

# Ocean Acidification Data: Weaves to be Tied on European and Global scale



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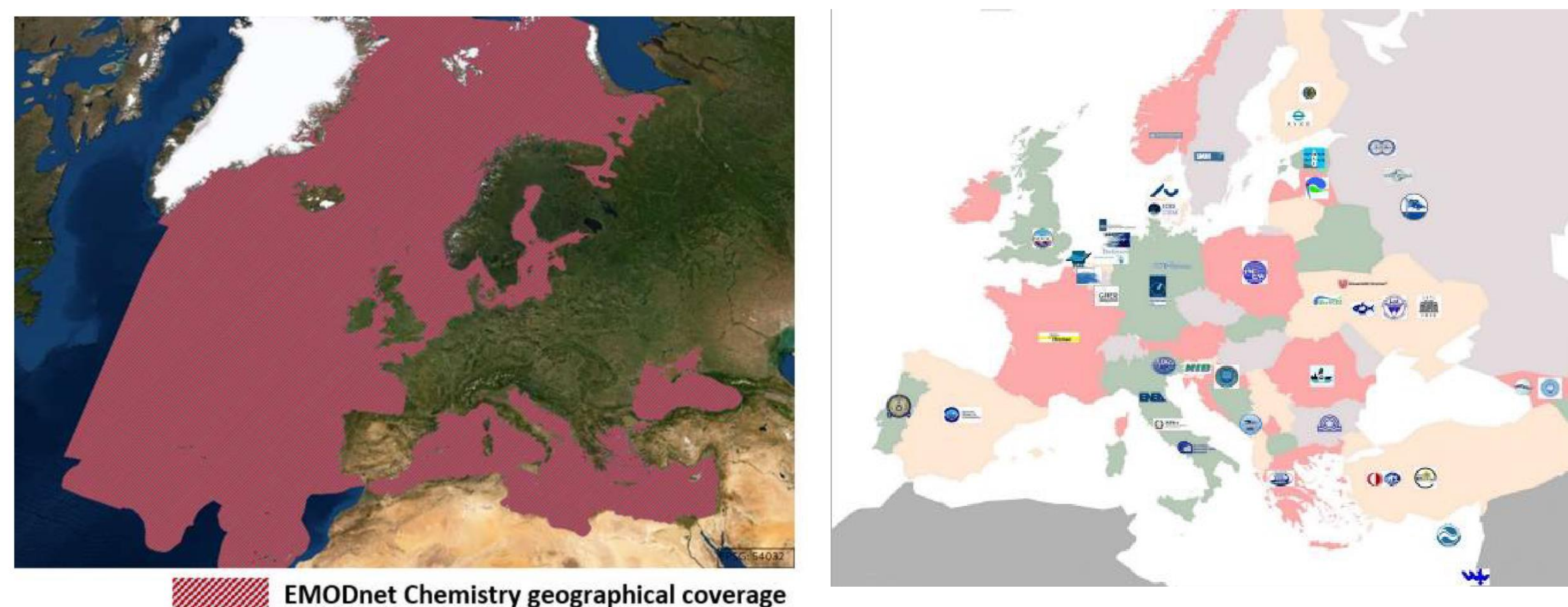
## Introduction

**FAIR** (Findable, Accessible, Interoperable and Reusable) **Ocean Acidification data** for knowledge of impacts on marine ecosystems are of increasing importance, as is the consolidating of dialogue between scientists and data scientists with policy makers to achieve the UN goal of **Good Environmental Status (GES)** for the oceans and seas. Open science can therefore help address the challenges facing our societies.

Here we give an **insight into the validated and aggregated Ocean Acidification dataset** provided by **EMODnet Chemistry**, the long-term European initiative involving a network of organizations working together to collect, process and make marine data freely available as interoperable data layers and data products.

