EMODnet

Annual report

2016

EMODnet

European Marine
Observation and
Data Network

Contents

Foreword

2016 was a successful year for EMODnet. We have already achieved what we set out to do by 2020; deliver a complete multi-resolution seabed map of European seas. EMODnet is now a reference source of data for those working in the coastal and offshore blue economy. It is already improving the forecasting of storm surges and helping national and regional authorities develop spatial plans and report the state of their marine environment.

Of course we need to maintain this effort. Businesses, authorities, scientists and civil society need to be sure that the services we are offering will continue. We have listened to their feedback and work is already in progress to develop the services further with higher resolution, more parameters and deeper integration with our sister initiatives: the Copernicus Marine Environment Service and the Data Collection Framework for fisheries.

This report describes what has been done in 2016. It has been a team effort with over 150 organisations participating, both public and private with representatives from every country in the European Union as well as neighbours sharing the same sea. I would like to take this opportunity to thank them. It is indeed a practical demonstration of what Europe can achieve if we work together.
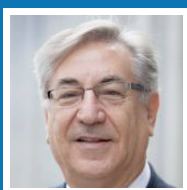
Karmenu Vella
Commissioner for Maritime Affairs and Fisheries,

EMODnet in a nutshell

The European Marine Observation and Data Network (EMODnet) is a long-term marine data initiative funded by the European Maritime and Fisheries Fund, which together with the Copernicus space programme and the Data Collection Framework for fisheries, implements the EU's Marine Knowledge 2020 strategy.

Over 150 organisations work together to assemble and make available marine data, metadata and products.

Its main purpose is to unlock fragmented and hidden marine data resources, make them available to public and private organisations and to facilitate investment in sustainable coastal and offshore activities through improved access to quality-assured, standardised and harmonised marine data and data products which are interoperable and free of restrictions on use.

EMODnet currently consists of five strands:

▶ seven thematic portals providing access to marine data collected, stored and managed by Member States and regional aggregators and creating data products;

▶ six Sea-basin Checkpoints assessing the availability and fitness for purpose of marine data in different regions;

▶ a Central Portal, supported by the Flanders Government, giving access to data provided by all the thematic portals and allowing the retrieval of data layers from multiple portals at the same time;

▶ an Ingestion Portal facilitating submission of new datasets (operational since February 2017);

▶ and the EMODnet Secretariat, established in September 2013, who ensure coherence between the different strands; monitor EMODnet; disseminate results, and analyse user feedback and statistics.

During 2016 financial support was also provided for the collection of additional oceanographic data from the upper 2000 metres of the ocean through an array of autonomous probes.

EMODnet Inauguration Conference, October 2015, Belgium

1.

EMODnet progress in 2016

Significant results achieved by EMODnet, from January to December 2016, were:

The development of new facilities:

▶ Launch of the new Ingestion Portal: a gateway designed to help public or private data owners share their data through a quick and simple process (www.emodnet-ingestion.eu);

▶ Design and implementation of the new portal for Human Activities (www.emodnet.eu/human-activities), for effectively finding, viewing and downloading data on human activities such as fisheries, shipping or construction of off-shore energy facilities;

▶ Creation of the Biology Download toolbox, a new interface improving the user-friendliness of the EMODnet Biology data portal.

More data & increased coverage:

▶ Increase of volume of data (2015 vs 2016): +6% bathymetry, +11% biology, +140% physics, +35% seabed habitats, +60% human activities, +8% chemistry;

▶ The coverage of topographic and habitat maps was extended to all European seas;

▶ Basin-scale data collections and maps of nutrient concentration for temporal trend analysis.

Improved coherence:

▶ Harmonization and seamless user experience of the thematic and checkpoint portals thanks to the EMODnet Central Portal;

▶ Consolidation of links with other EU initiatives such as INSPIRE Directive, the Marine Strategy Framework Directive and the Copernicus space programme.

More insights:

▶ Better understanding of fitness for purpose of Europe's marine data through results of stress tests undertaken by the Sea-basin Checkpoint projects;

▶ Identification, through the Coastal Mapping project (www.emodnet.eu/coastal-mapping), of the actions that need to be performed to survey Europe's shallow coastal waters.

Wider stakeholder engagement:

▶ Creation and establishment of the new EMODnet Associated Partnership Scheme enabling EMODnet to become a more flexible, open and inclusive network;

▶ Increased visibility of the EMODnet Central Portal: monthly views from 4.451 in 2015 to 7.490 in 2016;

▶ Support to real-life use cases: bathymetric data used for operational storm surge forecasting, seabed substrate data used by maritime spatial planners, and more.
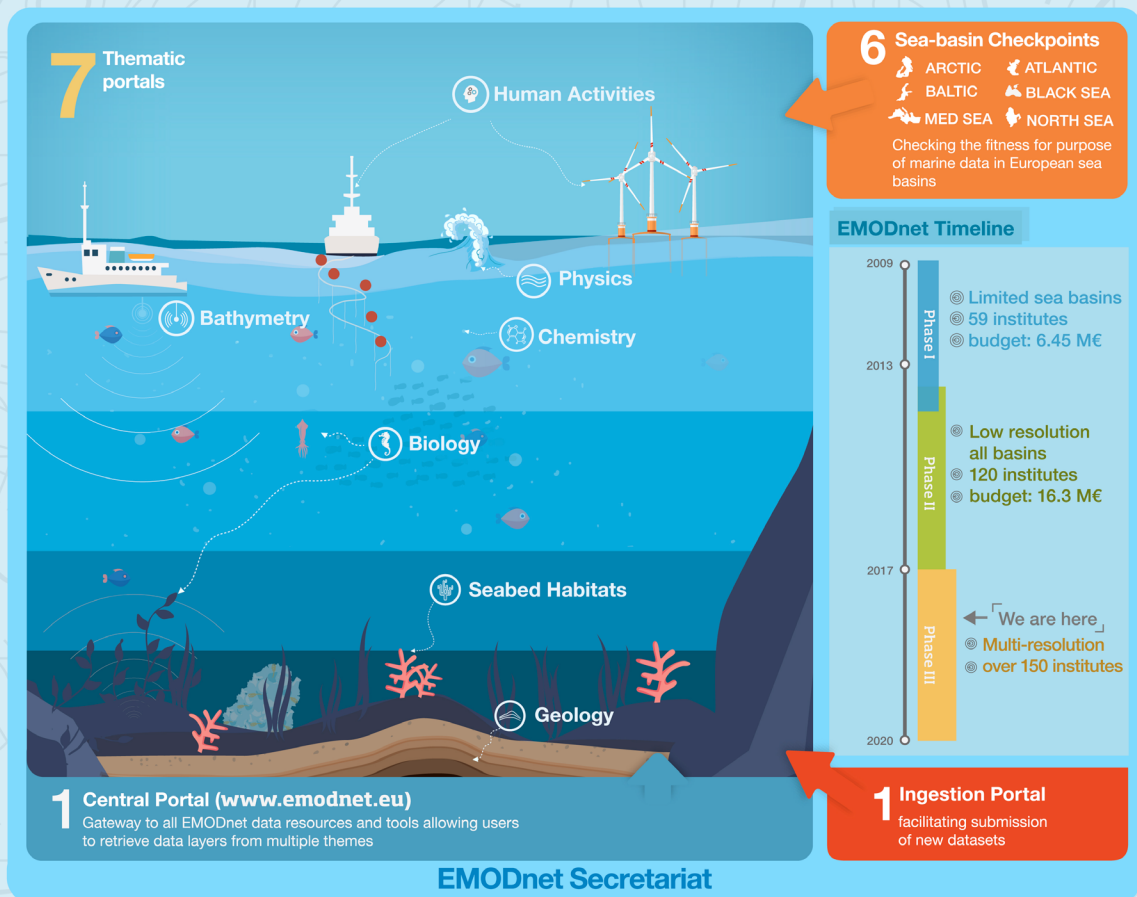
EMODnet
European Marine Observation and Data Network

