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REVIEW PAPER

Analysing the content of the European Ocean Biogeographic Information System (EurOBIS): available data, limitations, prospects and a look at the future

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Abstract The European Ocean Biogeographic Information System—EurOBIS—is an integrated data system developed by the Flanders Marine Institute (VLIZ) for the EU Network of Excellence "Marine Biodiversity and Ecosystem Functioning" (MarBEF) in 2004. Its principle aims are to centralise the largely scattered biogeographical data on marine species collected by European institutions and to make these quality-controlled data freely available and easily accessible. It is in essence a distributed system in which individual datasets go through a series of quality control procedures before they are integrated into one large consolidated database. EurOBIS is freely available online at www.eurobis.org, where marine biogeographical data—with a focus on taxonomy, temporal and spatial distribution—can be consulted and downloaded for analyses. Over the last 6 years, EurOBIS has collected 228 datasets contributed by more than 75 institutes, representing over 13.6 million distribution records of which almost 12.5 million records are species level identifications. It is now the largest online searchable public source of European marine biological data, holding biogeographical information on 26,801 species and 9,221 genera. EurOBIS acts as the European node of OBIS, the Ocean Biogeographic Information System of the Census of Marine Life (CoML). EurOBIS shares its data with OBIS, which in its turn shares its content with the Global Biodiversity Information Facility (GBIF). This article describes the status of the European Ocean Biogeographic Information System, identifies data gaps, possible applications, uses and limitations. It also formulates a strategy for the growth and improvement of the system and wants to appeal for more contributions.

Keywords Database · Biogeography · Marine biodiversity · Europe · Data integration · Data limitations

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Introduction

Data on the biological component of the marine environment—also in Europe—is mostly scattered throughout the scientific landscape and has often not been published (Grassle & Stocks, 1999; Grassle, 2000; Myers, 2000; Zeller et al., 2005). Moreover, marine scientists mainly conduct their research in their own field of expertise, focused on specific taxa or

ecosystem components and on relatively small temporal and spatial ranges (e.g. Costello & Vanden Berghe, 2006; Vandepitte et al., 2009) and they ignore the fact that these data can be deployed for other—often much broader—purposes (Froese et al., 1999). In addition, several—often long-term—national monitoring programmes are generating a vast amount of data, but international coordination, standardisation and automated data sharing procedures are not yet in place. However, bringing existing datasets together and making them easily accessible and freely available will provide a very powerful information resource, which could greatly broaden our current knowledge on marine community structure and the (changes within) temporal and spatial distribution of European marine species.

For these reasons, EurOBIS was developed in 2004 within the FP6 Network of Excellence "Marine Biodiversity and Ecosystem Functioning" (MarBEF NoE, 2004–2009). The principle aim of EurOBIS is twofold: (1) to centralise the largely scattered European biogeographical data on marine species in one easily accessible (virtual) location and (2) to make these quality-controlled biogeographical data freely and widely available, by providing its end-users—scientists, policy makers and the public at large—a searchable database on marine species, with a main focus on taxonomy and distribution records in space and time. EurOBIS covers an area of about 22 million km^2 and includes all the continental shelf seas of Europe, including the Mediterranean shelf and the Baltic Seas (Costello et al., 2001). The geographical boundaries are set to 90N–70E–26N–45W.

This article primarily aims to describe the status of EurOBIS, the data flow to international initiatives starting from this system, the quality control procedures and identifies gaps in the system in terms of taxonomic, geographical and temporal coverage. In addition, the system itself is critically evaluated to determine important gaps in the data collation process and how they can be filled in the future.

The EurOBIS database

The European Ocean Biogeographic Information System (EurOBIS) is a distributed system that allows searching multiple datasets simultaneously for geographical information on marine organisms, focused on three main parameters of a distribution record: taxonomy, temporal and geographical cover. The database consists of a standard list of data fields, the OBIS schema version 1.1, which is an extension of DarwinCore 2. This OBIS scheme is the content standard used by OBIS and is designed for marine biodiversity data, specifically to record the capture or observation of a particular species at a certain location. It can also be used for documenting specimens from museum collections and literature data. The scheme lists 74 data fields, of which 7 are mandatory and an additional 15 are classified as highly recommended. All other data fields are optional. For a full overview of the OBIS scheme, we refer to the OBIS website (http://www.iobis.org/node/304). EurOBIS is freely available online and can be explored through a dynamic search-interface (http://www.eurobis.org).

Contributing data to EurOBIS

Scientists or institutes can provide biological data from European marine waters to EurOBIS either by sending the digitised data directly to the EurOBIS data management team or by setting up a distributed database system (DiGIR, http://sourceforge.net/projects/digir/files/) (Fig. 2). In both cases the data custodian remains the owner of the provided data and updates are possible at any given time. DiGIR can be seen as a communication medium between the EurOBIS portal and the provider: when the portal is being queried, this query is also sent out to its distributed data contributors where it is translated into an equivalent request compatible with the structure of the local database. The response is translated to match the EurOBIS structure and is then shown on the EurOBIS web pages. Joining EurOBIS through this distributed data system as a contributor is relatively easy, as no adaptations to the local database structure are necessary: contributors only have to establish a link between the EurOBIS data fields and their own data fields, allowing DiGIR to recognise compliant fields and information. For performance reasons however—e.g. a decrease in reaction and performance speed due to network growth or certain sources being temporarily off-line—a local copy of all these distributed data is retrieved through DiGIR and is held at the Flanders Marine Institute (VLIZ) (see also Costello & Vanden Berghe, 2006). Regular

queries and updates between EurOBIS and these providers guarantee the completeness, quality and integrity of the data in the system. After quality control procedures, both the data and a thorough metadata description become freely available through the EurOBIS web portal. EurOBIS also accepts non-European marine data, provided they are collected by European institutes.

Although scientists may raise a lot of concerns for making their data widely available—e.g. regarding data control, potential misuse, sensitivity of data or possible competition—the majority of these arguments can easily be refuted or taken into account in data use agreements and data policies (e.g. Froese et al., 1999; Prance, 2000; Parr & Cummings, 2005; Costello, 2009). To avoid possible misuse of the publicly available data on the EurOBIS portal by third parties, a Terms of Use was developed. Its main points are listed in Box 1.

Since the start of EurOBIS in 2004, there has been a steady growth of freely available distribution records (Fig. 1a). In July 2010, 228 datasets are available representing 13,601,201 distribution records provided by more than 75 data custodian institutes. Appendix 1 in Supplementary material lists all the available datasets with their temporal and geographical span, number of taxa and distribution records. An overview of the largest data providers to EurOBIS with their respective number of distribution records is given in Table 1.

International data flow

Together with the host organisations or institutes of the 13 other Regional OBIS Nodes (RONs), the Flanders Marine Institute (VLIZ) has committed to a continuous support of OBIS, translated in serving distribution data on European marine species freely available online and developing a data provider and end-user community (www.iobis.org). The regional nodes generally have a better insight in the available data for the specific region and often have personal contact with the data collecting scientists (Chavan et al., 2005). Working on a smaller geographical scale also allows a good overview of possible data providers through networking and project involvement. These advantages make it more efficient to mobilise marine biodiversity information from their area compared to a data collection effort of a central, international portal. EurOBIS shares its data with OBIS through the use of DiGIR's client packages (Fig. 2) and is currently the largest data provider to OBIS: almost 50% of the total number of distribution records available in OBIS is shared with EurOBIS. OBIS is the information component of the Census of Marine Life (CoML), a 10-year initiative to assess and explain the diversity, distribution and abundance of life in the oceans—past, present and future (Grassle, 2000; Decker & O'Dor, 2003; Yarincik & O'Dor, 2005) and stores all marine biogeographical data gathered through the different CoML projects, but is not limited to this. In its turn, OBIS shares its data with GBIF—the Global Biodiversity Information Facility—which also uses DiGIR and XML transfer protocols (Fig. 2). GBIF is a network of data providers that facilitates the digitisation of biodiversity data and builds a biodiversity information infrastructure (http://www.gbif.org). OBIS is recognised as the marine thematic sub-network of GBIF and is one of its largest data providers (http://www.iobis.org). As of July 2010, OBIS has contributed 27.7 million distribution records to GBIF, accounting for almost 14% of GBIF's total number of records.

Box 1 EurOBIS Terms of Use

By consulting or downloading data or data products from EurOBIS, the user agrees to the following:

- To use the data for non-commercial purposes only. For commercial use, prior written consent of the original data custodian is required
- Not to redistribute the downloaded data through other media, but to refer to the EurOBIS website
- To cite each used data set and EurOBIS appropriately in each publication based on EurOBIS data
- To forward the citation of any publication / report that made use of the data provided by EurOBIS for inclusion in our list of references
- Not to hold neither EurOBIS nor the original data custodian liable for errors in the data. Whilst we have made every effort to ensure the quality of the database, we cannot guarantee the accuracy of these data

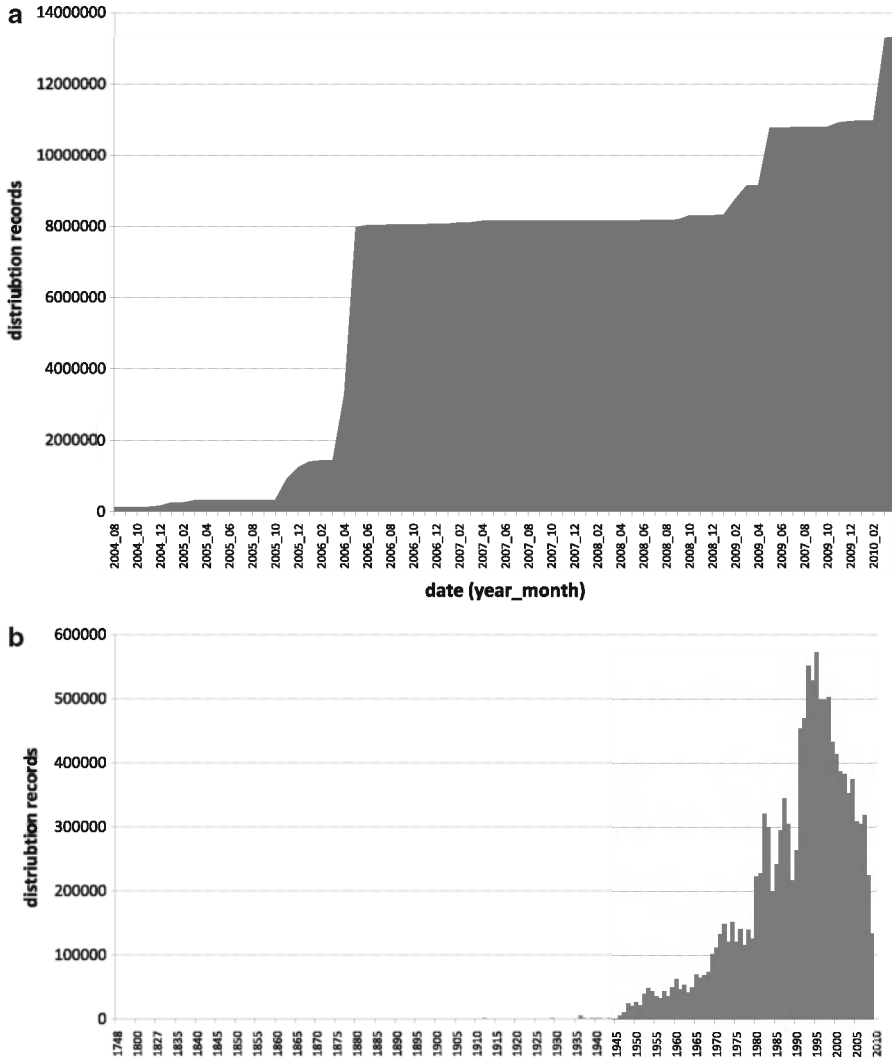

Fig. 1 Number of distribution records available in EurOBIS in June 2010. (**a**) Evolution in growth of number of distribution records; (**b**) total number of distribution records collected per year

The regional approach and thematic focus of EurOBIS—the European marine waters—gives the system a number of advantages compared to its umbrella systems OBIS and GBIF. As EurOBIS is a European system, it can apply for (co-)financing on the European level, for example by participating in framework programmes, ESFRI-infrastructures and other projects. National, regional or European funding agencies thus help finance the development and maintenance of the EurOBIS portal, thereby making continuous data gathering, integration and standardisation possible. Due to the specific scope of EurOBIS, its host institute can focus on gathering additional data and information which cannot be captured in the general OBIS Scheme. The Flanders Marine Institute (VLIZ)—as host institute—also has the opportunity to develop relevant analysis tools and applications for the portal not available in OBIS or GBIF. A similar approach has been followed by the thematic OBIS Node OBIS Seamap (e.g. Halpin et al., 2009; Read et al., 2011). This way, both portals have created added value and provide a higher precision of the data which cannot be transferred to OBIS due to the limited scheme for data exchange.

