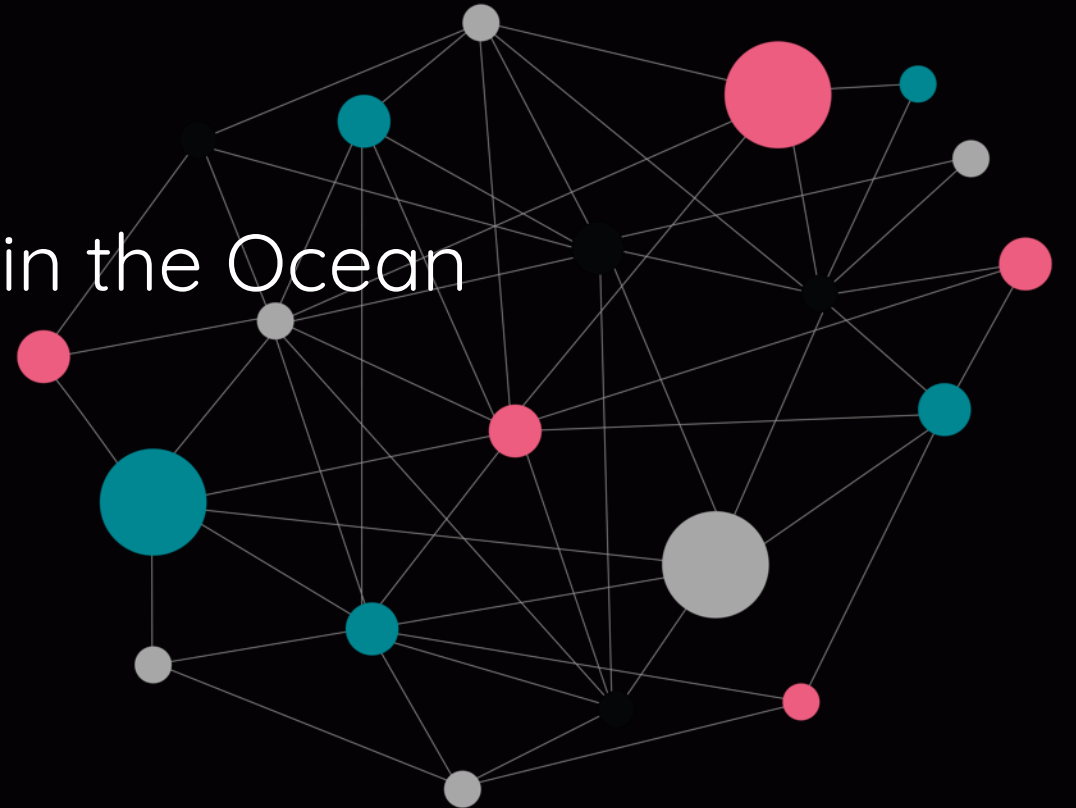


Scientific Use Case

Ocean Microbiome

Biological sequestration of carbon in the Ocean

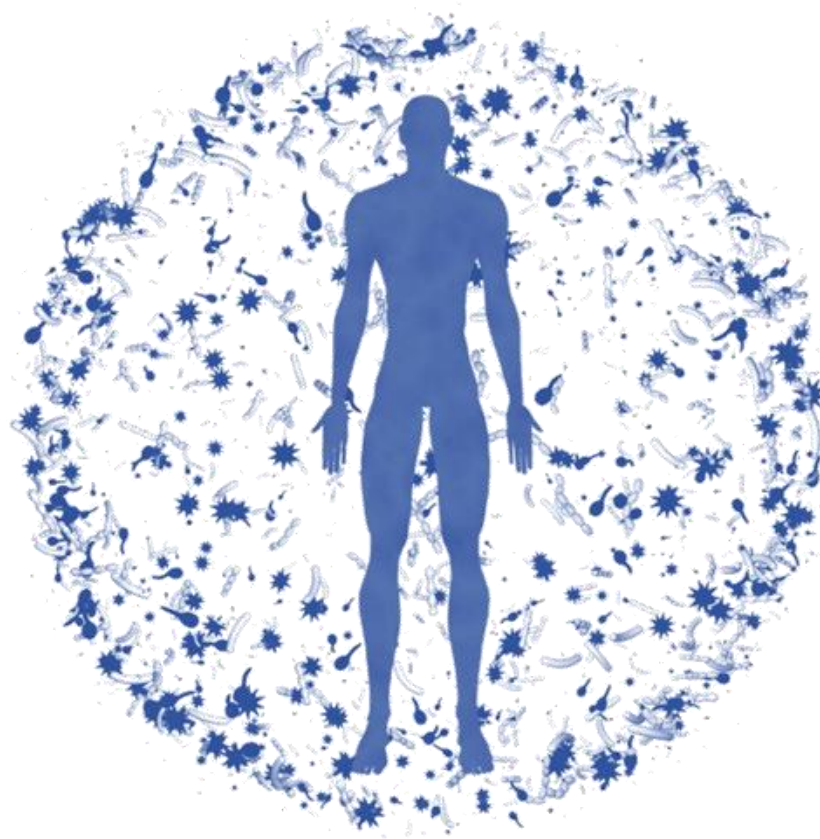
Stéphane Pesant



Ocean Microbiome

Why is it important?

