

EMODnet



European Marine
Observation and
Data Network

EMODnet Thematic Lot n° 4 - CHEMISTRY

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Executive summary

This report describes the activities and results achieved in the EMODnet Chemistry Phase III contract, which ran for two years from 6 March 2017. It is a follow-up of the earlier developments in Phase I and Phase II of EMODnet Chemistry projects, which took place since June 2009, and that resulted in the portal: <https://www.emodnet-chemistry.eu>.

EMODnet Chemistry Phase III had the overall objective of providing access to marine chemistry data sets and derived data products concerning **eutrophication**, **contaminants** and, as last extension, **marine litter** collected on beaches, in fishermen's nets, or in specific surveys. Compared to previous phases of EMODnet Chemistry, the geographic coverage was also broadened, including now **all major European sea regions**: Norwegian Sea and Barents Sea, Baltic Sea, N.E. Atlantic (Celtic Seas, Iberian coast and Bay of Biscay and Macaronesia), Greater North Sea, Mediterranean Sea and Black Sea, thereby adopting the geographical definitions of MSFD.

Phase III aims at a continuation of services, assembling, processing and making accessible more measurements and deriving products of chemical substances for eutrophication and contaminants, and extending the scope by including gathering, processing, and publishing of marine litter data. The last phase marked a major step in the implementation of the activities, given the adoption of EMODnet Chemistry as a data platform contributing to assessment of Descriptor 5 Eutrophication, Descriptor 8 Contaminants, Descriptor 9 Contaminants in seafood and Descriptor 10 Marine Litter, thus increasing confidence, and achieving acceptance in the data products and in the data services.

EMODnet Chemistry Phase III advanced on the following activities:

- **Customisation** of EMODnet Chemistry portal, its viewing and downloading services, its data and metadata formats and tools to users' needs. A new design, layout, contents, and revised sitemap were drafted and implemented for the EMODnet Chemistry portal with more focus on data and data products for the three chemical themes. This includes presenting marine litter related activities, regular posting of latest news and events, extension of CDI interface to allow additional search criteria, extension in data and metadata format to show information on data quality, on Limit of Detection/Quantification, on marine litter and for INSPIRE compliance.
- **Definition** and set-up of a unified data model and common data formats for beach litter, modelled after the OSPAR-MCS approach, taking into account MSFD TG-ML and UNEP/MAP requirements, for seafloor litter, modelled after the ICES-DATRAS approach, taking into account the MSFD TG-ML and MEDITS requirements, and for micro-litter, using the standard SeaDataNet format already adopted for other types of chemical data.
- **Development** of the first pan-European marine litter database, spanning from 2001 to 2018 in the case of beach litter (Addamo et al., 2018), from 2006 to 2018 for seafloor litter and from 2011 to 2018 for floating micro-litter. In total, it counts 7142 beach surveys, 3600 seafloor trawls and 163 floating microliter surveys (Figure 1), the most comprehensive collection of homogenised data available at pan-European scale.
- **Consolidation** of the process to create regional standardised harmonized validated data collections for all European seas now available for Eutrophication and Ocean Acidification, Contaminants, Beach and Seafloor Litter;
- **Revision** of the existing offer of interpolated maps for Eutrophication and Ocean Acidification to better match RSCs needs and tune activities in support of MSFD implementation;
- **Production** of marine litter maps at pan-European scale;

- **Evolution** of dedicated maps for contaminants. Maps below and above the Limit of Quantification (LOQ), maps with LOQ above or below 30 percent of EQSD threshold values and maps below and above EQSD threshold values were produced for a shortlist of contaminants (10 substances in total) in biota, water and sediment.

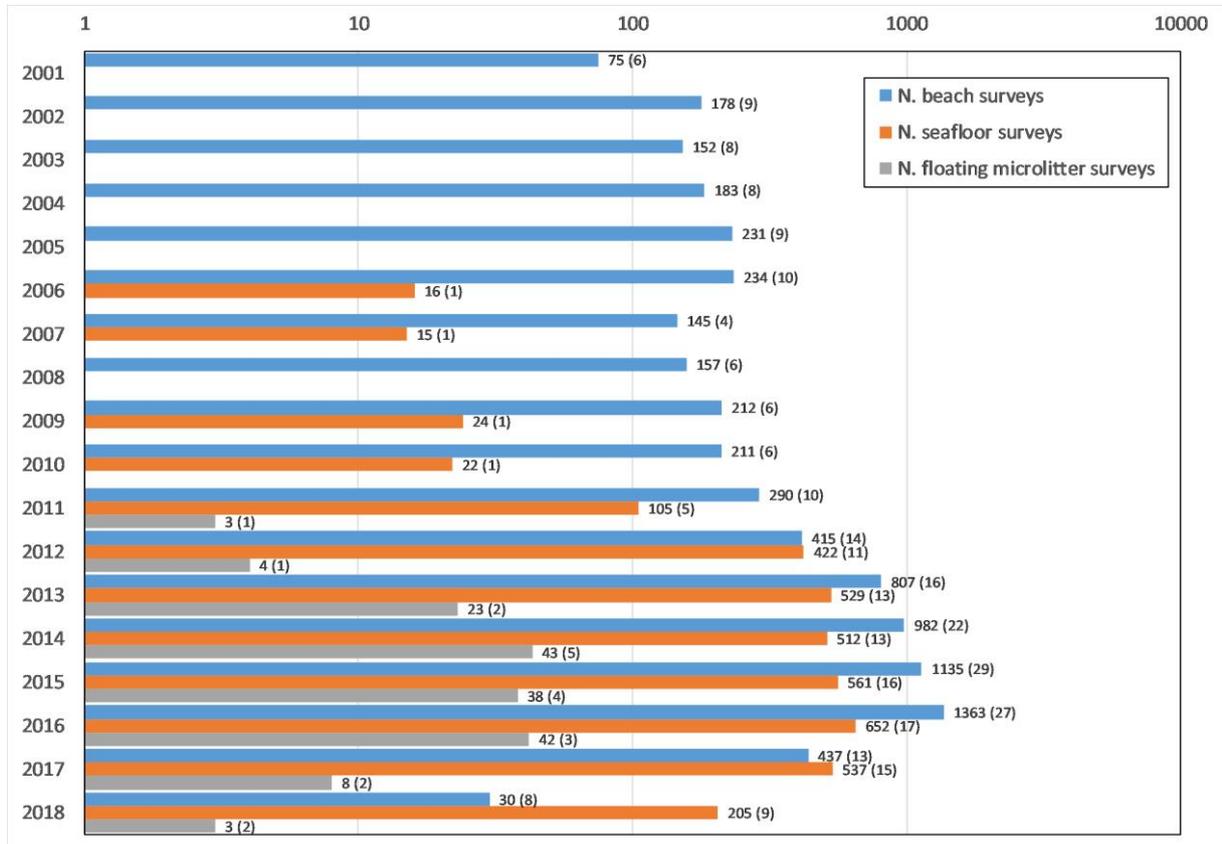


Figure: Number of beach litter, seafloor litter and floating micro-litter surveys by year. The number of countries providing data is indicated in brackets. Note the logarithmic scale.

During Phase III, EMODnet Chemistry reached a number of important milestones, marking a significant change for EMODnet Chemistry visibility and consideration:

- EEA decided to follow-up on the use of EMODnet Chemistry data for three EEA indicators (i.e. 'Hazardous substances in marine organisms', 'Nutrients in TCM waters' and 'Chlorophyll in TCM waters'). EIONET National Focal Points were encouraged to contact EMODnet Chemistry partner(s) to make available their MSFD monitoring data. This opportunity demonstrated the robustness of EMODnet to support the long-term availability of data and the completeness of EMODnet to provide qualified and updated information by complementing OSPAR and HELCOM data available at ICES and proving to be an alternative data resource for the Mediterranean Sea and Black Sea;
- MSFD TG-ML endorsed EMODnet Chemistry marine litter database, for gathering beach litter data on a European scale. As a result, EMODnet gathered all Member States monitoring data from 2012 to 2016, provided an integrated and harmonised data layer for baselines computation and is ready to gather the updating from 2017 onwards. In addition, sea floor litter database is made available for further use;

- EMODnet Chemistry started a close cooperation with Copernicus for contributing oxygen, chlorophyll-a, and nutrients aggregated, validated and harmonized data to Copernicus Marine Environment Monitoring Service (CMEMS) INSTAC. As part of this synergy and established Memorandum of Understanding, CMEMS INSTAC will encourage additional data providers to include their datasets in EMODnet Chemistry.

1 Introduction

This report details the results obtained within the EMODnet Chemistry Phase III contract, which ran for two years from 6 March 2017 to 5 March 2019. In addition, a two months extension was requested to allow the submission of the final report with the inclusion of the latest contaminants and marine litter maps. These were released after communication with its MSFD Board of Experts, with the MSFD Technical Group on Marine Litter (MSFD TG-ML), with EEA and the Regional Sea Conventions (RSCs). EMODnet Chemistry Phase III is a follow-up of the earlier developments in Phase I and Phase II, customised following the requirements gathered from its stakeholders, prioritised following the mandate to contribute to MSFD implementation. The approach was focused on seeking engagement with and direct involvement of the RSCs and MSFD experts.

EMODnet Chemistry Phase III required developing and maintaining:

- a common method of access to data held in repositories;
- products constructed from one or more data sources that provide users with information about the distribution of parameters in time and space;
- procedures for machine-to-machine connections to data and data products;
- a web portal allowing users to find, visualise and download data;
- coherence with efforts of regional sea conventions;
- interoperability with data distributed by non-EU organisations;
- a process to monitor performance and deal with user feedback;
- a help desk offering support to users.

The overall objective of the EMODnet Chemistry 3 project was to provide access to marine chemistry data sets and derived data products concerning **eutrophication**, **contaminants** and **marine litter** for six major European sea regions: Norwegian (incl. Barents), Baltic, N.E. Atlantic (Celtic Seas, Iberian coast and Bay of Biscay and Macaronesia), Greater North Sea, Mediterranean Sea and Black Sea. These data products are specifically relevant for Marine Strategy Framework Directive Descriptors 5 (eutrophication), 8 (chemical pollution), 9 (contaminants in seafood) and 10 (marine litter), based on the guidance of the MSFD Common Implementation Strategy.

EMODnet Chemistry Phase III consortium brought together **45 participants** from **27 countries** (20 EU member states) along European seas, mostly national marine monitoring agencies and major marine research institutes. The partners combine long-standing expertise and experiences of collecting, processing, quality controlling and managing of marine chemistry data and data products together with expertise in distributed data infrastructure development and operation. In addition, the consortium includes **3 international organisations**, ICES – International Council for the Exploration of the Sea, BSCS - Black Sea Commission Secretariat, and UNEP/MAP - United Nation Environment Programme / Coordinating Unit for the Mediterranean Action Plan, while OSPAR (Oslo Paris Commission) and HELCOM (Helsinki Commission) have provided a Letter of Support to be actively involved in the project.

The Chemistry portal and related activities build on products and services developed within the previous phases, aim for complete interoperability with services developed by the other thematic groups and with the INSPIRE Directive and are open to receive data provided through EMODnet ingestion facility.

In particular, the Chemistry lot has a request to consider the Marine Strategy Framework Directive in the identification of the measurements and of the digital map layers. For this reason, consistent efforts are

dedicated to deepening the dialogue with MSFD technical working groups, with RSCs and with Member States. In implementing this service, the following principles are respected:

- (1) Data are freely available, searchable and downloadable free of charge and free of restrictions of use respecting the ownership data policy,
- (2) Data and data products are accompanied by metadata covering ownership, assessment of accuracy and precision, indication of method used for their construction (for data products),
- (3) Open Geospatial Consortium (OGC) based standards are used to share data products of common interest, in respect of INSPIRE rules,
- (4) The base resolution of seabed products is three arc seconds.
- (5) The web portal is operating since the start date of the contract. It offers products and services developed under this contract.

Specific tasks applicable to the Chemistry lot and faced during the project:

Task 1: Implementation of a common method to access to data with the adoption of common and standard data and metadata formats, common vocabularies and common management tools. Data held by the national bodies are made available in a unified and standard way, without further processing.

Task 2: Development of products from one or more data sources that provide users with information about the distribution of parameters in time and space. These are made available free of charge and free of restrictions of use.

Task 3: Development of procedures for machine-to-machine connections to data and data products.

Task 4: Development of a new restyled and enriched web portal allowing users to find, visualise and download data and data products.

Task 5: Ensuring the involvement of regional sea conventions, with the creation of the MSFD Board of Experts.

Task 6: Facilitating interoperability with data distributed by non-EU organisations, with standards and protocols used by Australian, Canadian and United States colleagues.

Task 7: Installing a process to monitor performance and deal with user feedback, following definitions and instructions provided by the EMODnet secretariat and TRUST-IT.

Task 8: Operating a help desk offering telephone queries, e-mail contacts and an on-line chat service by means of a live operator available from 9:00 to 17:00 (Brussels time) from Monday to Friday to support EMODnet Chemistry users.

This report gives the progress of the EMODnet Chemistry Phase III contract, which run for 2 years from 6 March 2017.

2 Highlights in this reporting period

The highlights for the period March 2017 – March 2019 are listed below:

- Set-up and engagement of the **EMODnet Chemistry Board of MSFD experts**, with representatives identified by Regional Sea Conventions (RSCs), by JRC and by the marine research community. The first online workshop of the Board of MSFD experts took place in November 2017 and was focused on D5 (Eutrophication) while the second one was organized in March 2018 focused on D8 and D9 (Contaminants). This required a follow-up in March 2019 where the new results, developed following the expert's recommendations were showed. Also, the official release of marine litter maps at pan-European scale required a double step, with a discussion of the proposed representations and the release of the amended distribution maps (for trawls surveys, official beach monitoring and other sources).
- The new restyled EMODnet Chemistry **portal** was launched gathering the interest of scientific community and policy makers. Primary focus is given to data and data products discovery and access. The portal communicates more clearly the focus, the use cases and all updates in news and events.
- In 2017, EMODnet Chemistry contributed to the **Black Sea State of Environment** report of the Black Sea Commission by providing data on Nutrients and Contaminants. EMODnet Chemistry also contributed to the **Mediterranean Quality Status Report 2017 (QSR2017)** of UNEP-MAP (Barcelona Convention) for the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast. This concerned the development of the use case on EO5 (CI 13 and 14) with EMODnet Chemistry providing nutrient and chlorophyll-a data to derive products.
- In February 2018, EMODnet Chemistry contributed to MSFD TG DATA with a use case for D5C1 "Nutrients concentrations in water" showing that EMODnet metadata and data formats (SeaDataNet standards) can be **mapped to INSPIRE** following the INSPIRE data implementation rules. This can provide a tool for Member States to publishing their data and information underpinning their assessment reporting according to MSFD Art. 19(3).
- In early 2018, EMODnet Chemistry contributed to the **Proposal for a Directive** of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment, with an analysis of plastics distribution coming from fishing gear and single use plastics. The study uses the ICES DATRAS available data aggregated per MSFD regions and years.
- In fall 2018, EMODnet Chemistry released the first **European beach litter database**, modelled after the OSPAR-MCS approach, in close cooperation with JRC and TG ML, and taking into account UNEP/MAP requirements, and including data collected from all Member States from 2012 to 2016. The database was published in Addamo et al., Marine litter database: Lessons learned in compiling the first pan-European beach litter database, EUR 29469 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-97866-1, doi:10.2760/68866, JRC112895 and was used for EU Baselines and Thresholds computation.
- In 2018, EMODnet Chemistry contributed to the **EEA thematic report** on contaminants and eutrophication in Europe's seas. The aim was to collate available data (contaminants in water, sediments and biota plus bio-effects + total nitrogen, dissolved inorganic nitrogen (all types), total phosphorus, dissolved inorganic phosphate in the water column) and to identify 'problem areas' and 'non-problem areas' with regard to contaminants and to eutrophication in transitional, coastal and marine waters. A MoU was signed between EMODnet Chemistry and EEA to formalize the cooperation.

- All data providers have contributed with their data sets and further populated the EMODnet Chemistry infrastructure, based upon SeaDataNet standards and services, with new CDI and ODV entries, focusing on data concerning eutrophication (nutrients, chlorophyll and oxygen), followed by contaminants and micro-litter. Marine Litter data were also mobilised following the already existing standards and made available on the CDI Data Access service.
- The Proposal for gathering and managing data sets on marine micro-litter (= micro plastics) on a European scale, adopting and adapting the SeaDataNet CDI and ODV formats, was produced by EMODnet Chemistry, endorsed by MSFD TG-ML and JPI-Oceans and published at the EMODnet Chemistry portal. This reference now serves a wider spectrum of data providers wishing to share micro plastics datasets. In parallel, the Guidelines and forms for gathering marine litter data on beach litter and seafloor litter were released together with a number of format templates.
- In the last two years, EMODnet Chemistry contributed to 75 events. EMODnet Chemistry results were shared with 45 oral presentations, 4 posters and appeared in 16 publications.
- EMODnet Chemistry database reached almost **1 million of datasets available** from the CDI Data Discovery and Access Service, providing a wide coverage of the European Seas extended to open ocean. The impressive distribution map is given below:

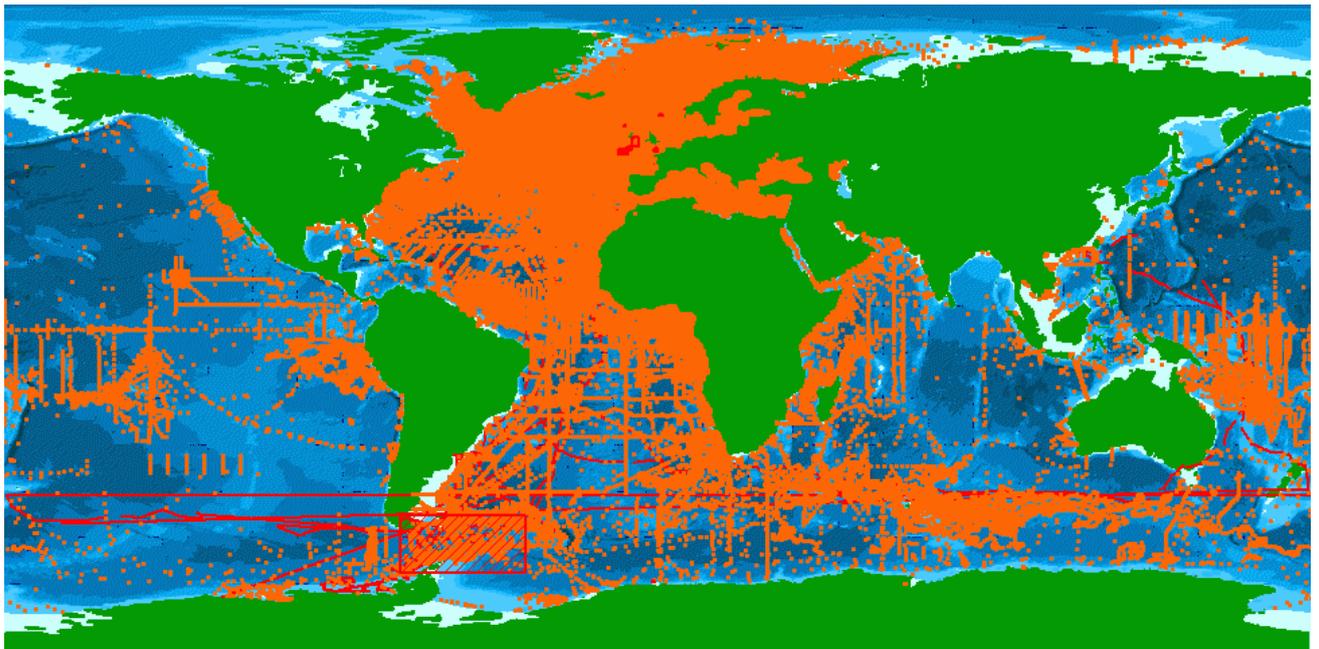


Figure: Distribution of CDI datasets, counting 999,797 entries

3 Summary of the work done

Following the project scheduling, the work done during the period March 2017 – March 2019 is described below per task specified in Section 1.4.1 of the Tender Specifications; all tasks were covered during the reporting period.

Task 1: Develop a common method of access to data held in repositories:

The distributed network of National Oceanographic Data Centers and national marine monitoring agencies use a common and standard data and metadata format, common vocabularies and common management tools, adopted and adapted from SeaDataNet. In order to collect marine litter data from relevant EMODnet Chemistry consortium members and others, IFREMER and OGS have defined Guidelines and Forms for gathering beach litter (nets, bottles etc) and seafloor litter (i.e. litter collected by fish trawl surveys). For micro plastics, the SeaDataNet CDI and ODV standards have been adopted and adapted, and finally endorsed by MSFD TG-ML. All guidelines have a DOI and are published at the EMODnet Chemistry portal. Data held by the national bodies are made available in a unified and standard way, without further processing.

