



Marine Monitoring

Advancing marine monitoring and protection with Copernicus Marine

Tina Silovic et al.- Mercator Ocean International



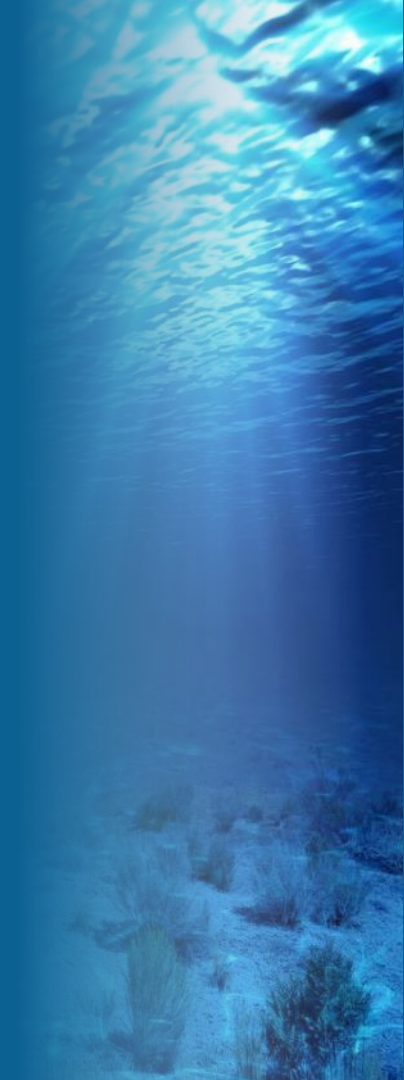
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Copernicus Marine Service



Copernicus
Marine Service



[Services](#) [Opportunities](#) [Access Data](#) [Use Cases](#) [User Corner](#) [About](#)

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Copernicus Marine Service

Providing free and open marine data and services to enable marine policy implementation, support Blue growth and scientific innovation.

Access Data

DATA

OCEAN PRODUCTS

A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.

EXPERTISE

OCEAN STATE REPORT

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

TRENDS

OCEAN CLIMATE TRENDS

Monitoring the health of the ocean.
[Ocean Monitoring Indicators](#)
[Ocean Climate Portal](#)

EXPLORATION

OCEAN VISUALISATION

Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users

Copernicus Ocean State Report 8 Release



The 8th issue of the EU Copernicus Ocean State Report (OSR) is now available online, along with an interactive Summary for policymakers. The OSR 8 is a flagship report of the EU Copernicus Marine Service, funded by the European Union and coordinated by Mercator Ocean International, and provides a comprehensive overview on the state, variability and change of the global ocean for scientists, members of the blue economy, decision makers and the general public. The OSR 8 has been established under international scientific collaboration, with contributions from over 120 participants.

[Learn more](#)

Online catalogue

marine.copernicus.eu

**More than 300
scientifically
qualified products**

User driven

>80 000 subscribers

Open and Free



Copernicus Marine Portfolio



COPERNICUS MARINE REGIONAL OCEAN PRODUCT DIVISIONS

- 1 Global Ocean
- 2 Arctic Ocean
- 3 Baltic Sea
- 4 European North West Shelf Seas
- 5 Iberian Biscay Ireland Seas
- 6 Mediterranean Sea
- 7 Black Sea



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Copernicus Marine Products – Green Ocean



MODEL



SATELLITE



IN SITU



100m a 25 km

Hourly, daily,
monthly, yearly

10 days
forecasts

Time series up to
30 years

Updated daily

EXAMPLES OF OTHER
VARIABLES INCLUDED IN
OUR PORTFOLIO:



REFLECTANCE



PHOTOSYNTHETICALLY
ACTIVE RADIATION



PHYTOPLANKTON SIZES
CLASS TYPES



DISSOLVED ORGANIC
CARBON



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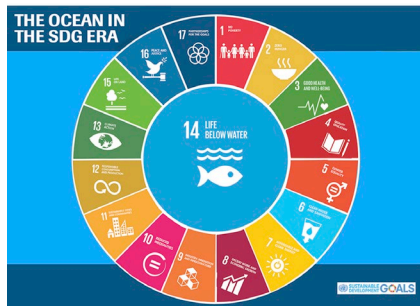


