

COLLOQUE - ACIDIFICATION DES OCÉANS

Conséquences sur les écosystèmes et les activités humaines

Le suivi du pH: Indicateur ODD 14

28 mars 2019

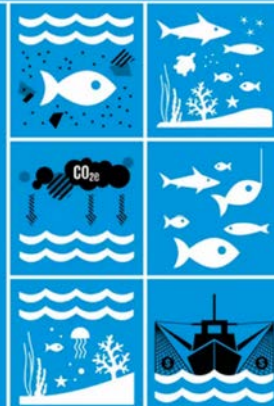
Marion Gehlen
IPSL/LSCE – membre du CS AO





SUSTAINABLE
DEVELOPMENT **GOALS**
KNOWLEDGE PLATFORM

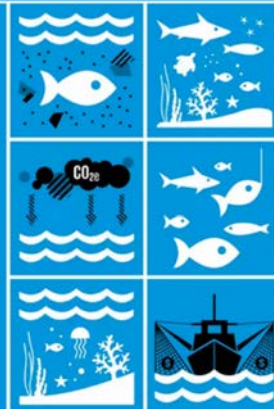
14 LIFE BELOW
WATER



Jürgen Freund/ 



14 LIFE BELOW WATER



TARGETS

14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

INDICATORS

14.1.1 Index of coastal eutrophication and floating plastic debris density

14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches

14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations

14.4.1 Proportion of fish stocks within biologically sustainable levels

Monitoring global surface ocean pH

A new indicator developed for the **Copernicus Marine Service**:



Global surface ocean pH from 2001 onwards

→ developed under the Multi-observation (MOB) TAC by
Anna Conchon (Mercator Ocean International), & Marion Gehlen (LSCE/IPSL)

Challenge:

Direct measurements of pH are rare; data sources include fixed ocean observatories (e.g. BATS, HOT) and scientific field campaigns

Approach:

- Reconstruction of global monthly mean surface ocean pH distribution (2001 to present) at $1^{\circ} \times 1^{\circ}$ spatial resolution
- Use of observed in situ pH data for independent validation of reconstructed pH
- Compute global mean annual time series of surface ocean pH

Reconstruction of surface ocean pH

Global (1°x1°) monthly surface ocean pH: 2100 to present
CO2sys van Heuven et al, 2011, Lewis & Wallace, 1998



Surface ocean $p\text{CO}_2$: $p\text{CO}_2^{\text{oc}} = g(\text{SSS}, \text{SST}, \text{SSH}, \text{MLD}, \text{Chl}, p\text{CO}_2^{\text{atm}}, \text{lon}, \text{lat})$
from a neural network

- SSS, SST, SSH, MLD, CHI
- CO_2^{atm} : www.bgc-jena.mpg.de
- $p\text{CO}_2^{\text{oc}}$: Bakker et al., 2016 – Surface Ocean CO_2 Atlas (SOCAT), training

Alkalinity

Empirical relationship: $\text{ALK} = f(\text{SSS}, \text{SST}, \text{nutrients})$, Carter et al. 2016, 2018

Reconstruction of surface ocean pH

Validation against independent data:

