Marine Ecosystem Analysis and Prediction (MEAP) Task Team

Co-chairs: Stefano Ciavatta (MOi, FR), Marjorie Friedrichs (VIMS, USA)

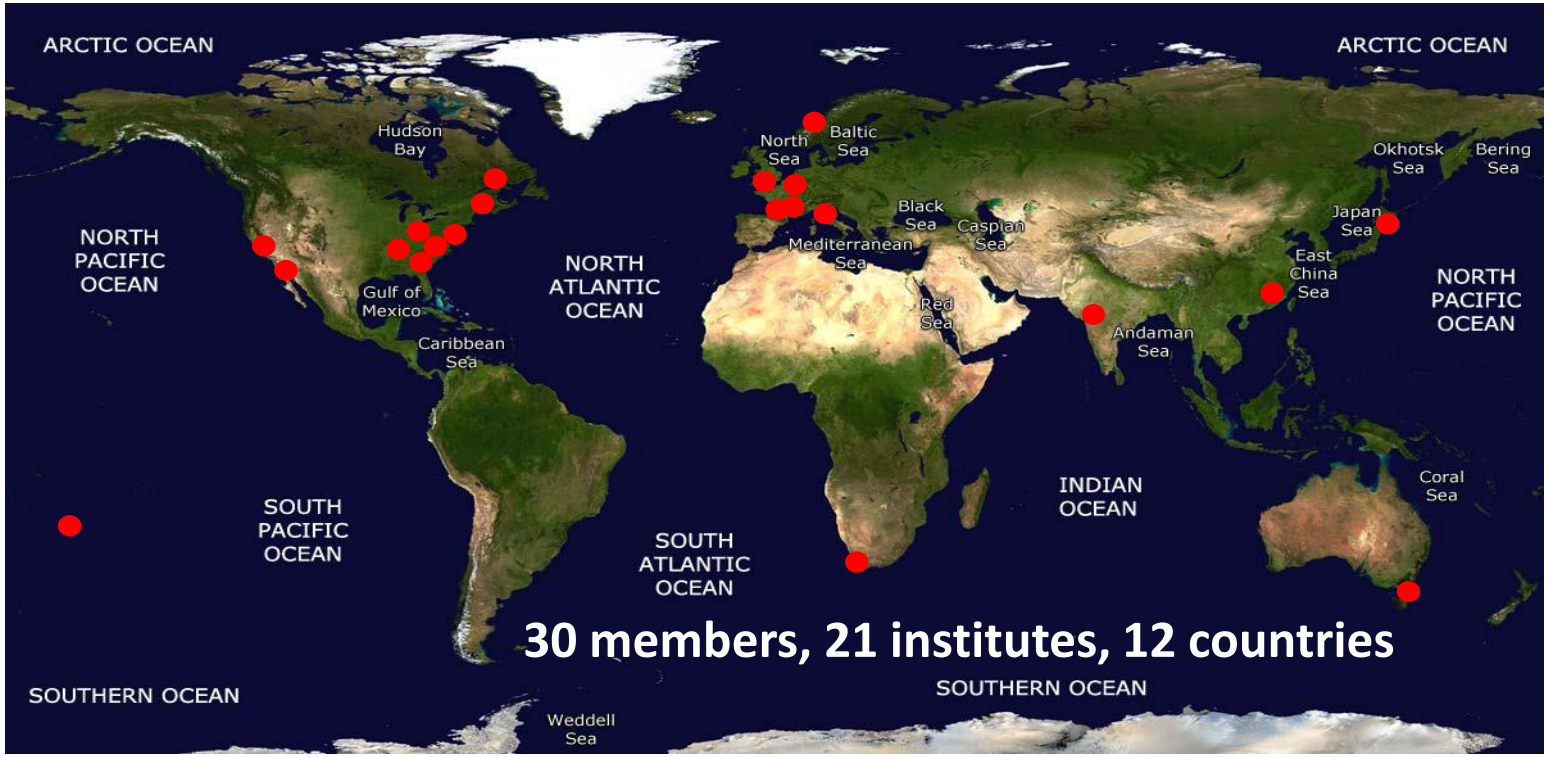
Patron: Paul Di Giacomo (NOAA, USA)

The Marine Ecosystem Analysis and Prediction Task-Team

OceanPredict
Advancing the science of ocean prediction

Mission: Advancing the science and tools for integration of biogeochemical and ecosystem models into operational systems.

