

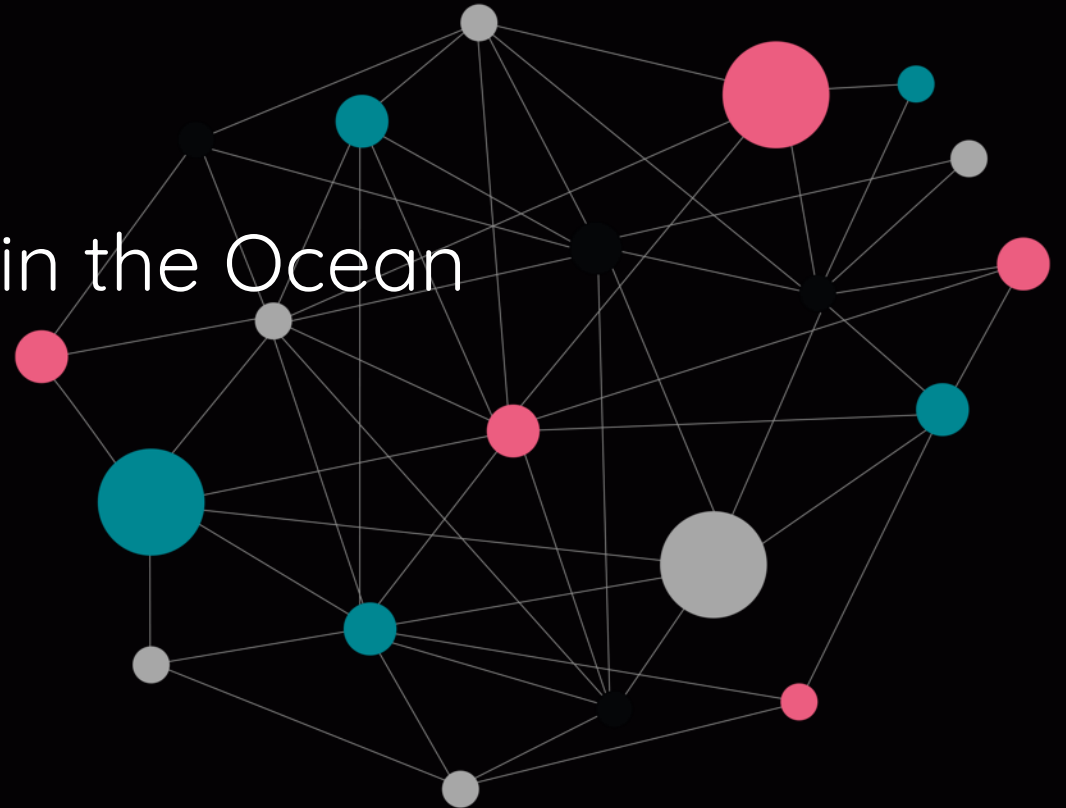
# Scientific Use Case

## Ocean Microbiome

Biological sequestration of carbon in the Ocean

Stéphane Pesant

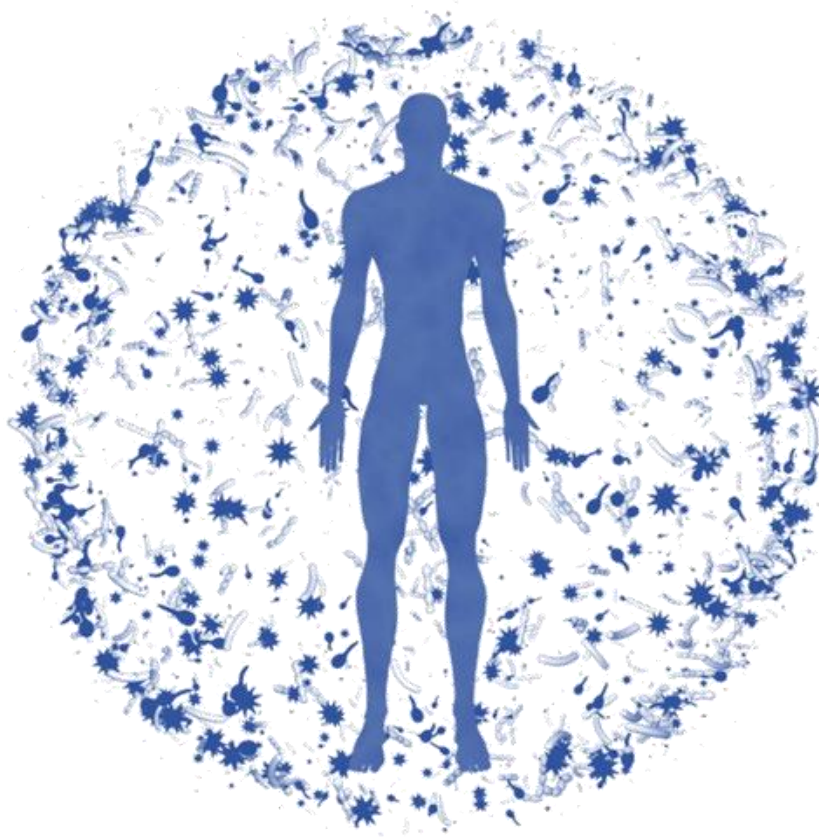
EMBL



# Ocean Microbiome

Why is it important?

- Diagnostic of the Health of the Ocean
- Supports Ecosystem Services for humanity



# Ocean Microbiome

## European Union Missions & Projects



REVIEW  
20 September 2023

**Microbiome-assisted  
restoration of degraded  
marine habitats: a new  
nature-based solution?**

Cinzia Corinaldesi, 6 more and  
Roberto Danovaro



**AtlantECO**  
Atlantic Ecosystems Assessment, Forecasting & Sustainability

 **BlueRemediomics**

 **Bluetools**



# Ocean Microbiome

James Morrison, Director Healthy Planet in DG Research of the European Commission



