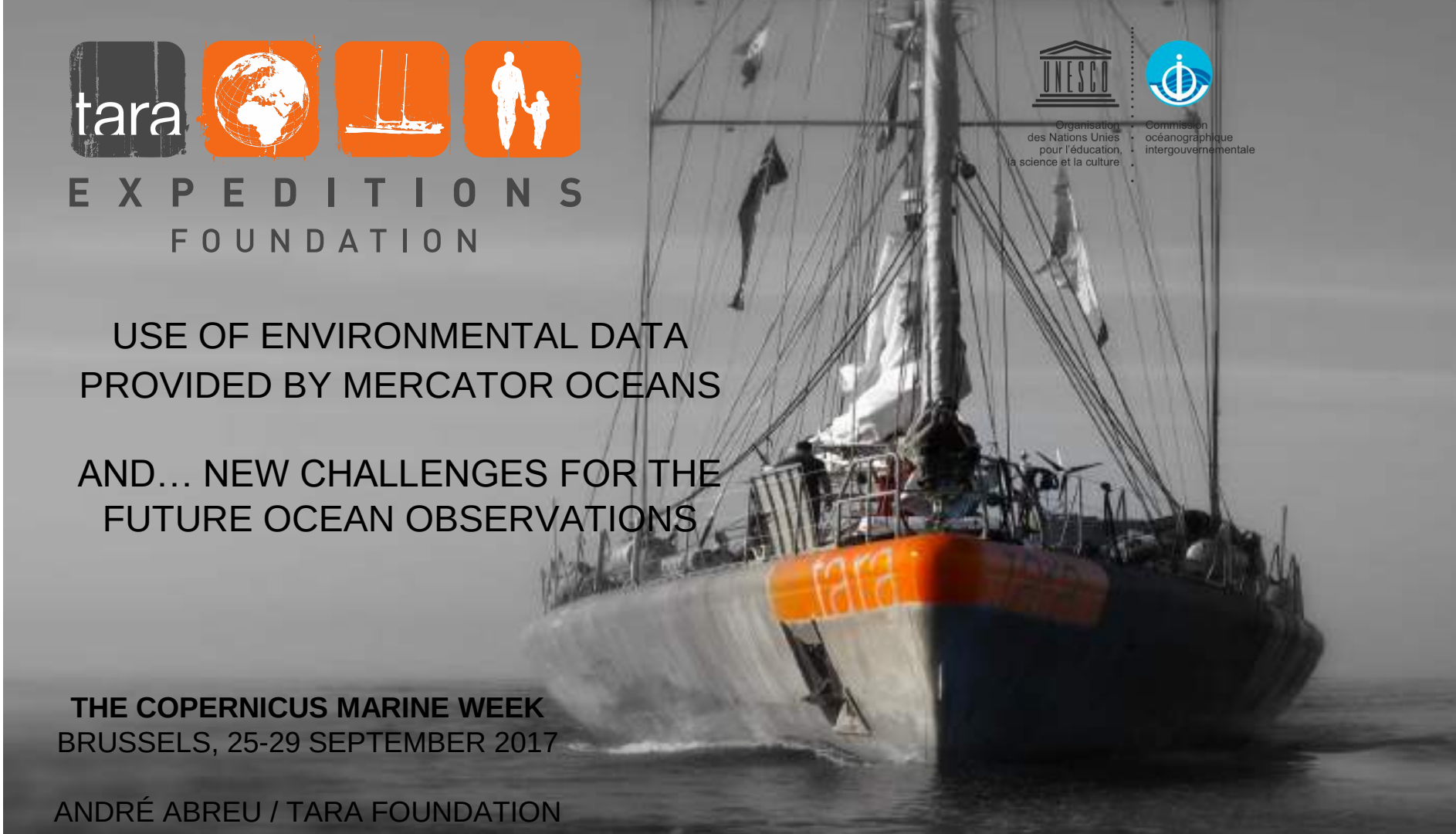
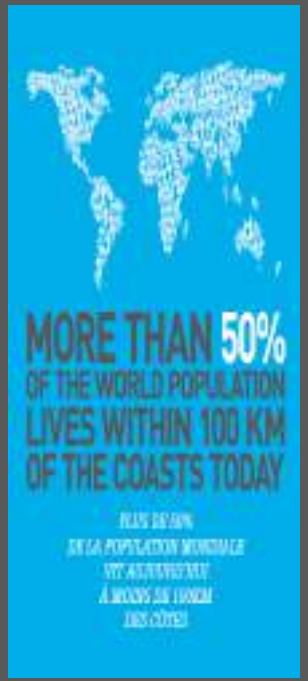

tara
EXPEDITIONS
FOUNDATION
UNESCO
Organisation des Nations Unies pour l'éducation, la science et la culture
Commission océanographique intergouvernementale
USE OF ENVIRONMENTAL DATA PROVIDED BY MERCATOR OCEANS
AND… NEW CHALLENGES FOR THE FUTURE OCEAN OBSERVATIONS
THE COPERNICUS MARINE WEEK
BRUSSELS, 25-29 SEPTEMBER 2017
ANDRÉ ABREU / TARA FOUNDATION

Context: Marine Biodiversity under threat

The current decade marks a period of important decisions related to governance of the ocean, with significant impacts on development issues. The effects of climate change on the ocean and the acceleration of marine biodiversity loss are now widely recognized, and their impact on territories and populations are more and more important.

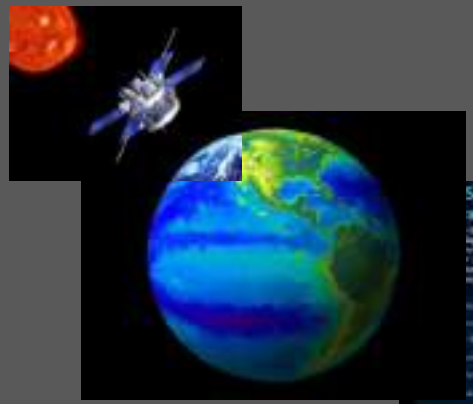
These impacts are not only affecting coastal areas, coral reefs and mangroves, but also are changing the physical, chemical and biological properties of the open ocean beyond national jurisdictions.