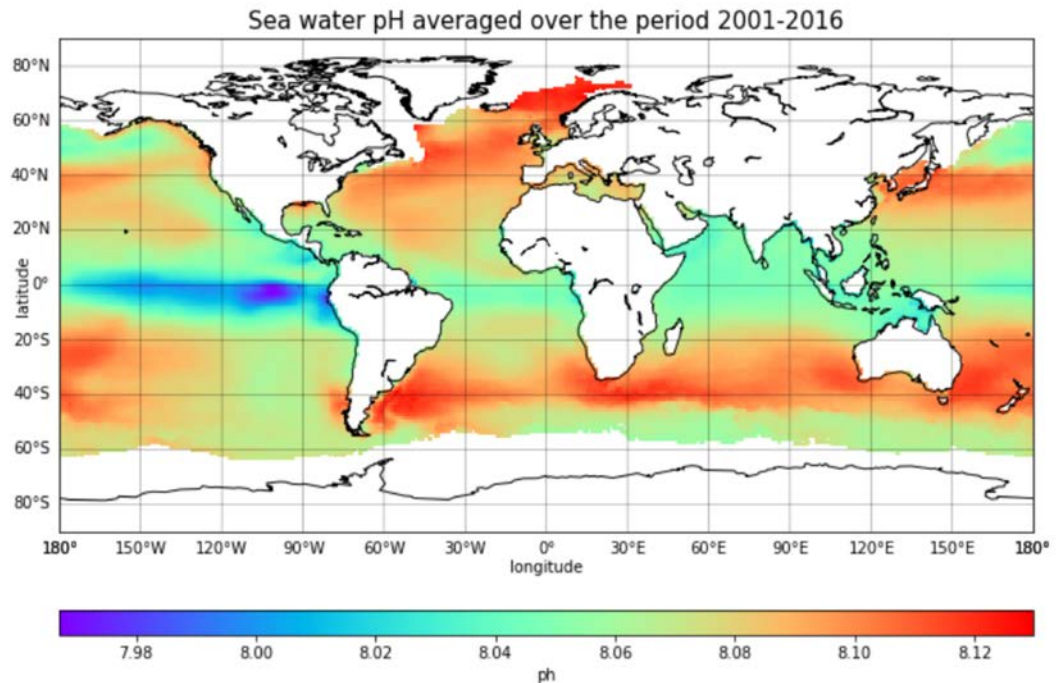


Copernicus
Marine Service

Example:

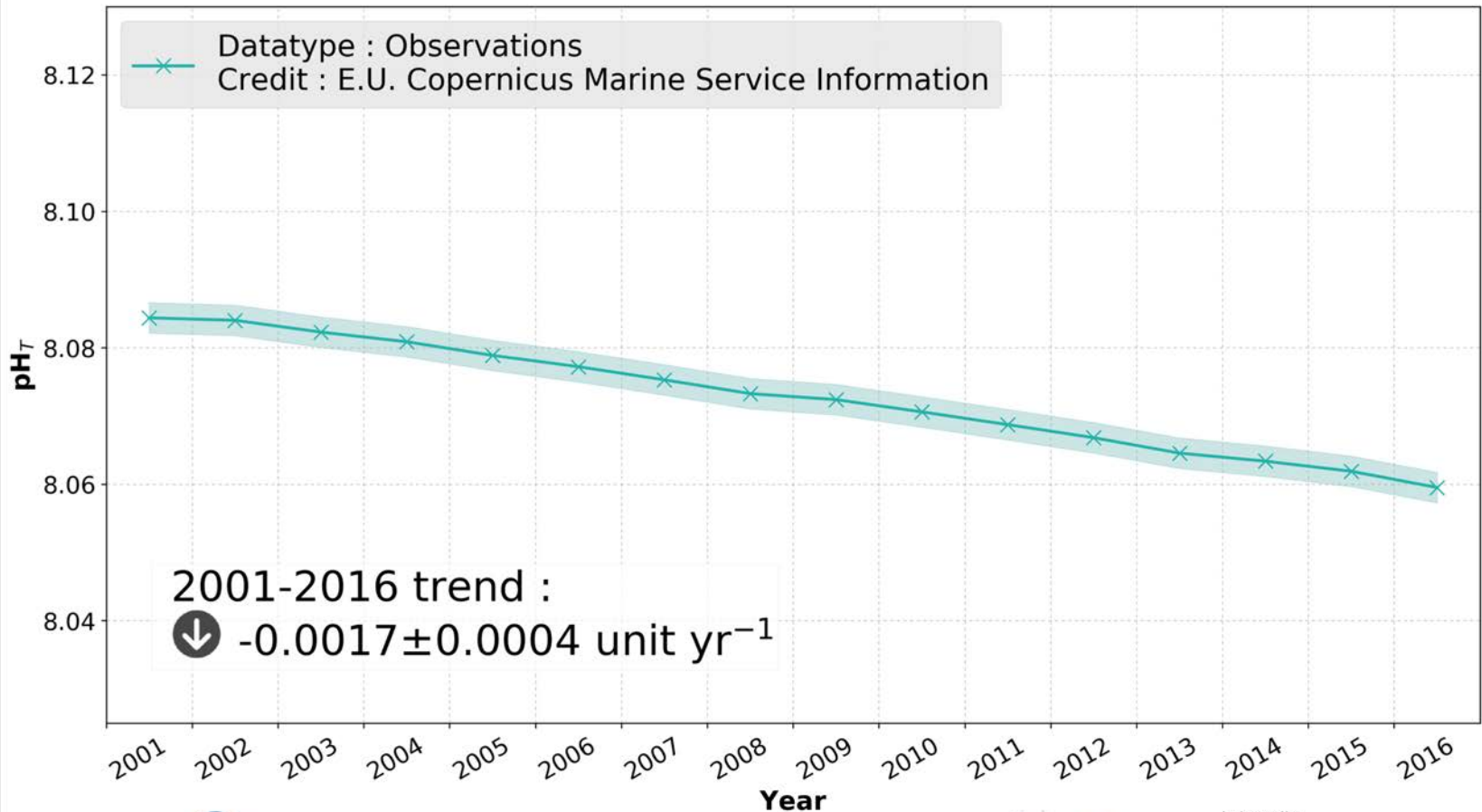
GLODAPv2
bottle data
n=4907
(Key et al., 2015)