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

EMODnet Chemistry range of parameters is extremely wide, spanning over 3 matrices (water, sediment, biota) for **16 groups of variables** (such as fertilisers, heavy metals, polychlorinated biphenyls, and others, including macro and micro litter in the sea, on the seafloor and on beaches) each having multiple parameters, measurement methods, laboratory methods, collection protocols, instruments used etc. The different parameters have varying time and space distributions, are managed by multiple organisations leading environmental monitoring and research activities in the different countries and undergo heterogeneous data policies. There are 6 regional coordinators preparing harmonised, aggregated and validated regional data collections and dedicated data products of specific parameters in time and depth per sea region. The first focus was on **eutrophication** (nutrients (PO₄, Total Phosphorus, NO₂+NO₃, NO₃, Total Nitrogen, NH₄ and SiO₄), oxygen, and chlorophyll), followed by **contaminants** (antifoulants, heavy metals, hydrocarbons, pesticides and biocides, pharmaceuticals, polychlorinated biphenyls, and radionuclides). Using DIVA (Data-Interpolating Variational Analysis) software, EMODnet Chemistry prepared spatially interpolated concentration maps at basin scale. In the case of contaminants, EMODnet Chemistry produced dedicated maps for priority hazardous substances along the coasts that could be a useful tool in environmental impact assessment analysis requested by many EU directives, in particular Marine Strategy Framework Directive and Water Framework Directive, and Regional Sea Conventions agreements. These are made available free of charge and free of restrictions of use.

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

EMODnet Chemistry offers a number of web services (see Chapter 10, indicator 8 to provide access to the validated, harmonised and aggregated data collections, now including marine litter next to contaminants and eutrophication. Communication with JRC and EEA for further analysis and harmonisation was necessary before to set machine-to-machine data access as an additional tool to personal contact. EMODnet Chemistry data layers are connected with the Information Platform for Chemical Monitoring, Enhancing access to chemical data (<https://ipchem.jrc.ec.europa.eu/>), D4Science and the European Atlas of the Seas.

Task 4: Develop a web portal allowing users to find, visualise and download data:

To increase visibility and interest of users, EMODnet Chemistry completely re-designed its web portal allowing users to find, visualise and download up-to-date data and products, news and events, to get

complete explanation of tools and functionalities. The restyled and upgraded portal is in operation since the end of November 2017.

Task 5: Ensure the involvement of regional sea conventions:

A specific Board of MSFD experts (including representatives of Regional Sea Conventions, of Member States and selected expertise) was created, consulted prior to the release of new products and animated with a dedicated mailing list. The Board met in three remote conferences, dedicated to Eutrophication, Contaminants, and Marine Litter, and organised to get feedback on products and services. In addition, EMODnet Chemistry was invited to BSC Regular Meetings and to ICG EUT meeting. Active interaction is ongoing with all RSCs for beach litter data management.

Task 6: Facilitate interoperability with data distributed by non-EU organisations:

The EMODnet Chemistry network of data centres includes several nodes from non-EU countries, from Eastern Europe and North Africa and it builds upon the SeaDataNet pan-European infrastructure, which has been widely implemented since the nineties. In addition, it takes advantage of the links and communication started within ODIP, the Ocean Data Interoperability Platform, developed as a European effort together with Australia, Canada, and USA. The formats as used by EMODnet Chemistry are in line and interoperable with international practices. This is assured by using the SeaDataNet standards for eutrophication and contaminants data which are proven to be interoperable with ICES and IODE standards and practices in USA, Canada, Australia and others as proven through the Ocean Data Interoperability Platform (ODIP) activities. For the Marine Litter formats close cooperation took place with TG-ML, ICES and other stakeholders, ensuring that the EMODnet Chemistry adopted formats and approaches are widely supported by ML experts.

Task 7: Install a process to monitor performance and deal with user feedback:

The usage of the different services giving access to data and products is constantly monitored through a number of indicators defined by EMODnet Secretariat and further tuned by TRUST-IT. Feedback from users are collected, analysed, answered rapidly if needed and continuously reported on three monthly basis (see Section 5). The Chemistry portal volunteered to test the installation of the central monitoring system (PIWIK), subsequently implemented operationally.

Task 8: Operate a help desk offering support to users:

Since the first months, the help-desk is available by online chat, email and telephone from 9:00 to 17:00 (Brussels time) from Monday to Friday. The online chat access icon is located at the right bottom of all pages and provides an immediate contact with a support agent. It is also possible to leave there a message while the service is offline. All contacts are recorded together with the reaction to them. The online chat is the system most widely used in the reporting period.

4 Challenges encountered during the reporting period

Overview of the main challenges encountered during the period March 2017 – March 2019 and the measures taken to address them.

Main challenge	Measures taken
Involvement of MSFD experts to the annual meetings	Interaction took place by remote meetings, focused on specific themes. The use of short questionnaire distributed to the experts prior to the online meeting facilitated feedback.
Definition of dedicated maps for contaminants, including selection of substances to focus on.	Internal calls for short but focused meetings, ad-hoc remote meeting with the Board of MSFD experts.
The development of marine litter databases and maps at European scale in one year	Synergy was established with relevant regional marine litter data systems through RSCs engagement, and formal cooperation was arranged.
Datasets release to EEA	Project timing was adjusted to match EEA needs
Data release to EEA - contaminants	Open dialogue took place with EEA (through ICES) to tune data format and metadata to be included in the data collection for Contaminants. Adjustment of ODV, Common Vocabularies and tools.
Homogenisation of beach litter data from JRC for Baselines	Additional efforts were dedicated to the task to match Baselines timing. The adoption of a common format was encouraged for future submissions.
Compute new indicators	Communication within the technical working group took place to set the proper tools and with Matomo administrator to save the needed information
Maintain a long-term perspective with the stakeholders despite the termination of the contract	Evidence of the lack of perspective was presented as an issue to Secretariat and DG MARE. The link with on-going data infrastructures (SeaDataCloud and EOSC) is kept. Participation in the new call for tenders issued by EASME for continuation.

5 Allocation of project resources

In this section, information about the efforts spent during the project period on the achieving the main objectives and tasks of the project is provided, as an overview of resource usage (percentage of project resources) divided into the following categories:

Categories	Resource usage (%)
Making data and metadata interoperable and available (Tasks 1 and 6)	30.41
Preparing data products (Task 2)	26.45
Preparing web-pages, viewing or search facilities (Tasks 3 and 4)	11.63
Managing user feedback (Tasks 7 and 8)	2.89
Project management (Task 9)	7.85
Outreach and communication activities (Task 5)	6.05
Others	14.72

6 Work package updates

This section lists the activities that occurred during the period March 2017 – March 2019, using the work package as a header.

WP1 – Project Management

As soon as the outcomes of the procurement procedure were received, the coordination activity started, with the following steps:

- i) Collection of administrative documents requested by EASME, writing and signing of the Consortium Agreement between the 27 partners and of bilateral Subcontract with 15 over the 18 subcontractors. UNEP/MEDPOL asked to set the collaboration through INFO/RAC and was reimbursed after participation to the Coordination group meetings while the Crimean MHI and IMBR decided to withdraw from the project. The Steering Committee decided to allocate the budget to Deltares.
- ii) Organisation of two Technical Working Group meetings (Venice, 4-5 April 2017 and Delft, 4-5 December 2017), of three Coordination Group meetings (17-18 May 2017, 6-7 February 2018 and 29-30 January 2019), of five Steering Committee meetings (16 May 2017, 25-26 September 2017, 8 February 2018, 4-5 September 2018 and 31 January 2019), of one Training workshop (19 May 2017).
- iii) Participation to EMODnet Steering Committee meetings, to the Technical Working Groups meetings, to the Communication meetings and to bilateral ad hoc meetings organised by the Secretariat upon need.
- iv) Participation to MSFD Technical Group on DATA (TG DATA), on Marine Litter (TG ML), on Contaminants (D8 and D9) and to the UNEP Meeting of the Ecosystem Approach Correspondence Group (CorMon) on Pollution Monitoring and on Marine Litter Monitoring.
- v) Presentation of the project results to 75 events (meeting or workshop) listed in Chapter 8 and 9.

Agendas, presentations and minutes of the above-mentioned meetings are made available on the Chemistry portal.

Regular meeting with the six Regional Leaders started with the release of the first Robot harvest and continued with monthly basis at least. These events are crucial to coordinate the development of regional datasets and data products and guarantee the adoption of shared protocols and tools.

Active collaboration with EMODnet Data Ingestion project is ensured with constant dialogue and the participation to plenary meetings (Limassol, Cyprus, April 2017; Barcelona, Spain, April 2018; Rome, Italy, April 2019) and EMODnet Steering Committee meetings (September 2017, March 2018, November 2018).

Quarterly progress reports were regularly submitted by email and approved by EU EASME. These reports includes highlights of the reporting periods, meetings held, work package updates (including updates in project management, data collection and metadata population, generation of data products, technical development and operation, uptake, outreach and interaction), list of specific challenges or difficulties encountered during the reporting period, user feedback, outreach and communication activities, updates on progress indicators. During the two years, the following indicators were periodically reported:

- Indicator 1 - Volume of data made available through the portal
- Indicator 2 - Organisations supplying each type of data based on (formal) sharing agreements and broken down into country and organisation type (e.g. government, industry, science)

- Indicator 3 - Organisations that have been approached to supply data with no result, including type of data sought and reason why it has not been supplied
- Indicator 4 - Volume of each type of data and of each data product downloaded from the portal
- Indicator 5 - Organisations that have downloaded each data type
- Indicator 6 - Using user statistics to determine the main pages utilised and to identify preferred user navigations routes
- Indicator 7 - List of what the downloaded data has been used for (divided into categories e.g. Government planning, pollution assessment and (commercial) environmental assessment, etc.)
- Indicator 8 - List of web-services made available and user organisations connected through these web-services

The Technical Coordinator took action to ensure a smooth but complete handover of EMODnet Chemistry portal and all its services to EASME at the end of the contract. This is arranged by means of a Transfer Protocol document and a digital storage medium with software sources, website, and results such as guidelines, metadata, data and data products.

During this project phase a series of Memorandum of Understanding (MoU) were finalised or are under finalisation, covering different subjects:

- The MoU between EMODnet Chemistry and EEA, identifying terms and conditions for sharing data and results (as regional aggregated data products) to be used as part of EEA's state of the Seas reports, was signed and is available on line (under the section Documents).
- The MoU with INFO-RAC to formalise the synergy between EMODnet Chemistry and INFO-RAC information platforms in the Mediterranean region by adopting and adapting EMODnet Chemistry standards and tools (for data related to D5, D8, D9 and D10) and by encouraging data sharing from additional data centres.
- The MoUs with OSPAR and ICES for marine litter data exchange.
- The MoU with CMEMS, the Copernicus Marine Environment Monitoring Service (led by Mercator-Océan) defining the collaboration, including the joint development and deployment of delayed mode services to access datasets from both EMODNet Chemistry and CMEMS INSTAC, the In Situ Thematic Assembling Centre in charge of the in-situ data delivery for other components (MFCs Marine Forecasting centres) of CMEMS.

WP2 – Data collection and metadata population

At the project kick-off meeting in March 2017, and midway at the first annual plenary meeting in February 2018, the aims, work plan and deadlines for WP2 were explained and reminded to all consortium members. The focus of WP2 has been on a continued gathering of data concerning **eutrophication (nutrients, chlorophyll and oxygen)** and selected **contaminants**, following the results of the previous EMODnet Chemistry Phase II. The scope has been expanded with **riverine input of nutrients** and moreover, gathering and populating of **marine litter** data has been added to the activities. In addition, data providers have been tasked with reviewing the data already included in the infrastructure, in particular to enrich the CDI metadata with additional information on monitoring/research purpose (with EDMERP references) and on Quality Assurance and Quality Control (QA/QC) procedures. Following the instructions and procedures, data providers have been active with gathering and populating new and reviewing and updating existing CDI and ODV entries. The initial focus has been on data concerning eutrophication (**nutrients, chlorophyll and oxygen**) because of meeting the 1st deadline of **October 2017** for the eutrophication data harvesting. Thereafter focus has been on **contaminants data** for meeting the 2nd deadline of **May 2018** for the contaminants data harvesting. Furthermore, an inventory on available riverine data on nutrient inputs has been prepared and made available at the portal (<https://www.emodnet-chemistry.eu/products/riverdatainventory>).

A lot of support has been given by MARIS for guiding the CDI catalogue population process, including regular updates and encouragements to data providers about the status of progress compared to expectations. In order to approach problems faced during the previous phases of EMODnet Chemistry in managing **contaminants** data collected in sediment and biota matrixes, updated guidelines for dataset preparation and formatting have been defined by core partners, based on the well consolidated experience of the partnership and on the outcomes of other similar EU projects. These guidelines have been circulated to the whole EMODnet Chemistry partnership and also have been explained during the plenary meetings. Overall, WP2 activities have resulted in a major increase of the total number of chemistry CDIs in the 1st year from **841356 to 942038** records and in the 2nd year from **942038 to 999797** records. More details can be found in the key indicators in Chapter 10. Both rounds of data harvesting (October 2017 and October 2018) have been successful and a few weeks later collections of 'raw' data sets for eutrophication respectively contaminants have been provided to the regional coordinators as input for their activities in WP3. The eutrophication harvest included nutrients, chlorophyll-a, oxygen, others ('ALKY', 'CORG', 'DOCC', 'PCO2', 'TCO2', 'COCC', 'HMSB'). Use has been made of the new MSFD regions, as received from EEA, to split the data harvest over the agreed sea regions. The coverage of the Arctic waters is derived from the ICES Ecoregions map. For eutrophication in total circa **608.000** CDIs and ODV files were delivered as **unrestricted** data and circa **92.000** as **restricted** data, provided by **58** data centres from **31** countries. For contaminants in total circa **57.000** CDIs and ODV files were delivered as **unrestricted** data and circa **33.000** as **restricted** data, provided by **41** data centres from **28** countries.

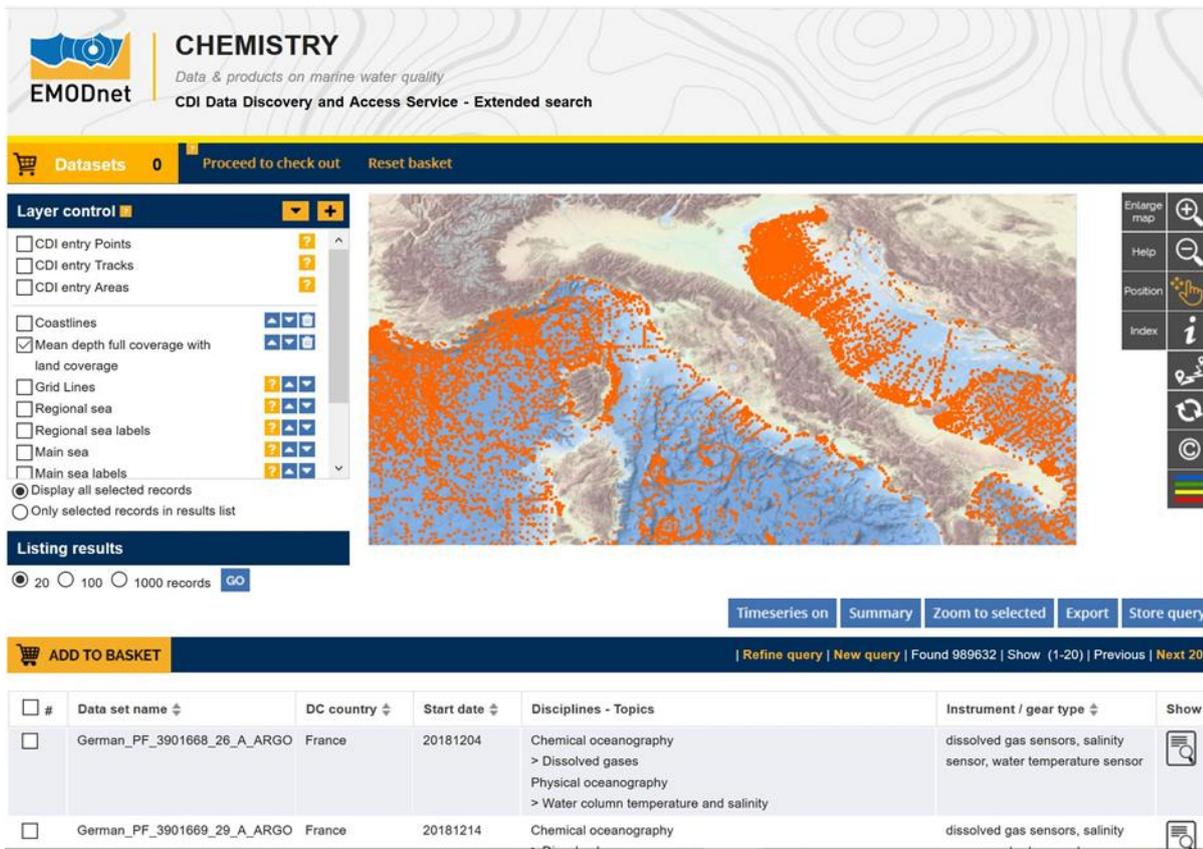


Figure: Example of the EMODnet Chemistry CDI Data Discovery and Access service

Marine litter is a new topic in EMODnet Chemistry and has a focus on:

- Beach litter (nets, bottles etc.)
- Seafloor litter (i.e. litter collected by fish trawl surveys)
- Floating micro plastics

The data management principle was to adopt consolidated data formats when already available and adapt them if needed. In the other case, new formats were considered. As part of WP4, two central EMODnet databases were specified and set-up by OGS. One database was created for the management of **beach litter**, modelled following the OSPAR-MCS approach and taking into account TG-ML and UNEP/MAP requirements. Another database was created for **seafloor litter**, modelled following the ICES-DATRAS approach and taking into account TG-ML and MEDITS requirements. The database for beach litter was populated by harvesting from the OSPAR – MCS database, together with MS data contributions for years from 2012 to 2016, as part of an intense cooperation with JRC and their EU project on Marine Litter baselines, and additional datasets from the partnership. This provided an excellent basis for the first European wide beach litter map. As a follow-up, additional loading of new MS data covering the years 2016 onwards is expected. Furthermore, the ingestion of the data coming from the Marine Litter Watch is ongoing and an open dialogue with key persons to face the possible issues is established.

The database for seafloor litter has been populated by harvesting from the ICES-DATRAS (the Database of Trawl Surveys), which includes also Baltic International Trawl Surveys (BITS) data, used for national fish trawl litter. Further communication is ongoing with the Mediterranean community, in particular MEDITS

(DCF related surveys) and DeFishGear (EU project), for arranging their input for the EMODnet seafloor database, also on a regular interval. EMODnet Chemistry is supported by TG-ML and JRC in this.

In order to arrange contributions for both EMODnet ML databases from relevant EMODnet Chemistry consortium members and others, IFREMER and OGS have defined Guidelines and Forms for gathering beach litter (nets, bottles etc) and seafloor litter (i.e. litter collected by fish trawl surveys). These guidelines are published at the EMODnet Chemistry portal and have been submitted in the **Ocean Best Practices** web site.

For micro plastics, the data management situation was less consolidated and more fragmented so it was decided to adopt and adapt the SeaDataNet CDI and ODV standards. A guideline for this was drafted by OGS and reviewed by TG-ML, JRC, and the JPI-Oceans BASEMAN project. This has resulted in a finalised guideline for describing marine **micro-litter** data sets using CDI and ODV files which has been published at the EMODnet Chemistry portal as well as in the Ocean Best Practices web site. Following this, EMODnet Consortium data providers are now underway with gathering and populating their first entries for micro plastics which requires careful guidance of the first submissions in order to ensure a consistent approach.

As part of the ML approach also new vocabularies for ML have been defined and these have been added by BODC to the overall SeaDataNet vocabularies.

A **cooperative working relationship with JRC** has been established in order to harmonise and compile beach litter datasets collected in the context of the litter baselines work (19 different data formats, 5 different lists of litter codes). The proposal to provide all available data for future accessibility through EMODnet was sent to MS through TG ML and all MS agreed to include their information.

Regular call meetings have been undertaken between OGS and JRC since the collaboration was set up (26-01-2018), including a face to face technical meeting held to plan the relevant steps for the setting up of the first pan-European database of Beach Marine Litter.

