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Session 4: Interdisciplinarity, societal needs

Tackling marine pollution in the Mediterranean Sea: needs for harmonized multidisciplinary data

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Societal needs:

- ❑ Assess marine pollution from local to regional scale;
- ❑ Several EU frameworks: Zero Pollution Strategy, MSFD – Good Environmental Status, WFD, MSP, Italian PNRR Zero Pollution,…

7 Ocean Decade Outcomes:

1. **A clean ocean** (pollution)
2. **A healthy and resilient ocean**
3. A productive ocean
4. A predicted ocean
5. A safe ocean
6. **An accessible ocean** (data access,…)
7. An inspiring and engaging ocean.

Key questions:

- ❑ Are the seas polluted?
- ❑ Can we reduce pollution (Where do pollutants come from)?
- ❑ What are the impacts of pollution (on ecosystems and human health)?

Do we have the data needed to answer these questions?

Marine pollution. What do we mean here?

Chemical pollutants

(heavy metals, hydrocarbons, pesticides/biocides, PCBs, DDTs, pharmaceuticals, contaminants of emerging concern, … often "***invisible***" pollution)

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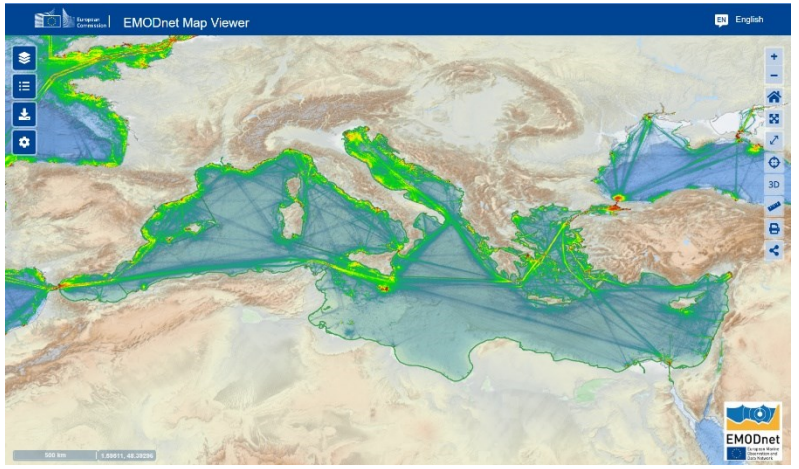
Are the seas polluted?



- ❖ Considering the Mediterranean Sea as a case study: land and sea-based sources of pollution have **long been a threat** to the quality of the marine environment
- ❖ Despite **long-term monitoring efforts** since the early 1980s, a coherent and harmonized **assessment** of pollution at the sub-basin scale remains **challenging**
- ❖ Pollution assessment requires information concerning:
  - contaminant **concentrations (spatial and temporal)**
  - **environmental characteristics**
  - anthropogenic **pressures** (pollution sources)
  - **biological effects**
- ❑ **multidisciplinary** and **heterogeneous** information (e.g. measurement units and different sampling and analytical methods for the same substance)
- ❑ multiple data sources, multiple scientific communities

Large heterogeneity requires:

- adoption of common standards
- «rich» metadata
- dialogue among different communities towards improved interoperability

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Contaminant **concentrations data management:**

EMODnet Chemistry approach

Based on SeaDataNet Pan-European infrastructure for ocean & marine data management and on its standards and tools

- **consolidated** open standards in terms of **metadata** profiles (CDIs), controlled **vocabularies (BODC NERC Vocabulary Server)**, dataset **formats (ODV)**, commonly agreed **quality control** procedures and **quality flagging** schema

WHAT

WHERE?

WHEN?

HOW?

WHO?