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



Ocean Microbiome

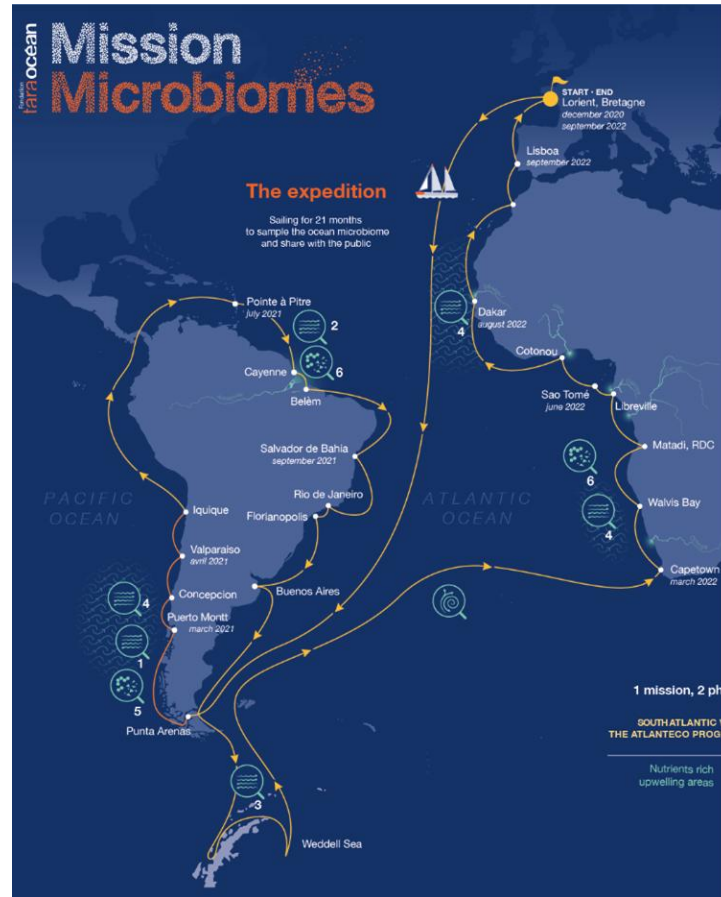
European Union Missions & Projects



REVIEW
20 September 2023

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

Cinzia Corinaldesi, 6 more and Roberto Danovaro



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”

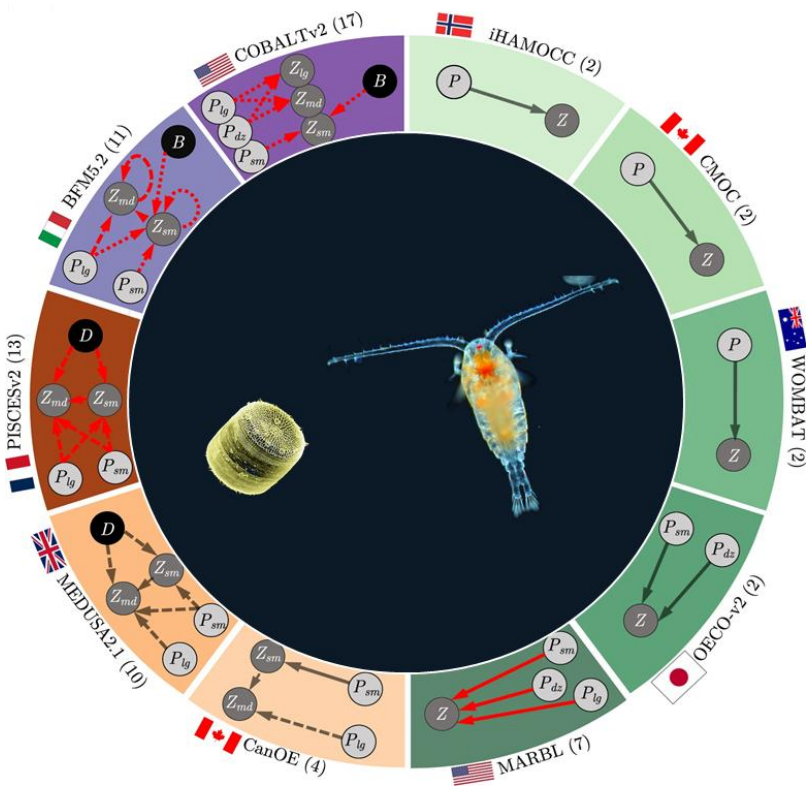
Ocean Microbiome

Climate Assessments



UN OCEAN CONFERENCE NICE 2025 FRANCE

Corinne Le Quéré

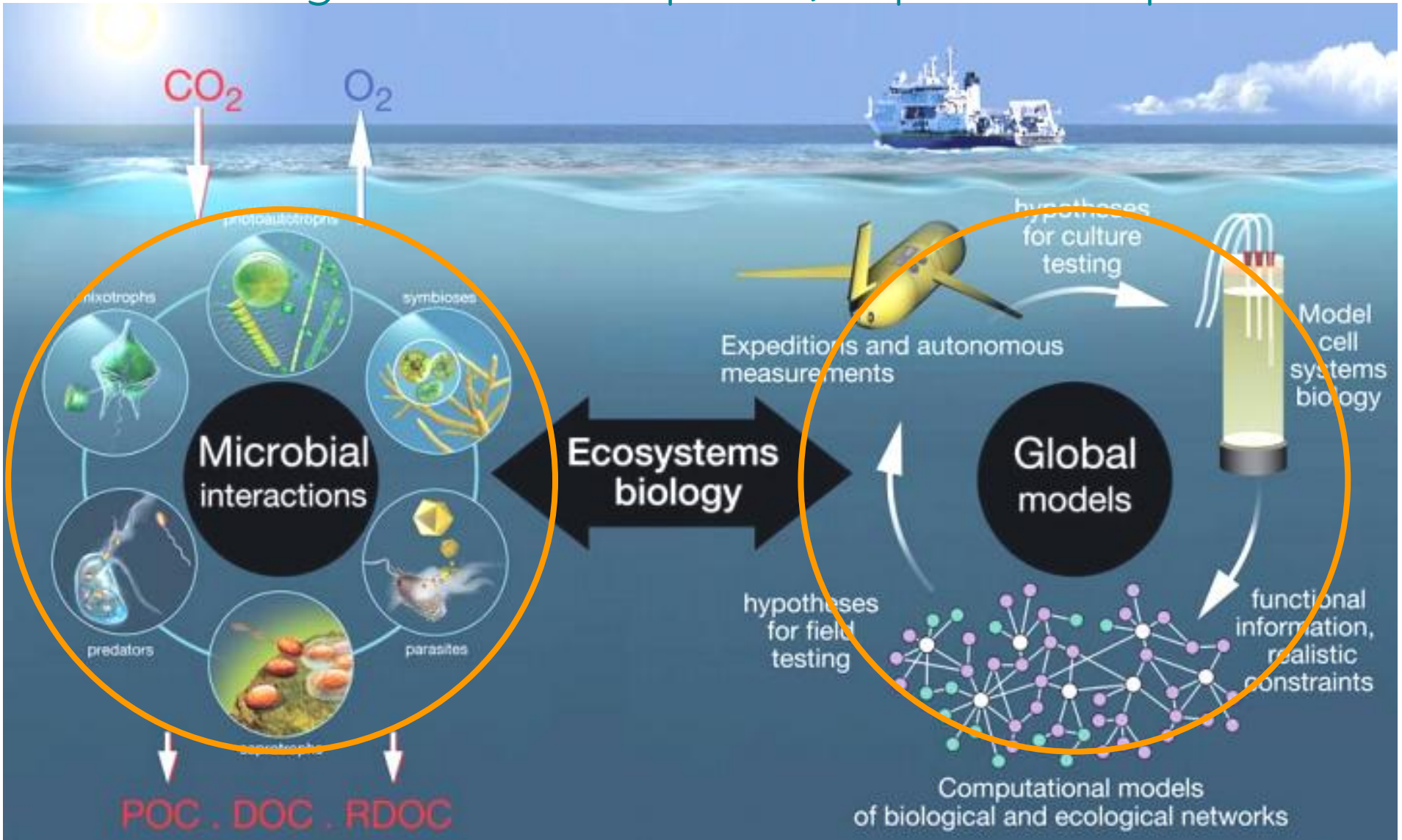


*“The representation of biological processes in Models that inform climate assessments is **very limited**”*