Model	RMSE	r^2	Absolute bias
Global	0.03	0.61	0.02



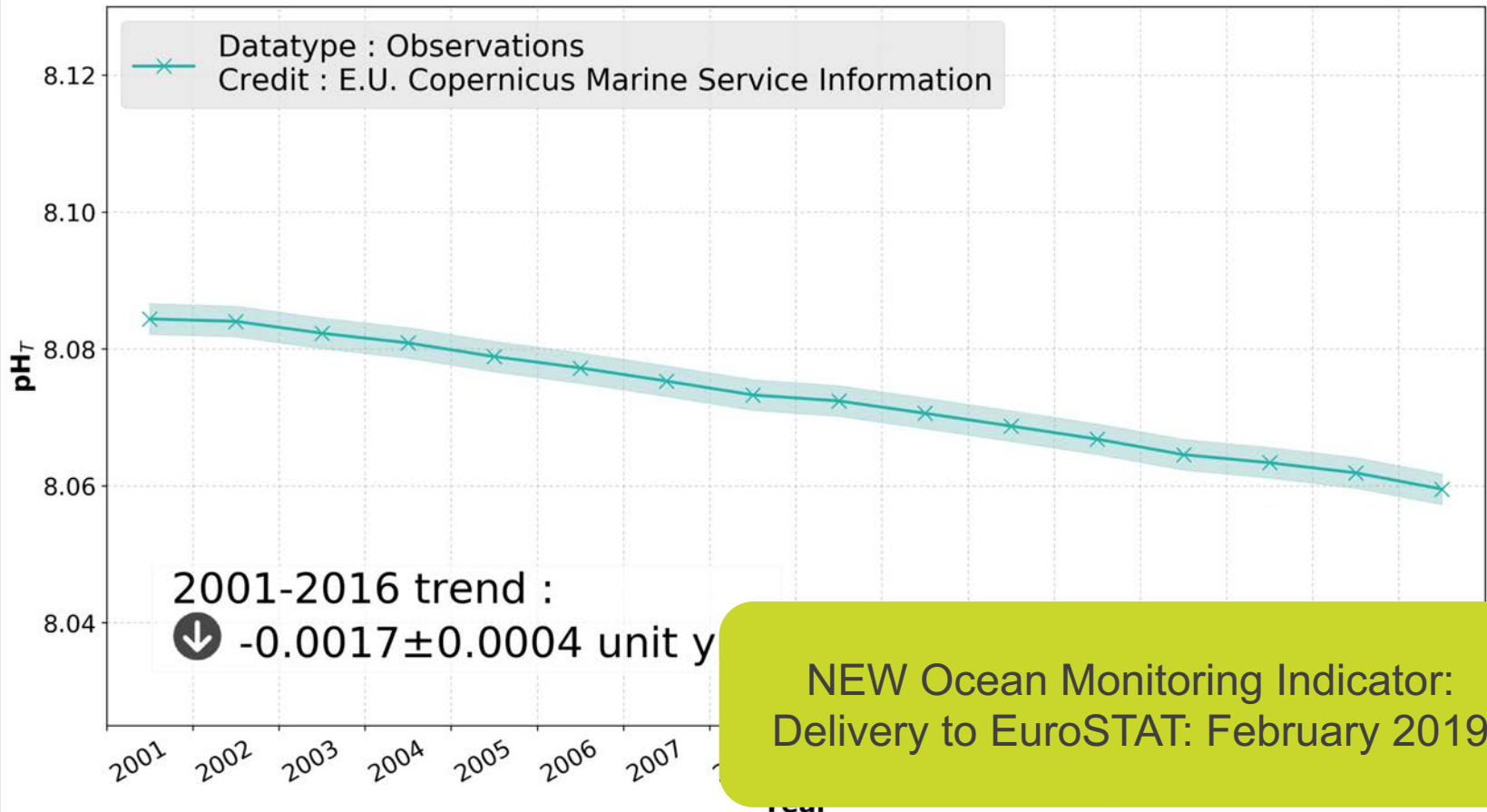
Reconstruction of surface ocean pH

Yearly Mean Surface Sea Water pH reported on total scale