National Oceanography Centre
British Oceanographic Data Centre BODC

NERC Vocabulary Server

Ocean Data View
https://odv.awi.de
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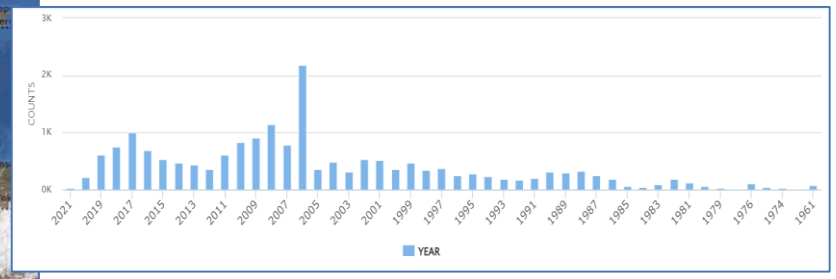
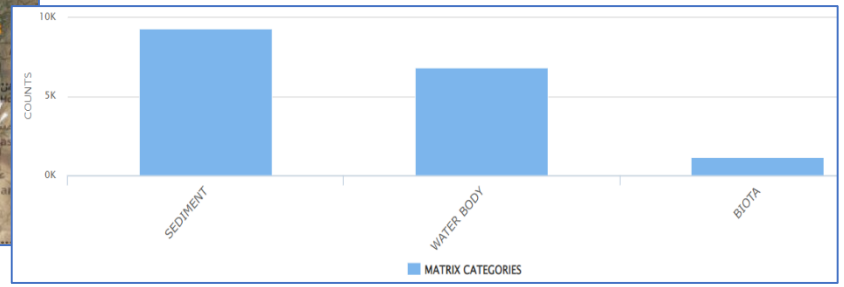
EMODnet Chemistry data availability: marine contaminants





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Several infrastructures manage data on pollutants
To improve data **interoperability**:

- ❑ Dialogue with other **data management frameworks** (e.g. ICES, WISEMarine, UNEP/MAP-IMAP, EU-IPCHEM, NORMAN) and with major data **users communities** (e.g. MSFD community, European Envir. Agency – EEA, EU JRC, Regional Sea Conventions) to **align metadata and data formats** to improve **interoperability** among different and multidisciplinary data infrastructures

Metadata and data templates compared with information available through EMODnet:

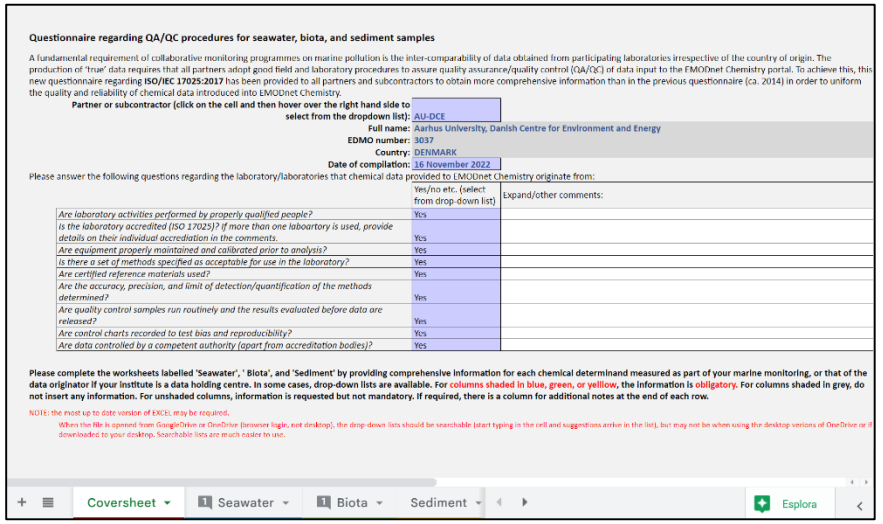
- UNEP/MAP MEDPOL (WG.467/8 2019)
- OSPAR & HELCOM (as provided by ICES)
- WISE6 (for WFD)
- JRC template (for WFD)
- NORMAN data/metadata template

⇒ **Need to collect additional** detailed methodological (and quality assurance/quality control) information to be linked with metadata

Additional detailed methodological information: **"QA/QC questionnaires"**

- ❑ Collection of harmonized information (as much as possible) using structured **user-friendly templates** based on standard codes (e.g. CAS number for chemicals) and **BODC vocabularies** to describe matrix sphere (S21 vocabulary), sampling device categories (L05), analytical method (S04) **(collected from over 18 data centers)**
- ❑ Made accessible together with data (link to **doi** https://doi.org/10.13120/ac1x-5e14)

- ❖ Required to improve **transparency in data quality**, reliability, comparability
- ❖ Ultimately to support **harmonized environmental status assessment** (are the seas polluted?)