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

Modelling the Ocean Microbiome

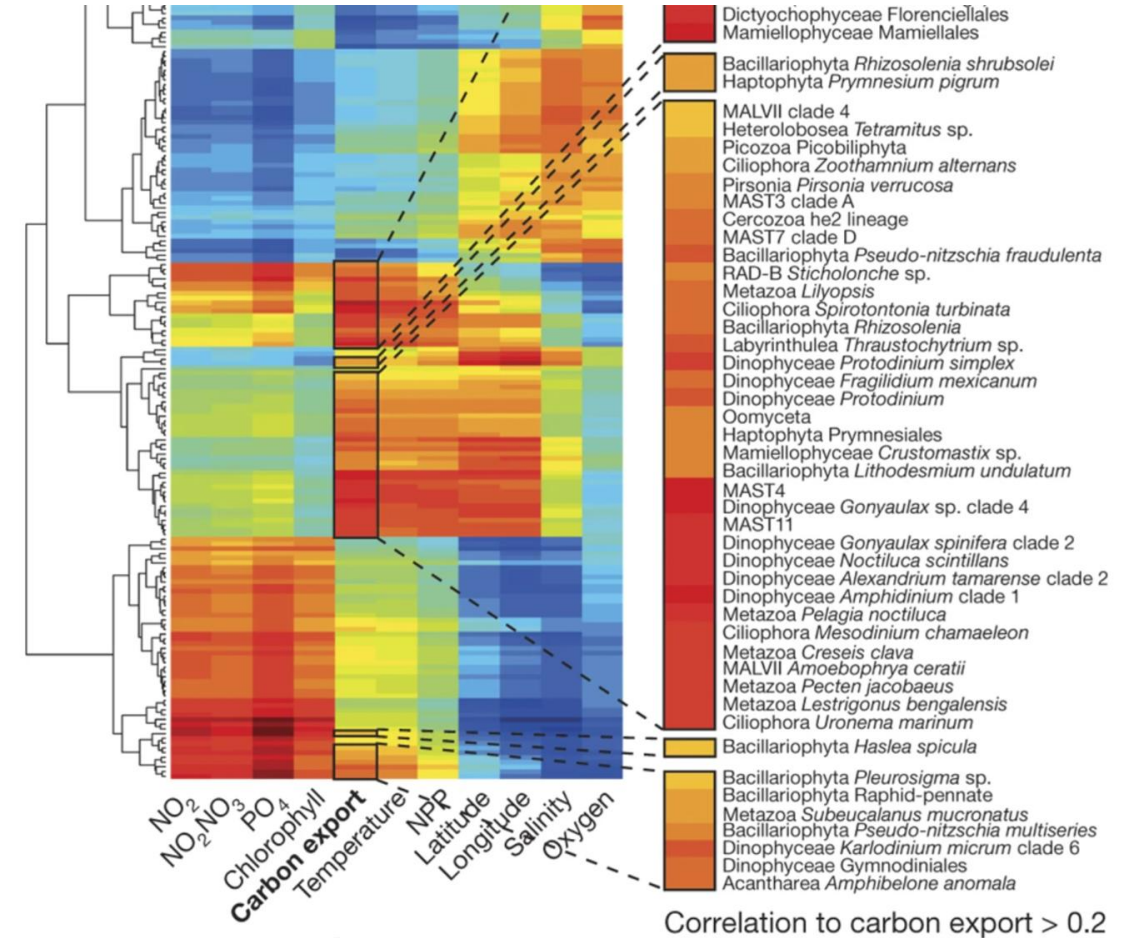
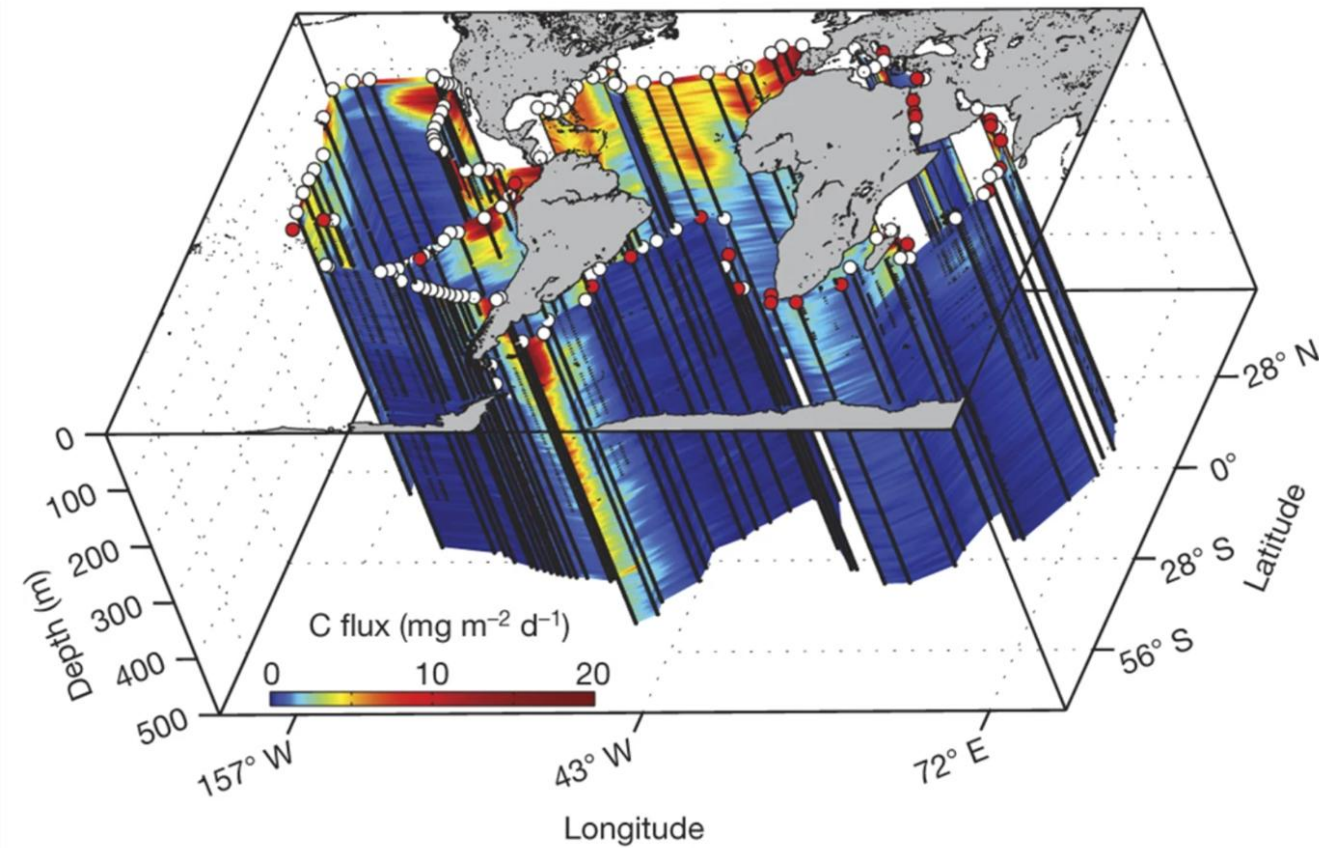
Ocean biological carbon uptake, export & sequestration



