EMODnet Lot 3 – Chemical data

SECOND INTERIM REPORT

Version 1.0

From 4/6/2010 to 4/12/2010

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INTRODUCTION

EMODnet Chemical pilot is undertaken by **25 partners** representing the SeaDataNet network of Data Centres, selected on their geographical coverage and specific expertise. These Data Centres already manage a large volume of relevant data sets and can enlarge the available data collections with relevant data sets from a number of data holders in their country. Moreover the SeaDataNet partnership includes ICES, which acts as data centre for monitoring data for OSPAR, HELCOM and EIONET, and that brought in this volume of data sets.

The EMODnet Chemical tender asks for data sets from the **Greater North Sea** and the **Black Sea** region. However, we planned to expand the pilot regions with **five spots from the Mediterranean** (Balearic Sea, Gulf of Lion, North Adriatic Sea, Gulf of Athens and NE Levantine basin).
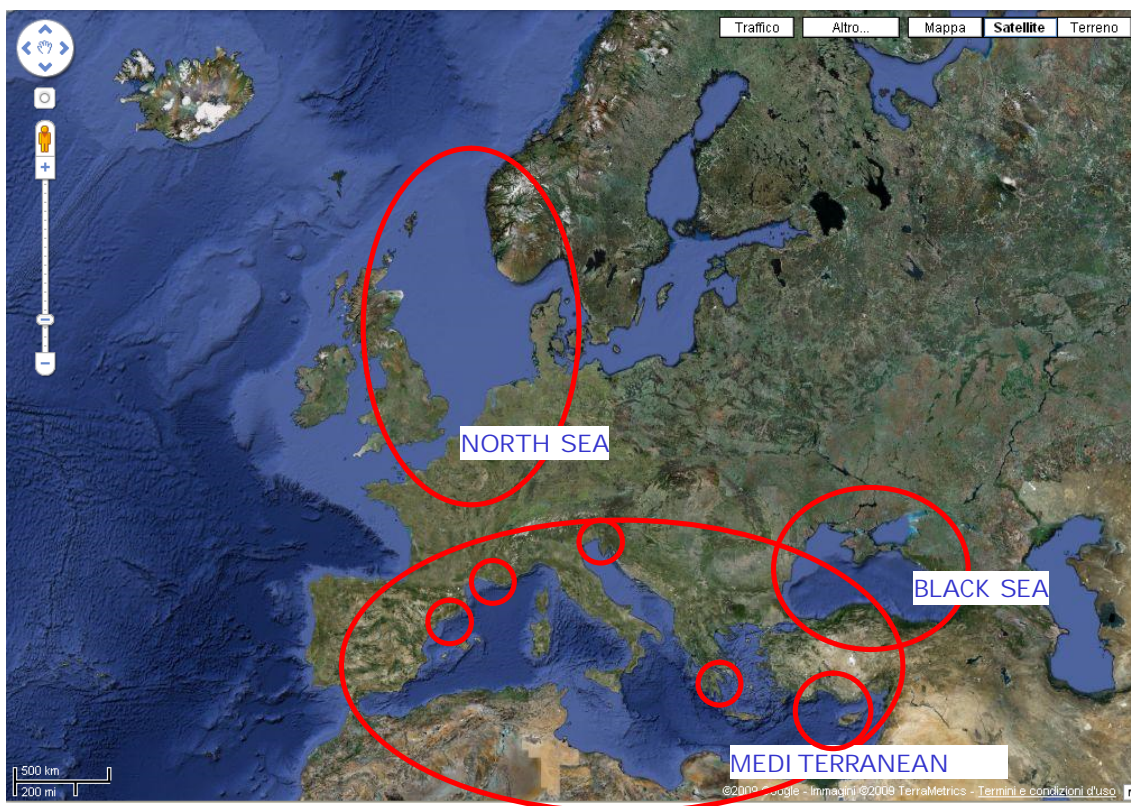
EMODnet Chemical pilot is focused on the **groups of chemicals** required for monitoring the Marine Strategy Directive:

1. synthetic compounds (i.e. pesticides, anti foulants, pharmaceuticals),

2. heavy metals,

3. radio nuclides;

4. fertilisers and other nitrogen- and phosphorus-rich substances;

5. organic matter (e.g. from sewers or mariculture);

6. hydrocarbons including oil pollution.

This Second Interim Report describes the activities carried out during the first six months of second year of EMODnet chemical pilot (4th of June 2010 – 3rd of December 2010), the deliverables produced by each work package as specified in the Technical Tender Form for Lot 3 – Chemical Data and any deviation from the project tender.

Based on SeaDataNet experience, the following strategy was proposed as approach for the EMODnet pilots:

- Develop a high-end dedicated portal, outfitted with a powerful spatial database, that is complemented with WMS, WFS and WCS services (OGC) to serve users and to provide layers for e.g. the other EMODnet portals, the prototype European Atlas of the Seas, and the broad-scale European Marine Habitats map;

- Provide data sets for producing interpolated maps with specific resolution for each geographical region, that are loaded and integrated afterwards into the portals' spatial database;

- Include a metadata discovery service in the portal, by adopting the SeaDataNet CDI metadata standard, that inter alia gives clear information about the background data, the access restrictions and distributors; this also ensures the connection of the EMODnet portals with the SeaDataNet distributed infrastructure.

In fact, EMODnet Chemical lot has used SeaDataNet V1 infrastructure for the technical set-up. This means:

- SDN Standards for background data, metadata and product,

- CDI mechanism to access data with data policy,

- ODV format for background data exchange,

- SDN Security Services for users registrations, and SDN Delivery Services for data access and downloading,

- DIVA software tool to produce gridded data products and error maps as NetCDF files,

- SDN Products catalogue (CAMIOON system) and SDN Products viewing services for free unlimited discovery, access, visualization and downloading of data products.

Nevertheless, during the first year the need of specific instruments to visualise the chemical data was highlighted. In fact, this chemical pilot is focused on a set of parameters showing a non homogeneous spatio-temporal distribution. A specific workshop has been organised to face the issue.

This Second Interim Report is organised into 5 sections, where the progress made in the 5 work packages according to the tender planning of activities is summarised. These are:

1 – Project management,

2 - Data collection and metadata compilation,

3 - QC/QA and products,

4 - Technical development and portal operation,

5 – Analysis and evaluation.

Some final remarks are given in the final section.

1.   PROJECT MANAGEMENT (WP1)

During the first six months of the second year of EMODnet chemical pilot (4th of June 2010 – 3rd of December 2010), corresponding to the Test and Monitor phase, the project management activities continued. In particular, the following meeting were organised:

-    4th Coordination group meeting, 05-06 July 2010, Trieste (Italy);

-    Expert Group meeting, 20-21 September 2010, Venice (Italy);

-    5th Coordination group meeting, 21 September 2010, Venice (Italy).

A report and/or action list is available in EMODnet Extranet for each event.

Moreover, OGS and representatives from the Chemical lot participated to:

- Third six-monthly progress meeting for ur-EMODNET preparatory actions, 29 November 2010, Brussels.

Finally, OGS with the contribution of all partners edited and revised the First Interim Report. Then were distributed the expected payments to each partner, when the relevant invoice or debit note was received.

About Venice Experts meeting

The expert meeting was organized inviting the coordination group and experts on data management, on marine chemistry and contaminants fields. The aim was to discuss what kind of products could be produced with data coming from EMODnet Chemistry data collection and the way to validate products. People that attended at meeting where:

-	Alessandra Giorgetti	OGS
-	Matteo Vinci	OGS
-	Alberto Brosich	OGS
-	Dick Schaap	MARIS
-	Mark Charlesworth	NERC-BODC
-	Anders Windelin	NERI
-	Eugeny Godin	MHI
-	Sissy Iona	HCMR
-	Gilbert Maudire	IFREMER
-	Charles Troupin	Ulg
-	Simon Claus	VLIZ
-	Rob Fryer	Marine lab in Scotland
-	Shepherd Iain	Shepherd Iain, European Commission; Directorate-General MARE
-	Pyhälä Minna	HELCOM Helsinki Commission
-	Volodymyr Myroshnychenko	BSC Commission for the Protection of the Black Sea Against Pollution Permanent Secretariat

- Beken Çolpan   Marmara Research Center of Turkish Scientific and Technological Council, TUBITAK

- Michael Angelidis   UNEP/MAP - MEDPOL Programme Officer

Presentations are available in the EMODnet Chemical portal at:

http://www.emodnet-chemistry.eu/portal/portal/emodnet/Meetings/CMSPortletWindow_27?action=2&uri=%2Fdefault%2Fnews%2Fpresentation_venice.html

The meeting was organized in a first session where a general introduction about the EMODnet Chemistry was given.

The session continued with the Regional Task Leaders for the three regions of interest. They described the situation of the data harvesting, the available data distribution in space and time and the metadata compilation.

Then the experts and the representative of Marine Conventions invited presented their activities and started open discussions about: chemical data and metadata availability and harvesting, data and metadata normalization, data analysis and possible products generation.

The open discussions were focused on :

- Review and discussion on EMODnet Chemical data and products availability;

- Review how to move from data to products, what kind of products can be done with EMODnet Chemical data;

- Best way of answering users needs from different sectors.

A summary of Experts feedback:

- Was suggested to take care of the "friendly" and "easy to use" approach of product viewing interface. The last updates of the viewing services described on the technical development of this report section followed these criteria.

- Was highlighted to show in a clear way how the products have been compiled and the datasets used. This will be done by the adoption of Camioon products metadata catalogue.

- There was long discussion about the kind of products to provide to users. Two main kind of products were discussed:

    o Interpolated maps for data with a suitable spatial coverage;

    o Not interpolated products for the other kind of data.

    All the parameters measured in the water column seem to have typically a spatial coverage suitable to provide interpolated maps.

    The situation is different especially for data from Biota and Sediment matrixes. These have a spatial distribution too sparse or limited to coastal areas, not suitable to make standard Diva analysis. The discussion brought to some conclusions. To manage properly this situation the Chemical lot will need to make a good work of analysis, normalization and metadata collection in order to obtain homogeneous datasets well

described. Then the idea is to show stations on maps linked to plots that describes the time series of measurements for each parameter considered. A first prototype of this kind of products was already presented during the November 2010 progress report in Bruxelles and is described in technical development section of this report.

- Was highlighted to be careful to collect and provide the best metadata available describing for example: sediment fraction measured, dry/wet weights measurements, measurement methodology. This in order to help a correct comparison between homogeneous sets of data and analyses. The continuous update of SDN common vocabularies helps to manage this.

A synthesis of the general conclusions from the action list of Expert workshop is:

- To show data availability maps. The matrix "Variables VS Marine regions" described in the technical development section could be a good answer to this.

- Standard Diva Interpolated maps will be produced for parameters with suitable data coverage, measured on basin scale.

- For parameters with a spatial coverage like:
    o coastal points repeated in time
    o datasets with fragmented coverage

  the common idea is to show station maps linked to plots of measured time series.

About the issue several time suggested to aggregate products and present graphs on demand the point of view of the coordination group was more focused on consistency of analysis and products meaning than on the difficulty of the technical development.

More than one time was proposed to the Chemistry Lot to provide a "more interactive" approach for users. The proposals were to provide services able to generate "on demand" maps by a free choice of datasets of interest.

Several discussions of the coordination group about this were done. The conclusions were focused on the issue that data managed by the Chemistry Lot are too "sensitive" for this kind of approach. In fact these data are already very much sensitive to analyze and to interpret for the expert that works in the Chemical Oceanography field. Furthermore the feedback from the experts about this was that we must pay attention on the meaning of products that we obtain. One of the benefits of the pre-prepared products approach is the possibility to quality-check them before to let them available.

Talking about the technical point of view the generation of graphics on-the-fly is certainly a desirable capability. It allows close interaction with the underlying data set (for example, adjusting the scale of the time series to make graphs directly comparable to data from another source). This capability would require low-latency machine-to-machine access to the data set. The current system is build on machine-to-human interaction. The SeaDataNet 2 proposal is specifically addresses on this issue. If funded it will provide the machine-to-machine infrastructure which is required to generate aggregated products and graphs on demand. Of course, despite the reachable technical upgrade about on-demand products, we always must find the way to keep the eyes on the quality of possible dynamically generated products. This to prevent wrong or dubious conclusions.

2.   DATA COLLECTION AND METADATA COMPILATION (WP2)

The contribution to data collection and metadata compilation by each EMODnet partner was presented at the Bruxelles progress meeting.

The overview of the progress on data collection and metadata compilation in the three regions is given here.