Questionnaire regarding QA/QC procedures for seawater, biota, and sediment samples

A fundamental requirement of collaborative monitoring programmes on marine pollution is the inter-comparability of data obtained from participating laboratories irrespective of the country of origin. The production of 'true' data requires that all partners adopt good field and laboratory procedures to assure quality assurance/quality control (QA/QC) of data input to the EMODnet Chemistry portal. To achieve this, this new questionnaire regarding **ISO/IEC 17025:2017** has been provided to all partners and subcontractors to obtain more comprehensive information than in the previous questionnaire (ca. 2014) in order to uniform the quality and reliability of chemical data introduced into EMODnet Chemistry.

Partner or subcontractor (click on the cell and then hover over the right hand side to select from the dropdown list):	AU-DCE
Full name:	Aarhus University, Danish Centre for Environment and Energy
EDMO number:	3037
Country:	DENMARK
Date of compilation:	16 November 2022

Please answer the following questions regarding the laboratory/laboratories that chemical data provided to EMODnet Chemistry originate from:

	Yes/no etc. (select from drop-down list)	Expand/other comments:
Are laboratory activities performed by properly qualified people?	Yes	
Is the laboratory accredited (ISO 17025)? If more than one laboartory is used, provide details on their individual accreditation in the comments.	Yes	
Are equipment properly maintained and calibrated prior to analysis?	Yes	
Is there a set of methods specified as acceptable for use in the laboratory?	Yes	
Are certified reference materials used?	Yes	
Are the accuracy, precision, and limit of detection/quantification of the methods determined?	Yes	
Are quality control samples run routinely and the results evaluated before data are released?	Yes	
Are control charts recorded to test bias and reproducibility?	Yes	
Are data controlled by a competent authority (apart from accreditation bodies)?	Yes	

Please complete the worksheets labelled 'Seawater', ' Biota', and 'Sediment' by providing comprehensive information for each chemical determinand measured as part of your marine monitoring, or that of the data originator if your institute is a data holding centre. In some cases, drop-down lists are available. For columns shaded in blue, green, or yellow, the information is obligatory. For columns shaded in grey, do not insert any information. For unshaded columns, information is requested but not mandatory. If required, there is a column for additional notes at the end of each row.

NOTE: the most up to date version of EXCEL may be required.

When the file is opened from GoogleDrive or OneDrive (browser login, not desktop), the drop-down lists should be searchable (start typing in the cell and suggestions arrive in the list), but may not be when using the desktop versions of OneDrive or if downloaded to your desktop. Searchable lists are much easier to use.

Coversheet | Seawater | Biota | Sediment | Esplora

http://vocab.nerc.ac.uk/search_nvs/ https://vocab.nerc.ac.uk/collection/L05/current/ Select from the drop-down list or search the NVS L05 vocabulary (above link) for the field sampling method/instrument (as 'preferred label') and copy and paste the preferred label	Autolink unless selecting from the NVS website	Provide either an ISO code or citation for the sampling method	Select from the drop-down list
Field sampling method	**L05 code**	**Sampling method link/citation**	**Sieved sediment?**
unconsolidated sediment corers	51		Unsieved
unconsolidated sediment corers	51		Unsieved
unconsolidated sediment corers	51		Unsieved
unconsolidated sediment corers	51		Unsieved

