Number of occurrence records	Dataset Focus	
105	<a href="#">SHARK - Marine soft bottom macrozoobenthos monitoring in Sweden since 1971</a>	233,584	benthos	<b>new</b> (harvested)
106	<a href="#">SHARK - Marine phytoplankton monitoring in Sweden since 1983</a>	342,647	phytoplankton	<b>new</b> (harvested)
107	<a href="#">SHARK - Marine bacterioplankton monitoring in Sweden since 1989</a>	11,756	plankton (other)	<b>new</b> (harvested)
108	<a href="#">SHARK - Marine zooplankton monitoring in Sweden since 1979</a>	60,511	zooplankton	<b>new</b> (harvested)

Table 27. list of datasets included by SMHI in the assessment inventory. All 4 datasets were new for EMODnet and harvested by 15 June 2016

### International Council for the Exploration of the Sea (ICES)

ICES mainly contributes data for the Greater North Sea area and is therefore discussed there. It should be mentioned however that ICES also contributed the [Gulf of Riga Larval Fish Survey](#) dataset - which focuses on fish larvae -. This dataset was created by the Estonian Marine Institute (EMI) and contains data from Estonian waters collected from 2004 to 2013.

## Bay of Biscay, Iberian Coast and Macaronesia

### *Partners that have provided data for this region*

#### Spanish Institute of Oceanography (IEO)

IEO is an organization belonging to the ‘Ministerio de Economía y Competitividad’ of Spain specifically devoted to RD activities in the ocean, including multidisciplinary oceanography, marine geology, marine pollution, fisheries and aquaculture, and the assessment to the Spanish Government on marine policies (fisheries and environmental aspects). These studies are carried out under the coordination of International Organizations (COI, ICES, OSPAR, etc). The human resources and infrastructures available (9 regional oceanographic centres, research fleet, 5 aquaculture facilities) are adequate to carry out multidisciplinary research. IEO is involved in the promotion of cooperation in marine research at the regional, national and international levels by leading and participating in research projects, training of oceanographers and disseminating oceanographic knowledge. In relation to the present proposal, the IEO is responsible of coordinating the implementation of the Marine Strategy Framework Directive (MSFD) and the maintenance of long-term observational projects aimed at the study of the North Iberian shelf and its ecosystems and pelagic resources.

The structural monitoring program ‘Radiales’ from IEO provides plankton (phytoplankton and zooplankton) abundance data by taxa to the species level. This information is acquired monthly at fixed coastal hydrographic stations distributed along the North Iberian shelf. The longest time series extents over 20 years, and is still ongoing.

NO	Dataset	Number of occurrence records	Dataset Focus	
22	<a href="#">Phytoplankton monitoring RADIALES - Section off Cudillero (N Spain, Cantabrian Sea); mid-shelf (station depth 130m); sampling depths 0, 5,</a>	5,465	phytoplankton	<b>new</b> (harvested)

	<a href="#">10,30, 40 and 70m</a>			
23	<a href="#">Phytoplankton monitoring RADIALES - Section off Gijón (N Spain, Cantabrian Sea); mid-shelf (station depth 108m); sampling depths 0, 35 and 70m</a>	1,371	phytoplankton	<b>new</b> (harvested )
24	<a href="#">Phytoplankton monitoring RADIALES - Section off Vigo (NW Spain, Galicia); coastal (station depth 39m); sampling depths 0, 5, 10 and 30m</a>	7,419	phytoplankton	<b>new</b> (harvested )
25	<a href="#">Phytoplankton monitoring RADIALES - Section off Vigo (NW Spain, Galicia); mid-shelf (station depth 97m); sampling depths 0, 5, 10, 20 and 30m</a>	7,503	phytoplankton	<b>new</b> (harvested )
26	<a href="#">Phytoplankton monitoring RADIALES: Section off A Coruña (NW Spain, Galicia); inner-shelf (station depth 77m); sampling depths 0, 5, 10, 20 and 30m</a>	14,750	phytoplankton	<b>new</b> (harvested )
27	<a href="#">Zooplankton monitoring RADIALES - section off A Coruña (NW Spain, Galicia); inner-shelf (station depth 77m)</a>	4,903	zooplankton	<b>new</b> (harvested )
28	<a href="#">Zooplankton monitoring RADIALES - section off Gijón (N Spain, Cantabrian Sea); mid-shelf (station depth 130m)</a>	315	zooplankton	<b>new</b> (harvested )
29	<a href="#">Zooplankton monitoring RADIALES - section off Santander (N Spain, Cantabrian Sea); coastal (station depth 30m)</a>	1,842	zooplankton	<b>new</b> (harvested )
30	<a href="#">Zooplankton monitoring RADIALES - section off Santander (N Spain, Cantabrian Sea); mid-shelf (station</a>	2,031	zooplankton	<b>new</b> (harvested



	<a href="#">depth 110m</a> )			)
31	<a href="#">Zooplankton monitoring RADIALES - section off Santander (N Spain, Cantabrian Sea); oceanic (station depth 850m)</a>	1,631	zooplankton	<b>new</b> (harvested )
32	<a href="#">Zooplankton monitoring RADIALES - section off Vigo (NW Spain, Galicia); coastal (station depth 39m)</a>	3,866	zooplankton	<b>new</b> (harvested )
33	<a href="#">Zooplankton monitoring RADIALES - section off Vigo (NW Spain, Galicia); mid-shelf (station depth 97 m)</a>	3,608	zooplankton	<b>new</b> (harvested )

Table 28. list of datasets included by IEO in the assessment inventory. All 12 datasets listed are new for EMODnet and were harvested by 15 June 2016

### The Institute of Marine Research (IMAR) & University of the Azores; Department of Oceanography and Fisheries (DOP/UAç)

IMAR was created in 1991, as a non-profit private organization. Its founder members are the majority of universities in Portugal which undertake research in Marine Science and Technology. The general objective of IMAR is the development of Marine Science and Technology in Portugal, through integration of different disciplines and promotion of scientific cooperation.

DOP/UAç is involved in research activities related to the marine sciences. Main research programs deal with the description, experiment and modelling of oceanic ecosystems, within the areas of Ecology, Marine Biology, Physical and Chemical Oceanography, and Fisheries. DOP/UAç supports and facilitates both pure and applied research within these areas. It also forms co-operative research activities with appropriate state, and private research organizations, including services for industry and public administration, and conducts outreach activities through the regional and national newspapers, radio stations, public television, museums and school systems.

IMAR and DOP/UAç agreed to provide monitoring data from the Azores Fisheries Observation Programme (POPA) which was launched in 1998 with the main goal of certifying the tuna caught around the Azores as a “dolphin safe product”. This label is attributed by the non-governmental organization Earth Island Institute to catches made without mortality of cetaceans. POPA has built an extensive database with information collected by the observers on board the tuna fishing vessels. This database includes information on tuna fisheries (e.g., location of fishing events, catches, and fishing effort), weather conditions (e.g., sea surface temperature, wind and visibility), live bait fisheries (e.g., location of fishing events, catches, gears used), cetaceans (e.g., occurrences, interaction with fishing events and association with other species), birds and sea turtles (e.g., occurrences).

Initially - pre-EMODnet II - POPA data was available with abundances from EMODnet as this was submitted to [OBIS-SEAMAP](#) from where it disseminated to EurOBIS and EMODnet. The initial updated data IMAR provided in February 2015 were missing these abundance data. After extensive discussion it was agreed that abundances would be provided. However, when the abundance data was actually prepared by May 2016, the data owner and the IMAR director decided that the abundance data cannot be made freely available through the EMODnet portal but that instead abundances can be provided to interested parties by request by email. IMAR and the data owner also requested that the POPA data submitted to OBIS-SEAMAP have this same restriction.

Other data provided are the Demersal surveys which were conducted annually (few exceptions) from 1996 to 2013, the underwater visual censuses (UVC) which run since 1997, data from 2 different Video Annotations surveys in deep waters and the COLETA database, which holds the IMAR/DOP-Uac reference collection with data from 1977 to 2012.

At the moment the report was drafted the Video Annotations dataset for the Condor seamount was still being prepared. The QC process carried out by IMAR before delivery indicated that there was a problem with the sampling date and this is currently being discussed with data owner. The dataset on macroalgae and invertebrate surveys is also still to be provided.

<b>NO</b>	<b>Dataset</b>	<b>Number of occurrence</b>	<b>Dataset Focus</b>	
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		e records		
44	<a href="#">COLETA - IMAR/DOP-UAc Reference Collection from 1977 to 2012</a>	7,270	varia	<b>new</b> (harvested )
45	<a href="#">Demersais survey in the Azores between 1996 and 2013</a>	9,837	benthos	<b>new</b> (harvested )
46	<a href="#">Underwater fish visual census in the Azores from 1997 to 2015</a>	5,775	benthos	<b>new</b> (harvested )
47	<a href="#">ImagDOP Benthic Video Annotations in the Faial-Pico Channel in 2011</a>	148,143	benthos	<b>new</b> (harvested )
48	<a href="#">ImagDOP Video Annotations in Condor seamount in 2014</a>		benthos	<b>new</b> (pending)
49	<a href="#">IMAR/DOP-UAz Underwater macroalgae and invertebrate surveys</a>		macroalgae	<b>new</b> (pending)
50	<a href="#">POPA- Fisheries Observer Program of the Azores: Sea bird sightings in the Azores between 2004 and 2013 recorded by Biosphere Expedition</a>	357	aves	<b>update</b> (harvested )
51	<a href="#">POPA- Fisheries Observer Program of the Azores: Seabird sightings in the Azores tuna fishery from 1998 to 2013: during the capture of live bait</a>	3,261	aves	<b>update</b> (harvested )
52	<a href="#">POPA- Fisheries Observer Program of the Azores: Seabird sightings in the Azores tuna fishery from 1998 to 2013: while fishing</a>	33,616	aves	<b>update</b> (harvested )
53	<a href="#">POPA- Fisheries Observer Program of</a>	57,804	aves	<b>update</b>