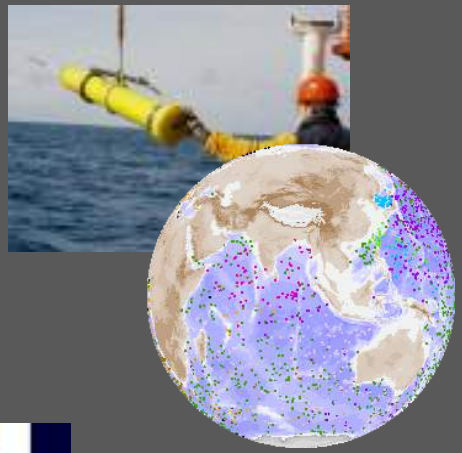


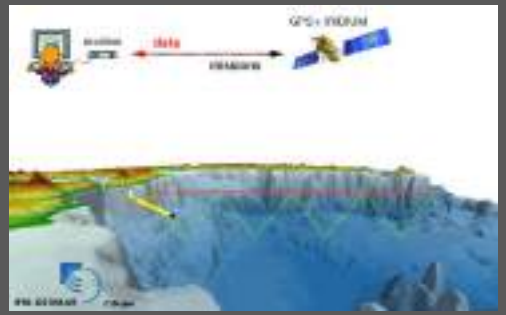
In the field: Big Challenges for Ocean Sciences today

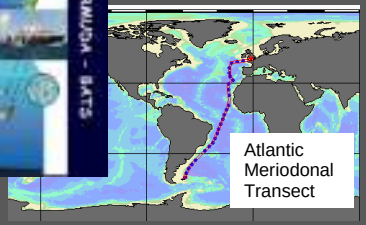
From a “users” perspective, we are now seeing a deep transformation in marine sciences with the quick development of new technologies like Next Generation Sequencing, Big Data analysis, robots, satellite sensors, bioinformatics and bioimaging. These will transform the way we see the ocean, in the same way that genetics transformed medicine and cancer prevention.

Ocean observation is evolving from shipboard studies to embrace real-time remote sensing

