Introduction to SeaDataNet and EMODnet pan-European infrastructures for marine data management

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Economy of data acquisition

- Marine data are collected by governments, research institutes, and private industry (in Europe already more than 1.000 organisations)

- Data for physics, geophysics, meteorology, chemistry, biology, geology, bathymetry

- Acquisition of oceanographic and marine data is expensive; annual costs in Europe estimated at **1.4 Billion Euro** (1.0 = in-situ; 0.4 = satellites)

Professional data management is required with agreements on standardisation, quality control protocols, long term archiving, catalogues, and access

What is SeaDataNet?

A pan-European infrastructure set up and operated for managing marine and ocean data in cooperation with the NODCs and data focal points of 34 countries bordering the European seas

90s	Metadata directories Medar/MedAtlas
2002-2005	Sea-Search (FP5)
2006-2011	SeaDataNet (FP6)
2011-2015	SeaDataNet II (FP7)
2016-2020	SeaDataCloud (H2020)

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SeaDataNet portal

Giving access to

- Standards, tools both for data centres and other users

- Data and metadata

- Products

http://www.seadatanet.org
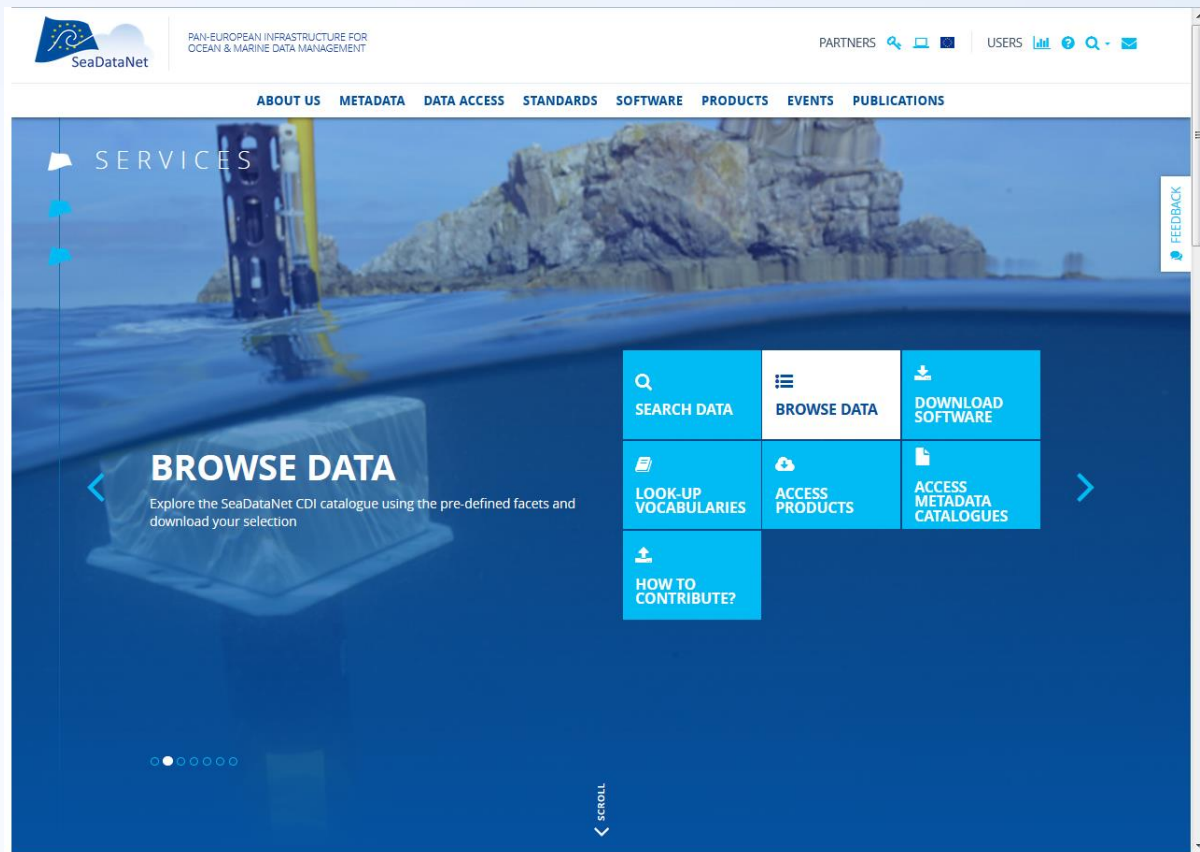
SeaDataNet standards