	<a href="#">the Azores: Seabird sightings in the Azores tuna fishery from 2000 on: during navigation or search mode</a>			(harvested )
54	<a href="#">POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores between 2004 and 2013 recorded by Biosphere Expedition</a>	600	mammalia	<b>update</b> (harvested )
55	<a href="#">POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores tuna fishery from 1998 on: during navigation or search mode</a>	26,520	mammalia	<b>update</b> (harvested )
56	<a href="#">POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores tuna fishery from 1998 to 2013: during the capture of live bait</a>	50	mammalia	<b>update</b> (harvested )
57	<a href="#">POPA- Fisheries Observer Program of the Azores: Marine mammal sightings in the Azores tuna fishery from 1998 to 2013: while fishing</a>	1,583	mammalia	<b>update</b> (harvested )
58	<a href="#">POPA- Fisheries Observer Program of the Azores: Tuna species caught in the Azores tuna fishery from 1998 to 2013</a>	27,024	pisces	<b>new</b> (harvested )
59	<a href="#">POPA- Fisheries Observer Program of the Azores: Accessory species caught in the Azores tuna fishery between 2000 and 2013</a>	381	pisces	<b>new</b> (harvested )
60	<a href="#">POPA- Fisheries Observer Program of the Azores: Discards in the Azores tuna fishery from 1998 to 2013</a>	728	pisces	<b>new</b> (harvested )
61	<a href="#">POPA- Fisheries Observer Program of the Azores: Fish caught to be used as</a>	5,747	pisces	<b>new</b> (harvested )

	<a href="#">bait in the Azores tuna fishery from 1998 to 2013</a>			)
62	<a href="#">POPA- Fisheries Observer Program of the Azores: Sea turtle sightings in the Azores between 2004 and 2013 recorded by Biosphere Expedition</a>	97	reptilia	<b>new</b> (harvested )
63	<a href="#">POPA- Fisheries Observer Program of the Azores: Turtle sightings in the Azores tuna fishery from 2000 on: during navigation or search mode</a>	3,621	reptilia	<b>new</b> (harvested )

Table 29. List of datasets included by IMAR in the assessment inventory. Of the 20 datasets listed, 8 were already included in EMODnet as the data was available through OBIS-SEAMAP. These are listed as updates, the other datasets are new for EMODnet. 18 datasets were harvested or updated by 15 June 2016, 2 datasets are still pending

### Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

SAHFOS also provided the large zooplankton dataset [Continuous Plankton Recorder Dataset \(SAHFOS\) - Zooplankton](#) which contains data from the entire North Atlantic, including the Bay of Biscay and Iberian Coast. However, as most records from this dataset are located in the Greater North Sea and Celtic Sea, the SAHFOS datasets are discussed in detail there.

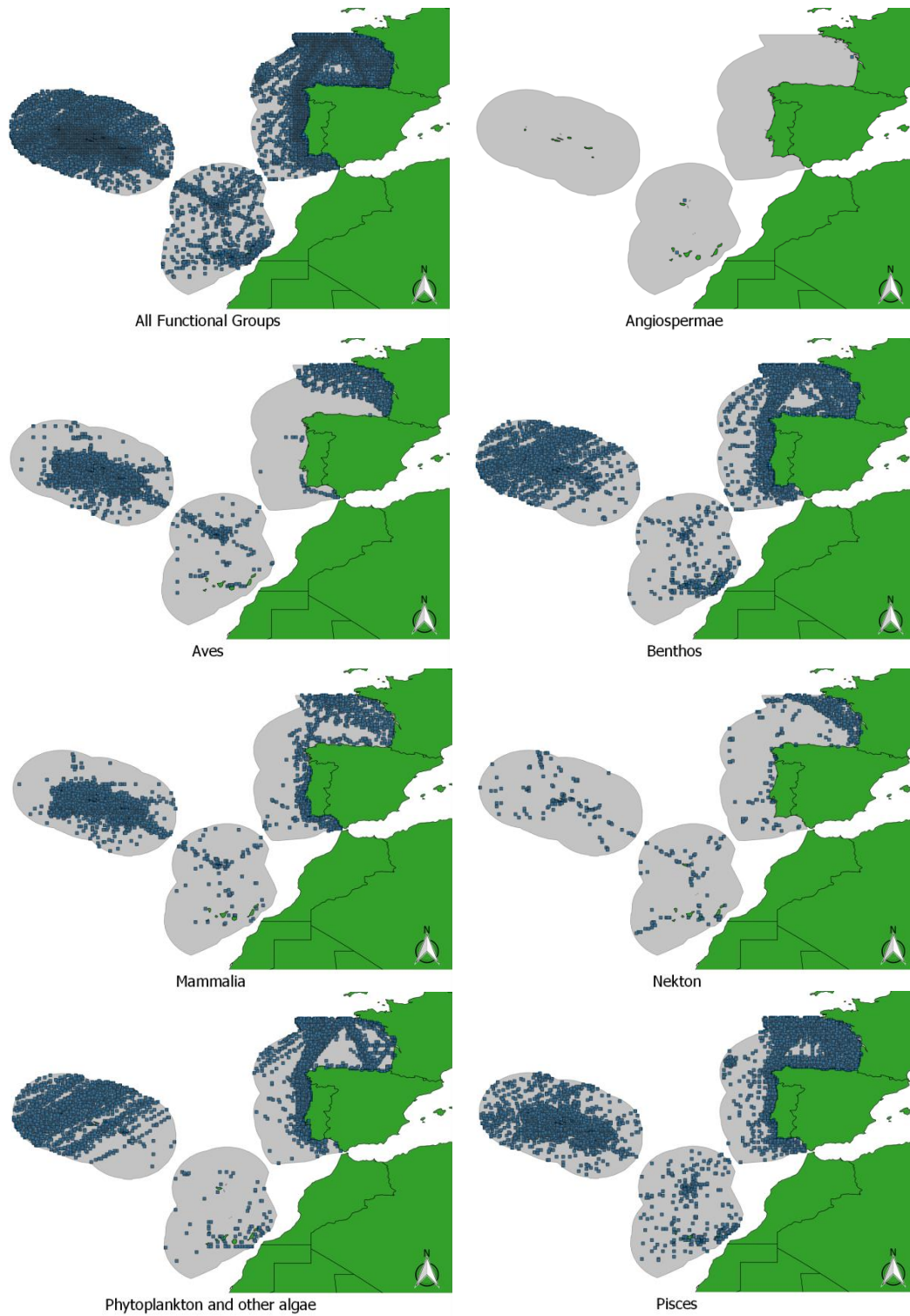


Figure 30. Distribution of occurrence records per functional group in the Bay of Biscay, Iberian Coast and Macaronesia

## Black Sea and Sea of Azov

### *Partners that have provided data for this region*

A lot of work to fill gaps in the Black Sea was carried out by data rescue grants during the first phase of the EMODnet project (EMODnet I). In the framework of WP4 Data archaeology and rescue several historical datasets were digitized.

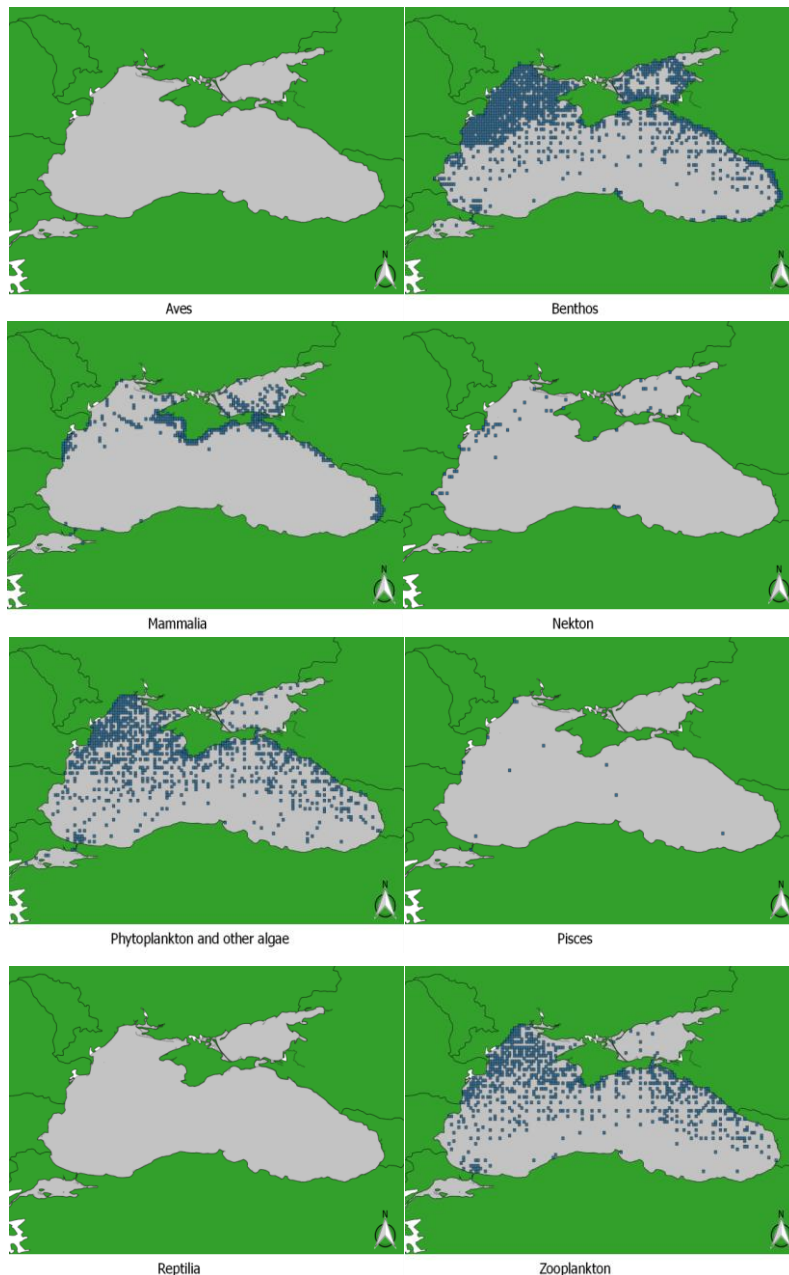
### WP 4 Data archaeology

As part of WP4 Data archaeology and rescue, old datasets which were only available on paper were digitized and processed to be uploaded to EMODnet (more detailed information is available in the section on WP4 of this rapport). For the Black Sea, benthos data from the Romanian institute National Research and Development Institute for Marine Geology and Geoecology (**EcoGeoMar**) and phytoplankton data from National Institute for Marine Research and Development "Grigore Antipa" (**NIMRD**) were made available through EMODnet by 15 June 2016.