THE EUROPEAN MARINE OBSERVATION AND DATA NETWORK - AT A GLANCE

Over **150 organisations** assembling and making available
marine data, metadata & products

7 Thematic portals

- Human Activities
- Physics
- Bathymetry
- Chemistry
- Biology
- Seabed Habitats
- Geology

6 Sea-basin Checkpoints

ARCTIC	ATLANTIC
BALTIC	BLACK SEA
MED SEA	NORTH SEA

Checking the fitness for purpose of marine data in European sea basins

EMODnet Timeline

2009

Phase I
- Limited sea basins
- 59 institutes
- budget: 6.45 M€

2013

Phase II
- Low resolution all basins
- 120 institutes
- budget: 16.3 M€

2017

Phase III
← We are here ⌐
- Multi-resolution
- over 150 institutes

2020

1 Central Portal (www.emodnet.eu)
Gateway to all EMODnet data resources and tools allowing users to retrieve data layers from multiple themes

1 Ingestion Portal
facilitating submission of new datasets

EMODnet Secretariat

Why EMODnet?

Every year, EU & its Member States invest 1.4 billion euro in marine observations and data collection.

Most of this data ends up in different databases and systems scattered around Europe and is difficult to find, access, assemble and use.

EMODnet is making a difference

From raw data to **real-life applications**

- Marine Observations
- Data
- Information
- Knowledge
- Application

EMODnet
European Marine Observation and Data Network
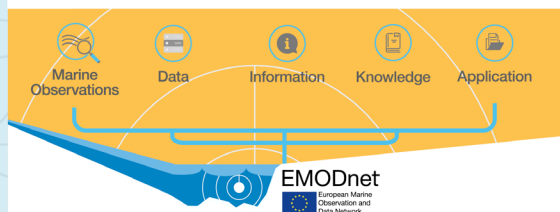
Who is EMODnet for?

Professionals from: 🏛 **Public Sector** ⚓ **Civil Society**
📊 **Private Sector** 🏛 **Research Community**

Benefits

👍 **Increased productivity:** Avoid costs of repeated collection of data by improving access to already existing data in compatible formats

👍 **Stimulation of innovation:** Anyone (including SMEs) can build value-added services using data from different sources

👍 **Reduction of uncertainty:** Better access to data improves forecasts of the behaviour of the seas, reducing costs of protecting life and property in coastal areas and offshore

👍 **Adding value to your own data:** Sharing data with EMODnet allows your own data to be combined with data from others to generate better value-added products and information and supports the global open data movement.

The timeline below offers a snapshot of the different activities performed by the EMODnet consortium to achieve these and many more results.

March 2016:

The importance of **cooperation** within EMODnet was exemplified by the cross-thematic activities developed jointly with the aim of assessing the confidence levels of EMODnet Seabed Habitat maps. Seabed Habitats required the active collaboration of Bathymetry and Geology, as its assessment depended on the reliability of the maps produced by these two thematic lots.

July 2016:

On 8th July, the EMODnet Secretariat received Karmenu Vella, European Commissioner for Environment, Maritime Affairs and Fisheries, at the Secretariat premises in the InnovOcean site in Oostende (Belgium). The visit concluded with a **formal signing ceremony** with the Secretary General of the Department of Economy, Science and Innovation of the Flemish Government to mark the agreement with Flanders to support EMODnet.

May 2016:

All EMODnet Checkpoints faced the **oil leak challenge** simultaneously and were asked to assess the impact of simulated oil spills in their basins. They all succeeded in delivering bulletins describing the fate of the oil and the potential effect on coastal ecosystems, populations and economic activities.

January 2016:

Release of EMODnet Chemistry **maps for eutrophication in all European seas** which can be visualised and animated to detect temporal trends.

EMODnet Human Activities designed a **Search Engine Optimisation** (SEO) strategy to improve the visibility of their activities. As part of the strategy, they set up a blog which has significantly increased the number of visits to their portal.

June 2016:

The fruitful cooperation between EMODnet Physics and Mercator Ocean, the organisation responsible for the implementation of the EC Copernicus Marine Monitoring Service (CMEMS), was formalised in a **Memorandum of Understanding** (MoU).

February 2016:

Outreach activities were particularly relevant during this period. Amongst them, **the EMODnet-EuroGOOS "Workshop on challenges of open marine data management"** was attended by the Head of the Secretariat and the coordinator of EMODnet Physics in Hamburg (Germany). EMODnet was also present at the **American Geophysical Union Ocean Sciences meeting** in New Orleans (USA) with contributions from Physics, Geology and Bathymetry thematic lots.

April 2016:

Launch of the **EMODnet Biology download tool**. The tool guides the user through a step-wise workflow where one can select datasets, perform predefined geographic and temporal selections and add taxonomic or functional filters.

June 2016:

EMODnet **Steering Committee** met in Brussels and noted significant progress on activities leading to a further harmonization amongst thematic lots, including the development of the central portal. EMODnet Geology delivers the **1:250,000 scale seabed-substrate dataset**, complemented by a 1:1 million scale dataset, enabling the production of a harmonised map covering about 65% of the European Seas, including a confidence assessment.

May 2016:

EMODnet successfully presented to a wide range of stakeholders on the occasion of the **European Maritime Day** in Turku (Finland) organised by DG MARE.

November 2016:

The EMODnet Secretariat participated to the Sustainable Ocean Summit (SOS) 2016, Rotterdam, **to forge links with the private sector**.

September 2016:

EMODnet Coastal mapping project members met in Dublin on 14-15 September 2016 to discuss actions needed to **survey Europe's shallow coastal waters**.
EMODnet Chemistry publishes data products on its portal, consisting of aggregated, validated and harmonized data collections for pollution, covering all European seas and available for on-the-fly visualisation.

October 2016:

After the 2016 summer period, all Checkpoints have steadily increased their activities to submit the first **Data Adequacy Reports** (DAR) for the Arctic, the Black Sea and the Baltic sea basins.
Last version of the **broad scale pan-European habitat map** made available in the EMODnet Seabed Habitats portal.

December 2016:

All thematic lots and the Coastal Mapping project **finished their current contracts** (corresponding to EMODnet Phase II).

August 2016:

EMODnet Phase II enters its concluding period with thematic lots preparing to submit **final reports** to DG MARE.

September 2016:

The coordinator of EMODnet Human Activities actively contributed to the INSPIRE Conference 2016, Barcelona, providing a concrete example of **INSPIRE implementation for marine data** in the framework of EMODnet.

October 2016:

EMODnet Bathymetry released the latest version of their global topographic maps on 4 October 2016 at the INMARTECH 2016 Conference in Bergen (Norway) with an **increase of a 10% in the number of source datasets used to produce the map**. These data sources are provided by 31 data holders from 18 countries.

November 2016:

The Atlantic, Baltic and Black Sea Checkpoints presented respectively in Copenhagen (Denmark) and Sofia (Bulgaria) their progress to an Expert Panel whose members represented **different stakeholder communities**, not only scientists, but also public bodies and industry.