Implemented by





Supporting wide range of applications



von Schuckmann et al., *Marine Policy* Vol 121, 2020, 104154



Ocean Health



Marine Conservation & Biodiversity

- | | | |
|--------------------------------------|--|-------------------------------|
| 1 POLAR ENVIRONMENT MONITORING | 5 SCIENCE & INNOVATION | 9 MARINE FOOD |
| 2 CLIMATE & ADAPTATION | 6 POLICIES & OCEAN GOVERNANCE & MITIGATION | 10 COASTAL SERVICES |
| 3 OCEAN HEALTH | 7 EDUCATION, PUBLIC HEALTH & RECREATION | 11 TRADE & MARINE NAVIGATION |
| 4 MARINE CONSERVATION & BIODIVERSITY | 8 EXTREMES, HAZARDS & SAFETY | 12 NATURAL RESOURCES & ENERGY |



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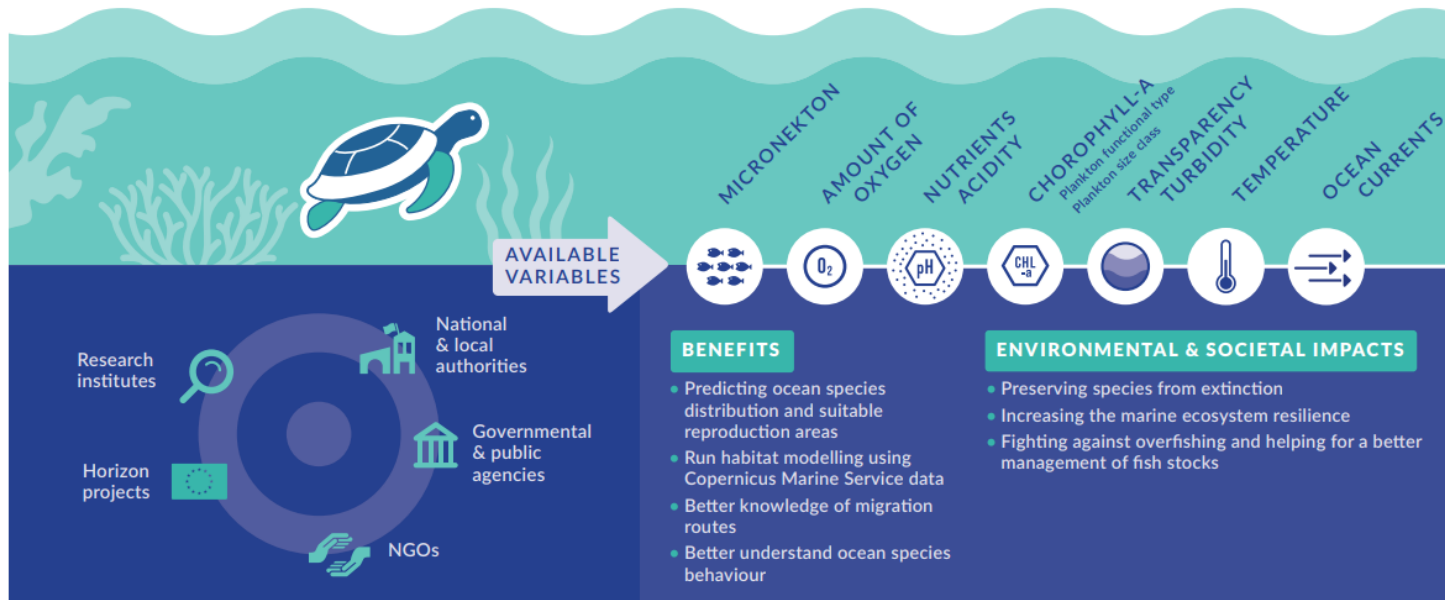
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MARINE CONSERVATION & BIODIVERSITY

The Copernicus Marine Service provides key data to monitor marine biodiversity and Marine Protected Areas, preserving at-risk ecosystems.