Predicting genetic potential for carbon export

Carbon export observations

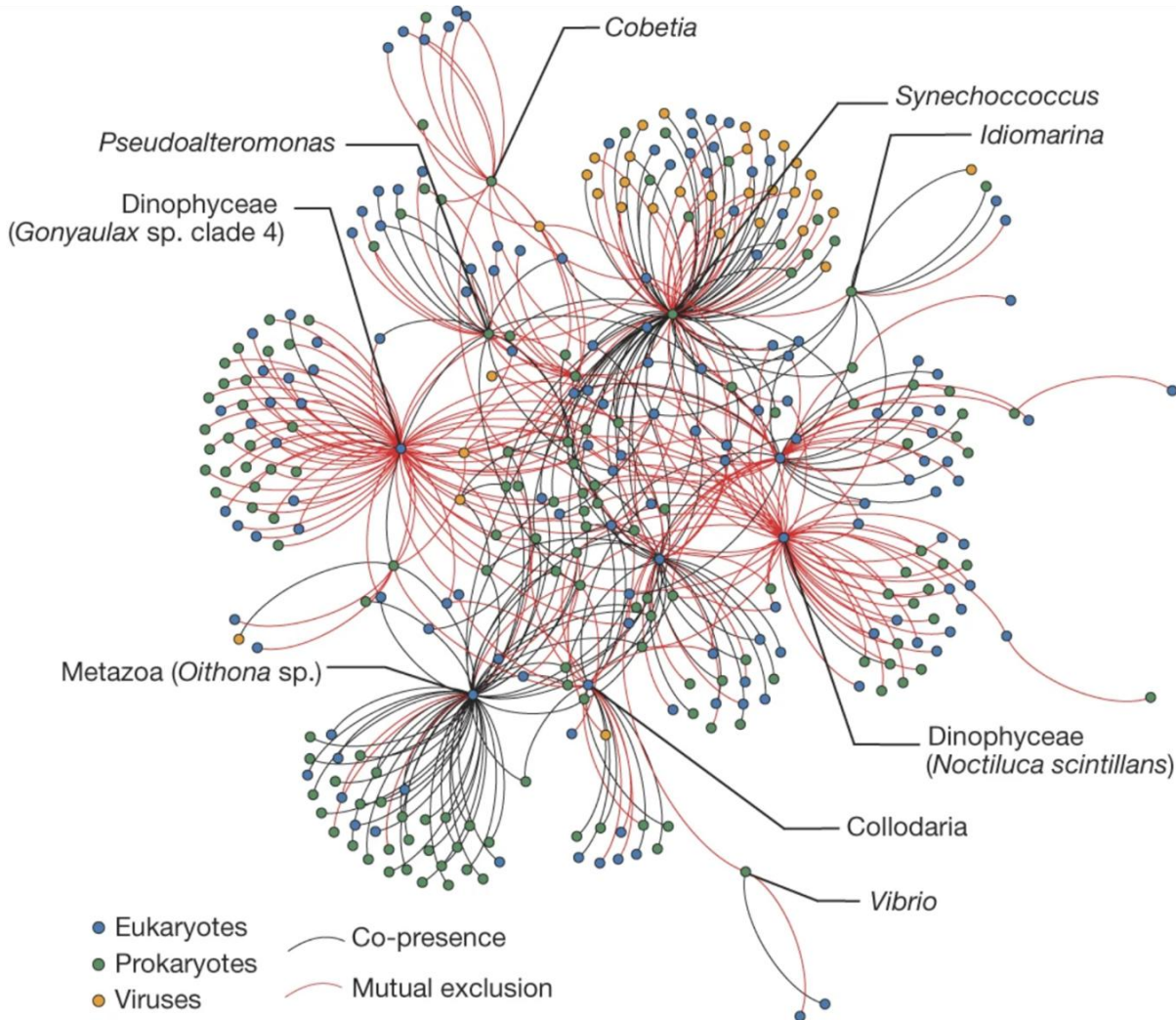
Genetic observations



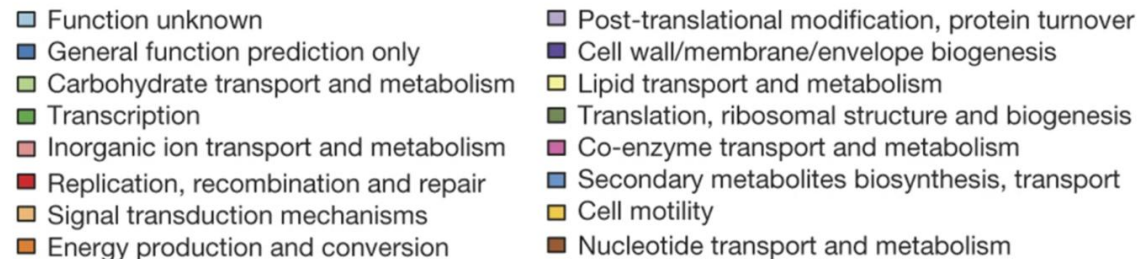
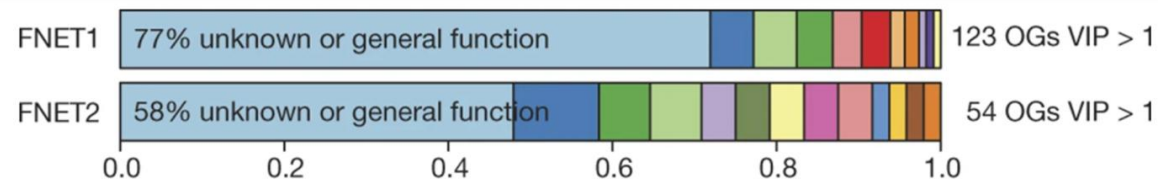
Guidi et al. 2016