The EurOBIS data infrastructure is also used as the central hub for making biological data available within EMODnet, the European Marine Observation and Data Network. EMODnet is currently carried out as a 3-year preparatory action (2009–2011) and aims at gathering experience for a later permanent operational system (Anon., 2009; http://bio.emodnet.eu).

Table 1 Absolute and relative share of the largest data contributions to EurOBIS

Provider	Total number of records	Relative proportion
ICES	5,543,476	40.8
CPR	1,838,855	13.5
PANGAEA	1,562,156	11.5
NBN	1,436,987	10.6
ESAS	1,122,883	8.3
MarBEF	422,518	3.1
REPHY	285,562	2.1
WOD	180,354	1.3
IBSS	151,610	1.1
Others	1,056,800	7.8
Total	13,601,201	100

ICES International Council for the Exploration of the Sea, *CPR* Continuous Plankton Recorder, *PANGAEA* Publishing Network for Geoscientific & Environmental Data, *NBN* National Biodiversity Network (UK), *ESAS* European Seabirds at Sea, *MarBEF* Marine Biodiversity and Ecosystem Functioning Network of Excellence, *REPHY* Réseau de Surveillance Phytoplanctonique, *WOD* World Ocean Database, *IBSS* Institute of Biology of the Southern Seas, *others* all other providers combined

Additionally, it is planned that EurOBIS will become one of the future LifeWatch components, providing services and access to marine species distribution information in Europe. LifeWatch will be a large-scale European research infrastructure for biodiversity data and observatories (www.lifewatch.eu). LifeWatch is currently in its preparatory phase and is expected to take off in 2012.

Quality control and standardisation procedures

Compiling data from different sources collected for various purposes and under diverse circumstances requires a minimum of standardisation and quality control before sound and useful integration becomes possible. An in-depth quality control on each contributing dataset in terms of taxonomy and geography improves both the quality of the individual source dataset and the quality of the integrated data, as all inconsistencies or doubts are communicated back to the data provider. This does not only provide a strong added value for the data custodian, but also for the user: being able to access and use higher quality data, controlled on different levels, will lead to more reliable and higher-level analyses, conclusions and decisions (Froese et al., 1999).

Taxonomic standardisation

EurOBIS uses the World Register of Marine Species (WoRMS, www.marinespecies.org) as a standard list for taxonomic names. WoRMS is an authoritative taxonomic list of species occurring worldwide in the marine environment (Appeltans et al., 2009). All taxon names are matched with WoRMS to trace and rule out spelling variations and resolve frequently used synonyms. Unmatched taxa are sent back to the data provider for a secondary check-up. If it concerns valid taxon names not yet present in WoRMS, these are passed on to the responsible taxonomic editors of WoRMS who will check them, resolve the taxonomy and may decide to add them to the Register. Taxa

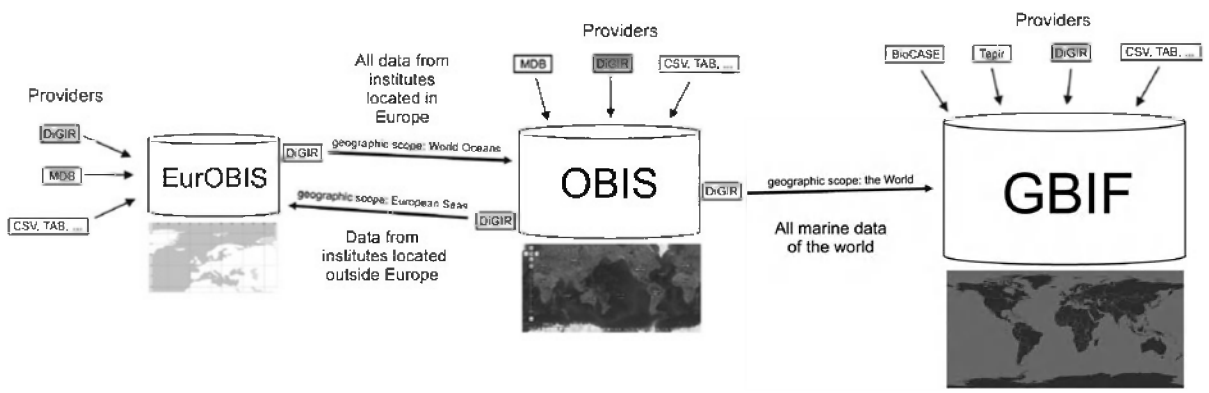

Fig. 2 Interrelatedness between the data providers of European marine biological data, the European node of the Ocean Biogeographic Information System (EurOBIS), the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF)

with uncertain determinations (e.g. sp.1; sp.; cfr.; aff.) are matched to the first suitable higher taxonomic level.

Geographical standardisation

Geographical information can be recorded in several ways. The most straightforward are geographical coordinates—latitude and longitude—expressed in decimal degrees. Standard quality control procedure implies plotting these coordinates on a map to identify possible positioning errors which can include sampling locations on land or outside the indicated geographical range due to accidental swapping of latitude and longitude or errors related to the use of the minus sign (the minus sign is used to indicate S and W in decimal degrees). Location data can also be delivered as a broader geographical range, e.g. present in the North Sea, the Mediterranean or the Kattegat. When coordinates are missing, EurOBIS makes use of the VLIZ Marine Gazetteer (VLIMAR)—a standard, relational list of geographical names—to assign matching latitudes and longitudes to a location (VLIZ, 2010). In these cases, a centroid coordinate for these respective sea basins is assigned as well as the precision—expressed in metres—thus evidently importing loss of precision into the system. A third generalised delivery of geographical information is a reference to a country, e.g. present in France, U.K. or Spain. For these records, the centroid coordinates of the country were assigned to the distribution records, giving rise to marine species distributions falling on land and thus an even greater loss of precision. In these cases, a note can accompany the distribution record, to draw the user's attention to this generalisation.

Fitness for use of the data and possible pitfalls

Using the available data in EurOBIS requires a critical mind: the relevant information and data should be filtered conscientiously prior to testing a hypothesis. This section gives a concise overview of the available data and information in EurOBIS, how this data can be put to use and which deficits and ambiguities have to be taken into account to perform reliable analyses at different levels.

Taxonomy

Taxonomic quality control procedures have identified 5,600 species and/or genus names which were spelled incorrectly and 4,772 species and/or genus names were considered synonyms by taxonomic experts. All these taxonomically unaccepted names are now linked to their valid counterparts, greatly improving the taxonomic quality of the available data. In July 2010, EurOBIS held biogeographical information on 26,801 species and 9,221 genera. Respectively, 84 and 88% of those species and genera have been documented within European marine waters. The remaining species were reported by European institutes to occur outside Europe. For two major taxonomic groups, over 50% of the documented species only occurred outside the European marine waters: Brachiopoda (77% or 102 species outside compared to 32 inside Europe) and Cephalorhyncha (59% or 13 species outside compared to 9 species inside Europe).

Overall, the numbers of recorded distinct species within European marine waters in EurOBIS for the 45 defined major taxonomic groups seemed high, but are for 37 of these (significantly) lower than the number of species documented in the European Register of Marine Species (ERMS) (Fig. 3). For eight groups (Bacteria, Chromista, Plantae, Echiura, Cephalochordata, Hexapoda, Pisces and Aves) this ratio is inverse, which can be explained by the fact that EurOBIS has a broader environmental scope than ERMS: whereas ERMS is limited to marine and brackish water species, EurOBIS, e.g. also includes plants or birds that are part of the coastal dunes or mudflats. Two additional explanations for this inverse ratio can be formulated: (1) these species do occur in European marine waters but have not yet been documented in ERMS, or (2) the species has been confused with resembling non-European species. For the former explanation, it has to be noted that ERMS has not recently been updated for a number of groups, possibly creating gaps in our knowledge on the geographical spread of species from these groups. In contrast to these gaps, all the European species of Agnatha, Reptilia and Cycliophora listed in ERMS are documented within EurOBIS (respectively, 6, 5 and 1 species), whereas Xenoturbellida, Myxozoa and Placozoa are not yet represented in the EurOBIS system.

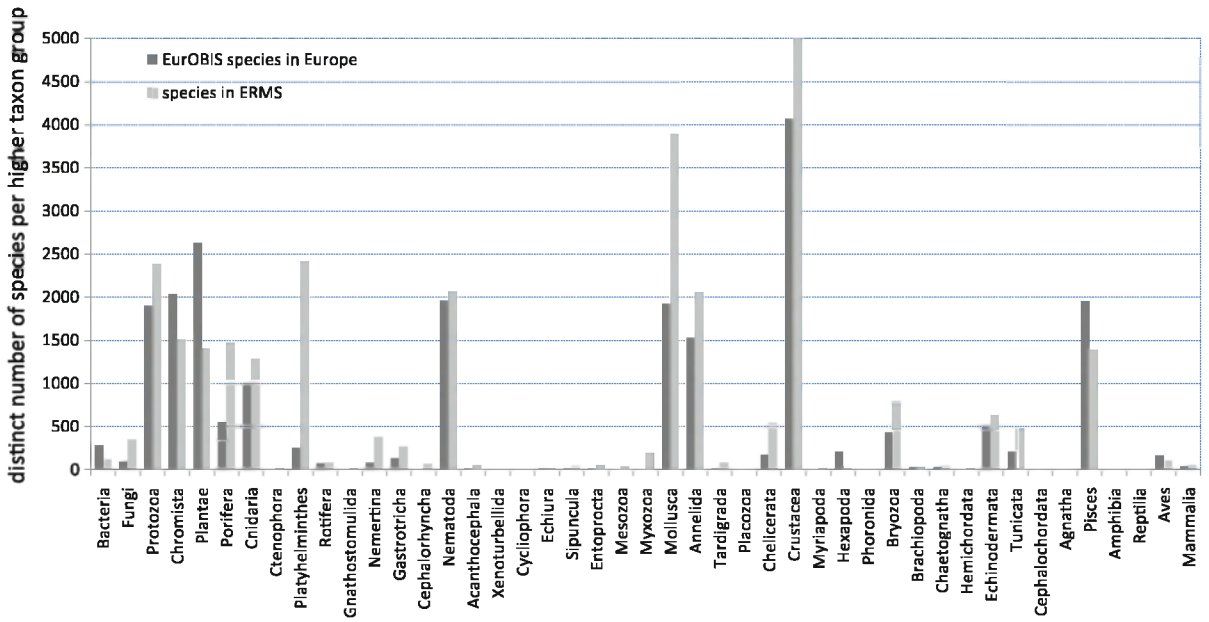

Fig. 3 Distinct valid species names per higher taxonomic group for EurOBIS and ERMS. ERMS contains over 7,000 Crustacea species, not all shown on the graph

The large differences between ERMS and EurOBIS in number of European distinct species within each defined major taxonomic group clearly indicate a (significant) gap in the taxonomic coverage of the system. For 13 of these major taxonomic groups, less than 50% of the species documented in ERMS are represented in EurOBIS, amounting to less than 25% for 6 of these groups (Platyhelminthes, Nemertea, Cephalorhyncha, Acanthocephala, Mesozoa and Tardigrada).