**All Atlantic Ocean Forum 2025 (Brussels)**

*"Ocean Microbiome research enables innovation and supports a blue economy"*

# Ocean Microbiome

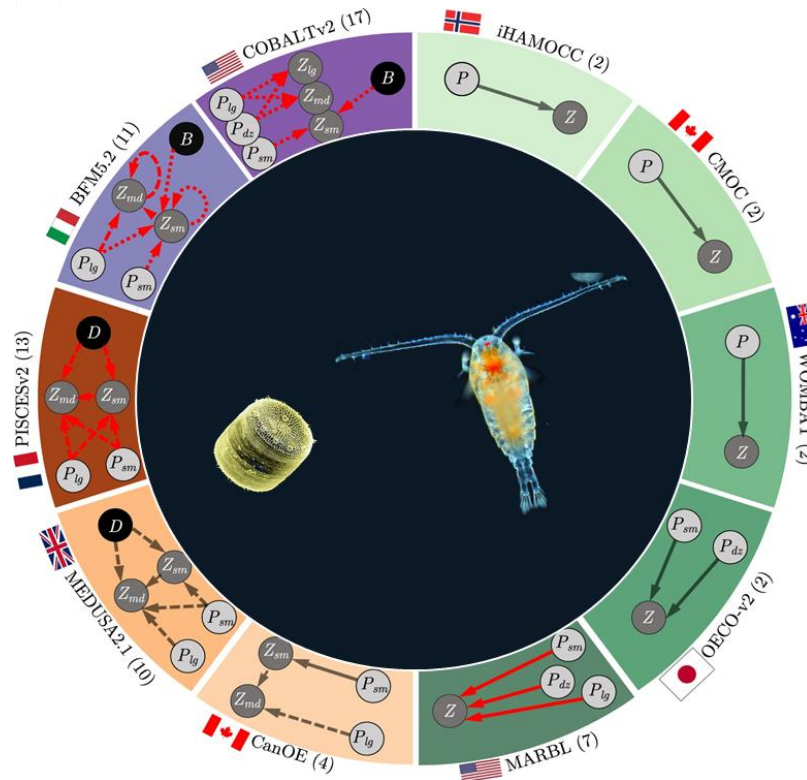
## Climate Assessments



Corinne Le Quéré



UN OCEAN  
CONFERENCE  
NICE 2025  
FRANCE



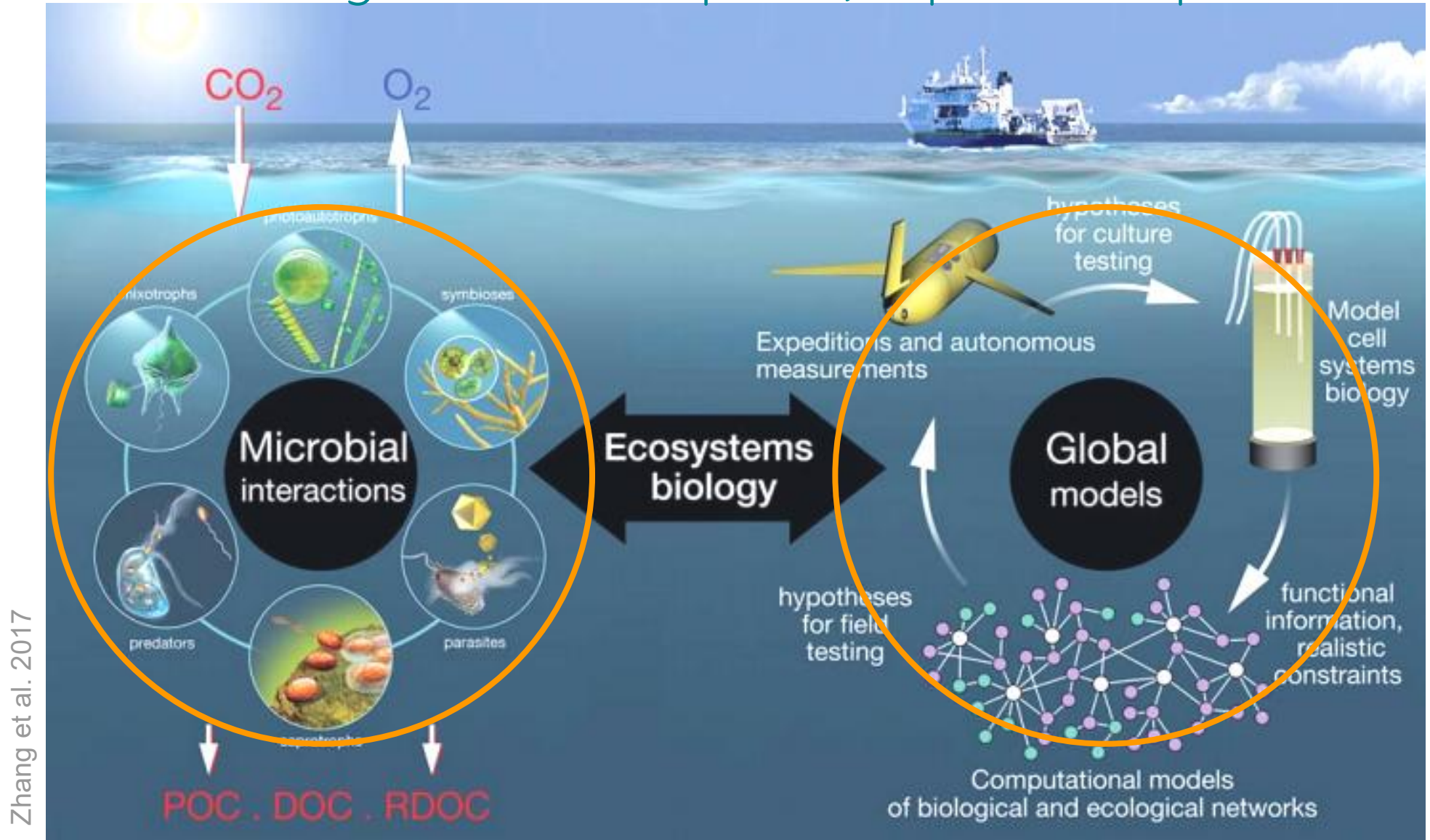
*“The representation of biological processes in Models that inform climate assessments is **very limited**”*

*“I challenge you to develop Ocean System Models (OSMs) that capture the complexity of the [Ocean Microbiome]”*