2. EMODnet 2016 achievements

2.1. Thematic Lots

2.1.1. Bathymetry

The EMODnet bathymetry (www.emodnet-bathymetry.eu) team achieved a major milestone by completing a new version of the EMODnet digital terrain model. This is a topographic map layer showing the water depth across all European seas at a resolution of 1/2 arc minutes (circa 230 metres). The new version included 10% more surveys than the previous version sourced from 31 data holders in 18 countries. It also featured higher resolution bathymetry for selected coastal waters and shipwrecks.

The number of available bathymetric datasets increased from 13.906 to 14.791. The number of composite topographic maps was stabilised at 78 entries (46 in September 2015). There was also an increase in the number of unrestricted datasets from 816 to 919.

*EMODnet Bathymetry portal view showing the topographic map with 1/8 * 1/8 arc minutes resolution*
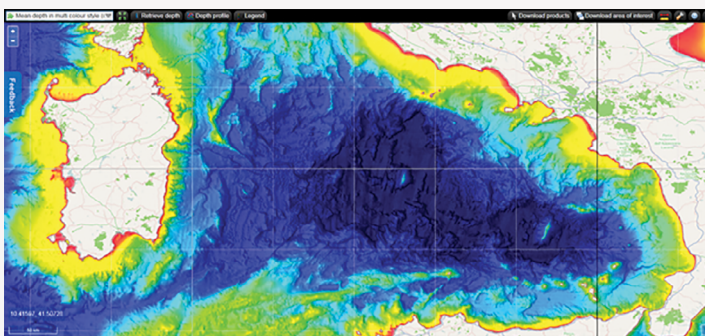
The work is fully integrated with international efforts: (i) the General Bathymetric Chart of the Oceans (GEBCO) is developing a digital terrain model for all the planet's seas albeit at a lower resolution than EMODnet. EMODnet provides more detailed map layers of European waters for inclusion in GEBCO. GEBCO data fill gaps in EMODnet where higher resolution surveys are not available; (ii) EMODnet data are included in the NOAA North Atlantic Data viewer, which provides an overview of the available bathymetric surveys from the United States and Europe for this area.

Coastal mapping

Near coastal waters are often uncharted because they are too shallow for navigation yet knowledge of their topography is essential for understanding processes such as coastal erosion. The very shallow depth makes mapping by traditional vessel-mounted acoustic methods expensive so a team has been investigating how other methods such as airborne LIDAR can be employed. By sharing knowledge of the effectiveness of different methods in Europe's seas and discussing needs for better maps with those working on coastal processes, a Joint European Coastal Mapping Programme has been drawn up. This indicates how increased coordination on surveying and the harnessing of European funding programmes could benefit the blue economy.

As part of the work an internet portal was set up to distribute data on coastlines and near-coastal topography. This work will be maintained and further developed by the EMODnet bathymetry team.

2.1.2. Geology

The EMODnet geology team assemble, process and distribute data on the history and structure of the ocean floor. This includes geophysical, geochemical, sedimentological and paleontological information on the ocean floor and coastal zone.

European sea-bed substrate map
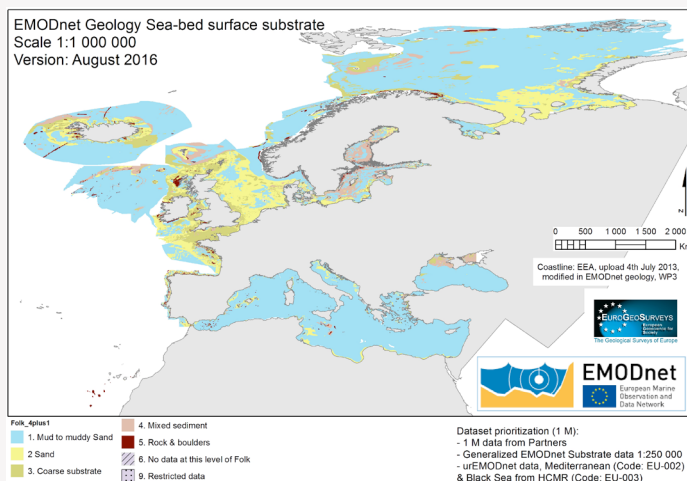
The data and map products now include information for European seas on the seabed substrate and rate of accumulation of recent sediments; the sea-floor geology; bedrock and quaternary geology (those deposited principally by ice during the last 2.58 million years) and all boundaries and faults that can be

represented at the 1:250,000 compilation scale. They include information on the lithology and age of each geological unit at the seabed; geological events and probabilities and minerals. For the coast, information on coastal type and behaviour has been supplemented by information on coastal erosion or sedimentation and the rate at which it occurs.

In 2016, work in reclassifying national sediment data into a shared EMODnet model was completed and the web portal (www.emodnet-geology.eu) improved to allow more intuitive browsing and downloading of products.

2.1.3 Seabed Habitats

In October 2016, the EMODnet Seabed Habitats team (www.emodnet-seabedhabitats.eu) released their key product: a pan-European broad-scale seabed habitat map.

Pan-European broad-scale seabed habitat map
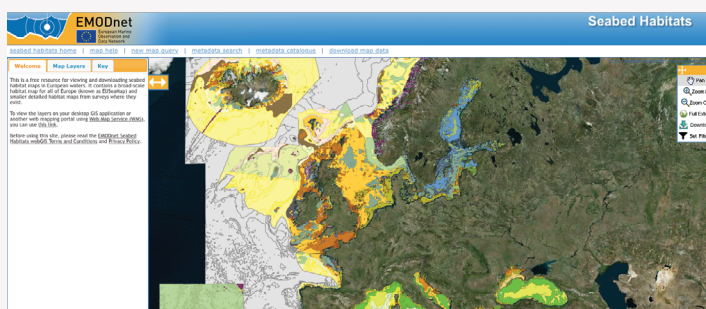
This divides the sea into habitat zones based on parameters such as water depth, salinity, turbidity, sediment type and temperature that influence how ecosystems can be supported. The accuracy of previous map layers was improved through a better definition of the photic zones and the use of higher resolution models for hydrodynamic conditions. Coverage was extended to all European sea basins. By using the standard EUNIS classifications developed by the European Environment Agency, analysis across and between these sea basins has, for the first time, became feasible.

As in all EMODnet products, significant effort has gone into determining the confidence levels of the habitats. This will allow future survey efforts to be strategically directed to areas where there is relatively low confidence.

As well as the modelled habitats with the common classification, the group has made available higher resolution survey-based maps of specific areas using different classifications. At the end of 2016, 481 datasets were available on the portal, compared to 349 in 2015.

2.1.4. Chemistry

The EMODnet Chemistry team (www.emodnet-chemistry.eu) assembles and disseminates information on the concentration of natural and man-made chemicals in the water column, sediments and biota. This includes chemical substances relevant for assessing eutrophication and pollution.

One of the major challenges has been to produce continuous digital map layers from scattered and heterogeneous points measurements. Originally it had been hoped that this could be done through an automatic interpolation process that allowed the map layers to be updated from the raw data as new or improved data became available. However, experience quickly showed that this was technically impossible. Measurement values across a sea basin do not change linearly but can vary considerably within very short timescales and distances depending on river discharges and currents. The team therefore prepared these digital map layers in a more complex process with the aid of (1) automated robot harvesting of regional data collections for nutrients, oxygen, chlorophyll, and contaminants, provided by more than 60 data centres (2) production of harmonised, aggregated and validated regional data collections for the 5 major European sea regions (3) spatial interpolation, particularly in near-coast regions, of dissolved oxygen, nitrates, nitrites, phosphates, silicates, ammonium, total nitrogen, total phosphorus, chlorophyll a, pH, antifoulants, heavy metals, hydrocarbons, pesticides, biocides, polychlorinated biphenyls, and radionuclides. Users can browse, visualize and download observation densities, profiles and map layers in order to gain insights into temporal changes and spatial distribution.