Rare species occurrences—e.g. only one or a few distribution records for a certain species—should be checked carefully before including or excluding them in analyses. Within EurOBIS, 6,292 species (23%) have only been documented once (single records), 12,065 species (45%) have been recorded five times or less. A lack of more observations can be due to the organism either being poorly known, recently discovered, difficult to catch and/or preserve, thereby hampering accurate identification or it is just very rare. It can also concern wrongfully identified species not naturally occurring in Europe. In the latter case, one wants to exclude them, for the former, inclusion or exclusion will depend on the influence of rare species on the formulated hypothesis. The top 10 of most commonly documented species within EurOBIS (more than 100,000 observations) consists solely of birds (4 species) and fish (6 species), led by common dab (*Limanda limanda*) having 750,539 observations within European marine waters. Additionally, for 4,317 of the species recorded in EurOBIS, the distribution information is limited to non-European marine waters.

Geography

The North Sea, the Celtic Sea and the English Channel are—based on a combination of the number of available distribution records, major taxonomic groups (as listed in Fig. 3), genera and species—very well documented within EurOBIS (Table 2). The Baltic Sea is only preceded by the North Sea in number of distribution records (830,000 vs. 4.9 million records), but its number of associated major taxonomic groups, genera and species is significantly lower compared to the IHO regions with a similar amount of distribution records. This might be due to the nature of the available datasets which largely focus on macrobenthic invertebrates, compared to other regions. A recent publication on the Baltic Sea (Ojaveer et al., 2010) confirms the lack of information on certain groups such as meiobenthos and

Table 2 Overview of number of distribution records, number of major taxonomic groups, number of distinct species and number of distinct genera in the 30 sea areas falling completely within the EurOBIS scope

IHO area	Distr. records	Major taxonomic groups	Species	Genera
North Sea	4,977,880	38	6,638	3,563
Baltic Sea	832,893	25	913	730
Celtic Sea	670,510	34	4,027	2,580
English Channel	656,594	37	5,745	3,132
Inner Seas off the West Coast of Scotland	575,049	37	2,816	1,848
Irish Sea and St. George's Channel	529,274	37	4,528	2,516
Kattegat	317,657	35	1,780	1,257
Norwegian Sea	246,923	27	2,396	1,617
Skaggerak	236,226	24	744	632
Bay of Biscay	207,940	25	2,646	1,608
Mediterranean Sea—Western Basin	147,027	28	2,686	1,717
Bristol Channel	106,201	30	1,550	1,193
Black Sea	74,332	23	1,922	829
White Sea	70,223	17	159	146
Barentsz Sea	58,600	23	1,165	822
Mediterranean Sea—Eastern Basin	51,015	23	2,866	1,532
Tyrrhenian Sea	50,687	25	2,466	1,373
Adriatic Sea	45,507	22	2,285	1,244
Aegean Sea	44,027	23	3,028	1,875
Balearic Sea	43,448	14	1,207	681
Greenland Sea	38,635	25	1,237	934
Ionian Sea	28,028	18	1,377	908
Alboran Sea	27,618	20	537	412
Gulf of Bothnia	13,456	17	759	412
Gulf of Riga	10,198	13	91	86
Gulf of Finland	2,491	13	74	66
Ligurian Sea	1,631	14	214	256
Sea of Marmara	798	9	49	49
Strait of Gibraltar	288	14	107	116
Sea of Azov	23	2	18	13
Total	10,065,179*	42**	22,513**	8,114**

Classification of the seas is based on the chart 'Limits of Oceans and Seas' of IHO (Anon., 1953). IHO areas are arranged in descending order of number of distribution records

*Sum of all records collected within the listed IHOs. Records from outside European marine waters are not listed here

**Total number of distinct European major taxonomic groups, species and genera available in EurOBIS

non-commercial fish species for this region. Of the 5 IHO areas with the least number of distribution records (less than 2,500; Table 2), the northern IHO's are characterised by the lowest number of documented major taxonomic groups, genera and species (Gulf of Finland, Sea of Marmara and Sea of Azov). Figure 4 represents the number of major taxonomic groups in the European marine environment, showing that the Arctic Ocean and the African side of the Mediterranean Sea have hardly any data represented in EurOBIS. Due to the incomplete nature of EurOBIS in terms of data coverage, this map cannot be seen as a representative picture of the general state of the biodiversity within European marine waters. Both Fig. 4 and Table 2 should merely be seen as a proxy for the general data coverage which is so far

Fig. 4 Number of distinct larger taxonomic groups (as represented in Fig. 3) per grid-cell of 1 by 1 degrees. This figure represents the general data coverage reached so far rather than a view of the true biodiversity

available within EurOBIS. As data gathering efforts can differ strongly between regions—depending on their accessibility and/or cost to reach and sample the desired area—comparing, e.g. the actual species richness or predicting the expected species richness between regions should be done cautiously. Additionally, such comparison should not only take into account the sampling effort, but should also consider a possible sampling selectivity as, e.g. certain trawl surveys might be exclusively focused on mapping the distribution of commercial (fish) species, thus not giving a representative view of all species present in a given area.

Analysing data from EurOBIS on a European or regional sea basin level and based on presence information is rather straightforward and can include both point locations and generalised indications of a sampling location, as discussed in the quality control procedures. The generalisations (e.g. Mediterranean, see Fig. 4) can however become problematic when investigating or comparing areas smaller than the originally mentioned areas (e.g. Eastern and Western Mediterranean Basin), in which these generalised records should ideally be ignored. It becomes even more difficult when literature sources for example state 'present in France'. In such case, one cannot be sure whether this refers to the Atlantic or Mediterranean side of France—or even both—and mostly leads to exclusion of these records. On a European analysis level however, these records might prove to be useful for composing species lists on country-level.

Sampling depth—the third dimension of a geographical position—is documented for 44% of the distribution records, with samples collected from the surface till the deepest point of the geographical scope (−6,339 m). Over 80% of these depth-documented records were collected in the upper 10 m layer of the water column or in intertidal areas. Currently, there is no quality control procedure in place for these depth values. In the future, a quality control procedure for depth values will be developed. Two bathymetric models will be used to test the tracing of possible inaccurate values: the ETOPO Global Relief Model (Amante & Eakins, 2009) and the General Bathymetric Chart of the Oceans (GEBCO; Anon., 2010).

Temporal coverage

The detail of the temporal information captured in EurOBIS (year-month-day) makes almost all distribution records suitable for, e.g. seasonal analyses. Of all time-referenced distribution records (13,073,541 records), less than 1% (86,711 records) has been collected prior to 1950, with the oldest record dating back to 1748 (Fig. 1b). From 2001 onwards, fewer distribution records are available, possibly explained by the time-lag in making data available. Post-2000 data are relatively recent and researchers are not prone to share data in such an early stage of their research or data processing. Moreover, species identifications can be very time-consuming, adding to the time-lag in data availability.

A total of 62 datasets have a temporal span of ten or more years and 14 of them—equalling 8.8 million distribution records—represent a continuous time-series within their temporal span, making them very suitable in monitoring or long-term related research.

Time-related data—both recent and historical—represent an indispensable component of the global representation of species distributions. Historical data can give scientists new insights on ocean life before human impacts (e.g. Fortibuoni et al., 2010; Thurstan & Roberts, 2010), reveal regime shifts and the effect of climate change and they can ultimately provide adequate information to counter the shifting baseline syndrome. Shifting baselines (Pauly, 1995) have already been given extensive attention in the marine realm (e.g. Jackson et al., 2001; Baum & Myers, 2004; Balmford & Bond, 2005), but an overall picture on baselines for invertebrates seems to be lacking. This stresses the need to fill these gaps by gathering occurrence data prior to 1950. This can be accomplished by 'data rescue' actions, focusing on tracing historical paper-based datasets and digitizing them. However, to keep a healthy balance in relation to the temporal scale, future efforts should also keep up the pace with data collating efforts of post-1950 datasets.

Abundances

All distribution records represent the presence of a taxon in a given place, at a given time. These presence data can be used in geographical taxon occurrences or in analysing species richness. In addition, almost 15% of these distribution records contain abundance information, broadening the possibilities of the data usage in, e.g. biodiversity analyses. The use of the available abundance data is however not always straightforward. Standardisation of abundance data from different sources requires a detailed study of the available metadata. Sampling details such as mesh size, sampling size or duration of sampling in case of trawling events have however not been documented consistently during the data submission process, making standardisation between datasets and thus in-depth and sound comparisons a complicated and time-consuming matter.

Life stage

Information on the life stage of the recovered taxa is only documented sporadically and detailed specifications vary greatly since a controlled vocabulary is missing (e.g. juvenile, immature, adult, nauplius, zoea, …).

In certain cases, information on the life stage of species is indispensable when subdividing marine taxa into larger 'functional' or non-taxonomical groups such as benthos or plankton. Its importance is immediately demonstrated when dealing with, e.g. Bivalvia, Gastropoda or Cnidaria, where individuals go through both a pelagic and a benthic stage during their life cycle. If one would conduct an analysis related to the benthos, one should ideally exclude all Bivalvia where the life stage has not been defined as it is uncertain whether it concerns the pelagic larvae or the benthic adults and where metadata do not clarify whether benthos or plankton has been sampled.

Future recommendations: how to resolve the identified limitations and gaps

EurOBIS is now the largest online searchable public source of European marine biological data. The above mentioned limitations and shortcomings such as the lack of abundance data and missing information on the life stage can be addressed in future data collation, by pointing out to data custodians this information can be of the utmost importance in integrated analyses and will give rise to a more correct use of the available data, improving future analyses.

A large part of the incompleteness on the level of metadata—mesh size, used sampling equipment, …—could be improved by carrying out a thorough literature study based on the mentioned publications coming forth from the delivered datasets, in combination with an extensive and detailed questionnaire sent to the original data owners, providers and/or managers. In parallel, a number of fields which are now defined as highly recommended could be made mandatory in the future. This would especially be true for the time-related fields: the collection year should at least become mandatory, month and day can remain as highly recommended fields, as this information might not be available anymore for historical data. A distinction between actual observations and literature data would be necessary, as literature does not always clearly state when observations were made. The data

delivery should not only be extended to highly recommended fields such as the time indication, but should also include some of the optional fields, e.g. life stage of individuals (cfr. benthos vs. plankton). Drawing up a controlled vocabulary for the life stage would facilitate the standardisation.