Based on MSFD requirement, on the data distribution in time and space (as time series geographically representative), a set of chemicals was selected from the 8 groups in the 3 matrices (water column, sediment, biota), to make a set of 17 selected parameters for product generation in the three regions. All these parameters were mapped to SeaDataNet vocabularies (mainly P021 for CDI and P061 for units, and P011 for ODV) as reported in the following tables.

	water column			
EMNC	Chemical group	Parameter	SDN P021 CODE	SDN PARAMETERS P021 TERM
C1	Pesticides	Dichlorodiphenyltrichloroethane (DDT)	PEWB	Pesticide concentrations in water bodies
C2	Pesticides	Hexachlorobenzene (HCB)	PEWB	Pesticide concentrations in water bodies
C3	Antifoulants	Tributyltin (TBT)	WCOC	Concentration of other organic contaminants in the water column
C4	Antifoulants	Triphenyltin (TPT)	WCOC	Concentration of other organic contaminants in the water column
C5	Pharmaceuticals	Oxytetracycline ($C_{22}H_{24}N_2O_9$)	PHWB	Pharmaceutical concentrations in water bodies
C6	Heavy metals	Mercury (Hg)	MTWD	Dissolved metal concentrations in the water column
C6	Heavy metals	Mercury (Hg)	MTWT	Total metal concentrations in the water column
C6	Heavy metals	Mercury (Hg)	MTWP	particulate metal concentrations in the water column
C7	Heavy metals	Cadmium (Cd)	MTWD	Dissolved metal concentrations in the water column
C7	Heavy metals	Cadmium (Cd)	MTWT	Total metal concentrations in the water column
C7	Heavy metals	Cadmium (Cd)	MTWP	particulate metal concentrations in the water column
C8	Heavy metals	Lead (Pb)	MTWD	Dissolved metal concentrations in the water column
C8	Heavy metals	Lead (Pb)	MTWT	Total metal concentrations in the water column
C8	Heavy metals	Lead (Pb)	MTWP	particulate metal concentrations in the water column
C9	Hydrocarbons	Anthracene ($C_{14}H_{10}$)	PCHW	column
C10	Hydrocarbons	Fluoranthene ($C_{16}H_{10}$)	PCHW	column
C11	Radionuclides	Tritium	WRAD	Radioactivity in the water column
C12	Radionuclides	Cesium 137	WRAD	Radioactivity in the water column
C13	Radionuclides	Plutonium 239	WRAD	Radioactivity in the water column
C14	Fertilisers/Nitrogen	Nitrate (NO_3)	NTRA	Nitrate concentration parameters in the water column
C15	Fertilisers/Phosphorus	Phosphate (PO_4)	PHOS	Phosphate concentration parameters in the water column
C16	Organic matter	Organic Carbon (C)	CORG	Particulate total and organic carbon concentrations in the water column
C17	Organic matter	Organic Nitrogen (N)	NTOT	Particulate total and organic nitrogen concentrations in the water column

	sediment			
EMNC	Chemical group	Parameter	SDN P021 CODE	SDN PARAMETERS P021 TERM
C1	Pesticides	Dichlorodiphenyltrichloroethane (DDT)	PESD	Pesticide concentrations in sediment
C2	Pesticides	Hexachlorobenzene (HCB)	PESD	Pesticide concentrations in sediment
C3	Antifoulants	Tributyltin (TBT)	SCOC	Concentration of other organic contaminants in sediment samples
C4	Antifoulants	Triphenyltin (TPT)	SCOC	Concentration of other organic contaminants in sediment samples
C5	Pharmaceuticals	Oxytetracycline ($C_{22}H_{24}N_2O_9$)	PHSE	Pharmaceutical concentrations in sediments
C6	Heavy metals	Mercury (Hg)	MTSD	Metal concentrations in sediment
C7	Heavy metals	Cadmium (Cd)	MTSD	Metal concentrations in sediment
C8	Heavy metals	Lead (Pb)	MTSD	Metal concentrations in sediment
C9	Hydrocarbons	Anthracene ($C_{14}H_{10}$)	SCAH	sediment samples
C10	Hydrocarbons	Fluoranthene ($C_{16}H_{10}$)	SCAH	sediment samples
C11	Radionuclides	Tritium	SRAD	Radioactivity in sediment
C12	Radionuclides	Cesium 137	SRAD	Radioactivity in sediment
C13	Radionuclides	Plutonium 239	SRAD	Radioactivity in sediment
C16	Organic matter	Organic Carbon (C)	CBSD	Carbon concentrations in sediment
C17	Organic matter	Organic Nitrogen (N)	NTSD	Nitrogen concentrations in sediment
C14	Fertilisers/Nitrogen			
C15	Fertilisers/Phosphorus			

	biota			
EMNC	Chemical group	Parameter	SDN P021 CODE	SDN PARAMETERS P021 TERM
C1	Pesticides	Dichlorodiphenyltrichloroethane (DDT)	PEBI	Pesticide concentrations in biota
C2	Pesticides	Hexachlorobenzene (HCB)	PEBI	Pesticide concentrations in biota
C3	Antifoulants	Tributyltin (TBT)	BCOC	Concentration of other organic contaminants in biota
C4	Antifoulants	Triphenyltin (TPT)	BCOC	Concentration of other organic contaminants in biota
C5	Pharmaceuticals	Oxytetracycline ($C_{22}H_{24}N_2O_9$)	PHBI	Pharmaceutical concentrations in biota
C6	Heavy metals	Mercury (Hg)	BCMT	Metal concentrations in biota
C7	Heavy metals	Cadmium (Cd)	BCMT	Metal concentrations in biota
C8	Heavy metals	Lead (Pb)	BCMT	Metal concentrations in biota
C9	Hydrocarbons	Anthracene ($C_{14}H_{10}$)	BCAH	Concentration of polycyclic aromatic hydrocarbons
C10	Hydrocarbons	Fluoranthene ($C_{16}H_{10}$)	BCAH	Concentration of polycyclic aromatic hydrocarbons
C11	Radionuclides	Tritium	BRAD	Radioactivity in biota
C12	Radionuclides	Cesium 137	BRAD	Radioactivity in biota
C13	Radionuclides	Plutonium 239	BRAD	Radioactivity in biota
C14	Fertilisers/Nitrogen			
C15	Fertilisers/Phosphorus			
C16	Organic matter			
C17	Organic matter			

Data collection started with nutrients in the water column, was then extended to all other selected chemicals in the water column (organic matter – DOC and TN, …), and to synthetic compounds, hydrocarbons and heavy metals in the sediments and biota (considering the target species MYTILUS). This was the target for 3 regions, but at the data distribution is very different. This is mainly depending by the historical background on the geographic area that has a strong impact on present data monitoring and data management activity.

All partners produced ODV files and sent them to the regional task leaders (NERI, MHI, and HCMR). Besides, all partners produced the CDI entries to link the collected data to EMODnet CDI User interface.

2.1   DATA COLLECTION IN THE NORTH SEA – REGIONAL DATA POOL

A lot of the data concerning the EMODnet chemical parameters are also available in the ICES database DOME. Therefore an extraction from DOME to the regional data pool (EMODnet Chemical Buffer Database) has been done. The Greater North Sea partners only have to report additional datasets (except nutrients). For this purpose ICES distributed to all partners in the region a worksheet with the content of the database per submitting institute, per parameter and per matrix in order to determine what additional data had not already been included. The handling of duplicates in a systematic and operational way is beyond the scope of the EMODNET Chemical pilot and it has been included in the context of the SeaDataNet II proposal, where it is intended to tackle the issue for all nodes in the distributed network.

The boundaries for the area covered are the following:

The EMODnet Chemical Buffer database (North Sea regional data pool) was initially created from ICES database (DOME). The buffer aggregates all the data from the regional partners. All the data will be used to produce the products, even restricted data. However these will be treated as restricted in case of user requests. All metadata will be included in SeaDataNet infrastructure (CDI User Interface).

A short overview of the EMODnet Chemical data collection for the Greater North Sea with collected samples per parameter per matrix is shown in the table (status November 2010):

Parameter Group	Parameter	WATER COLUMN	SEDIMENT	BIOTA
Pesticides	Dichlorodiphenyltrichloroethane (DDT)	1.317	1.219	14.233
Pesticides	Hexachlorobenzene (HCB)	609	1.260	16.843
Antifoulants	Tributyltin (TBT)	510	894	1.513
Antifoulants	Triphenyltin (TPT)	125	378	182
Pharmaceuticals	Oxytetracycline ($C_{22}H_{24}N_2O_9$)	Not in the CBD database at the moment		
Heavy metals	Mercury (Hg)	1.783	6.685	67.042
Heavy metals	Cadmium (Cd)	3.217	6.695	58.378
Heavy metals	Lead (Pb)	1.178	4.771	57.775
Hydrocarbons	Anthracene ($C_{14}H_{10}$)	166	11.977	1.502
Hydrocarbons	Fluoranthene ($C_{16}H_{10}$)	228	8.856	1.630
Radionuclides	Tritium	Not in the CBD database at the moment		
Radionuclides	Cesium 137	Not in the CBD database at the moment		
Radionuclides	Plutonium 239	Not in the CBD database at the moment		
Nutrients	Nitrate (NO_3)	77.654	0	0
Nutrients	Phosphate (PO_4)	90.811	0	0
Organic matter	Organic Carbon (C)	25.169	54.422	0
Organic matter	Organic Carbon (N)	0	735	0

The first EMODnet Chemistry goal is to collect data and show reliable and useful interpolated maps. A remark about the possibility to generate and provide maps to users brought to do an analysis about data spatial and temporal distribution.

This analysis highlighted that:

- in the biota matrix data collection there are many different species and items measured (liver, muscles ...)

- in the sediment matrix there are different grain size categories

- a lot of the measurements from biota and sediment matrix are few coastal stations with repeated measurements during time

The previous situations bring to manage small, homogeneous datasets without a good spatial coverage to provide interpolated maps. To illustrate the highlighted points some analysis on data spatial and temporal distribution are shown.

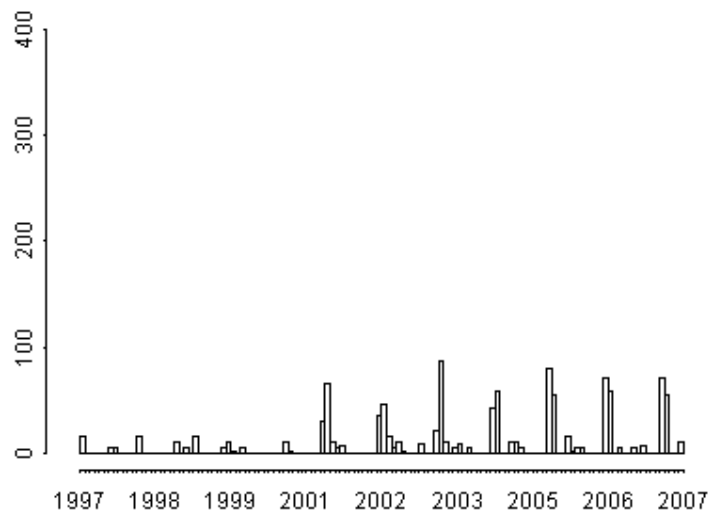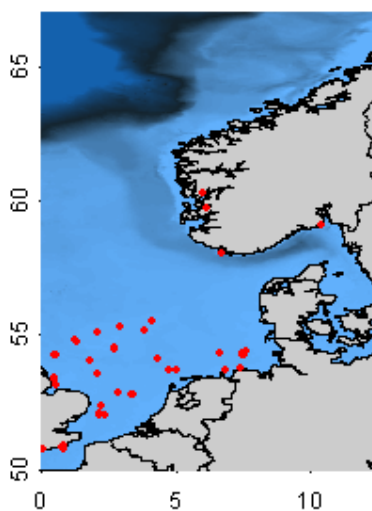**Matrix Biota** – spatial and temporal coverage analysis for North Sea:

Overall data distribution: the spatial distribution map of samples on the left and the temporal distribution plot on the right are both good.
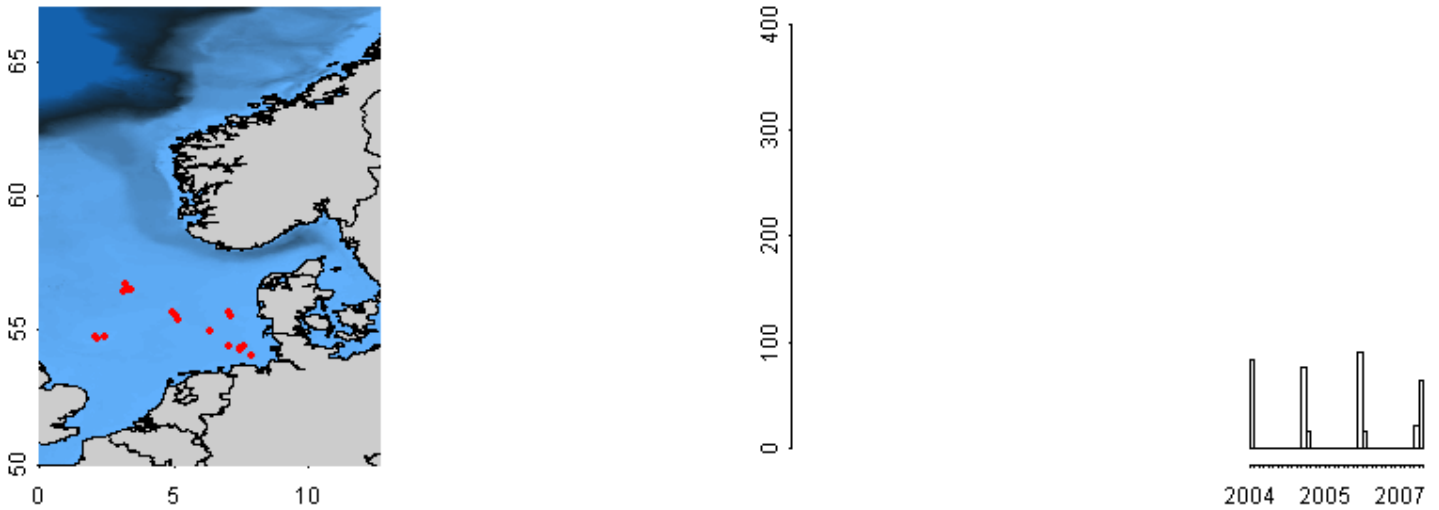