Conservation & Biodiversity - USE CASES

Use Cases

Home > Services > Use Cases

Region

All

Country

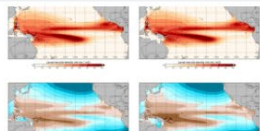
All

Markets

Marine Conservation & Biodiversity

☐ Mobile Application
☐ Demo

Search



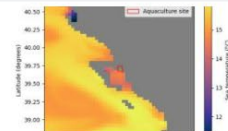
SEAPODYM - Evaluating Conservation Impact of Marine Protected Areas for Pacific Tunas



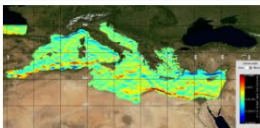
SEA CLEARLY - A tool to assess ocean plastic transport on and by aquaculture farms



Real-time assessment of MPAs with marine megafauna movements and bio-physical ocean variables



Enhancing traceability and tracking in Aquaculture and fisheries supply chain through the use of blockchain and earth observation



T-MEDNet - Tracking the effects of climate change in the Mediterranean



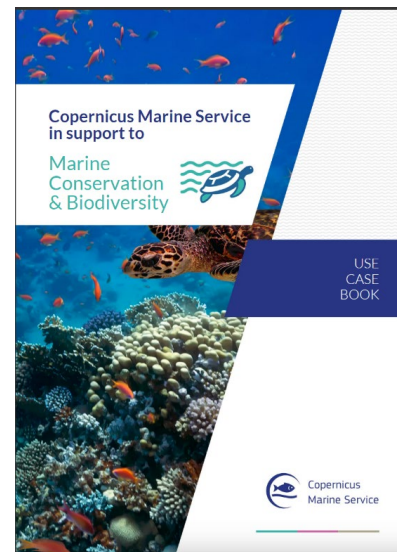
The MarCOSouth Western Indian Ocean Coral Bleaching Monitoring Service



From open data to marine knowledge: A service for augmented data access and reproducible data analysis



TURTLES: Effects of swimming behaviour on oceanography on sea turtle hatchling dispersal



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Challenges for Conservation & Biodiversity



OCEAN ACIDIFICATION

UNITS: pH units/decade

TIME: 1985–2022



*A decrease in pH denotes an Increase in ocean acidification.

Global Ocean

Northeast Atlantic and Adjacent Seas



-0.017

±0.002 pH units/decade



-0.017

±0.01 pH units/decade



Atmospheric Carbon Dioxide

Absorbed by the ocean



Water



Carbonic Acid

pH ↓

↑ Ocean Acidification

↓ Carbonate

Ocean acidification threatens marine ecosystems and impacts many biological processes. Changing ocean chemistry is particularly dangerous to calcifying organisms like shellfish and coral.



OCEAN ACIDIFICATION: THE OCEAN IS BECOMING MORE ACIDIC

The ocean is a major sink of anthropogenic excess CO_2 . This absorption of carbon mitigates the effects of global warming, but it also results in a major threat to marine life — ocean acidification.

The pH of contemporary surface ocean waters is already 0.1 pH units lower than in pre-industrial times. As pH is logarithmic, this 0.1 pH unit change is equivalent to a nearly 30% increase in ocean acidity since pre-industrial times.

CHALLENGES:

- > Increasing Pollutions
- > Over – fishing
- > Heatwaves
- > De-Oxygenation
- > Ocean acidification
- > Loss of Habitats

GOALS:

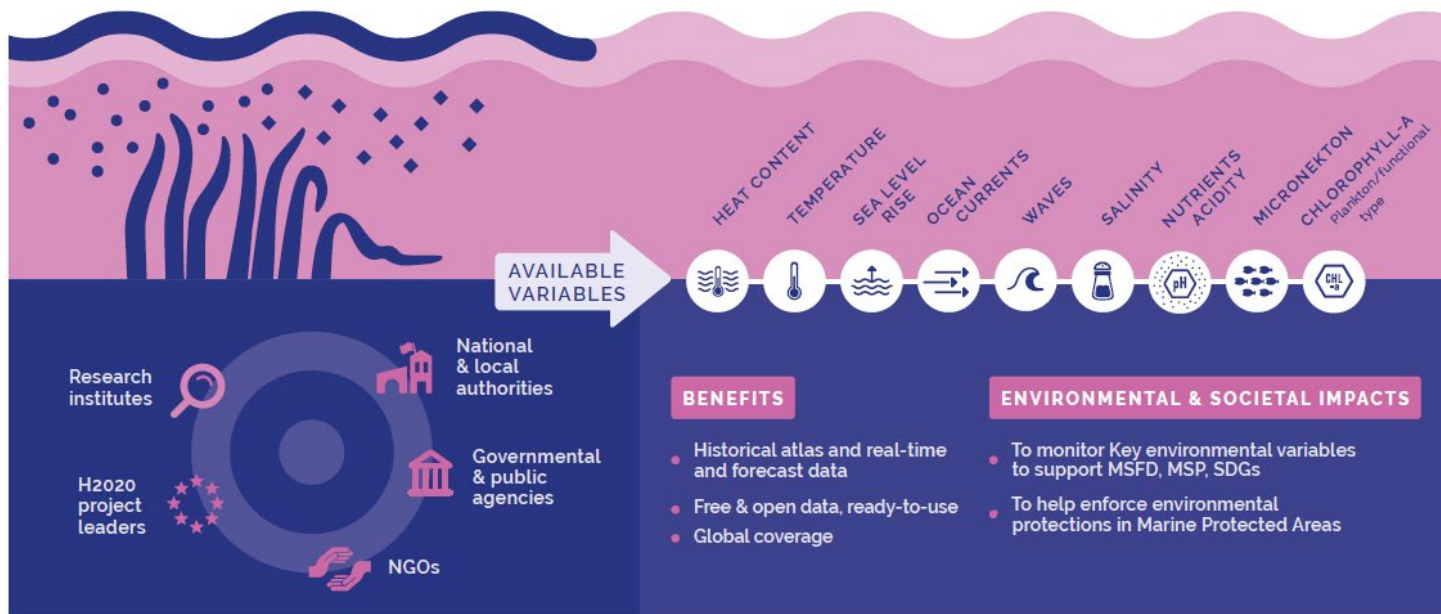
- > Protected marine biodiversity
- > Sustainable exploitation of marine resources
- > Environment policies



Support Policies and Ocean Governance

POLICIES & OCEAN GOVERNANCE & MITIGATION

Copernicus Marine Service provides key data to support European Member States in the implementation of European Directives (MSFD, MSP, SDG). It also supports Marine Protected areas to preserve at-risk and coastal ecosystems.





BLUE OCEAN

Currents, temperature,
waves, sea level, ...



WHITE OCEAN

Ice coverage, velocity,
concentration, Icebergs ...



GREEN OCEAN

CO₂, nutrients, oxygen,
primary production, ...

Copernicus Marine Service in COPENICUS 2 :

Continuity of the Blue/White/Green Offer

+ a series of major evolutions developed depending on priorities & budget

Coastal



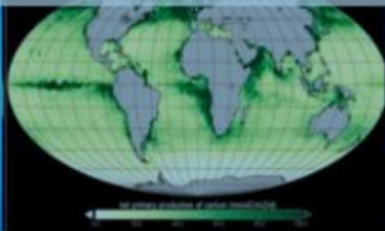
Arctic



Marine Biology



Ocean Climate



Digital services





Gathering and processing of new biogeochemical and biology *in situ* and **satellite observations**

- **New processes** in biogeochemical models (benthic/pelagic coupling, riverine inputs).
- **Ecosystem modelling** (low → mid → high tropic level) – NECCTON project
- **Assessing scenarios** for climate change impacts on stocks and protected species – SEACLIM project
- **Digital Twin of the Oceans** (DTOs) includes ecosystem models and data, what-if scenarios.

Inform marine biodiversity and food resource management



Convention on
Biological Diversity



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CMEMS BEFORE NECCTON

CMEMS AFTER NECCTON
(new and improved products)

MARINE POLLUTION

POP

Hg

BIOGEOCHEMISTRY AND LOWER TROPHIC LEVEL

HIGHER TROPHIC LEVEL

CLIMATE CHANGE PROJECTIONS

BENTHIC HABITAT

BIOGEOCHEMISTRY AND LOWER TROPHIC LEVEL

NECCTON

neccton.eu

PI: Stefano Ciavatta, M...