Network Analysis - Carbon Export Cluster

Cluster of key Taxa



Cluster of key Metabolic Functions

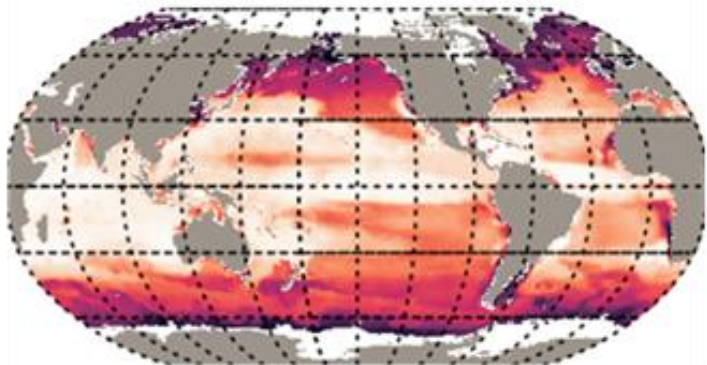




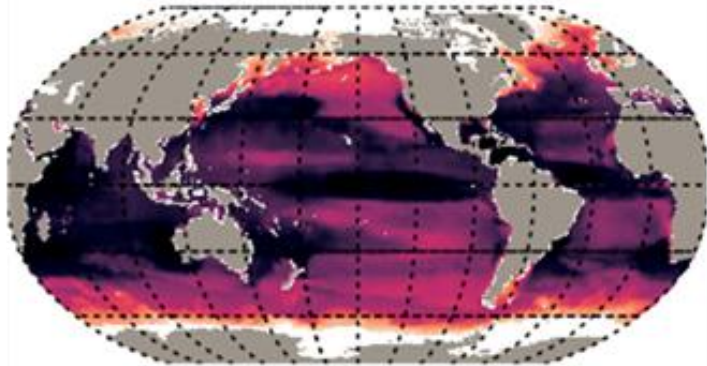
Key taxa of the Cluster

Diversity of the Cluster

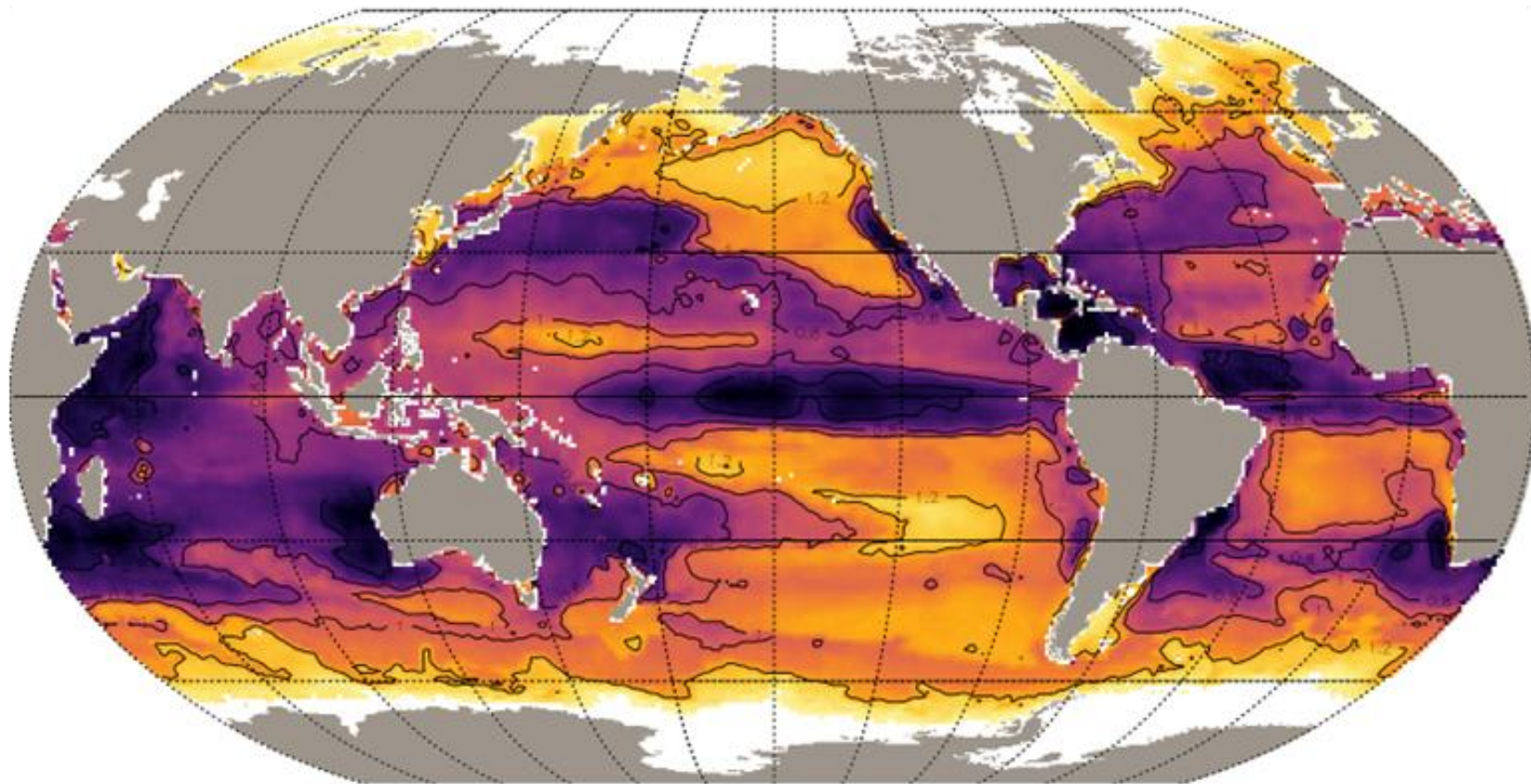
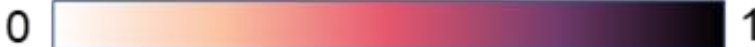
Pseudoalteromonas