On a geographical level, an indication of precision or reliability of the positions could be provided, indicating if the given coordinates are actual observations (exact coordinates, GPS-based), aggregated or generalised (e.g. aggregated to a grid of 5×5 or 10×10 km) or derived from literature (e.g. Mediterranean, with a general assigned coordinate from the VLIZ Marine Gazetteer). This information can easily be stored on the metadata level. Planned technical developments will make it possible to plot exact and generalised coordinates in a different way, so the user knows he is dealing with distribution records of varying precision.

One relevant piece of information not included in the OBIS scheme is sampling equipment, e.g. the kind of equipment that was used to collect the sample. Comparing different types of equipment is not always straightforward and scientific analyses might require this knowledge to include or exclude certain data or to correctly convert or extrapolate the data. This information should be included in the metadata and its proper documentation should be given more attention in the future.

Conclusion

In spite of sometimes lacking or incomplete information, EurOBIS does represent the largest compilation of quality-controlled biological data for the European marine waters. Although integrated databases are incomplete, the possibilities of such systems should not be underestimated. EurOBIS is a very useful tool to identify geographical, temporal and taxonomical gaps in our knowledge on the distribution of marine species as an incentive to work towards completion. Additionally, EurOBIS can help in creating a general idea of how sea-living creatures are spread over the European marine waters—from both a historical and current point of view—and what areas need special attention in light of data rescue, data sharing or future research. Analysing EurOBIS data in search of large-scale biodiversity patterns and their evolution through time does however require a critical mind: as EurOBIS has a number of gaps (taxonomy, space and time), a sound selection of data prior to large-scale analyses is important.

EurOBIS will continue its data collation efforts in the future and will try to integrate both large data collections as well as small scale and local data collections from individual scientists. The latter might even need digitisation before they can be integrated. It is especially these data that are most vulnerable to loss or corruption and they should be considered as an equally important contribution compared to the large data collection initiatives. A good communication with data providers should be able to mend a number of gaps listed above and thus greatly improve the data quality and launch the data for future use.

The continued existence of the system and its applications is however fully dependent on the scientific world: EurOBIS succeeds or fails with the willingness of researchers to make their data publicly available through the portal. Making research or monitoring data freely available online, gives them a longer life span and the possibility to be included in similar research projects. Publishing data through EurOBIS is however more than making the data publicly available online. The system also provides a clear and unique citation of the dataset which can be compared to a literature citation. Moreover, all people involved in the collection and processing of the dataset are acknowledged in the description, by listing their names, institutes and roles. By providing greater visibility, a clear-cut citation and acknowledgements, EurOBIS hopes to encourage scientists to publish their data and give them a chance to have a ‘second life’.

It is assumed that a large amount of data is presumably available—in a digital or paper format—but has not yet found its way to freely and easily accessible quality-controlled data collation initiatives such as EurOBIS. The EurOBIS data management team is on a constant lookout for data. Each dataset containing marine biogeographical taxon information is welcomed and is seen as a valuable contribution to EurOBIS. Scientists interested in sharing their data through the EurOBIS portal, can contact us at info@eurobis.org.

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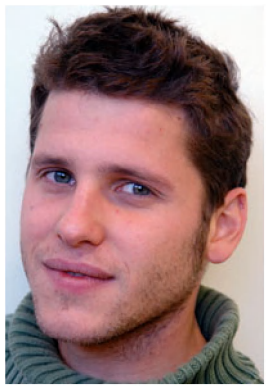
Zeller, D., R. Froese & D. Pauly, 2005. On losing and recovering fisheries and marine science data. Marine Policy 29: 69–73.

Author Biographies

Leen Vandepitte is trained as a marine biologist (MSc in Biology & Master after Master in Marine and Lacustrine Sciences) at the University of Ghent. She is part of the scientific staff of the Flanders Marine Institute where she started working on coastal indicators. Her main area of interest is integrated databases. She has been involved in the data management activities of the European MarBEF project and she currently manages the content of EurOBIS and is involved in the implementation of the biological preparatory action of EMODnet.

Francisco Hernandez holds an MSc in Biotechnology and an MSc in Environmental sciences. He is highly experienced in bioinformatics and carrying out ICT projects. He is head of the VLIZ Data centre and participates in various networks, projects and expert workshops including WoRMS, OBIS, IODE, SeaDataNet, EMODnet, GEBICH, SCOR data publishing WS, IOC-JCOMM standards WS, PESI, LifeWatch, ….



Simon Claus has an MSc in Ecology from the Catholic University of Leuven and an MSc in Oceanography from the University of Liège. He is a scientific staff member of the data centre of the Flanders Marine Institute (VLIZ) and is involved in data management activities of several European Research Projects (MarBEF, ENCORA, THESEUS) and in the implementation of the biological preparatory action of EMODnet.

Bart Vanhoorne is IT specialist and has several years of experience in GIS systems, taxonomic databases and datawarehouses. He is the technical manager of the taxonomical, geographical and biological databases at VLIZ (e.g. VLIMAR, MarBOUND, ERMS, WoRMS and EurOBIS).

Nathalie De Hauwere obtained her Msc in Geography from the Free University of Brussels followed by a Master after Master in Marine and Lacustrine Sciences from the University of Ghent. Since 2007 she is a scientific assistant at VLIZ where she is responsible for all the geographical tasks performed by the institute. She maintains and completes the databases and creates maps for VLIMAR, MarBound, EurOBIS, SchkeldeMonitor, and many other geography based projects.

Klaas Deneudt has an MSc in Zoology and is employed as project leader at the Flanders Marine Institute since 2001. At the VLIZ data centre he has developed expertise in scientific data management for marine and estuarine chemical, physical and biological data. He has been involved in several EU, national and regional projects and has contributed to the development of several marine data and information systems.

Ward Appeltans has an MSc in Environmental Biology and employed by VLIZ since 2002, where he is project leader at the data centre. He has been leading several data management work packages in EU projects like MarBEF and PESI. Ward is also the manager of the World Register of Marine Species (WoRMS) and associated databases, and is council member/secretary of the Society for the Management of Electronic Biodiversity Data (SMEBD).

Jan Mees is the general manager of the Flanders Marine Institute in Ostend since its establishment in 1999. He is trained as a marine biologist (MSc Zoology, MSc Environmental Sanitation, and PhD Biology) at Ghent University, where he is part-time professor and has been teaching courses on data analysis, statistics, coastal ecosystems and fisheries. An experienced marine ecologist and taxonomist - contributing a.o. to the World Register of Marine Species (WoRMS) that is hosted at his institute—he is the author of more than sixty scientific publications, mostly published in peer-reviewed international journals. Jan Mees is vice-chair of the Marine Board of the European Science Foundation, and member of several European and global oceanography and marine biodiversity networks (e.g. POGO, MARS, MarBEF, EurOcean).

Appendix 1: overview of all available datasets within EurOBIS, with an indication of their temporal and geographical cover, number of taxa and distribution records. Classification of the geographical cover is based on the chart 'Limits of Oceans and Seas' of IHO (Anon., 1953). If there was a comparable cover of northern and southern marine IHO's, the geographical cover was indicated as 'European marine waters'. Temporal covers indicated with an asterix (*) indicate uninterrupted time-series of 10 or more years.

citation	temporal cover	geographical cover	taxa	distribution records
Guiry, M.D. & Nic Dhonncha, E. ***AlgaeBase.*** National University of Ireland, Galway, Galway, Ireland. World-wide electronic publication, http://www.algaebase.org/	/	European marine waters	10153	56899
Dahle S., R. Palerud & N. Anisimova, 1992. ***Benthic fauna around Franz Josef Land***. Akvaplan-niva, Norway.	1992	Barentsz Sea	285	1714
Dahle S. & S. Cochrane, 1992. ***Northern Barents Sea 1992***. Akvaplan-niva, Norway.	1992	Barentsz Sea	312	1410
NRCC, University of Texas Medical Branch, P. Lee, & J. B. Wood; Biology Department, Dalhousie University, C. L. Day and R. K. O'Dor, 1998. ***CephBase (European data)***. National Resource Center for Cephalopods (NRCC), Galveston, Texas.	/	European marine waters	56	272
Froese, R. & D. Pauly (eds.). ***Fishbase.*** International Center for Living Aquatic Resources (ICLARM). Manila, Philippines, Version: Fishbase2000 (21 Aug 2004), database, http://www.fishbase.org	1800 – 2003	European marine waters	2194	89817
Fautin, D. G., 2010. ***Hexacorallians of the World***. http://geoportal.kgs.ku.edu/hexacoral/anemone2/index.cfm	/	European marine waters	1065	5964
Vanaverbeke, J., T. Deprez & M. Vincx, 2006. ***Meiobenthos of subtidal sandbanks on the Belgian Continental Shelf***. Ghent University, Department of Biology, Marine Biology Section (MarBIOL), Belgium.	1997 - 1998	North Sea	330	6491

Steyaert, M., 1999. ***Meiobenthos at station 115bis - bentho-pelagic coupling***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1999	North Sea	106	4016
Deprez, T. et al. ***NeMys - Generic Taxonomic Database System on Mysida and Nematoda***. World Wide Web electronic publication: http://nemys.ugent.be.	2002 - 2007	European marine waters	1903	5863
Craeymeersh, J., P. Kingston, E. Rachor, G. Duineveld, C. Heip & E. Vanden Berghe, 1986. ***North Sea Benthos Survey***.	1985 - 1986	North Sea, Skaggerak, North Atlantic Ocean	939	16838
Flanders Marine Institute (VLIZ). ***Taxonomic Information System for the Belgian coastal area***. Oostende, Belgium. Accessed on dd/mm/yyyy.	1768 - 2007	European marine waters (world)	7331	22150
Degraer, S., J. Wittoeck, W. Appeltans, K. Cooreman, T. Deprez, H. Hillewaert, K. Hostens, J. Mees, E. Vanden Berghe & M. Vincx, 2006. ***Macrobel: Long term trends in the macrobenthos of the Belgian Continental Shelf***. Oostende, Belgium. http://www.vliz.be/vmdcdata/macrobel/	1976 - 2001	North Sea	344	21086
Vanaverbeke, J., 1999. ***Nematodes from station 330: structural and functional biodiversity on the Belgian Continental Shelf***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1999	North Sea	149	2848
Weslawski J.-M., E. Malec, R. Jaskuła, M. Włodarska-Kowalczuk & M. Kędra, 2002. ***Polish Arctic Marine Programme. Macrobenthic data from Hornsund from 2002.*** Polish Academy of Sciences, Institute of Oceanology, Poland.	2002	Greenland Sea	116	603
Picton, B.E., C.S. Emblow, C.C. Morrow, E.M. Sides, P. Tierney, D. McGrath, G. McGeough, M. McCrea,P. Dinneen, J. Falvey, S. Dempsey, J. Dowse & M. J. Costello, 1999. ***Marine sites, habitats and species data collected during the BioMar survey of Ireland***. Environmental Sciences Unit, Trinity College, Dublin, Ireland.	1975 - 1996	Irish Sea & St. George's Channel, North Atlantic Ocean, Inner Seas off the West Coast of Scotland, Celtic Sea	1766	93003