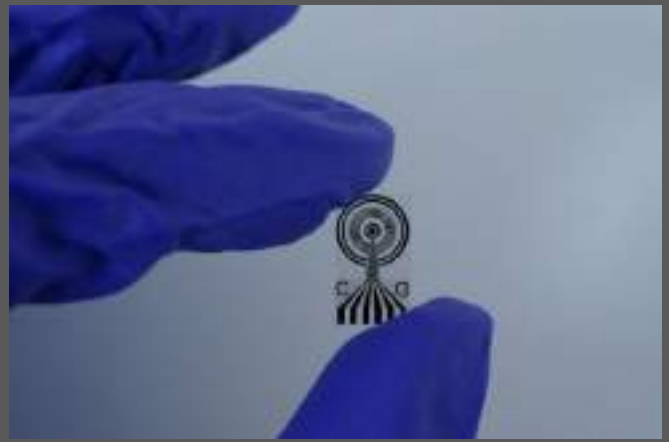




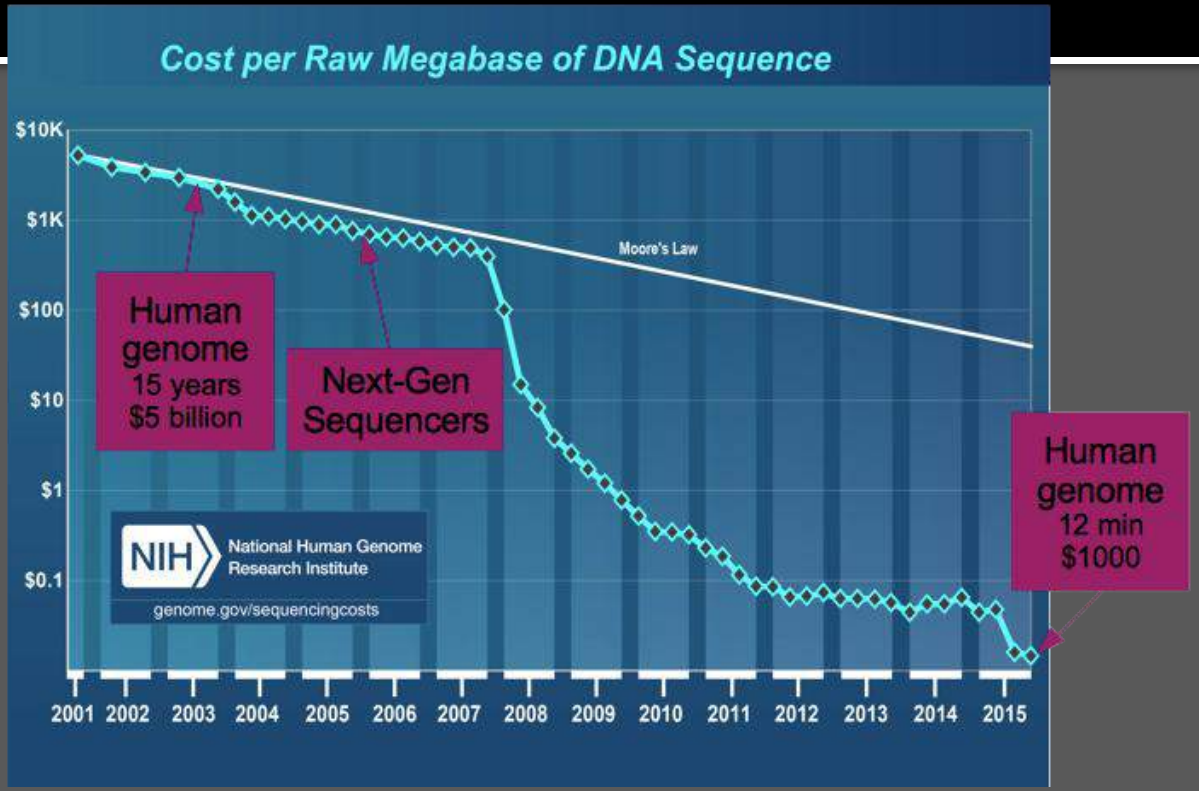


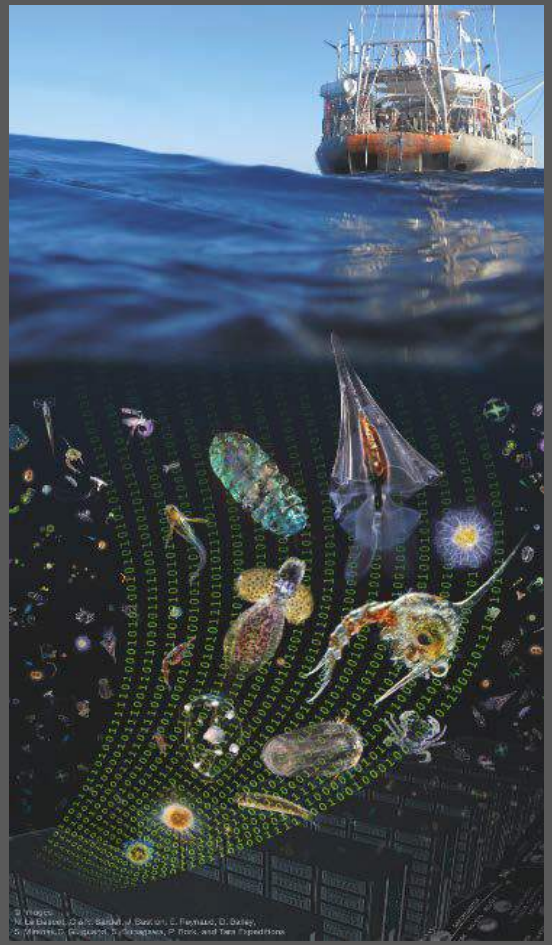


…. and genomics



The reason: costs are crashing

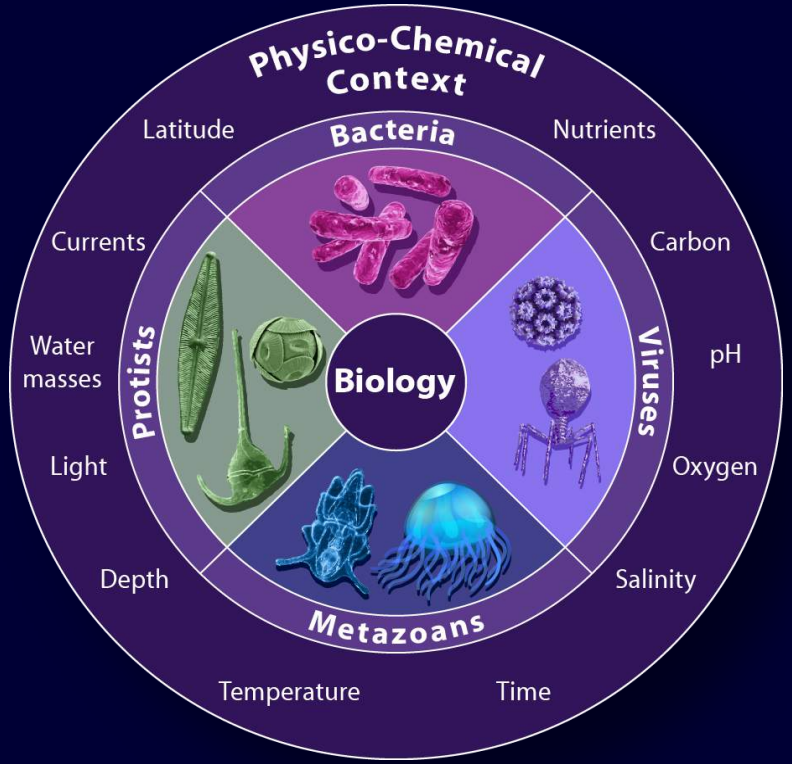




The example of the Tara Oceans program: Eco-Systems Biology at Planetary Scale in Open Access

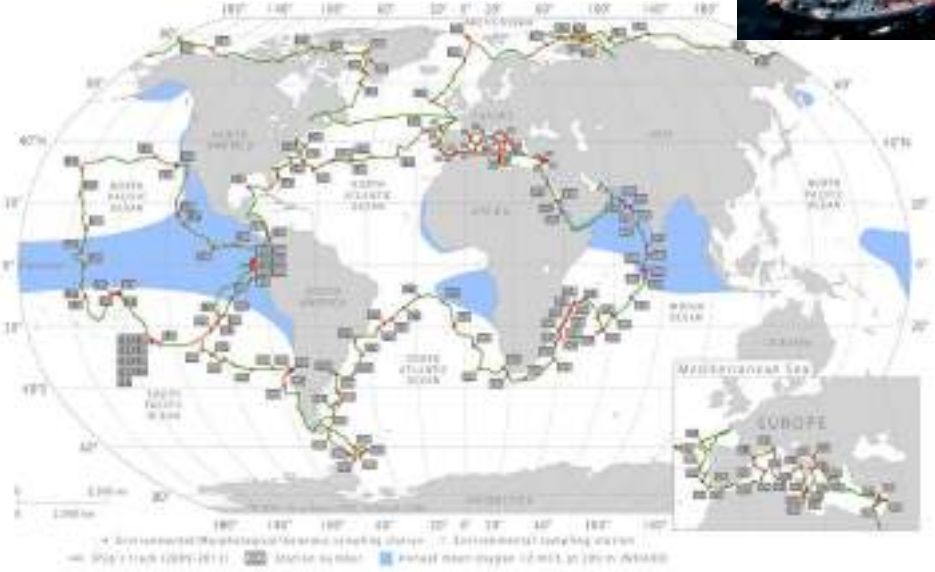
In 2008, a science program joined a team of researchers with complementary skills in ocean biology and ecology, physical oceanography, cell and systems biology, genomics and imaging, around the schooner *Tara. The Tara Oceans team* had a common dream: assessing a planetary ecosystem globally, from viruses to animals, from genes to the entire community, and integrating biological data into a rich context of physico-chemical parameters.

