EMODnet Chemistry
From the Pilot Project
To the second phase

Matteo Vinci and Alessandra Giorgetti, – OGS – NODC group, OCE - BSGES 2013, Constanta, Romania October 2013
- Emodnet Introduction
- Chemistry Pilot:
  - Where;
  - What;
  - How;
  - Main Challenges;
  - Products;
  - Lessons Learned;
- Chemistry Lot New Phase:
- Ongoing activities.
EMODNET introduction:

There is an increasing interest in the environmental/oceanographic data management to go:

- From a situation of fragmented ad inaccessible environmental data;
- To a continuous, public-accessible, interoperable and long-term use data flow.

Why?

- Seas and Oceans provide an essential part of our wealth and well-being but they are under huge pressure from human activities and climate change;
- To increase Quality and Quantity of environmental data and human activities pressures information to build a “knowledge base” able to drive a sustainable development.

How?...At EU level two main principles driving this:

- INSPIRE directive (2007): giving standards and implementing rules for an harmonized and interoperable EU Geographic Information Infrastructure for Geographic Data, Metadata and Services;
- MSFD (2008): for monitoring of seas and oceans at national → regional → EU level with reporting (WISE Marine) of environmental status based on Descriptors → Criteria → Indicators; objective → GES.
Six service contracts were launched in 2009 by DG-MARE for creating pilot components of the European Marine Observation and Data Network (EMODNET):

Lot 1 – Hydrographic data  
Lot 2 – Marine geological data  
Lot 3 – Chemical data (2009-2012)  
Lot 4 – Biological data  
Lot 5 – Habitants maps  
Lot 6 – Physics

In 2012, a new call was opened by DG-MARE: Knowledge base for growth and innovation in ocean economy, to conclude 7 service contracts for observing marine data, metadata and data products and facilitating their access and re-use:

Lot 1 - bathymetry  
Lot 2 - geology  
Lot 3 - physical habitats  
Lot 4 - chemistry  
Lot 5 - biology  
Lot 6 - physics  
Lot 7 - human activity
The Chemistry Pilot: where 3 areas of interest

Regional Leaders:
- North Sea – NERI
- Black Sea – MHI
- Med Sea – HCMR
The Chemistry Pilot: what

- a choice of **parameters** based on **MSFD requirements**;
- from **8 groups of compounds**;
- in **3 matrices**: water column, biota, sediment.

→ **17 selected parameters** for product generation:

<table>
<thead>
<tr>
<th>Chemical group</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides</td>
<td>Dichlorodiphenyltrichloroethane (DDT)</td>
</tr>
<tr>
<td>Pesticides</td>
<td>Hexachlorobenzene (HCB)</td>
</tr>
<tr>
<td>Antifoulants</td>
<td>Tributyltin (TBT)</td>
</tr>
<tr>
<td>Antifoulants</td>
<td>Triphenyltin (TPT)</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>Oxytetracycline (C_{22}H_{24}N_{2}O_{5})</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>Mercury (Hg)</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>Cadmium (Cd)</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>Lead (Pb)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical group</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Hydrocarbons</td>
<td>Anthracene (C_{14}H_{10})</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>Fluoranthen (C_{16}H_{10})</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>Tritium</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>Cesium 137</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>Plutonium 239</td>
</tr>
<tr>
<td>Fertilisers/Nitrogen</td>
<td>Nitrate (NO_{3})</td>
</tr>
<tr>
<td>Fertilisers/Nitrogen</td>
<td>Phosphate (PO_{4})</td>
</tr>
<tr>
<td>Organic matter</td>
<td>Organic Carbon (C)</td>
</tr>
<tr>
<td>Organic matter</td>
<td>Organic Nitrogen (N)</td>
</tr>
</tbody>
</table>
The Chemistry Pilot:

How

Based on SeaDataNet:

- **An efficient distributed Marine Data Management Infrastructure** for large and diverse sets of data from in situ and remote observation of the seas and oceans.
- **Actively involved** in standards implementation following INSPIRE;
- A *de-facto standard* with: **44 partners** and **14 subcontractors** from **35 countries** EU and not.
- **Connected to** Marine Data Management Infrastructure from USA and Australia thanks to the ODIP activities.
The Chemistry Pilot: How

Principle of “ADOPTED AND ADAPTED”

**SDN Standards for metadata, data and products:**
- for metadata CDI (xml ISO 19115 → ISO 19139);
- for common terms Standard Vocabs (P021,P011,P061 → P02,P01,P06);
- for background data exchange ASCII format ODV.

**SDN Infrastructure Services:**
- to access data with data policy management → CDI mechanism,
- for users registrations → SDN Security Services,
- for discovery, visualization and downloading of metadata, data and data-products → SDN search and viewing services

**SDN Softwares:**
- **MIKADO** → metadata mapping and xml generator
- **NEMO** → data formatting tool
- **DIVA** software → gridded data products and error maps as NetCDF files,
- **ODV** software → for “time series” products generation and QC
The Pilot Project: 
**challenge to face** along the path from **DATA to PRODUCTS**

**Data complexity:**
- from 8 groups of compounds;
- 3 matrices (sediment, water column and biota);
- 17 selected parameters for products generation;

**Heterogeneity:**
- **Data availability** in the different areas of interest;
- Of the **sampling/data distribution** (eg: coastal points time series Vs homogenous sampling at basins level);
- Of **measurement methods** (eg: instrument, target species, target basis, grain sizes).
The Chemistry Pilot
Data Products and QC/QA:

- The analysis of available data;
- The **Expert workshop** with contribution of the **Marine Conventions**;
- Highlighted **2 main subsets from the available data**:
  - **Standard Diva Interpolated maps** produced for parameters with **homogeneous data coverage**, measured on **basin scale**;
  - **Time series plots** showing stations distribution linked to **plots of measured data**.