## EMODnet Chemistry Ocean Acidification Data

**Ocean acidification** is related to a number of physical and biogeochemical processes involving the carbonate system of seawater. **EMODnet Chemistry** provides several parameters related to ocean acidification such as **pH**, **Total Alkalinity (TA)**, **Total Dissolved Inorganic Carbon (DIC)** and **partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>)**. EMODnet Chemistry receives data from **66 European centers**, 5 international organizations and 500+ data providers from 32 countries. Standard tools and approaches such as standard metadata, common file formats and common vocabularies based on the BODC Parameter Usage Vocabulary are used. **Table 1** shows the number of CDIs for pH, TA, DIC and pCO<sub>2</sub> for the five European sea regions.



**Figure 1:** Left panel: EMODnet Chemistry geographical coverage of the European Seas; Right panel: EMODnet data providers (NODCs).

	Baltic Sea	North East Atlantic	Black Sea	Mediterranean Sea	North Sea
<b>pH</b>	31374	18394	27115	24497	15098
<b>Total Alkalinity</b>	9986	2173	15665	3852	4305
<b>DIC</b>	0	1443	4	763	337
<b>pCO<sub>2</sub></b>	0	11	0	0	1

**Table 1:** Number of CDIs of water body pH, water body total alkalinity, water body dissolved inorganic carbon (DIC), water body partial pressure of carbon dioxide (pCO<sub>2</sub>) for the five different sea regions covered by EMODnet Chemistry.

## Data exploration and data extraction

The **webODV** (<https://emodnet-chemistry.webodv.awi.de/>) service facilitates to explore, subset, visualize, and extract the data sets in multiple formats from the harmonized, standardized, validated data collections that **EMODnet Chemistry** is regularly producing and publishing for all European sea basins for eutrophication, **ocean acidification** and contaminants.

## New Guidelines for Ocean Acidification Data/Metadata

Detailed vocabulary and the according metadata will guarantee the correct description of the carbonate system and therefore also the long term usability of the data. In 2022 new guidelines for Ocean Acidification data and metadata were released and an analysis of the Ocean Acidification Vocabulary (P01 and P35 codes) has been done (doi: [10.13120/C1933032-9FA9-4678-8539-EFFA1560921C](https://doi.org/10.13120/C1933032-9FA9-4678-8539-EFFA1560921C)).