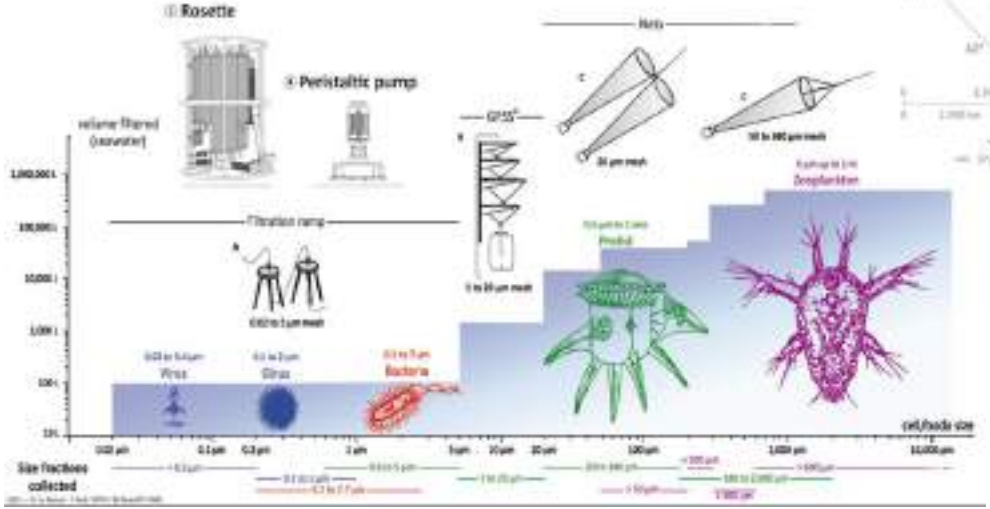
A necessary step for Marine Sciences: Adding Biological Parameters into Oceanographic Research



Use Case: Tara Oceans

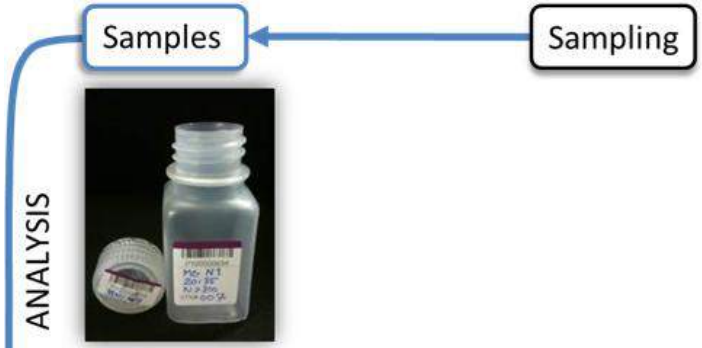
- Global study of Plankton
- 210 stations in 20 biogeo. provinces
- State of the art oceanographic equipment

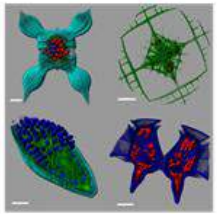




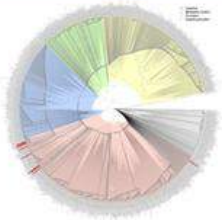
- State of the art plankton protocols
- across size spectra (0.02 µm - 2 m)
- across taxonomic spectra (virus to jellyfish)