Reconstruction of surface ocean pH

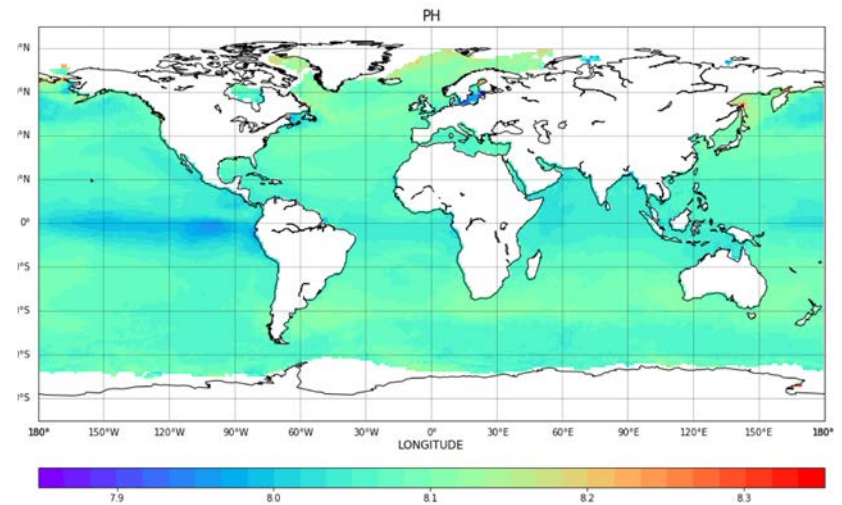
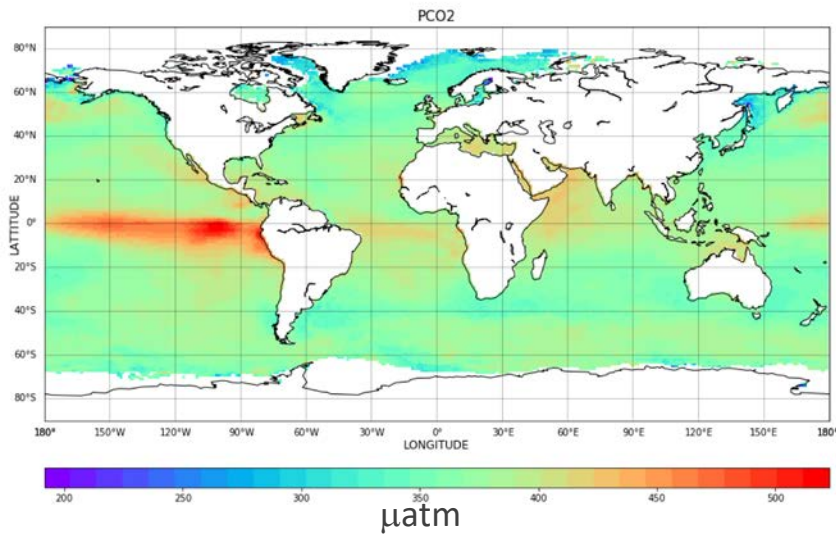
Yearly Mean Surface Sea Water pH reported on total scale