"Operational":
- Hindcasts/reanalyses
- Short-term & seasonal forecasts
- Climate projections
- Scenarios



Applications

1) Carbon cycle research, carbon accounting
- Quantification of carbon fluxes
- Sensitivity of carbon fluxes to climate forcing
- National carbon accounting

2) Marine ecosystems health and productivity
- Fisheries management
- Conservation of endangered species
- Design of MPAs
- Marine health indicators (eutrophicat., acidificat., deoxygenat.)

Fennel et al., 2019, https://doi.org/10.3389/fmars.2019.00089

Recent MEAP-TT activities

- **Networking, sharing, discussions, contributions**

  - Set-up a Microsoft Team Group
  - Channels for sharing presentations, MEAP papers, other relevant papers and documents
  - Chats on news, scientific challenges, job opportunities

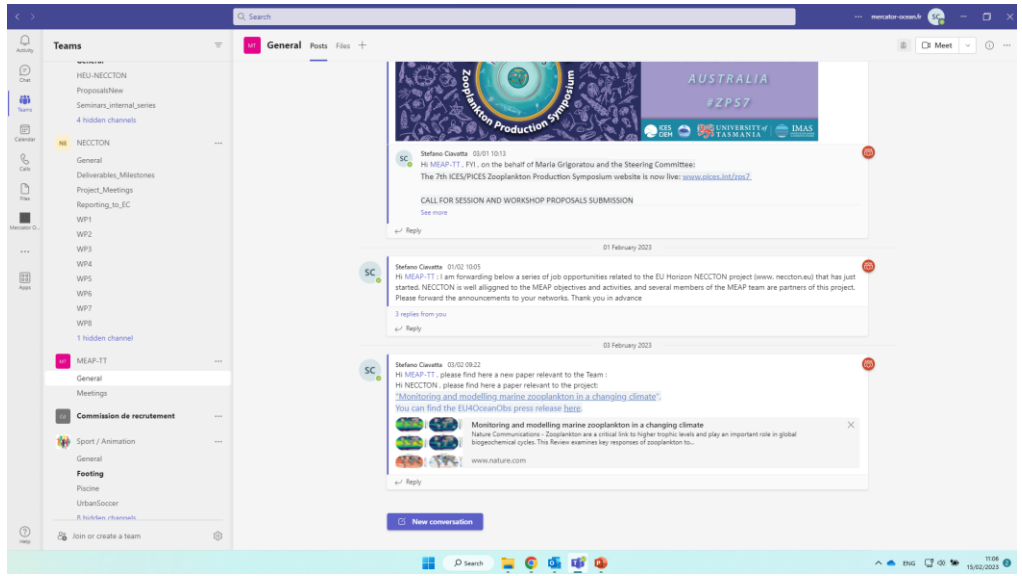
  - Monthly scientific meetings (1st Wednesday of the month 14 UTC) – to be launched starting March

  - Active MEAP collaborations in projects (e.g., SEAMLESS, NECCTON)

  - Active collaborations in dissemination activities (e.g. ETOOFS manual, IOCCP Annual meeting)

  - Contribution to UN Decade initiatives (e.g. ForeSea SC, SynObs SC, Marine Life 2030, GOOS co-design)

  - Contribution to Ocean Prediction DCC SC



Scientific/network/impact highlights of MEAP members

- **Scientific results and dissemination (joint papers and reports):**

  - Primer article "Ocean biogeochemical modelling" in Nature Reviews Methods Primers by Fennel et al., https://www.nature.com/articles/s43586-022-00154-2

  - Mignot *et al.* Decrease in air-sea CO_2 fluxes caused by persistent marine heatwaves. *Nat Commun* **13**, 4300 (2022). https://doi.org/10.1038/s41467-022-31983-0