The Pipeline: Imaging, Genomics, and Environmental samples

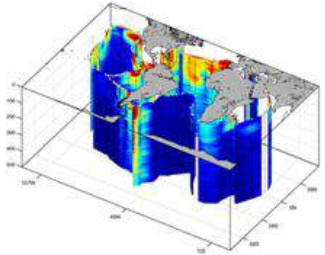




Imaging Data



Nucleotides Data



Environmental Data

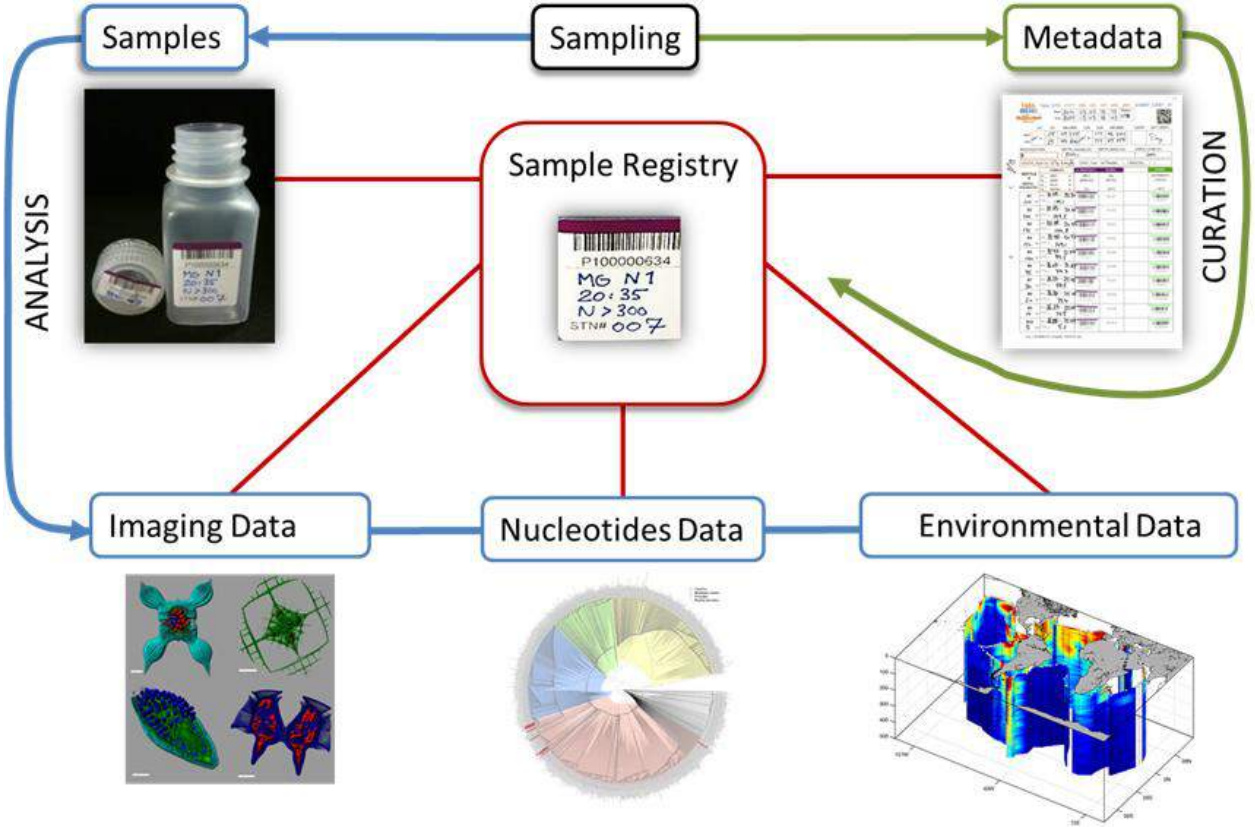
+ oceano. sensors

+ climatologies

+ satellite products

#Samples:	17,000	9,000	5,000 (biogeochemistry)

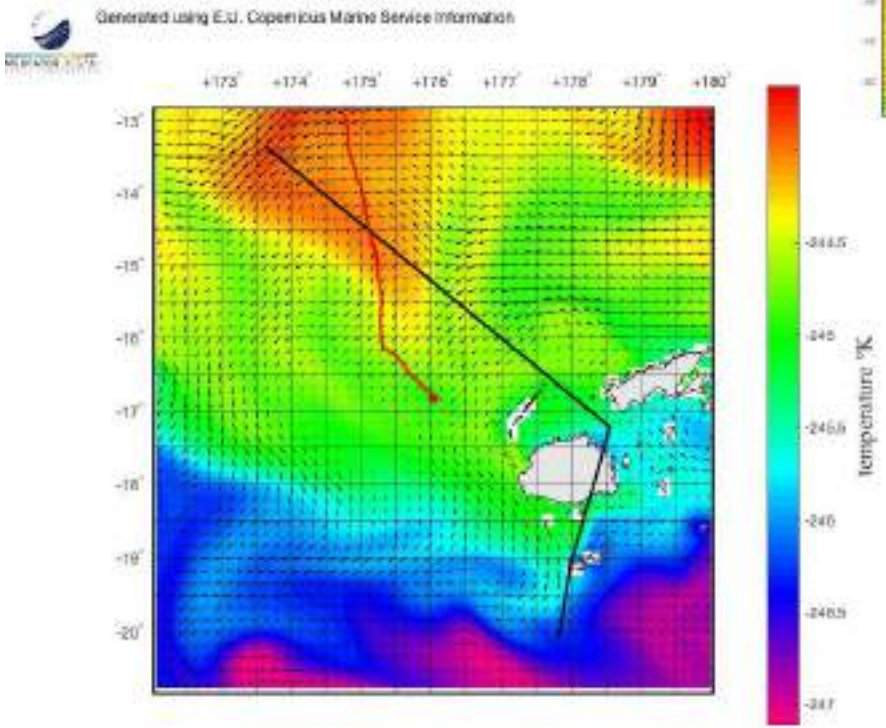
Context / Provenance is key to data integration