MATRIX: BIOTA
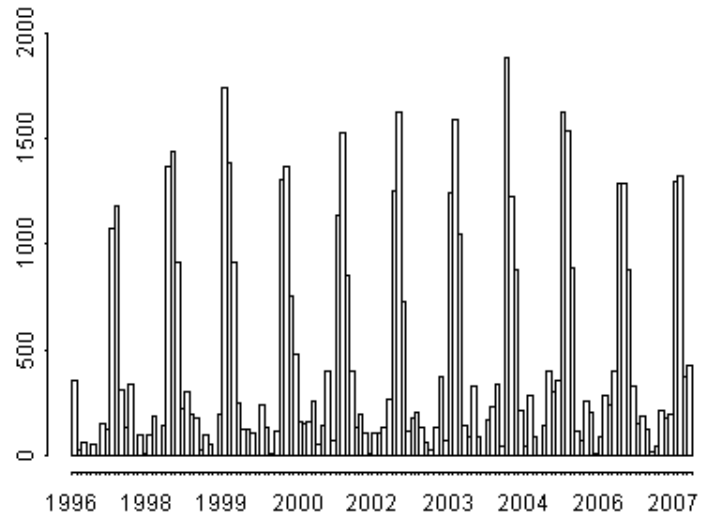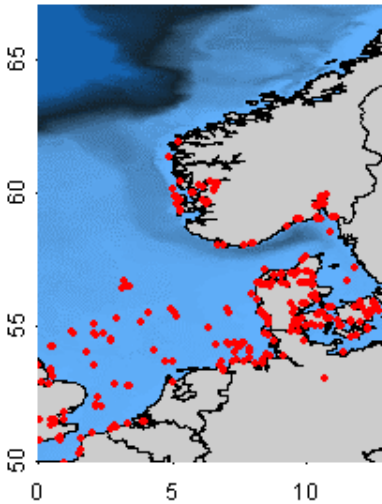
Limanda limanda liver measurements data distribution: the spatial distribution of samples on map on the left is not good, the temporal distribution plot on the right could be better.
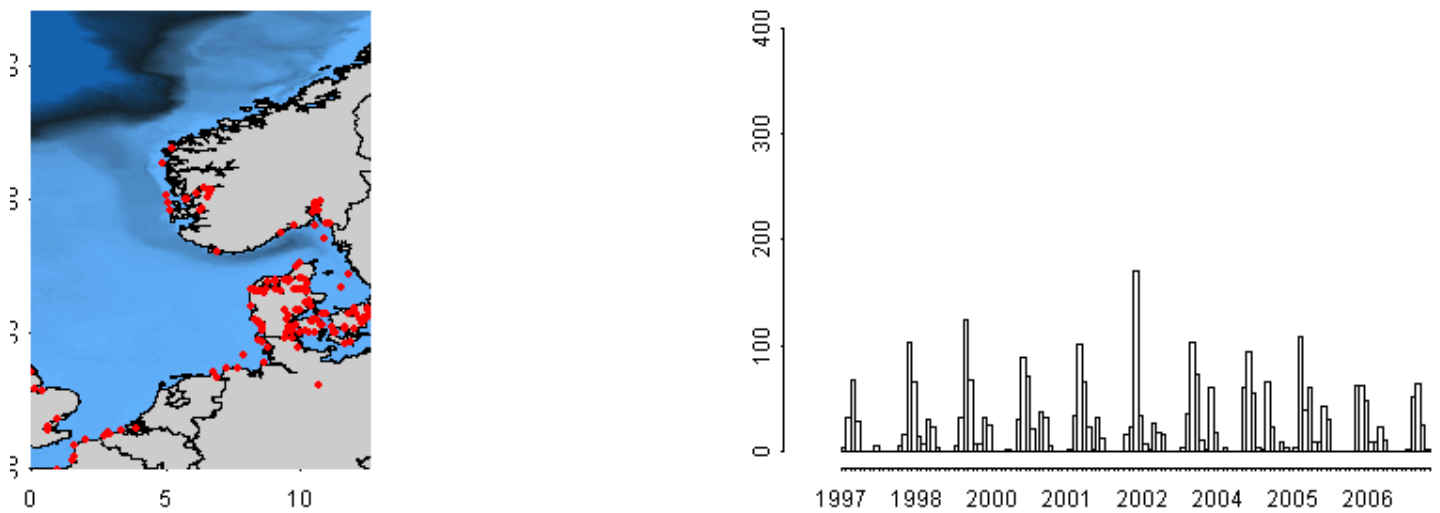

PB in LI Limanda limanda Biota

Limanda limanda muscle measurements data distribution: the spatial distribution map of samples on the left and the temporal distribution plot on the right are not good.

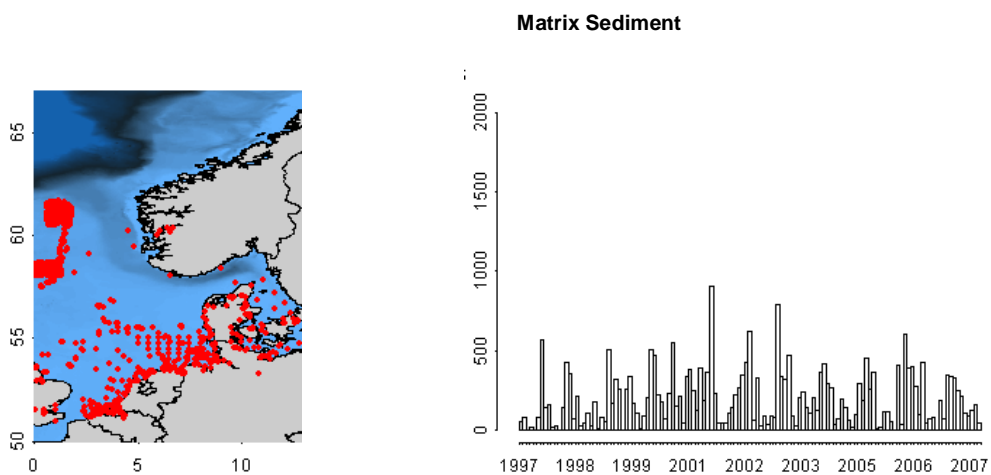
PB in MU Limanda limanda Biota

Mytilus edulis soft part measurements data distribution : the : the spatial distribution map of samples on the left shows only coastal stations with a poor coverage on the entire basin, the temporal distribution plot on the right is good.


PB in SB Mytilus edulis Biota

Matrix Sediment – spatial and temporal coverage analysis for North Sea:

Overall data distribution: the spatial distribution map of samples on the left and the temporal distribution plot on the right are both good.

Matrix Sediment

Sediment fraction 2000 (µm) data distribution: the spatial distribution map of samples on the left shows only coastal stations with a poor coverage on the entire basin, the temporal distribution plot on the right could be better.

PB in SED2000 Sediment
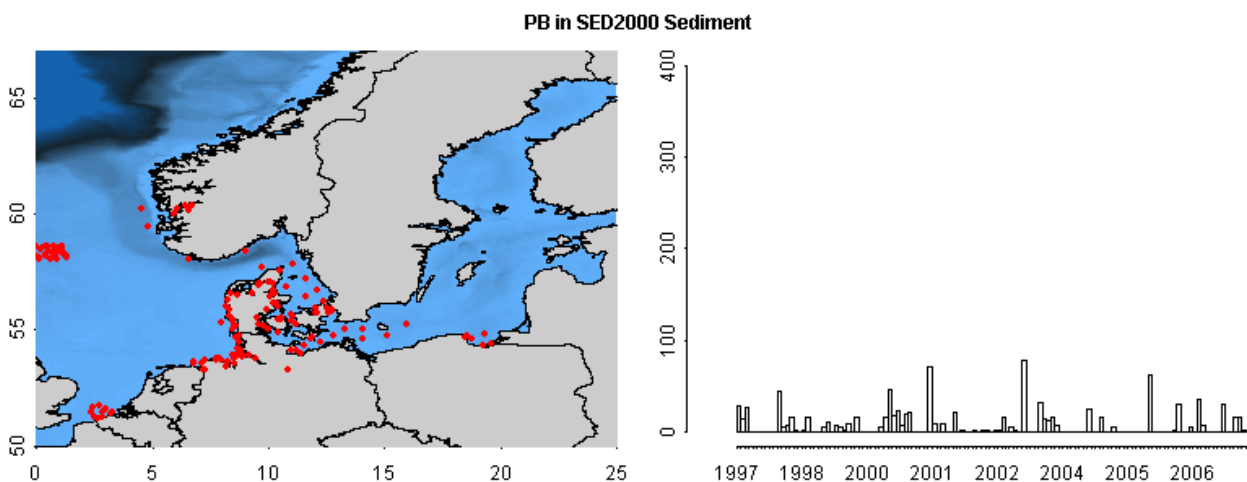
2.2   DATA COLLECTION IN THE BLACK SEA

The data collected in Black Sea are summarised in the following table (status at November 2010):

Nr00	Partner	Country	Total profiles	Measurements									
				O2	PO4	Total P	PH	Alk	SIO3	NO2	NO3	NH4	Total N
13	RIHMI-WDC	RU	904	5343	3680	3	3404	635	2469	1654	280	33	14
14	SIO-RAS	RU	147	888	837	249	226	286	855	311	361	876	152
15	MHI	UA	2500	16946	877	306	127	839	379	2361	2601	436	488
16	IO-BAS	BG	124	865	277	703	248	0	0	0	0	0	0
17	NIMRD	RO	2268	9995	6548	0	0	0	10207	6892	7729	5275	0
18	TSU-DNA	GE	10	20	25	0	0	0	0	27	30	29	27
	Yug NIRO	UA	215	1265	365	0	0	0	122	39	0	0	0
	Mb UHMI	UA	144	745	214	0	0	64	118	0	0	0	0
	Ukr SCES	UA	1916	3587	1578	819	1456	0	0	1155	549	0	836
	TOTAL		8228	39654	14401	2080	5461	1824	14150	12439	11550	6649	1517

| Nr	Partner	Country	Total profiles	Measurements							
				DDT	Pb	Hg	Cd	Cs-137	Cs-134	Sr-90	Heavy metals in sediments
14	RIHMI-WDC	RU	398	98	100	100	100	0	0	0	0
15	MHI	UA	1267	0	0	0	0	422	422	423	75
18	TSU-DNA	GE		0	0	0	0	0	0	0	349
	TOTAL		1665	98	100	100	100	422	422	423	424

At the moment, about the Black Sea data source situation, we have complete information only from some countries. For example about Ukraine, Russia and Georgia we are informed that there is no exact difference between "research" and "environment" agencies. Indeed the data are mostly from "research" agencies because "environment" (non-governmental) agencies have no proper equipment to measure chemical elements and pollutants in seawater.

Specifically about Ukraine only UkrSCES can be considered as environment agency and it is a component of the governmental ecological structure. A part of the Black Sea data are from them. At the moment, as presented during the last meeting in Bruxelles, this data are passing the quality check procedure.

Still in Ukraine there is an ecological station under Odessa National University located on Zmeiny island. It is not a research agency either. Black Sea data pool plan to receive data from it within 2011. Besides this they hope to get some additional data from the institutions participating in BlackSeaScene Upgrade Project in 2011.

At the moment about Bulgaria and Romania we don't have enough information to describe their situation.

Black Sea spatial distribution of profiles:
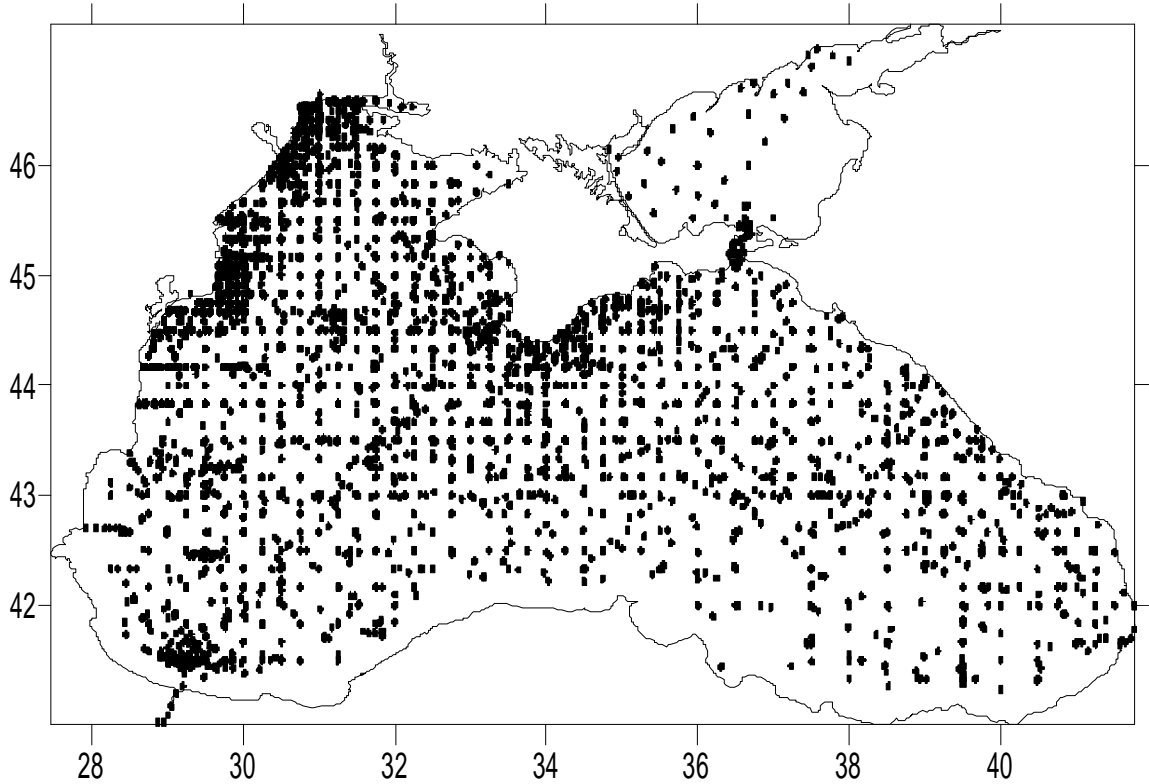
2.3   DATA COLLECTION IN THE MEDITERRANEAN SEA

In the Mediterranean Sea 5 spots were identified:

- Balearic Sea
- Gulf of Lion
- North Adriatic Sea
- Gulf of Athens
- NE Levantine basin

The data collected for the water column in 5 spots of the Mediterranean Sea are summarized in the 5 column of the following table (status at November 2010):

PARAMETERS	SPAIN: 3153 st	FRANCE: 826 st	ITALY: 2482 st	GREECE: 1681 st	CYPRUS: 136 st
FERTILAISERS					
NTRA [millimole/m3] NITRATE (C14)	2532	435	1706	1668	101
PHOS [millimole/m3] PHOSHATE (C15)	2518	512	1542	1665	102
ORGANIC MATTER					
TOCW [millimole/m3] TOTAL ORGANIC CARBON (C16)				274	
Particulate Organic Carbon (C16)					
POCP [milligram/m3]PARTICULATE ORGANIC CARBON/POC		56			
PC1P [millimole/m3] PARTICULATE ORGANIC CARBON/POC			360	629	
Dissolved Organic Carbon (C17)					
CORG [millimole/m3] Dissolved Organic Carbon		56	367		
Particulate Organic Nitrogen (C17)					
PONP [milligram/m3] PARTICULATE ORGANIC NITROGEN		42			
PN1P [millimole/m3] PARTICULATE ORGANIC NITROGEN		17			
Dissolved Organic Nitrogen (C17)					
NORG [millimole/m3] DISSOLVED ORGANIC NITROGEN		57			
HEAVY METALS					
Dissolved Cd [ng/l] (C7)				701	
Dissolved Pd [ng/l] (C8)				702	
Suspended Cd [ng/l] (C7)				486	
Suspended Pd [ng/l] (C8)				550	
RADIONUCLIDES					
Cesium 137 [mBq/l] (C12)					15