NO	Dataset	Number of occurrence records	Dataset Focus	
120	<a href="#">Romanian Black Sea Phytoplankton data from 1956 to 1960</a>	6,118	phytoplankton	<b>new</b> (harvested)
121	<a href="#">Benthos data collected in the Black Sea during the Leg 2 EROS Cruise in 1997</a>	341	Benthos	<b>new</b> (harvested)
122	<a href="#">Historical benthos data from the Pre-deltaic Romanian Black Sea Coast in 1960</a>	834	Benthos	<b>new</b> (harvested)
12	<a href="#">Historical benthos data from the Romanian Black Sea Coast</a>	2,007	Benthos	<b>new</b> (harvested)

3	<a href="#">between 1954 and 1968</a>			)
12 4	<a href="#">Historical benthos data from the Romanian Black Sea Coast between 1959 and 1961</a>	1,033	Benthos	<b>new</b> (harvested )
12 5	<a href="#">Macrobenthos data from the Romanian part of the Black Sea between 2003 and 2011</a>	5,656	Benthos	<b>new</b> (harvested )
12 6	<a href="#">Benthos data collected in the Black Sea during the IAEA Cruise in 1998</a>	112	pisces	<b>new</b> (harvested )

Table 30. List of Black Sea datasets provided in the framework of WP4 Data archaeology and rescue. This list only includes the datasets which harvested by EMODnet on 15 June 2016





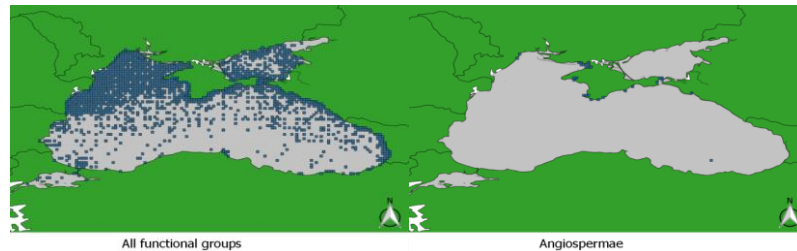


Figure 31. Distribution of occurrence records per functional group in the Black Sea and Sea of Azov

## Greater North Sea and Celtic Sea

### *Partners that have provided data for this region*

#### **Aarhus University (AU)**

AU is a public non-profit organization under the Danish University Act. The mission of Aarhus University is to develop knowledge, welfare and culture through research and research-based education, knowledge dissemination and external advice. The tenderer of this contract is DCE – Danish Centre for Environment and Energy, Aarhus University. The party responsible for executing this contract is Department of Bioscience, within the Faculty of Science and Technology. The overall responsibility lies with the board of Aarhus University, while the day-to-day management lies with the Dean.

Aarhus University provided the benthic data from the ODAM database to EMODnet. It contains data coming from NERI's own cruises, the Danish counties and from other marine research institutes in Denmark, Sweden, Norway and Germany. The geographical coverage of the database is the Danish fjords and coastal waters, the inner Danish waters, the western Baltic Sea, Skagerrak and the eastern North Sea. The data goes as far back as 1911 and currently contains almost 800.000 occurrence records. The database contains data on invertebrates in and on soft sediment bottoms (from coarse sand to soft mud). Fauna data are number of individuals and biomass (one or several of the measures wet weight, dry weight including shells and ash-free dry weight) on species level from each replicate sample (taken with different quantitative gears) available for the following invertebrate groups: Annelida mainly Polychaeta, Mollusca mainly Gastropoda and Bivalvia, Echinodermata and Arthropoda mainly Peracarida (Crustacea). Station data include geographical coordinates, sampling water depth,

number of samples taken at each sampling occasion, sampling dates. Other information available is sampling and extraction methods (such as area covered by sampling gear and mesh size, the latter mostly 1 mm).

NO	Dataset	Number of occurrence records	Dataset Focus	
1	<a href="#">Danish benthic marine monitoring data from ODAM</a>	794,717	Benthos	<b>new</b> (harvested)

Table 31. List of datasets included by AU in the assessment inventory. This large benthos dataset was new for EMODnet and harvested by 15 June 2016

### DELTARES

Deltares ([www.deltares.nl](http://www.deltares.nl)) is a leading independent research and internationally operating specialist consultancy institute (not-for-profit) for water and subsurface issues with its base in the Netherlands. Throughout the world, their advanced expertise enables safe, clean and sustainable living in deltas, coastal areas and river basins. With this goal in mind, Deltares develops knowledge, innovative products and services, pool their knowledge with others, and make the results available. They advise governments and the private sector, and use their expertise to make sound and independent assessments of the physical condition of deltas, coastal seas and river basins. All contracts and projects, whether financed privately or from strategic research budgets, contribute to the consolidation of their knowledge base. Furthermore, Deltares believes in openness and transparency, as is evident from the free availability of our software and models. Open source works, is their firm conviction. Through the combination of the former institutes, it has excellent resources of appropriate expertise based on more than 300 years of experience.

Mainport Development Rotterdam initiated the extension of the harbor with a huge suppletion in the North Sea in the area called Voordelta in the Dutch part of the North Sea which has a status of the Natura2000 area. According to European laws the extension of the harbor had to be compensated for loss of habitat. This resulted in a so called sea floor protection area. A consortium by Deltares, Imares, CSO, Bureau Waardenburg and Arcadis conducted a long term monitoring of the area of benthic fauna, fish species, birds, recreational and professional use of the Voordelta and geomorphological changes. The birds and fish data were delivered by Deltares through OCG web services and the benthos data by IMARES through SeaDataNet.

	Dataset	Number of occurrence	Dataset	
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NO		records	Focus	
2	<a href="#">Monitoring of birds in the Voordelta</a>	15,191	aves	<b>new</b> (harvested)
3	<a href="#">Monitoring of fish in the Voordelta</a>	16,225	pisces	<b>new</b> (harvested)
4	<a href="#">Monitoring of macrozoobenthos in the Voordelta</a>	14,610	benthos	<b>new</b> (harvested)

Table 32. List of datasets included by Deltares in the assessment inventory. All 3 datasets are new for EMODnet and were harvested by 15 June 2016. The dataset “Monitoring of macrozoobenthos in the Voordelta” was provided by IMARES

### International Council for the Exploration of the Sea (ICES)

ICES, established in 1902, is an intergovernmental organization whose main objective is to improve the scientific knowledge of the marine environment and its living resources, and to use this knowledge to provide sound scientific advice on their use. The ICES scientific network draws upon the expertise from its 20 member states, as well as associated countries. ICES has focused on the North Atlantic Ocean and the Baltic Sea. The ICES Secretariat has been based in Copenhagen, Denmark, since 1902. The Secretariat staff provides secretarial, administrative, scientific, and data handling support to the ICES community. The ICES Data Centre consists of data managers, data scientists and computer programmers/database developers who support the entire ICES organization with data handling, data products and guidance on best practices.

The ICES Database contains fisheries, oceanographic, contaminants, biological effects, and biological data extending back more than 120 years. During the first phase of EMODnet, ICES had already made available a large amount of data through the Biology Portal, including many datasets from DATRAS and the ICES DOME community dataset.

During this second phase, ICES has given access to an additional 5 datasets which are subsets of the large Egg and Larvae database as well as the opportunity to update the DATRAS dataset.

The DATRAS data was made available through web services by ICES in May 2016. It features 2 new datasets for EMODnet (ICES Beam Trawl Survey - Irish Sea (VIIa) and PT-IBTS: Portuguese International Bottom Trawl Survey) and updates for 6 datasets. However, during the draft of the report (13 June 2016) VLIZ still needed to develop a harvesting script adapted to harvest the DATRAS web services. It is anticipated that this script would be developed by July 2016 so the DATRAS data in EMODnet is likely to be updated by August 2016. For 4 of the 12 DATRAS datasets the ICES data submitter did not approve of harvest by EMODnet and will therefore not be included.

In the framework of WP4 Data archaeology and rescue, 2 historical datasets from the Limfjord area Denmark were digitized by ICES. A dataset with data on benthos ranging from 1908 to 1963 (Historic data (1908-1963) of benthic macrofauna from the Limfjord, Denmark) and a fish dataset with data on fish ranging from 1921 to 1953.

NO	Dataset	Number of occurrence records	Dataset Focus	
5	<a href="#">Historic data (1908-1963) of benthic macrofauna from the Limfjord, Denmark</a>	11,737	benthos	<b>new</b> (harvested )
6	<a href="#">Historic fish data (1921-1953) from the Limfjord, Denmark</a>	2,664	pisces	new (harvested )
7	<a href="#">Atlantic Anguilla surveys (1862-2007)</a>	15,700	pisces	<b>new</b> (harvested )
8	<a href="#">Gulf of Riga Larval Fish Survey</a>	2,011	pisces	<b>new</b> (harvested )
9	<a href="#">Mackerel and horse mackerel eggs</a>	42,878	pisces	<b>new</b> (harvested )
10	<a href="#">North Sea cod and plaice egg surveys (2004, 2009)</a>	75,713	pisces	<b>new</b> (harvested )
11	<a href="#">The International Herring Larvae</a>	195,983	pisces	<b>new</b> (harvested )

	<a href="#">Surveys</a>			)
12	<a href="#">ICES Fish stomach contents dataset</a>	133,374	varia	<b>update</b> (pending)
13	<a href="#">ICES Biological community dataset</a>	157,965	varia	<b>update</b> (pending)
14	<a href="#">Scottish West Coast Survey for commercial fish species</a>	415,764	pisces	update (pending)
15	<a href="#">ICES Baltic International Trawl Survey for commercial fish species</a>	768,651	pisces	<b>update</b> (pending)
16	<a href="#">ICES Beam Trawl Survey for commercial fish species</a>	390,947	pisces	<b>update</b> (pending)
17	<a href="#">Northern Irish Ground Fish Trawl Survey</a>	163,508	pisces	<b>update</b> (pending)
18	<a href="#">ICES French Southern Atlantic Bottom Trawl Survey for commercial fish species</a>	260,027	pisces	<b>update</b> (pending)
19	<a href="#">ICES Beam Trawl Survey - Irish Sea (VIIa)</a>	169,548	pisces	<b>update</b> (pending)
20	<a href="#">ICES North Sea International Bottom Trawl Survey for commercial fish species</a>	2,960,513	pisces	<b>update</b> (pending)
21	<a href="#">Scottish Rockall Survey for commercial fish species</a>	44,906	pisces	<b>update</b> (pending)