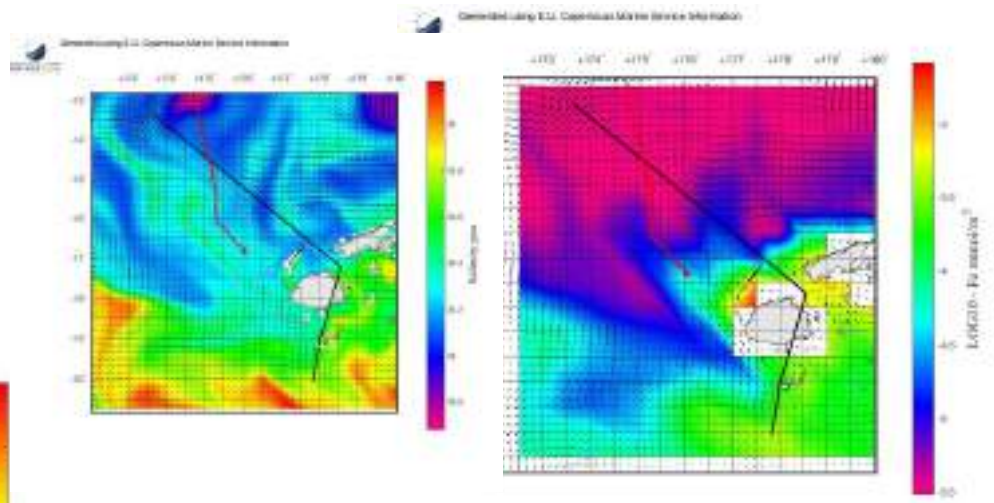


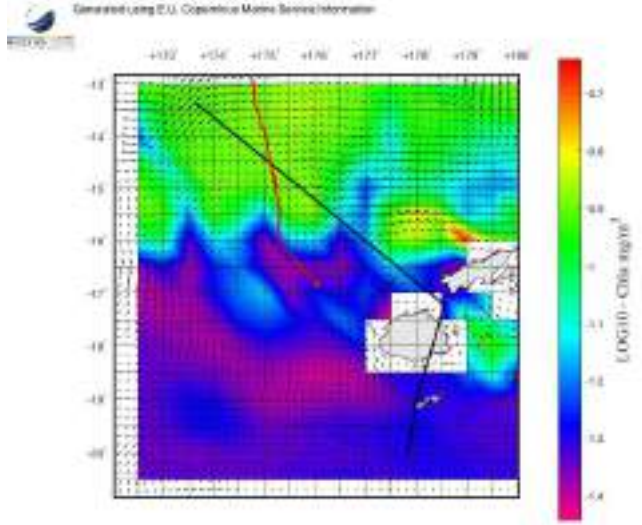
Environmental Data

Mercator Ocean:

Tara Pacific / Fiji - June2017

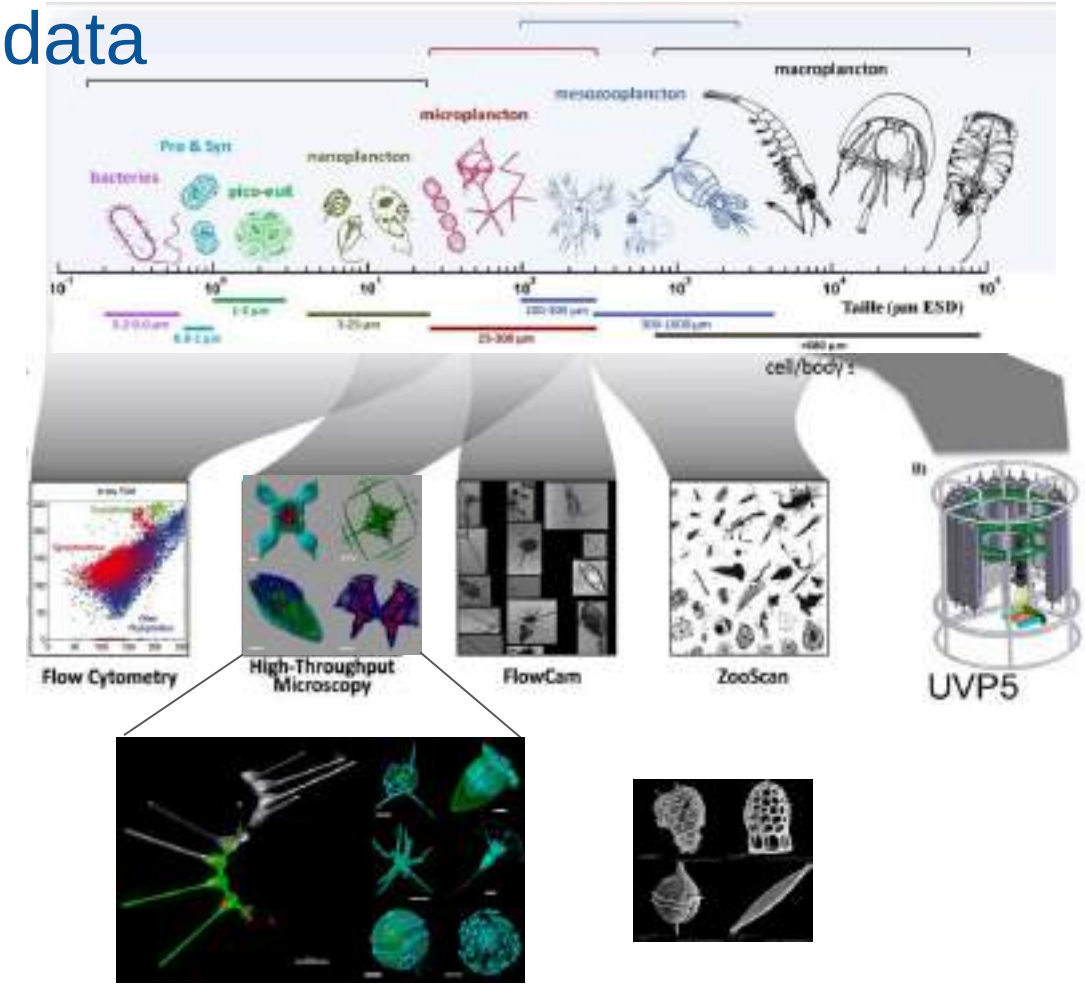






Tara Oceans: Imaging data

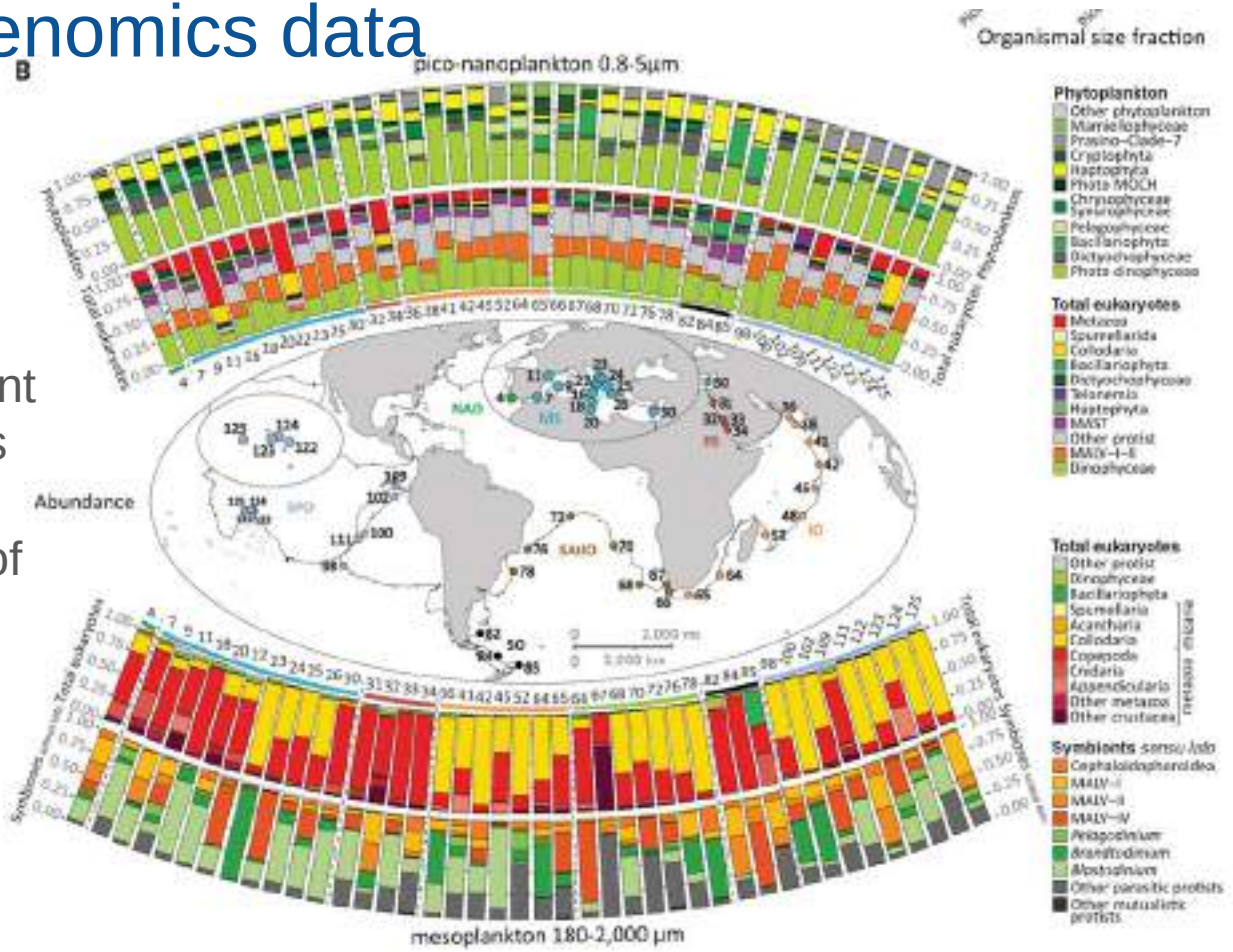
- **>4 million Images**
- **>30 terabytes**
- State of the art automated methods adapted to organism from 0.1µm to 0.1m
- Semi-automatic recognition -- Machine learning (supervised)
- Network approach for data sharing, expert annotation and training



From BioMed Technologies to environmental imaging

Tara Oceans: Genomics data

- **40 million genes** -- Largest-ever genomics effort in marine science
- **12 terabytes** -- equivalent to 135x human genomes
- **>7000 data sets** - One of the richest molecular collection in the public domain



[De Vargas *et. al. (2015)*]

Inputs on the EU Blue Cloud expert meeting:

Build on cross-disciplinary Standards

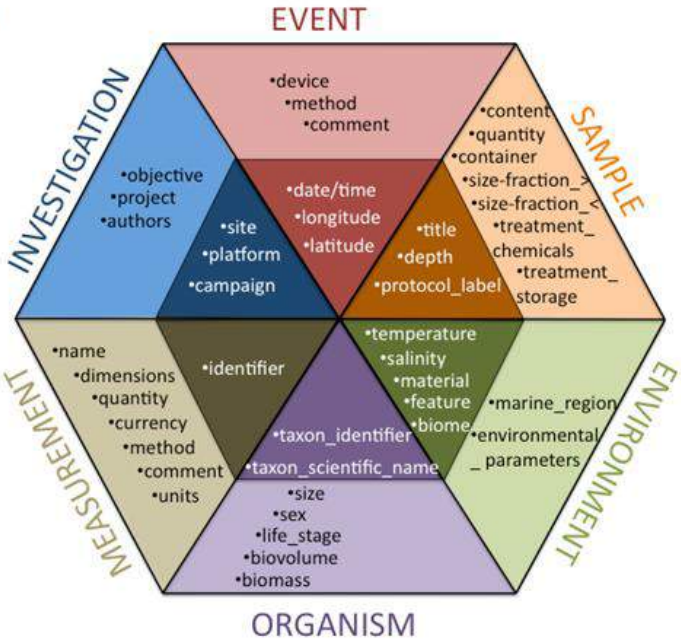
Registries & ontologies

Marineregions.org

Envo

WoRMS World Register of Marine Species

ChEBI



Ten Hoopen P., Pesant S., Kottmann R., Kopf A., Bicak M., Claus S., Deneudt K., Borremans C., Thijsse P., Dekeyzer S., Schaap D., **Bowler C.**, Glöckner F.O., **Cochrane G.** **Data standards for Marine Microbial Biodiversity, Bioinformatics and Biotechnology (M2B3)** *Standards in Genomic Sciences* 10:20 doi:10.1186/s40793-015-0001-5 (2015).