Dahle S., S. Cochrane & S. Denisenko, 1992. ***Benthic fauna around Pechora Sea***. Akvaplan-niva, Norway.	1992	Barentsz Sea	421	1324
Zettler M.L., 2001. ***Historical benthic data from the southern Baltic Sea (1839-2001)***. Baltic Sea Research Institute Warnemünde (IOW), Germany.	1839 - 2001	Baltic Sea, Kattegat	514	41422
Hellenic Centre For Marine Research. ***MedOBIS – Mediterannean Ocean Biogeographic Information System***. Hellenic Centre for Marine Research; Institute of Marine Biology and Genetics; Biodiversity and Ecosystem Management Department, Heraklion, Greece. http://www.medobis.org/	1937 - 2007	Black Sea, Ionian Sea, Aegean Sea, Alboran Sea, Adriatic Sea, Mediterranean Sea - Eastern Basin	2551	34017
Fabri, M-C. et al. ***Ifremer BIOCEAN database (Deep Sea Benthic Fauna)***. Institut Français de Recherche pour l'Exploitation de la Mer, Ifremer, Issy-les-Moulineaux, France. World Wide Web electronic publication, http://www.ifremer.fr/isi/biocean.	1967 - 2006	world marine waters	3565	29954
Sistermans, W. & H. Hummel, 2003. ***Biogeography Scheldt Estuary***. Netherlands Institute of Ecology; Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=496	1962 - 2003	North Sea	386	31747
Rees, H.L. et al. ***A comparison of benthic biodiversity in the North Sea, English Channel and Celtic Seas***. Centre for Environment, Fisheries and Aquaculture Science; Burnham Laboratory, 12 Apr 2005, Essex, UK.	1992 - 1996	Irish Sea & St. George's Channel, Bristol Channel, Celtic Sea, Inner Seas off the West Coast of Scotland, English Channel, North Sea	404	2589
Kendall, M., 1996. ***Arctic soft-sediment macrobenthos***. Plymouth Marine Laboratory, UK.	1991	Barentsz Sea, Greenland Sea, Arctic Ocean	210	1005
Kendall, M. & S. Widdicombe, 1999. ***Plymouth sound dataset. Soft sediment macrobenthos from the Plymouth Sound from 1995.*** Plymouth Marine Laboratory, UK.	1995	English Channel	127	1343

Bachelet, G., 2004. ***Benthos Gironde Estuary***. Université Bordeaux 1, Station Marine d'Arcachon, Laboratoire d'Océanographie Biologique, France.	1979 - 2004	Bay of Biscay	170	3019
Hummel, H., 2004. ***BIS dataset of the south-western part of Netherlands (1985-2004)***. Netherlands Institute of Ecology; Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=599	1974 - 2004	North Sea	515	136161
Zettler, M. L., 2005. ***Macrozoobenthos baltic sea (1980-2005) as part of the IOW-Monitoring***. Institut für Ostseeforschung Warnemünde, Germany.	1980 - 2005	Baltic Sea, Gulf of Finland	212	3589
Addink, W. ***Zoologisch Museum Amsterdam (ZMA)-Porifera***. Zoologisch Museum, Universiteit van Amsterdam, 04 Oct 2005, Amsterdam, Netherlands.	1880 - 2005	European marine waters	512	3301
Kotwicki L., 1996. ***Bay of Puck dataset***. Polish Academy of Sciences, Institute of Oceanology, Department of Marine Ecology, Poland.	1996	Baltic Sea	30	539
Herrmann, M. & J. Laudien, 2004. ***Soft bottom community structure and diversity in Arctic Kongsfjorden***. Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany.	2003	Greenland Sea	61	210
Whomersley, P., 2003. ***National Marine Monitoring Programme. Benthos data of the North Sea, Irish Sea, English Channel from 2002-2003***. CEFAS, Burnham On Crouch, UK.	2002 - 2003	Celtic Sea, North Sea, English Channel	206	1161
Rumohr, H. & D. Fleischer, 2004. ***N3 data of Kiel Bay***. Leibniz Institute of Marine Sciences, Marine Ecology Division, Germany.	1986 – 2004*	Baltic Sea	171	8944
Rumohr, H., 1995. ***Kiel Bay intercalibration data set***. Leibniz Institute of Marine Sciences, Marine Ecology Division, Germany.	1995	Baltic Sea	56	1144

Blachowiak-Samolyk, K. and M. Angel. ***Atlas of Southern Ocean Planktonic Ostracods***. University of Southampton, Southampton Oceanography Centre and Polish Academy of Sciences, Institute of Oceanology , Southampton, UK and Sopot, Poland. http://ocean.iopan.gda.pl/ostracoda/	1882 - 2003	European marine waters	33	1169
Ostler, R. ***Marine Nature Conservation Review (MNCR) and associated benthic marine data held and managed by JNCC***. Joint Nature Conservation Committee, Centre for Ecology and hydrology, Aberdeenshire, UK.	1954 - 2000	Celtic Sea, North Sea, North Atlantic Ocean, Bristol Channel, Irish Sea & St. George's Channel, Inner Seas off the West Coast of Scotland, English Channel	4160	584476
Parr, J. ***Marine Life Information Network (MarLIN) marine survey data (Professional)***. Marlin, Collated Marine Life Survey Datasets, Marine Biological Association of the UK, Plymouth, UK.	1964 - 2004	Bay of Biscay, Irish Sea & St. George's Channel, North Atlantic Ocean, Celtic Sea, North Sea, Inner Seas off the West Coast of Scotland, English Channel, Bristol Channel	2207	129635
Parr, J. ***Marine Life Survey Data (collected by volunteers) collated by MarLIN***. MarLIN, collated Marine Life Survey Datasets, Marine Biological Association of the UK, Plymouth, UK.	1976 - 2007	North Atlantic Ocean, North Sea, English Channel, Celtic Sea, Inner Seas off the West Coast of Scotland, Irish Sea & St. George's Channel	617	10046
Wilkinson, S. ***Marine benthic dataset (version 1) commissioned by UKOOA***. Joint nature Conservation Committee, Peterborough, UK.	1975 - 1998	North Sea, North Atlantic Ocean, Skaggerak, Inner Seas off the West Coast of Scotland, Norwegian Sea	1999	203945
Countryside Council for Wales. ***Marine Nature Conservation Review (MNCR) and associated benthic marine data held and managed by CCW.*** Countryside Council for Wales, Gwynedd, UK.	1993 - 2001	Celtic Sea, Irish Sea & St. George's Channel, Bristol Channel	983	13897

Schratzberger, M., 1998. ***Structure of sublittoral meiofauna assemblages around the UK coast***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1997 - 1999	Celtic Sea, Bristol Channel, English Channel, Irish Sea & St. George's Channel, North Sea	246	2222
Schratzberger, M., 1999. ***Structure of sublittoral nematode assemblages at four offshore stations around the UK***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1996 - 1999	North Sea, English Channel, Celtic Sea	120	1331
Schratzberger, M., 2000. ***Impacts of experimental trawling disturbance on nematode communities***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1999 - 2000	North Sea	140	3041
Schratzberger, M., 2000. ***Impacts of chronic trawling disturbance on nematode communities***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	2000 - 2001	North sea	148	3383
Schratzberger, M., 2000. ***Structure of nematode communities in the south western North Sea***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	2000 - 2001	North Sea	169	2769
Vincx, M., 1984. ***Free-living marine nematodes from the Southern Bight of the North Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1971 - 1985	North Sea	368	7521
Vanreusel, A., 1985. ***Free-living nematodes of the Voordelta***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1984 - 1985	North Sea	208	2611
Soetaert K., 1993. ***Deep-sea Meiobenthos***. Netherlands Institute of Ecology; Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=665	1966 - 1991	Arctic Ocean, Strait of Gibraltar, North Atlantic Ocean, Mediterranean Sea - Western Basin	319	1583

Soetaert K., 1999. ***Size of Atlantic nematodes***. Netherlands Institute of Ecology; Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=668	1993	North Atlantic Ocean	18	950
Steyaert, M., 1996. ***Spatial heterogeneity of nematodes on an intertidal flat in the Westerschelde Estuary***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1996	North Sea	80	1540
Steyaert, M., 1997. ***Tidal migration of nematodes on an estuarine tidal flat***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1997	North Sea	73	1102
Jian, L., 1992. ***Free-living nematodes in a brackish tidal flat of the Westerschelde***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1982 – 1992*	North Sea	58	3050
Lampadariou, N., 1993. ***Heraklion harbour meiobenthos***. Hellenic Centre for Marine Research (HCMR), Greece.	1993	Aegean Sea	132	1012
MarBEF, 2006. ***MarBEF Publication Series data***. Available online on EurOBIS. Consulted on dd-mm-yyyy.	1800 - 2005	European marine waters	617	1777
Gambi, C. & R. Danovaro, 1992. ***Meiofauna of the Ligurian Sea***. Polytechnic University of Marche; Faculty of Sciences, Department of Marine Sciences, Italy.	1991 - 1992	Ligurian Sea	92	447
Gambi, C. & R. Danovaro 1997. ***Meiofauna of the North Adriatic Sea***. Polytechnic University of Marche, Faculty of Sciences, Department of Marine Sciences, Italy.	1996 - 1997	Adriatic Sea	18	325
English Nature. ***Marine Nature Conservation Review (MNCR) and associated benthic marine data held and managed by English Nature.*** English Nature, Peterborough, UK.	1995 - 1999	North Sea, Irish Sea & St. George's Channel, English Channel, Celtic Sea	1305	13769

Scottish Natural Heritage. ***Marine Nature Conservation Review (MNCR) and associated benthic marine data held and managed by Scottish Natural Heritage***. Scottish Natural Heritage, Edinburgh, UK.	1993 - 1998	North Sea, North Atlantic Ocean, Inner Seas off the West Coast of Scotland, Irish Sea & St. George's Channel	828	16531
Lambshead, J., 1978. ***Nematode data from the Firth of Clyde (Scotland)***. Natural History Museum (NHM), UK.	1978	Inner Seas off the West Coast of Scotland	106	1299
Dale Rostron. ***Pembrokeshire Marine Species Atlas***. Countryside Council for Wales, Gwynedd, UK.	1899 - 1998	Celtic Sea, Bristol Channel	2476	42591
Urban-Malinga, B., 2001. ***Meiofauna from Kongsfjorden (Spitbergen, Arctic)***. Polish Academy of Sciences, Institute of Oceanology (IOPAS), Poland.	2001	Greenland Sea	34	450
Gheskiere, T., 2000. ***Nematode assemblages from a Belgian sandy beach***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	2000	North Sea	85	641
Urban-Malinga, B., 2004. ***Meiofauna of the Southern Baltic***. Polish Academy of Sciences, Institute of Oceanology (IOPAS), Poland.	2003 - 2004	Baltic Sea	38	447
McEvoy, A. & M. Austen, 1996. ***Offshore nematodes from Rame (UK) and in microcosm experiment (exposure to metals)***. Plymouth Marine Laboratory (PML), UK.	1993	English Channel	60	184
Somerfield, P.J., 1994. ***Nematodes of the Plymouth Sound***. Plymouth Marine Laboratory (PML), UK.	1994	English Channel	73	1433
Austen, M., 1995. ***Nematodes of Solbergstrand, Norway (in presence and absence of* Brissopsis*)***. Plymouth Marine Laboratory (PML), UK.	1995	North Atlantic Ocean	71	319
Somerfield, P.J., 1991. ***Liverpool Bay Nematoda and Copepoda (UK)***. Plymouth Marine Laboratory (PML), UK.	1991	Irish Sea & St. George's Channel	106	2041
Somerfield, P.J., 1997. ***Nematodes from Kongsfjord, Svalbard***. Plymouth Marine Laboratory (PML), UK.	1997	Greenland Sea	89	817