Table 33. List of datasets included by ICES in the assessment inventory. The 5 eggs and larvae datasets were new for EMODnet and harvested by 15 June 2016. For the DATRAS datasets (numbers 14 to 21), which already available from EMODnet prior to EMODnet II, ICES provided updated data through their web services. EMODnet is still to re-harvest these. For the biological community and stomach content datasets ICES is working to make updated data available through their web services. The list also includes the 2 datasets digitized by ICES in the framework of WP4 and harvested by EMODnet by 15 June 2016

### Institute for Agricultural and Fisheries Research (ILVO)

ILVO is a Flemish Scientific Institute attached to the Flemish Government's Agriculture and Fisheries Policy Area. ILVO performs scientific research and provides services to policy-makers and professionals in agriculture, horticulture and fisheries. ILVO's national and international co-operation is extensive. The department of aquatic environment and quality within ILVO is responsible for the collection of biological and chemical monitoring data in the Southern Bight of the North Sea.

The Biological Environmental Research department within ILVO is responsible for the monitoring of the benthos (epi- and macrofauna) and demersal fish fauna in the Belgian Part of the North Sea (BPNS). This monitoring activity started at the end of the seventies, but with a differing temporal and spatial intensity over this period. The Benthos (macrofauna) is sampled with a Van Veen grab (+ 0.1m<sup>2</sup>), whereas the epi- and demersal fish fauna is sampled with an 8m beam trawl, equipped with a fine-meshed shrimp net. Currently, most taxa records (species, genera or higher tax level) were gathered for the macrobenthos species group (39,000). For epibenthos and demersal fish fauna there are respectively 9,200 and 8,800 taxa records. In recent years (2009-2010) some zooplankton samples on the BPNS are taken with a plankton net (D=0.7m; 200µm mesh size), delivering a proximately 3,500 available taxa records for this species group.

NO	Dataset	Number of occurrence records	Dataset Focus	
34	<a href="#">Epibenthos and demersal fish monitoring in function of aggregate extraction</a>	3,093	pisces and benthos (epi)	<b>new</b> (harvested )
35	<a href="#">Epibenthos and demersal fish monitoring in function of dredge disposal monitoring</a>	3,578	pisces and benthos (epi)	<b>new</b> (harvested )
36	<a href="#">Epibenthos and demersal fish monitoring at long-term monitoring stations in the Belgian part of the North Sea</a>	6,729	pisces and benthos (epi)	<b>new</b> (harvested )
37	<a href="#">Epibenthos and demersal fish monitoring in function of wind energy</a>	2,184	pisces and benthos	<b>new</b> (harvested )

	<a href="#">development</a>		(epi)	)
38	<a href="#">Macrobenthos monitoring at long-term monitoring stations in the Belgian part of the North Sea between 1979 and 1999</a>	4,658	benthos	<b>new</b> (harvested )
39	<a href="#">Macrobenthos monitoring at long-term monitoring stations in the Belgian part of the North Sea from 2001 on</a>	17,489	benthos	<b>new</b> (harvested )
40	<a href="#">Macrobenthos monitoring in function of dredge disposal monitoring in the Belgian part of the North Sea</a>	7,120	benthos	<b>new</b> (harvested )
41	<a href="#">Macrobenthos monitoring in function of aggregate extraction activities in the Belgian part of the North Sea</a>	18,089	benthos	<b>new</b> (harvested )
42	<a href="#">Macrobenthos monitoring in function of the Water Framework Directive in the period 2007-2009</a>	3,455	benthos	<b>new</b> (harvested )
43	<a href="#">Zooplankton monitoring in the Belgian Part of the North Sea between 2009 and 2010</a>	3,708	zooplankton	<b>new</b> (harvested )

Table 34. List of datasets included by ILVO in the assessment inventory. All 10 datasets are new for EMODnet and were harvested by 15 June 2016

### Institute for Marine Resources & Ecosystem Studies (IMARES)

The Dutch Institute IMARES specializes in strategic and applied marine ecological research with a focus on Marine Living Resource Management (the sustainable conservation, harvesting and multiple use of the sea and coastal areas). The institute, founded in 2006, is composed of the former Netherlands Institute for Fisheries Research (RIVO) and divisions of Alterra and TNO. The institute has modern research facilities, is ISO 9001 and 17025 certified and accredited to undertake chemical and ecotoxicological research. IMARES core competencies are (salt) water ecology, water quality and the related environmental risks of contaminants, biological production systems and optimization of the sustainable multifunctional use within the marine environment, coastal and catchments areas. The

field of work comprises field research, experiments on a realistic scale, laboratory-scale exploratory studies, monitoring, data management and modelling. The focus of IMARES' research is on strategic and applied ecological research relating to economic developments that respect the sea's ecology and ecological values and emphasizes: a) The impact of natural change versus human intervention on ecosystem dynamics; b) Assessment of (economically beneficial) functionality and the multifunctional use from an ecological perspective; c) Protection of marine ecosystems; d) Development of management systems including comprehensive databases and advice on the consequences of management scenarios for the marine environment and fisheries (modelling). IMARES is involved in the development of Marine Protected Areas in response to the Bird and Habitat Directives, implementation of EU marine strategy and the Water Framework Directive, environmental risk assessment and development of new forms of aquaculture.

Two datasets of IMARES have been added to the inventory, although at the time, it was still under investigation whether the data could be mobilised for EMODnet:

- Annual sampling of Zeeuwse Banken during 2009-2012. The area of Zeeuwse Banken is a resource for bottom sediment extraction in the Southern part in the Netherlands. The sand is used for coastal defence and inland use. The impact of sand mining is assessed on the basis of an annual variable number of sampling stations of which a number are permanent.
- Annual sampling of the Westerschelde in Spring and Autumn 2007-2012. The area of Zeeuwse Banken is a resource for bottom sediment extraction in the Southern part in the Netherlands. The sand is used for coastal defence and inland use. The impact of sand mining is assessed on the basis of an annual variable number of sampling stations of which a number are permanent.

Currently the owner of both datasets (Rijkswaterstaat) still hasn't decided that the data can be made publicly available. Until permission is granted, IMARES will be unable to provide the datasets to EMODnet.

NO	Dataset	Number of occurrence records	Dataset Focus	
112	Annual sampling of the Westerschelde in Spring and Autumn 2007-2012		benthos	<b>new</b> (pending)
113	Annual sampling of Zeeuwse Banken		benthos	<b>new</b>



	during 2009-2012		(pending)
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Table 35. List of datasets included by IMARES in the assessment inventory. For both datasets the data owner is still to provide permission to IMARES to make the dataset available through EMODnet

**Institute of Marine Research (IMR)**

The Institute of Marine Research (IMR) from Norway mainly provides data from the Norwegian sea and is therefore discussed there. IMR however also provided the [IMR Zooplankton North Sea](#) dataset with over 6,600 zooplankton occurrences in the Greater North Sea.

**Marine Biological Association of the United Kingdom (MBA)**

MBA was founded in 1884 and has over a century of experience in the collation and management of data and scientific information and delivering advice on the marine environment to policy makers and the public. The mission statement of the MBA is ‘to promote scientific research into all aspects of life in the sea, including the environment on which it depends, and to disseminate to the public the knowledge gained’ which is met through active research and knowledge exchange activities including internationally recognized projects such as DASSH (the UK Archive for Marine Species and Habitats data), MarLIN (the Marine Life Information Network), BIOTIC (the Biological Traits Information Catalogue) and the MECN (Marine Environmental Change Network).

The UK Data Archive for Seabed Species and Habitats (DASSH) – hosted at MBA - works in collaboration with UK government and the statutory nature conservation bodies charged with collecting monitoring data, to ensure that the data are collected, stored and made available according to international data and metadata standards and in appropriate formats for the inclusion within EMODnet. The underlying biological data supporting the indicators and targets used to assess progress toward good environmental status will be archived and made available through DASSH, including those data relating to the initial assessments for each of the biological descriptors. The monitoring data will complement the existing holdings of DASSH, which currently exceeds 2 million records of marine species. These data cover the UK continental shelf, including the English Channel, North and Irish Seas and Western Approaches, from the late nineteenth century to present day. Primarily focusing on benthic and pelagic species with most of the major taxonomic groups being represented, the data includes qualitative and quantitative abundance data and present absence records.

NO	Dataset	Number of occurrence records	Dataset Focus	
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80	<a href="#">DASSH: The UK Archive for Marine Species and Habitats Data</a>	314,317	varia	<b>new</b> (harvested )
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Table 36. List of datasets included by MBA in the assessment inventory. Three different subsets of this dataset were already available through EMODnet prior to EMODnet II. This new version (which was harvested by 15 June 2016) however provides over 200.000 new occurrence records to EMODnet

### Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

The mission of the SAHFOS is to provide and maintain a critical long term and geographically extensive biological observing system for the marine environment, to understand long term ecological changes in the oceans, and to deliver scientific evidence needed to inform scientists, governments and society of the changes to the health and biodiversity of our oceans. SAHFOS is an internationally funded charity that operates the Continuous Plankton Recorder (CPR) survey. The Foundation has been collecting data from the North Atlantic and the North Sea on biogeography and ecology of plankton since 1931. SAHFOS is involved in EU and international research and policy projects, the results of which are used by marine biologists, scientific institutes, environmental change studies and policy makers across the world. The CPR team is based in Plymouth, England.

The SAHFOS Continuous Plankton Recorder (CPR) survey is the longest and most geographically extensive marine biological survey in the world. The CPR survey has been in operation in the North Sea and North Atlantic since 1946 and has systematically sampled up to 500 phyto- and zooplanktonic taxa from the major regions of the North Atlantic at a monthly resolution. Over 1.000.000 locations have been sampled.