QR code linking to neccton.eu

neccton.eu

PI: Stefano Ciavatta, MOi



→ *enable CMEMS to inform marine biodiversity conservation and food resources management, by fusing innovative ocean ecosystem models and new data*



Towards a new offer for marine biology

NECCTON products

Pelagic Biogeochemistry



Mesozooplankton biomass



Micronekton biomass



Suspended particulate matter (SPM)



Particulate Organic Matter (POM)



Dissolved Organic Matter (DOM)



Reflectance

Benthic



Oxygen near bottom



pH near bottom



Light at bottom



Carbon flux to bottom



Carbon in sediment



Macrozoobenthos



Benthic flora



Sedimentary rates

Nekton



Small-pelagic biomass



Large pelagics biomass



Marine mammals



Unspecified fish and biomass



Higher Trophic Level Habitat



Demersal fish

Stressors



Plastic



Persistent Organic Pollutants



Mercury



Oil



Fisheries pressure



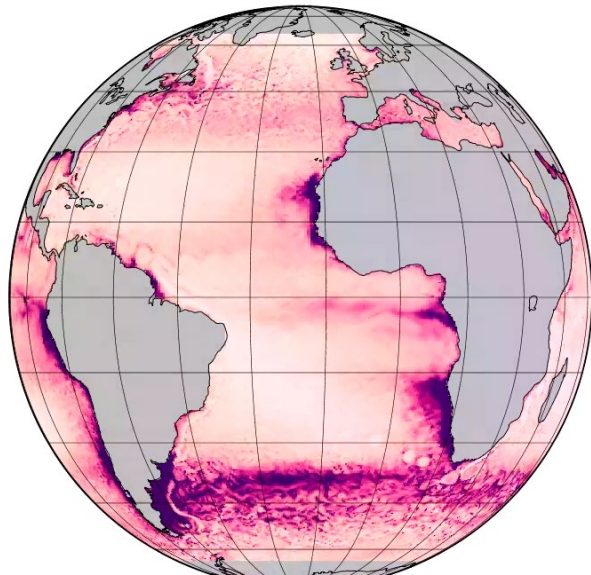
Climate change stressor index



Multi-stressor index



New essential ocean variables (EOVs)



GLORYS Ocean physics
reanalysis + PPsat (or BGCH
model) = **zooplankton**

Products 1



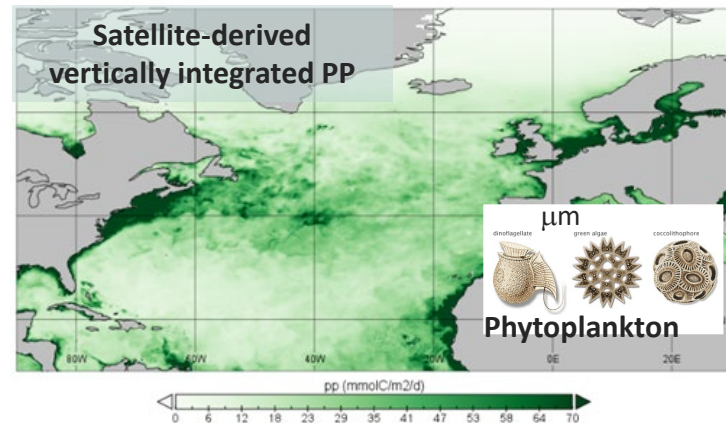
Global ocean low and mid trophic
levels biomass content hindcast
GLOBAL_MULTYEAR_BGC_001_033
Models
Global, 0.083° × 0.083° × 3 levels
1 Jan 1998 to 31 Dec 2023, daily
Temperature, velocity, nekton, plankton, optics

Season and year had no effect on
40-Hz calling rates, but prey biomass
did, confirming its food-associated
function for the first time..