- Set of common standards for the marine domain, adapting ISO and OGC standards and achieving INSPIRE compliance
  - **Adoption of ISO 19115 – 19139 standard for describing metadata** on data sets, research cruises, monitoring networks, and research projects => marine metadata profiles, schemas, schematron rules
  - **Controlled vocabularies** for the marine domain (>65,000 terms in 82 lists), with international governance and web services
  - **Standard data exchange formats** : ODV ASCII and NetCDF (CF) fully supported by controlled vocabularies
- Maintenance and dissemination of standard QA-QC procedures, together with IOC/IODE and ICES

SeaDataNet services and tools

- **Set of tools** to be used each data centre and freely available from the SeaDataNet portal: metadata editor, data conversion software, data analysis software (ODV), data interpolation software (DIVA)

- **Capacity building** by training
  workshops for uptake of standards
  and tools by the data centres
  in order to achieve standardisation

- **Pan-European services** for harmonised discovery, access, visualisation of data and data products

- Common SeaDataNet **Data Policy** and License
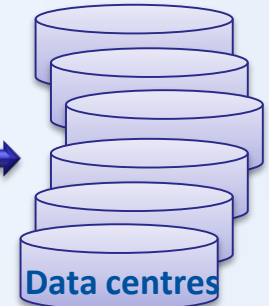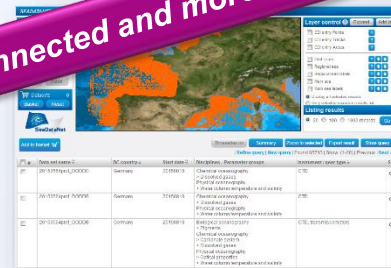
CDI Data Discovery and Access service
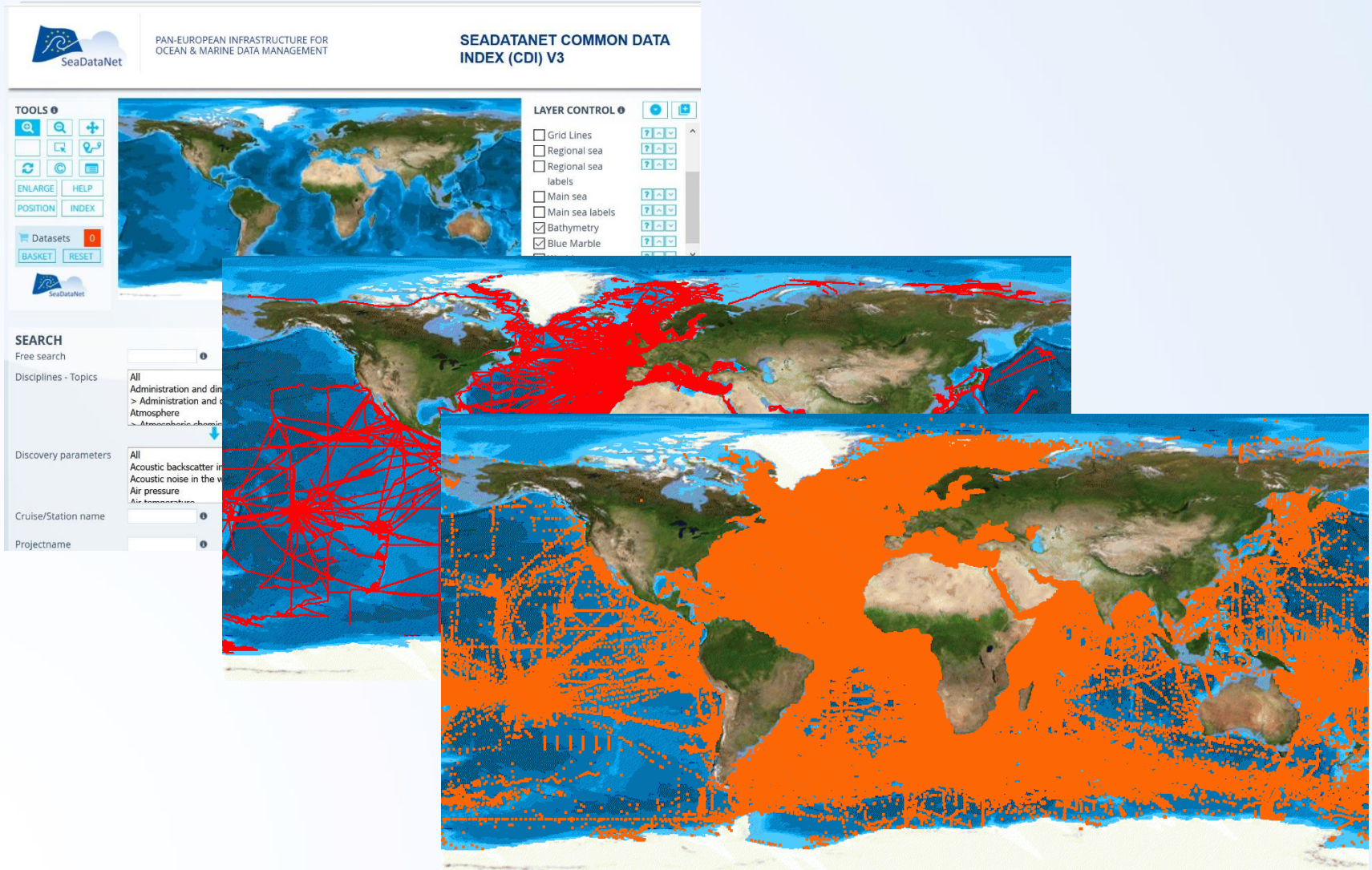
SeaDataNet portal
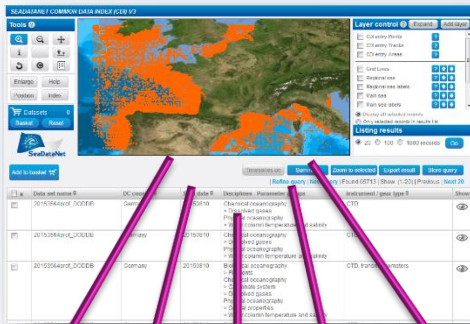
Search and Shop