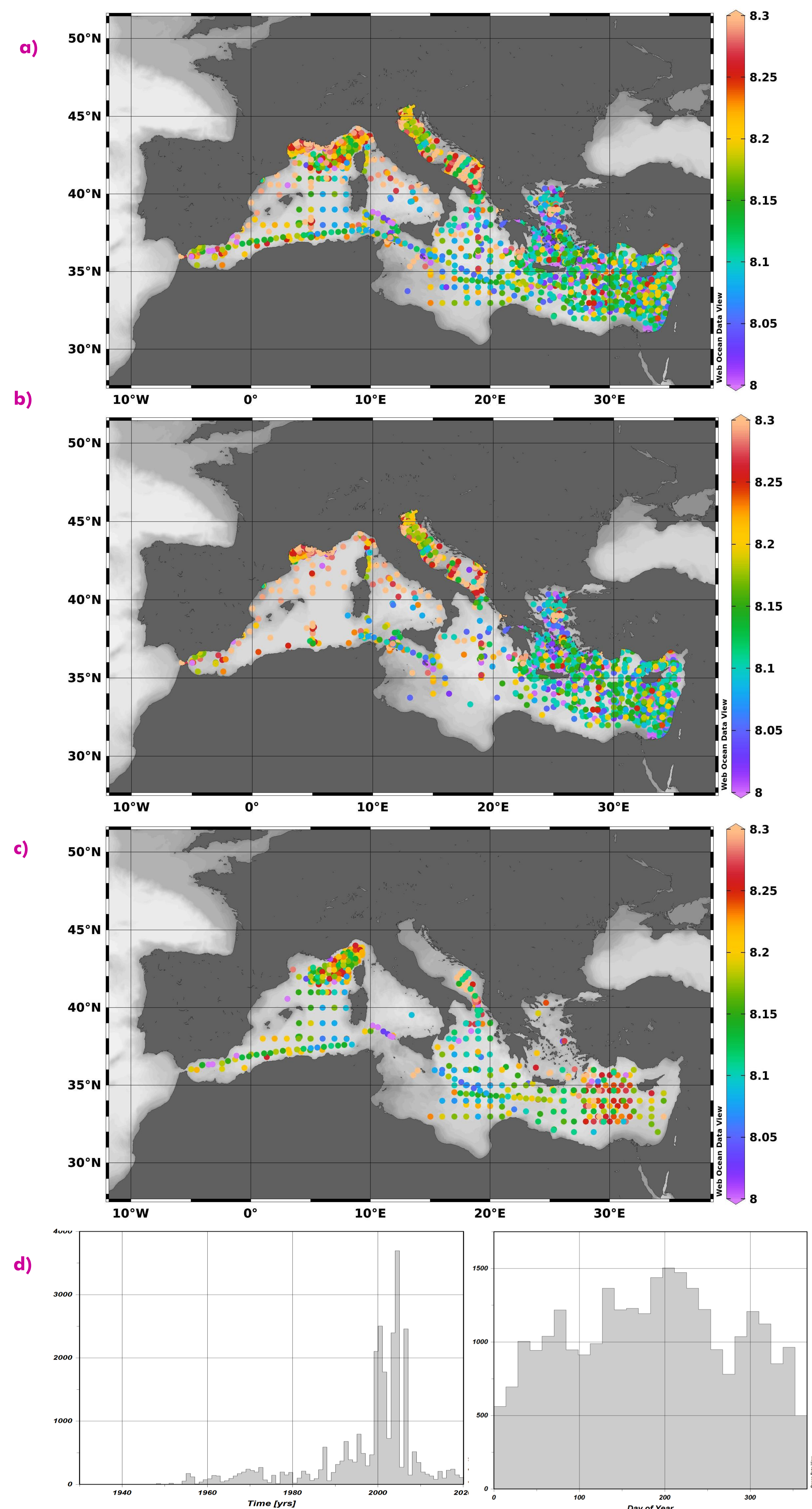
## Aim and future perspectives

The overall aim is to **harmonize the EMODnet Chemistry Ocean Acidification metadata** with world-wide ocean acidification databases. To enable the exchange of datasets the metadata requirements of all platforms involved will have to be aligned. Therefore EMODnet Chemistry participated at regular vocabulary and metadata meetings with the **UNESCO SDG 14.3.1. working groups** and will implement the more detailed metadata proposed by UNESCO.



## Ocean Acidification Data in the Mediterranean Sea

**pH data** from the latest aggregated EMODnet Chemistry dataset are used to show the **available data** for the entire Mediterranean Sea. **Figure 2a** shows the pH values and the spatial data distribution for the whole water column (**0-5000 m**). **Figure 2b,c** show the pH values and the data distribution for surface and intermediate layers together (**0-700 m**) and for the deepest layers (**700-5000 m**). **Figure 2d** shows the histogram of data measurements since the beginning of the measurements and the according seasonal data distribution.



**Figure 2:** Data distribution and values of water body pH from the latest EMODnet Chemistry aggregated dataset through **a)** the entire water column (**0-5000 m**), **b)** the surface and intermediate layers together (**0-700 m**) **c)** the deepest layer (**700-5000 m**). **d) Left panel:** Histogram of data measurements since the beginning of the data collection; **Right panel:** Seasonal histogram of the data.

Units are **pH units**.

Plots were done using **webODV**: <https://emodnet-chemistry.webodv.awi.de/> and the latest Mediterranean Sea - Eutrophication and Acidity aggregated datasets 1911/2020 v2021 (<https://doi.org/10.6092/ep6n-tp63>).