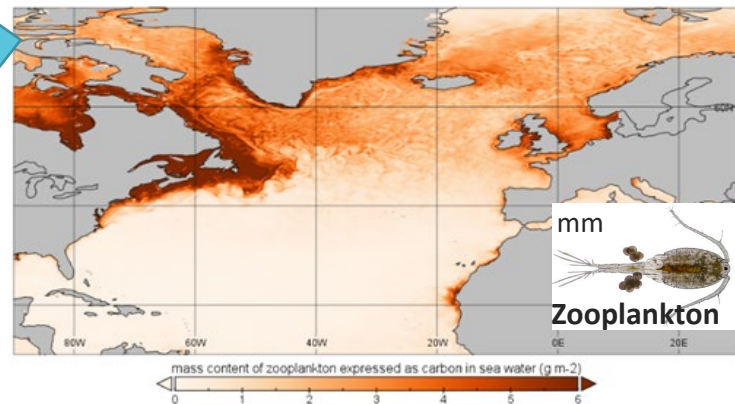
Food talk: 40-Hz fin whale calls are
associated with prey biomass

Miriam Romagosa¹, Sergi Pérez-Jorge¹, Irma Cascão¹, Helena Mourino²,
Patrick Lehoudey³, Andreia Pereira⁴, Tiago A. Marques^{5,6}, Luis Matias⁴ and
Mónica A. Silva¹

2019 - Nov 1: satellite derived NPP



2019 - Nov 1: predicted biomass of zooplankton





Towards a new offer for marine biology

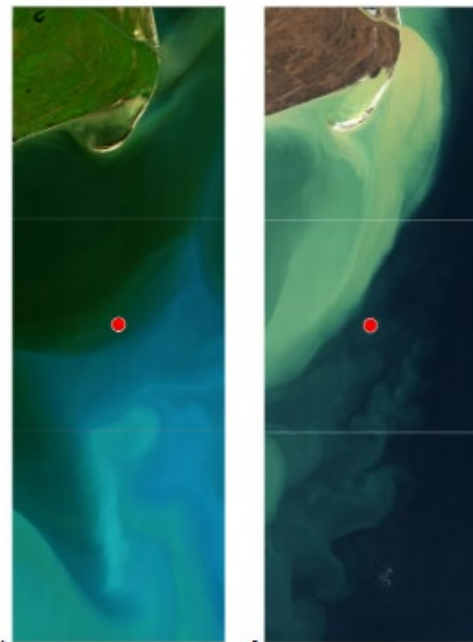


NECCTON

NECCTON D4.2 Assessment of L2 PRISMA production chain, outputs and transferability

Braga, Federica (Researcher)¹ ; Profeti, Giuliana (Researcher)¹ ; Lazzari, Paolo (Researcher)² ;
Alvarez, Eva (Researcher)³ ; Marco Scarpa, Gian (Researcher)¹ ; Manfè, Giorgia (Researcher)¹ ;
Gonzalez Vilas, Luis (Researcher)¹ ; Sikakala, Jozef (Researcher)⁴ ;
Brando, Vittorio (Researcher)¹

Show affiliations



- ✓ PRISMA (PRecursore IperSpettrale della Missione Applicativa) is a hyperspectral imaging mission launched by the Italian Space Agency (ASI)
- ✓ covers a spectral range of 400–2500 nm with high spatial resolution
- ✓ **potential** for enhancing the understanding of aquatic ecosystems through hyperspectral imaging, (→advanced atmospheric correction algorithms tailored for marine and coastal environments are necessary)
- ✓ PACE compared with in situ hyperspectral data from WATERHYPERNET to test the transferability of the validation approach
- ✓ **outcome:** integration of PRISMA data with biogeochemical models can enhance the description of plankton and optically active properties



Copernicus
Marine Service

The Copernicus Marine Service for biodiversity policy: the future

Major evolutions planned in Copernicus 2 (2021-2028) via R&D projects (Horizon) will expand marine biodiversity monitoring and protection supporting EU policy needs

- ✓ Gathering and processing new biogeochemical and biology in situ and **satellite observations**
- ✓ **Data assimilation** of new satellite products (including biogeochemistry and biology)
- ✓ **Habitats for key protected species** (e.g. marine mammals), **Marine Protected Areas** design.
- ✓ Assessing scenarios for climate change impacts on stocks and protected species.
- ✓ **Critical role** of present (S2, S3) and future (**CHIME, S2NG, S3NG**) **Sentinel missions** and in-situ observations (e.g. acoustic data, plankton imaging, omics, pollutants, plastic, fish surveys and landings)
- ✓ **Digital Twin of the Oceans** (DTOs) includes ecosystem models and data, MPAs DTO, what-if scenarios





Marine Monitoring

THANK YOU



Copernicus Marine Service



Newsletter

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