Data

Already 113 data centres connected and more underway

European data sources

data centres ← ≈ 650 originators

Metadata

+ transaction data

Data centres

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CDI Data Discovery and Access service

Data Products and viewers

SeaDataCloud

- Standards and information technology are always evolving, there is a move towards cloud storage and cloud computing, and the SeaDataNet infrastructure must stay up-to-date to maintain and further expand its services to its leads customers and major stakeholders

- SeaDataCloud project, started Nov 2016 with 4 year run and 10 Meuro funding

- A strategic and operational cooperation between the SeaDataNet consortium of marine and ocean data centres and the EUDAT consortium of e-infrastructure service providers

Towards a Blue Cloud as blue print for the European Open Science Cloud (EOSC)

SeaDataCloud

Added-value services and applications – Cloud Platform

Downstream Services

Standards OGC, ISO, W3C & Vocabularies

Upstream Services

Discovery and access to datasets from many sources
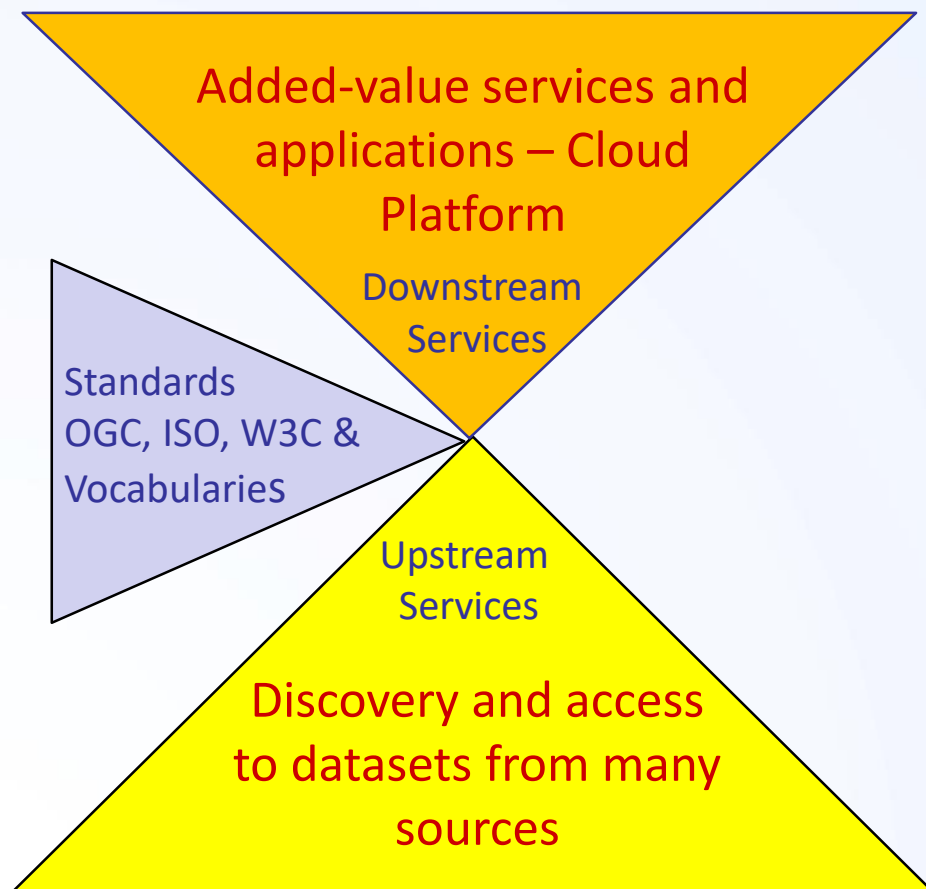
- Cloud platform with common services for data pre-processing, analyses, visualizations, publishing, DOIs…