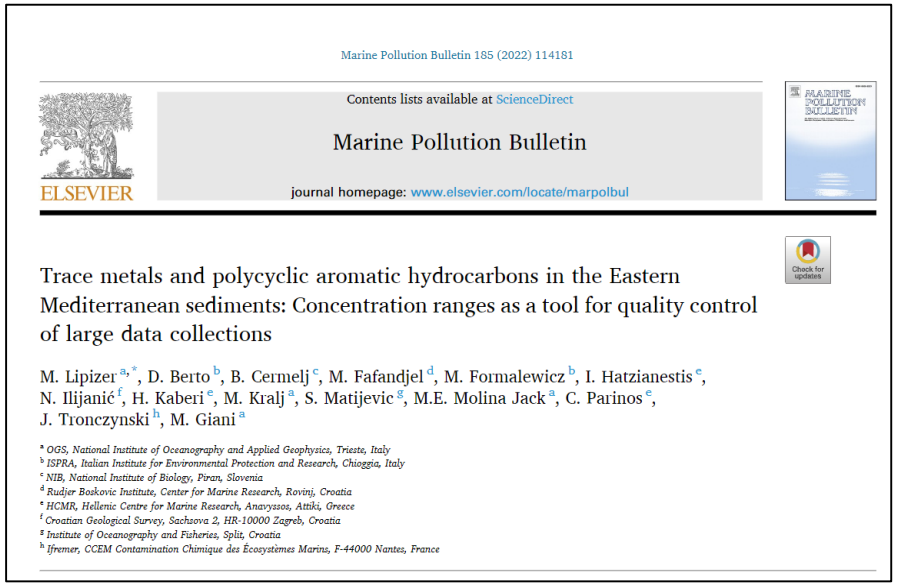
		http://vocab.nerc.ac.uk/search_nvs/ https://vocab.nerc.ac.uk/collection/S27/current/ https://vocab.nerc.ac.uk/collection/S06/current/ Insert each determinand (or in some cases, the group of substances) by selecting from the drop-down list. If not shown in the drop-down list (searchable if using Excel in browser, see coversheet), search the worksheet 'main parameters' for alternative names to find the determinand name in the searchable list. If the substance is not listed, search for the variable in the NVS S27/S06 vocabulary links (as 'preferred label') above and copy and paste below.	Autolink unless selecting from the NVS website	Autolink unless selecting from the NVS website	Autolink unless selecting from the NVS website	This information is important, please provide if possible.	Provide the Limit of detection (LOD) for each analyte/determinand. Ensure that the units are correct and the same as those used for reporting the determinand in EMODnet Chemistry (this information is within the P01 code)	Provide the Limit of quantification (LOQ). See the comment for the LoD units.	This information is important, please check that the units are correct and that the units for the LoD, LoQ, and reported parameter are the same.
Matrix	S21 code	**Determinand full name (see above comment)**	S27 or S06 code	CAS number	Determinand group (P36 full term)		**Method/formula used to determine LOQ. Please check for correctness.**	**LOD**	**LOQ**	**Determinand units (select from drop-down list or insert if other)**
Sediment	S21S022	Aluminium and its compounds	CS002991	7429-90-5	Other compounds		3*LOD	1.71	5.12	mg/kg
Sediment	S21S022	Antimony	CS002962	7440-36-0	Heavy metals		3*LOD	4.19	12.57	mg/kg
Sediment	S21S022	Arsenic	CS002328	7440-38-2	Heavy metals					
Sediment	S21S022	Barium	CS002335	7440-39-3	Other compounds					

Contaminant **data management: specific requirements**

- ❑ Dedicated **evolution of vocabulary** to include important information (e.g. matrix characteristics: sampled sediment; sampling, analytical methods,...)
- ❑ **Harmonization** of measurement units
- ❑ Identification of **ancillary parameters** (required to assess pollution)
- ❑ Identification of **concentration ranges** to carry out data Quality Control (e.g. broad range comparison)

Challenges:

- ❑ In EMODnet Chemistry, contaminant datasets currently include more than **260 different chemical substances** in **3 major matrices** (water, sediment, biota) and "sub-matrices (different sediment sizes, organisms, organs/tissues,….)"
- ❑ **Growing number** of substances being measured (e.g. CEC)
- ❑ Ranges not yet available for the majority of substances
- ❑ In the **Eastern Mediterranean**: dedicated research on sediment ranges for specific areas (**research needed at larger scale!**)



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Trace metals and polycyclic aromatic hydrocarbons in the Eastern Mediterranean sediments: Concentration ranges as a tool for quality control of large data collections