NEW Ocean Monitoring Indicator:
Delivery to EuroSTAT: February 2019

Surface ocean pCO₂ and pH

pCO₂^{atm} : 396.52 +/-0.12 (NOAA)



yearly averages 2013



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Ocean product catalogue, to download or visualize data across more than 10 variables, including historic, current and forecasted data.

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Essential variables monitoring the health of the ocean

[TRENDS](#)

OCEAN STATE REPORT

Extensive annual analysis on the state of the ocean over nearly 20 years and severe/notable annual events

[EXPERTISE](#)

2018
22
MAR.

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LATEST NEWS FLASH

CMEMS-7324-A
New Service Release on 22 March 2018 - Status on updates
[INFORMATION](#)

[ALL NEWS FLASH](#)

28
MARCH

EVENTS AGENDA



PARTNERS AND STAKEHOLDERS



FOCUS ON



TRAINING AGENDA

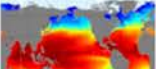


OUR OCEAN STATE REPORT AWARDED THE DENNY MEDAL




We are delighted to announce that the Ocean State Report produced by the Copernicus Marine Service has been awarded the Institute of Marine Engineering, Science and Technology (IMarEST) Denny Medal, an annual award for the most worthy paper published with the Journal of Operational Oceanography (JOO).

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SAL_ANALYSIS_FORECAST_PHY_001_024			
PACIFIC OCEAN 1°12' PHYSICS ANALYSIS AND FORECAST UPDATED DAILY			
<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	(1)	GLO	
SURV MLD T BIT SIC S-SMUV degree x 0.033 degree (50 depth levels) 006-12-27 to Present mean, hourly-mean			
 ADD TO CART	 WMS Sub-setting		

SAL_ANALYSIS_FORECAST_BIO_001_014			
PACIFIC OCEAN BIOGEOCHEMISTRY ANALYSIS AND WEEKLY FORECAST			
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CHLOROPHYLL A degree x 0.5 degree (50 depth levels) 012-01-01 to Present mean			
 ADD TO CART	 WMS Sub-setting		