Spatial distribution of phosphate concentration in European basins for the winters of 2003 to 2012
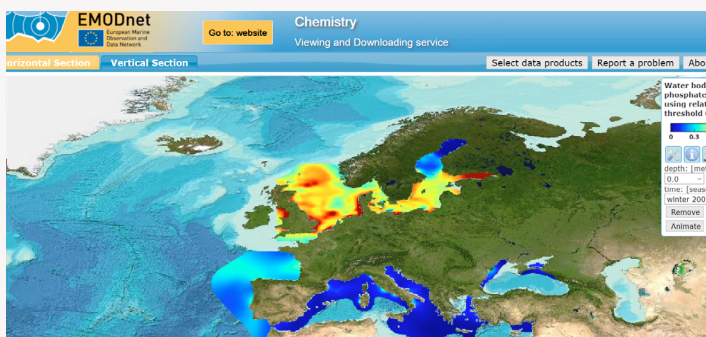

Priority was given to those parameters that are relevant for Member States, Regional Sea Conventions, and EU for assessing the state of the European waters under the Marine Strategy Framework Directive. For that purpose, experts from Regional Sea Conventions and EU were engaged in dedicated workshops organised by EMODnet Chemistry for tuning products and discussing their fitness for purpose.

2.1.5. Biology

The huge diversity of marine life and the multitude of ways of measuring it, make the work of the EMODnet team responsible for biology particularly challenging. Unlike the other EMODnet thematic areas which are largely built on national databases, the biological data are mainly held by the Ocean Biogeographic Information System (OBIS), which was created by the Census of Marine Life and is now under the International Oceanographic Data and Information Exchange (IODE) programme of UNESCO. Although this system does include some fish data, the EMODnet team focus their work on other marine species, leaving the EU's Data Collection Framework to deal with the fish.

Distributions of Calanus finmarchicus (above) and Calanus helgolandicus (below) illustrating the evolution of sea surface temperatures over the last fifty years
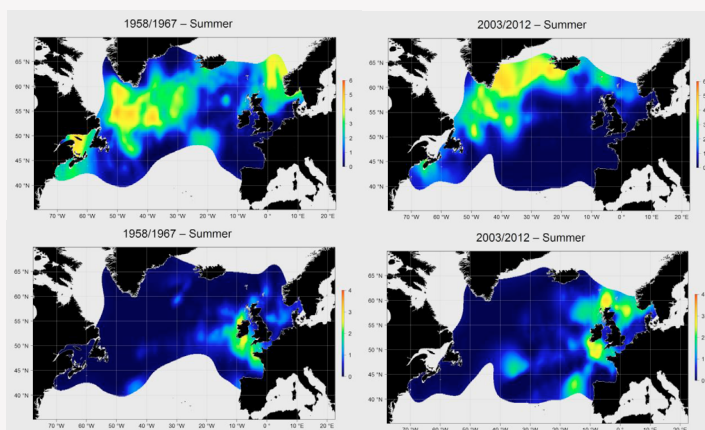
In April 2016, EMODnet Biology (www.emodnet-biology.eu) updated its portal by launching a new data download toolbox to enhance public access to data and products. This was the result of a long process that led to the creation of new gridded products to illustrate the temporal and geographic variability of occurrences and abundances of marine phytoplankton, zooplankton, macro-algae, angiosperms, fish, reptile, bird and sea mammal species.

Analysis of ecosystem health and human impact on it requires long time series of data. Special effort was devoted to the rescue and digitization of historical biological data which translated into an additional four new datasets.

In 2016, the number of records available in the EMODnet Biology portal increased by approximately 11% reaching over 21 million records from 713 datasets.

The portal made available more than 60 data products indicating the

abundance of different marine species, spanning a wide taxonomic range, from the smallest organisms (e.g. bacteria, viruses) to the largest (e.g. fish, mammals), and encompassing all trophic levels.

2.1.6. Physics

The work of the EMODnet Physics partners (www.emodnet-physics.eu) is built on the EuroGOOS network of observing stations and the SeaDataNet protocol for accessing archived physical data from national oceanographic data centres. The measurement of physical parameters is largely an automated process which allows the dissemination of near-real-time information.

The infrastructure for storing and distributing these data is shared with the Copernicus Marine Environment Monitoring Service. A memorandum of understanding with Copernicus, defining the roles of both parties, was signed during the year. Much of the effort goes into ensuring that the monitoring stations - drifting buoys, ferryboxes, gliders, fixed buoys, profiling floats, Argo floats and High Frequency Radars - remain connected to the network and connecting new ones. The number of platforms increased from approximately 5.000 in September 2015 to 12.000 in August 2016 despite the loss of some platforms in the Mediterranean which are no longer maintained due to budget cuts.

Sea surface temperature recorded by drifting buoys over the past 60 days
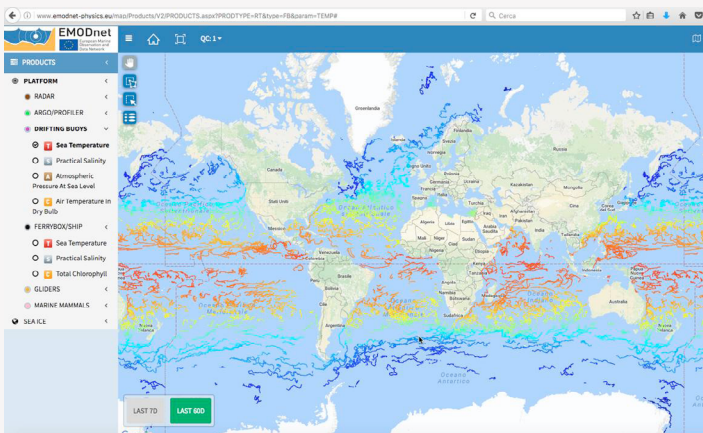
A second focus has been the development of new services and products such as time averages that make physical changes in the ocean easier to visualise and the data easier to use. A new dashboard service allows the retrieval of statistics concerning the portal usage. The sea level, wind and ice cover products were the most popular with users. Whilst access to the near-real time data is immediate, there are still some delays in deliveries of the archived data that will need to be dealt with in the next phase of EMODnet.

Monitoring the oceans and climate change with Argo

Whilst the first priority of EMODnet is to provide access to existing sources of oceanographic data, support has also been given to the Euro-Argo partners. This legally-recognised European research infrastructure maintains 800 autonomous floats as part of an international effort that provides unique information on temperature, salinity and currents in the upper 2000 metres of ocean. This contributes to our understanding of how climate is affecting ocean circulation and our knowledge of the planet's heat balance. The data are essential for calibrating and validating the EU's Copernicus oceanographic forecasts.

The EMODnet programme has provided financial support for the procurement and deployment of 150 of these floats and the subsequent processing of data. All 150 floats have been delivered and tested in a pool. 87 were shipped to deployment locations in global oceans as well as the eastern Mediterranean and Black Sea by the end of 2016.