There is free access to all CPR presence data from the EMODnet portal and access to long term near-surface phytoplankton and zooplankton abundance data from the Continuous Plankton Recorder monitoring the North Sea and North East Atlantic in the form of gridded products for three CPR phytoplankton and three CPR zooplankton species. The CPR sampling does not include species biomass. However, the Phytoplankton Colour Index (PCI) is determined, which is an indicator for the total phytoplankton biomass.

The phytoplankton and zooplankton data (presence only) were already available through the EMODnet Portal before the start of EMODnet II. Updates were provided for 4 of the 6 SAHFOS CPR datasets currently held by EMODnet.

Upon finalizing the draft for this report (15 June 2016) 3 of these 4 datasets are updated in EMODnet with the most recent available data (data till 2014). The fourth dataset (CPR Phytoplankton in the North Atlantic) was postponed as the scientific names in this dataset were not yet associated with an LSID form the World Register of Marine Species (WoRMS).

NO	Dataset	Number of occurrence records	Dataset Focus	
101	<a href="#">Continuous Plankton Recorder Dataset (SAHFOS) - Pacific Phytoplankton</a>	23,852	phytoplankton	<b>update</b> (harvested)
102	<a href="#">Continuous Plankton Recorder Dataset (SAHFOS) - Pacific Zooplankton</a>	57,292	zooplankton	<b>update</b> (harvested)
103	<a href="#">Continuous Plankton Recorder Dataset (SAHFOS) - Zooplankton</a>	205,7411	zooplankton	<b>update</b> (harvested)
104	<a href="#">Continuous Plankton Recorder (Phytoplankton)</a>	869,247	phytoplankton	<b>update</b> (pending)

*Table 37. List of datasets included by SAHFOS in the assessment inventory. All four datasets were already available through EMODnet prior to EMODnet II. Updated versions were provided and harvested by 15 June 2016, for the CPR datasets of the Pacific Ocean and the Atlantic zooplankton dataset. For the CPR phytoplankton dataset in the North Atlantic will be updated soon*

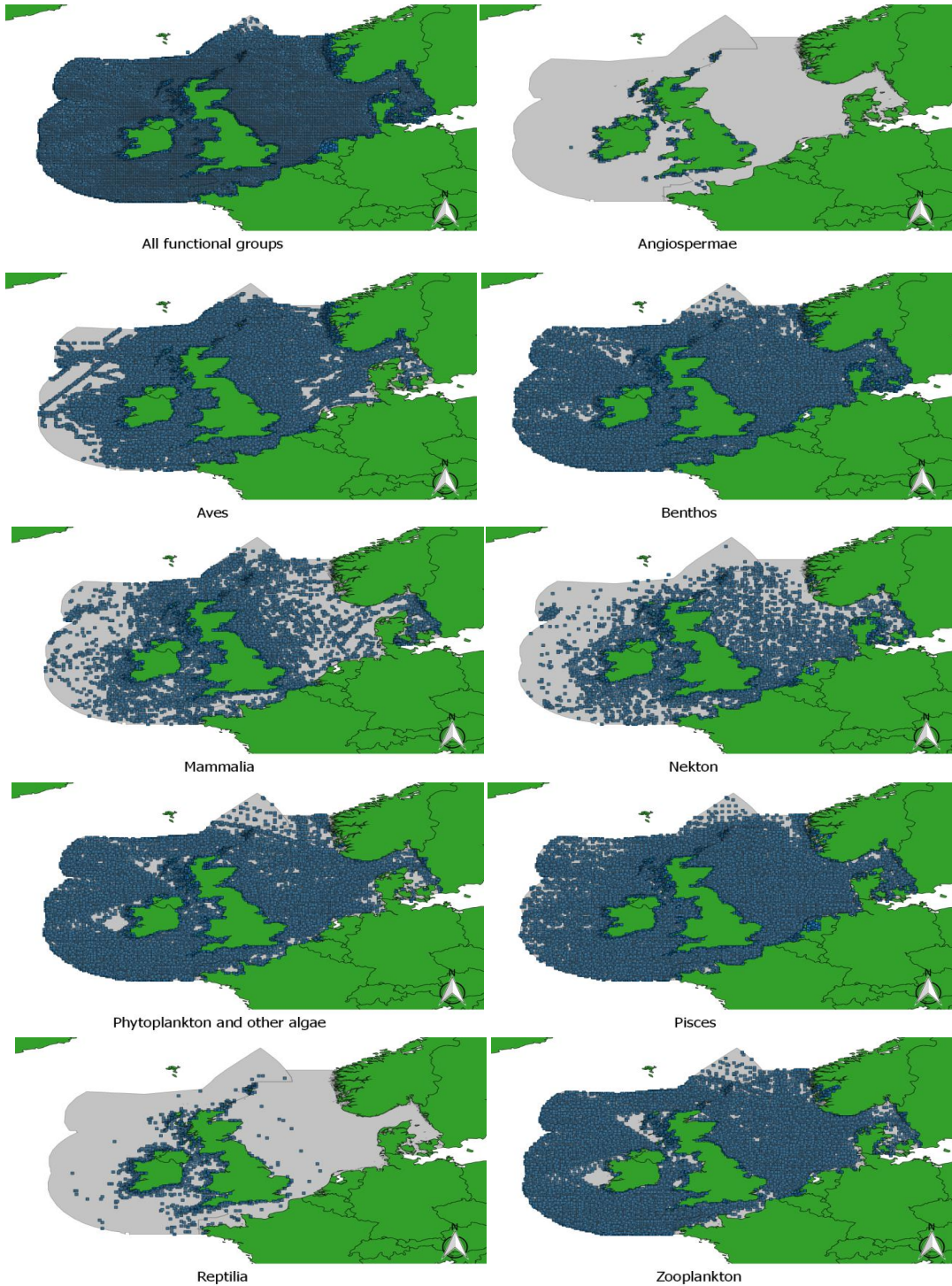


Figure 32. Distribution of occurrence records per functional group in the Greater North Sea and Celtic Seas

## Mediterranean Sea

### *Partners that have provided data for this region*

#### **Hellenic Centre for Marine Research (HCMR)**

The Hellenic Centre for Marine Research is supervised by the General Secretariat of Research and Development (Ministry of Development). The Institute of Marine Biology, Biotechnology and Aquaculture (IMBBA) – one of the three institutes of HCMR - conducts research in the fields of biodiversity, structure and dynamics of the ecosystem, ecosystem management and genetics of marine organisms. IMBBA has track record in innovative services and products in all of the above areas of research and has recently been accredited an EU excellence status from an independent committee. The Institute has received two national excellence grants and currently runs an EU excellence project funded under REGPOT. The partner has actively participated to a number of international and EU funded projects on marine biodiversity such as OBIS, BIOMARE, MARBENA, ELME, PESI, ViBRANT and VECTORS. It has also been an active partner in the MarBEF and MGE Networks of Excellence. Involved in the EMBRC and LifeWatch ESFRIs. IMBBA leads the construction and implementation phase of the national LifeWatch node.

The Hellenic Centre for Marine Research (HCMR) also functions as the Mediterranean Node of the Ocean Biogeographic Information System (OBIS). In this capacity HCMR prepares data curated by HCMR as well as data from other institutes in the Mediterranean to be harvested by OBIS and EurOBIS.

HCMR has access to long-term benthic and planktonic datasets from the Greek waters, including data covering the Saronikos Gulf, the Evoikos Gulf, the Amvrakikos lagoons and the Lakonikos Gulf. The data also include datasets related to the Inter-annual series from the deep-sea of the Aegean and Cretan Seas.

NO	Dataset	Number of occurrence records	Dataset Focus	

11 4	Long-term benthos data from the Saronikos Gulf		benthos	<b>new</b> (pending)
11 5	Long-term plankton data from the Saronikos Gulf		plantkon	<b>new</b> (pending)
11 6	Long-term benthos data from the Evoikos Gulf		benthos	<b>new</b> (pending)
11 7	Inter-annual benthos data from the Amvrakikos lagoons		benthos	<b>new</b> (pending)
11 8	Benthos data from the Lakonikos Gulf		benthos	<b>new</b> (pending)
11 9	Inter-annual benthos data from the deep sea of the Aegean and Cretan Seas		benthos	<b>new</b> (pending)
12 5	<a href="#">Benthic communities in Amvrakikos Wetlands: Mazoma, Tsopeli, Tsoukalio, Rodia and Logarou lagoons (September 2010 – July 2011)</a>	1482	benthos	<b>new</b> (harvested)
12 6	<a href="#">Benthos Cretan Continental Shelf</a>	2670	benthos	<b>new</b> (harvested)
12 7	<a href="#">Eastern Mediterranean Syllidae from three locations in Crete and Israel</a>	997	benthos	<b>new</b> (harvested)
12 8	<a href="#">Polychaetes from two subtidal rocky shores of the North coast of Crete, collected for the NaGISA project 2007-2008</a>	1359	benthos	<b>new</b> (harvested)
12 9	<a href="#">Records of fish species in coastal lagoons and sea shore that belong to Municipality of Preveza, for the period 2002-</a>	249	pisces	<b>new</b> (harvested)



	<a href="#">2011</a>			
130	<a href="#">Records of fish species in coastal lagoons that belong to Municipality of Arta, for the period 1999-2011</a>	409	pisces	<b>new</b> (harvested)

Table 38. List of datasets of HCMR

### French Research Institute for Exploitation of the Sea (IFREMER)

IFREMER is a public institute of an industrial and commercial nature (EPIC). It is supervised jointly by the Ministry of Higher Education and Research; Ministry of Ecology, Energy, Sustainable Development and Sea; and Ministry of Food, Agriculture and Fisheries. IFREMER works in a network with the French scientific community, but also in collaboration with partner organizations in numerous other countries. This cooperation is centered on large international programs, on French overseas regions and targeted countries (United States, Canada, Japan, China, Australia, Russia), and on Mediterranean policy-forming partnerships between Europe and countries of the southern Mediterranean coast. IFREMER performs targeted applied research to address the questions posed by society (climate change effects, marine biodiversity, pollution prevention, seafood quality etc.). Results include scientific knowledge, technological innovations, and systems for ocean observation and exploration. Partnerships may be public, private or a combination of the two. Monitoring of the seas and coastal waters is conducted in support of public policy on management of the environment and its resources. Through expert advice, reports on studies, evaluation campaigns, and monitoring or surveillance networks of the marine environment, IFREMER provides expertise on the major scientific questions in its fields of competence and in collaboration with the professionals of the maritime world. IFREMER oversees the development, management and provision of large-scale research facilities – a research fleet, mainframe computer, data centres and experimental facilities – which are available to national and European scientific communities, as well as within private or public research partnerships. IFREMER is the French national data host for marine monitoring data concerning the water framework directive. The institute is also the coordinator of the pilot of the Seadatanet 2 project.