Synechococcus



Relative abundance (0 – 200 m)

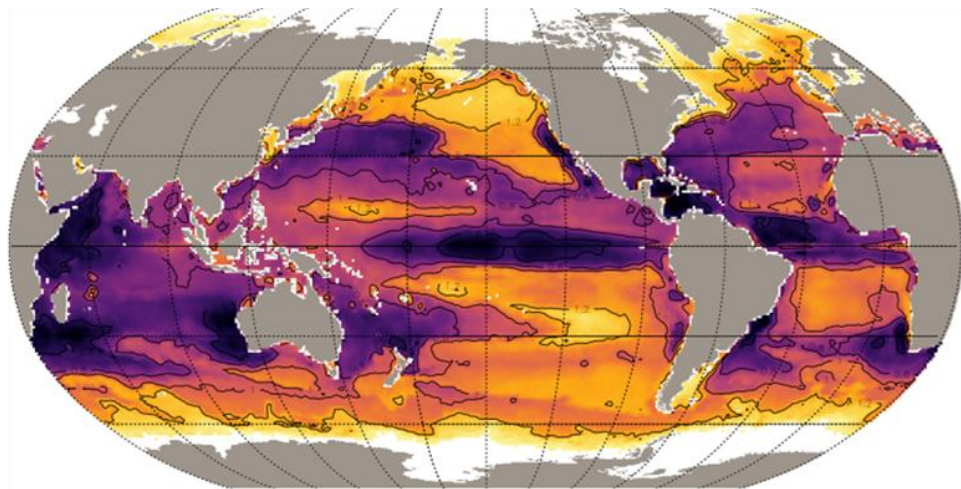


Shannon diversity index (normalized 0 – 100)



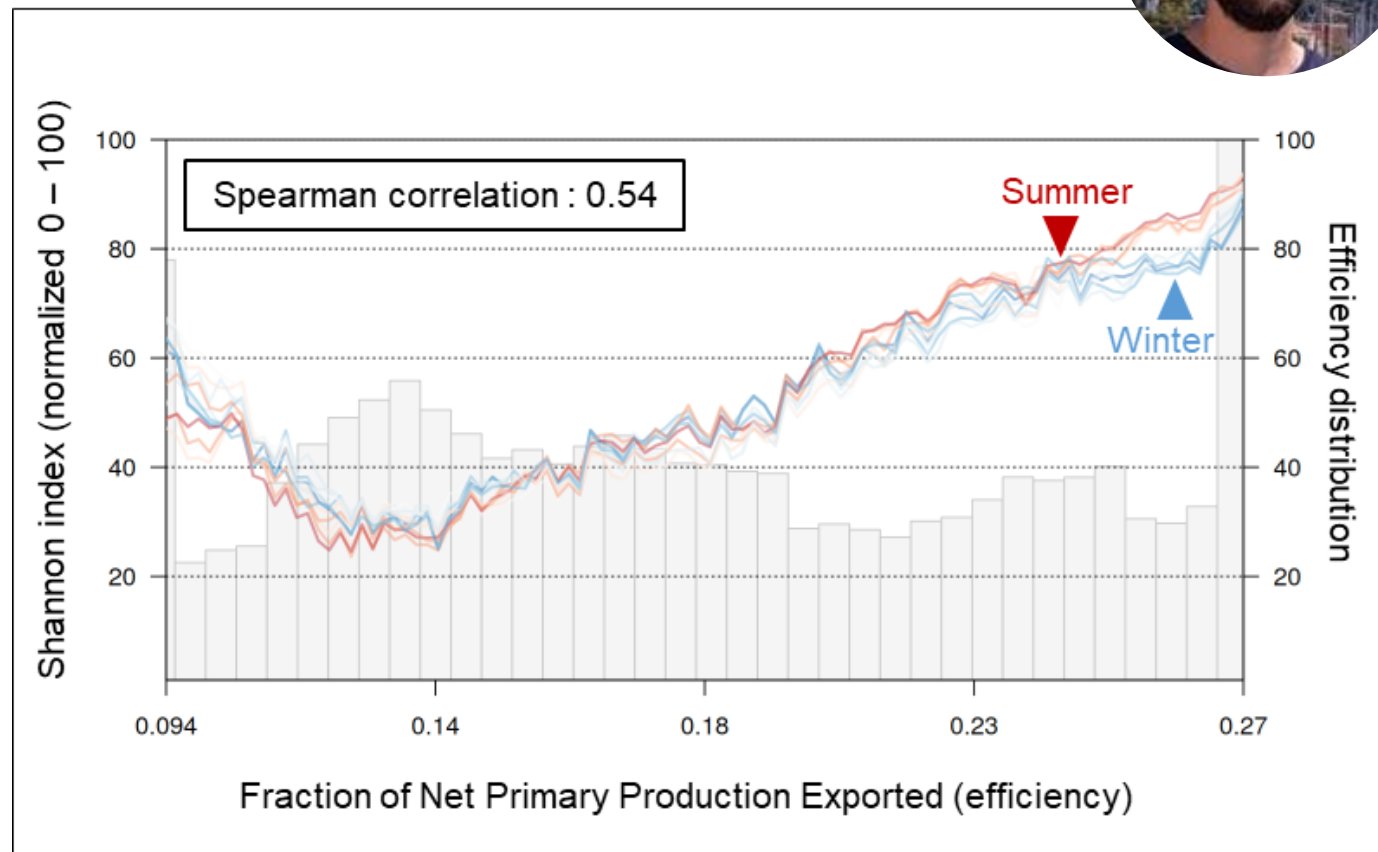
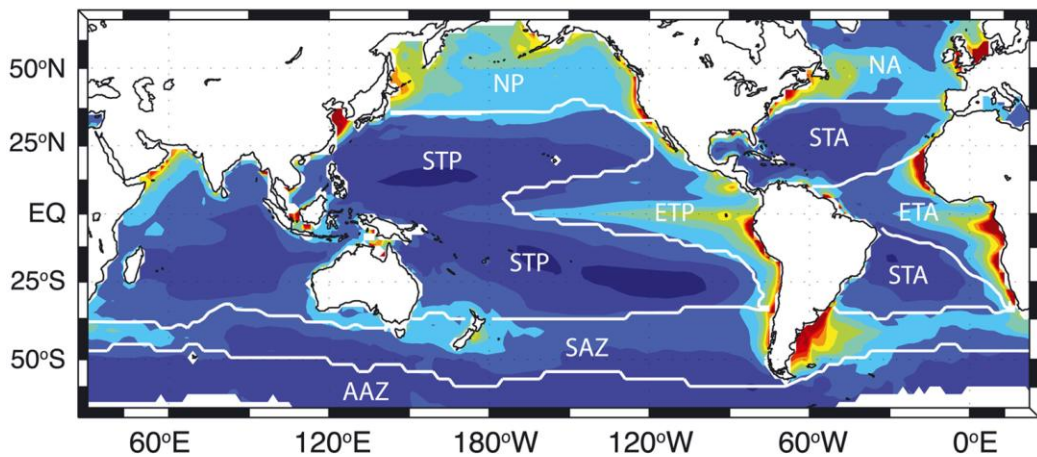
Predicting genetic potential for carbon export