Argo float

2.1.7. Human Activities

Unlike the other EMODnet groups, which are built on measurements or observations made by scientists or engineers, the Human Activities partnership (www.emodnet-humanactivities.eu) primarily assembles information held by national or regional authorities on anthropogenic activities that have an impact on the marine or coastal environment.

The main challenges are to keep the information up to date and to ensure a common way of describing these activities. It had originally been hoped that most of the data could be pulled from national databases using INSPIRE protocols but this proved impossible. Few countries had covered the desired parameters and those that had, did not use the same descriptions as their neighbours.
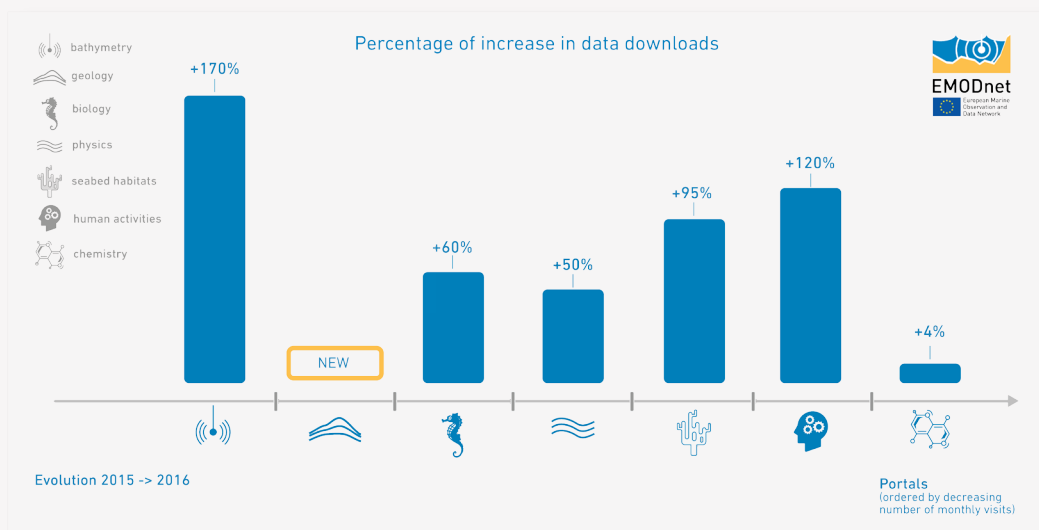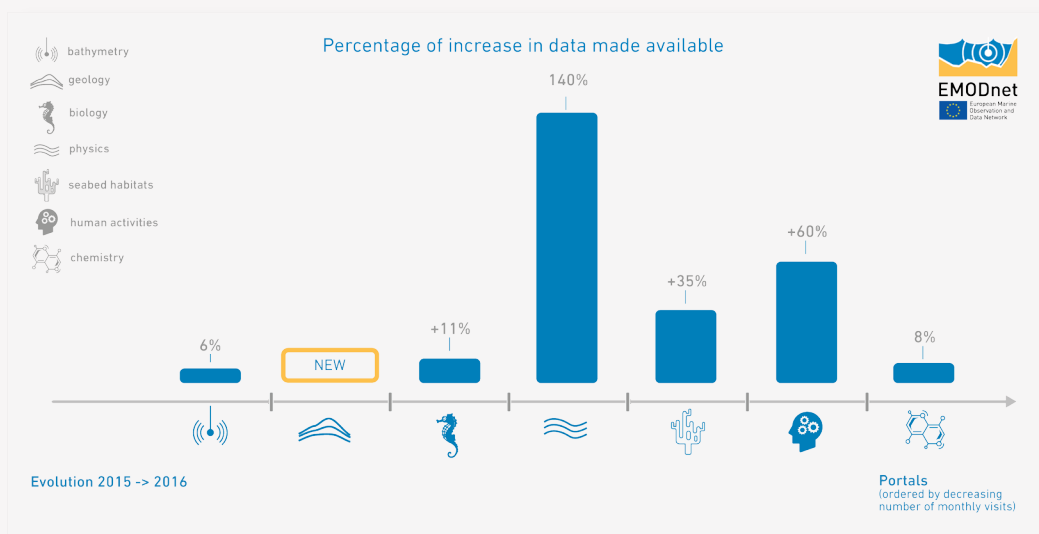
Wind farms map
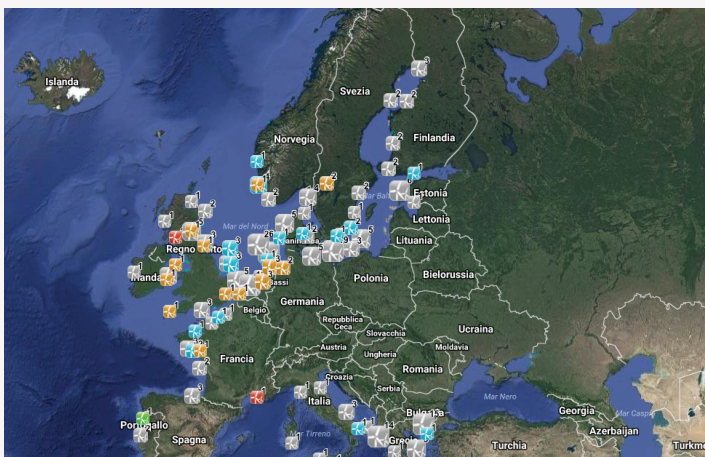
By the end of 2016, the Human Activities portal was maintaining 32 datasets for 13 themes related to human activities, ranging from wind farms to dredging, waste disposal to cultural heritage.

These datasets included points, lines, polygons, related tables or records, and raster tiles. Two new layers were added namely: 'monthly first sales of fish in EU ports' and 'Lighthouses'. A blog on certain data layers attracted new users. A survey of these users indicated that datasets such as shipping density and oil and gas pipelines should be enhanced and/or included in the future.

2.1.8. EMODnet in numbers

Percentage of increase in data made available

- bathymetry
- geology
- biology
- physics
- seabed habitats
- human activities
- chemistry

140%

+60%

+35%

+11%

6%

8%

NEW

Evolution 2015 -> 2016

Portals
(ordered by decreasing
number of monthly visits)

Percentage of increase in data downloads

- bathymetry
- geology
- biology
- physics
- seabed habitats
- human activities
- chemistry

+170%

+120%

+95%

+60%

+50%

+4%

NEW

Evolution 2015 -> 2016

Portals
(ordered by decreasing
number of monthly visits)

2.2. Central Portal

The EMODnet central portal provides a gateway to data and results from all thematic lots and Sea-basin Checkpoints as well as background information on the initiative and news.

During 2016 progress was made in consolidating access to data and data products from the different themes through one unique interface. Whilst all the thematic lots had based their protocols on open standards and INSPIRE principles, some fine-tuning to achieve full interoperability was required.

The revised portal now provides product catalogues, a map viewer and search facilities covering a wide range of data. This work is also contributing to a more standardised application programme interface that contributes to the development of downstream applications.