- Applying common standards and interoperability solutions for providing harmonised data and metadata

- Providing harmonised discovery and access to data output from multiple sources, European and international

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SeaDataNet cooperation

- **Copernicus Marine Environmental Monitoring Services (CMEMS):** providing long-term archives and standards

- **Marine Strategy Framework Directive (MSFD):** providing infrastructure, standards and data collections for several indicators

- **Large ocean monitoring systems (EuroGOOS, AtlantOS, Euro-ARGO, JERICO-Next, ..):** providing standards and validation + long-term archiving services

- **Ocean Data Interoperability Platform (ODIP):** exploring and demonstrating common standards and interoperability with leading data management infrastructures in USA and Australia

- **GEOSS - EuroGEOSS:** Maintaining the GEOSS portal with SeaDataNet in-situ data collections from large community of European data holders (> 100 data centres; >600 data originators)

- **European Open Science Cloud (EOSC)**: shaping the pilot Blue Cloud

- **European Marine Observation and Data Network (EMODnet)** driven by Marine Knowledge 2020 and Blue Growth
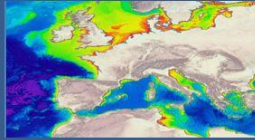
SeaDataNet and EMODnet
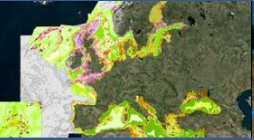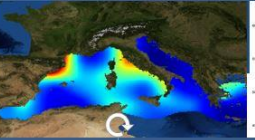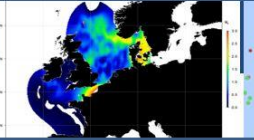
- EU initiative for an overarching **European Marine Observation and Data Network (EMODNet)** driven by Marine Knowledge 2020 and Blue Growth

- SeaDataNet qualified as a leading infrastructure for the EMODnet data management component and is driving several thematic portals from the start in 2008

'Bottom-up meets top-down'

- This synergy has resulted in many more data centres adopting SeaDataNet standards and connecting to the CDI Data Discovery and Access service while it gave a flying start to EMODnet