WP2 contributes to the following tasks:

- Task 1: Implementation of a common method to access to data with the adoption of common and standard data and metadata formats, common vocabularies and common management tools. Data held by the national bodies are made available in a unified and standard way, without further processing.
- Task 6: Facilitating interoperability with data distributed by non-EU organisations, with standards and protocols used by Australian, Canadian and United States colleagues.

Both tasks have been completed as described in the WP2 report above.

WP3 – Generation of data products

On the basis of the collected data (WP2) a regional data Quality Control has been performed according to common procedures defined within EMODnet, and several groups of data products have been implemented during EMODnet Chemistry Phase 3. All products are available in EMODnet Chemistry Products Catalogue: <https://www.emodnet-chemistry.eu/products/catalogue#/search?from=1&to=20>.

Groups of data products:

Harmonised and validated Eutrophication and Ocean Acidification aggregated datasets (version 2018) available for 6 marine basins:

Sea Basin	Time frame	Doi link to landing page
Arctic Region	1925/2017	https://doi.org/10.6092/ea84d664-07d1-4f1c-b5d2-0ac7a7fad1e0
Baltic Sea	1902/2017	https://doi.org/10.6092/595D233C-3F8C-4497-8BD2-52725CEFF96B
North Sea	1902/2017	https://doi.org/10.6092/fc711389-b876-4f23-a6f7-397f99528ae7
North East Atlantic	1921/2017	https://doi.org/10.6092/459d8254-6c7b-4a0e-9fdb-04effe5f5a77
Mediterranean Sea	1911/2017	https://doi.org/10.6092/89576629-66d0-4b76-8382-5ee6c7820c7f
Black Sea	1935/2016	https://doi.org/10.6092/80466a9d-1b90-4ca8-a95f-ac78723ce10a

Regional datasets concerning eutrophication and ocean acidification have been automatically harvested as outlined above. The resulting collections have been aggregated and quality controlled by the six Regional Leaders, using ODV Software and following a common methodology, agreed between all Sea Regions (<https://doi.org/10.6092/9f75ad8a-ca32-4a72-bf69-167119b2cc12>). Parameter names are standardized based on P35, the EMODnet Chemistry aggregated parameter names vocabulary, which is available at: https://www.bodc.ac.uk/resources/vocabularies/vocabulary_search/P35/. ITS-90 water temperature and Water body salinity variables have been also included (as-is) to complete the Eutrophication and Ocean Acidification data.

Detailed documentation data collections of eutrophication explaining all standardization, harmonization and validation steps applied is available at: <https://doi.org/10.6092/ec8207ef-ed81-4ee5-bf48-e26ff16bf02e>.

These aggregated datasets are also fully described in the Sextant catalogue and are public domain, freely available for all users, following the specified citation format. Free user registration is required.

Interpolated maps on parameters related to eutrophication produced with Geostatistical data analysis by DIVA (Data-Interpolating Variational Analysis) tool, available for 6 marine basins (see above). Maps are available at seasonal basis, as moving 6-year analysis for concentrations of:

- Chlorophyll-a

- Dissolved inorganic nitrogen (DIN)
- Dissolved oxygen
- Phosphate
- Silicate

Maps are made available for standard depths (according to IODE and, for the Baltic, HELCOM standard depths). Files contain analysed fields, error fields and combined field with the deepest value for each grid point selected. Also, pre-masked fields using relative error threshold 0.3 and 0.5 are available.

The entire set of related maps can be found in the viewing service: <http://ec.oceanbrowser.net/emodnet/>.

All documentation is available on: http://www.emodnet-chemistry.eu/repository/EMODnet_Chemistry_DIVA_Maps_Description.pdf and in EMODnet Chemistry Products Catalogue: <http://www.emodnet-chemistry.eu/products/catalogue#/search?from=1&to=20>.

Harmonised and validated Contaminants aggregated datasets (version 2018) available for 6 marine basins:

Sea Basin	Time frame	Doi link to landing page
Arctic Region	1974/2015	https://doi.org/10.6092/scta-bh67
Baltic Sea	1972/2017	https://doi.org/10.6092/Q0ER-SS61
North Sea	1970/2017	https://doi.org/10.6092/36hb-6g72
North East Atlantic	1970/2017	https://doi.org/10.6092/kwbp-rk03
Mediterranean Sea	1974/2017	https://doi.org/10.6092/k3yj-6a02
Black Sea	1974/2016	https://doi.org/10.6092/jaxt-5g53

The regional aggregated datasets contain all unrestricted EMODnet Chemistry data on contaminants, available in seawater, biota and sediment. Data are available for most sea areas as profiles and time series. Regional datasets concerning contaminants are automatically harvested. Parameter names in these datasets are based on P01, BODC Parameter Usage Vocabulary, which is available at: http://seadatanet.maris2.nl/bandit/browse_step.php. Each measurement value has a quality flag indicator. The resulting data collections for each Sea Basin are harmonised, and the collections are quality controlled by EMODnet Chemistry Regional Leaders using ODV Software and following a common methodology for all Sea Regions." Aggregated datasets are public domain and freely available for all users, following the specified citation format. Free user registration is required.

Validation is described in http://www.emodnet-chemistry.eu/repository/EMODnet_Chemistry_aggregated_data_sets_Contaminants.pdf and involves: checks on file format and metadata correctness, harmonization of unit and parameter naming, quality flagging of data and metadata, checks for clearly impossible data ranges (ex. Different orders of magnitude), for inconsistent measurement units.

Generating dedicated maps on contaminants

EMODnet Chemistry Phase III has been in charge of producing dedicated maps for contaminants along the coasts that could be a useful tool in environmental impact assessment analysis requested by many EU directives, in particular Marine Strategy Framework Directive and Water Framework Directive, and Regional Sea Conventions agreements.

As there is a large heterogeneity of data from monitoring on contaminants, it is very important to find, as a very first step, a set of basic parameters, units and matrix that are common for all basins, with the objective of developing products that are comparable at European scale. In order to achieve such objective a first list of specific contaminants, measurement units and associated matrix has been proposed and discussed in kick-off, annual and technical meetings held during this first year of activity. Such list has also served as a guide to assign priority for the data collection activity and has taken into account specific requests of harmonized and validated data sets from European Environmental Agency.

A detailed analysis of the requirements included in MSFD Guidance Document 14 on the update of environmental assessment (art. 8), Good Environmental Status definition (art. 9) and Environmental Target determination (art. 10) and of the New Commission Decision 2017/848 of 17th May 2017, regarding Descriptor 8 and 9 has been carried on. Furthermore, linkages with Water Framework Directive assessment and monitoring programme including, in particular, provisions from Environmental Quality Standard Directive 2013/39/UE (EQSD) (amends 2008/105/EC) on threshold values and performance criteria on Limit of Quantification for priority hazardous substances in water and biota has also been taken into account. Such analysis has also been shared and discussed during dedicated on-line meeting with EMODnet Chemistry MSFD board of experts.

The following table summarize the proposed list of contaminants:

Matrix	Contaminants
Water	Pesticides and biocides: DDT, Hexachlorobenzene Antifoulants: TBT, TPT Heavy metals: mercury, cadmium, lead Hydrocarbons (PAH): Anthracene, Fluoroanthene, Benzo(a)pyrene
Sediments	Pesticides and biocides: DDT Antifoulants: TBT Heavy metals: mercury, cadmium, lead Hydrocarbons (PAH): Anthracene, Naphtalene, Hexachlorobenzene
Biota	Pesticides and biocides: total DDT Heavy metals: mercury, lead and cadmium Hydrocarbons (PAH): Fluoroanthene, Benzo(a)pyrene, Hexachlorobenzene

Selected parameters for contaminant maps

As a further step, a work process has been planned and implemented to produce and publish contaminant maps according to the following steps:

- Data collected from data providers and regionally harvested

- Harmonization, validation and transposition with vocabulary decomposition from P01 to substance, matrix, species monitored by regional leaders
- Aggregation for time period or biota species groups (molluscs, crustaceans, fish and others)
- Map production and coding in shapefile format with each point representing at least one record that match the criteria
- Publishing with Ocean Browser through WMS implementation

Measurement units have also been selected and data sets harmonized according to the units indicated for Good Environmental Status assessment in EQSD 2013/39/UE and New Commission Decision 2017/848 of 17th May 2017 as:

- Water: all data expressed as µg/l
- Sediment: all data expressed as µg/kg of dry weight
- Biota: all data expressed as µg/kg of fresh weight for biota following RSC guidelines (BUT: mussel in dry weight).

The following temporal ranges, according to MSFD report timeline based on a 6-year cycle starting from 2012, have been considered:

- Before 2012
- From 2012 to today
- For 6-year windows

A crucial issue for water quality monitoring data is represented by the “fitness for use for environmental quality assessment” in terms of data below and above Limit of Quantification (LOQ): data with LOQ above 30 percent of EQSD threshold values should be considered as not compliant for assessment purposes. Species groups selection for contaminants in biota has also been highlighted as an important theme to compare environmental assessment at European level as different species groups presents different bioaccumulation and biomagnification process.

Contaminant types of maps discussed and produced are the following ones:

- a) Maps showing values: above or below LOQ. Example:
 - Green points: below LOQ
 - Orange points: above LOQ
- b) Maps showing data with LOQ above or below EQSD threshold values:
 - Green points: LOQ below 30% of EQSD threshold values
 - Red points: LOQ above 30% of EQSD threshold values
- c) Maps showing matrix monitored:
 - a) Blue points: water
 - b) Brown points: sediments
 - c) Green points: biota

- d) Maps showing species group monitored (at least for Fluoranthene, HCB, Mercury and Benzo(a)pyrene) according to EQSD thresholds for biota:
- Green point: Molluscs
 - Orange point: Crustaceans
 - Blue point: Fish
 - Grey point: Others

Future developments might address a dynamic implementation of the work process to produce up-to-date maps and additional maps showing the range of concentrations subdivided in appropriate percentile classes, the availability of a normalizer (TOC or Loss on ignition for organic substances, Li, Al or clay-silt fraction for metals) for sediments and concentration values above or below EQS threshold values.

Proposals and discussions with EMODNet Chemistry MSFD board of experts online meetings are available at the following links:

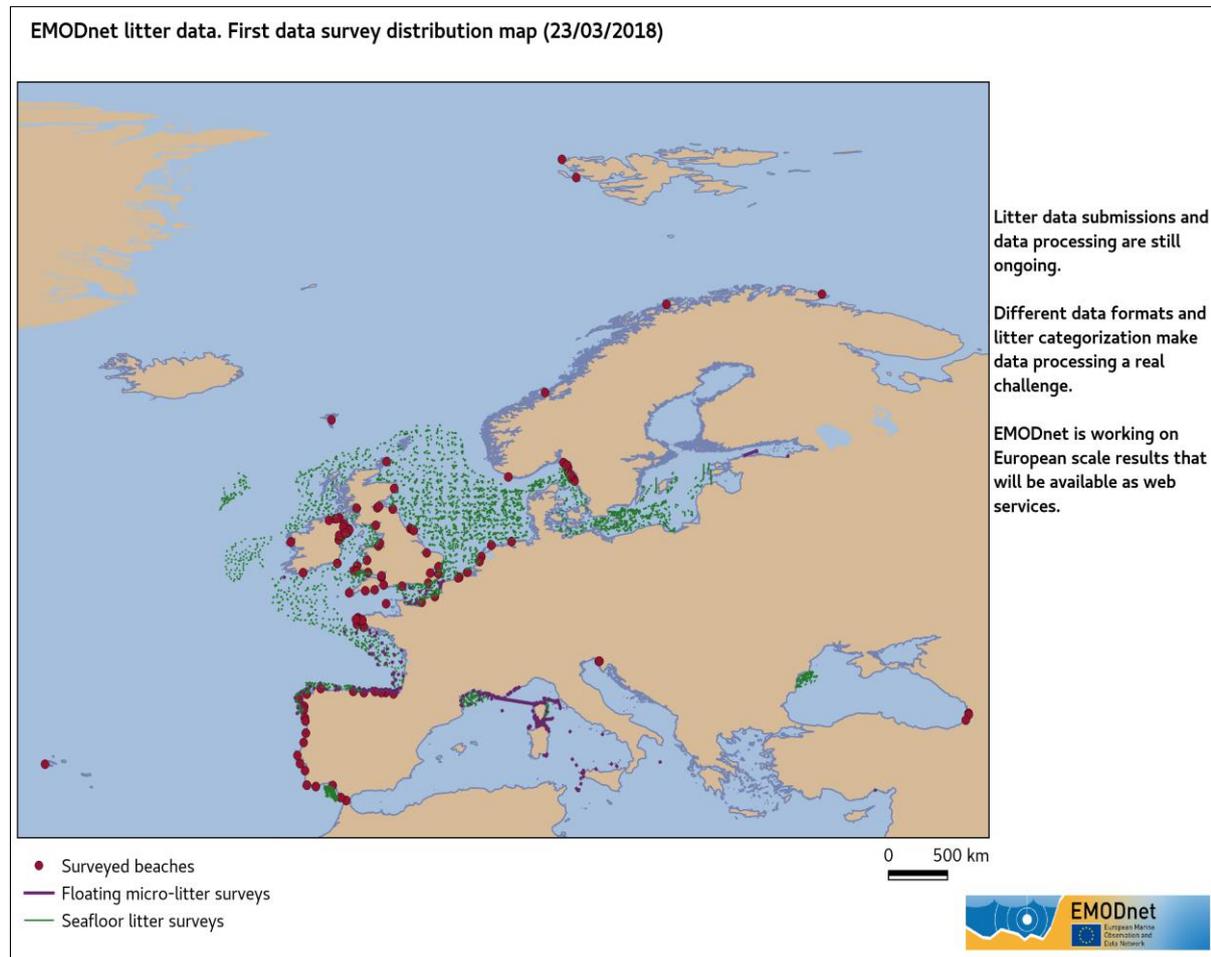
- 16th march 2018 with minutes available at the following link: http://www.emodnet-chemistry.eu/newsevents/events/MSFD_board_of_experts_for_EMODnet_Chemistry_Contaminants_online_workshop_16_March_2018_Online

Generating validated maps for marine litter and beach litter

As already presented in the summary of the work done in the reporting period, the scope of EMODnet Chemistry data management has been extended to marine litter following the requirements of the Marine Strategy Framework Directive Descriptor 10.

EMODnet Chemistry phase 3 is responsible for producing maps for beach macro litter, seafloor macro litter and floating micro-litter. The production of the first maps was due by the end of the first year of the project. Quality control and harmonization of data was performed during the ingestion process to remove duplicates and to correct inconsistencies.

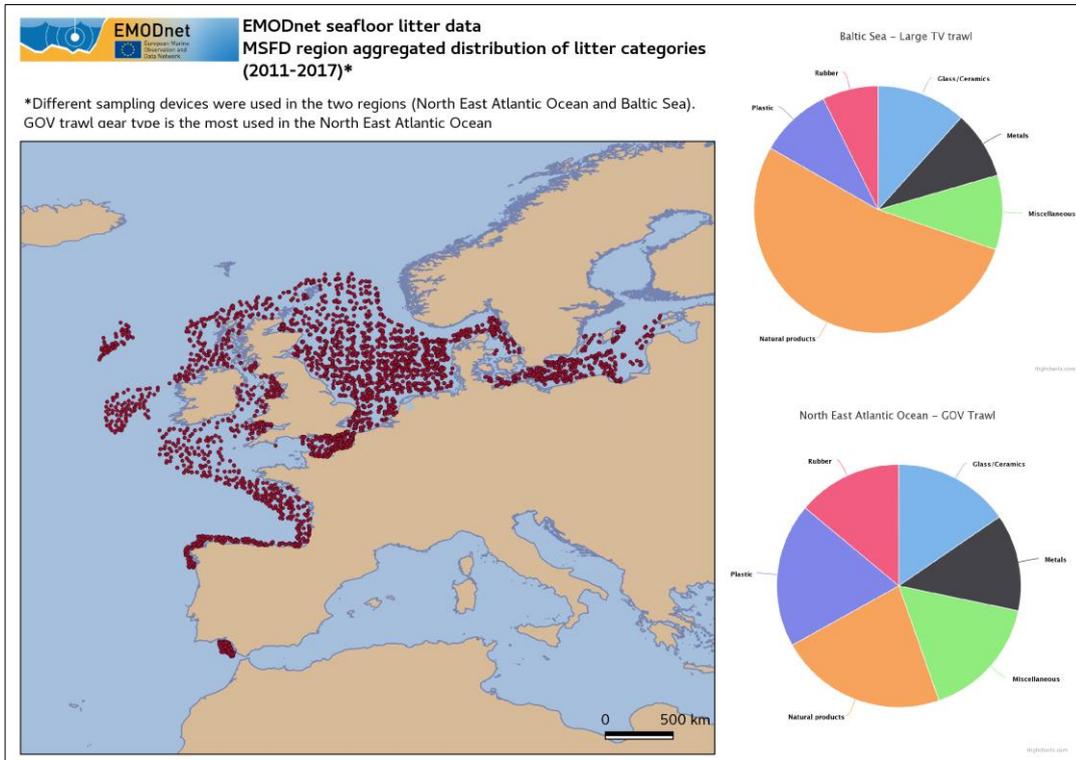
Due to the various types of data input formats, litter reference codes, sampling devices, etc. further work on harmonisation was needed to develop common products on a European scale. The following images give examples of resulting maps for marine litter.



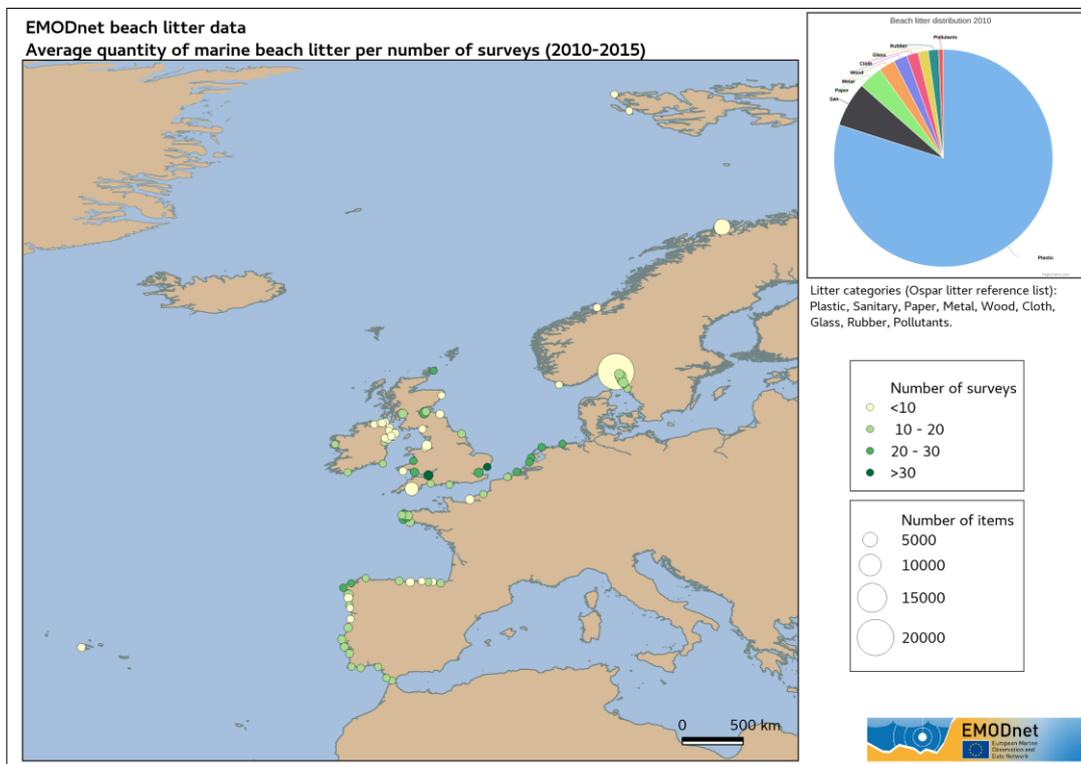
The achievement of this first, apparently simple, result has required an unexpected load of work coming from the handling of the extreme heterogeneity of the three types of marine litter (beach, sea floor and floating micro) also to the different quality of data received.

A partial preliminary version of data products based on the most homogeneous sets of data (as mentioned above, OSPAR and ICES):

Seafloor litter:



Beach litter:



As data gathering progresses and harmonisation and aggregation of data improved new standardised and uniform data products were developed by Ifremer during the second year, with an increasing spatial coverage.