IFREMER agreed to mobilize 2 large long term monitoring datasets on phytoplankton (**REPHY**), benthos (**REBENT**) for EMODnet, as well as data from a regional monitoring program in Languedoc-Roussillon (**RSL**).

The dataset “REPHY: Network Monitoring phytoplankton” contains phytoplankton data since 1987 collected in the French part of the Atlantic Ocean and the French part of the Mediterranean. IFREMER

already provided a version of the REPHY dataset to EurOBIS in 2010, but since then new data has been collected and thus the version in EurOBIS is due for an update.

The dataset REBENT: Benthic Network is a compilation of datasets which results from the monitoring program set up by IFREMER in 2003 after the wreck of the Erika and the reported lack in coastal habitats monitoring.

A first updated version of the REPHY dataset was made available by IFREMER through SeaDataNet as early as October 2015. However, this update was not harvested by EMODnet due to an apparent large reduction in the number of taxa present in this new version compared to the 2010 version held in EurOBIS. The October 2015 version only held taxa identified as toxic algae and permission needed to be asked before IFREMER would be able to provide data for all taxa. By February 2016, permission was granted and IFREMER started preparing the data. By then IFREMER also started preparing the REBENT dataset according to the SeaDataNet format, but upon finalizing the draft for this report (15 June 2016), IFREMER is still to provide both datasets.

IFREMER commented that formatting the data according to the SeaDataNet format is very time consuming, but that they would provide all 3 datasets before the end of EMODnet phase 2. However the REBENT & RSL datasets will be provided at this stage without the angiosperms and macroalgae records, due to change in personnel at IFREMER (Morgan Le Moigne replaced Antoine Huguet as contact responsible for EMODnet data delivery) and because the data producers are still to agree to disseminate their data to EMODnet.

NO	Dataset	Number of occurrence records	Dataset Focus	
109	<a href="#">REPHY: Network Monitoring phytoplankton</a>	285,562	phytoplankton	<b>update</b> (pending)
110	<a href="#">REBENT: Benthic Network</a>		benthos	<b>new</b> (pending)
111	<a href="#">RSL: Lagoon Monitoring Network of Languedoc-Roussillon</a>		varia	<b>new</b> (pending)

Table 39. List of datasets included by IFREMER in the assessment inventory. The REPHY dataset was already available through EMODnet prior to EMODnet II, the REBENT and RSL dataset are new for EMODnet. By 15 June 2016 the updated version of the REPHY dataset and a new version of the REBENT and RSL datasets



### ***Possible IFREMER datasets for next phase***

The IFREMER datasets REBENT and RSL will be provided without the angiosperms and macroalgae records. IFREMER indicates that these data can be made available in the next EMODnet phase.

### **Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)**

The Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (Nationale Institute of Oceanography and Experimental Geophysics) (**OGS**) is a multidisciplinary research institute in the field of Earth Science, which carries out basic and applied research in the fields of Oceanography (physics, chemistry and biology), Applied Geophysics and Marine geology and Seismology. The division of Oceanography has a long time experience in coastal monitoring based on integrated continuous systems and is responsible of the Long Term Ecological Research (LTER) site of the Gulf of Trieste, North Adriatic Sea, that continues the historical series of hydrological, biological and biochemical data started in the 1970s by the University of Trieste, and which now contributes to the international LTER network. Research activities of the Oceanographic division face thematic issues covering various temporal and spatial scales, and go from Operational Oceanography (integration of data and short term forecasts of biogeochemical properties of the marine system) to climate studies (impact of the scenarios of global change on the characteristics of the ecosystems in coastal and pelagic areas), from biogeochemistry to more traditional marine biology (focused on the understanding of the dynamics of marine ecosystems and on the evaluation of the role of the oceans in the global energy balance), including numeric analysis and modelling studies (development and use of end-to-end models from viruses to fish and their integration with transportation models). OGS, moreover hosts the Italian National Oceanographic Data Center (NODC) that is part of the International system of exchange of Oceanographic Data (IODE) of the Intergovernmental Oceanographic Committee (IOC) of UNESCO.

OGS agreed to make long-term time series of plankton data from the North Adriatic Long Term Ecological Research program accessible through EMODnet. This data includes time series (1986 - 2011) of phytoplankton abundance and time series (1998 - 2011) of zooplankton abundance.

OGS also made plankton and benthos data available from other monitoring projects which collected samples in the Adriatic Sea, including the ALPE ADRIA Project, the SESAME Project, the PRISMA1-Flussi Project and the INTERREG-FVG Project.

NO	Dataset	Number of occurrence records	Dataset Focus	
81	<a href="#">Macrobenthos North Adriatic-ALPE ADRIA Project</a>	3,118	benthos	<b>new</b> (harvested)
82	<a href="#">Macrobenthos North Adriatic-INTERREG-FVG Project</a>	2,367	benthos	<b>new</b> (harvested)
83	<a href="#">Meiobenthos North Adriatic-INTERREG-FVG-Projects</a>	362	benthos	<b>new</b> (harvested)
84	<a href="#">Microphytobenthos North Adriatic-Gulf of Trieste LTER time-series</a>	1,665	benthos	<b>new</b> (harvested)
85	<a href="#">Microphytobenthos North Adriatic-INTERREG Project</a>	1,386	benthos	<b>new</b> (harvested)
86	<a href="#">Phytoplankton Adriatic-SESAME Project</a>	1,181	phytoplankton	<b>new</b> (harvested)
87	<a href="#">Phytoplankton North Adriatic-ALPE ADRIA Project</a>	6,030	phytoplankton	<b>new</b> (harvested)
88	<a href="#">Phytoplankton North Adriatic-Gulf of Trieste LTER time-series</a>	28,604	phytoplankton	<b>new</b> (harvested)
89	<a href="#">Phytoplankton North Adriatic-INTERREG-FVG Project</a>	3,732	phytoplankton	<b>new</b> (harvested)
90	<a href="#">Phytoplankton South Adriatic-PRISMA1-Flussi Project</a>	955	phytoplankton	<b>new</b> (harvested)
91	<a href="#">Netplankton North Adriatic-ALPE ADRIA Project</a>	3,146	plankton (other)	<b>new</b> (harvested)
92	<a href="#">Picoplankton Adriatic-SESAME Project</a>	320	plankton (other)	<b>new</b> (harvested)

93	<a href="#">Picoplankton North Adriatic-Gulf of Trieste LTER time-series</a>	1,087	plankton (other)	<b>new</b> (harvested)
94	<a href="#">Mesozooplankton North Adriatic-Gulf of Trieste LTER time-series</a>	4,228	zooplankton	<b>new</b> (harvested)
95	<a href="#">Mesozooplankton North Adriatic-INTERREG Project</a>	426	zooplankton	<b>new</b> (harvested)
96	<a href="#">Mesozooplankton South Adriatic-PRISMA1-Flussi Project</a>	680	zooplankton	<b>new</b> (harvested)
97	<a href="#">Microzooplankton North Adriatic-ALPE ADRIA Project</a>	495	zooplankton	<b>new</b> (harvested)
98	<a href="#">Microzooplankton North Adriatic-Gulf of Trieste LTER time-series</a>	3,943	zooplankton	<b>new</b> (harvested)
99	<a href="#">Microzooplankton North Adriatic-INTERREG Project</a>	5,562	zooplankton	<b>new</b> (harvested)
100	<a href="#">Microzooplankton South Adriatic-PRISMA1-Flussi Project</a>	2,025	zooplankton	<b>new</b> (harvested)

Table 40. List of datasets included by OGS in the assessment inventory. All 20 datasets are new for EMODnet and were harvested by 15 June 2016

### Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

SAHFOS also provided the large zooplankton dataset [Continuous Plankton Recorder Dataset \(SAHFOS\) - Zooplankton](#) which contains data from the entire North Atlantic, including the West Mediterranean Basin. As most of the records from this dataset are located in the Greater North Sea and Celtic Sea, the SAHFOS datasets are discussed in detail there.