EMODnet thematic portals

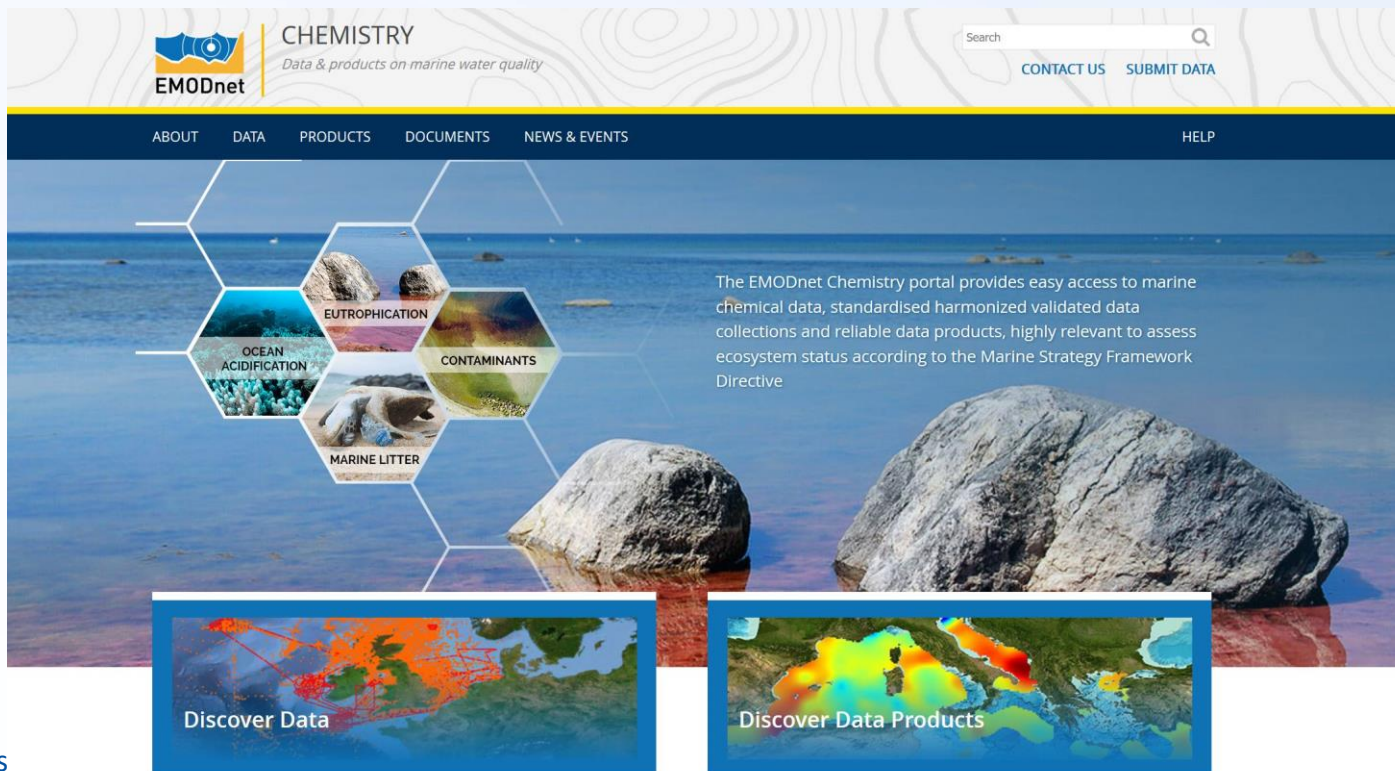| Bathymetry	Geology	Seabed Habitats	Chemistry	Biology	Physics	Human activities
Minimum cell water depth	Seabed substrate	Data on modelled seabed habitats (depth, seabed substrate, broad scale biological zone, T, S, light, oxygen, energy due to waves & current)	Pesticides & Biocides	Biomass	Waves	Aggregate Extraction Dredging
Maximum cell water depth	Sediment accumulation rate		Antifoulants	Abundance	Water temperature	Fisheries
Average cell water depth	Sea-floor geology		Phamaceuticals	Gridded Abundance maps	Water salinity/conductivity/density	Hydrocarbon Extraction Main Ports
Standard deviation of cell water depth	Seabed lithology		Heavy Metals	species groups:	Currents	Mariculture
Number of values used for interpolation of cell water depth	Stratigraphy	Broad-scale physical habitat map	Hydrocarbons	· phytoplankton	Light attenuation/ fluorescence	Ocean Energy Facilities
Horizontal coordinate reference system	Coastline migration	Detailed habitat maps from surveys	Radionuclides	· zooplankton	Sea level	Pipelines and Cables
Depth reference system	Aggregate resources	Individual habitat modelling outputs	Fertilizers	· angiosperms	Atmospheric parameters	Protected Areas
Lowest Astronomical Tide	Geological events	Habitat point data	Acidity	· macro-algae	Wind	Waste Disposal
			Dissolved Gasses	· invertebrate bottom fauna	Underwater noise	Wind Farms
			Plastics	· birds	Rivers	Other Forms of Area Management / Designation
			Marine Litter Beach litter Seafloor litter Micro litter	· mammals	Ice	
			Chlorophyll Silicates Organic Matter	· reptiles		
				· Fish		

EMODnet Chemistry

- Collecting, validating, and harmonising data, and developing regional data products and new services for sharing and visualising data and data products, relevant for MSFD

- Close interaction with EU DG Environment, EEA, TG-DATA, TG-ML, and Regional Sea Conventions

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EMODnet Chemistry

- Validated data collections and trend maps for MSFD indicators 5 (Eutrophication), 8 (Contaminants), 9 (Sea-food contaminants) and 10 (Marine Litter).