Ifremer started working on Marine Litter maps generation in August 2018, when OGS provided a complete dataset of beach and seabed litter. Several products proposal were discussed during the Steering Committee in Rome in September 2018. In addition, several videoconferences were organised with OGS to tune the results (12/11/2018; 11/01/2019 ;24/01/2019 ;14/02/2019) and to follow comments received by the MSFD expert group (a dedicated on-line meeting took place on 10/12/2018). Remarks provided during those meetings were taken into account and the products undergo successive upgrading.

The technical aspects have been settled in close collaboration with the University of Liege to display online on EMODnet Chemistry viewing and downloading service the different products using a web service from MapServer to Ocean Browser. The resulting map products is given in the following:

- Beach litter (2001-2018)
 - Official monitoring
 - Beaches locations and litter list used
 - Number surveys & temporal coverage
 - Mean total number of litter items per 100m & to 1 survey
 - Composition of litter according to material categories in percent
 - Mean number of Cigarette related items per 100m & to 1 survey - without UNEP_MARLIN
 - Mean number of Fishing related items per 100m & to 1 survey
 - Mean number of Plastic bags related items per 100m & to 1 survey
 - Other sources
 - Beaches locations and litter list used
 - Number surveys & temporal coverage
 - Mean total number of litter items per 100m & to 1 survey
 - Composition of litter according to material categories in percent
 - Mean number of Cigarette related items per 100m & to 1 survey - without UNEP_MARLIN
 - Mean number of Fishing related items per 100m & to 1 survey
 - Mean number of Plastic bags related items per 100m & to 1 survey
- Seabed litter (2006-2018)
 - Trawls locations
 - Density (Nb. Items/km²)
 - Material categories percentage per year
 - Fishing related items density (Nb. Items/km²)
 - Plastic bags density (Nb. Items/km²)

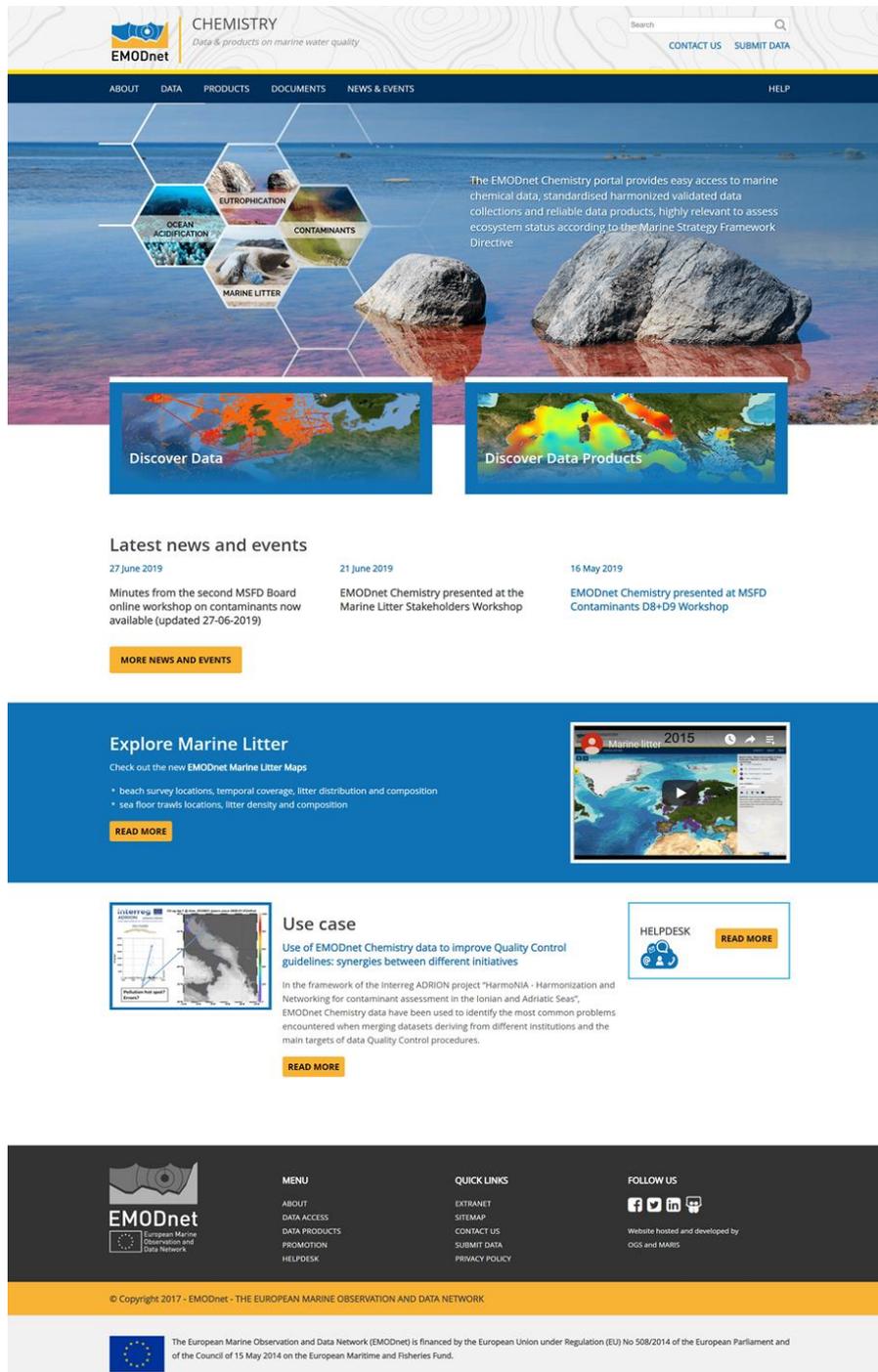
The methodology applied for the generation of the visualisation products is described in the document: « Visualization products for Beach and Seafloor Litter data » downloadable on the EMODnet Chemistry website.

WP4 – Technical development and operation

The EMODnet Chemistry portal has been completely redesigned in styling, texts, and sitemap by OGS and MARIS in order to put the services for discovery and access of marine chemistry data and data products in a central position. For users it is now directly clear that the EMODnet Chemistry portal is dealing with data themes of relevance for MSFD, namely **Eutrophication, Pollution, Ocean Acidification** and **Marine Litter**. Also, the new EMODnet styling and site instructions as provided by TRUST-IT have been adopted. The upgraded portal has been officially launched at the end of November 2017 and has been maintained since. As part of the portal upgrading also the styling and structure of the various services has been overhauled. This concern:

- **CDI Data Discovery and Access Service:** the CDI matrix of chemical groups per sea region has been redesigned by MARIS and the geographical coverage and naming of sea regions has been adapted to the MSFD regions which were provided as shape files by EEA. Moreover, the standard Chemistry CDI user interfaces for extended search and quick (facet) search have been upgraded in styling. On top of the CDI matrix interface a set of [OGC WMS-WFS services](#) was configured which facilitate sharing interactive maps with the GeoViewer at the EMODnet Central portal to illustrate the coverage of data sets for chemical substances by EMODnet Chemistry;
- **OceanBrowser Viewing Service:** this service, giving facilities for viewing, browsing and downloading Chemistry DIVA data products has been restyled by MARIS and ULiege and some functionality has been revised;
- **Sextant Products catalogue service,** giving facilities for searching and downloading Chemistry DIVA data products through the link with the OceanBrowser viewing service has been restyled by IFREMER and embedded by OGS as API in the new portal pages. The number of DIVA product entries in the catalogue has been reviewed and reduced from 160 to 45 by concatenating coverage per regions to European cover. Moreover, DOIs have been attributed to each of the products and DOI landing pages have been published with download and viewing links.
- **Advanced viewing services for time series and profiles,** allowing users to generate and view dynamic plots for selected parameters from data sets, selected from the harmonised, aggregated and validated data collections. The performance of these services and also their interaction with the OceanBrowser have been reviewed and optimised by Deltares and ULiege. Moreover, Deltares has revised the database tables and procedures for importing eutrophication respectively contaminants data collections, also to facilitate development of an API which will support controlled data exchanges with users such as Regional Sea Conventions and EEA.

The new EMODnet Chemistry portal Home page is shown in the following:



The screenshot shows the EMODnet Chemistry portal Home page. At the top, there is a navigation bar with the EMODnet logo, the word "CHEMISTRY", and the tagline "Data & products on marine water quality". Below this is a secondary navigation bar with links for ABOUT, DATA, PRODUCTS, DOCUMENTS, NEWS & EVENTS, and HELP. The main content area features a large background image of a rocky coastline with a hexagonal grid overlay. The grid contains icons for OCEAN ACIDIFICATION, EUTROPHICATION, CONTAMINANTS, and MARINE LITTER. To the right of the grid, a text box states: "The EMODnet Chemistry portal provides easy access to marine chemical data, standardised harmonized validated data collections and reliable data products, highly relevant to assess ecosystem status according to the Marine Strategy Framework Directive". Below the grid are two buttons: "Discover Data" and "Discover Data Products".

Latest news and events

- 27 June 2019: Minutes from the second MSFD Board online workshop on contaminants now available (updated 27-06-2019)
- 21 June 2019: EMODnet Chemistry presented at the Marine Litter Stakeholders Workshop
- 16 May 2019: EMODnet Chemistry presented at MSFD Contaminants D8+D9 Workshop

Explore Marine Litter

Check out the new EMODnet Marine Litter Maps

- beach survey locations, temporal coverage, litter distribution and composition
- sea floor trawls locations, litter density and composition

Use case

Use of EMODnet Chemistry data to improve Quality Control guidelines: synergies between different initiatives

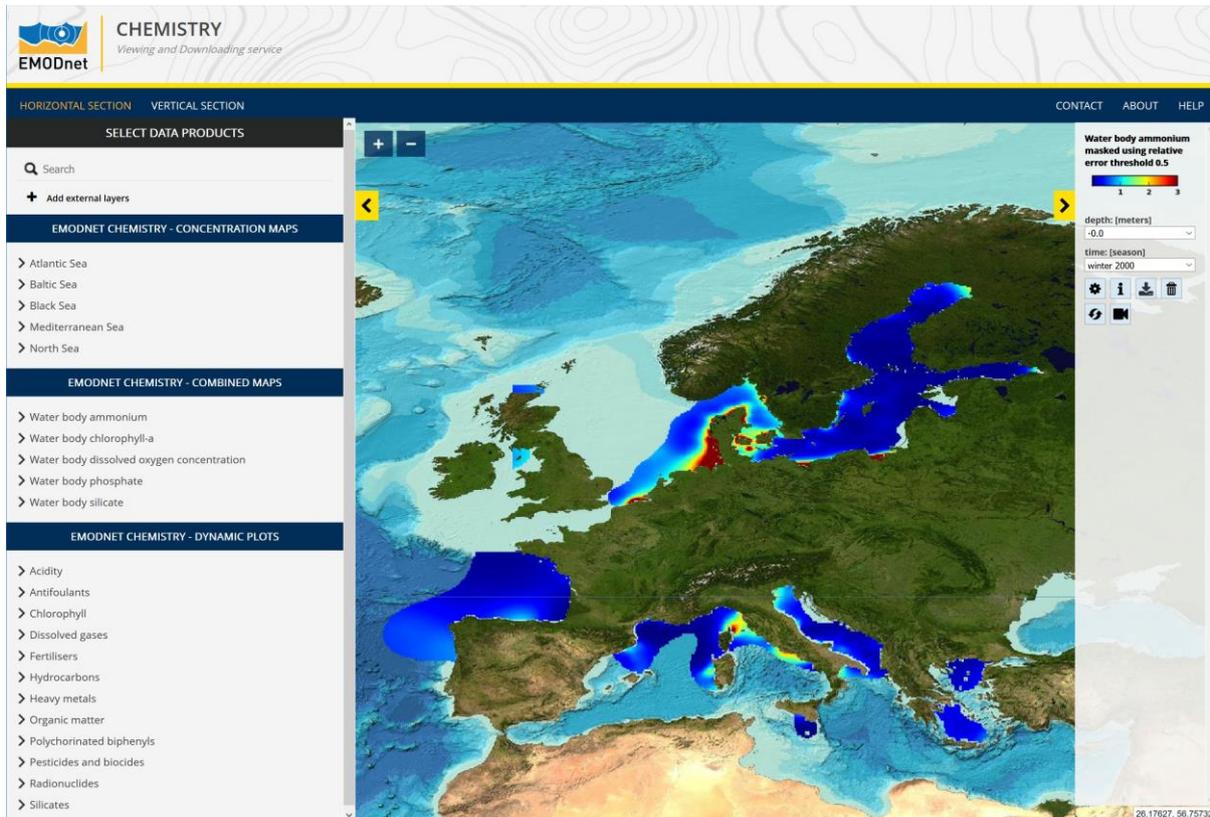
In the framework of the Interreg ADRIION project "HarmonIA - Harmonization and Networking for contaminant assessment in the Ionian and Adriatic Seas", EMODnet Chemistry data have been used to identify the most common problems encountered when merging datasets deriving from different institutions and the main targets of data Quality Control procedures.

HELPDESK

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The European Marine Observation and Data Network (EMODnet) is financed by the European Union under Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund.

All viewing services are adapted to the new styling. In addition, the presentation of Ocean Browser is completely renewed, giving the possibility for simultaneous layer selection and viewing. In the following, the example with combined maps for ammonium:



The Technical Working Group (TWG) made and implemented a plan for handling Marine Litter. Considering the situation with Marine Litter data management in Europe, it decided to develop 2 central EMODnet databases for beach litter data respectively seafloor litter data, while adopting and adapting the SeaDataNet CDI – ODV standards for micro plastics data. Also it was decided to seek intensive cooperation and tuning with existing initiatives in the European field of marine litter data management, such as TG-ML for protocols and classifications, OSPAR-MCS, ICES-DATRAS, and MEDITS, for data collection and management, and a number of relevant projects, in particular DeFishGear, JRC project on ML baselines, and JPI-Oceans Baseman project. Following the TWG plan, OGS developed first **pan European Marine Litter Database** (MLDB) and made it ready for ingesting beach litter respectively seafloor litter datasets. The beach litter database was modelled after the OSPAR-MCS approach and the seafloor litter database after ICES-DATRAS approach, while OGS also had to deal with identified differences in classifications used by different parties for making the databases also fit for data ingestions from MEDITS and DeFishGear. The close cooperation with TG-ML proved very useful. More details about the Marine Litter data collection are given in the WP2 report. In addition to the MLDB, EMODnet Chemistry holds data of **floating micro-litter** from EMODnet partners and external research projects. This is achieved in the CDI service by developing a specific version of the ODV format. Both the MLDB and the floating micro-litter data are now **discoverable and accessible** via the CDI Data Discovery and Access service.

Additional work was undertaken together with IFREMER for developing functionality for publishing European marine litter maps with statistic views. This is described in more detail with examples of European marine litter maps in the WP3 report.

Further technical work was undertaken for harmonising monitoring site statistics. Integration of PIWIK/MATOMO was proposed by TRUST-IT as a standard web statistics application and all portals were asked to include a script in their portals. This script reports web activity to the PIWIK/MATOMO account that is configured at the EMODnet Central Portal. MARIS undertook a successful test to see how the stats

from a portal with distributed services, each provided with the PIWIK script, could be combined together in an overall statistics, whereby visitors are normalised between the portal and services. Also, work was undertaken for registering users that are downloading data products in order to provide more information about uses.

Furthermore, considerable progress was made with developing a prototype Virtual Research Environment (VRE) which is done in synergy with the EU HORIZON SeaDataCloud (SDC) project. Recently an SDC prototype VRE was demonstrated and tried out by 25 persons in parallel. This system consists of a number of analytical components that are deployed on a cloud platform by means of docker containers. Interfacing is arranged by menus or in some cases by i-notebooks. The SeaDataCloud VRE focuses on a work flow for Temperature and Salinity and it includes cloud-based versions for the ODV software (WebODV) and the DIVA software (DIVA Online) which are both also used in the EMODnet Chemistry workflow for the QA-QC process and the product generation process. The VRE itself is a cloud-based analytical framework which will empower researchers with a packaged collection of services and tools, tailored to their specific needs, supporting research and enabling generation of added-value products from marine and ocean data, and interfacing to the large multidisciplinary data resources as can be found in SeaDataNet and EMODnet.

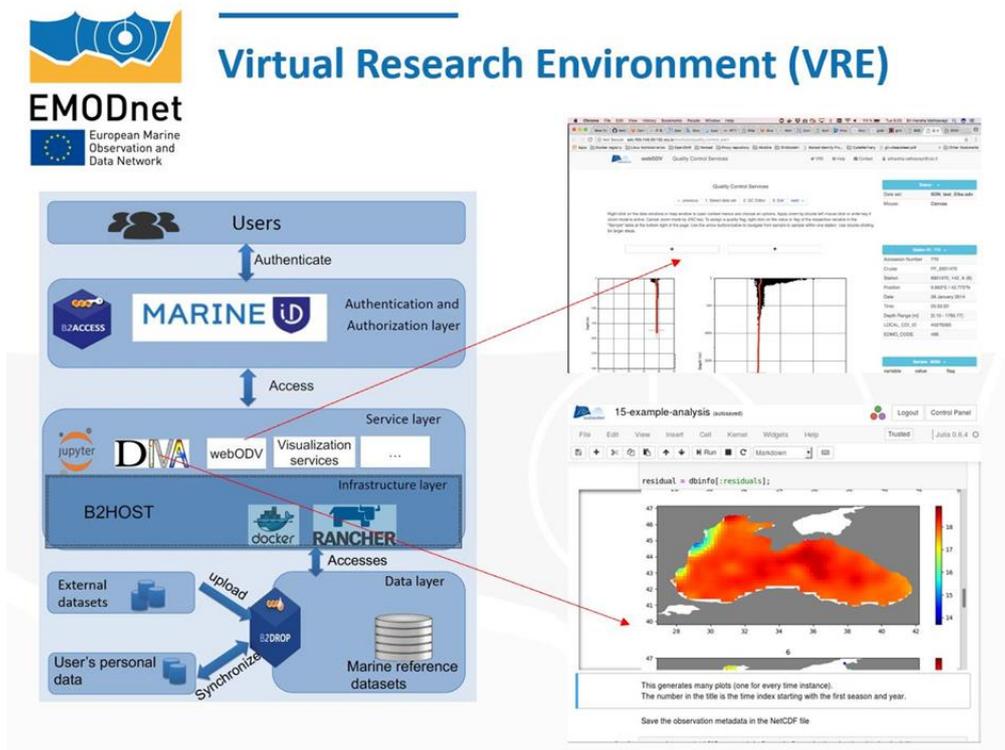


Figure: Illustration of the prototype Virtual Research Environment (VRE) with ODV and DIVA software

Considering the common tools and common database it is planned in a next phase to work out the VRE Work Flow for EMODnet Chemistry. The VRE solution should make it more efficient for regional coordinators to retrieve the 'raw' data sets from the buffers and to undertake the processing steps with the Ocean Data View (ODV) software for extraction, harmonisation, aggregation and QA-QC activities, followed by the processing and generation of interpolated maps using the Data-Interpolating Variational Analysis (DIVA) software. It should also be possible for regional coordinators to interact with neighbouring regions as DIVA requires specific extra margins at the edges for good results in the target areas. The

process also should interact with the Sextant catalogue services, as now is also the case with DIVA, to generate metadata descriptions for the new map products and data collections. Once satisfied, the regional coordinators should be able to publish the finalised versions of their data products through the OceanBrowser and advanced viewing services. This work is planned for the coming years as part of the consecutive contract for EMODnet Chemistry.

The technical developments were coordinated by the Technical Working Group (TWG), chaired by the Technical Coordinator. Several members of the TWG also participated in the central EMODnet Technical Working Group.

WP2 contributes to the following tasks:

- Task 3: Development of procedures for machine-to-machine connections to data and data products.
- Task 4: Development of a new restyled and enriched web portal allowing users to find, visualise and download data and data products.

Both tasks have been completed as described in the WP4 report above.