The data collected for Biota Matrix of the Mediterranean Sea in the following table (at the moment only Greece supplied Biota matrix data):

Parameters	Cyprus	Greece	France	Italy	Spain
Heavy Metal					
Cd (C7)*		133 samples *			
Pd (C8)*		21 samples *			
Pesticides					
DDT (C1)*		74 samples			
HCB (C2)*		54 samples			

Mediterranean Sea spatial data distribution for water column stations:
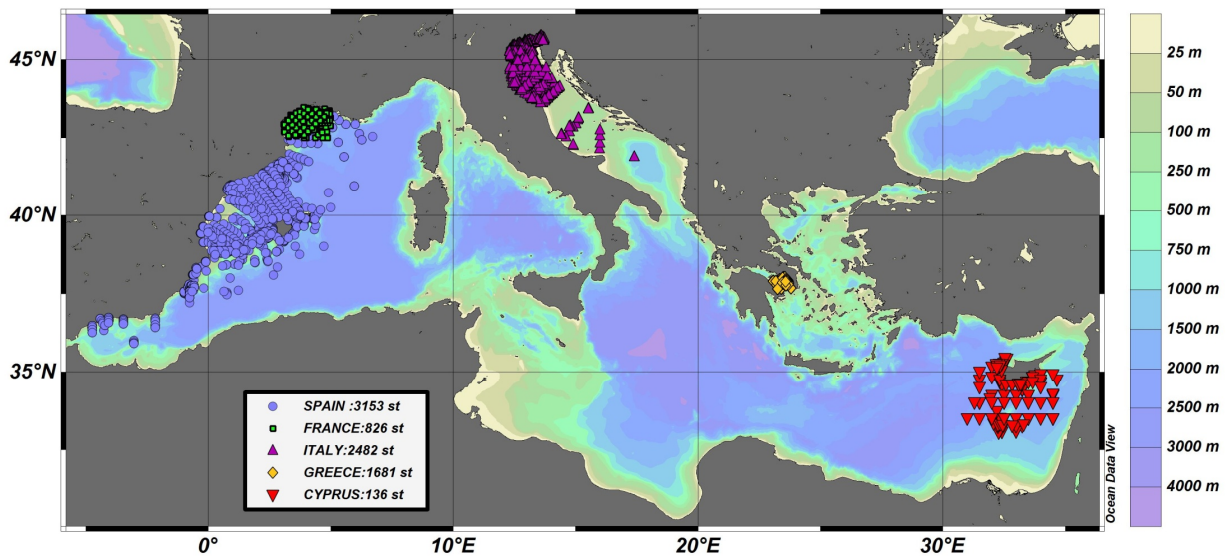
Synthesis about spatial and temporal distribution analysis on the water column:

A well detailed analysis showing temporal and spatial distribution of collected measurements, provided by Mediterranean Regional Task Leader, was presented in Bruxelles at progress meeting of end November 2010. The presentation is now available on the extranet of dedicated portal.

Here a synthesis about the results of analysis is presented:

- **Spain**: the analysis about measurements spatial and temporal distribution highlighted that the seasonal time scale is the best choice for interpolated products generation.

- **France**: the analysis about measurements spatial and temporal distribution highlighted that the seasonal time scale is the best choice for interpolated products generation.

- **Italy**: The first dataset sent has got an error that doesn't allow the import of all stations. A correct data set has been requested to perform the complete analysis.

- **Greece**: the analysis about measurements spatial and temporal distribution highlighted that the seasonal time scale and selected years are the best choice for interpolated products generation.

- **Cyprus**: the monthly time scale of specific years was chosen for the interpolated products generation.

By seasonal time scale it is meant the division of all available years in four seasons (winter, spring, summer, fall).

As winter are selected the first three months of the year: January, February and March. (and so on for the rest of the seasons).

In the Cyprus case the data are in a synoptic scale e.g. specific cruises in specific months. So, depending on the data density, highlighted by the spatial and temporal analysis, the products are computed on a monthly scale of specific years.

2.4   METADATA COMPILATION

The total CDI inventory for the EMODnet Chemical P021 terms and target areas gives an overview on the data availability through the EMODnet CDI User Interface (as each data profile is identified by a CDI entry).

Partner	Country	Records nb
All-Russia Research Institute of Hydrometeorological Information - World Data Centre (RIHMI-WDC) National Oceanographic Data Centre (NODC)	RUSSIAN FEDERATION	38757
British Oceanographic Data Centre (BODC)	UNITED KINGDOM	17594
Bulgarian National Oceanographic Data Centre(BGODC), Institute of Oceanology	BULGARIA	40
Cyprus Oceanographic Data Center, Oceanography Center	CYPRUS	499
Finnish Meteorological Institute (FMI)	FINLAND	2084
Flanders Marine Institute	BELGIUM	1382
German Oceanographic Datacentre (NODC)	GERMANY	16423
Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre (HCMR/HNODC)	GREECE	19110
IFREMER / IDM/SISMER	FRANCE	35068
Institute of Biology of the Southern Seas, NAS of Ukraine	UKRAINE	5
Institute of Fishery Resources (IFR)	BULGARIA	88
Institute of Marine Sciences, Middle East Technical University	TURKEY	1507
Institute of Oceanography and Fisheries	CROATIA	1477
International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	MALTA	128
Israel Oceanographic and Limnological Research (IOLR)	ISRAEL	3120
Iv.Javakhishvili Tbilisi State University, Centre of Relations with UNESCO Oceanological Research Centre and GeoDNA (UNESCO)	GEORGIA	43
Laboratory of Marine Ecology-Central Laboratory of General Ecology	BULGARIA	51
Latvian Institute of Aquatic Ecology	LATVIA	134
Management Unit of the North Sea and Scheldt estuary Mathematical Models, Belgian Marine Data Centre (MUMM-BMDC)	BELGIUM	3146
Marine Hydrophysical Institute	UKRAINE	2050
Marine Institute	IRELAND	4521
National Environmental Research Institute, University of Aarhus, Department of Marine Ecology	DENMARK	116439
National Institute for Marine Research and Development Grigore Antipa	ROMANIA	3374
National Institute of Biology - NIBMarine Biology Station	SLOVENIA	3242
National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences	BULGARIA	50
Netherlands Institute for Ecology, Centre for Estuarine and Marine Ecology (NIOO-CEME)	NETHERLANDS	7987
NIOZ Royal Netherlands Institute for Sea Research	NETHERLANDS	4137
Odessa National I.I.Mechnikov University	RUSSIAN FEDERATION	324
OGS, National Institute of Oceanography and Experimental Geophysics, Department of Oceanography	ITALY	38526
P.P.Shirshov Institute of Oceanology, RAS	RUSSIAN FEDERATION	122
Rijkswaterstaat Waterdienst	NETHERLANDS	11132
Scientific - Research Firm "GAMMA"	GEORGIA	308
Sinop University, Fisheries Faculty	TURKEY	32
Spanish Oceanographic Institute	SPAIN	9563
Swedish Meteorological and Hydrological Institute, SMHI	SWEDEN	53662
Ukrainian scientific center of Ecology of Sea (UkrSCES)	UKRAINE	3409
	TOTAL RECORDS	399534

3.   QC/QA AND PRODUCTS (WP3)

3.1   QUALITY ASSURANCE AND QUALITY CONTROL STANDARDS

Ultimately, the usefulness of the data that is collated and distributed through the EMODnet Chemical portal will be largely due to the uniform quality and reliability of these data. The work package is divided into a number of distinct activities, all of which contribute to the overall quality control and assurance of the data in the portal.

3.2   ADOPTING STANDARDS AND PROTOCOLS

At the outset of the EMODnet Chemical pilot it was stated that existing international standards and best practices would be adopted for the transport and display of data in the portal. By doing this, the partners ensure that they are following the best available knowledge and will most likely contribute to the further refinement of the adopted standards. EMODnet Chemical is using the data formats and vocabularies employed by the established data project "SeaDataNet".

One of the key areas, from a chemical perspective, has been ensuring the correct mapping and populating of the parameters and methods that make up the SeaDataNet vocabularies. This involves a lot of work and many experts input, as they key to inter-operability is the ability to point to a parameter from 2 distinct places and be confident that it is the same parameter, collected in a comparable way and measured in an acceptable fashion.

In addition, the standards and guidelines from relevant marine conventions (the Black Sea Commission, MEDPOL, Ospar and HELCOM) have been consulted when establishing baseline procedures when choosing matrices, chemical units, methods and other supporting information.

3.3   GUIDELINE DOCUMENTATION

A basic QC/QA guidance document has been produced for the regional partners

http://nodc.ogs.trieste.it/emodoc/QC_Guidelines_EMD-Chemical_version1.1.doc

This should be seen as a first working version, which will be amended and enhanced as the project develops. To many marine chemists this document will appear rudimentary and broad in scope. This is because the guideline is designed to be applicable across 3 marine regions and understandable to non-chemists, as the national data centres that co-ordinate the data collection need to be able to follow the QC process.

The guidelines have been extracted from the ICES working procedures for chemical data, which in turn draws from HELCOM COMBINE manual, OSPAR MON recommendations and specific input from ICES working groups that regularly use the data in assessments. However, it should be noted that in a broader EMODnet setting, many of the checks and criteria are not relevant as the guidelines were largely developed from a northern European perspective.

In 2010 both OSPAR and HELCOM monitoring groups that cover chemical contamination accepted a change in data reporting that originated from the ICES Marine Chemistry Working Group (ICES MCWG). This means that the quality assurance aspect of chemical data which are largely dealt with at the laboratory/institute will not to be reported at length when transmitting the data elsewhere. The results of QA exercises, reference material tests etc. which currently need to accompany data when it is exchanged will no longer be necessary (although may still be recommendable). The data should now have an uncertainty value and a method of calculating the uncertainty.

The guidelines for this method of data exchange are still being defined and will be updated to the EMODNET Chemical QA/QC guidelines in early 2011.

A placemarker has been made for late in the lifecycle of the project to run a review of the QA/QC of the data referenced under the EMODNET Chemical umbrella. There are a number of possibilities on how to run this and it may be a workshop of regional experts who will critically evaluate the data and meta-data or it might also take the form of a regional review of how well the data that has been reported fulfils the criteria set out in the QA/QC guideline.

At this stage there are no 'automated' checks in place for the data, beyond what the national data centres already perform, however with the documentation in place and with the use of standard formats and vocabularies it is intended to explore how the Ocean Data View (ODV) software may be able to perform some of these functions.

3.4   MAPS PRODUCTION

Interpolated maps

Maps generation started with nutrients in the water column (for the 3 regions), then extended to other chemicals in the water column.

As agreed on the first annual meeting for EMODnet Chemical Lot a small working group have interact with domain experts at their institutes to ask them which products could be useful and how to create them (data and map processing). The guidelines for products was shortly presented at the ur-EMODnet meeting in Copenhagen (25th may 2010) and is available at EMODnet chemical portal.

The aim for the guidelines for the DIVA maps production is to establish a common and documented basis for the maps production with focus on the pre-processing of data and the validation of the produced maps. The guidelines are divided into four steps:

1.   Data extraction

2.   Pre-processing of data

3.   Maps production

4.   Validation of the produced maps

The regional task leaders, which are responsible for the regional data pools are recommended to work through the listed processes. The following figure describes the overall concept for the DIVA maps production and is recommended as the working process for the maps production.
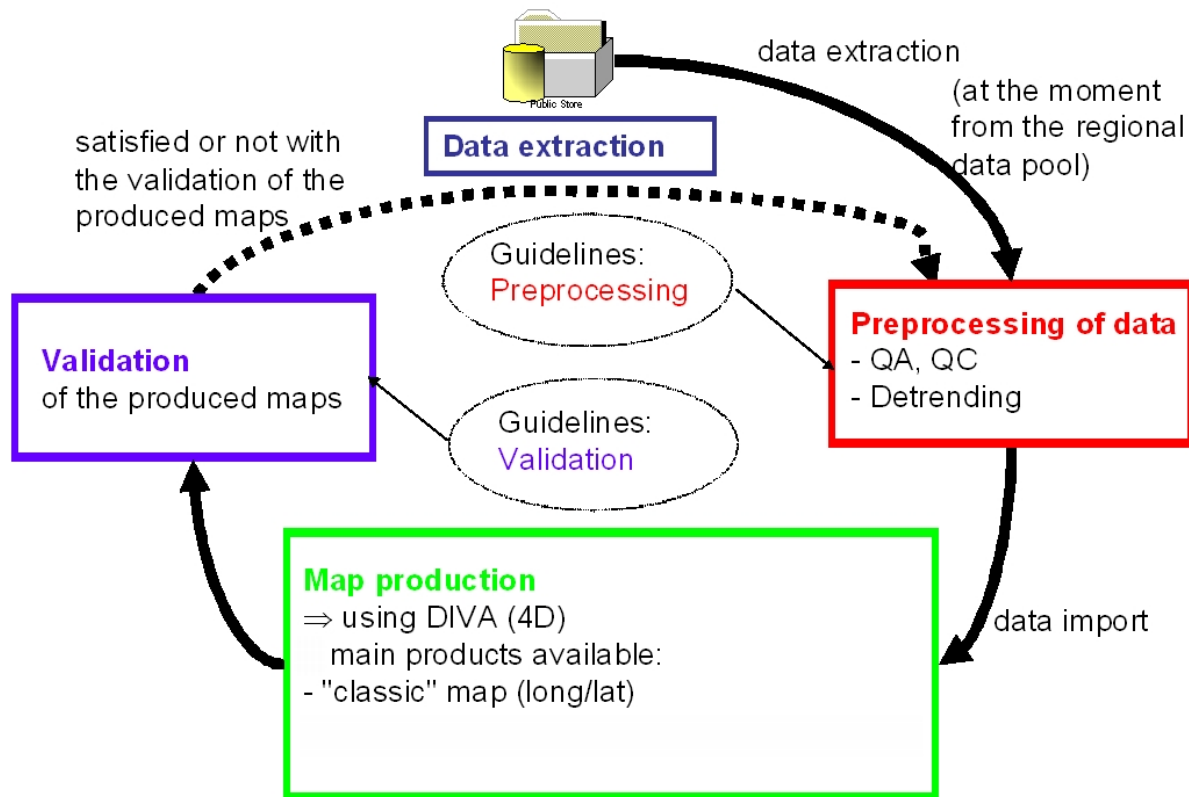
Besides, we have to be careful in which map we decide to make, on how to validate the gridded field before showing products, because very strong gradients can appear for a lot of this parameters. Probably we have to consider the data availability, and analyse the data distribution in space and time (gap analysis). At the same time, DIVA computes the error field that can be used to mask interpolated fields over a fixed threshold.