Somerfield, P.J., 1992. ***Nematoda and Copepoda from the Fal estuary (UK)***. Plymouth Marine Laboratory (PML), UK.	1991 - 1992	English Channel	106	1617
Somerfield, P.J. & M. Austen, 1993. ***Meiofauna from Lynher estuary in microcosms with contaminated sediment from the Fal estuary***. Plymouth Marine Laboratory (PML), UK.	1993	English Channel	38	111
Somerfield, P.J., 1981. ***Meiofauna from the Firth of Clyde (Scotland)***. Plymouth Marine Laboratory (PML), UK.	1981	Inner Seas off the West Coast of Scotland	121	442
Austen, M. & A. McEvoy, 1993. ***Nematodes from the Lynher estuary (UK): microcosm experiments***. Plymouth Marine Laboratory (PML), UK.	1992	English Channel	30	171
Austen, M. & A. McEvoy, 1993. ***Nematodes from the Exe estuary (UK): microcosm experiments***. Plymouth Marine Laboratory (PML), UK.	1992	English Channel	71	792
Austen, M. & A. McEvoy, 1993. ***Experimental effects of TBT on meiobenthic communities***. Plymouth Marine Laboratory (PML), UK.	1993	English Channel	92	1739
Vriser, B. & M. Grego, 2005. ***Meiofauna of the Gulf of Trieste (NIB-MBS database on meiofauna version 1.2)***. National Institute of Biology, Marine Biological Station Piran (MBS), Slovenia.	1972 - 1995	Adriatic Sea	115	4774
Marine Conservation Society. ***Seasearch Marine Surveys***. Marine Conservation Society, Ross-on-Wye, UK.	1977 - 2007	North Sea, English Channel, North Atlantic Ocean, Celtic Sea, Irish Sea & St. George's Channel, Inner Seas off the West Coast of Scotland, Bristol Channel	2250	159873
National Biodiversity Network Trust. ***Marine Turtles***. National Biodiversity Network Trust, Newark, UK.	1748 - 2007	Inner Seas off the West Coast of Scotland, Norwegian Sea, Bristol Channel, Irish Sea & St. George's Channel, English Channel, North Sea, Bay of Biscay, Celtic Sea, North Atlantic Ocean	6	2288

Mitchell, P.I., S.F. Newton, N. Ratcliffe & T.E. Dunn. ***Seabird 2000***. Joint Nature Conservation Committee, Peterborough, UK.	1994 - 2003*	Irish Sea & St. George's Channel, Bristol Channel, Celtic Sea, North Sea, Norwegian Sea, North Atlantic Ocean, Inner Seas off the West Coast of Scotland, English Channel	27	24193
Steyaert, M., 1994. ***Meiobenthos at the stations 115, 702, 790 on the Belgian Continental Shelf***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1993 - 1994	North Sea	163	4276
Fockedey, N., B. Beyst, A. Cattrijsse, A. Dewicke, K. Deneudt, J. Mees & M. Vincx, 2004. ***Historical hyperbenthos data (1987-2001) from the North Sea and some adjacent areas***. Collaboration between Ghent University (UGent), Biology Department, Marine Biology Section and Flanders Marine Institute (VLIZ).	1987 - 2001	North Sea, Celtic Sea	667	35153
Van Gaever, S., 2000. ***Meiobenthos of the Darwin mounds (North-East Atlantic)***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	2000	North Atlantic Ocean	186	2858
Lampadariou, N., 1998. ***Aegean Sea bathyal nematodes***. Hellenic Centre for Marine Research (HCMR), Greece.	1997	Aegean Sea	134	1017
Vanaverbeke, J., T. Deprez & M. Vincx, 2006. ***Meiobenthos of subtidal sandbanks on the Belgian Continental Shelf***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1997 - 2004	North Sea	276	8814
Cooper, K.M., S.E. Boyd & H.L. Rees. ***Cross Sands broadscale survey 1998***. Centre for Environment, Fisheries and Aquaculture, Burnham laboratory, Essex, UK.	1998	North Sea	179	557
Continuous Plankton Recorder (CPR) data (phytoplankton) from the Sir Alister Hardy Foundation for Ocean Science (SAHFOS). Available from http://www.eurobis.org/ [Accessed DATE].	1946 - 2003*	European marine waters	195	632473

Continuous Plankton Recorder (CPR) data (zooplankton) from the Sir Alister Hardy Foundation for Ocean Science (SAHFOS). Avaiable from http://www.eurobis.org/ [Accessed DATE].	1946 - 2003*	European marine waters	216	1206382
Gheskiere, T., 2000. ***Nematodes from Italy and Poland***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	2000	Tyrrhenian Sea, Baltic Sea	111	612
PANGAEA-Publishing Network for Geoscientific & Environmental Data, AWI/MARUM, doi:10.1594/pangaea	1900 - 2008	World marine waters	10786	1562156
Vanaverbeke, J., 1993. ***Meiobenthos and nematodes from the continental shelf of the Laptev Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1993	Artic Ocean, Laptev Sea	95	448
Vanaverbeke, J., 1998. ***Length, width and biomass measurements of nematodes from sandbanks on the Belgian Continental Shelf***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1997 - 1998	North Sea	1	3529
Rosier, G. ***Posidonia oceanica Survey 2005***. KennaEcodiving, Girona, Spain.	2005	Mediterranean Sea - Western Basin	69	1933
Kotwicki, L., 1998. ***Meiobenthic data Manuela***. Polish Academy of Sciences, Institute of Oceanology (IOPAS), Poland.	1997 - 1998	Baltic Sea	9	742
Soetaert K., 1985. ***Length and width measurements of nematodes in the Ligurian Sea***. Netherlands Institute of Ecology, Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=841	1985	Mediterranean Sea - Western Basin, Strait of Gibraltar	109	2290
Soetaert, K., 1992. ***Length and width measurements of nematodes in the Indian Ocean***. Netherlands Institute of Ecology, Centre for Estuarine and Marine Ecology (NIOO-CEME), the Netherlands.	1992	Indian Ocean	143	493

Bisschop, G. & M. Vincx, 1976. ***Nematode fauna of the North Sea near the Westerschelde Estuary***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1976	North Sea	53	702
Huotong, C. & M. Vincx, 1986. ***The meiobenthos of the Southern Bight of the North Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1985 - 1986	North Sea	216	1299
Jensen, P. & M. Vincx,1973. ***Nematode fauna from the bottom of the Southern North Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1973	North Sea	125	853
Vandenberghe, R. & A. Coomans, 1985. ***Study of the meiobenthos from a dumping site in the Southern Bight of the North Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1985	North Sea	207	1495
Sharma, J. & M. Vincx, 1980. ***A study of the nematode fauna of three estuaries in the Netherlands***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1975 - 1980	North Sea	137	957
Heip, C., 1986. ***Nematodes from the NSBS***. Netherlands Institute of Ecology, Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=849	1986	North Sea	339	1057
Rose, A., 2004. ***Major meiofauna taxa and Harpacticoida species from Hooksiel***. Forschungsinstitut Senckenberg; Deutsches Zentrum fur Marine Biodiversitätsforschung (DZMB), Germany.	2004	North Sea	44	1266
Schratzberger, M., 1997. ***Effects of various types of disturbances on nematode communities***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1995 - 1997	English Channel	124	1146
Schratzberger, M., 1998. ***Effects of simulated deposition of dredged material on the structure of nematode assemblages: the role of burial***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1998	North Sea	58	170

Schratzberger, M., 1999. ***Effects of simulated deposition of dredged material on the structure of nematode assemblages: the role of contamination***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1999	North Sea	60	204
Schratzberger, M., 2001. ***Effects of paint-derived tributyltin (TBT) on the structure of estuarine nematode assemblages in experimental microcosms***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	2001	North Sea	56	177
Vanreusel, A., 1993. ***Nematodes at two abyssal sites in the Northeast Atlantic***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1991 - 1993	North Atlantic Ocean	78	318
Vanreusel, A., 1994. ***Nematodes of the central Arctic Ocean***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1991 - 1994	Arctic Ocean	114	496
Danovaro, R., 1997. ***Meiofauna and nematodes from the Atacama slope and trench***. Polytechnic University of Marche; Faculty of Sciences; Department of Marine Sciences, Italy.	1997	South Pacific Ocean	110	425
Lampadariou, N., 1992. ***Malia nematodes***. Hellenic Centre for Marine Research (HCMR), Greece.	1992	Aegean Sea	117	488
Lampadariou, N., 1992. ***Nematodes from Crete sandy beaches***. Hellenic Centre for Marine Research (HCMR), Greece.	1992	Aegean Sea	69	793
Türkay, M. ***Senckenbergisches Sammlungsverwaltungssystem, SeSam***. Senckenbergische Naturforschende Gesellschaft , Frankfurt, Germany. http://sesam.senckenberg.de/	/	World marine waters	3148	21469
Veit-Köhler, G. & J. Laudien, 2005. ***Arctic meiofauna succession***. Forschungsinstitut Senckenberg; Deutsches Zentrum fur Marine Biodiversitätsforschung (DZMB), Germany.	2003 - 2005	Greenland Sea	44	363

Martínez Arbizu, P. & G. Veit-Köhler, 2002. ***ANDEEP-1: Antarctic deep-sea meiofauna***. Forschungsinstitut Senckenberg; Deutsches Zentrum fur Marine Biodiversitätsforschung (DZMB), Germany.	2002	Southern Ocean, South Atlantic Ocean	26	1476
Rosenberg et al. ***A Biotic Database of Indo-Pacific Marine Mollusks***. Morris, P., Pennsylvania, USA. http://data.acnatsci.org/obis	1883 - 1999	European marine water	86	234
The Norwegian Oil Industry Association, 2002. ***Offshore reference stations, Norwegian/Barents Sea***. The Norwegian Oil Industry Association (OLF), Akvaplan-niva and Det Norske Veritas, Norway.	1991 - 2001*	North Sea, Norwegian Sea	939	46377
The Norwegian Oil Industry Association, 2000. ***Offshore reference stations, Finnmark***. The Norwegian Oil Industry Association (OLF), Akvaplan-niva and Det Norske Veritas, Norway.	1998 - 2000	Barentsz Sea, Norwegian Sea	462	9669
The Norwegian Oil Industry Association, 2001. ***Offshore reference stations, North/Norwegian sea***. The Norwegian Oil Industry Association (OLF), Akvaplan-niva and Det Norske Veritas, Norway.	1990 - 2002	North Sea	337	7959
Vanhove, S., 1989. ***Nematodes from the Weddell Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1989	Southern Ocean	158	960
Vanhove, S., 2002. ***Nematodes from the South Sandwich Trench***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	2002	South Atlantic Ocean	76	333
Addinck, W. & M. de Kluijver, M., 2003. ***North Sea observations of Crustacea, Polychaeta, Echinodermata, Mollusca and some other groups between 1986 and 2003***. Expert Centre for Taxonomic Idenditification (ETI), the Netherlands.	1986 - 2003	North Sea	568	35886
Schratzberger, M., 1996. ***Effects of physical disturbance on nematode communities in sand and mud***. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK.	1996	English Channel	87	1196
Worsfold, T., 2003. ***Weed rinsings from Cullercoats Bay***. Unicomarine.	2003	North Sea	43	53