WP5 – Uptake, outreach and interaction

Help Desk

EMODnet Chemistry Help Desk offers a quick communication with both users and partners via three channels: online chat, email and phone. A web page describing these channels is easily accessible, but even without reading it, web site visitors cannot ignore the online chat access icon, which is located at the right bottom of all pages. They can click on it for having an immediate contact with a support agent, or also leave there a message while the service is offline. We've embedded a JavaScript code which provides this functionality. Support agents communicate with users via a web application or even a smartphone app. The agents are well informed of all updated EMODnet Chemistry activity and the underlying infrastructure. Usually there is no need to contact SeaDataNet or other collaborating partners. The system allows also whispering: direct chat between agents which could help providing a better response. In case of a missed chat, an email is sent to all group, so an email contact could be made as soon as possible. The chat is logged and being reported in the help desk online sheet. An extensive research has been done in order to find the best chat solution, which is actually free: <https://www.tawk.to/>. Also support calls via email and phone are registered in the same online sheet. Help via email is using anti-spammers verification. For the phone assistance we have a dedicated phone number: +390402140491. A voice introduction has been created by a text-to-speech script so the accent is very clear. The introduction content is: "Welcome to the EMODnet Chemistry Helpdesk. After the beep, please provide the reason for calling, your name and phone number. We will contact you as soon as possible. All data will be handled respecting the General Data Protection Regulation, and eventually transmitted to the European Commission.". Calling users listen to this introduction, and can record a voice message, which is being attached to an email message. The recording is immediately removed from the system.

Interaction and regular dialogue with MSFD stakeholders

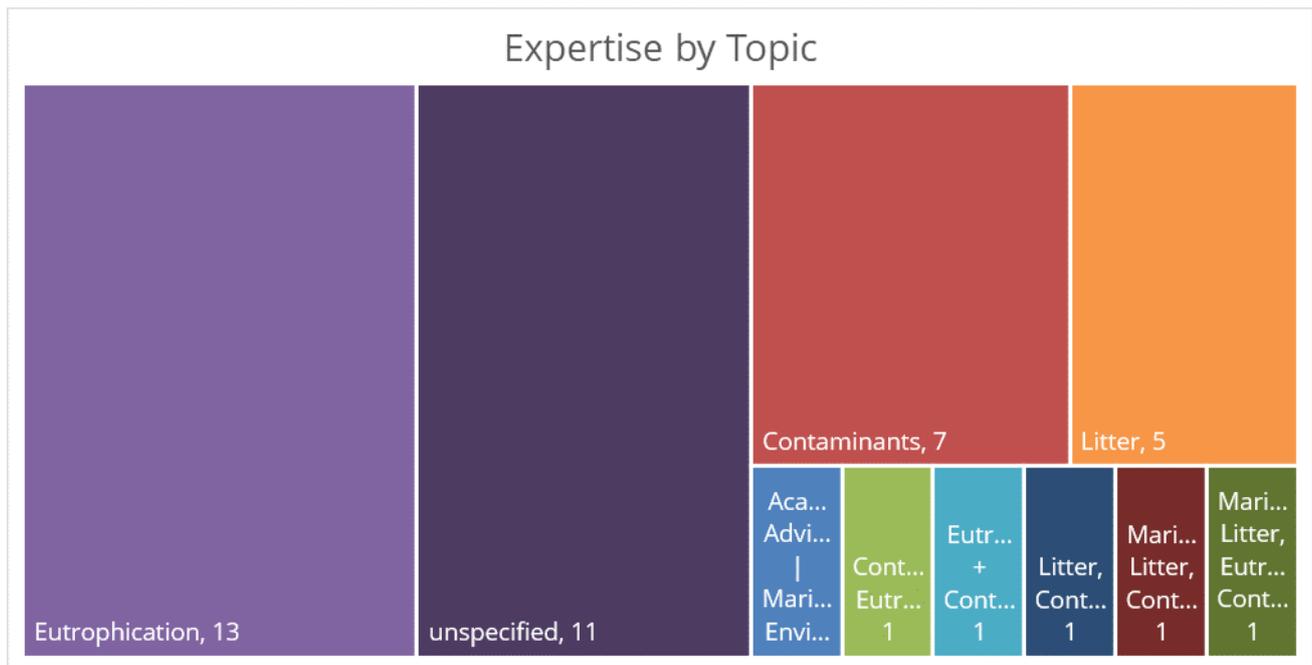
As outlined in the proposal, an MSFD board of experts was established within month 3 of the inception of EMODnet Chemistry Phase III. Although the previous phase of EMODnet Chemistry had had a continuous interaction with MSFD stakeholders, such as the regional sea conventions (RSC's), and the Commission

and its agencies (DG ENV, EEA, JRC), the stakeholders themselves had expressed the need for a different approach in this phase. The main aim of the MSFD board of experts is therefore to ensure that the thematic experts working within the context of RSC's and the EEA/JRC are consulted, and included in the specification of map and data products resulting from EMODnet Chemistry. In simple terms, the board of experts:

- Advise on (suitable) products (and choices of data scope)
- Monitor development of services (i.e. vocabs)
- Be in continuous dialogue

This ensures a more direct connection between the data product technical generation (EMODnet), and the existing expert use cases as seen in the ecosystem assessments coming from the RSC's (such as the OSPAR Interim Assessment 2017 and HELCOM Holistic Assessment II, 2017).

The MSFD board of experts now comprises 42 experts from across the MSFD marine regions. Their expertise is specific to the data products envisaged within the scope of EMODnet Chemistry – Eutrophication (Descriptor 5 in MSFD), Contaminants (D8) and Marine Litter (D10). The membership is mainly national experts working within the context of RSC assessments and indicators, but also includes project managers and specialists from the EEA, JRC and RSC Secretariats.



Although many of the experts were invited to the kick-off meeting of EMODnet Chemistry phase III, this was not a very practical means to arrange the interaction on the three Descriptors. Therefore, each Descriptor, and its pool of experts, was split into separate workshop dialogue meetings. Each workshop was planned as a relatively short online web conference to maximise the attendance of the experts. The workshop is preceded by a package of information from EMODnet, including a questionnaire that outlines the kind of information that EMODnet would be seeking clarification or acceptance of. Due to the differences between the Descriptors, and also the maturity of the data products that can be generated, the questionnaires and the workshops have so far been quite different in nature even though they have followed the same template.

The first workshop was convened on 27th November, 2017 and focussed on D5 Eutrophication. Eutrophication data and data products are the longest established in EMODnet, and as such the questionnaire reflected on the current product offering and how this could be aligned with the needs of assessments input for MSFD purposes. The summary and video of the meeting can be found under [news and events](#) on the EMODnet Chemistry website. Overall the specific feedback was very useful and was brought forward into the technical steering group of EMODnet Chemistry, as well as the annual meeting and steering group discussions on the next generation of products.

Partially because of this interaction and follow-up discussions with the EEA, as well as a growing interest from the EEA on streamlining its own data services which run through the EIONET network, there was a significant change in approach announced by the EEA on the 21st December 2017. The EEA announced that it would rely on EMODnet in combination with ICES to fulfil its data needs for the three EEA indicators on 'Hazardous substances in marine organisms' (CSI 049/MAR 001), 'Nutrients in TCM waters' (CSI 021/MAR 005 and 'Chlorophyll in TCM waters'. Their justification being that although they had good coverage of the northern MSFD regions as ICES was already providing these data, that there was poor coverage of data for the Mediterranean and Black Sea coming through the EIONET data flow. So it is hoped that the synergy of these sources can provide a good basis for the EEA indicators. This also challenges the EMODnet project as in addition to the existing contractual milestones and deliverables, there are now expectations and dependencies from the EEA which are not entirely aligned with the existing planned timings of data harvesting and data product generation envisaged by the project.

The 2nd workshop was convened on the 16th March, 2018 and focussed on D8 contaminants ([see report here](#)). The workshop was quite different from the Eutrophication workshop as many of the participants were less familiar with EMODnet Chemistry, and also EMODnet was proposing an entirely new set of products that are quite different from the ones that are currently published on the EMODnet products portal. The workshop and video are yet to be published on the EMODnet website, briefly the feedback was generally positive to the proposal which will incorporate maps of specific contaminants based on their relation to limits of quantification and Ecological Quality Standards (EQS) values. As the idea of the board of experts is to have a continuous dialogue, a follow-up workshop will be held in the Autumn ahead of the public release of the D8 products to provide an opportunity for the experts to evaluate the products and to be included in the publication process.

The 3rd workshop focussed on Marine Litter (D10) was held 13th December 2018 and followed up on the recently [released data products](#) for D10 Marine litter. The connection to MSFD needs is well established as the JRC/Georg Hanke and Francois Galgani (co-chairs of TG Litter) have been heavily engaged in developing the data streams and the data visualization maps, as well as Alessandra representing EMODnet at the TG Litter meeting in 2017. Having said that, the RSC's had a number of questions and challenges to the way the maps had been produced, visualized and calculated. This feedback was very useful in refining the maps and supporting documentation¹ throughout the beginning of 2019, and will also inform the developments to these products into the next phase of EMODnet Chemistry.

A further follow-up workshop on D8 Contaminants was held in March 2019 to demonstrate how the feedback from the MSFD board of experts had been accounted for in the development of the map products for contaminants. As described in the [minutes](#), this feedback loop helped clarify and address further issues that the experts observed in the draft maps, leading to a more robust outcome. The maps

¹ See http://www.emodnet-chemistry.eu/repository/20190321_EMODnet_Beach_Seabed_ML_Products.pdf

are now drafted and awaiting transfer to the production environment of the EMODnet Chemistry portal and supporting services.

EMODnet Chemistry has also been engaged with the more technical part of the MSFD community via activities related to TG Data. EMODnet, together with SeaDataCloud was able to provide support to example for use in a guideline that was developed on the [publication of datasets](#) under Article 19.3 (of the MSFD).

Overall, the interaction with MSFD experts through the board has raised awareness of EMODnet as a network of data providers, the technical capabilities and capacity, as well as increasing the understanding between the thematic experts and EMODnet Chemistry. This format, and the group, now well established will serve the consortium well in the next phase of development.

Interaction with TG DATA

In addition, EMODnet Chemistry strives for INSPIRE compliance and this is planned by adopting the central transformation services that SeaDataNet is developing for converting SeaDataNet data sets (CDI and ODV / NetCDF formats) to relevant INSPIRE application schemas, depending on types of data. The feasibility of transforming SeaDataNet formats into INSPIRE data standards has already been positively analysed by BODC and SYKE, following the INSPIRE data implementation rules, as part of the SeaDataCloud project. The INSPIRE Directive aims to create a European Union (EU) spatial data infrastructure to enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to this data across Europe. Implementation of the INSPIRE Directive is based on harmonised common data models and standardised ways to share the data. Of primary concern for EMODnet Chemistry – SeaDataNet are the INSPIRE Themes 'Environmental Monitoring Facilities (EF)' and 'Oceanographic Features (OF)', which have both been defined based upon the OGC Observations & Measurements (O&M) model. In addition to the EF and OF data specifications, a SeaDataCloud technical guideline document has been composed detailing the requirements for the sharing of observations and measurements data.

The MSFD Directive 2008/56/EC defines some obligations, in accordance with Member States (MS), for the implementation of strategies for achieving or maintaining good environmental status (GES) in the marine environment. One of these obligations, described in the **Article 19(3)**, prescribes that MS shall make data resulting from Article 8 and Article 11 available in agreement with the Directive 2007/2/EC (**INSPIRE**). In this context, the **Technical Group on Marine Data (TG-DATA)**, formed in 2012, has taken actions for improving the MSFD Article 19(3) and providing recommendations for the publication of datasets under the MSFD Article 19(3). These guidelines propose [some examples and best practices](#).

EMODnet Chemistry is participating in TG-DATA and was asked to work out together with the MEDCIS project an INSPIRE use case for nutrients data in the Mediterranean Sea. This concerned MSFD Criterion D5C1 "Nutrients concentrations in water". For the use case the results of the SeaDataCloud transformation analysis were successfully applied. Test data were provided by SeaDataCloud and EMODnet Chemistry partner IOF (Croatia). The data were provided with metadata in the SeaDataNet CDI format, and data in SeaDataNet ODV format. The solution developed and proposed in the SeaDataCloud project to deliver data in a INSPIRE compliant way was adopted and adapted.

The classes used in this work are:

- Environmental Monitoring Facility (EMF);
- Feature of Interest (FoI);

- Procedure (Proc) and
- Observed Property (Obs).

The resulting mapping between SeaDataCloud formats and INSPIRE elements can be found at: http://nodc.ogs.trieste.it/INSPIRE_compliant/INSPIREmatching_MEDCIS.xlsx

This mapping has been developed using the matching tables for the EF theme, as improved by SeaDataCloud and uploaded in the INSPIRE Thematic Clusters platform: <https://themes.jrc.ec.europa.eu/file/view/170503/inspire-ef-matching-table>

A complete version of XML files are downloadable at the following link: http://nodc.ogs.trieste.it/INSPIRE_compliant where an example of nutrients data acquired in Mediterranean is described by INSPIRE standards.

The exercise demonstrates the completeness of SeaDataNet / EMODnet Chemistry metadata with respect to INSPIRE requirements and the feasibility to map SeaDataNet / EMODnet Chemistry data to INSPIRE models. It also demonstrates that the EMODnet Chemistry platform, powered by SeaDataNet, could be used by Member States to expose monitoring data following Article 19(3), i.e. compliant with INSPIRE, through a centralized transformation service, to be developed to convert formats. This use case as reported to TG-DATA has major potential for paving the way for Member States to adopt SeaDataNet standards for part of their monitoring data and EMODnet Chemistry as a distribution platform for providing references to their data in INSPIRE format to MSFD without having to undertake extra INSPIRE efforts themselves.

7 User Feedback

List of feedback received by EMODnet Chemistry during the period March 2017 – March 2019.

The full Help Desk service with telephone, online chat and email with answer in 2 working days was operative. It is clear that the online chat is the preferred helpdesk channel. No calls were received via email/phone. Website visitors got quick support via this channel. EMODnet Chemistry agents were handling also questions about SeaDataNet infrastructure, contacting SeaDataNet helpdesk only upon need.

Date	Organisation	Type of user feedback (e.g. technical, case study, etc.)	Response time
23/05/17	ICES	The user had urgent need for a specific presentation and couldn't find it since the portal was in updating process. The file was promptly sent to him even before updating the portal.	<1 min
09/06/17	IHE Delft Institute for Water Education	An error. User having problem with registration to Copernicus	<1 min
07/24/17 11:37 AM	CEFAS	The user was quering the "Emodnet-chemistry CDI search" with some selected options (he attached a file with the criteria), when he added the result to the basket he received an error (a screenshot has been added). The problem has been reported to the web search interface's administrators.	<1 min
07/31/17 12:53 PM	FAS	The user asked for the possibility to do a search "based on a list of files in a txt file" (for example by submitting this list through the "Emodnet-chemistry CDI search" interface). The issue has been reported to the web search interface's administrators.	<1 min
18/10/2017	Deltares	Netcdf files not correctly created. The problem is due to some bug in the program that created the netcdf files. The issue will be solved when the new products are out (spring 2018).	<1 min.
10/11/2017	MARINE AND FRESHWATER RESEARCH INSTITUTE	Some questions related the data submission.	<1 min.
18/01/2018	Royal Belgian Institute of Natural Sciences	A question about finding information.	<1 min.
12/02/2018	BMM	A question about why are there two different OceanBrowser interfaces	<1 min.
22/03/2018	Private	User wonders how to handle the downloaded ODV data files.	<1 min.
09/03/2018	European Commission	User: I would be interested to know when the map on marine litter will be available. Agent: we hope we'll have something within next months	<1 min.
23/03/2018	Royal Belgian Institute of Natural Sciences	User: Thank you for answering. I would have hoped for something more explicit. Is it possible to e-mail me when you have a clear view on the release?	<1 min.

		People at DG MARE, and especially Directorate A which is responsible for Maritime Affairs and Blue Economy, are keen to use the map. Thank you in advance.	
04/04/18	N/A	Helpdesk online chat: Questions about SDN licence and unrestricted access, and about duplicates in SDN RSM	3 minutes
05/04/18	N/A	Helpdesk online chat: How to use the downloaded ODV files	Less than 1 minute
09/04/18	N/A	Helpdesk online chat: Data request sea floor litter: timeseries for a statistic course in university	17 minutes
12/04/18	ICES	Use case: ICES and EMODnet Chemistry providing a comprehensive European data source for the European Environment Agency	N/A
23/04/18	British Oceanographic Data Centre (BODC)	Helpdesk online chat: Reported broken link	Less than 1 minute
11/5/18	EMODnet Secretariat	Helpdesk e-mail: Reported malfunctioning OceanBrowser as a result of GeoServer problem	8 minutes
18/06/18	N/A	Helpdesk online chat: How to use the downloaded ODV files	Less than 1 minute
27/08/2018	JRC	Feedbacks on EU 2012-2016 beach litter dataset were received through MSFD TG ML Wiki, as part of the collaboration with JRC.	On-going
4-5/9/2018	EEA	A series of requests on the released data collections was provided through ICES. In particular, it was requested to split P01 in subcomponents and to transpose the matrix with all data. This would allow ICES to easily merge EMODnet data.	Within the next release planned for November
25/10/18	ICM-CSIC	Email: possible collaboration	46 minutes
09/11/18	Private	Email: technical	25 minutes
28/11/18	ICES	Chat: technical	124 minutes
30/11/18	Mercator Océan	Email: technical	7 minutes
1/2/2019	Private from the Sustainability Institute and Camborne School of Mines, under the University of Exeter	Technical via Helpdesk email	4.5 hours

8 Meetings held/attended since last report

List of the internal and external meetings held/participated by the contractor during the period March 2017 – March 2019.

Date	Location	Title	Attended / Organised	Internal/External + Short Description
14-15/03/2017	Brussels,, Belgium	Workshop on Marine Litter Baselines	A	Workshop dedicated to understand the availability of data on marine litter in the various compartments/matrices
28-31/03/2017	Kuala Lumpur, Malaysia	24th Session of the IOC Committee on IODE	A	Informative information on EMODnet Chemistry were provided to IODE representatives
03-04/04/2017	Venice, Italy	First EMODnet Chemistry Technical Working Group	O	With MARIS, OGS, IFREMER, ICES, AWI, ULg, ISPRA, NERC-BODC and Deltares, aimed to set the strategy for the Marine Litter data collection, the updating and optimization of viewing services, related data and metadata
10-12/04/2017	Limassol, Cyprus	EMODnet Data Ingestion Meeting	A	Discussing ingestion priorities for Chemistry and pathways
24-28/04/2017	Las Palmas de Gran Canaria	Maritime Spatial Planning, Ecosystem Approach and Supporting Information Systems (MaPSIS)	A	EMODnet chemistry results in support to EU marine policies: use cases
11/05/2017	Skype	Meeting with UNEP/MAP	A	Meeting with UNEP/MAP, OGS and HCMR to identify how to use EMODnet Chemistry data for the Mediterranean QSR.
16/05/2017	Trieste, Italy	1 st EMODnet Chemistry Steering Committee meeting	O	With OGS, MARIS, IFREMER, IMR, AU-DCE, SMHI, HCMR, NIMRD, ICES and ISPRA, aimed to agree on the 1 st year work plan and deliverables
17-18/05/2017	Trieste, Italy	1 st EMODnet Chemistry Coordination group meeting with session dedicated to the Board of MSFD experts	O	1 st Plenary meeting aimed to share the work plan, with deadlines and deliverables with the whole group and the Board of MSFD experts. The need to get feedback on existing data products to tune future development was strongly underlined
23/05/2017	Brussels, Belgium	EMODnet Kick-off meeting	A	Organized by EASME with the coordinators from all lots, the secretariat and DG MARE
07/06/2017	Copenhagen Denmark	TG DATA	A	Discussion on data flow to fulfill MSFD Art 19.3 with EEA, INSPIRE, MS and EMODnet

08-09/06/2017	Gdansk, Poland	MSFD TG Marine Litter	A	EMODnet Chemistry approach was presented together with the data format defined for micro-litter
15/06/2017	Rome, Italy	Meeting with INFO/RAC	O	Informal meeting to discuss and agree on the integration of EMODnet standards into the Mediterranean platform
5-6/07/2017	Genova, Italy	EMODnet Central Portal TWG	A	Technical meeting for the discussion of the central portal features and new reporting requests
25/07/2017	Skype	Meeting with OSPAR and MCS	O	Meeting between OSPAR, OGS and MCS to set the terms of reference for beach litter data exchange
29/08/2017	Skype	Meeting with UNEP/MAP	O	Meeting between UNEP/MAP and OGS to clarify administrative issues linked to their subcontracting
12/09/2017	Lisbon, Portugal	JPI Ocean BASEMAN	A	Invitation to BASEMAN workshop to present and discuss EMODNet Chemistry format for micro-litter
13-15/09/2017	Rome, Italy	8 th EMODnet Steering Committee	A	Presenting project progress and contributing to discussions
25-26/09/2017	Gotheborg, Sweden	EMODnet Chemistry Steering Committee	O	Monitoring progress and planning further activities
27/11/2017	Video-conference	MSFD board of experts for EMODnet Chemistry: Eutrophication online workshop	O	The first online workshop of the MSFD board of experts for EMODnet Chemistry was aimed to consolidate the cooperation with Regional Sea Conventions in order to tune EMODnet activities in support of MSFD implementation. This first workshop was focused on MSFD Descriptor 5 Eutrophication.
4-5/12/2017	Delft, Netherlands	2nd Technical Working Group Meeting	O	Meeting of the technical group to discuss the status of development and the next steps
11/01/2018	Video-conference	Agreement of the format and content for the INSPIRE use case	A	TG DATA meeting to contribute to Art 19.3 recommendations on publication of datasets
18/01/2018	Paris, France	SeaDataCloud-EMODnet Chemistry-CMEMS strategic meeting	A	Meeting to discuss the terms of reference for two bilateral MoU for data exchange
22-25/01/2018	Porto, Portugal	EUDAT Conference "Putting the EOSC vision into practice"	A	Presentation on Adopting and adapting SeaDataNet services for EMODnet Chemistry
06-08/02/2018	Roskilde, Denmark	EMODnet Chemistry Annual Plenary and SC meeting	O	
12-13/02/2018	Brussels, Belgium	TG DATA	A	INSPIRE compliance for EMODNet Chemistry data models