**Not homogeneous distribution**
In time and space (basins)

**Homogeneous distribution**
In time and space (basins)

**Expert workshop**, summary of decisions to highlight data features with Products generation:

- **Standard Diva Interpolated maps** produced for parameters with **homogeneous data coverage**, measured on **basin scale**;
- **Time series plots** showing stations distribution linked to **plots of measured data**.

This for not homogeneous data as:
- **coastal points** repeated in time,
- **datasets with fragmented coverage**.
Data products

DIVA interpolated maps:

- Focus on **nutrients in the water column** based on **data availability**;
- Focus on **annual and seasonal scale** based on **data availability**;
- Interpolated maps generated by **Diva** software;
- Metadata file generated by **DivadoXML** script;
DIVA interpolated maps

Ocean Browser (Gher group)

* Interpolated fields loaded as WMS layers
Data products

Time Series plots:
- Focus on the parameters with **fragmented coverage** (spatial/temporal);
- suggested use of **ODV** software for plots generation;
- ratio of **1 plot:1 station:1 parameter:1 depth**;
- metadata collected in a **INDEX file** ([http://www.data-assimilation.net/mediawiki/index.php/OceanBrowser#Observation_index_files](http://www.data-assimilation.net/mediawiki/index.php/OceanBrowser#Observation_index_files))

Recommendations:
- to **avoid plots** for stations with **less than 3 measures**;
- to **avoid linkage lines** between single measures (we are not showing trends but measures!);
- to provide TS plots in **vector format** (as SVG);
Time Series plots

Ocean Browser (Gher group)

* products loaded as WMS layers

Note that some browser cannot display images in SVG format.
Lessons Learned/Open issues from Pilot

- QC for «exotic parameters» (e.g.: contaminants...) no spikes can be detect for them because they are events. At the moment not enough data to calculate regional ranges.

- Lack of «Under detection limit» information (limit not specified!);

- Technical development/usersfriendliness:
  - Finalization of products metadata catalogue;
  - Improvements of web interfaces search criteria;
  - Improvement of handling of Chemical Parameters metadata;

- Need of group of experts for the data-products periodic validation for each region + workshop.
Chemistry Lot is ongoing
The New Phase (MARE/2012/10)

- Official Start 16th August 2013 -

- Enlarged partnership: 32 partners + 14 sub-contractors = total of 46 participants (about twice!) coordinated by OGS;

- Specific focus on MSFD needs:
  - focus on MDFS descriptors: D.5: Eutrophication and D.8: Contaminants;
  - support for WISE Marine reporting infrastructure.

- Specific focus on Coastal Data.

- New products: coastal visualization + pilot assessment tool;
The portal should cover **all European waters**

Note: This map is derived from the EU Tender document but lacks the Norwegian sea

### Parameters:

**In 3 matrices:**
- Water column;
- Biota;
- Sediment.

<table>
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<th>Examples</th>
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<tr>
<td>Pesticidides and biocides</td>
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<td>Mercury, cadmium, lead</td>
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<td>Hydrocarbons</td>
<td>Anthracene, fluoroanthene</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>Cs$^{137}$, Pu$^{239}$</td>
</tr>
<tr>
<td>Fertilisers</td>
<td>Nitrogen (DIN, TN), phosphorus (DIP, TP)</td>
</tr>
<tr>
<td>Organic matter (e.g. from sewers or mariculture)</td>
<td>Total carbon (TOC)</td>
</tr>
<tr>
<td>Chlorophyll</td>
<td></td>
</tr>
<tr>
<td>Silicates</td>
<td></td>
</tr>
<tr>
<td>Partial pressures of dissolved gases</td>
<td>Oxygen, carbon dioxide</td>
</tr>
<tr>
<td>Plastics</td>
<td>Polyethylene, polypropylene</td>
</tr>
<tr>
<td>Acidity (from pH, pCO2, Total Inorganic Carbon, alkalinity)</td>
<td>pH</td>
</tr>
</tbody>
</table>
Regional level:

Data harvesting (WP1) and products generation (WP2) will be always organized at Regional level. This time 5 sea regions have been defined as:

- **Greater North Sea** (including **Norwegian Sea** and **Celtic Sea**);
- **Atlantic Sea** (including **Atlantic Coast** and **Macaronesia**);
- **Baltic Sea**;
- **Black Sea**;
- **Mediterranean Sea**.
Conclusions and Ongoing activity

-QC for exotic parameters:
  - To keep an open dialogue with MSFD requirements/guidelines;
  - The data harvesting will provide new data to calculate regional ranges;
  - To keep an open dialogue with Marine Conventions experts;
  - Efforts to collect «detection limits» for an inventory in the different areas.

-To continue to highlight/fill GAPS;

-QC workshop with the Regional experts \(\rightarrow\) will be organized at month 12.
Thanks for your attention!

Questions?

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