Vanaverbeke, J., 1994. ***Nematodes from the Goban Spur (OMEX) - 1994***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1994	North Atlantic Ocean, Celtic Sea	1	3720
Vanaverbeke, J., 1993. ***Meiofauna from the Goban Spur (OMEX) - 1993***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1993	North Atlantic Ocean, Celtic Sea	119	1082
Bonne, W., 1997. ***Copepods from the Middelkerkebank (North Sea)***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1997	North Sea	53	248
Bonne, W., 1999. ***Bentho-pelagic coupling in the North Sea – Copepoda***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1999	North Sea	62	762
Raes, M., 2004. ***Nematoda from Kenya and Zanzibar***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	2002 - 2004	Indian Ocean	196	6627
Huys, R. & G. De Smet, 1993. ***Copepoda from the Dutch Continental Shelf, spring 1993***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1993	North Sea	85	1895
Herman, R., 1984. ***Copepods from the Southern Bight of the North Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1978 - 1984	North Sea	115	993
Huys, R., 1984. ***Copepods from a sublittoral sandy station in the North Sea***. Ghent University, Department of Biology, Marine Biology Section (MARBIOL), Belgium.	1983 - 1984	North Sea	79	438
British Oceanographic Data Centre, UK. ***Biogeographic data from BODC***. in : EurOBIS. http://www.marbef.org/data/eurobissearch.php?dataprovider=47, accessed on [date].	1971 - 2006	World marine waters	1582	124043
Benedetti-Cecchi, L., 2004. ***Rocky shore data from the Capraia Marine***	2003 - 2004	Tyrrhenian Sea	42	1615

Protected Area. Dipartimento di Biologia, Università di Pisa, Italy.				
Benedetti-Cecchi, L., 2004. ***Lowshore macrobenthos assemblages near Porto Santo Stefano***. Dipartimento di Biologia, Università di Pisa, Italy.	2003 - 2004	Tyrrhenian Sea	38	1013
Benedetti-Cecchi, L., 2001. ***Rocky shore data from the Giannutri island MPA***. Dipartimento di Biologia, Università di Pisa, Italy.	1999 - 2001	Tyrrhenian Sea	35	4121
Benedetti-Cecchi, L., 2001. ***Intertidal rocky shore assemblages near Porto Ercole***. Dipartimento di Biologia, Università di Pisa, Italy.	1998 - 2001	Tyrrhenian Sea	31	6541
Emig, C., 1999. ***Brachiopoda from sampling campaigns in the French part of the Mediterranean during the 1970-1990s***. Centre National de la Recherche Scientifique; Institut National de Science de l'Univers; Centre d'Océanologie de Marseille; Station Marine d'Endoume, France.	1970 - 1999	Mediterranean Sea - Western Basin, Tyrrhenian Sea, Ligurian Sea, Strait of Gibraltar	5	468
Węslawski, J.M., 1997. ***Svalbard tidal zone data***. Polish Academy of Sciences; Institute of Oceanology (IOPAS), Poland.	1988 - 1997	Greenland Sea, Norwegian Sea, Barentsz Sea	192	1400
Harris R. & C. Widdicombe, 2007. ***L4 Plankton Monitoring Programme***. Plymouth Marine Laboratory (PML), United Kingdom.	1988 - 2007*	English Channel	361	49597
Munda, I., 1967. ***Characteristic features of the benthic algal vegetation along the Snaefellsnes peninsula***. Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia.	1967	North Atlantic Ocean	148	1487
Munda, I., 1969. ***Benthic algal vegetation of Borgafjördur***. Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia.	1969	Greenland Sea	129	1060
Munda, I., 1969. ***Benthic marine algae in the Northern Adriatic Sea***. Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia.	1967 - 1967	Adriatic Sea	47	382
Munda, I., 1965. ***Benthic algal vegetation of Mjóifjürdur***. Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Ljubliana, Slovenia.	1965	Greenland Sea	127	711

Munda, I., 1968. ***Survey of the benthic algal vegetation of the Berufjördur, southeastern Iceland***. Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia.	1968	North Atlantic Ocean	142	1602
Orlando-Bonaca, M., 2006. ***Rocky shore algal data from North Adriatic Sea (Piran) in 2006***. Marine Biology Station Piran (MBSS), Slovenia.	2006	Adriatic Sea	51	1062
Orfanidis, S. & E. Tsiaga, 2004. ***National monitoring of macrobenthos in the Kavala Gulf***. National Agricultural Research Foundation; Fisheries Research Institute (FRI), Greece.	2004	Aegean Sea	69	764
Antoniadou, C., 1998. ***Macro- and megafauna from the North Aegean Sea from 1997-1998***. Aristotle University of Thessaloniki, Department of Biology, Laboratory of Zoology, Greece.	1997 - 1998	Aegean Sea	395	6402
Bakker K., & P. Herman, 1990. ***Phytoplankton in the Oosterschelde before, during and after the storm-surge barrier (1982-1990)***. Netherlands Institute of Ecology; Centre for Estuarine and Marine Ecology, Netherlands. Metadata available at http://data.nioo.knaw.nl/imis.php?module=dataset&dasid=1646	1982 - 1990	North Sea	113	12782
Kędra, M., 2006. ***Kongsfjorden monitoring data – grid – 2006***. Polish Academy of Sciences, Institute of Oceanology (IOPAS), Poland.	2006	Greenland Sea	153	949
Sousa-Pinto, I. & R. Araújo, 2003. ***Macroalgal communities of intertidal rock pools in Portugal***. Centro Interdisciplinar de Investigaçao Marinha e Ambiental (CIMAR), Portugal.	2003	North Atlantic Ocean	109	2382
Sousa-Pinto, I. & R. Araújo, 2003. ***Intertidal rocky shore assemblages in Portugal***. Centro Interdisciplinar de Investigaçao Marinha e Ambiental (CIMAR), Portugal.	2003	North Atlantic Ocean	135	7164
Munda, I., 1980. ***Macroalgae of the Tjornes Peninsula in the North of Iceland***. Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia.	/	Greenland Sea	126	2540

Historical dataset of marine biological records. Institute of Biology of the Southern Seas, NAS Ukraine.	1960 - 1993	European marine waters	640	86192
Leibniz-Institut für Meereswissenschaften an der Universität Kiel - Germany. ***Amrum Bank and inner German Bight Benthos***. http://www.vliz.be/vmdcdata/nsbp. accessed on [yyyy/mm/dd].	2000 - 2001	North Sea	123	1026
Alfred Wegener Institut für Polar- und Meeresforschung; Senckenbergische Naturforschende Gesellschaft. - Germany. ***Macrozoobenthos data from the southeastern North Sea in 2000.*** http://www.vliz.be/vmdcdata/nsbp. accessed on [yyyy/mm/dd].	2000 - 2002	North Sea	426	10283
CEFAS. - UK. ***Macrobenthos from English waters between 2000-2002***. http://www.vliz.be/vmdcdata/nsbp. accessed on [yyyy/mm/dd]	2000 - 2002	North Sea	596	3999
Marine Ecological Surveys Ltd. - UK. ***Macrobenthos from the eastern English Channel in 1999 and 2001***. http://www.vliz.be/vmdcdata/nsbp. accessed on [yyyy/mm/dd].	1999 - 2001	English Channel	812	24357
Nehring, S., 1999. ***BfG-Monitoring in the German North Sea estuaries: Macrozoobenthos***. Federal Institute of Hydrology.	2000	North Sea	58	286
Dewarumez J.-M. & N. Desroy, 2000. ***Eastern Channel dataset***. Station Marine de Wimereux, France.	2000	North Sea, English Channel	167	493
Dewarumez, J.-M., J.-C. Dauvin & N. Desroy, 2000. ***Macrobenthos from Copale - Authie***. Station Biologie de Wimereux, France.	2000	North Sea, English Channel	111	1073
Koninklijk Nederlands Instituut voor Zeeonderzoek (Texel), National Institute for Coastal and Marine Management (Ministery of Transport and Public Works), 2001. ***Macrobenthos in the Dutch Sector of the North Sea 1991-2001***.	2000 - 2001	North Sea	269	4663
Oug, E. & B. Rygg, 2000. ***Macrobenthos data from the Norwegian Skagerrak coast***. Norwegian Institute for Water Research (NIVA) and Norwegian Pollution Control Authority.	2000	North Sea, Skaggerak	280	1918

Rumohr, H. ***Historical benthosdata from the North Sea and Baltic Sea from 1902-1912***. Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences; Marine Ecology Division; Benthos Ecology section, Kiel, Germany.	1902 - 1912	Norwegian Sea, Baltic Sea, North Sea, Skaggerak, Kattegat	554	6399
Rumohr, H. ***Historical data on invertebrates from the Baltic Sea and Gdansk Bay***. Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences; Marine Ecology Division; Benthos Ecology section, Kiel, Germany.	1880 - 1881	Baltic Sea	61	270
Rumohr, H. ***Holsatia-expedition 1887 - animals collected with a dredge during the expedition***. Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences; Marine Ecology Division; Benthos Ecology section, Kiel, Germany.	1887	Baltic Sea	24	64
Rumohr, H. ***The Baltic Expedition 1901 of the German sea fisheries association***. Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences; Marine Ecology Division; Benthos Ecology section, Kiel, Germany.	1901	Baltic Sea	31	137
Rumohr, H. ***Historical quantitative benthos grab samples from the Southern Baltic Sea - Polish data***. University Kiel, Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences; Marine Ecology Division; Benthos Ecology Section.	1953	Baltic Sea	1	8039
Rumohr, H. ***Historical quantitative benthos grab samples from the Southern Baltic Sea - German data***. University Kiel, Christian-Albrechts-University Kiel; Leibniz Institute of Marine Sciences; Marine Ecology Division; Benthos Ecology Section.	1952	Baltic Sea	1	7547
Van Dalfsen, J., 2000. ***Macrobenthos data from the Doggerbank - 2000***. Institute for Marine Resources and Ecosystem Studies; Vestiging Den Helder, The Netherlands.	2000	North Sea	114	566

Fisheries Research Service, Marine Laboratory. ***Macrobenthos samples collected in the Scottish waters in 2001***.	2001	North Sea, North Atlantic Ocean	555	4681
Hillewaert, H., 2000. ***Macrozoobenthos from the Belgian Continental Shelf, collected in 2000***. Vlaamse Overheid; Beleidsdomein Landbouw en Visserij; Instituut voor Landbouw- en Visserijonderzoek; Kenniseenheid: Dier; Onderzoeksdomein Visserij, Belgium.	2000	North Sea	117	636
Cochrane, S., 2001. ***Macrobenthos from the Norwegian waters***. Akvaplan-niva, Norway.	2000 - 2001	North Sea, Norwegian Sea	576	14891
National Museum of Natural History, Smithsonian Institution NMNH Invertebrate Zoology Collection Database. National Museum of Natural History, Smithsonian Institution, 10th and Constitution Ave. N.W., Washington, DC 20560-0193, 2001, Version 3.2.04 (0802221).	1829 - 2007	World marine waters	2288	10291
UK National Biodiversity Network, Dorset Environmental Records Centre - ***Ross Coral Mapping Project - NBN South West Pilot Project Case Studies .***	1994 - 1995	English Channel	11	32
UK National Biodiversity Network, Royal Society for the Protection of Birds - ***Seabird nearshore winter survey in South-West England 1994-95.***	1994 - 1995	Celtic Sea, English Channel	19	1480
UK National Biodiversity Network, Conchological Society of Great Britain & Ireland - ***Mollusc (marine) data for Great Britain and Ireland.***	1842 - 1999	English Channel, North Sea, Inner Seas off the West Coast of Scotland, Celtic Sea, Bristol Channel, North Atlantic Ocean, Irish Sea & St. George's Channel	537	47599
UK National Biodiversity Network, British Phycological Society - ***Seaweed data for Great Britain and Ireland.***	1750 - 2003	Inner Seas off the West Coast of Scotland, Bristol Channel, North Atlantic Ocean, English Channel, Irish Sea & St. George's Channel, Celtic Sea, North Sea	742	111682