22-23/02/2018	Athens, Greece	MEDCIS Stakeholder Workshop on Marine Litter and Contaminants	A	EMODnet Chemistry activity and standards
27/02/2018	Video-conference	Regional data aggregation and validation	O	Consultation on results and open issues faced by the RLs
27/03/2018	Trieste, Italy	Workshop	O	OGS-JRC bilateral workshop to discuss beach litter data collection. Timeline with agreement on future steps.
3-5/4/2018	Liege, Belgium	Workshop	A	DIVA workshop. Important technical update on DIVA tool. Attended by Regional Leaders.
9/4/2018	On-line	Meeting	O	Videoconference with EEA. Agreement for sending them the aggregated data collections.
13/4/2018	On-line	Meeting	O	Videoconference on Marine data and INSPIRE to evaluate cooperation for standard adoption.
13/4/2018	On-line	Conference	O	Data products videoconference. *
16-17/4/2018	Barcelona, Spain	Conference	A	EMODnet Ingestion plenary meeting.
18-19/4/2018	Split, Croatia	Conference	A	2018 MEDITS Coordination Meeting. Agreement on cooperation and data exchange.
20/4/2018	Athens, Greece	Workshop	A	HarmoNIA stakeholder workshop. Dissemination of EMODnet standards and results.
26/4/2018	On-line	Conference	O	Data products videoconference. *
15/5/2018	On-line	Conference	O	Data products videoconference. *
7/6/2018	On-line	Conference	O	Data products videoconference. *
8/6/2018	Trieste, Italy	Conference	O	EMODnet Day – Italia: Marine data for the industry and the private sector towards sustainable development. Dissemination.
12/6/2018	On-line	Meeting	O	Meeting with EEA. Agreement on Marine Litter Watch data exchange.
26-27/6/2018	Larnaka, Cyprus	Conference	A	11th meeting of the MSFD TG Marine Litter. Updating activities for getting endorsement.
28/6/2018	Larnaka, Cyprus	Conference	A	MSFD Baselines meeting. Presentation of EMODnet Beach litter database adopted for Baselines computation at European scale.

03/7/2018	On-line	Meeting	O	Data products videoconference. *
09/8/2018	On-line	Meeting	A	Update EMODnet Secretariat on last project developments.
30/8/2018	On-line	Meeting	A	Meeting with JRC to coordinate feedbacks to Beach litter database.
4-5/9/2018	Rome, Italy	Meeting	O	EMODnet Chemistry 4 th Steering Committee meeting.
7/9/2018	Rome, Italy	Meeting	O	Meeting with Adriatic LNG to agree on monitoring data exchange.
7/9/2018	On-line	Meeting	A	1 st Communication meeting with EMODnet Secretariat.
14/9/2018	On-line	Meeting	O	Data products videoconference. *
18-21/9/2018	Antwerp, Belgium	Conference	A	INSPIRE Conference. Presentation of the transformation of EMODnet nutrients data to INSPIRE data models.
1-2/10/2018	Brussels	Meeting	A	4 th EMODnet Technical Working Group
3-5/10/2018	Cagliari	Conference	A	DATA REVOLUTION, Open Data panel
16-17/10/2018	Isola dei Pescatori	Meeting	A	SeaDataCloud scientific committee to present how EMODnet Chemistry is using SeaDataNet data infrastructure
31/10/2018	On-line	Meeting	O	Data products videoconference. *
5-7/10/2018	Barcelona	Conference	A	International Conference on Marine Data and Information Systems
12/11/2018	On-line	Meeting	O	Videoconference to internally review marine litter maps
15/11/2018	On-line	Meeting	A	Virtual Meeting with Deloitte to present EMODnet Chemistry results and usage
19-20/11/2018	Brussels	Meeting	A	EMODnet Steering Committee
20-21/11/2018	Brussels	Meeting	A	GOOS DataMEQ to present EMODnet Chemistry products and discuss interaction with Copernicus
21-23/11/2018	Brussels	Conference	A	EOOS Conference
27/11/2018	On-line	Meeting	O	Data products videoconference. *

3-4/11/2018	Copenhagen	Meeting	A	TG DATA to present EMODnet Chemistry work on INSPIRE and discuss the possible use of EMODnet Chemistry platform for MSFD data reporting by MS
13/12/2018	On-line	Meeting	O	MSFD board of experts: Marine Litter online workshop to evaluate marine litter maps
27/11/2018	On-line	Meeting	O	Data products videoconference. *
08/01/2019	On-line	Meeting	O	Data products videoconference. *
11/01/2019	On-line	Meeting	O	Fine-tuning of marine litter maps
29-31/01/2019	Madrid	Meeting	O	EMODnet Chemistry final meeting and Steering Committee meeting
30-31/01/2019	Athens	Meeting	A	TG ML Joint Litter Category List meeting organised to review the Master List of marine litter items. EMODnet provided information from the EMODnet Marine Litter database.
14/02/2019	On-line	Meeting	O	Fine-tuning of marine litter maps
14-15/02/2019	Rome	Meeting	A	TG ML Floating Marine Macro Litter workshop organised to evaluate additional data sources. EMODnet provided expertise on marine litter data management.
18-22/02/2019	Tokyo	25 th Session of IOC/IODE	A	Sharing knowledge on EMODnet data standards
SUM of O			33	(Total # of meetings organised)
SUM of A			38	(Total # of meetings attended)

* Data products videoconferences are periodic working events to align the regional data aggregation and validation activity. Consultation on results and open issues faced by the regional leaders preparing the data products.

9 Outreach and communication activities

List of the relevant communications/outreach activities or products developed/executed during the period March 2017 – March 2019. Relevant scientific and/or popular articles are reported as well.

Date	Communication	Short description (of the material, title, ...) and/or link to the activity	Short description and/or link to the activity
14-15/3/2017	Presentation	EMODnet Chemistry	Introduction to EMODnet Chemistry with focus on marine litter approach for ML Baselines.
28-31/3/2017	Poster	The Italian National Oceanographic Data Center	Demonstration on how EMODnet data infrastructure supports IODE objectives as it is further building over the European network of NODCs.
24-28/4/2017	Presentation	EMODnet chemistry results in support to EU marine policies: use cases	Oral presentation to Maritime Spatial Planning, Ecosystem Approach and Supporting Information Systems (MaPSIS)
7/6/2017	Presentation	EMODnet	For all lots, with the point of view of OSFD data reporting
8-9/6/2017	Presentation	EMODnet Chemistry	EMODnet Chemistry approach and the micro-litter data format
15/6/2017	Presentation	EMODnet Chemistry platform for sharing marine monitoring data for contaminants, nutrients and marine litter in support to MSFD implementation	EMODnet chemistry data infrastructure
16-20/5/2017	interview		Interview at local and national radio broadcast and four articles in the local newspaper (se links on the portal)
25/8/2017	Presentation	EMODnet Chemistry	EMODnet Chemistry data portal presented to CMEMS-Med-MFC-Biogeochemistry group
September 2017	Paper	Spatio - temporal variability of chemical seawater parameters around the Spanish coasts	Underline the importance of homogenize and validate Data to be included in EMODnet for long-term accessibility
12/9/2017	Presentation	EMODnet Chemistry	EMODnet Chemistry approach and the micro-litter data format
6/10/2017	Presentation	Updates from EMODnet Chemistry	EMODnet Chemistry presented the last results focused to Black Sea area to the 33rd BSC Regular Meeting, Istanbul. The BSC welcomed the cooperation with EMODNet Initiative and endorsed the draft MoU with OGS (Italy) representing the EMODNet Chemistry II
18-19/10/2017	Presentation	SeaDataCloud annual meeting	EMODnet Chemistry was presented

23-24/10/2017	Presentation	EMODnet Chemistry platform to address the needs of WMO and UNESCO's IOC community: use cases	EMODnet Chemistry platform and its link to SeaDataNet have been presented to JCOMM-5 Marine Technical Conference, WMO headquarters
31/10/2017	Poster	Romanian Research Salon	EMODnet Chemistry was presented at the Romanian Research Salon organized by the Romanian Ministry of Research and Innovation between 25-27 October 2017, in the Palace of Parliament, Bucharest (Romania).
7/10/2017	Presentation	scientific meeting in Daugavpils University by Latvian Institute of Aquatic Ecology	EMODnet Chemistry was presented on the 6th of December, 2017 during a scientific meeting in Daugavpils University by Latvian Institute of Aquatic Ecology.
9-10/11/2017	Presentation	EMODnet Chemistry contribution to data publication	EMODnet Chemistry presented and discussed at the 5 th TG DATA meeting, with action for the development of end-to-end examples on the use of INSPIRE data-models
15-17/11/2017	Openday	Open Sea Lab	A three day open data bootcamp hackathon to ideate and co-create innovative solutions to unique problems using EMODnet's marine data and ocean observations
01/12/2017	Article	EMODnet Chemistry Spatial Data Infrastructure for observations, data and information	Submitted the article to the Ocean & Coastal Management MaPSIS conference special issue
18/01/2018	Presentation	EMODnet Chemistry objectives and possible interfaces to/from CMEMS	The available data products and the interoperability solutions are presented to evaluate possible collaborations
22-25/01/2018	Presentation	Adopting and adapting SeaDataNet services for EMODnet Chemistry	EMODnet Chemistry data infrastructure and its link to SeaDataNet was presented to a wider audience, Porto, Portugal
12-13/02/2018	Presentation	Using INSPIRE for describing MSFD Criterion D5C1 "Nutrients concentrations in water"	Bruxelles, Belgium
22/02/2018	Presentation	Marine litter data management at European scale EMODnet	Athens, Greece
23/02/2018	Presentation	How EMODnet could help to collect and manage data to be used for GES assessment, which are not in national databases (e.g. from regular monitoring or research projects)	Athens, Greece

16/03/2018	Video-conference	What is EMODnet?	New contaminants maps presented to MSFD board of experts
June 2018	Publication	Seasonal and interannual trends of trophic status in northern Adriatic Sea in relation to nutrient loadings	Makes use of EMODnet Chemistry data
18/4/2018	Oral presentation	Marine litter data management at European scale EMODnet	2018 MEDITS Coordination Meeting. Agreement on cooperation and data exchange.
20/4/2018	Oral presentation	EMODnet Chemistry data infrastructure	HarmoNIA (Harmonization and Networking for contaminant assessment in the Ionian and Adriatic Seas) stakeholder workshop. Purpose: Dissemination of EMODnet standards and results. Result: Adoption of EMODnet Chemistry standards and tools for data management
8/6/2018	Oral presentation	Multiple presentations of activities and use cases.	EMODnet Day – Italia: Marine data for the industry and the private sector towards sustainable development. Purpose: Dissemination. Activity: Distribution of promotional material. Result: 4 press clippings.
26/6/2018	Oral presentation	EMODnet - Marine litter	MSFD TG -DATA meeting. Presentation of the use case: INSPIRE transformation of SeaDataNet nutrients data (from EMODnet Chemistry). Propose: Updating activities for getting endorsement
28/6/2018	Oral presentation	The EMODnet Beach Litter database for the Baseline	MSFD Baselines meeting. Result: EMODnet Beach litter database adopted for Baselines computation at European scale.
10/7/2018	Oral communication	Bilateral meeting with Saipem S.p.A. Promotion of EMODnet Chemistry infrastructure for data management.	Started dialogue with Saipem S.p.A. as part of EMODnet for Business campaign
7/9/2018	Oral communication	Bilateral meeting with Adriatic LNG. Promotion of EMODnet Chemistry infrastructure for data management.	Adriatic LNG agreed to share metadata with EMODnet as well as data under request. Both data and metadata will be included in the Italian NODC.
10/9/2018	Oral presentation	From data to knowledge for sustainable blue growth	Lessons for Master ASSESS - Advanced Skills in Safety, Environment and Security at Sea. Organized by the MARITIME TECHNOLOGY CLUSTER FVG, OGS, University of Trieste, CNR - Marine Technology Research Institute and co-funded by the European Maritime and Fisheries Fund

16-17/10/2018	Oral presentation	SeaDataCloud scientific committee	The usage of SeaDataNet data infrastructure by EMODnet Chemistry was presented together with the main results achieved.
07/11/2018	Oral presentation	Enlarging the EMODnet Chemistry focus with the EU marine litter data challenge	Presentation was printed in the conference book and uploaded to the conference website
05/11/2018	Poster	Eutrophication and contaminants Black Sea data management in the framework of EMODnet Chemistry.	Presentation was printed in the conference book and uploaded to the conference website
05/11/2018	Oral presentation	Mentioned in "The SeaDataCloud Virtual Research Environment: researching the sea from the cloud"	Presentation was printed in the conference book and uploaded to the conference website
05/11/2018	Oral presentation	Mentioned in "Preparation of oceanographic data for international projects"	Presentation was printed in the conference book and uploaded to the conference website
06/11/2018	Oral presentation	An example of adopting and adapting SeaDataCloud and INSPIRE data models to map EMODnet nutrients data	Presentation was printed in the conference book and uploaded to the conference website
05/11/2018	Oral presentation	Mentioned in "Assessment of existing services and new services provided by the Copernicus Marine In Situ Thematic Assembly Centre (INSTAC)"	Presentation was printed in the conference book and uploaded to the conference website
13/11/2018	Oral presentation	Long-term changes of hydrological and chemical regime including water pollution indices for the Black Sea North-Western part coastal regions. - In: VII All-Ukrainian Scientific Conference "Problems of Hydrology, Hydrochemistry and Hydroecology"	Abstract was printed in the conference book
20-21/11/2018	Oral presentation	EMODnet Chemistry products were presented to GOOS DataMEQ	Agreement on further collaboration and data exchange
3-4/11/2018	Oral presentation	Presentation of EMODnet Chemistry work on INSPIRE	Agreement on further use of EMODnet Chemistry platform for MSFD data reporting by MS
13/12/2018	Oral presentation	MSFD board of experts: Marine Litter online workshop	Marine Litter maps evaluation before the official publication
30/1/2019	Oral presentation	EMODnet Chemistry inputs to MSFD Master List	Contribution to MSFD Joint Litter Category List meeting
7/2/2019	Oral presentation	Presented at HarmonIA International Workshop in the Adriatic Ionian Region: Integration	Good collaboration as expressed in a new published use case in Chemistry Portal.

		of different maritime activities, Challenges and tools, Split, Croatia	
14-15/2/2019	Oral presentation	EMODnet Chemistry, Marine litter data management	DATA FORMAT - UNITS AND REPORTING in MSFD Floating Marine Macro Litter workshop, Rome, Italy
21-22/2/2019	Oral presentation	Presented at the <u>Inception Workshop Of The EMBLAS-Plus Project</u> , Istanbul, Turkey.	Presentation of the synergy with EMODnet objectives and topics and regarding the data on ML, obtained during the field works conducted by TSU and R/C GAMMA independently and within EMBLAS 2, delivered EMODnet and, further on, assimilated for creation of the first European maps on Marine litter. Continuation of these activities (e.g. interchange of data and creation of common Database on ML of the Black Sea) has been considered reasonable.
18-22/02/2019	Poster	EMODnet Chemistry poster in the 25th Session of the IOC/IODE Session and Scientific Conference, Tokyo, Japan	Sharing knowledge on data standards adopted at European scale.
SUM of oral presentations	42		(Total # of oral presentations)
SUM of posters presented	4		(Total # of poster presented)
SUM of publication	3		(Total # of publication presented)

List of relevant publications:

Grilli F., F. Bernardi Aubry, M. Bastianini, C. Bergami, M. Cabrini, E. Camatti, A. Campanelli, B. Cataletto, S. Cozzi, P. Del Negro, M. Giani, S. Guicciardi, M. Marini, A. Penna, P. Penna, A. Pugnetti, M. Ravaioli, F. Riminucci, A. Rinaldi, F. Ricci, C. Totti, P. Viaroli, Seasonal and interannual trends of trophic status in northern Adriatic Sea in relation to nutrient loadings, to be presented at 49° Congresso della Società Italiana di Biologia Marina, Cesenatico (FC), 4-8 June 2018.

Matteo Vinci, Alessandra Giorgetti, and Marina Lipizer, The role of EMODnet Chemistry in the European challenge for Good Environmental Status, *Nat. Hazards Earth Syst. Sci.*, 17, 197–204, 2017, www.nat-hazards-earth-syst-sci.net/17/197/2017/, doi:10.5194/nhess-17-197-2017.

A. Giorgetti, E. Partescano, A. Barth, L. Buga, J. Gatti, G. Giorgi, A. Iona, M. Lipizer, N. Holdsworth, M.M. Larsen, D. Schaap, M. Vinci, M. Wenzer, EMODnet Chemistry Spatial Data Infrastructure for marine observations and related information. *Ocean and Coastal Management*, in press.

E Tel, M Alvarez, A Bode, A Cabrero, I Chamarro, MC Garcia-Martinez, C. Rodriguez-Puente, P Velez, A Vilorio 2017. Spatio - temporal variability of chemical seawater parameters around the Spanish coasts. IAPSO-IAMAS-IAGA. Cape Town, 27/08/2017 - 01/09/2017

Date	Name of journal, conference, ...	Publication title	Authors	Organisation(s)
13-14 November 2018	VII All-Ukrainian Scientific Conference "Problems of Hydrology, Hydrochemistry and Hydroecology", Dedicated to 100th Anniversary Since the Foundation of the National Academy of Sciences of Ukraine	Long-term changes of hydrological and chemical regime including water pollution indices for the Black Sea North-Western part coastal regions.	ILYIN Y.P., ILYIN D.Y., ILYINA O.I., KLEBANOV D.O.	UHMI, Kyiv
5-7 November 2018	Bollettino di Geofisica teorica ed applicata, vol. 59, SUPPL. 1, IMDIS 2018 International Conference on Marine Data and Information Systems	Enlarging the EMODnet Chemistry focus with the EU marine litter data challenge	M. Vinci, A. Giorgetti, M.E. Molina Jack, A. Brosich, M. del Mar Chaves Montero, A.M. Addamo, G. Hanke and F. Galgani	OGS, JRC, Ifremer
5-7 November 2018	Bollettino di Geofisica teorica ed applicata, vol. 59, SUPPL. 1, IMDIS 2018 International Conference on Marine Data and Information Systems	Eutrophication and contaminants Black Sea data management in the framework of EMODnet Chemistry	L. Buga and G. Sarbu	National institute for Marine Research and Development "Grigore Antipa" (Romania)
5-7 November 2018	Bollettino di Geofisica teorica ed applicata, vol. 59, SUPPL. 1, IMDIS 2018 International Conference on Marine Data and Information Systems	The SeaDataCloud Virtual Research Environment: researching the sea from the cloud	M. Buurman, P. Thijsse, S.H. Vathsavayi, S. Mieruch, G. Leblan, G. Santinelli and A. Barth	Deutsches Klimarechenzentrum GmbH, MARIS, Tieteen Tietotekniikan Keskus OY, AWI, Ifremer, Deltares, University of Liege
5-7 November 2018	Bollettino di Geofisica teorica ed applicata, vol. 59, SUPPL. 1, IMDIS 2018 International Conference on Marine Data and Information Systems	Preparation of oceanographic data for international projects	A. Mikheev and E. Viazilov	ALL-Russian Research Institute of Hydrometeorological Information - WDC
5-7 November 2018	Bollettino di Geofisica teorica ed applicata, vol. 59, SUPPL. 1, IMDIS 2018 International Conference on Marine Data and Information Systems	An example of adopting and adapting SeaDataCloud and INSPIRE data models to map EMODnet nutrients data	E. Partescano, A. Giorgetti, A. Sarretta and D. Schaap	OGS, ISMAR, MARIS
5-7 November 2018	Bollettino di Geofisica teorica ed applicata, vol. 59, SUPPL. 1, IMDIS 2018 International	Assessment of existing services and new services provided by the Copernicus Marine In	P. de la Villéon Loïc, P. Sylvie and the CMEMS INSTAC partners	Ifremer, CMEMS INSTAC partner

	Conference on Marine Data and Information Systems	Situ Thematic Assembly Centre (INSTAC)		
13 November 2018	ABSTRACTS - Kyiv, UHMI, 2018, VII All-Ukrainian Scientific Conference "Problems of Hydrology, Hydrochemistry and Hydroecology", Dedicated to 100th Anniversary Since the Foundation of the National Academy of Sciences of Ukraine (Kyiv, Ukraine, 13-14 November 2018)	Long-term changes of hydrological and chemical regime including water pollution indices for the Black Sea North-Western part coastal regions	ILYIN Y.P., ILYIN D.Y., ILYINA O.I., KLEBANOV D.O.	UHMI

On 27th March 2019, EMODnet Chemistry beach litter map was promoted as Map of the Week for the European atlas of the seas.