EMODnet Central Portal: number of unique visitors (log scale)
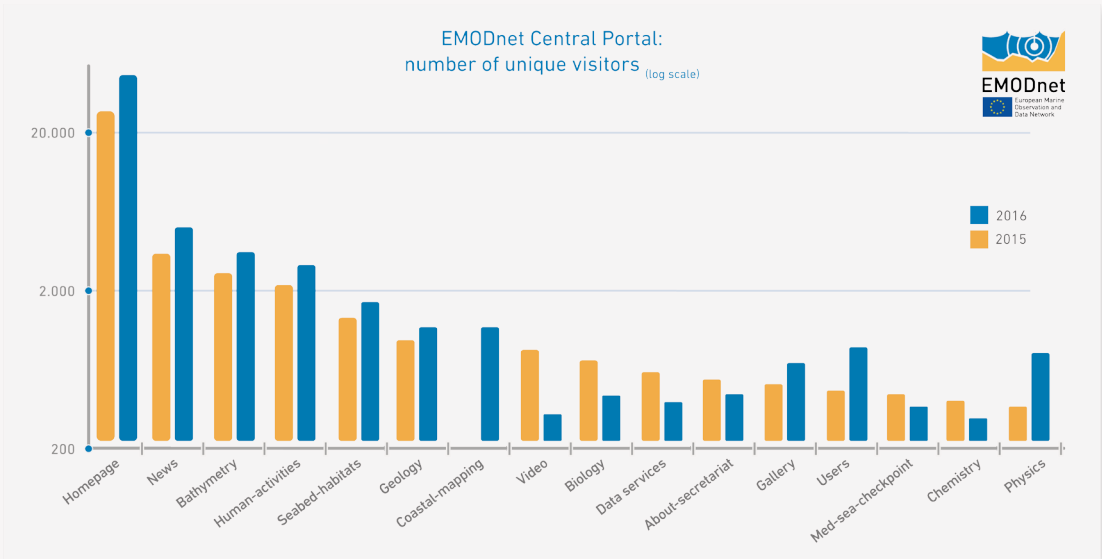
2.3 Sea-basin Checkpoints

EMODnet Sea-basin Checkpoints

ARCTIC

ATLANTIC

BALTIC

BLACK SEA

MED SEA

NORTH SEA

A series of stress tests have been set up to determine how fit for purpose Europe's marine data are. Independent "Checkpoints" were entrusted with checking how well the data perform in real life challenges.

This is not only to test EU initiatives such as EMODnet, Copernicus and the Data Collection Framework, but also to determine whether the right data have been collected in the first place.

In 2016, considerable progress has been achieved for all six Sea-basin Checkpoints, the most recent four (the Baltic, the Arctic, the Atlantic and the Black Sea began work in June 2015) clearly benefiting from experience acquired by the first two pilots, the North Sea and the Mediterranean Sea, which were launched in 2013.

2016 saw the launch of all new checkpoint web portals and the production of Literature Survey Reports, describing the marine data sources available in their respective sea-basins and assessing if there are references to the adequacy and fitness for use of those data. The North Sea and the Mediterranean Sea checkpoints were in a more advanced stage, each of them delivering Data Adequacy Reports and products for the different challenges identified in the call for tenders.

On 10 May 2016, an oil-spill challenge was launched simultaneously for all 6 Sea-basin Checkpoints. The checkpoint teams assessed how quickly and how well they could estimate the fate of a simulated oil spill and its impacts on ecosystems, human populations and economic activities. Bulletins produced 24 and 72 hours after the spill were delivered and published in the DG MARE Maritime Forum (https://webgate.ec.europa.eu/maritimeforum/en/node/3917).

The Checkpoint oil leak challenges were launched in May 2016

After the 2016 summer period all Checkpoints submitted Data Adequacy Reports and started preparing the EMODnet Sea-basin Checkpoint Stakeholder Conference held on 14-15 February 2017, Brussels.

*EMODnet Sea-basin Checkpoint
Stakeholder Conference*

All Data Adequacy Reports are available via the EMODnet Central Portal (emodnet.eu/checkpoints/reports).

3.

How EMODnet provides solutions

3.1. Improving storm surge modelling in the North Sea

Changes in coastal sea level caused by the combined effect of surface winds and air pressure have the potential to cause widespread coastal flooding, damage to infrastructure and loss of life.

The low-lying lands bordering the North Sea are particularly vulnerable as was seen most notably in the catastrophic events of 1953. It is expected that climate change will increase the frequency and severity of such events.

To protect life and property, the UK Met Office operates a storm surge forecast that runs four times a day. Knowledge of the topography of the sea floor is crucial to the accuracy of these forecasts. After extensive testing, the UK Met Office found that replacing the previous topographical data with that from EMODnet, made massive improvements to the forecasts. The EMODnet data were therefore incorporated in the operational system.

Waves in the North Atlantic ocean

3.2. Enhancing marine topographical data discovery and access in the North Atlantic

The digital topographic map layers produced by EMODnet do not only show the depth of water, they also indicate where surveys are sparse and confidence in data is low. Extending this analysis for more distant waters requires collaboration with countries outside the EU who have similar programmes.

The Galway Statement signed by the European Union, Canada, and the United States in May 2013 facilitates this. Its Implementation Committee mandated an Atlantic Seabed Mapping International Working Group to take care of the issue. As a result, a prototype map viewer was developed showing EMODnet map layers together with those produced by Norway, Canada and the United States. This provides a basis for setting priorities for further surveys.

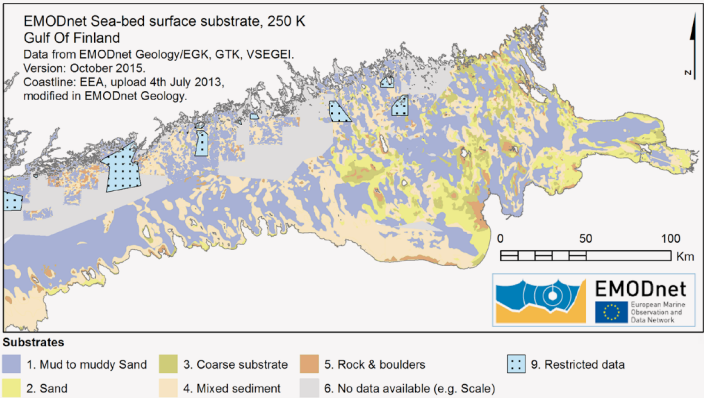*The North Atlantic data viewer prototype*
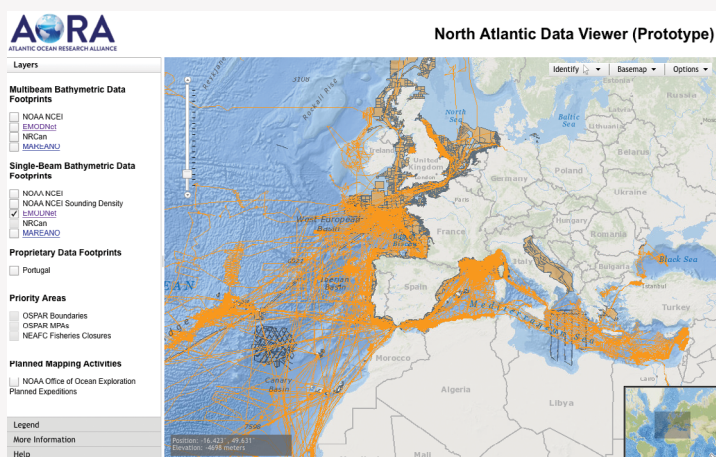
Surge storm

3.3. Gulf of Finland assessment

The development of EMODnet standard classifications for the various categories of seabed substrate allowed a digital map layer covering Russian, Finnish and Estonian waters to contribute towards the Gulf of Finland assessment published in 2016. This was one of the most important outcomes of the Gulf of Finland Year arranged by the three countries in 2014. The map, which shows that erosion, transportation, and accumulation bottoms have combined to give a patchy substrate distribution, also formed the basis of the regional spatial plan for the sea area created by the Regional Council of Kymenlaakso.