DIVA provides a lot of tools to optimize products and we can use it. In parallel is important to ask the experts opinion to understand which kind of maps that make sense. This is to focus on a number of basic products that we must make available at the EMODnet portal.

Not Interpolated products

For the Sediments and Biota (considering the target species MYTILUS) matrixes the data distribution analysis highlighted that data coverage is not the best to produce interpolated maps. This because many data are collected as time series of coastal monitoring, with a small number of stations for more or less long time periods. For these two matrixes common alternative products must be decided.

As described in the WP1 activities a specific Expert workshop has been done in Venice to discuss the issue.

The spatial distribution too sparse or limited to coastal areas is clearly not suitable to make standard Diva analysis.

To manage properly this situation the Chemical lot will need to make a good work of analysis, normalization and metadata collection in order to obtain homogeneous datasets well described.

The technical solution commonly agreed was to show the single stations on maps linked to plots pre-calculated by using ODV software that describes the time series of measurements for each parameter considered.

A first prototype of this kind of products was already presented during the November 2010 progress report in Bruxelles and is described in technical development section of this report.

The EMODnet Chemical portal give access to all the integrated maps of selected parameters produced at regional level, through the EMODnet Data Products Viewing and Downloading Service and the EMODnet Data Products Discovery Service Catalogue.

From Venice expert meeting discussions

The possibility to do DIVA calculations suing time and length along coastline as variables was suggested for variables located along the coastline. This idea was later dropped for several reasons.

Among others DIVA and the product viewer would need to be adapted to generate and visualize such products. In some cases this would be quite a significant adaptation.

Several questions remain also open: how to avoid an erroneous interpolation between two adjacent bays which are largely disconnected when the problem is reduced to only one spatial dimension? How can data which are not exactly at the coastline be included? They would probably need to be excluded from the analysis.

For the DIVA products we have decided to show only the gridded field where the expected error does not exceed a given threshold. For parameters where data are only available near the coastline, the offshore analysis will be masked. This approach will be quite similar to performing the analysis only at the coastline, but with the benefit that the real topography is taken into account and that all data can be used.
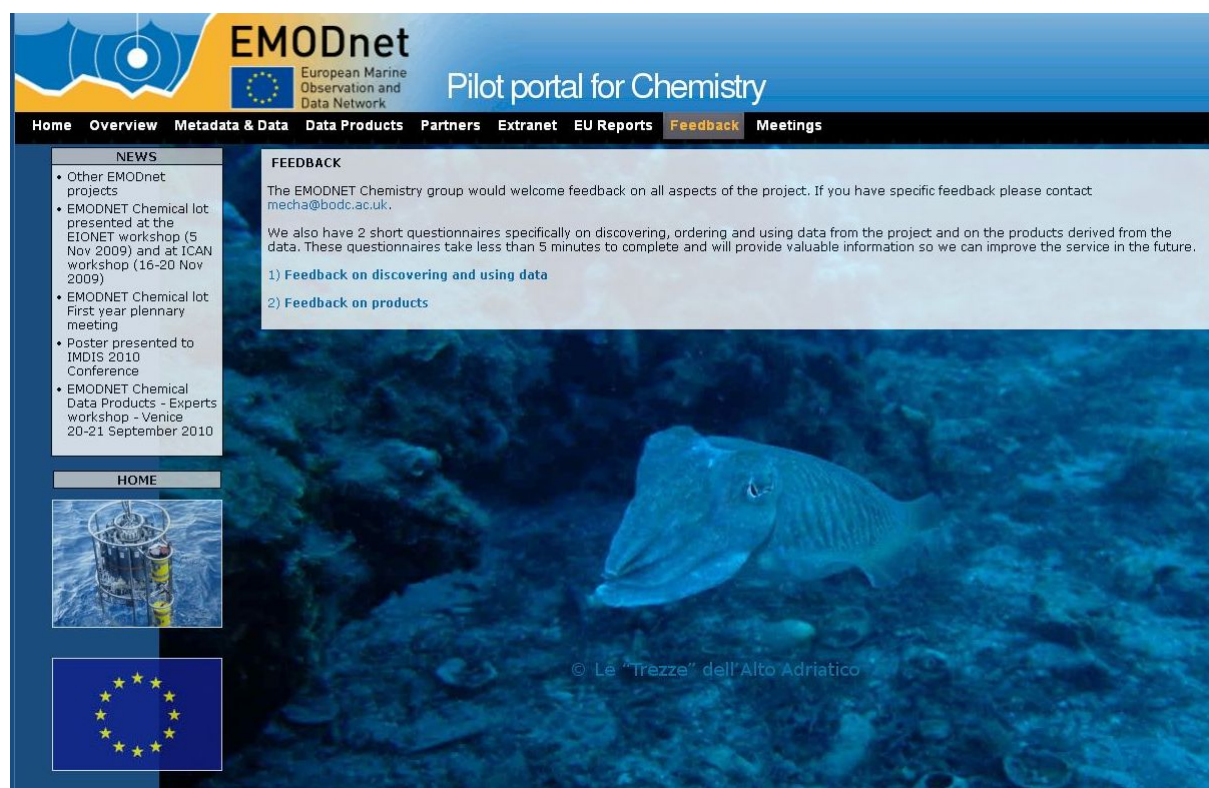
4.   TECHNICAL DEVELOPMENT AND PORTAL OPERATION (WP4)

EMODnet Chemical pilot project technical developments included in the first six months of the second year some upgrading activities.

Feedback

First of them (October 2010) was to fill the portal with the feedback link set up by Mark E. Charlesworth (NERC-BODC) using the software 'Survey Monkey'. This link lets to users and experts to fulfil two short on-line questionnaires about:

- data discovering and using (users can suggest about CDI interface, the obtained results, data format, used criteria for search data)

- products (the suggestions are given about data product characteristics, accuracy of contaminant's representation, how to improve the portal)
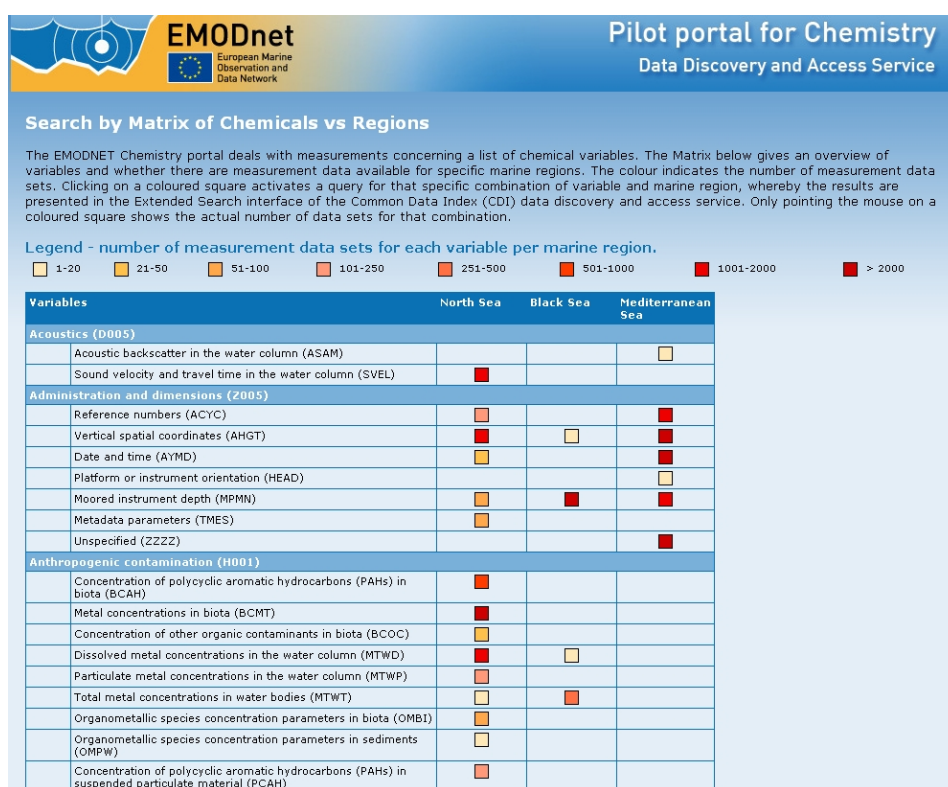

EMODNET Pilot: Feedback page.

A more detailed description about this action is given on the next chapter "Analysis and evaluation"

Matrix Variables Vs Regions

A new metadata discovery service called "CDI matrix Variables VS Regions" was set-up from Maris (November 2010). This to show in a clear way the data availability in the 3 regions of interest per each parameter considered. The matrix is linked directly to the CDI discovery service in order to help the users to search data in which are interested in.

The image below gives an overview of "CDI matrix Variables VS Regions". The matrix shows variables and whether there are measurement data available for specific marine regions. Colours indicate the number of measurements. Clicking on a coloured square activates a query for that specific combination of variable and marine region, whereby the results are presented in the Extended Search interface of the Common Data Index (CDI) data discovery and access service. Only pointing the mouse on a coloured square shows the actual number of data sets for that combination.

New CDI discovery service "matrix Variables VS Regions".

Ocean Browser

For the Ocean Browser viewing service new features were added during the last month of activities:

- Changed directory structure: 1st level: masked field, 2nd level complete field and other fields;

- Better integration of CDI interface: the location of all available data can be overlaid to the gridded products and zoom level is maintained;

- The interface has now two modes: panning and zooming by drawing an area.
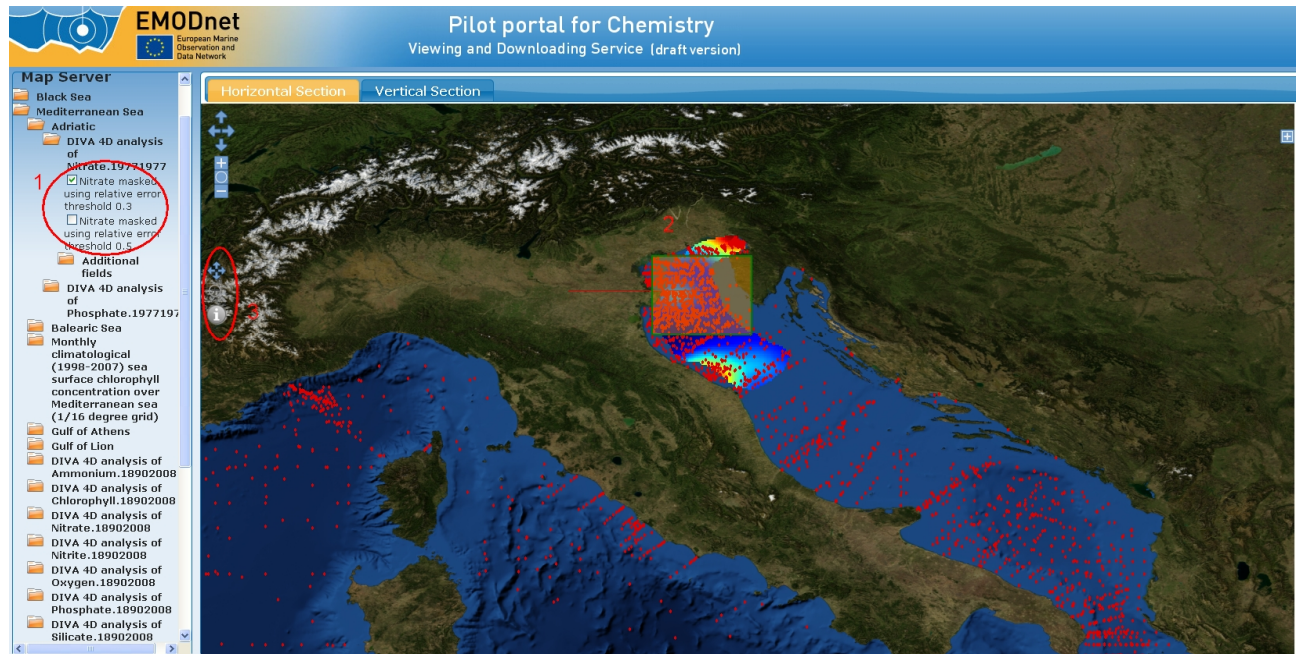
Ocean Browser new feature:

1. *changed structure;*

2. *zoom level maintained adding CDI layer;*

3. *panning and zooming mode.*

Ocean Browser & "time series data"

A test link was set up thanks to Gher and Ifremer collaboration to suggest a possible technical solution to visualize "time series data". The Idea at the moment is to provide time series plots (ODV software) and then to visualize them by the Ocean Browser viewing service:

- First step could be to store the images at a centralized place

- Afterwards we will consider to use the regional buffers as a place to store these images (decentralized approach) linked to OceanBrowser
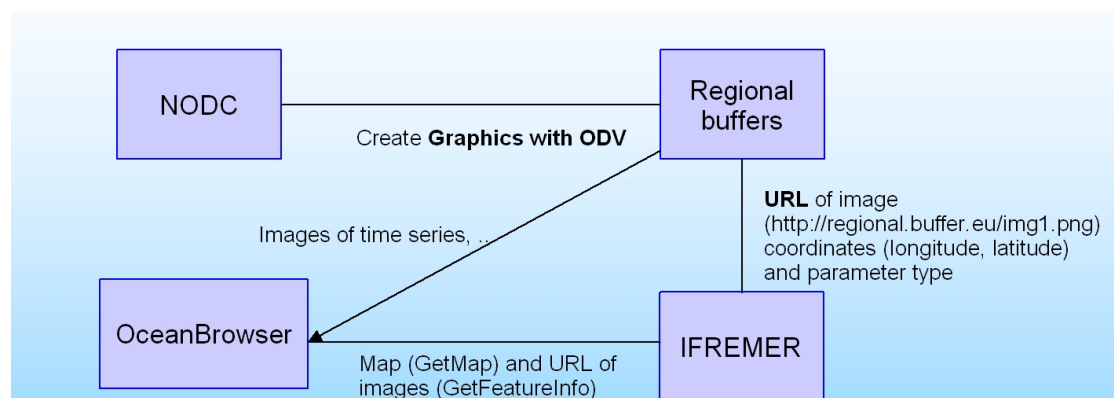
Technical development flow chart
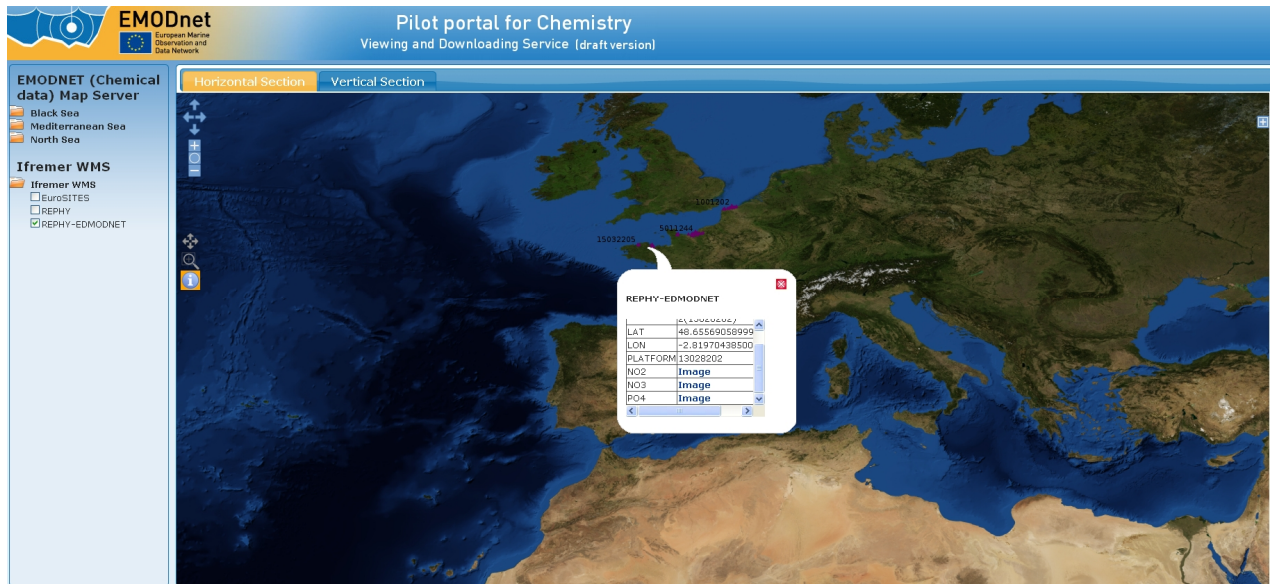
Ocean Browser "time series mode"
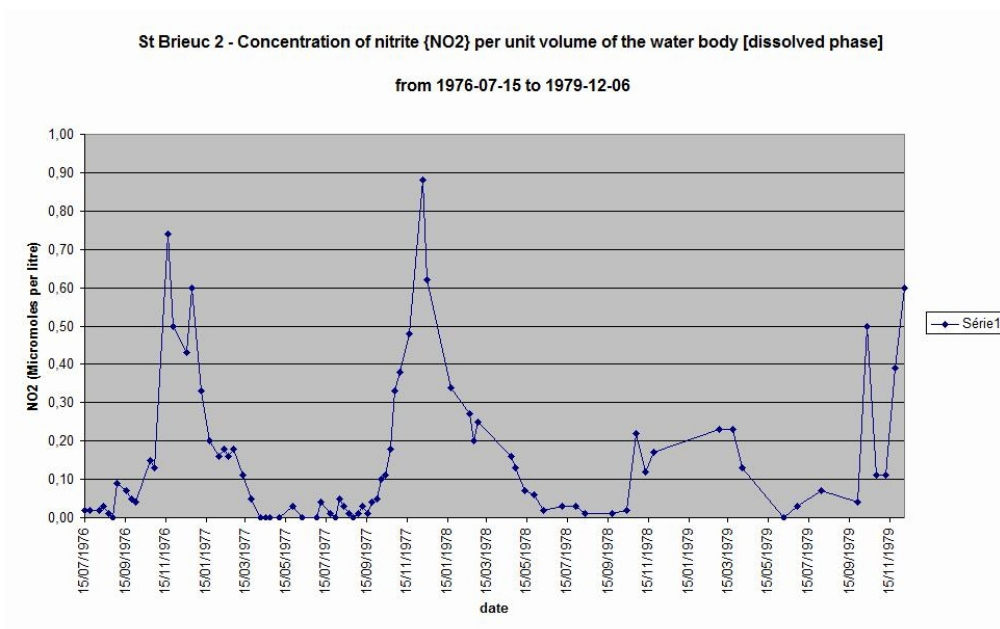
Time series Plots linked to Ocean Browser viewing service

The integration with other Web Map Servicers is possible thanks to the OGC standards compliance. For this reason is possible to query an inventory of layers from other WMS servers and visualize them in the EMODnet Chemical portal together with the chemical data products.
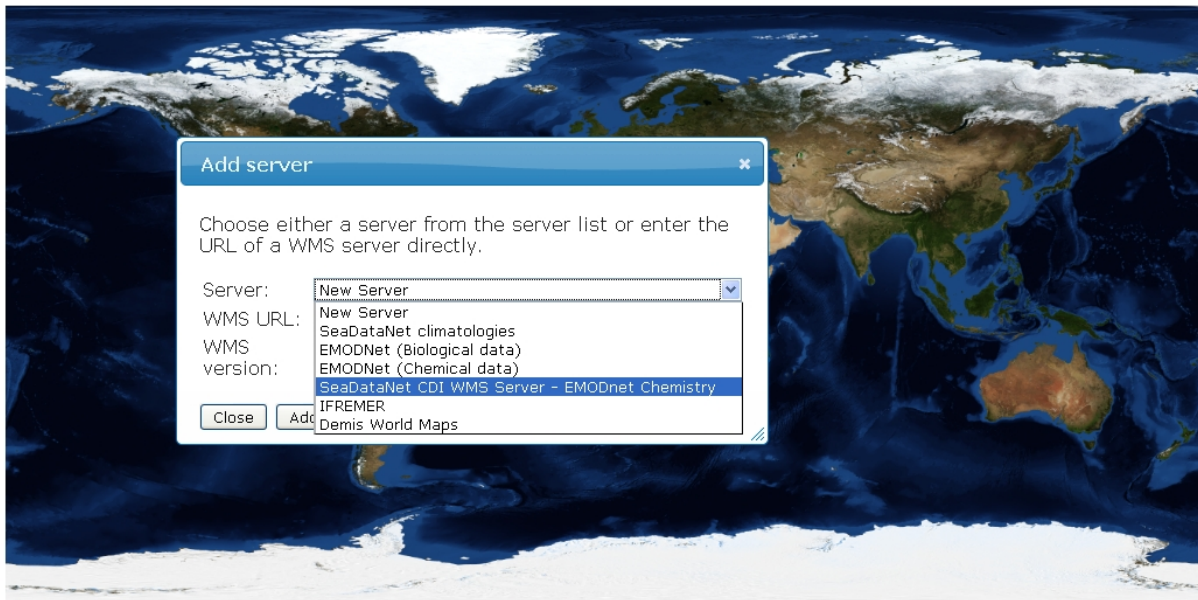
Integration with other Web Map Services

5.   ANALYSIS AND EVALUATION

The main 2 pieces of work within this work package have been to develop on-line questionnaires to gather feedback from users and to calculate statistics on use of the EMODnet chemistry portal and CDI interface.

A specific page on the EMODnet portal has been developed to receive feedback and users may either provide direct feedback to the consortium or can complete a questionnaire. There are 2 questionnaires which are designed for getting feedback from users who discover, download and access data and also users who access the products. They can be accessed from the below links (Ctrl and click)

Feedback on discovering and using data

Feedback on products

An example screen shot of the questionnaire for discovering and using data is shown below. The questions are limited to 10 to encourage users to provide feedback and have been designed to get information on how to improve the service and identify and barriers to the provision or use of the data and identify gaps in data which then can be prioritised. Feedback is being collected and a full analysis will be undertaken of the results in the final year.

The below figure shows that since the launch of the data discovery service number of visitors have remained fairly stable but shows signs of increasing in the last quarter of 2010. In the later stages of the project users who have registered to download data will be prompted to complete the questionnaires.
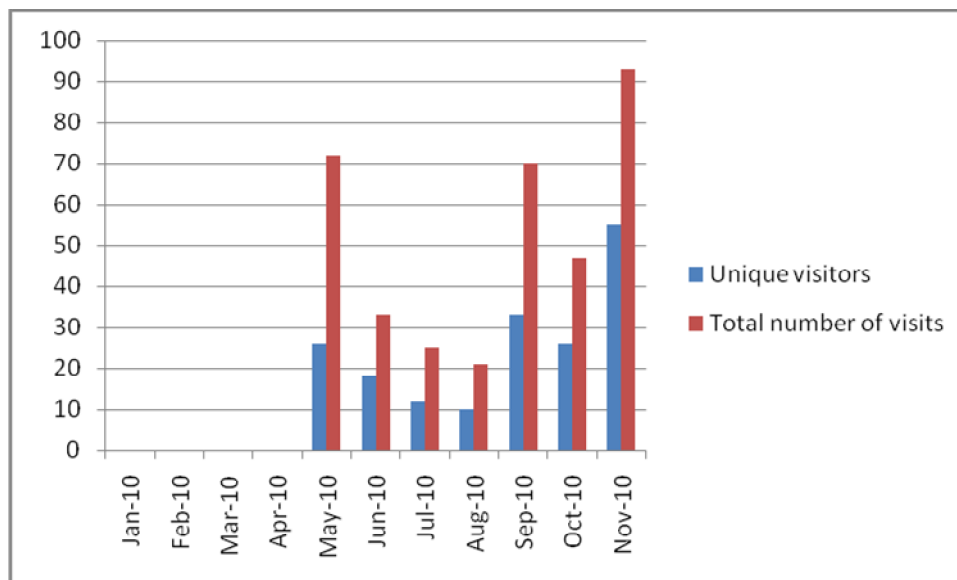
Users from 18 identifiable countries have accessed the data discovery and download service since the launch.
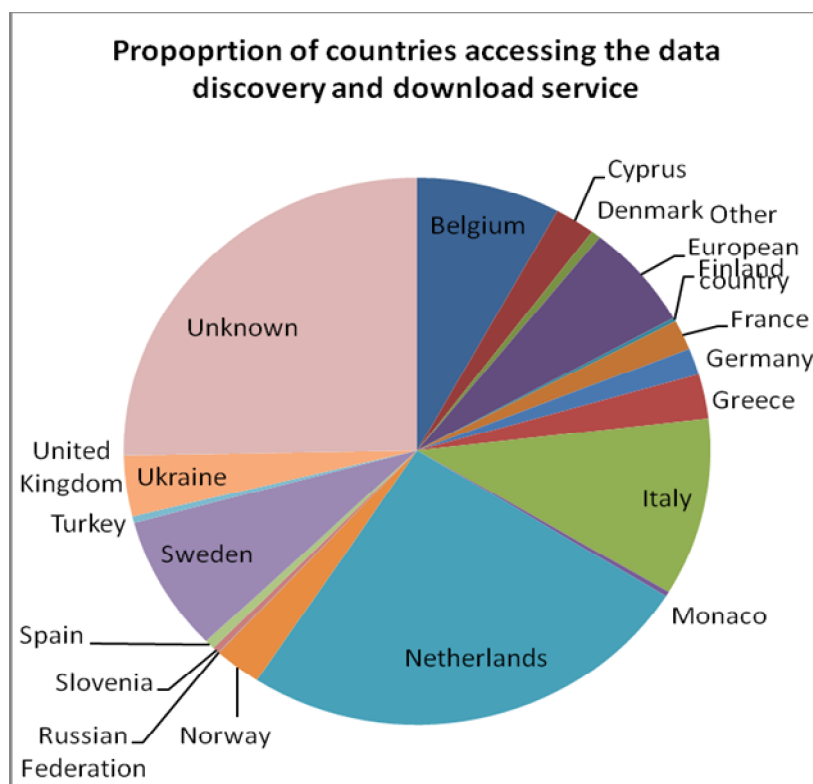
2011 will concentrate on gathering further feedback both from the users and also the consortium to identify any barriers to the provision of data. This will then identify technical

areas which need improvement in the future and also areas where further determinands and/or geographic areas should be concentrated upon. It is expected that use of the portal will increase with further dissemination in the final year.

The figures below show the monthly report of visits of the EMODnet portal. The most visited page is the "Extranet" section: the number of visits has grown since the launch of the area where documents are accessible.

Monthly history

Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Jan 2010	2	2	2	17	378.19 KB
Feb 2010	2	9	43	43	345.92 KB
Mar 2010	6	14	87	87	267.86 KB
Apr 2010	11	19	45	45	583.91 KB
May 2010	12	31	86	86	793.66 KB
Jun 2010	10	19	37	37	563.70 KB
Jul 2010	12	44	180	1003	4.99 MB
Aug 2010	12	20	44	44	700.78 KB
Sep 2010	23	31	41	63	144.42 MB
Oct 2010	19	24	27	27	96.23 MB
Nov 2010	24	41	52	52	617.74 KB
Dec 2010	14	23	60	271	986.80 KB
Total	147	277	704	1775	250.76 MB

In the following diagram there is the countries list of the visitors. The used criteria are to check the extension of the incoming domain. Main users come from Italy. There are a considerable number of visitors under the label "Unknown IP number", which are identified only by the number of the internet provider (in this case the country is masked).