10 Updates on Progress Indicators

Using the indicator as a header, the metrics collated and the time interval are listed.

Indicator 1 - Volume of data made available through the portal

The total number of CDIs for chemistry data sets has increased from **841356 to 999797**.

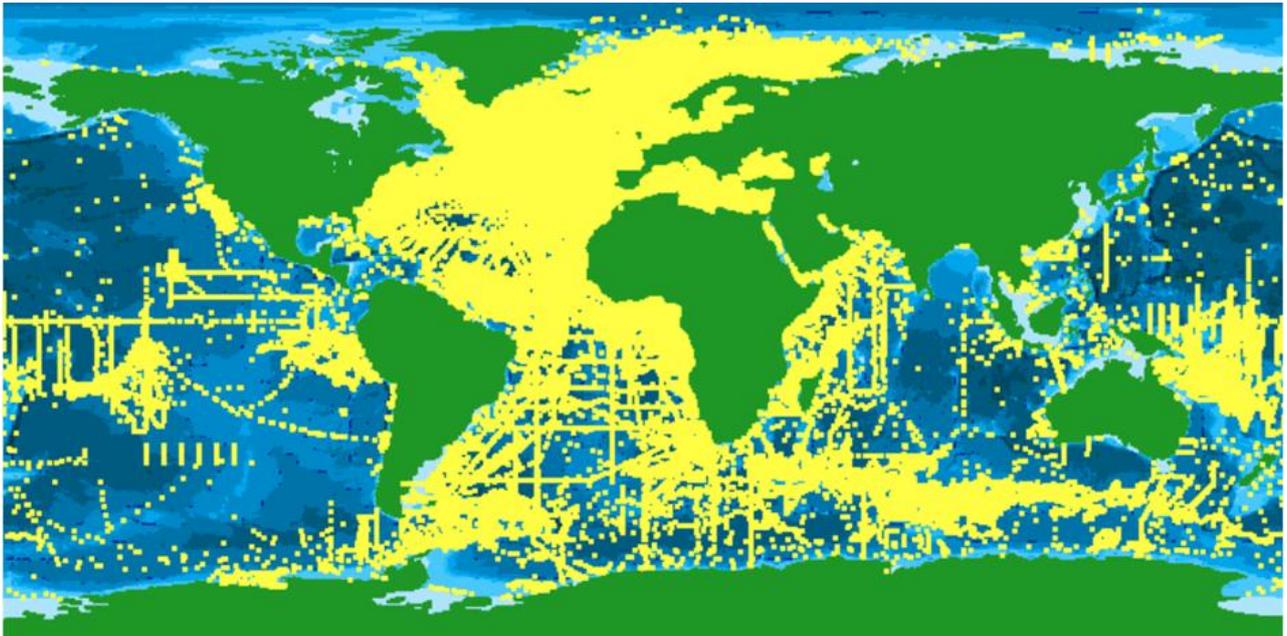


Image: Map of all entries in the CDI catalogue service

The total in production covers the whole globe. Specifically relevant for European waters (Lat Long box: **N80, W-30; N20, E45**) has increased from **745551 to 873908**.

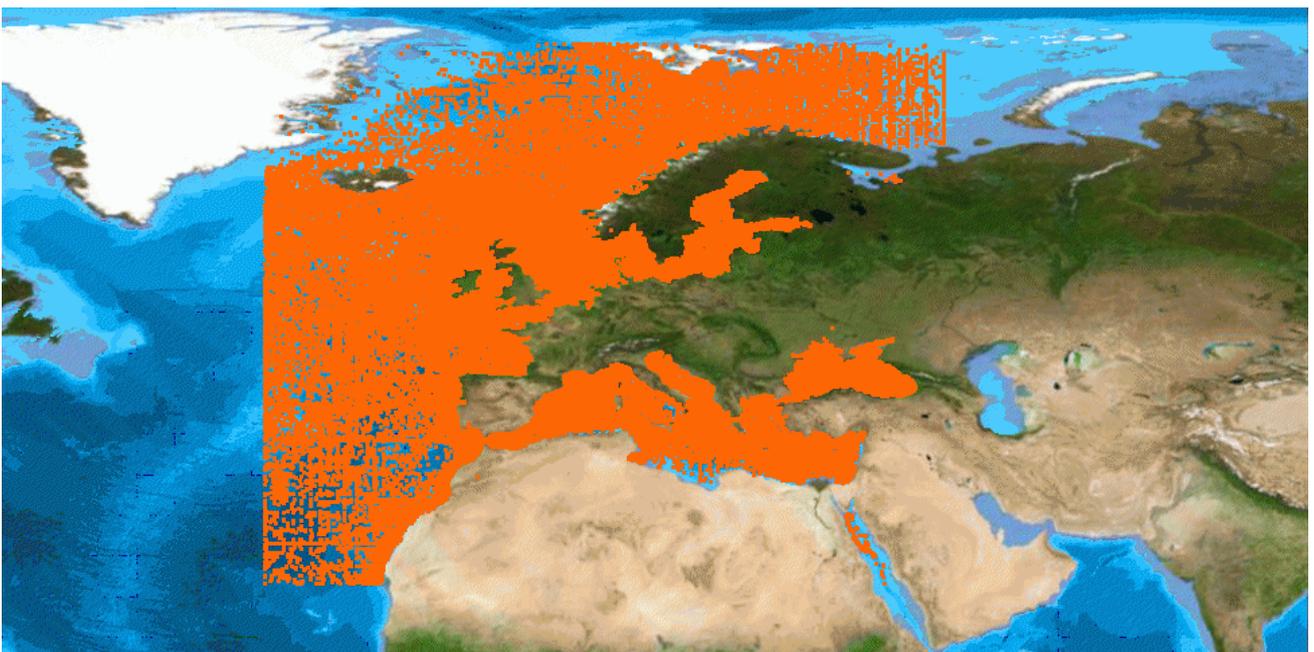


Image: Map of entries in the CDI catalogue service for European marine waters

Of these **852837 (85.3%)** are unrestricted (unrestricted and SeaDataNet license), while others (**146960**) require (possible) negotiation due to restrictions. Users can submit requests for access by means of the shopping mechanism in the CDI Data Discovery and Access service. This way data providers are informed about the requests and will contact the users by email or telephone for further discussing their requests. Most of the time this leads to positive decisions and delivery of data sets through the CDI Data Discovery and Access service or directly by e-mail by-passing the CDI service. It can also be that no agreement can be reached and then users will not get access to the requested data sets. Anyway, the negotiation is an issue between the users and the data providers whereby the CDI service and in particular its Request Status Manager (RSM) service can serve as an instrument, but it can be by-passed.

The division per **Groups of variables** is as follows:

Sub-theme	Atlantic	Arctic	Baltic	Black Sea	Med Sea	North Sea	Other Seas	Total Volume per theme
Acidity	17475	2836	29257	35933	39186	18642	28752	172072
Antifoulants	616	0	333	80	1294	1762	127	4212
Chlorophyll	28814	22417	69200	4314	40006	82672	32701	279939
Dissolved gasses	85984	23588	151050	49354	101786	152806	76926	641493
Fertilisers	58239	41118	105021	39741	45340	124287	46503	460245
Heavy metals	11534	313	3937	5972	10135	16643	4347	52879
Hydrocarbons	8118	1163	2559	27493	5355	11952	11208	67848
Marine Litter	6636	187	4273	171	1864	7354	0	20477
Organic matter	5294	84	11361	1665	9522	20183	11420	59529
Pesticides and biocides	3731	715	1263	15703	2565	5771	1502	31250
Polychlorinated biphenyls	6628	191	938	1799	2215	8209	256	20236
Radionuclides	0	19	416	1699	170	604	128	3036
Silicates	34746	35194	79521	34114	33988	94153	32572	344287

Table: Overview of parameter groups and number of CDI entries in the European seas

Areas (km²): Atlantic 7281229 km²; Arctic 5610745 km²; Baltic 392215 km²; Black Sea 473894 km²; Mediterranean Sea 2516652 km² North Sea 654179 km².

Indicator 2 - Organisations supplying each type of data broken down into country and organisation type (e.g. government, industry, science)

Organisation name	Type	Country	No restricted	restricted	% of restricted data
British Oceanographic Data Centre	Research	United Kingdom	54377	26213	32.53
German Oceanographic Datacentre	Research	Germany	14843	3813	20.44
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Research	Italy	44641	27694	38.29
CNR, Institute of Marine Sciences S.S. of Lerici (SP)	Research	Italy	1	681	99.85
CNR, Institute of Marine Science (ISMAR) - Ancona	Research	Italy	4482	0	0.00
CNR, Institute of Atmospheric Sciences and Climate (ISAC) (Rome)	Research	Italy	874	0	0.00
Institute of Fishery Resources (IFR)	Research	Bulgaria	257	0	0.00
Institute of Meteorology and Water Management National Research Institute, Maritime Branch in Gdynia (IMWM MB)	Government	Poland	0	2726	100.00
Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre (HCMR/HNODC)	Research	Greece	8907	3636	28.99
IEO/ Spanish Oceanographic Institute	Research	Spain	7343	18083	71.12
Marine Institute	Research	Ireland	6629	0	0.00
Flanders Marine Institute	Research	Belgium	2927	798	21.42
IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	Research	France	94681	328	0.35
Swedish Meteorological and Hydrological Institute	Government	Sweden	67100	0	0.00
IHPT, Hydrographic Institute	Government	Portugal	3037	941	23.66
Polish Geological Institute - National Research Institute, Branch of Marine Geology (PGI BMG)	Research	Poland	0	326	100.00
Institute of Marine Research - Norwegian Marine Data Centre (NMD)	Research	Norway	43209	0	0.00
NIOZ Royal Netherlands Institute for Sea Research	Research	Netherlands	5033	14	0.28
Netherlands Institute for Ecology, Centre for Estuarine and Marine Ecology	Research	Netherlands	2145	10749	83.36
All-Russia Research Institute of Hydrometeorological Information - World Data Centre (RIHMI-WDC) National Oceanographic Data Centre (NODC)	Research	Russian Federation	91490	107	0.12

P.P.Shirshov Institute of Oceanology, RAS	Research	Russian Federation	2136	0	0.00
National Institute of Fisheries Research (INRH)	Research	Morocco	0	552	100.00
Bulgarian National Oceanographic Data Centre(BGODC), Institute of Oceanology	Research	Bulgaria	1528	52	3.29
Iv.Javakhishvili Tbilisi State University, Centre of Relations with UNESCO Oceanological Research Centre and GeoDNA (UNESCO)	Research	Georgia	641	0	0.00
Institute of Marine Sciences, Middle East Technical University	Research	Turkey	2155	6478	75.04
National Institute for Marine Research and Development Grigore Antipa""	Research	Romania	3000	5210	63.46
Latvian Institute of Aquatic Ecology	Research	Latvia	4304	0	0.00
Institute of Oceanography and Fisheries	Research	Croatia	2484	0	0.00
International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	Research	Malta	976	0	0.00
Marine Systems Institute at Tallinn University of Technology	Research	Estonia	17887	511	2.78
State Oceanographic Institute (SOI)	Research	Russian Federation	0	21893	100.00
Marine Hydrophysical Institute	Research	Ukraine	2058	2594	55.76
Aarhus University, Department of Bioscience, Marine Ecology Roskilde	Research	Denmark	200573	0	0.00
International Council for the Exploration of the Sea (ICES)	Research	Denmark	40225	0	0.00
Karadeniz Technical University, Faculty of Marine Sciences	Research	Turkey	29	217	88.21
Sinop University, Fisheries Faculty	Research	Turkey	343	0	0.00
Dokuz Eylul University, Institute of Marine Science and Technology	Research	Turkey	0	1603	100.00
Istanbul University, Institute of Marine Science and Management	Research	Turkey	171	232	57.57
Institute of Biology of the Southern Seas, NAS of Ukraine	Research	Ukraine	998	0	0.00
Ukrainian Hydrometeorological Institute - Marine Branch	Research	Ukraine	27486	0	0.00
Russian State Hydrometeorological University, St-Petersburg	Research	Russian Federation	172	0	0.00
National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences	Research	Bulgaria	602	237	28.25
Israel Oceanographic and Limnological Research (IOLR)	Research	Israel	3623	2263	38.45
BRGM / Office of Geological and Mining Resources	Research	France	1	1376	99.93
Finnish Environment Institute	Research	Finland	14512	0	0.00

Ukrainian scientific center of Ecology of Sea (UkrSCES)	Research	Ukraine	5512	0	0.00
Odessa National I.I.Mechnikov University	Research	Ukraine	25	864	97.19
National Institute of Biology - Marine Biology Station	Research	Slovenia	4460	4188	48.43
Institut National des Sciences et Technologies de la Mer "INSTM"	Research	Tunisia	21	868	97.64
Scientific - Research Firm GAMMA"	Industry	Georgia	1194	0	0.00
Rijkswaterstaat Water, Traffic and Environment	Government	Netherlands	12419	0	0.00
Institute of Geology and Geography of Nature Research Centre	Research	Lithuania	212	0	0.00
Management Unit of North Sea and Scheldt Estuary Mathematical Models, Belgian Marine Data Centre	Government	Belgium	9909	0	0.00
Geological Survey of Estonia	Research	Estonia	542	0	0.00
Finnish Meteorological Institute	Research	Finland	25381	0	0.00
Ankara University	Research	Turkey	24	0	0.00
Danube Hydro-meteorological Observatory	Research	Ukraine	0	44	100.00
Faculty of Geography and Earth Sciences, University of Latvia (LU)	Research	Latvia	0	721	100.00
National Environmental Agency of the Ministry of Environment Protection and Natural Resources	Government	Georgia	153	0	0.00
Institute of Marine Biology (IMBK)	Research	Montenegro	798	66	7.64
ISPRA-Institute for Environmental Protection and Research	Government	Italy	4539	0	0.00
PANGAEA - Data Publisher for Earth & Environmental Science	Research	Germany	9054	0	0.00
Portuguese Institute of Ocean and Atmosphere	Government	Portugal	57	882	93.93
ORION	Company	Cyprus	657	0	0.00

Table: Overview of data centres and number of CDI entries for European marine waters

These centres are government and research institutes, except for one private company. No industry.

Indicator 3 - Organisations that have been approached to supply, collected data with no result

During Phase III, MEDITS network was contacted and promised to share its marine litter data, collected in the Mediterranean. Despite several dialogues, no results were achieved so far.

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

Statistics during EMODnet phase 3 (March 2017 –March 2019) of all datasets downloaded via SeaDataNet and EMODnet Chemistry portals:

Number of shopping requests	1152
Number of CDIs requested	834687
Number of individual users	310
Number of data centres involved	63

These results demonstrate that the work of EMODnet Chemistry (in particular the gathering and making available a large collection of marine chemistry data sets) has reached many additional users through other portals than only the EMODnet Chemistry portal, in particular through the SeaDataNet portal.

In addition, the project released the regional standardised harmonized validated data collections directly to EEA (for eutrophication and contaminants) and JRC (for marine litter) following to their request. Data format and metadata were customised accordingly.

5,388,348 CDIs were sent to EEA in 2018, while 570,229 CDIs were sent in 2019, for a total of 5,958,577 CDIs (requested and downloaded).

EMODnet Chemistry data layers are made available through the Information Platform for Chemical Monitoring, Enhancing access to chemical data (<https://ipchem.jrc.ec.europa.eu/>), D4Science and the European Atlas of the Seas

Data product	Downloads (NetCDF)
water body ammonium	430
water body chlorophyll-a	661
water body dissolved inorganic nitrogen (DIN)	255
water body dissolved oxygen concentration	877
water body dissolved oxygen saturation	41
water body nitrate	293
water body nitrate plus nitrite	226
water body nitrite	67
water body pH	89
water body phosphate	670

water body silicate	647
water body total nitrogen	199
water body total phosphorus	199

Download of the DIVA products (interpolated maps available as NetCDF)

Indicator 5 - Organisations that have downloaded each data type

From CDI service:

Organisation	Country	Users	Orders	CDIs
UNIGIS SALZBURG	Austria	1	1	6
EMODNET SECRETARIATE	Belgium	1	1	2
RBINS	Belgium	6	18	29838
UNESCO	Belgium	1	1	1000
UNIVERSITY OF GHENT	Belgium	1	1	2
UNIVERSITY OF LIEGE	Belgium	6	12	43905
UNKNOWN	Belgium	1	3	3
VLIZ	Belgium	6	28	476
UNIVERSITY OF VALE DO ITAJAI	Brazil	1	2	445
IO/BAS	Bulgaria	1	21	805
NIMH - BAS	Bulgaria	1	3	7
DFO	Canada	1	1	1
TSINGHUA UNIVERSITY	China	1	1	1
CENTRE DE RECHERCHE OCEANOLOGIQUES	Côte d'Ivoire	1	3	47
AARHUS UNIVERSITY BIOS	Denmark	1	13	16434
CIEM/ICES	Denmark	1	1	20
DEFENCE CENTER FOR OPERATIONAL OCEANOGRAPHY	Denmark	1	1	6
ICES	Denmark	1	1	258
NERI	Denmark	1	4	32107
NIVA	Denmark	1	1	1817
TUT DEPARTMENT OF MARINE SCIENCES	Estonia	5	11	1148
FINNISH ENVIRONMENT INSTITUTE (SYKE)	Finland	3	5	5973
FMI	Finland	3	7	2539
UNKNOWN	Finland	2	4	287
ACOA Conseil	France	1	1	6
ACRI-HE	France	1	10	22533
AIX-MARSEILLE UNIVERSITY	France	1	1	9
ALTRAN	France	2	19	73
CNRS	France	1	7	7361
CNRS - LEGOS	France	1	3	12056
EAU ET RIVIERES DE BRETAGNE	France	1	3	662
IFREMER	France	10	29	1590
IRD	France	1	1	104
SHOM	France	1	5	6
UNIVERSITY OF BOLOGNA	France	1	6	329
UNIVERSITY PAUL SABATIER	France	1	1	2
UNKNOWN	France	2	2	7
UPMC	France	1	13	1361
UPPA (ENSGTI)	France	1	1	1
AWI	Germany	3	3	941
BGR	Germany	1	2	2

BSH	Germany	2	3	23
DKRZ	Germany	1	1	20
GEOMAR	Germany	1	1	69
GERMAN FEDERAL ARMED FORCES	Germany	1	3	1186
LEIBNIZ INSTITUTE FOR BALTIC RESEARCH (IOW)	Germany	1	1	20
UNIVERSITY OF BREMEN	Germany	1	2	2
UNIVERSITY OF KASSEL	Germany	1	1	2
UNIVERSITY OF KIEL	Germany	1	1	3
UNKNOWN	Germany	3	6	18
DEMOCRITUS UNIVERSITY OF THRACE	Greece	1	1	124
HCMR	Greece	2	3	302
HCMR/HNODC	Greece	2	14	584
UNIVERSITY OF THE AEGEAN	Greece	2	2	32
UNKNOWN	Greece	4	10	21712
MARINE AND FRESHWATER INSTITUTE (MFRI)	Iceland	2	5	11
GOA UNIVERSITY	India	1	2	32
UNKNOWN	India	1	4	10
INDONESIAN INSTITUTE OF SCIENCES	Indonesia	1	1	17
INIOAS	Iran, Islamic Republic of	2	9	50
MARINE INSTITUTE	Ireland	7	39	131563
UNIVERSITY COLLEGE CORK	Ireland	1	1	2
UNKNOWN	Ireland	1	1	1
IOLR	Israel	2	3	5
CINECA	Italy	1	1	1
CNR	Italy	2	6	3156
CNR - IIA	Italy	1	1	1
CNR-ISMAR	Italy	3	7	16146
CORILA	Italy	1	1	1
ENEA	Italy	2	11	755
ERM ITALY	Italy	1	2	678
JRC, EU	Italy	2	4	30
MIRAMARE MARINE PROTECTED AREA	Italy	1	1	3
OGS	Italy	14	50	16041
UNIVERSITY OF BOLOGNA	Italy	2	3	2014
UNIVERSITY PARTHENOPE OF NAPLES	Italy	2	11	16149
UNKNOWN	Italy	6	11	3336
KENYA MARINE AND FISHERIES RESEARCH INSTITUTE	Kenya	1	1	1
KODC	Korea, Republic of	1	1	1
UNKNOWN	Korea, Republic of	1	1	2
LATVIAN INSTITUTE OF AQUATIC ECOLOGY	Latvia	3	5	1900
UNKNOWN	Lithuania	1	1	1
AQUABT	Malta	1	26	96800
UNIVERSITY OF MALTA	Malta	1	1	1
UABC	Mexico	1	1	1