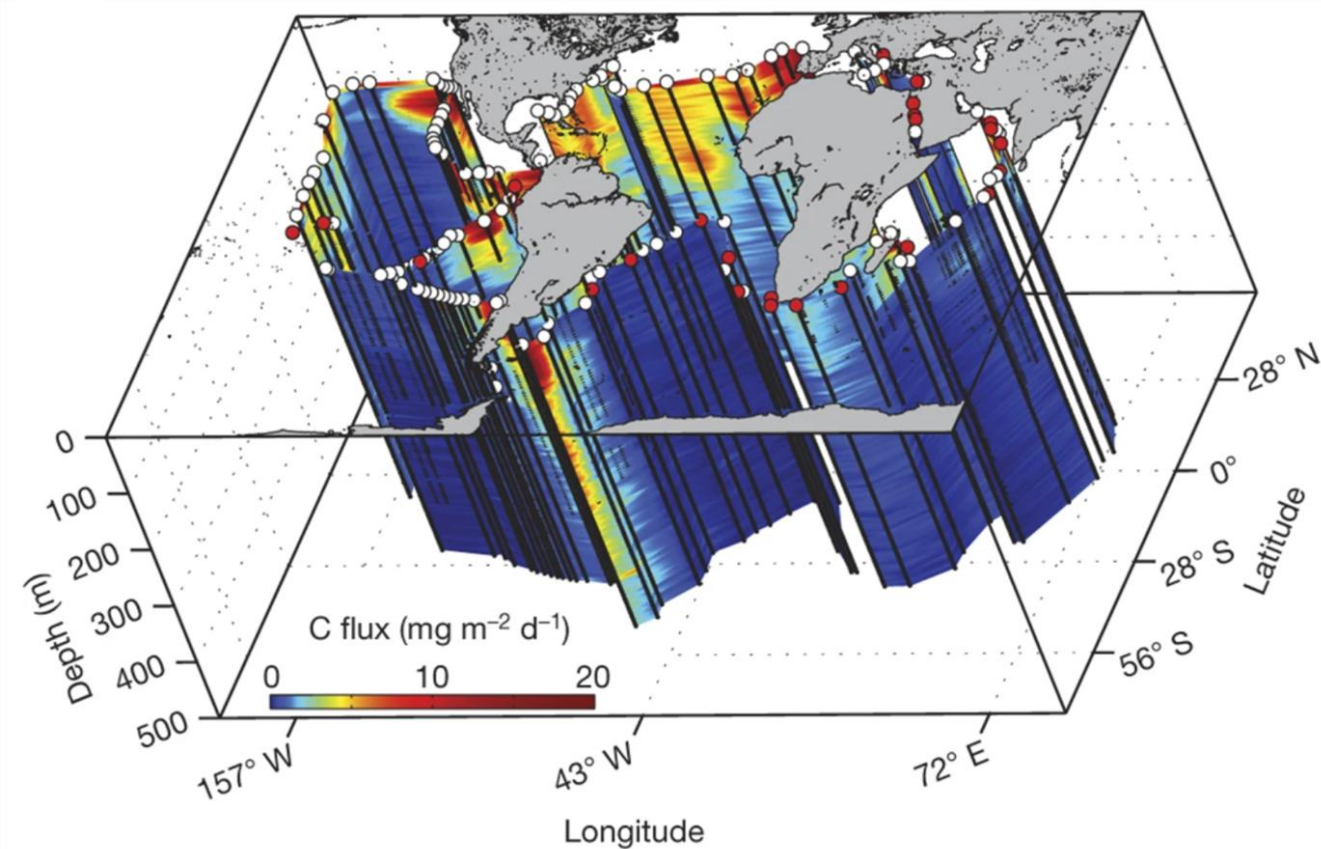
# Modelling the Ocean Microbiome

Ocean biological carbon uptake, export & sequestration



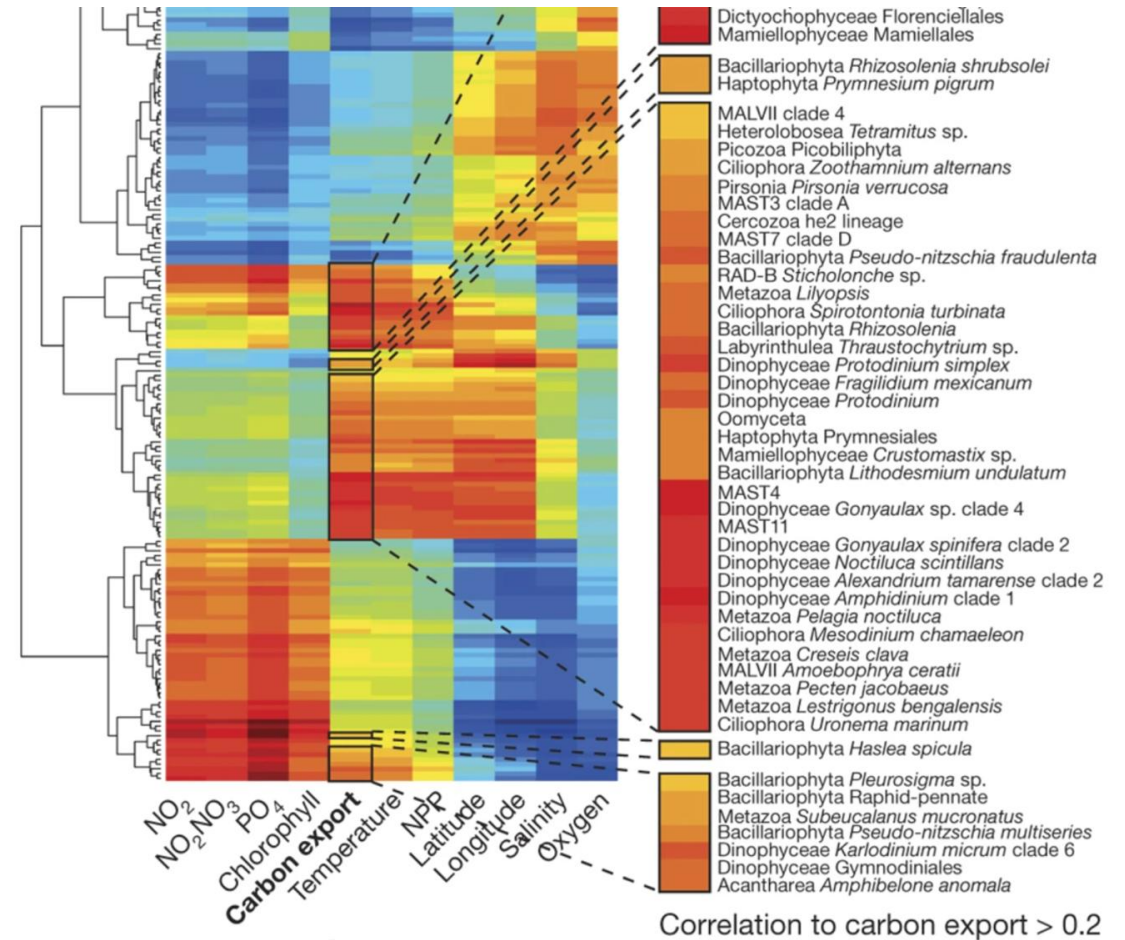
# Predicting genetic potential for carbon export