MSFD regions

Group of Variables	Baltic Sea	Iberian peninsula - Macaronesia - Bay of Biscay	Greater North Sea - Celtic Sea - Faroes	Arctic Ocean - Norwegian Sea - Greenland Sea - Barents Sea - Icelandic Waters	Mediterranean Sea	Black Sea - Sea of Azov - Marmara Sea
Acidity ⓘ	■ (>25000)	■ (5001-10000)	■ (10001-25000)	■ (2501-5000)	■ (>25000)	■ (>25000)
Antifoulants ⓘ	■ (251-1000)	■ (51-250)	■ (1001-2500)	■ (51-250)	■ (251-1000)	■ (1-50)
Chlorophyll ⓘ	■ (>25000)	■ (10001-25000)	■ (>25000)	■ (10001-25000)	■ (>25000)	■ (2501-5000)
Dissolved gasses ⓘ	■ (>25000)	■ (>25000)	■ (>25000)	■ (10001-25000)	■ (>25000)	■ (>25000)
Fertilisers ⓘ	■ (>25000)	■ (10001-25000)	■ (>25000)	■ (>25000)	■ (>25000)	■ (>25000)
Hydrocarbons ⓘ	■ (2501-5000)	■ (2501-5000)	■ (2501-5000)	■ (251-1000)	■ (2501-5000)	■ (>25000)
Heavy metals ⓘ	■ (2501-5000)	■ (2501-5000)	■ (10001-25000)	■ (251-1000)	■ (5001-10000)	■ (5001-10000)
Organic matter ⓘ	■ (5001-10000)	■ (10001-25000)	■ (>25000)	■ (51-250)	■ (5001-10000)	■ (2501-5000)
Polychlorinated biphenyls ⓘ	■ (251-1000)	■ (251-1000)	■ (10001-25000)		■ (1001-2500)	■ (2501-5000)
Pesticides and biocides ⓘ	■ (1001-2500)	■ (251-1000)	■ (5001-10000)	■ (251-1000)	■ (1001-2500)	■ (10001-25000)
Radionuclides ⓘ	■ (251-1000)		■ (251-1000)	■ (1-50)	■ (51-250)	■ (251-1000)
Silicates ⓘ	■ (>25000)	■ (10001-25000)	■ (>25000)	■ (>25000)	■ (>25000)	■ (>25000)

Legend:
- ■ 1-50
- ■ 51-250
- ■ 251-1000
- ■ 1001-2500
- ■ 2501-5000
- ■ 5001-10000
- ■ 10001-25000
- ■ >25000

Legend - number of measurement data sets for each variable per marine region

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Developing and promoting SWE uptake

- SeaDataNet deals with validating and making collected data sets discoverable and accessable. These concern delayed mode and operational data

- For the latter SDN develops and promotes adoption of Sensor Web Enablement (SWE) standards by operators of research vessels and observation platforms for:

  - streamlining the (near) real time data flows from platforms to data centres,

  - Receiving well documented data streams

  - facilitating easy access by means of operational viewing services

Workshop goals
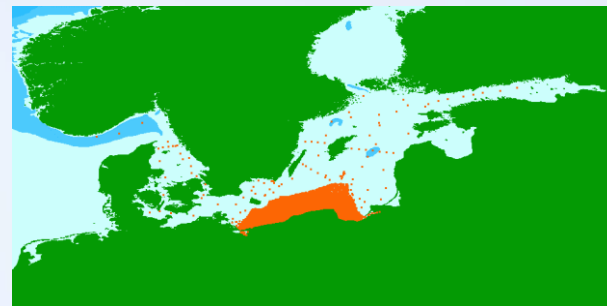
- To inform and make marine data collectors in Poland interested in connecting and actively populating the SeaDataNet infrastructure with their data and metadata; at present we have input from IMGW, PIG, and IO PAN

- To make managers and technicians from operators of oceanography platforms and networks in Poland more aware about SWE developments and its opportunities

- To encourage operators in Poland to join and participate in the European operational oceanography data exchange.