Proportion of countries accessing the portal

- Italy — 53%
- Unknown IP number — 33%
- Network — 5%
- Turkey — 3%
- France — 2%
- Belgium — 2%
- Greece — 2%

Number of visits per month to the main EMODnet chemistry website
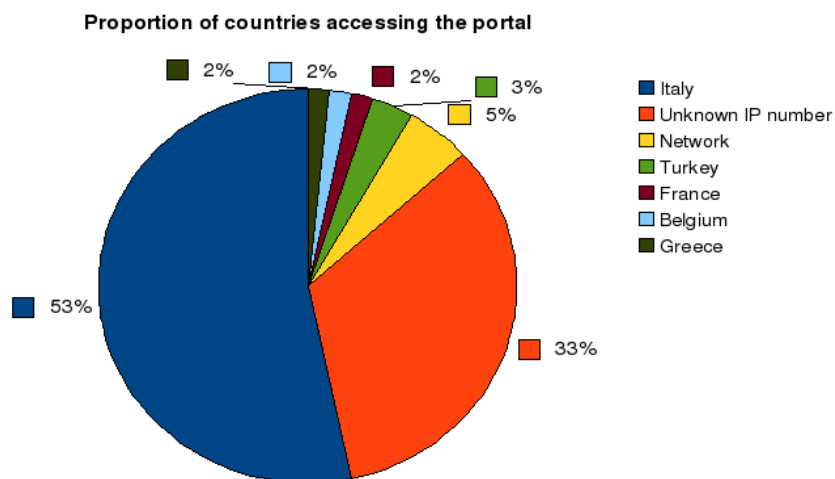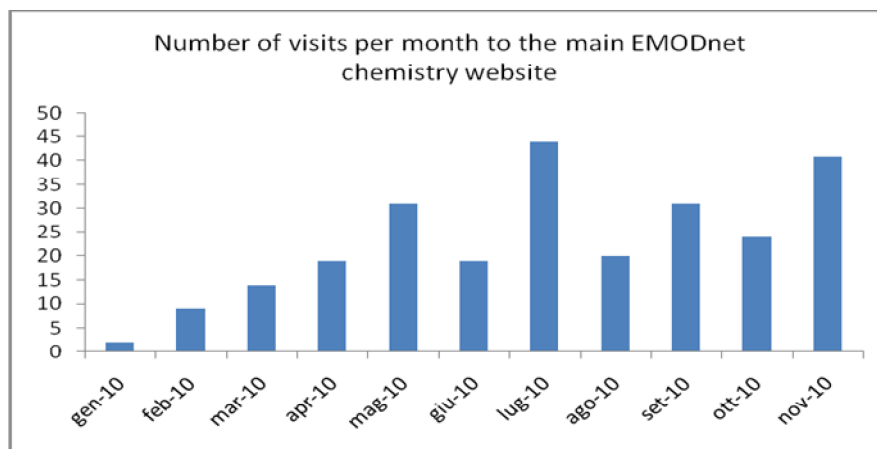
The number of visits to the main EMODnet chemistry website has grown steadily since launch and in November reached 41 visits.

6.   CONCLUSIONS

The first year of EMODNET Chemical pilot activity was dedicated to set up the system components (the three internal regional data pools dedicated to the product generation, the SeaDataNet vocabularies used for chemical parameters mapping and their extension to cover all the EMODNET Chemical lot parameters, the portal core services, discovery and viewing systems based on SeaDataNet CDI interface).

The main difficulties in the EMODNET Chemical pilot are represented by the data complexity management.

The measurements we are dealing with are related to:

- 8 groups of parameters (pesticides, antifoulants, pharmaceuticals, heavy metals , hydrocarbons, radionuclides, fertilisers, organic matter)

- 3 matrices (sediment, water column and biota).

The Chemical Lot is facing the management and standardization of the heterogeneity of data and metadata:

- the sampling (coastal points time series Vs homogenous sampling on basin scale)

- different measurement methods and targets (instrument, method, target species, target basis, grain sizes)

Great attention on the collection and management must be kept. Will be crucial to provide the best metadata available describing for example: sediment fraction measured, dry/wet weights measurements, measurement methodology. This in order to help a correct comparison between homogeneous sets of data and analysis. The continuous update and upgrade of SDN common vocabularies will help to manage this.

It is clear that the use of DIVA standard interpolation is suitable only for the more "classic" sets of parameters measured in the water column.

For the parameters measured in the other two matrixes such as Biota and Sediment the spatial and temporal distribution of available data highlighted the need of a different commonly agreed analysis approach.

An Expert workshop (Venice, September 2010) was organised to deepen the discussion and define the most appropriate way to represent the data. The cooperation with Marine Conventions (OSPAR, HELCOM and BSC) and MEDPOL was crucial for products definition and for the success of the workshop.

The conclusion of the Expert workshop were:

- To show data availability maps. The matrix "Variables VS Marine regions" described in the technical development section could be a good answer to this.

- Standard Diva Interpolated maps will be produced for parameters with suitable data coverage, measured on basin scale.

- For parameters with a spatial coverage like:
  o coastal points repeated in time
  o datasets with fragmented coverage

the common idea is to focus the Chemical lot activity on the need to make a good work of analysis, normalization and metadata collection in order to obtain homogeneous datasets well described. Then the idea is to show stations on maps linked to ODV pre-calculated plots that describe the time series of measurements for each parameter considered.

The next Phase will be focused on:

- Progress with data population, analysis, normalization, products generation and dataset updates;

- Common products generation with the extension to the time series (ODV plots) and technical solutions to link them to the viewing service (WMS);

- SDN infrastructure upgrade to manage data complexity VS adopted standard needs (vocabularies, products metadata).

7.   ANNEX I – LIST OF ACRONYMS

BSC Black Sea Commission

CAMIOON CAtalogue and Management of products of operatIOnal OceaNography

CDI Common Data Index (SeaDataNet metadata format)

DIVA Data Interpolating Variational Analysis

DOC Dissolved Organic Carbon

DOME Database on Oceanography and Marine Ecosystems

EEA European Environmental Agency

EU European Union

GHER GeoHydrodynamics and Environment Research, University of Liège

HCMR Hellenic Centre for Marine Research

HELCOM Helsinki Commission (for Baltic marine protection)

ICES International Council for the Exploitation of the Sea

IFREMER Institut Français de Recherche pour l'Exploitation de la Mer

IO-BAS Institute of Oceanology - Bulgarian Academy of Science

MARIS Mariene Informatie Service 'MARIS' BV

MEDPOL Mediterranean Pollution Monitoring and Research Programme

MHI Marine Hydrophysical Institute, Ukraine

MSFD Marine Strategy Framework Directive

NERC-BODC National Environmental Research Council – British Oceanographic Data Centre

NERI-MAR National Environmental Research Institute

NetCDF Network Common Data Format

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

ODV Ocean Data View

OGC Open Geospatial Consortium

OGS Istituto Nazionale di Oceanografia e di Geofisica Sperimentale

OSPAR Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic)

QA/ QC Quality Assurance/ Quality Control

RIHMI-WDC All Russian Research Institute of Hydro-meteorological Information – WDC B

SDN FP7 EU SeaDataNet project

SIO-RAS P.P. Shirshov Institute of Oceanology - Russian Academy of Science

TN Total Nitrogen

TSU-DNA Iv. Javakhishvili Tbilisi State University

WCS Web Coverage Service

WFS Web Feature Service

WMS Web Map Service

XML eXtensible Markup Language

8.   ANNEX II – OVERVIEW OF CDI RECORDS INCLUDED IN EMODNET CDI USER INTERFACE

The following table gives an overview of CDI records for EMODNET Chemistry per Data Centre giving the source of data (Originator), the principal activity of the organization and the related legal status. The following codes are used:

Activity Type

REC	Research	organisations only or mainly established for research purposes
EDU	Education	organisations only or mainly established for education/training, e. g. universities, colleges, schools
IND	Industry	industrial organisations private and public, both manufacturing and industrial services – such as industrial software, design, control, repair, maintenance
OTH	Others	

Legal Status

GOV	Governmental	local, regional or national public or governmental organisations e. g. libraries, hospitals, schools
INO	International Organisation	an international organisation established by national governments
EUB	European Body	A European organisation
PUC	Public Commercial Organisation	commercial organisation established and owned by a public authority
PRC	Private Commercial Organisation including Consultant	any commercial organisations owned by individuals either directly or by shares
EEI	European Economic Interest Group	
PNP	Private Organisation, Non Profit	Any privately owned non profit organisation

collator	Per Originator	Country	Datasets	Activity Type	Legal Status
BSH-DOD	Alfred Wegener Institute for Polar and Marine Research (AWI), Geophysics Department	Germany	3775	REC	GOV
BSH-DOD	Alfred-Wegener-Institute for Polar- and Marine Research	Germany	5271	REC	GOV
BSH-DOD	Baltic Sea Research Institute Warnemuende (IOW)	Germany	1316	REC	GOV
BSH-DOD	Elbe River Water Authority	Germany	715	REC	GOV
BSH-DOD	Federal Institute of Hydrology (BFG)	Germany	10	REC	GOV
BSH-DOD	Federal Maritime and Hydrographic Agency	Germany	3382	REC	GOV
BSH-DOD	Federal Research Centre for Fisheries (Cuxhaven)	Germany	57	REC	GOV
BSH-DOD	Federal Research Centre for Fisheries (Hemburg)	Germany	212	REC	GOV
BSH-DOD	German Hydrographic Institute	Germany	26	REC	GOV
BSH-DOD	GKSS Research Center	Germany	122	REC	GOV
BSH-DOD	Institute of Biochemistry and Food Chemistry, University Hamburg	Germany	27	EDU	GOV
BSH-DOD	Institute of Biogeochemistry and Marine Chemistry (IfBM), University of Hamburg	Germany	80	EDU	GOV
BSH-DOD	Lower Saxony Water Management, Coastal Defense and Nature Conservation Agency	Germany	341	REC	GOV
BSH-DOD	Senckenberg by the Sea, Marine Science Department	Germany	157	REC	GOV
BSH-DOD	State Agency for Environment, Nature and Geology, Mecklenburg-Vorpommern	Germany	1379	REC	GOV
BSH-DOD	State Agency for Nature and Environment of Schleswig Holstein (LANU)	Germany	2528	REC	GOV
BSH-DOD	State Office for Agriculture, Environment and Rural Areas of Schleswig Holstein (LLUR)	Germany	209	REC	GOV
BSH-DOD	State Office for Water Economy and Shore, Schleswig-Holstein, Kiel	Germany	36	REC	GOV
BSH-DOD	State Office of Ecology of Lower Saxony	Germany	473	REC	GOV
BSH-DOD	Waterways and Shipping Authority Wilhelmshaven	Germany	26	REC	GOV
BSH-DOD	Waterways and Shipping Office Cuxhaven	Germany	28	REC	GOV
BSH-DOD	Weser River Management Bureau	Germany	8	REC	GOV
FIMR	Finnish Institute of Marine Research (FIMR)	Finland	2104	REC	GOV
GAMMA	Scientific - Research Firm GAMMA	Georgia	308	REC	PUC
HCMR	Hellenic Centre for Marine Research, Institute of Oceanography (HCMR/IO)	Greece	19110	REC	GOV
IEO	Baleares Islands University. Environmental Biology Department. UIB	Spain	223	REC	GOV
IEO	Centre for Advanced Studies of Blanes (CEAB-CSIC)	Spain	256	REC	GOV
IEO	IEO/ Murcia Oceanographic Centre	Spain	1225	REC	GOV
IEO	IEO/ Balearic Islands Oceanographic Centre	Spain	670	REC	GOV
IEO	IEO/ La Coruna Oceanographic Centre	Spain	658	REC	GOV
IEO	IEO/ Malaga Oceanographic Centre	Spain	1129	REC	GOV
IEO	IEO/ Santander Oceanographic Centre	Spain	1746	REC	GOV
IEO	IEO/ Vigo Oeanographic Centre	Spain	1111	REC	GOV
IEO	Institute of Marine Sciences. Mediterranean Marine and Environmental Research Centre	Spain	509	REC	GOV
IEO	Spanish Oceanographic Institute	Spain	2036	REC	GOV
IFERMER	CEA / INSTITUT DE RADIOPROTECTION ET DE SURETE NUCLEAIRE	France	221	REC	GOV
IFERMER	CEA / LABORATOIRE DES SCIENCES DU CLIMAT ET DE L' ENVIRONNEMENT	France	282	REC	GOV
IFERMER	CEREGE	France	15	REC	GOV
IFERMER	CNRS / Center of Oceanology of Marseille (COM) La-Seyne-Sur-Mer	France	92	REC	GOV
IFERMER	CNRS / COM - LAB. D' OCEANOGRAPHIE & DE BIOGEOCHIMIE -ENDOUME	France	507	REC	GOV
IFERMER	CNRS / COM - LAb. D'OCEANOGPHIE ET DE BIOGEOCHIMIE - TOULON	France	152	REC	GOV
IFERMER	CNRS / LABORATOIRE DE MICROBIOLOGIE MARINE	France	137	REC	GOV
IFERMER	CNRS / LEGOS	France	57	REC	GOV
IFERMER	CNRS / STATION BIOLOGIQUE DE ROSCOFF	France	3	REC	GOV
IFERMER	DEPARTEMENT DE GEOLOGIE ET OCEANOGRAPHIE (UNIV. BORDEAUX 1) (UNIVE	France	268	EDU	GOV
IFERMER	IFREMER	France	1040	REC	GOV
IFERMER	IFREMER / BE-DPT CHEMICAL POLLUTENTS, BIOGEOCHEMISTRY & ECOTOXICOL	France	72	REC	GOV
IFERMER	IFREMER / CENTRE DE BREST	France	333	REC	GOV
IFERMER	IFREMER / CENTRE MANCHE - MER DU NORD	France	81	REC	GOV
IFERMER	Ifremer / Crela	France	172	REC	GOV
IFERMER	IFREMER / DYNECO-DPT DYNAMIQUES DE L'ENVIRONNEMENT COTIER	France	368	REC	GOV
IFERMER	IFREMER / EEP/LEP-DEEP ENVIRONMENT LABORATORY	France	16	REC	GOV
IFERMER	IFREMER / EMH-DEPARTEMENT ECOLOGIE ET MODELES POUR L'HALIEUTIQUE	France	388	REC	GOV
IFERMER	IFREMER / GM-MARINE GEOSCIENCES	France	5	REC	GOV
IFERMER	IFREMER / STATION DE LA TREMBLADE	France	273	REC	GOV
IFERMER	IFREMER / STATION DE LA TRINITE	France	26	REC	GOV
IFERMER	IFREMER / STATION DE SETE	France	45	REC	GOV
IFERMER	IFREMER / STH-DEPARTEMENT SCIENCES ET TECHNOLOGIES HALIEUTIQUES	France	72	REC	GOV
IFERMER	Ifremer / Tahiti Centre COP	France	105	REC	GOV
IFERMER	IFREMER/EEP/ DEEP SEA ENVIRONMENT DEPARTMENT	France	1	REC	GOV
IFERMER	INSTITUT DE PHYSIQUE DU GLOBE DE PARIS / OBSERVATORIES - IPGP	France	131	REC	GOV
IFERMER	IRD / CENTRE DE CAYENNE- GUYANE	French Guiana	477	REC	GOV
IFERMER	IRD / CENTRE DE MONTPELLIER	France	840	REC	GOV
IFERMER	IRD / CENTRE DE PAPEETE	France	863	REC	GOV
IFERMER	IRD / CENTRE OF ABIDJAN	Cote D'Ivoire	2958	REC	GOV
IFERMER	IRD / CENTRE OF POINTE NOIRE	Congo	725	REC	GOV
IFERMER	IRD / CENTRE TOGA LE HAVRE	France	48	REC	GOV
IFERMER	IRD /CENTRE DE BRETAGNE	France	1815	REC	GOV
IFERMER	IRD ANTENNE INSTITUT OCEANOGRAPHIQUE (IRD)	France	601	EDU	GOV
IFERMER	LABORATOIRE DE PHYSIQUE DES OCEANS/UBO (UNIVERSITE DE BRETAGNE OC	France	1026	EDU	GOV
IFERMER	LABORATORY of OCEANOGRAPHY and CLIMATE (LOCEAN)	France	3241	REC	GOV
IFERMER	LABORATORY OF OCEANOGRAPHY of VILLEFRANCHE (LOV)	France	1940	REC	GOV
IFERMER	LABORATORY of PHYSICAL OCEANOGRAPHY (LPO) UMR 6523 CNRS-IFREMER-IR	France	1864	EDU	GOV
IFERMER	METEO FRANCE / CENTRE METEOROLOGIQUE NEVERS	France	65	REC	GOV
IFERMER	MUSEUM NATIONAL D'HISTOIRE NATURELLE / DEPARTEMENT MILIEUX PEUPLEM	France	31	REC	GOV
IFERMER	MUSEUM NATIONAL D'HISTOIRE NATURELLE / LABORATOIRE D'OCEANOGRAPHIE	France	760	REC	GOV
IFERMER	Observatoire Oceanologique De Banyuls (Université de Paris VI)	France	655	EDU	GOV
IFERMER	SHOM (SERVICE HYDROGRAPHIQUE ET OCEANOGRAPHIQUE DE LA MARINE)	France	401	REC	GOV
IFERMER	Universite D'Angers / Laboratoire Des Bio-Indicateurs Actuels Et Fossiles (Biaf)	France	26	REC	GOV
IFERMER	UNIVERSITE DE BORDEAUX I / IGBA TALENCE	France	19	REC	GOV
IFERMER	UNIVERSITE DE BORDEAUX I / INSTITUT DE BIOLOGIE MARINE	France	27	REC	GOV
IFERMER	Universite de Bordeaux I / Laboratoire De Physico Et Toxico-Chimie Ism	France	19	REC	GOV
IFERMER	UNIVERSITE DE BRETAGNE OCCIDENTALE (UBO) / LAB. D'OCEANO. CHIMIQUE L	France	150	EDU	GOV
IFERMER	UNIVERSITE DE LA MEDITERRANNEE (U2) / CENTRE D'OCEANOLOGIE DE MARSE	France	100	EDU	GOV
IFERMER	UNIVERSITE DE LA MEDITERRANNEE (U2) / COM - LAB. OCEANOG. & BIOGEOCHI	France	1469	EDU	GOV