## Carbon export observations



Guidi et al. 2016

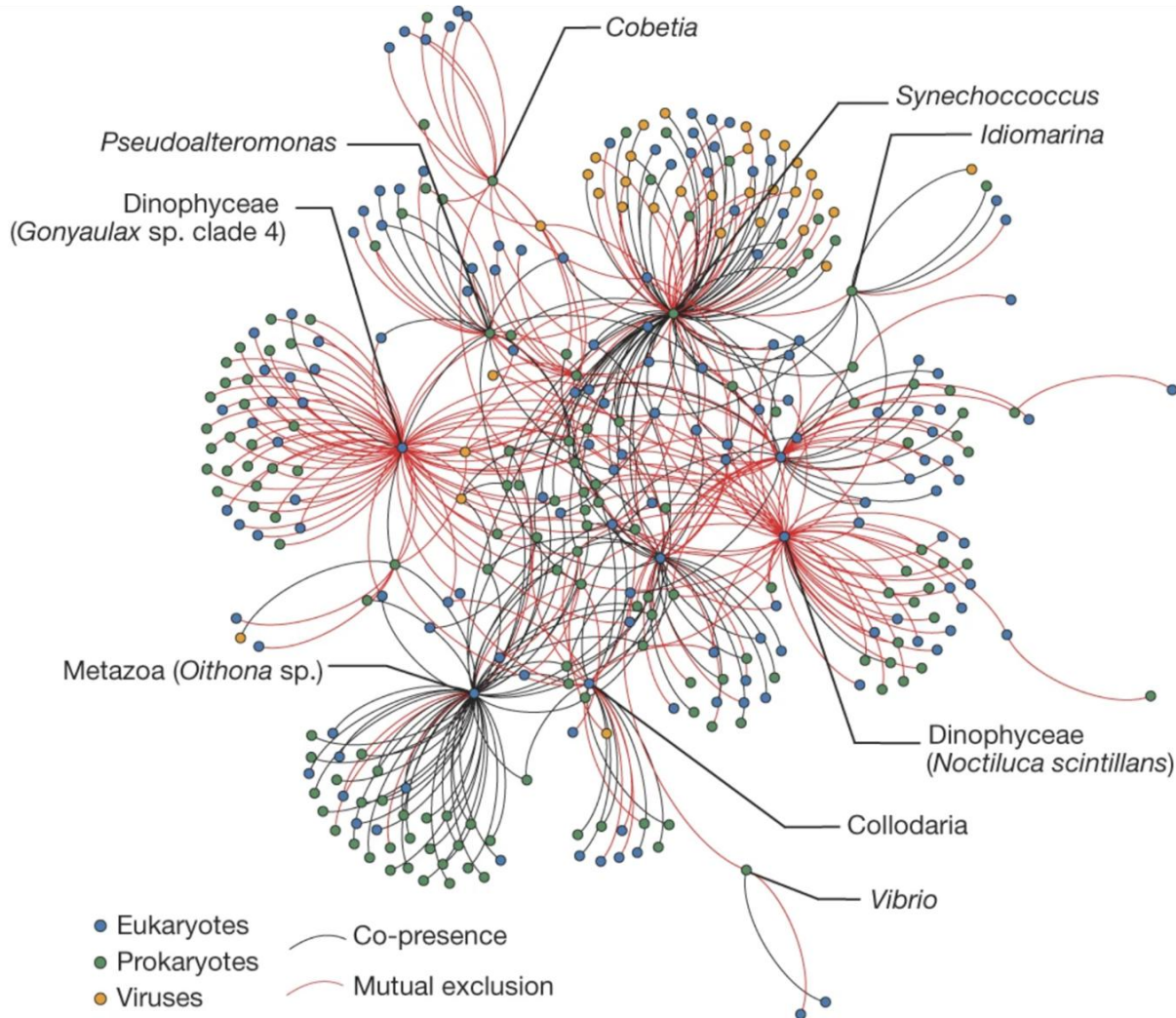
## Genetic observations



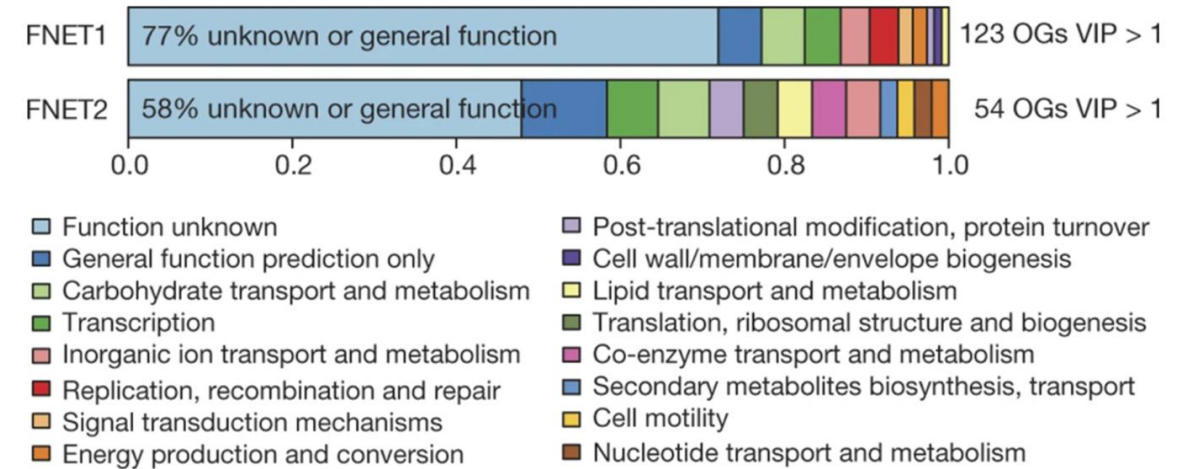


# Network Analysis - Carbon Export Cluster

## Cluster of key Taxa



## Cluster of key Metabolic Functions



Guidi et al. 2016