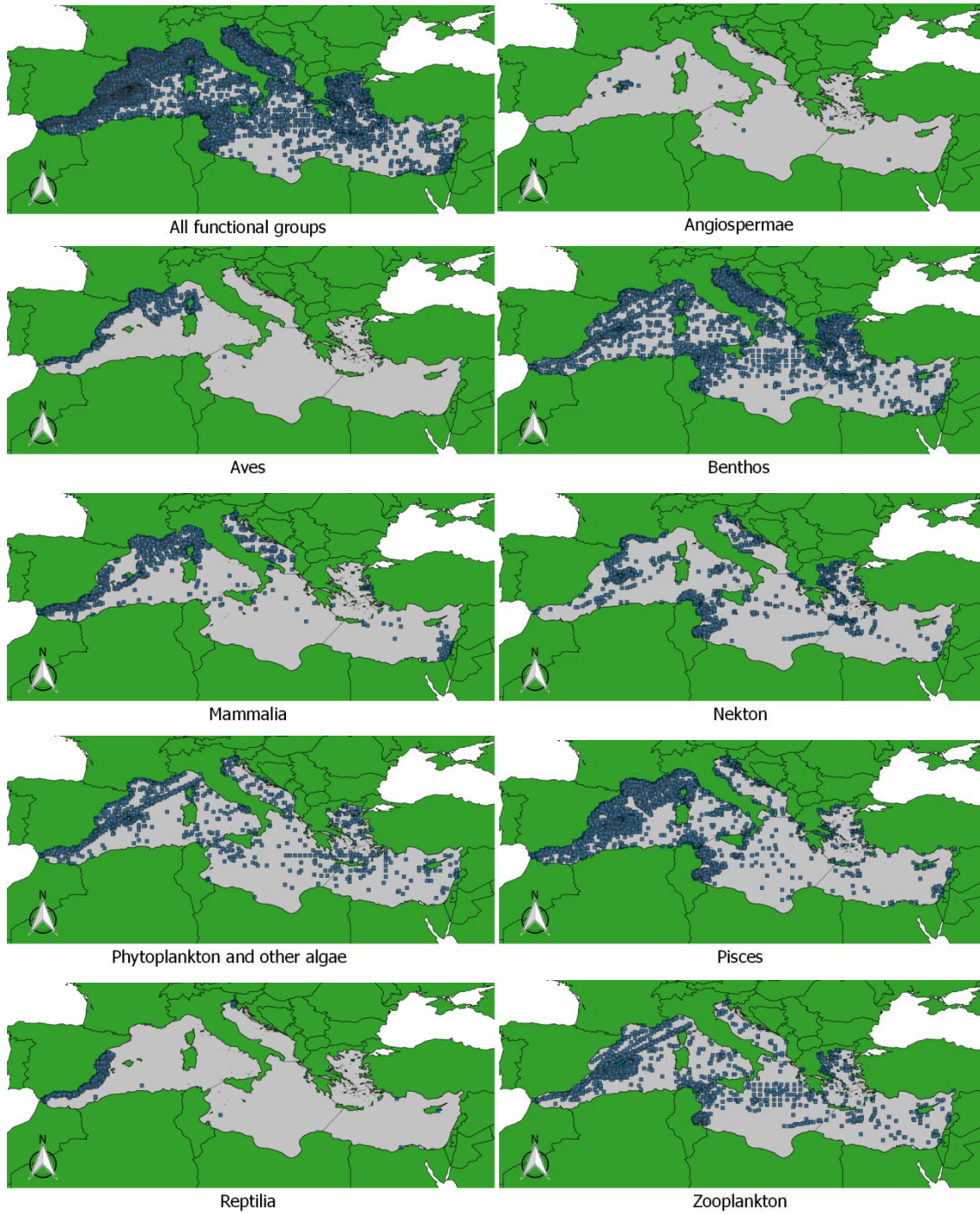


Figure 33: Distribution of occurrence records per functional group in the Mediterranean Sea

## Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen

### *Partners that have provided data for this region*

#### **Institute of Marine Research (IMR)**

IMR is a national governmental institution under the Ministry of Fisheries and Coastal affairs in Norway. The main tasks are to do ecosystem monitoring and research for better management advice on the marine ecosystems of the Barents, Norwegian and North seas and the Norwegian coastal zone, and on aquaculture. In addition, IMR has a significant activity in developing countries. IMR has marine experts covering the whole ecosystem from physics to whales. A skilled group of numerical modellers are simulating climate/physics, primary and secondary production, harmful algal blooms, fish larvae growth and distribution, and contaminants with the main aim of understanding the impact of varying climate and lower trophic levels on the dynamics of marine ecosystems/fisheries. IMR hosts the Norwegian Marine Data centre.

The biotic and plankton databases contain data from bottom trawls, pelagic trawls and a variety of plankton nets on species level and with biomass and abundance data. Station data include geographical coordinates, sampling water depth and sampling dates. The time span for biotic data is approximately 80 years, fisheries data starting in the early 1930s. IMR contributes data from the Norwegian zooplankton monitoring program with data from 1981 till 2014 for the Barents Sea and data from 1984 till 2014 for the Norwegian Sea and the Sea of Jan Mayen. Also contributed are data from the juvenile fish, Capelin larvae and Herring larvae monitoring programs, and data from 4 surveys focusing on fish eggs. The MARBUNN database contains benthos from the seabed in the Norwegian coastal and offshore areas, covered by the MAREANO project. In addition, data and information on deep sea coral reefs are collected. These data are more of recent origin, since 2006.

There were some difficulties in the delivery of the abundance data. The data was originally provided without abundances and biomass records even though in the EMODnet agreement it was specified that these could be made available. After some discussion the abundance and biomass records were also provided. However, for the 3 zooplankton datasets this resulted in a large reduction of occurrence records (e.g. from 78,689 to 30,759 records for the dataset MR Zooplankton Norwegian Sea), because the abundances provided were summed over all life stages. On 15 June 2016 the EMODnet version of this dataset does not hold abundance data (the version with 78,689 records was kept), as it's still being investigated by IMR whether the abundances for each life stage can be provided.

NO	Dataset	Number of occurrence	Dataset Focus	

		e records		
69	<a href="#">MAREANO - Base-line mapping of fauna obtained with grab</a>	11,760	benthos	<b>new</b> (harvested )
70	<a href="#">MAREANO - Base-line mapping of epifauna obtained with Beamtrawl</a>	7,338	benthos (epi)	<b>new</b> (harvested )
71	<a href="#">MAREANO - Base-line mapping of hyperbenthic crustacea fauna obtained with RP-sledge</a>	6,074	benthos (hyper)	<b>new</b> (harvested )
72	<a href="#">IMR Capelin larvae monitoring</a>	2,899	pisces	<b>new</b> (harvested )
73	<a href="#">IMR Fish eggs survey</a>	891	pisces	<b>new</b> (harvested )
74	<a href="#">IMR Herring larvae monitoring</a>	4,497	pisces	<b>new</b> (harvested )
75	<a href="#">IMR Juvenile fish monitoring</a>	5,615	pisces	<b>new</b> (harvested )
76	<a href="#">IMR Macroplankton surveys</a>	5,342	plankton (other)	<b>new</b> (harvested )
77	<a href="#">IMR Zooplankton Barents Sea</a>	21,193	zooplankton	<b>new</b> (harvested )
78	<a href="#">IMR Zooplankton North Sea</a>	8,048	zooplankton	<b>new</b> (harvested )

				)
79	<a href="#">IMR Zooplankton Norwegian Sea</a>	78,689	zooplankton	<b>new</b> (harvested )

Table 41. List of datasets included by IMR in the assessment inventory. All 12 datasets are new for EMODnet and were harvested by 15 June 2016

### Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

SAHFOS also provided the large zooplankton dataset [Continuous Plankton Recorder Dataset \(SAHFOS\) - Zooplankton](#) which contains data from the entire North Atlantic, including the Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen. However, as most records from this dataset are located in the Greater North Sea and Celtic Sea, the SAHFOS datasets are discussed in detail there.



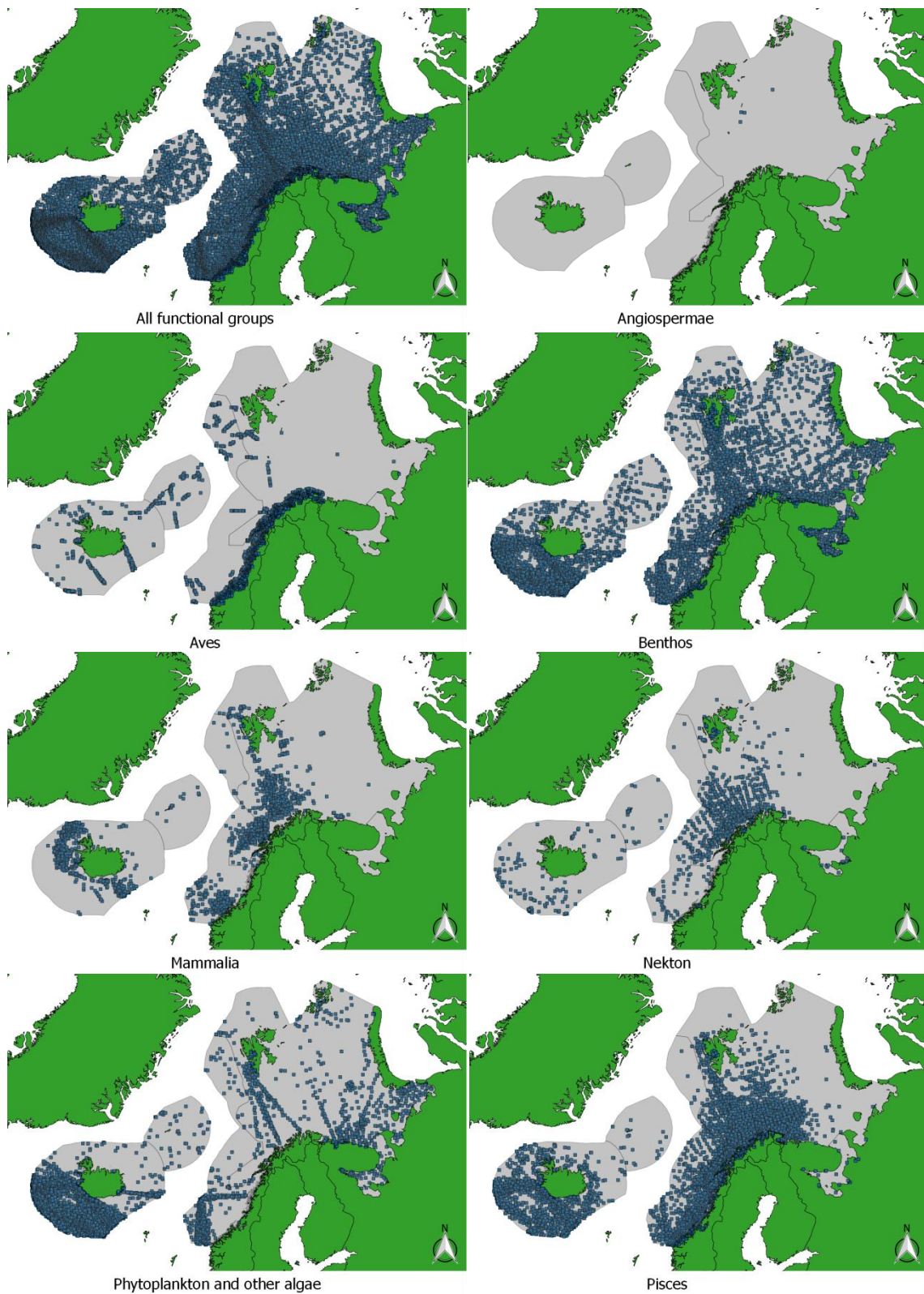


Figure 34: Distribution of occurrence records per functional group in the Norwegian Sea, Arctic Ocean, Iceland Sea and Sea of Jan Mayen