IFERMER	UNIVERSITE DE MONTPELLIER II / LABORATOIRE DYNAMIQUE DE LA LITHOSPHEF	France	73	EDU	GOV
IFERMER	UNIVERSITE DE PERPIGNAN / CEFREM	France	31	EDU	GOV
IFR	Institute of Fishery Resources (IFR)	Bulgaria	138	REC	GOV
IFREMER	IRD / CENTRE DE LA REUNION	Reunion	1549	REC	GOV
IFREMER	IRD / CENTRE OF HANN	Senegal	153	REC	GOV
IFREMER	IRD / CENTRE OF JAKARTA	Indonesia	81	REC	GOV
IFREMER	IRD / CENTRE OF MADAGASCAR	Madagascar	1	REC	GOV
IFREMER	IRD CENTRE DE NOUMEA	New Caledonia	4839	REC	GOV
IMS-METU	Institute of Marine Sciences, Middle East Technical University	Turkey	1507	EDU	GOV
Institute of Oce	Center for marine research - Rudjer Boskovic Institute	Croatia	578	REC	GOV
Institute of Oce	Institute of Oceanography and Fisheries	Croatia	899	REC	GOV
IO-BAS	Institute of Oceanology, Bulgarian Academy of Sciences (IO-BAS)	Bulgaria	40	REC	GOV
IOLR	Israel Oceanographic and Limnological Research (IOLR)	Israel	3119	REC	GOV
Latvian Institut	Latvian Institute of Aquatic Ecology	Latvia	134	REC	GOV
MHI	Institute of Biology of the Southern Seas, NAS of Ukraine	Ukraine	339	REC	GOV
MHI	Marine branch of Ukrainian Hydrometeorological Institute	Ukraine	98	REC	GOV
MHI	Marine Hydrophysical Institute	Ukraine	2050	REC	GOV
MHI	Scientific Research Institute of Ecological Problems (USRIEP)	Ukraine	4	REC	GOV
MHI	Ukrainian scientific center of Ecology of Sea (UkrSCES)	Ukraine	4691	REC	GOV
NERC-BODC	Agri-Food and Biosciences Institute (AFBI)	United Kingdom	477	REC	GOV
NERC-BODC	British Antarctic Survey (BAS)	United Kingdom	27	REC	GOV
NERC-BODC	Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory	United Kingdom	2215	REC	GOV
NERC-BODC	Dunstaffnage Marine Laboratory (DML)	United Kingdom	640	REC	GOV
NERC-BODC	Fisheries Research Services, Aberdeen Marine Laboratory	United Kingdom	196	REC	GOV
NERC-BODC	Institute of Oceanographic Sciences Deacon Laboratory	United Kingdom	128	REC	GOV
NERC-BODC	Institute of Oceanographic Sciences Wormley Laboratory	United Kingdom	303	REC	GOV
NERC-BODC	Institute of Oceanographic Sciences, Bidston Laboratory	United Kingdom	277	REC	GOV
NERC-BODC	Marine Institute	Ireland	4521	REC	GOV
NERC-BODC	Marine Scotland Science	United Kingdom	3298	REC	GOV
NERC-BODC	National Oceanography Centre (NOC), Southampton	United Kingdom	18	REC	GOV
NERC-BODC	Newcastle University Department of Marine Science and Coastal Management	United Kingdom	1	REC	GOV
NERC-BODC	Northern Ireland Environment Agency (NIEA), Water Management Unit	United Kingdom	709	REC	GOV
NERC-BODC	Plymouth Marine Laboratory (PML)	United Kingdom	89	REC	GOV
NERC-BODC	Proudman Oceanographic Laboratory (POL)	United Kingdom	1	REC	GOV
NERC-BODC	Proudman Oceanographic Laboratory (POL)	United Kingdom	719	REC	GOV
NERC-BODC	Scottish Association for Marine Science (SAMS)	United Kingdom	110	REC	GOV
NERC-BODC	Scottish Environment Protection Agency (SEPA)	United Kingdom	2089	REC	GOV
NERC-BODC	Scottish Office Agriculture and Fisheries Department (SOAFD) - Aberdeen Marine Labor	United Kingdom	2302	REC	GOV
NERC-BODC	Scottish Office Agriculture Environment and Fisheries Department (SOAEFD) - Aberdeen	United Kingdom	275	REC	GOV
NERC-BODC	Southampton Oceanography Centre	United Kingdom	49	REC	GOV
NERC-BODC	The Environment Agency (EA)	United Kingdom	3428	REC	GOV
NERC-BODC	University of Cambridge Department of Earth Sciences	United Kingdom	16	EDU	GOV
NERC-BODC	University of Plymouth, Institute of Marine Studies	United Kingdom	3	EDU	GOV
NERC-BODC	University of Southampton Department of Oceanography	United Kingdom	2	EDU	GOV
NERC-BODC	University of Wales, School of Ocean Sciences	United Kingdom	222	EDU	GOV
NERI-MAR	National Environmental Research Institute, University of Aarhus, Department of Marine E	Denmark	116439	REC	GOV
NIBM	National Institute of Biology - NIBMarine Biology Station	Slovenia	3242	REC	GOV
NIMH-BAS	Laboratory of Marine Ecology-Central Laboratory of General Ecology	Bulgaria	101	REC	GOV
NIMRD	National Institute for Marine Research and Development Grigore Antipa	Romania	3374	REC	GOV
NODC	Netherlands Institute for Ecology, Centre for Estuarine and Marine Ecology (NIOO-CEME	Netherlands	7987	REC	GOV
NODC	NIOZ Royal Netherlands Institute for Sea Research	Netherlands	4137	REC	GOV
NODC	Rijkswaterstaat Waterdienst	Netherlands	11132	OTH	GOV
OC-UCY	Cyprus Oceanographic Data Center, Oceanography Center	Cyprus	499	EDU	GOV
OGS	ARPA Emilia-Romagna - Struttura Oceanografica Daphne	Italy	4512	REC	GOV
OGS	ARPA Toscana, Area tutela ambiente marino	Italy	246	REC	GOV
OGS	CNR, Istituto di Scienze Marine (Sezione di Ancona)	Italy	2277	REC	GOV
OGS	CNR, Istituto di Scienze Marine (Sezione di Bologna)	Italy	49	REC	GOV
OGS	CNR, Istituto di Scienze Marine (Sezione di La Spezia)	Italy	573	REC	GOV
OGS	CNR, Istituto di Scienze Marine (Sezione di Trieste)	Italy	1853	REC	GOV
OGS	CNR, Istituto di Scienze Marine (Sezione di Venezia - ex IBM)	Italy	3746	REC	GOV
OGS	CNR, Istituto per lo Studio della Dinamica delle Grandi Masse	Italy	900	REC	GOV
OGS	Commissione Permanente per lo Studio dell'Adriatico, Venezia	Italy	106	REC	GOV
OGS	ICRAM, Chioggia	Italy	283	REC	GOV
OGS	ICRAM, Palermo	Italy	753	REC	GOV
OGS	Istituto Idrografico della Marina, Genova	Italy	599	REC	GOV
OGS	Marine Biology Laboratory of Trieste	Italy	643	REC	GOV
OGS	OGS, National Institute of Oceanography and Experimental Geophysics, Department of	Italy	21142	REC	GOV
OGS	Zoological Station 'A. Dohrn' - Laboratory of Biological Oceanography	Italy	844	REC	GOV
RBINS-MUMM	Management Unit of North Sea and Scheldt Estuary Mathematical Models, data acquisi	Belgium	41	REC	GOV
RBINS-MUMM	Management Unit of the North Sea and Scheldt Estuary Mathematical Models	Belgium	2836	REC	GOV
RBINS-MUMM	Université Libre de Bruxelles, Ecology of Aquatic systems	Belgium	230	EDU	GOV
RBINS-MUMM	Vrije Universiteit Brussel, Laboratory of Ecology and Systematics	Belgium	39	REC	GOV
RIHMI-WDC	Atlantic Scientific Research Institute for Marine Fishery and Oceanography	Russian Federation	48	REC	GOV
RIHMI-WDC	Far Eastern Regional Hydrometeorological Research Institute	Russian Federation	49	REC	GOV
RIHMI-WDC	Odessa Branch of SOI (State Oceanographic Institute)	Ukraine	37742	REC	GOV
RIHMI-WDC	Odessa National I.I.Mechnikov University	Ukraine	324	REC	GOV
RIHMI-WDC	P.P.Shirshov Institute of Oceanology, RAS	Russian Federation	504	REC	GOV
SMHI	Geological Survey of Sweden, SGU	Sweden	3	REC	GOV
SMHI	IVL Swedish Environmental Research Institute	Sweden	198	REC	GOV
SMHI	Stockholm Marine Research Centre, SMF	Sweden	821	REC	GOV
SMHI	Swedish Meteorological and Hydrological Institute, SMHI	Sweden	51108	REC	GOV
SMHI	Umea Marine Sciences Centre, UMF	Sweden	1532	REC	GOV
SNU-FF	Sinop University, Fisheries Faculty	Turkey	183	EDU	GOV
TSU-DNA	Iv.Javakhishvili Tbilisi State University, Centre of Relations with UNESCO Oceanological	Georgia	43	EDU	GOV
University Of M	Malta Centre for Fisheries Sciences	Malta	128	REC	GOV
VLIZ	Flanders Marine Institute	Belgium	1382	REC	GOV
	UNKNOWN	Unknown	3359		