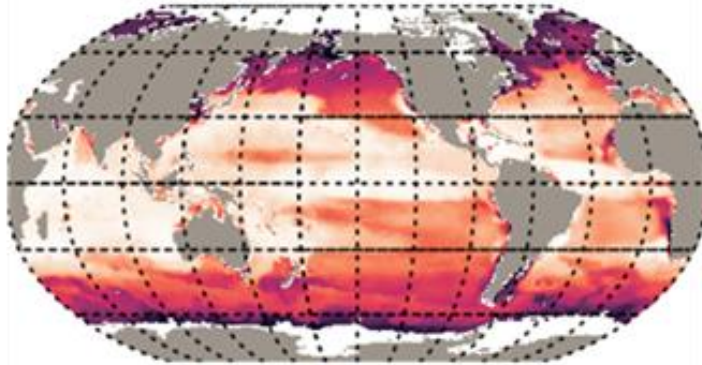




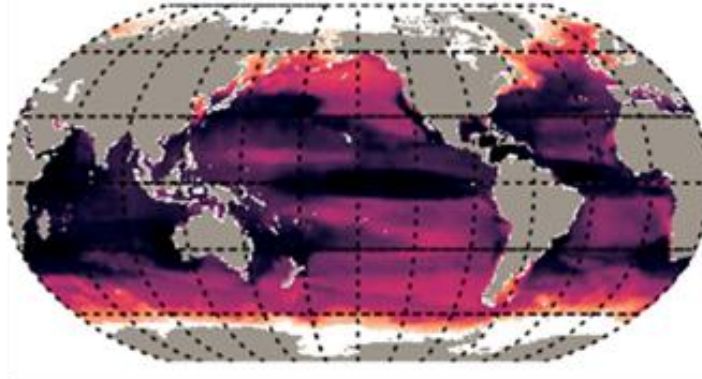
## Key taxa of the Cluster

## Diversity of the Cluster

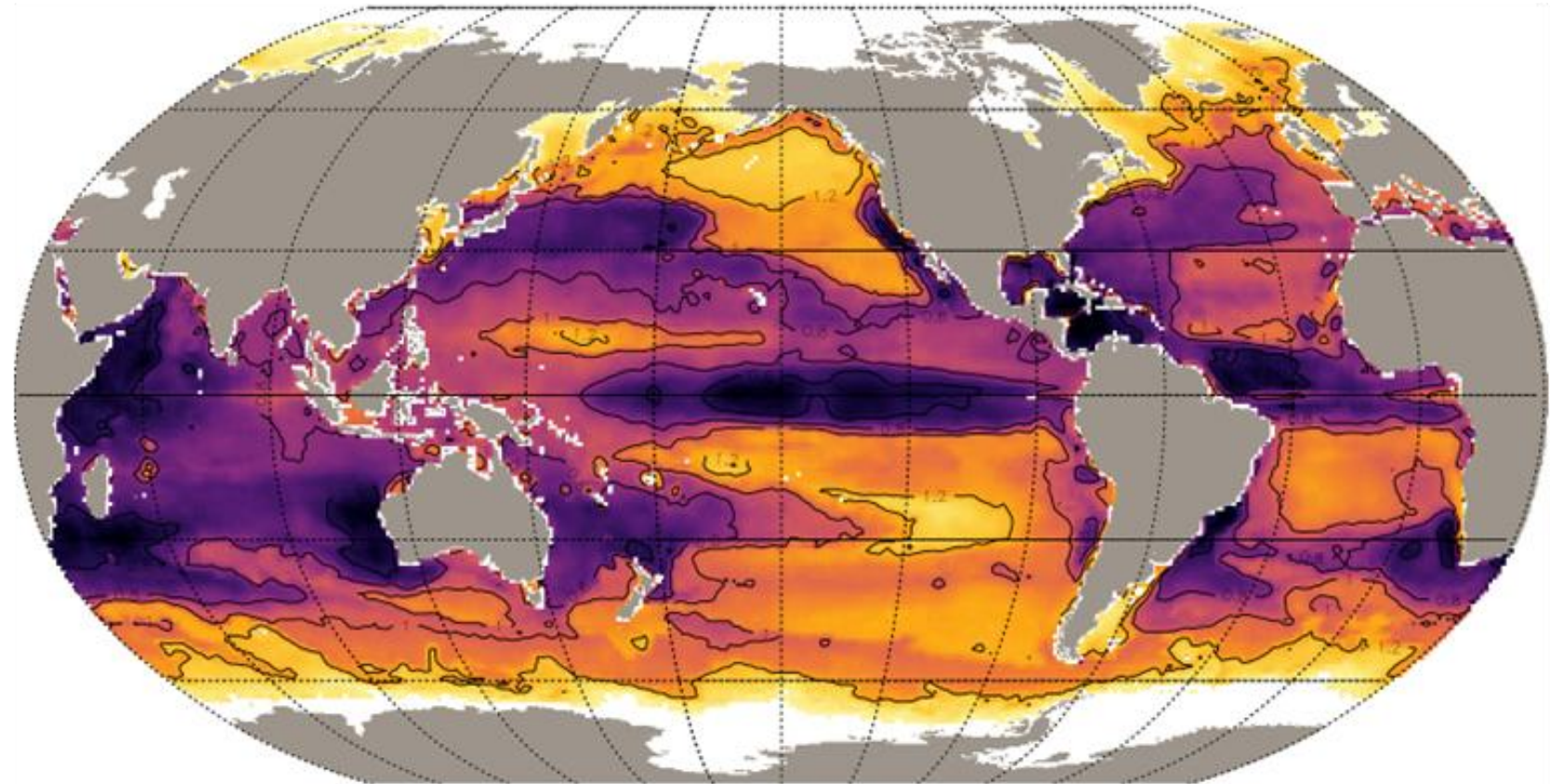
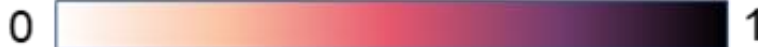
**Pseudoalteromonas**



**Synechococcus**



Relative abundance (0 – 200 m)