Link modelled Cluster diversity & modelled Carbon export



Shannon diversity index (normalized 0 – 100)

Modeled particle export (mgC m⁻² d⁻¹)



Scientific Use Case Objectives

The logo for the eosc Federation, featuring a stylized 'e' icon composed of two overlapping loops in teal and pink, followed by the text 'eosc | Federation' in white. The background is a dark grey network diagram with nodes and connecting lines, some of which are labeled with 'eosc Node' and various scientific domains like 'Slovakia', 'Data Terra Environment', 'BBMRI-ERIC Health & Food', 'Poland', 'Finland', 'PaNOSC Physical Sciences & Engineering', 'CERN Physical Sciences & Engineering', 'SURF The Netherlands', and 'Digital Twin of the Ocean Environment'.

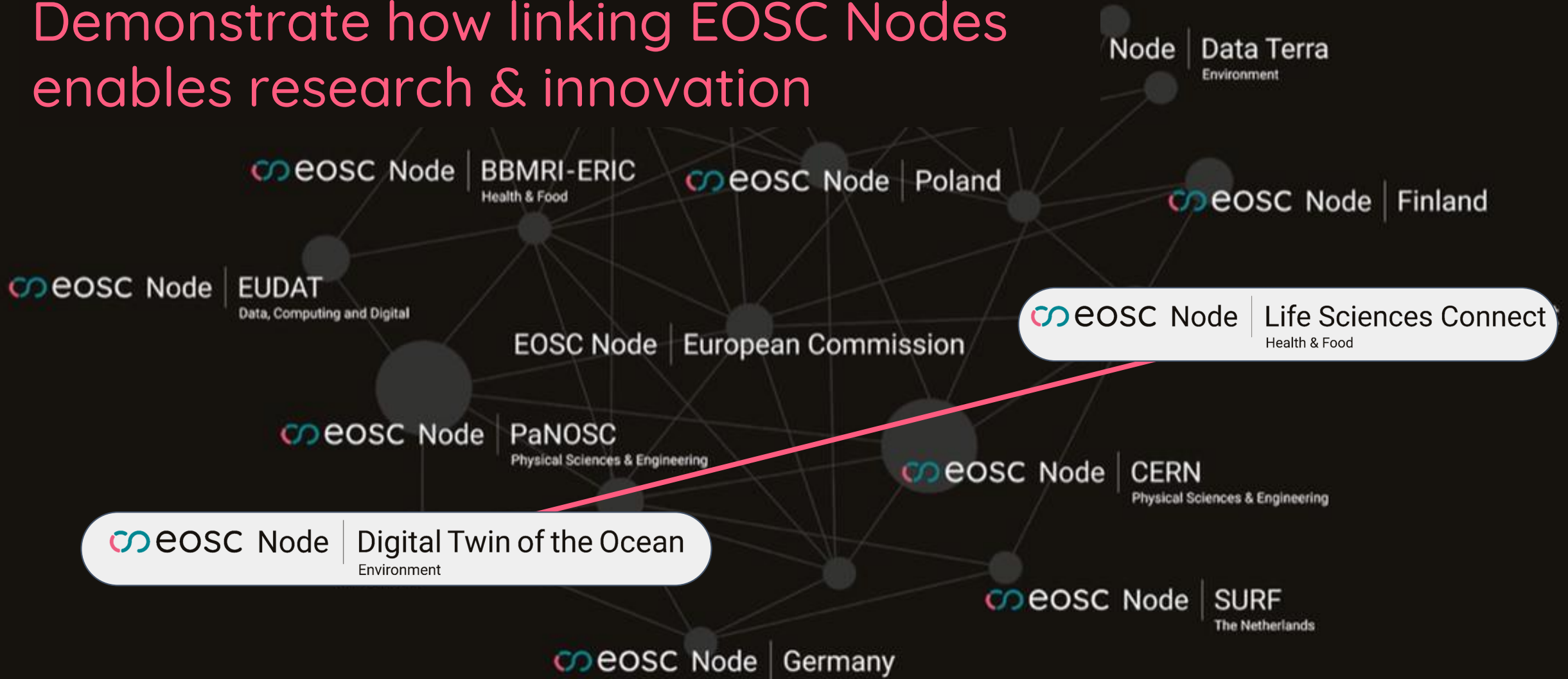
eosc | Federation

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



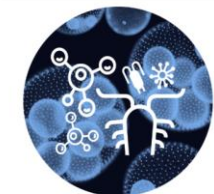
Relevant Node Services



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



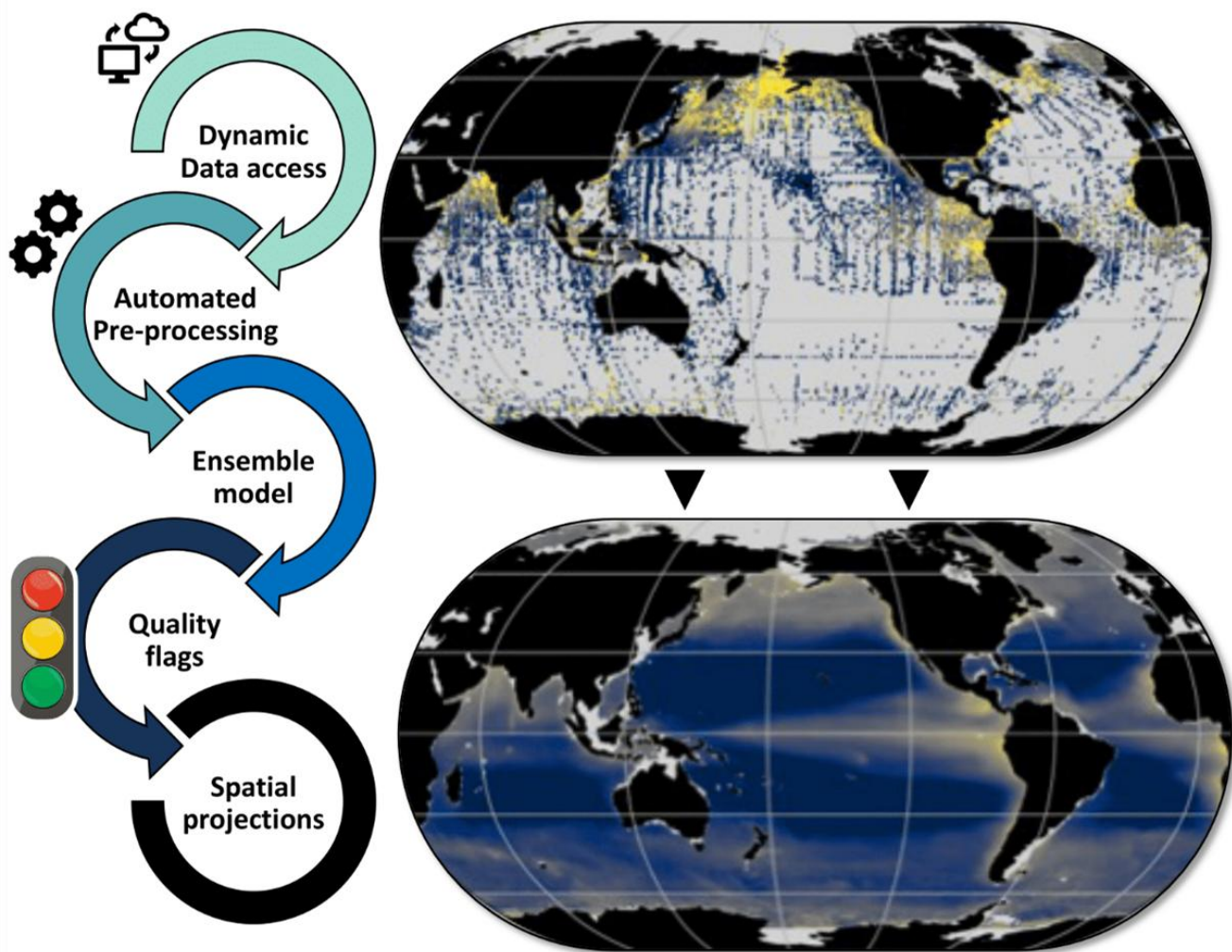
Coastal currents from observations



Fish, a matter of scales



Aquaculture Monitor



eOSC Node | Life Sciences Connect
Health & Food

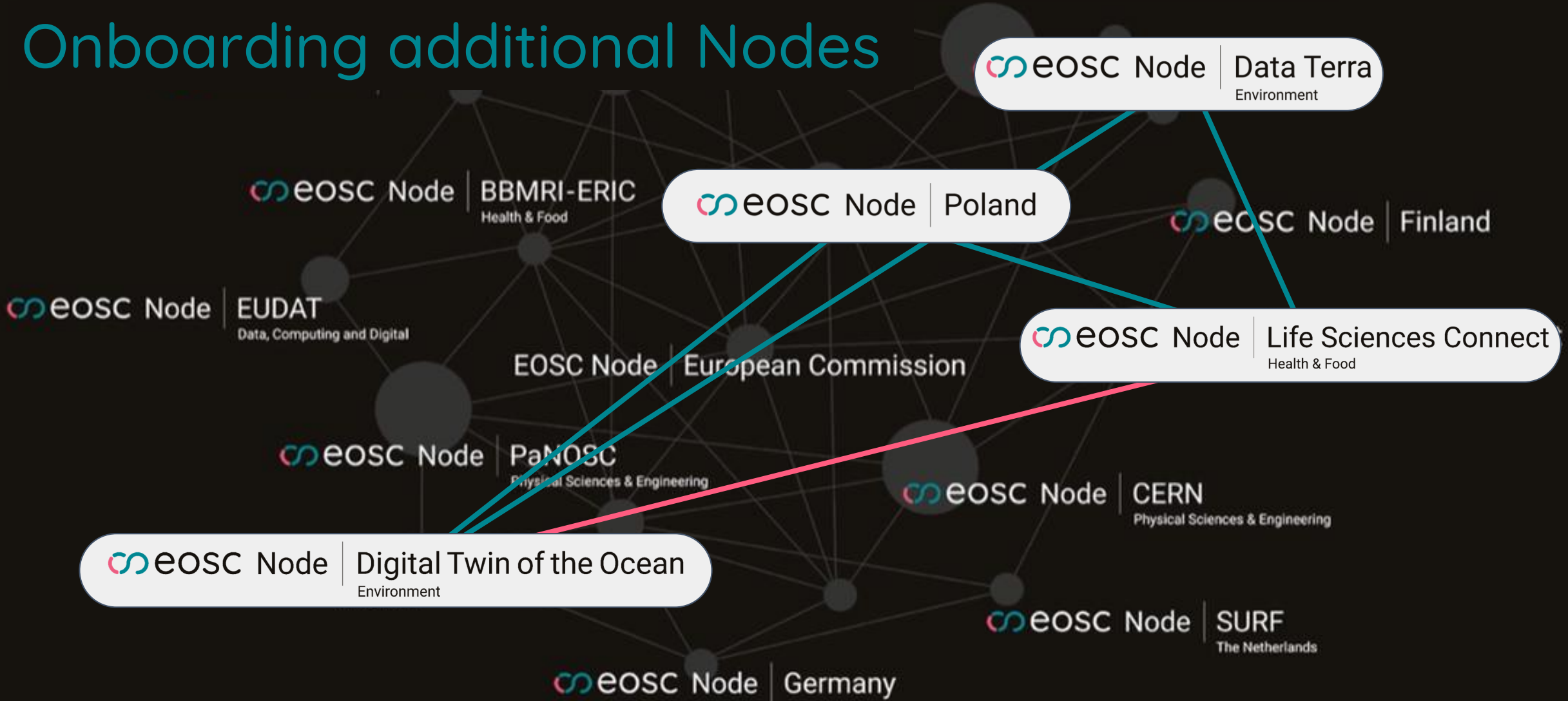
Global Observations (biomolecular)
Ocean Microbiome taxonomy
Ocean Microbiome functions

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