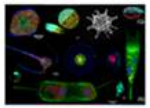
EMBL-EBI

SeaDataNet

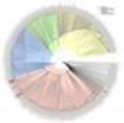
EMODnet

Inputs on the EU Blue Cloud expert meeting:

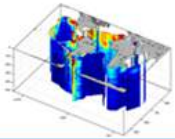
Build on existing Data Resources & Infrastructures



Imaging Data



Genomics Data



Environmental Data

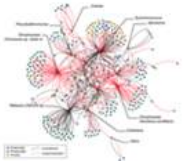
User-driven innovations
Tara Oceans
EuroMarine

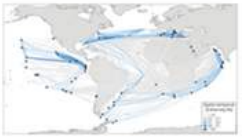
EcoTaxa BETA

ENA
European Nucleotide Archive

PANGAEA Data Publisher

Innovative modelling





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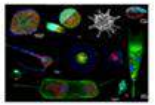
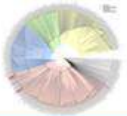
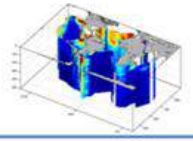


Imaging Data



Genomics Data



Environmental Data

User-driven innovations
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EuroMarine

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ENA
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PANGAEA Data Publisher

Migrate to EU Infrastructures

EURO-BIOIMAGING

elixir

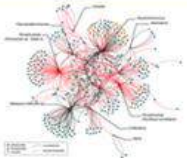
ICSU WORLD DATA SYSTEM

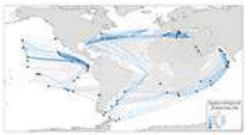
Copernicus
Europe's eyes on Earth

1. Brokering &
2. Computing

Blue Cloud

Innovative modelling



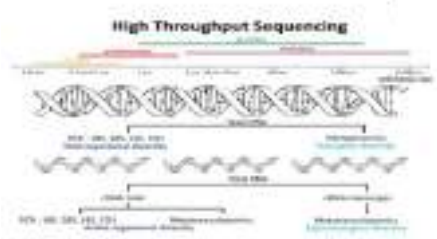


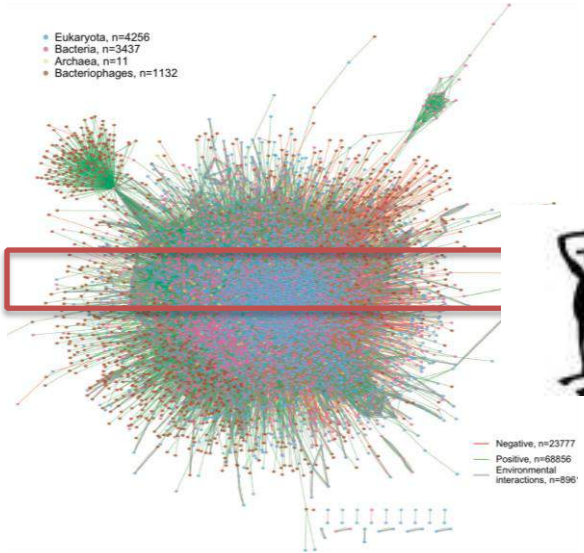
The Ocean's Biological Carbon Pump

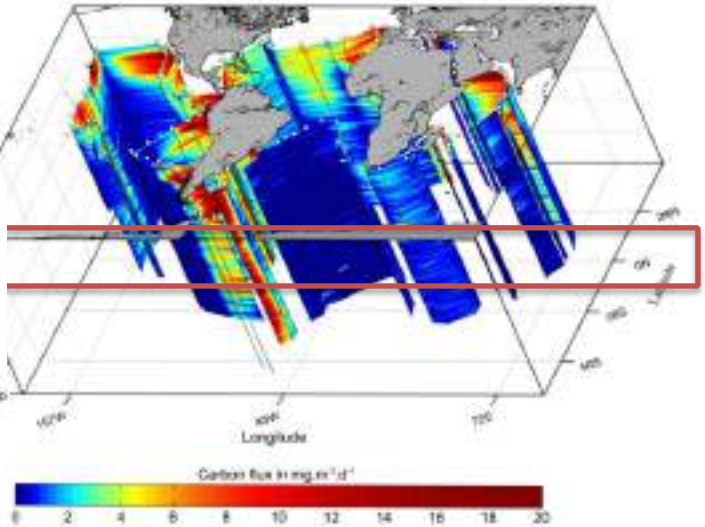
- 40-50 billion tons of organic C/year
- 10% of pl… sinks …
- G… …ates oil and gas fossil fuels

Which plankton species are the main drivers of the biological pump ?

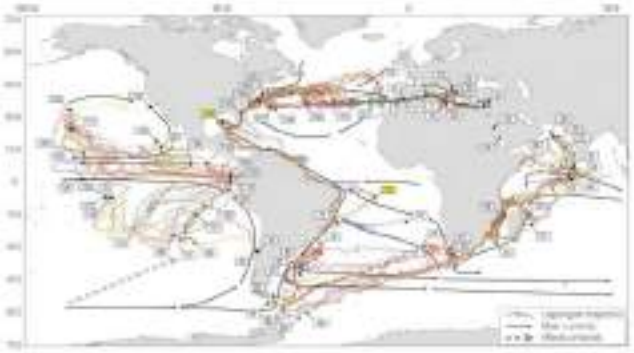
Deriving a plankton network associated with carbon export



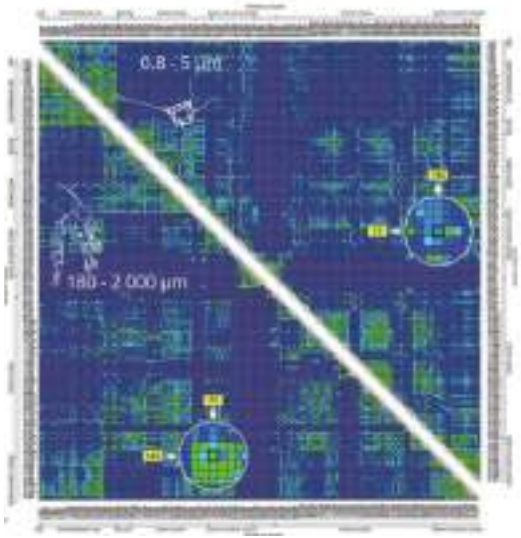




How do ocean currents affect plankton communities ?



Estimated travel times between sampled water masses



Similarities of different plankton species at different sampling sites

Connectivity between plankton communities at global scale

Richter et al. In prep


ocean-climate.org
Appel de l'océan pour le climat
Océan en bonne santé, climat préservé
#OceanforClimate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Commission océanographique intergouvernementale
Thank you !
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