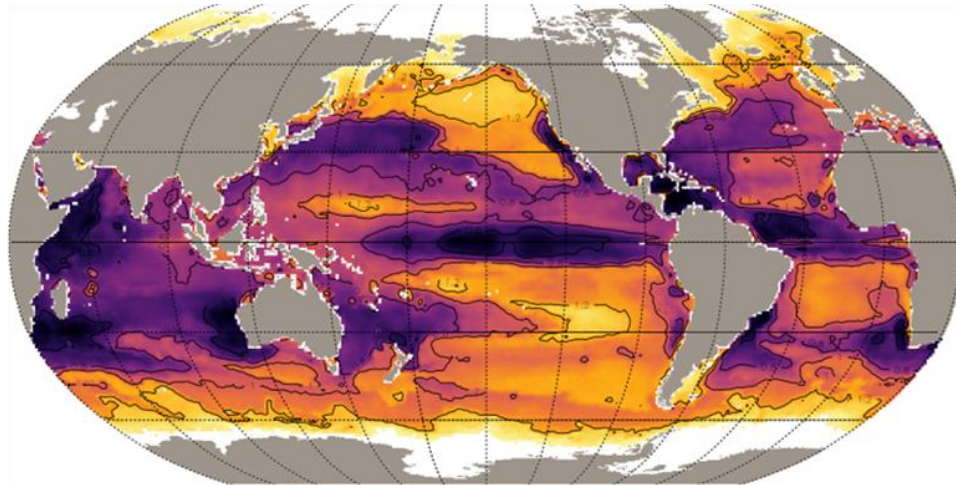
Shannon diversity index (normalized 0 – 100)





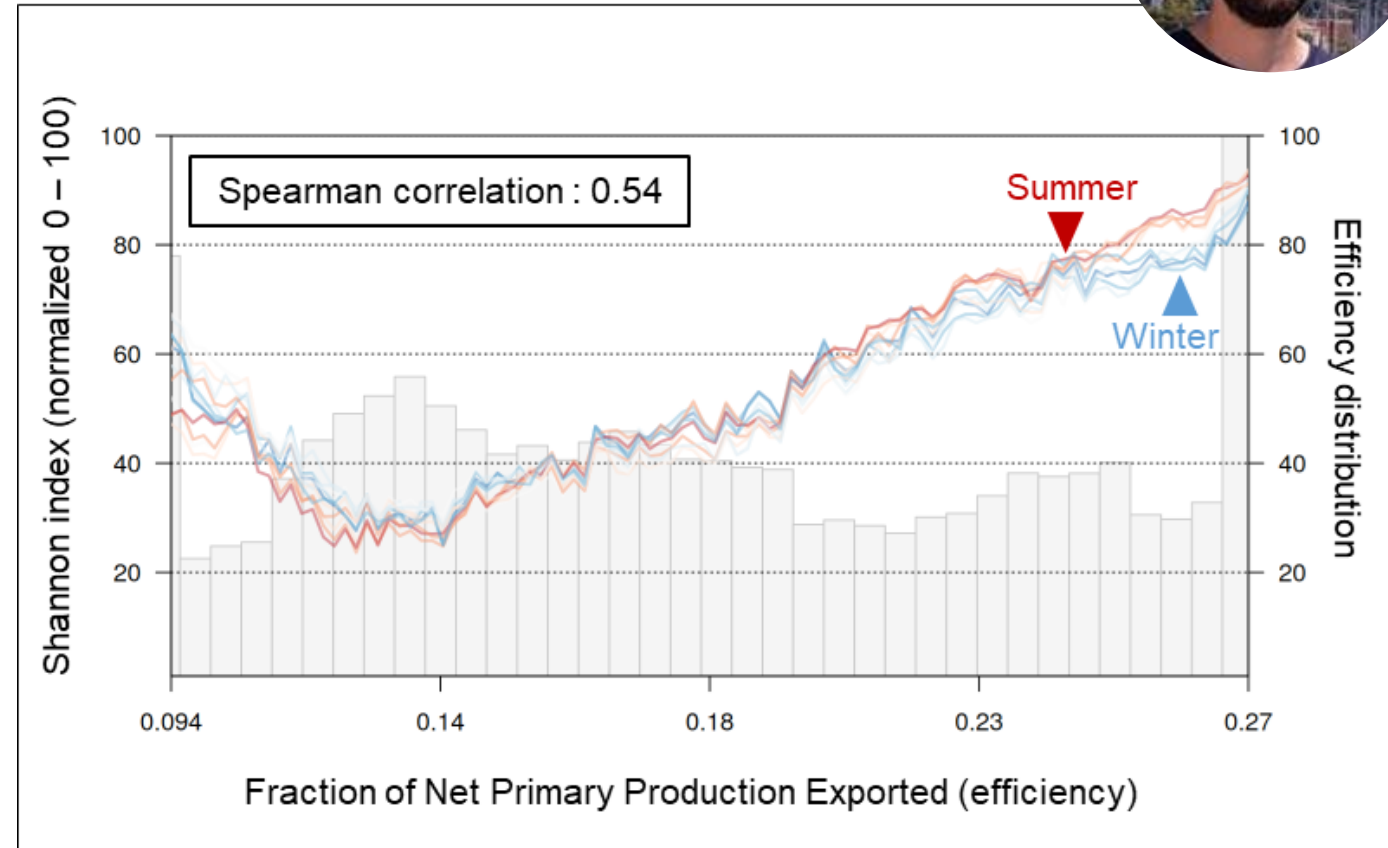
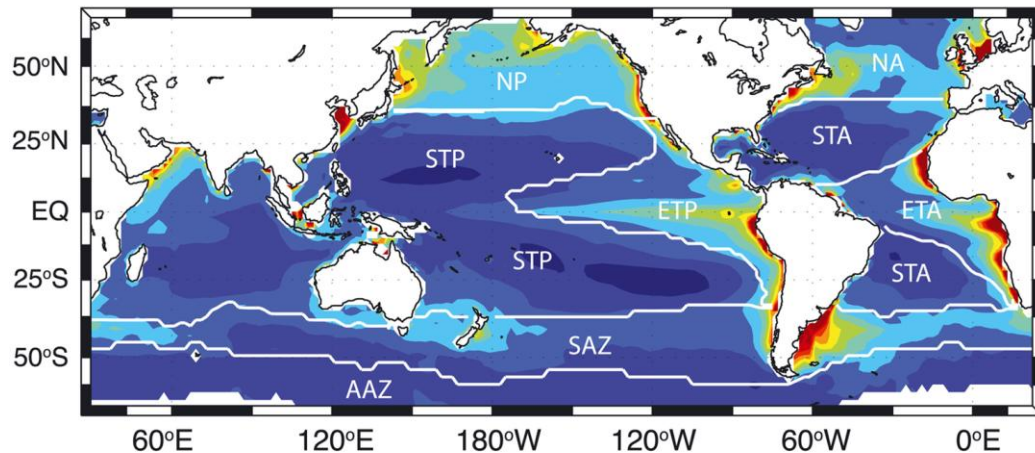
# Predicting genetic potential for carbon export