INSTITUTE OF MARINE BIOLOGY	Montenegro	3	30	4892
DELTARES	Netherlands	3	3	124
MARIS	Netherlands	15	217	3481
NIOO-CEME	Netherlands	1	1	1
NIOZ	Netherlands	5	24	340
UN-IHE Delft	Netherlands	1	8	8118
UNIVERSITY OF UTRECHT	Netherlands	1	1	48
UNKNOWN	Netherlands	3	10	332
COGNITE AS	Norway	1	1	20
IMR	Norway	2	23	58724
NERSC	Norway	2	4	22032
NIVA	Norway	2	5	2837
UNKNOWN	Norway	1	2	5
UNKNOWN	Philippines	1	1	1
UNIVERSIDADE DO ALGARVE - CCMAR	Portugal	1	1	85
UNIVERSITY OF AVEIRO	Portugal	1	1	12
NIMRD	Romania	1	6	9194
AEROCOSMOS	Russian Federation	1	1	1
MURMANSK MARINE BIOLOGICAL INSTITUTE	Russian Federation	1	1	1
P.P. SHIRSHOV INSTITUTE OF OCEANOLOGY RAS	Russian Federation	2	5	94
RIHMI-WDC	Russian Federation	3	49	37121
UNKNOWN	Russian Federation	7	8	410
VNIIOKEANGELOGIYA	Russian Federation	1	6	592
SLOVAL ACADEMY OF SCIENCES	Slovakia	1	1	1529
MARINE BIOLOGY STATION OF SLOVENIA	Slovenia	1	4	4
NATIONAL INSTITUTE OF BIOLOGY	Slovenia	3	31	8856
TC VODE	Slovenia	1	1	4693
UNKNOWN	Slovenia	4	4	538
AZTI-TECNALIA	Spain	1	1	8
CSIC	Spain	3	3	1784
IEO	Spain	8	27	9810
IGME	Spain	1	6	35344
UNIVERSIDAD DE CANTABRI	Spain	1	1	66
UNIVERSITY OF SEVILLA	Spain	1	5	425
UNIVERSITY OF VALENCIA	Spain	1	1	1
UNKNOWN	Spain	2	2	2
UTM-CSIC	Spain	1	2	2
SMHI	Sweden	5	25	3418
ETH ZURICH	Switzerland	1	2	1156
UNIVERSITY OF FRIBOURG	Switzerland	1	1	17
INSTM	Tunisia	1	1	1
MIO-CNRS	Tunisia	1	3	421
DEU-INSTITUTE OF MARINE SCIENCE AND TECHNOLOGY	Turkey	1	2	116
ISTANBUL TECHNICAL UNIVERSITY	Turkey	1	4	1474
METU	Turkey	2	4	29639

SIMSOF	Turkey	1	1	2
UNKNOWN	Turkey	1	1	2
MHI	Ukraine	2	26	6564
NATIONAL ACADEMY OF SCIENCE OF UKRAINE	Ukraine	1	8	8071
ODESSA NATIONAL UNIVERSITY	Ukraine	1	2	2
UKRSCES	Ukraine	1	12	13
UNKNOWN	Ukraine	1	2	2
APEM LTD	United Kingdom	2	2	37
BODC	United Kingdom	5	6	13
British Antarctic Survey	United Kingdom	1	1	1
CEFAS	United Kingdom	3	3	4618
NOC	United Kingdom	1	1	10
SEASTAR SURVEY	United Kingdom	1	1	1
SEPA	United Kingdom	1	1	4813
UNIVERSITY OF CAMBRIDGE	United Kingdom	1	1	301
UNIVERSITY OF EXETER	United Kingdom	2	11	42651
UNIVERSITY OF HULL	United Kingdom	1	1	5
UNIVERSITY OF PLYMOUTH	United Kingdom	2	2	131
UNIVERSITY OF READING	United Kingdom	1	1	631
UNIVERSITY OF SOUTHAMPTON	United Kingdom	1	1	20
UNIVERSITY OF ST ANDREWS	United Kingdom	2	2	37
UNIVERSITY OF ULSTER	United Kingdom	1	2	10097
UNKNOWN	United Kingdom	4	7	6642
JOHN HOPKINS UNIVERSITY - APPLIED PHYSICS LABORATORY	United States	1	1	1
MBARI	United States	1	1	246
PERFECTION LEARNING	United States	1	1	1
UNKNOWN	United States	1	3	4984
VIRGINIA WESLEYAN UNIVERSITY	United States	1	1	46
TOTALS		310	1152	834687

Table: Overview of organisations that have requested data from the CDI service

Indicator 6 - User statistics to determine the main pages utilised and identify user navigation routes

The following statistics are provided by AWStats open source analysis tool.

Chemistry main portal: <http://www.emodnet-chemistry.eu/>

Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Mar 2017	9	13	16	19	38.32 MB
Apr 2017	2	3	11	11	34.80 KB
May 2017	23	40	51	53	6.80 MB
Jun 2017	22	35	68	80	34.69 MB
Jul 2017	303	840	2051	6689	944.10 MB
Aug 2017	348	904	2122	7911	1177.6 GB
Sep 2017	326	867	2205	9619	2437.12 GB
Oct 2017	426	1067	2612	10336	4935.68 GB
Nov 2017	520	1176	4263	18961	4249.6 GB
Dec 2017	450	1128	6100	28178	5130.24 GB
Jan 2018	549	5666	33817	141239	15.74 GB
Feb 2018	489	3681	26586	119077	95.05 GB
Mar 2018	713	1,528	4,731	24,380	8.50 GB
Apr 2018	622	1,572	7,656	40,037	20.51 GB
May 2018	557	2,192	10,178	49,087	67.09 GB
Jun 2018	503	1,729	5,163	45,127	7.58 GB
Jul 2018	496	1,674	6,897	39,491	14.74 GB
Aug 2018	474	1,639	9,434	33,019	2.48 GB
Sep 2018	446	1,150	6,755	25,821	66.82 GB
Oct 2018	975	1,823	8,186	21,759	1.47 GB
Nov 2018	818	1,575	6,068	21,453	7.59 GB
Dec 2018	502	952	2,742	12,964	7.35 GB
Jan 2019	535	1,150	4,980	21,319	47.77 GB
Feb 2019	199	338	1,120	5,688	834.87 MB
Mar 2019	936	1,624	5,165	31,115	6.45 GB

Chemistry CDI data discovery and access service: http://emodnet-chemistry.maris2.nl/v_cdi_v3/search.asp

Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Mar-17	228	564	6,679	18,378	204.77 MB
Apr-17	232	366	3,478	11,398	259.62 MB
May-17	294	592	9,932	21,818	377.69 MB
Jun-17	207	464	6,502	16,555	282.10 MB
Jul-17	170	342	5,444	14,577	368.66 MB
Aug-17	314	540	6,345	12,783	253.91 MB
Sep-17	196	409	7,937	17,216	304.92 MB

Oct-17	218	485	6,126	18,980	532.60 MB
Nov-17	278	586	10,768	44,617	679.74 MB
Dec-17	145	306	6,021	18,757	255.34 MB
Jan-18	152	281	6,472	15,414	376.21 MB
Feb-18	170	311	7,764	17,312	241.44 MB
Mar-18	198	411	7,889	18,841	440.33 MB
Apr-18	199	371	8,202	19,210	1.04 GB
May-18	152	375	6,162	15,109	604.65 MB
Jun-18	175	335	5,775	13,720	321.76 MB
Jul-18	133	315	9,392	19,550	227.94 MB
Aug-18	187	355	5,410	12,551	260.69 MB
Sep-18	214	499	7,983	22,900	286.23 MB
Oct-18	276	446	4,682	13,881	161.67 MB
Nov-18	193	440	9,753	23,769	290.08 MB
Dec-18	137	206	2,678	8,230	160.57 MB
Jan-19	131	258	7,930	20,747	207.29 MB
Feb-19	162	275	7,613	19,655	125.73 MB
Mar-19	356	545	10,279	29,017	185.12 MB

Chemistry Products – Ocean Browser service: <http://ec.oceanbrowser.net/emodnet/>

Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Mar 2017	179	347	22084	29312	11.79 GB
Apr 2017	166	340	24692	32255	5.20 GB
May 2017	268	540	63159	71949	3.79 GB
Jun 2017	186	446	59978	68033	5.13 GB
Jul 2017	127	315	23741	28885	7.93 GB
Aug 2017	90	248	31370	36583	827.22 MB
Sep 2017	158	414	31218	39446	77.69 GB
Oct 2017	202	600	54544	69967	22.69 GB
Nov 2017	213	581	66875	81865	14.55 GB
Dec 2017	225	561	37061	46754	49.45 GB
Jan 2018	248	616	32475	43543	7.24 GB
Feb 2018	272	606	40894	53933	40.85 GB

Products metadata catalogue: <http://www.emodnet-chemistry.eu/products/catalogue>

Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Mar 2017	47	97	11738	16882	496.94 MB
Apr 2017	27	76	6584	8824	285.19 MB
May 2017	36	98	9725	12092	467.91 MB
Jun 2017	31	80	4401	5938	232.32 MB
Jul 2017	19	56	2319	2975	150.68 MB
Aug 2017	22	60	1393	1754	94.42 MB
Sep 2017	27	144	15639	18592	619.47 MB
Oct 2017	40	89	6252	7371	361.62 MB
Nov 2017	63	114	10040	12802	311.03 MB
Dec 2017	54	130	27159	34600	885.72 MB
Jan 2018	66	158	19465	23672	739.16 MB
Feb 2018	65	126	13013	15743	436.01 MB
Mar 2018	16	23	1471	1899	53.70 MB
Apr 2018	11	13	333	463	17.40 MB
May 2018	10	48	4363	5459	45.93 MB
Jun 2018	9	54	2811	3635	51.92 MB
Jul 2018	21	71	6850	8831	93.27 MB
Aug 2018	6	49	10938	12892	127.74 MB
Sep 2018	12	56	5806	7005	363.97 MB
Oct 2018	20	40	4496	5527	437.47 MB
Nov 2018	18	58	7046	8956	1.38 GB
Dec 2018	11	18	655	865	265.44 MB
Jan 2019	27	78	11222	13638	2.34 GB
Feb 2019	33	63	5348	6798	606.72 MB
Mar 2019	10	20	1444	1838	143.30 MB

Tables: Web statistics of EMODnet Chemistry main portal, CDI Data Discovery and Access service, Products viewing service, Products catalogue.

Since Matomo analysis tool is available only from 04/10/2017, from the above statistics we computed the following table for the period March-September 2017:

Visibility & Analytics (Portal overview)	Value
Unique visitors	497
Visits	1,228
Page views	127,728

For the period October 2017- March 2019, the following statistics are provided by Matomo analysis tool:
 Unique page views of the Home page: 3,815.

Visibility & Analytics (Portal overview)	Value
Unique visitors	13,232
Unique returning visitor	3,443
Visits	14,612
Unique page views	58,694
Bounce rate	37%

Glossary:

- **Visit:** If a visitor comes to your website for the first time or if they visit a page more than 30 minutes after their last page view, this will be recorded as a new visit.
- **Bounce:** left the website after visiting only one page.

As entry page, entrances number via the direct data download link (2564) is slightly higher than entrances via the Home page (2541).

Dividing the web content to web sections (All pages related to a specific menu item) provides us the following metrics:

Web section	Unique page views
Data	8994
News and Events	7064
Documents	6317
Products	6138
About	3173
Help	800

Tables: Web statistics of EMODnet Chemistry portal (main component, CDI Data Discovery and Access service, Products viewing service, Products catalogue all together).

Indicator 7 - List of what the downloaded data has been used for

Users of the CDI Data Discovery and Access service are asked to give a reason for their data requests. The following relevant reasons for downloading Chemistry datasets were given.

Organisation type	Reason for downloading
Research	Input for master theses
Research	Input for scientific research
Research	Testing the service
Industry	Input for scientific research
Unknown	Input for scientific research

Table: Reason for downloading data from the CDI service

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

The following web services are provided by the EMODnet Chemistry:

- Data product Viewing and Downloading service
- Dynamic Timeseries visualizations and requests for graphs
- Plot time series of certain location
- CDI Data Discovery and Access service
- OPeNDAP

Detailed usage documentation (API), explaining what is offered by each service and how to use it (with examples), is provided at <https://www.emodnet-chemistry.eu/products/api>.

11 Recommendations for follow-up actions by the EU

The list of recommendations and suggestions given in the interim period is still extremely valid. Unfortunately, despite the results obtained during the last phase, the Chemistry portal, as all the other portals, suffered a consistent budget reduction:

Lot	theme	2008 call	2012 call	2016 call	2018/2019 call
1	Hydrographic/ Bathymetry	€ 975,000 + 2.000.000	€ 2,000,000	€ 4,917,000	€ 3,720,000
2	Geology	€ 925,000	€ 4,200,000	€ 4,500,000	€ 1,770,000
3	Seabed habitats		€ 1,390,000	€ 1,400,000	€ 552,000
4	Physics		€ 1,000,000	€ 1,400,000	€ 950,000
5	Chemistry	€ 700,000	€ 4,000,000	€ 2,820,000	€ 1,400,000
6	Biology	€ 850,000	€ 1,700,000	€ 1,770,000	€ 1,770,000
7	Human activities		€ 2,060,000	€ 1,700,000	€ 1,700,000

The first recommendation for follow-up actions by the EU would be to keep sustaining with appropriate and continuous funding the strong data infrastructure in the future. Europe started to count on it and several initiatives make use of it as a vital instrument. Looking at the Chemistry portal in particular, it became crucial for a number of DGs:

- The **synergy with DG ENV** was strengthened in the TG-DATA, where it was demonstrated that Member States can provide INSPIRE Compliant data according to MSFD Art. 19(3) via EMODnet Chemistry platform. In addition, EMODnet Chemistry shared eutrophication and contaminants data with EEA and started a process for customising the data sharing to the reporting needs. Finally, EMODnet Chemistry supported TG ML and JRC in the development of the European beach litter database and is already projected to interact for seafloor and micro-litter components. Dedicated resources are assigned to each compartment, which has its own criticism and requires focused efforts (e.g. nutrients and contaminants needs to be completed with detailed information on the data collection method, contaminants spread into more than one thousand parameters that would need to be homogenised to evaluate if the results can be comparable, marine litter opened a completely new section where the standardisation still needs to be defined).
- The **synergy with DG GROW** through Copernicus Marine Services was signed with a dedicated MoU intended to share products and services available for the marine community. In addition, EMODnet Chemistry results for MSFD will be shared for a common benefit.
- The **synergy with DG RTD** represents a good example of interaction with different goals but sharing knowledge, expertise, practices and technology without overlapping the activities. This guarantees funding to the EMODnet Chemistry data platform adopted and adapted for different purposes.
- United Nations undertakes efforts towards the International Decade of Ocean Science for Sustainable Development (2021-2030) as a unique opportunity to engage the ocean science community in archiving SDG14 – globally, regionally and locally. EMODnet represents a crucial element contributing to the data flow from national to global level to achieve globally integrated observations and data sharing.

12 List of abbreviations and acronyms

BSCS is the Black Sea Commission Secretariat.

CDI, Common Data Index, provides a highly detailed description of the data, answering to the questions: where, when, how and who collected the data, and how to get them. One CDI describes a data series which can be a vertical profile on a fixed location, a time series or a trajectory data set.

CMEMS, the Copernicus Marine Environment Monitoring Service (led by Mercator-Océan).

CorMon, UNEP Correspondence Group of the Ecosystem Approach

DeFishGear, Derelict Fishing Gear Management System in the Adriatic Region is the 3-year long project implemented within the framework of the IPA Adriatic Cross-border Cooperation Programme, co-funded by the European Union.

DIN is Dissolved Inorganic Nitrogen.

DIVA, Data-Interpolating Variational Analysis, is a software tool that allows to spatially interpolate (or analyse) observations on a regular grid in an optimal way.

EDMO is the European Directory fo Marine Environmental Data.

EQS, Environmental Quality Standards.

EQSD, Environmental Quality Standards Directive (Legislative instrument).

GES is Good Environmental Status.

HELCOM Convention = Baltic Marine Environment Protection Commission is the governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, known as the Helsinki Convention.

INSTAC is the In Situ Thematic Assembling Centre of CMEMS in charge of in-situ data delivery.

LOD, Limit Of Detection, means the output signal or concentration value above which it can be affirmed, with a stated level of confidence that a sample is different from a blank sample containing no determinand of interest.

LOQ, Limit Of Quantification, means a stated multiple of the limit of detection at a concentration of the determinand that can reasonably be determined with an acceptable level of accuracy and precision. The limit of quantification can be calculated using an appropriate standard or sample, and may be obtained from the lowest calibration point on the calibration curve, excluding the blank.

MEDITS is the International bottom trawl survey programme in the Mediterranean.

MoU is Memorandum of Understanding.

MSFD is Marine Strategy Framework Directive.

NODC, National Oceanographic Data Centre defined within the International Oceanographic Data Exchange (IODE) System of the UNESCO Intergovernmental Oceanographic Commission (IOC).

Ocean Browser is the EMODnet Chemistry data products viewing and downloading service that allows to visualize gridded fields on-line. It is based on open standards from the Open

Geospatial Consortium (OGC), in particular Web Map Service (WMS) and Web Feature Service (WFS).

ODV, Ocean Data View, is a freely available software package that provides interactive exploration, analysis and visualization of oceanographic and other geo-referenced profiles or sequence data. ODV and NetCDF data file formats are used as mandatory data exchange format in SeaDataNet/EMODnet Chemistry.

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

P01 = British Oceanographic Data Centre (BODC) Parameter Usage Vocabulary, is one of SeaDataNet Common Vocabularies based upon a semantic model that is the simple concatenation of three 'themes' (what, where/matrix and how/methods) and used to describe individual measured phenomena in ODV data transport format. P01 are narrower terms of P02. At present P01 already contains more than 30.000 concepts.

P02 = SeaDataNet Parameter Discovery Vocabulary, is one of SeaDataNet Common Vocabularies describing fine-grained related groups of measurement phenomena designed to be used in dataset discovery interfaces (namely CDI metadata records).

P35 = EMODnet chemistry lot aggregated parameter names, is one of SeaDataNet Common Vocabularies used to facilitate data aggregation and data labelling (as in products description).

QA/QC = Quality Assurance/Quality Control.

Robot Harvester is the system used for discovery and gather data from SDN infrastructure of distributed NODCs via the CDI Discovery and Shopping mechanism with an almost full automatic method. It is configured to harvest data on selected sea areas (or MSFD regions) and for specific chemical parameters.

RSC are Regional Sea Conventions.

SDN, SeaDataNet is the pan-European infrastructure for ocean & marine data management sponsored within FP7 (grant agreement 283607, 1/10/2011-30/9/2015) linking more than 100 national oceanographic data centres and marine data centres from 35 countries riparian to all European seas.

Sextant products metadata catalogue is the EMODnet Chemistry data products discovery service used for searching Chemistry data products and linking to the viewing service.

TG DATA is the MSFD Common Implementation Strategy Technical Group on Marine Data.

TG-ML is the MSFD Common Implementation Strategy Technical Group on Marine Litter

TN is Total Nitrogen.

UNEP/MAP is the United Nations Environment Programme, Mediterranean Action Plan for the Barcelona Convention adopted by 16 Mediterranean countries and the European Community.

VRE, Virtual Research Environment.

WPS, Web Processing Services.