## Annex 4: List of data products

Sea Basin	Taxonomic group	Taxon	Period	Data source	Number of slices	Temporal resolution
Atlantic (Azores)	Birds	<i>Calonectris diomedea</i>	2000-2003	POPA	27	Seasonal
		<i>Larus cachinnans</i>	2000-2004	POPA	27	Seasonal
	Mammals	<i>Delphinus delphis</i>	1998-2006	POPA	11	Yearly
		<i>Physeter macrocephalus</i>	1998-2005	POPA	11	Yearly
		<i>Stenella frontalis</i>	1998-2007	POPA	11	Yearly
		<i>Tursiops truncatus</i>	1998-2008	POPA	11	Yearly
	Reptiles	<i>Caretta caretta</i>	1998-2009	POPA	11	Yearly
Atlantic and Mediterranean (France)	Phytoplankton	Dynophisis spp.	1995-2014	IFREMER	72	Seasonal
		Harful/(harmful+Harmless)	1995-2015	IFREMER	72	Seasonal
		Taxa richness	1995-2016	IFREMER	72	Seasonal
Atlantic and North Sea	Phytoplankton	Total diatoms	1958-2012	SAHFOS	184	Seasonal
		Total dinoflagellates	1958-2012	SAHFOS	184	Seasonal
	Zooplankton	Acartiaspp.	1958-2013	SAHFOS	188	Seasonal
		<i>Calanus finmarchicus</i>	1958-2012	SAHFOS	184	Seasonal
		<i>Calanus helgolandicus</i>	1958-2012	SAHFOS	184	Seasonal
		Large copepods	1958-2013	SAHFOS	188	Seasonal
		<i>Metridia lucens</i>	1959-2013	SAHFOS	188	Seasonal
		Copepods Large/(large+small)	1958-2013	SAHFOS	188	Seasonal
		Small copepods	1958-2013	SAHFOS	188	Seasonal
		<i>Temora longicornis</i>	1958-2013	SAHFOS	188	Seasonal
Oithonaspp.	1958-2013	SAHFOS	188	Seasonal		
Baltic	Benthic invertebrates	Marenzelleriaspp.	1987-2013	SMHI, SYKE, AU	24	Yearly
		<i>Acartia bifilosa</i>	1995-2013	SMHI	1	Yearly
		<i>Acartia clausi</i>	1995-2013	SMHI	1	Yearly
		Acartiaindet.	1995-2013	SMHI	1	Yearly
		<i>Acartia longiremis</i>	1995-2013	SMHI	1	Yearly
		<i>Acartia tonsa</i>	1995-2013	SMHI	1	Yearly
		Appendiculariaindet.	1995-2013	SMHI	1	Yearly
		Bivalviaindet.	1995-2013	SMHI	1	Yearly
		<i>Bosmina (Eubosmina) coregoni</i>	1995-2013	SMHI	1	Yearly
		Bryozoaindet.	1995-2013	SMHI	1	Yearly
		<i>Calanus finmarchicus</i>	1995-2013	SMHI	1	Yearly
		Calanusindet.	1995-2013	SMHI	1	Yearly
		<i>Centropages hamatus</i>	1995-2013	SMHI	1	Yearly
		Centropagesindet.	1995-2013	SMHI	1	Yearly
		<i>Centropages typicus</i>	1995-2013	SMHI	1	Yearly
		Cirripediaindet.	1995-2013	SMHI	1	Yearly
		Copepodindet.	1995-2013	SMHI	1	Yearly
		Cyclopoidindet.	1995-2013	SMHI	1	Yearly
		Echinodermataindet.	1995-2013	SMHI	1	Yearly
		Eurytemoraindet.	1995-2013	SMHI	1	Yearly
		Evadneindet.	1995-2013	SMHI	1	Yearly
		<i>Evadne nordmanni</i>	1995-2013	SMHI	1	Yearly
		Fritillariaindet.	1995-2013	SMHI	1	Yearly
Gastropodaindet.	1995-2013	SMHI	1	Yearly		
Harpacticoidaindet.	1995-2013	SMHI	1	Yearly		
<i>Keratella cochlearis</i>	1995-2013	SMHI	1	Yearly		
<i>Keratella cruciformis</i>	1995-2013	SMHI	1	Yearly		
<i>Keratella quadrata</i>	1995-2013	SMHI	1	Yearly		

Sea Basin	Taxonomic group	Taxon	Period	Data source	Number of slices	Temporal resolution	
Baltic	Benthic invertebrates	<i>Limnocalanus macrurus</i>	1995-2013	SMHI	1	Yearly	
		Microsetellaindet.	1995-2013	SMHI	1	Yearly	
		Oikopleuraindet.	1995-2013	SMHI	1	Yearly	
		Oithonaindet.	1995-2013	SMHI	1	Yearly	
		Paracalanusindet.	1995-2013	SMHI	1	Yearly	
		<i>Podon leuckartii</i>	1995-2013	SMHI	1	Yearly	
		<i>Podon polyphemoides</i>	1995-2013	SMHI	1	Yearly	
		Polychaetaindet.	1995-2013	SMHI	1	Yearly	
		<i>Pseudocalanus elongatus</i>	1995-2013	SMHI	1	Yearly	
		Pseudocalanusindet.	1995-2013	SMHI	1	Yearly	
		Radiospermaindet.	1995-2013	SMHI	1	Yearly	
		Rotiferaindet.	1995-2013	SMHI	1	Yearly	
		Synchaetaindet.	1995-2013	SMHI	1	Yearly	
		<i>Temora longicornis</i>	1995-2013	SMHI	1	Yearly	
Thecosomataindet.	1995-2013	SMHI	1	Yearly			
North Sea	Benthic invertebrates	<i>Abra prismatica</i>	1986	NSBS	1	Yearly	
		<i>Amphiura filiformis</i>	1986	NSBS	1	Yearly	
		<i>Bathyporeia elegans</i>	1986	NSBS	1	Yearly	
		<i>Chaetozone setosa</i>	1986	NSBS	1	Yearly	
		<i>Echinocardium cordatum</i>	1986	NSBS	1	Yearly	
		<i>Goniada maculata</i>	1986	NSBS	1	Yearly	
		<i>Harpinia antennaria</i>	1986	NSBS	1	Yearly	
		<i>Lunatia poliana</i>	1986	NSBS	1	Yearly	
		<i>Mysella bidentata</i>	1986	NSBS	1	Yearly	
		<i>Nephtys hombergii</i>	1986	NSBS	1	Yearly	
		<i>Nephtys longosetosa</i>	1986	NSBS	1	Yearly	
		<i>Ophelia borealis</i>	1986	NSBS	1	Yearly	
		<i>Ophiura albida</i>	1986	NSBS	1	Yearly	
		<i>Owenia fusiformis</i>	1986	NSBS	1	Yearly	
		<i>Scoloplos armiger</i>	1986	NSBS	1	Yearly	
		<i>Spio filicornis</i>	1986	NSBS	1	Yearly	
	<i>Spiophanes bombyx</i>	1986	NSBS	1	Yearly		
	<i>Spiophanes kroyeri</i>	1986	NSBS	1	Yearly		
	Birds		<i>Alca torda</i>	1980-2010	JNCC	92	Seasonal
			Fulmarusspp.	1980-2010	JNCC	92	Seasonal
			<i>Larus argentatus</i>	1980-2010	JNCC	88	Seasonal
			<i>Morus bassanus</i>	1980-2010	JNCC	92	Seasonal
			<i>Rissa tridactyla</i>	1980-2010	JNCC	92	Seasonal
			<i>Somateria mollissima</i>	1980-2010	JNCC	92	Seasonal
			Stercorarius spp.	1980-2010	JNCC	91	Seasonal
			<i>Thalasseus sandvicensis</i>	1980-2010	JNCC	92	Seasonal
	Fishes		<i>Clupea harengus</i>	1965-2012	ICES	25	Yearly
<i>Engraulis encrasicolus</i>			1965-2012	ICES	25	Yearly	
<i>Gadus morhua</i>			1965-2012	ICES	39	Yearly	
Ammodytidae			1965-2012	ICES	25	Yearly	
<i>Scomber scombrus</i>			1965-2012	ICES	25	Yearly	
<i>Sprattus sprattus</i>			1965-2012	ICES	25	Yearly	
Mammals		Dolphin	1980-2010	JNCC	22	Yearly	
		Phocidae	1980-2010	JNCC	92	Seasonal	
		<i>Phocoena phocoena</i>	1980-2010	JNCC	92	Seasonal	
		Whale	1980-2010	JNCC	23	Yearly	
Microorganisms		Cyanobacteria	2007-2008	NIOZ	1	Yearly	
		Picoeukaryotes	2007-2009	NIOZ	1	Yearly	
		Nano-eukaryotes	2007-2010	NIOZ	1	Yearly	
		Bacteria	2007-2011	NIOZ	1	Yearly	
		Viruses	2007-2012	NIOZ	1	Yearly	
Phytoplankton		Chlorophyll a concentration	1974-2014	RWS	160	Seasonal	

*Table 42. List of the data products. Data sources: AU, Aarhus University, Aarhus, Denmark; ICES, International Council for the Exploration of the Sea, Copenhagen, Denmark; IFREMER, French Research Institute for Exploitation of the Sea; JNCC, Joint Nature Conservation Committee, UK; NIOZ, Netherlands Institute for Sea Research; NSBS, North Sea Benthos Survey (ICES, 1986); POPA, Azores Fisheries Observer Programme, Portugal; RWS, Rijkswaterstaat: Dutch Ministry of Infrastructure and the Environment; SAHFOS, Sir Alister Hardy Foundation for Ocean Science, UK; SMHI, Swedish Meteorological and Hydrological Institute; SYKE, Finnish Environment Institute*

## ***Annex 5: References***

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