Link modelled Cluster diversity & modelled Carbon export



Shannon diversity index (normalized 0 – 100)

Modeled particle export ( $\text{mgC m}^{-2} \text{d}^{-1}$ )





# Scientific Use Case Objectives

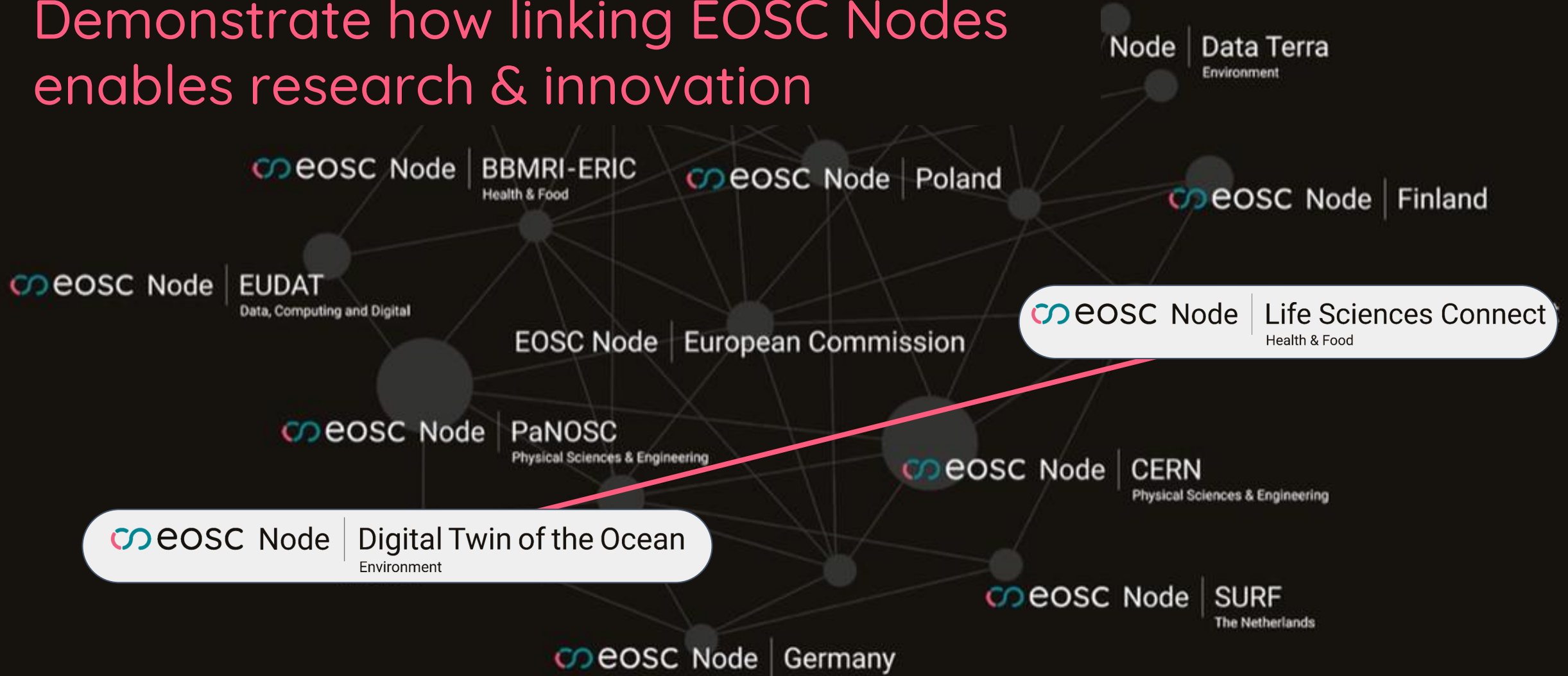


## Use Core Capabilities across Nodes

- Seamless Authentication and Authorisation
- Catalogues of connected Services & Research Products
- Augmented Storage and Compute Capacity

# Scientific Use Case Objectives

Demonstrate how linking EOSC Nodes enables research & innovation





## Relevant Node Services



- Curation
- Repositories
- Analysis
- Compute



## Relevant Node Services



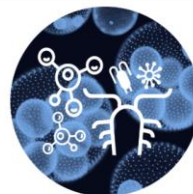
Consiglio Nazionale  
delle Ricerche



### Workbenches for Essential Ocean Variables (EOVs)

A number of data-intensive **Workbenches for selected Essential Ocean Variables (EOVs)** are being developed and tested in Blue-Cloud 2026. Ocean and Data scientists will implement efficient workflows that allow them to harmonise, validate and qualify large and various in situ data sources, exploiting the blue analytical services available in the **Blue-Cloud Virtual Research Environment**.