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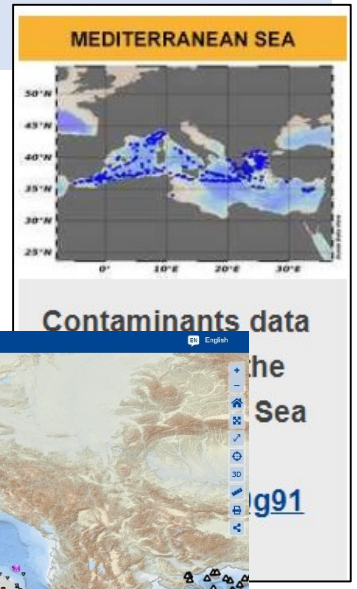
❖ Pollution assessment requires information concerning:

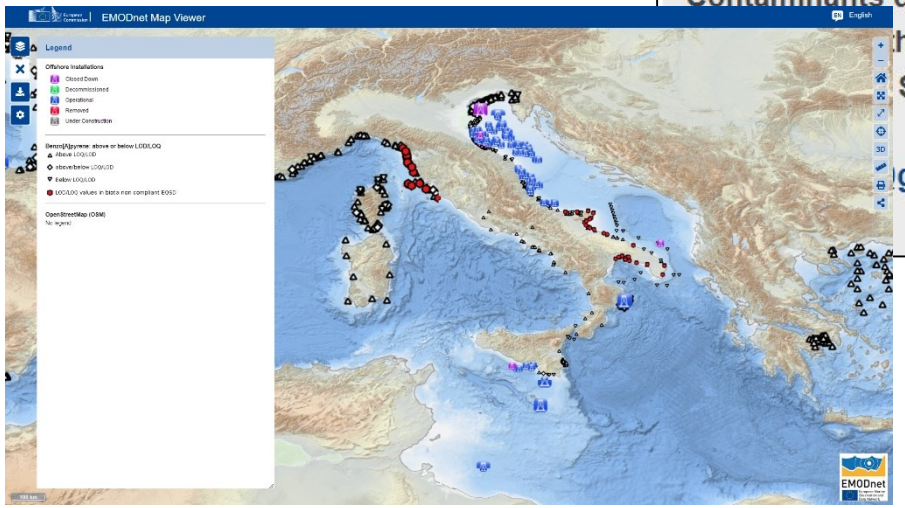
- contaminant **concentrations**
- anthropogenic **pressures** (pollution sources)
- **biological effects**

EMODnet provides: harmonized datasets (which can allow pollution assessment, maps of pollution,…)



Where do pollutants come from?

- ❑ Information on several human activities which may cause pollution available through EMODnet Central Portal
- ❑ Interoperability of data and information management allows to compare possible **pollution sources** (e.g. offshore platforms) with **pollutant maps** (e.g. hydrocarbons) and help improve the management of maritime activities towards the goals set by several legal obligations (e.g. the Marine Strategy Framework Directive for the achievement of Good Ecological Status, European Zero Pollution Strategy, and Marine Spatial Planning).



What are the impacts of pollution?

- ❑ Availability of harmonized data on impacts on the ecosystem (ecotoxicology, biological effects, …) is currently one of the major **weakness**
- ❑ Efforts are needed to harmonize **monitoring**, **assessment** and **data management** approaches

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Take home messages:

- Contaminants data management is **complex** due to the **large number** of substances, **heterogeneity** and to the need of **detailed metadata**
- Access to **methodological information** (QA/QC protocols, analytical and assessment methods,…) is **crucial** to use data to assess marine pollution
- Availability of **standardized and harmonized** large scale data collections supports a coherent pollution assessment, as well as helps identify gaps and needs in monitoring and research priorities
- By providing data on contaminant concentrations, on spatial distribution of human activities, and on biodiversity, EMODnet is a **good example of an integrated and interdisciplinary ocean data systems** to address marine pollution
- **Dialogue** with major data user communities (RSCs, JRC, EEA, National Authorities) is fundamental to continuously improve data management to better address societal needs

*"Pollution caused by human activity accumulates in the seas. Yet **poor** and **inaccessible** **data** means building a coherent and holistic picture of marine pollution is impossible"*

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Thanks for your attention

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