Seabed substrate map over the Gulf of Finland in scale 1:250.000

EMODnet Sea-bed surface substrate, 250 K
Gulf Of Finland
Data from EMODnet Geology/EGK, GTK, VSEGEI.
Version: October 2015.
Coastline: EEA, upload 4th July 2013,
modified in EMODnet Geology.

Substrates

1. Mud to muddy Sand
2. Sand
3. Coarse substrate
4. Mixed sediment
5. Rock & boulders
6. No data available (e.g. Scale)
9. Restricted data

Frozen stones. Baltic sea

3.4. Coordinating data collection on offshore exploration and extraction of oil and gas

Petroleum companies have complete information on their own offshore installations and authorities responsible for licensing them know what is in their own waters. But until recently, there has been no complete inventory of installations for any of Europe's sea basins.

The EMODnet human activities team therefore undertook a major effort to develop a digital map of boreholes, licences and offshore structure and classify them according to their operator, their purpose (exploration, exploitation) and their status (active, abandoned) and (where known) the type of hydrocarbon. This involved contacting the competent authorities, cross-checking data and translating national or corporate descriptions into a common set of attributes and geographical coordinates.

This has become a reference dataset that is now used by representatives of the industry themselves, by a group analysing options for spatial planning in the Celtic Sea and on any analysis requiring knowledge of what is happening in areas including waters of different national jurisdiction – for spatial planning, for environmental impact assessments and for emergency management.

The team recount the challenges of collecting, processing and distributing these data in a blog (www.emodnet-humanactivities.eu/blog).

Offshore oil and gas

3.5. Operational zooplankton data service: a long-term monitoring programme

Copepods are the most abundant members of the zooplankton family and the major source of food for many fish, whales and seabirds. Their importance to the global marine ecosystem cannot be overstated; both in the ocean food web and in the carbon cycle. Since the 1930s their abundance has been measured by the Continuous Plankton Recorder which is towed behind merchant ships and is one of the longest running biological monitoring programmes in the world.

The analysis method has remained unchanged since the 1950s and the results are unique in providing comparable data on the geographical distribution, seasonal cycles and year-to-year changes in abundance of plankton over a large spatial area.

Geospatial modelling by the EMODnet biology team turned these data into Operational Oceanographic Products and Services (OOPS) which are gridded map layers showing the average abundance of marine species for different time windows.

In turn, these OOPS feed into the "Ecosystem Overviews" of the International Council for the Exploration of the Sea (ICES) which describe the trends in pressures and state of regional ecosystems and underpin ICES's scientific advice on the exploitation and stewardship of the marine ecosystem and marine living resources in the North Atlantic.
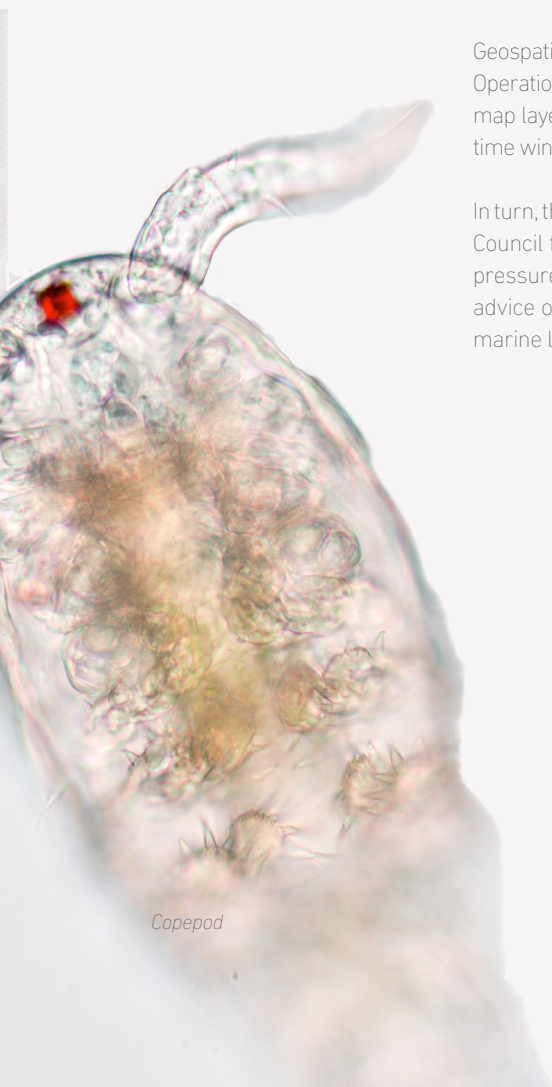
Copepod

3.6. Exploiting citizen science for collecting data on marine biodiversity

Wildsea Europe Route offers tourists access to routes connecting European coastal destinations that allow them to learn about marine wildlife and participate actively in conservation efforts; including the collection and propagation of marine biodiversity data. "Citizen science" activities such as these are increasingly being recognised as an important source of information with the potential to contribute to our knowledge of the sea and increase participants' sense of responsibility and ownership of the marine environment.

The partners of EMODnet Biology provided information on how to contribute data on marine biodiversity sightings and Wildsea now highlights EMODnet as a repository for the marine biodiversity data collected.

Dolphin watching excursion

4. Widening the EMODnet Network

In response to the increasing number of requests from organisations who wish to contribute to and join the EMODnet partnership, in June 2016 the EMODnet Steering Committee agreed to establish a new membership category: the Associated Partnership scheme. This flexible arrangement facilitates more organisations to join EMODnet in a straightforward and transparent way. It allows interested parties, who are not formal project partners, to contribute to and benefit from the network.

Benefits of associated partnership

▶ Private sector: improve corporate social responsibility by subscribing to the core principles of EMODnet, including adherence to good data management practices and open sharing of data where possible;

▶ Be part of a growing network of key public and private organisations, learning from others and enjoying the huge benefits of working together to address common marine data and sharing challenges;

▶ Have a say in the development of future EMODnet products and services and the refinement of existing ones;

▶ Explore options to share infrastructures or processes to save costs and share benefits;

▶ Be informed with first-hand information about global and pan-European marine data landscape, policy developments and funding opportunities.

APPLY NOW!
emodnet.eu/emodnet-associated-partners

Three new Associated Partners have formally joined the network in 2016:

5. Budget

The figures below represent the money committed to signed contracts in thousands of euro. All of these, except the grant for Argo floats, were implemented through procurement procedures awarded following open calls for tender. Payments are made after delivery of agreed outputs. Some projects are still ongoing. All the completed projects have been paid in full.