- Data Lake
- Virtual Labs
- Workbenches



Carbon-Plankton Dynamics



Global Fisheries Atlas



Coastal currents from  
observations

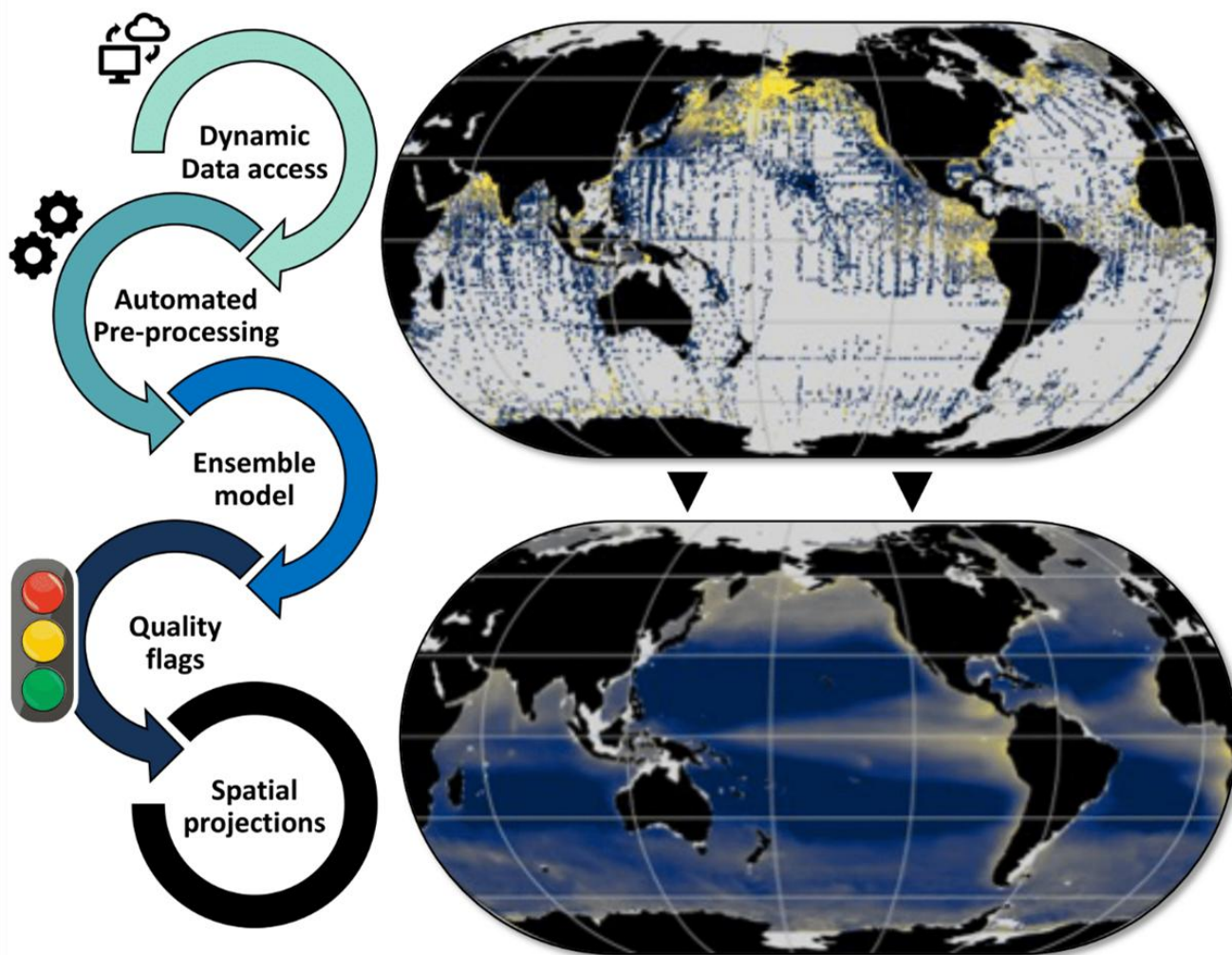


Fish, a matter of scales



Aquaculture Monitor





eOSC Node | Life Sciences Connect  
Health & Food

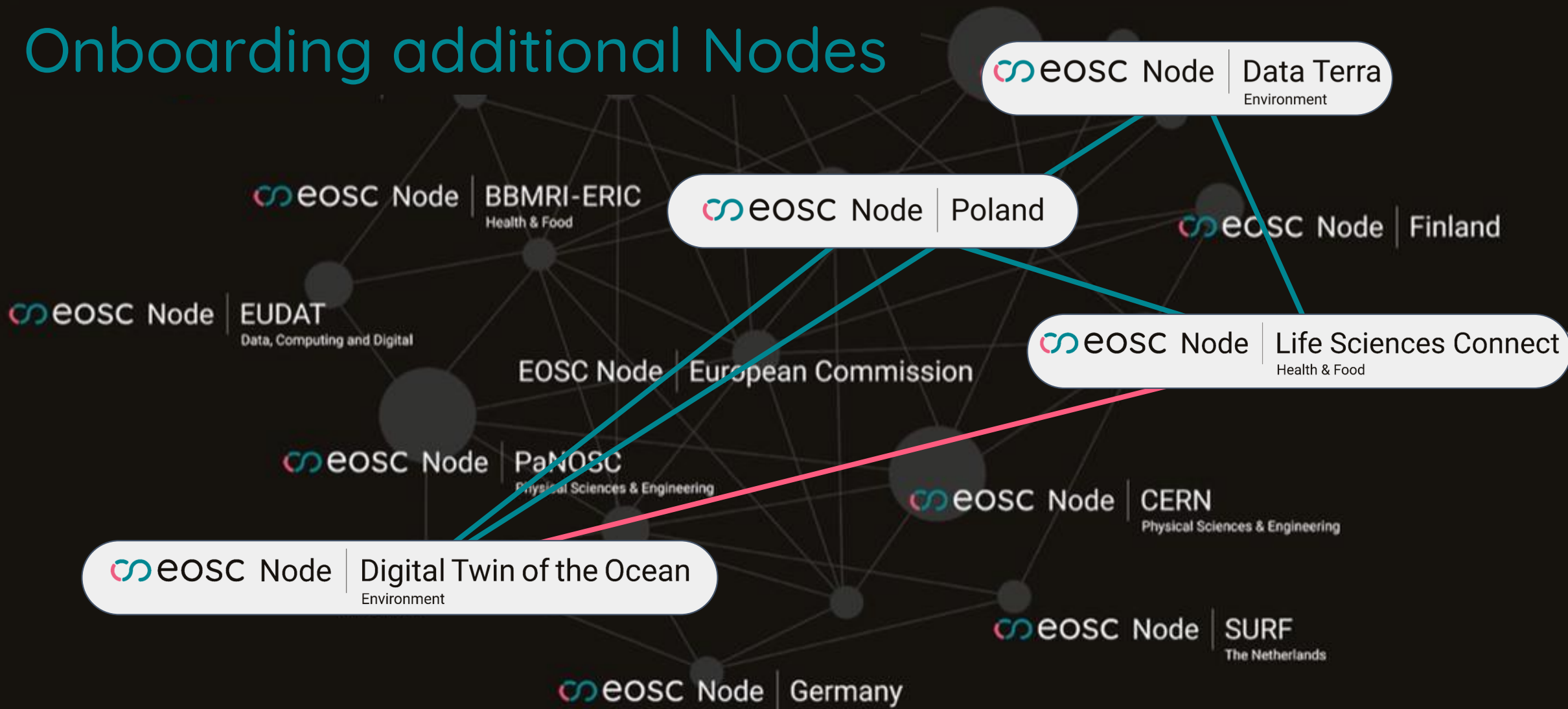
Global Observations (biomolecular)  
Ocean Microbiome taxonomy  
Ocean Microbiome functions

eOSC Node | Digital Twin of the Ocean  
Environment

Ensemble of Machine Learning Models  
Global maps of the predicted  
Ocean Microbiome genetic potential

# Scientific Use Case Objectives

## Onboarding additional Nodes





# Thank you

## Ocean Microbiome

### Biological sequestration of carbon in the Ocean

Stéphane Pesant

EMBL