UK National Biodiversity Network, Countryside Council for Wales - ***Survey of North Wales and Pembrokeshire Tide Influenced Communities.***	2002 - 2003	Celtic Sea, Irish Sea & St. George's Channel	606	6895
UK National Biodiversity Network, Marine Biological Association - ***Ongoing UK MarLIN Shore Thing timed search results.***	2006 - 2008	English Channel, Irish Sea & St. George's Channel, Celtic Sea, Bristol Channel	20	441
UK National Biodiversity Network, Marine Biological Association - ***DASSH Data Archive Centre expert sighting records.***	1855 - 2007	Bristol Channel, Inner Seas off the West Coast of Scotland, Celtic Sea, North Sea, English Channel, Irish Sea & St. George's Channel	293	781
UK National Biodiversity Network, Marine Biological Association - ***DASSH Data Archive Centre Academic surveys.***	1841 - 2001	North Atlantic Ocean, Bristol Channel, English Channel, Inner Seas off the West Coast of Scotland, North Sea, Irish Sea & St. George's Channel, Celtic Sea	1468	62099
UK National Biodiversity Network, Marine Biological Association - ***Volunteer sightings data held by the DASSH Data Archive Centre.***	1947 - 2007	North Atlantic Ocean, North Sea, English Channel, Celtic Sea, Inner Seas off the West Coast of Scotland, Irish Sea & St. George's Channel	394	4734
Martinez Arbizu, P., C.R. Smith, S. Keller & B. Ebbe (Eds). ***Biogeographic Database of the Census of Abyssal Marine Life***. [date accessed]. World Wide Web electronic publication. Available online at http://www.cedamar.org/biogeography	/	World marine waters	3055	12337
Aráujo, R., I. Bárbara, M. Tibaldo, E. Berecibar, P. Díaz Tapia, R. Pereira, R. Santos & I. Sousa-Pinto. ***Checklist of benthic marine algae and cyanobacteria of northern Portugal***. Centre of Marine and Environmental Research; Interdisciplinary Centre for Marine and Environmental Research (Porto) (Ciimar).	1999 - 2007	North Atlantic Ocean	224	1756

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ALNITAK. ***Alnitak Cetaceans and sea turtles surveys off Southern Spain***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu, 2007-11-19 13:40:07-05, vector digital data.	1990 - 2006*	North Atlantic Ocean, Ligurian Sea, Strait of Gibraltar, Alboran Sea, Balearic Sea, Mediterranean Sea - Eastern Basin, Mediterranean Sea - Western Basin	15	4010
College of the Atlantic, Allied Whale. ***Allied Whale / College of Atlantic North Atlantic Humpback Whale Catalogue, 1976 - 2003, ver2***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/, 2004-11-16 14:25:44.414534-05, vector digital data.	1981 - 2000	Norwegian sea, barentsz Sea, Greenland Sea, North Atlantic Ocean	1	123
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Weir, C.R., K.A. Stockin & G.J. Pierce, 2007. ***Spatial and temporal trends in the distribution of harbour porpoises, white-beaked dolphins and minke whales off Aberdeenshire (UK), north-western North Sea (vessel surveys)***. Journal of the Marine Biological Association of the UK: 87: 327-338. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/.	1999 - 2001	North Sea	3	71
Cronin, M., C. Duck, O. O. Cadhla, R. Nairn, D. Strong & C. O'Keeffe (2007). ***An assessment of population size and distribution of harbour seals in the Republic of Ireland during the moult season in August 2003***. Journal of Zoology: Vol. 273 pp. 131-139. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/.	2003	North Atlantic Ocean, Celtic Sea, Irish Sea & St. George's Channel, Inner Seas off the West Coast of Scotland	2	435
Barnard, M.G., N. Ascroft & J.H. Nicholls (Comp.), 2002. ***HMAP - History of Marine Animal Populations Database***. Hull, United Kingdom.	1920 - 1984	European marine waters	133	100815
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Neal, P. R. & D.J. Patterson. ***MICROBIS.*** 1 Jan. 2005, Version 1 (European data).	2002 - 2003	North Atlantic Ocean	445	23261
National Institute of Marine Sciences and Technologies, Republic of Tunisia Trawling Surveys. AfrOBIS, South Africa, Salambo, Republic of Tunisia..	1983 - 2006	Strait of Gibraltar, Alboran Sea, Mediterranean Sea - Eastern Basin, Mediterranean Sea - Western Basin	224	7652
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Canadian Wildlife Service. ***PIROP Northwest Atlantic***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/, 2006-03-21 18:32:15-05, vector digital data.	1965 - 1992	European marine waters	72	9836
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Stocks, K., 2005. ***Seamounts Online: an online information system for seamount biology.*** San Diego Supercomputer Center, San Diego, California. World Wide Web electronic publication. http://seamounts.sdsc.edu.	/	Ionian Sea, Alboran Sea, Norwegian Sea, North Atlantic Ocean, Bay of Biscay, Mediterranean Sea - Eastern Basin	866	3945
Sea Mammal Research Unit (SMRU). ***SMRU Grey Seal Tracking in the North Sea, 1991-1993***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/, 2004-03-11 13:13:58.956105-05, vector digital data.	1991 - 1993	North Sea, Norwegian Sea, North Atlantic Ocean	1	9454
Sea Mammal Research Unit (SMRU). ***SMRU Small Cetacean Abundance in the North Sea (SCANS), 1994***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/, 2004-05-07 10:26:49.566991-04, vector digital data.	1994	North Sea, Skaggerak, Inner Seas off the West Coast of Scotland, Norwegian Sea, Kattegat, North Atlantic Ocean, English Channel, Celtic Sea	16	2376
Pugh, P. ***Discovery Collections Midwater Database***. National Oceanography Centre, Southampton SO14 3ZH, U.K, 2000.	1965 - 1997	North Atlantic Ocean, Celtic Sea, Strait of Gibraltar, Alboran Sea, Mediterranean Sea - Western Basin - Mediterranean Sea - Eastern Basin	1672	68000
Asso Chene. ***Study of young rehabilitated harbour seals in the north of France***. In: OBIS-SEAMAP. OBIS-SEAMAP, http://seamap.env.duke.edu/.	2005 - 2008	Bay of Biscay, Celtic Sea, North Sea, English Channel, North Atlantic Ocean	1	1237
United Kingdom Natural History Museum. ***UK NHM Stranded Whale Recording Scheme, UK & Eire 1970-1979***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/, 2004-03-11 12:42:47.154484-05, vector digital data.	1970 - 1979*	Celtic Sea, Irish Sea & St. George's Channel, English Channel, North Atlantic Ocean, Bristol Channel, North Sea, Inner Seas off the West Coast of Scotland	15	378

UK Royal Navy. ***UK Royal Navy Marine Mammal Observations***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu, 2006-12-07 10:09:57-05, vector digital data.	1972 - 2003	European marine waters	8	113
Steiner, L., M.A. Silva, J. Zereba & M.J. Leal, 2007. ***Bryde's whales, Balaenoptera edeni, observed in the Azores: a new species record for the region.***	2004	North Atlantic Ocean	1	38
The Years of the North Atlantic Humpback Whale (YoNAH). ***The Years of the North Atlantic Humpback Whale***. In: OBIS-SEAMAP . OBIS-SEAMAP, http://seamap.env.duke.edu/, 2005-05-13 12:38:34.440766-04, vector digital data.	1992 - 1993	Barentsz Sea, Norwegian Sea, Greenland Sea, North Atlantic Ocean	1	253
Rogers, A. & J. Hall-Spencer. ***Cold-water Corals***. UNEP World Conservation Monitoring Centre (UNEP-WCMC), 2005. Version 2.0.	/	European marine waters	119	3365
Arctic Ocean Diversity (ArcOD). ***Data from the Alaska Ocean Observing System***. http://www.aoos.org/about/contact.html	1946 - 2004	Greenland Sea, Kara Sea, White Sea, Arctic Ocean, North Atlantic Ocean, Gulf of Finland, Barentsz Sea, Norwegian Sea	462	21681
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The Danish Biodiversity Information Facility. ***Marine Benthic Fauna List, Island of Læsø, Denmark***	1959 - 1965	Kattegat	576	577
The Danish Biodiversity Information Facility. ***Nivå Bay species list, Zealand, Denmark***	1758 - 2004	Kattegat	733	770
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ICES Biological Community database (DOME – Community). The International Council for the Exploration of the Sea, Copenhagen. 2010. Online source: http://ecosystemdata.ices.dk.	1979 - 2008*	Kattegat, Gulf of Riga, Gulf of Finland, Skaggerak, Baltic Sea, Gulf of Bothnia	222	17683

ICES Contaminants and biological effects database (DOME – Biota). The International Council for the Exploration of the Sea, Copenhagen. 2010. Online source: http://ecosystemdata.ices.dk.	1978 - 2009	European marine waters	89	736839
Historical Black Sea zooplankton records. Plankton Department, Institute of Biology of the Southern Seas, NAS Ukraine.	1954 - 1995	Black Sea, Sea of Marmara	60	65418
Belmonte, G., 2000. ***Cysts from plankton from the South Adriatic Sea***. University of Salento, Department of Biological and Environmental Science and Technologies, Laboratory of Zoology and Marine Biology (LZMB), Italy.	2000	Adriatic Sea	76	146
Belmonte, G., 2000. ***Microzooplankton - Crustacea from the South Adriatic Sea***. University of Salento, Department of Biological and Environmental Science and Technologies, Laboratory of Zoology and Marine Biology (LZMB), Italy.	2000	Adriatic Sea	124	197
Belmonte, G. ***Mesozooplankton - Crustacea from the South Adriatic Sea***. University of Salento, Department of Biological and Environmental Science and Technologies, Laboratory of Zoology and Marine Biology (LZMB), Italy.	/	Adriatic Sea	16	16
Belmonte, G. ***Zooplankton - Crustacea from the Taranto Seas***. University of Salento, Department of Biological and Environmental Science and Technologies, Laboratory of Zoology and Marine Biology (LZMB), Italy.	/	Ionian Sea	109	109
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H. G. Gudfinnson, H. Debes, T. Falkenhaug, E. Gaard, Á. Gislason, H. Petursdottir, T. Sigurdsson & H. Valdimarsson, 2008. ***Abundance and productivity of the pelagic ecosystem along a transect across the northern Mid- Atlantic Ridge in June 2003***. ICES CM 2008/C:12	2003	North Atlantic Ocean	82	1066
Post, A., 1987. ***Pelagic transects of FRVs "Walther Herwig" and "Anton Dohrn" in the Atlantic Ocean 1966 to 1986***. Mitt. Inst. f. Seefischerei d. BfaFi Hamburg, 42: 1-68.	1973 - 1986	North Atlantic Ocean, Greenland Sea	410	7138
REPHY - Réseau de surveillance du phytoplancton. Institut Français pour la Recherche et l'exploitation de la mer, Nantes, France.	1987 - 2010*	Strait of Gibraltar, Celtic Sea, Mediterranean Sea - Western Basin, English Channel, North Sea, Tyrrhenian Sea, Bay of Biscay	427	285562