Theme and Project	Preparatory Actions[1] 2008-2010 (k€)	Maritime Policy Fund[2] 2011-2013 (k€)	European Maritime and Fisheries Fund[3] 2014 (k€)	2015 (k€)	2016 (k€)	Grand Total (k€)
central services		520		4,565	155	5,240
ingestion				4,045		4,045
office and infrastructure		0				0
secretariat		520		520		1,040
secretariat support					155	155
checkpoints		1,695	4,175			5,870
Arctic			906			906
Atlantic			1,590			1,590
Baltic Sea			784			784
Black Sea			895			895
Mediterranean		1,095				1,095
North Sea		600				600
observation				4,000		4,000
Argo				4,000		4,000
studies	230	450				732
costs and benefits		450				450
current status	230					230
observation benefits					52	52
thematic lots	6,350	16,350	1,194	4,917	13,483	42,294
Bathymetry	2,175	2,000		4,917		9,092
Biology	750	1,700			1,770	4,220
Chemistry	700	4,000			2,805	7,505
Coastal mapping			1,194			1,194
Geology	925	4,200			4,500	9,625
Human Activities		2,060			1,608	3,668
Seabed Habitats	800	1,390			1,400	3,590
Physics	1,000	1,000			1,400	3,400
Grand Total (K€)	6,580	19,015	5,369	13,482	13,690	58,136

[1] as defined in article 54 of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union

[2] Regulation (EU) No 1255/2011 of the European Parliament and of the Council of 30 November 2011 establishing a Programme to support the further development of an Integrated Maritime Policy

[3] Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund

6. Conclusions and Future Work

Open data requires a cultural and behavioural change from scientists, public agencies and governments. As EMODnet gains momentum, this cultural change is happening within the marine community. There are already concrete examples of improved productivity for those analysing Europe's seas and coasts. And increased knowledge of the state and dynamics of the sea is already contributing toward protecting marine and coastal ecosystems and the lives and livelihoods of those working offshore.

In 2017 the third phase of EMODnet development will begin. This will offer higher resolution seabed maps and new parameters such as river inputs and marine plastic distribution. The unveiling of a data ingestion portal will facilitate stewardship of data, particularly from research projects and environmental impact assessments, that would have otherwise have remained hidden. Conclusions about the fitness for purpose of Europe's marine data infrastructure, based on the results of the stress tests undertaken by the Sea-basin Checkpoint projects, will be available to guide future investments, both in EMODnet and in marine monitoring programmes.

Further efforts to involve private industry will be made, both to assess their needs and to encourage them to release their data as part of their corporate responsibility. A user group will be set up.

Contacts with programmes for managing marine data in other continents will be established as a first step towards a shared global approach.

EMODnet and friends

EMODnet team

EMODnet Policy Officer
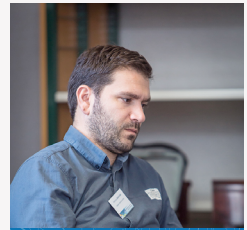Iain Shepherd

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Coastal Mapping

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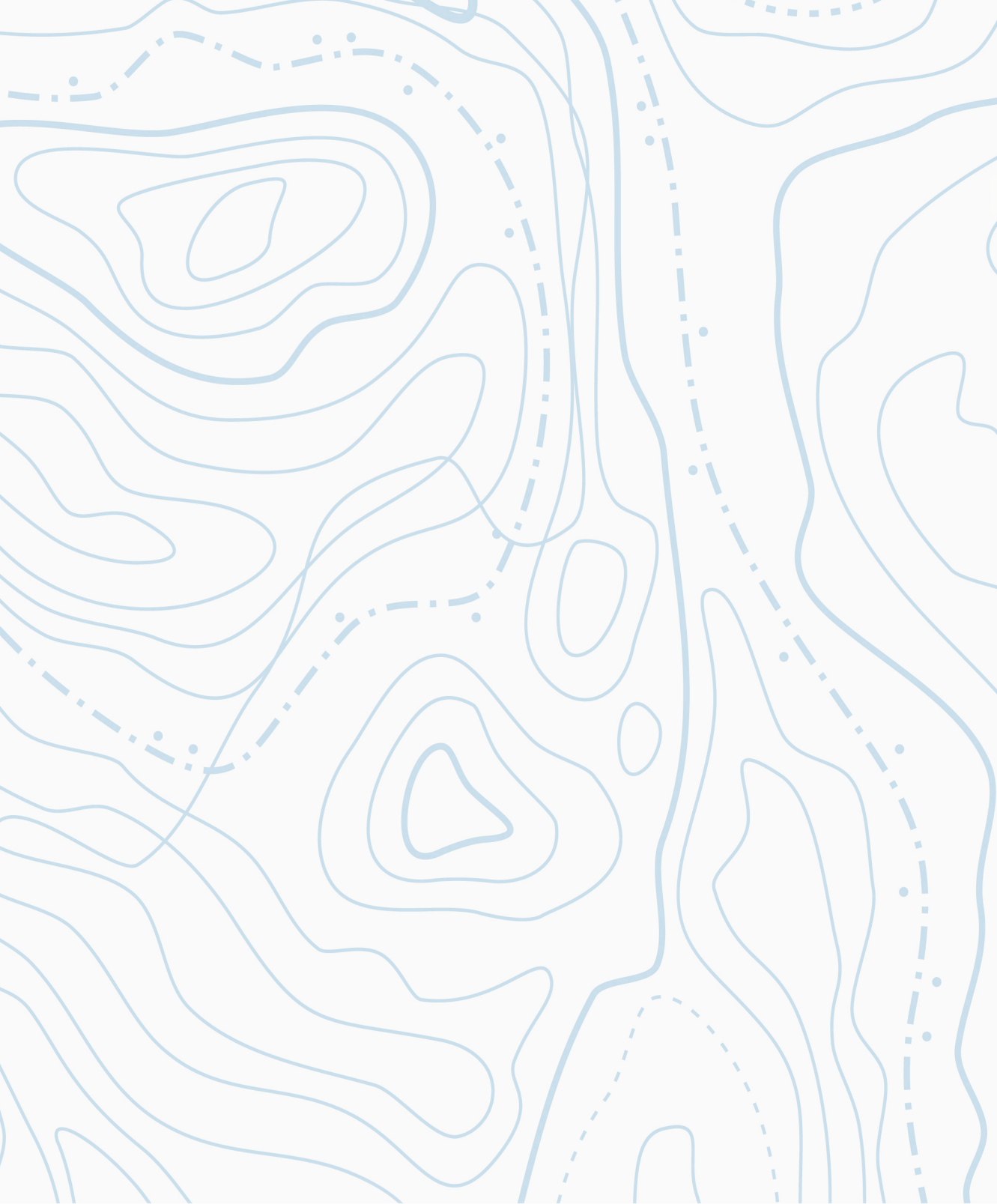## Argo Floats

Pierre Yves Le Traon

www.euro-argo.eu

References

Detailed information and each thematic lot annual progress report can be found on the Maritime Forum (https://webgate.ec.europa.eu/maritimeforum/) and on the EMODnet Central Portal (www.emodnet.eu)

EMODnet Thematic Portals and Sea-basin Checkpoint Portals:

- ▶ EMODnet Bathymetry – **www.emodnet-bathymetry.eu**
- ▶ EMODnet Geology – **www.emodnet-geology.eu**
- ▶ EMODnet Seabed Habitats – **www.emodnet-seabedhabitats.eu**
- ▶ EMODnet Chemistry – **www.emodnet-chemistry.eu**
- ▶ EMODnet Biology – **www.emodnet-biology.eu**
- ▶ EMODnet Physics – **www.emodnet-physics.eu**
- ▶ EMODnet Human Activities – **www.emodnet-humanactivities.eu**
- ▶ EMODnet Data Ingestion Portal – **www.emodnet-ingestion.eu**
- ▶ Arctic Checkpoint – **www.emodnet-arctic.eu**
- ▶ Atlantic Checkpoint – **www.emodnet-atlantic.eu**
- ▶ Baltic Checkpoint – **www.emodnet-baltic.eu**
- ▶ Black Sea Checkpoint – **www.emodnet-blacksea.eu**
- ▶ MedSea Checkpoint – **www.emodnet-mediterranean.eu**
- ▶ North Sea Checkpoint – **www.emodnet.eu/northsea/home**