Marine
Monitoring

THE COPERNICUS MARINE SERVICE

MULTI-YEAR

10 to 45 years



REAL-TIME

Daily, hourly



FORECAST

2 to 10 days

ESSENTIAL MARINE VARIABLES

- Physics
- Sea-ice
- Waves
- Biogeochemistry

OBSERVATIONS

In-situ & Satellites



NUMERICAL MODELS &

data assimilation



Open and Free access



1 Global

2 Arctic

3 Baltic

4 NWS

5 IBI

6 Med Sea

7 Black Sea

K. von Schuckmann (karina.von.schuckmann@mercator-ocean.fr)



European
Commission

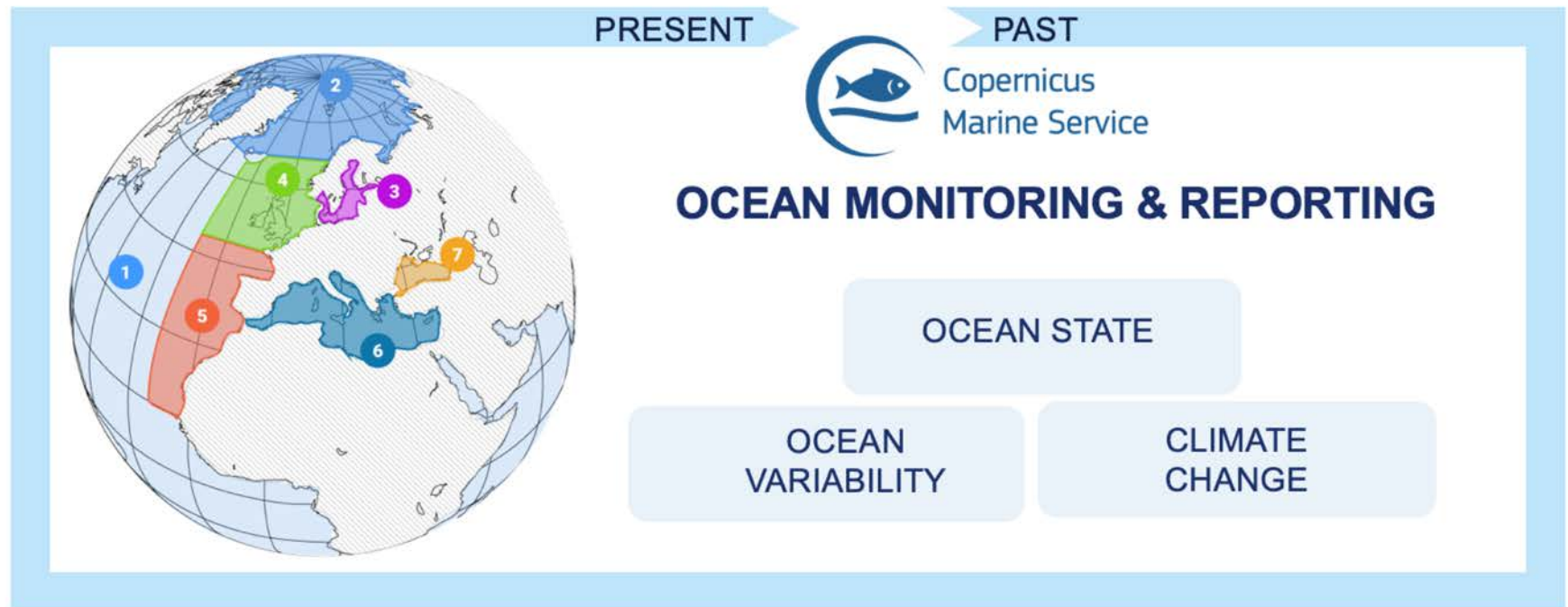
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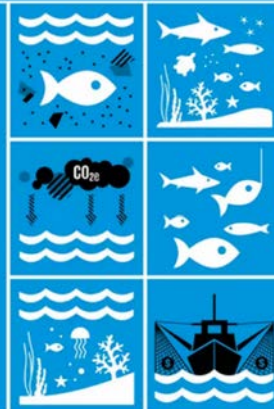
Copernicus Marine Service REPORTING: OBJECTIVE

Develop a fundamental source of CMEMS value-added information and indicators for the monitoring & reporting of the European regional seas and the global ocean state, variability and change from the past to the present.



EUROPE: Link to C3S, EEAMSF, ICES, EC, EuroGOOS, ...

INTERNATIONAL: Link to SDG, BAMS, GCP, WMO, Ocean & Climate platform, ...



pH, New Ocean Monitoring Indicator

- time series of global annual mean pH
- distributed through CMEMS portal, first quarter 2019
- global, 1°x1° resolution, monthly fields
- data-based: model assessment
- monitoring of ocean pH at regional, basin and global scale



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Jürgen Freund/