  - "A solution for autonomous, adaptive monitoring of coastal ocean ecosystems: Integrating ocean robots and operational forecasts" in Front. Mar. Sci. by Ford et al., https://doi.org/10.3389/fmars.2022.1067174

  - “Evaluation of biogeochemical models performance and recommendation on observing system design using an unsupervised machine learning algorithm, BGC-Argo floats and assessment metrics”, Mignot et al., Biogeosciences, in press, https://doi.org/10.5194/bg-2021-2

  - Observability of the target indicators in the 3D CMEMS MFC systems (D3.4), Brasseur et al., Deliverable report of project H2020 SEAMLESS (grant 101004032.). doi: 10.5281/zenodo.7584865

Scientific/network/impact highlights of MEAP members

- **New projects you are involved in**

  - Ocean Alk-align project (funded by Additional Ventures, US$11M for 5 years, lead PI: Fennel) is focussed on ocean alkalinity enhancement as a mCDR technology

  - Current CoCO2 project (funded by European H2020 program), aiming at building up the next Copernicus CO2 Monitoring Service; MOi is in charge of providing "corrected" air-sea CO2 fluxes (through assimilation of carbonates data) as oceanic boundary conditions to the ECMWF IFS (new open position: https://www.mercator-ocean.eu/wp-content/uploads/2023/01/offre-demploi-OSABD-2023-EN.pdf)

  - H2020 SEAMLESS project (2021-2023)

  - Horizon Europe NECCTON project (2022-2025)

SERVICES BASED ON ECOSYSTEM DATA ASSIMILATION: ESSENTIAL SCIENCE AND SOLUTIONS (SEAMLESS)

Partners

Advisory board

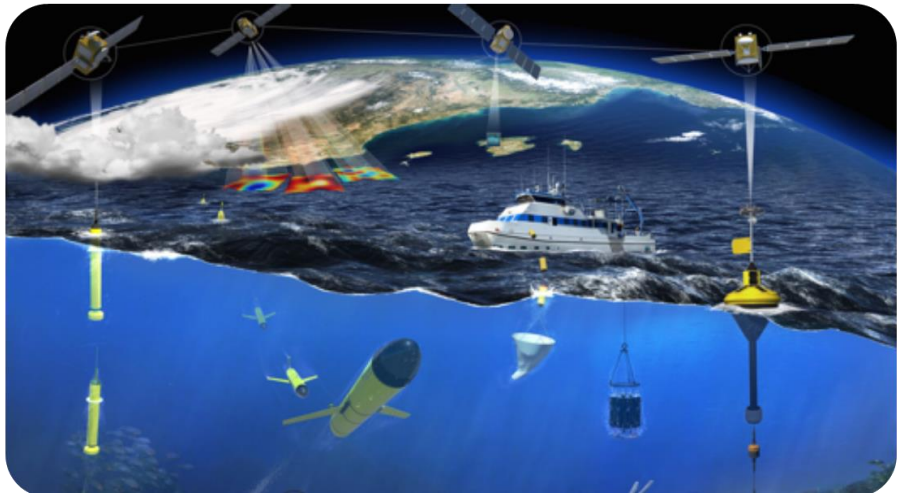
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004032.

Vision and mission

Novel opportunities and aspiration
to predict better ocean ecosystems,
by integrating new data and models

Vision
to support sustainable food-security
from the ocean in a changing climate

Mission
to improve the operational simulation
of indicators related to
climate impact, marine food-webs and
stakeholders' needs



2021 2030 United Nations Decade of Ocean Science for Sustainable Development

A predicted ocean

Copernicus Marine Service

System	DA method	Error covariances / Error subspace	Updated BGC variables	Uncertainty estimation
NWS CMEMS	NEMOVar	Prescribed stats (monthly climatol.)	Univariate DA (Chl) + balancing scheme	No
NWS SEAMLESS	Hybrid Ensemble/NEMOVar	3D ensemble-based	Univariate DA (Chl) + balancing scheme	Ensemble spread
IBI CMEMS	None			
GLO CMEMS	SEEK Filter Fixed basis	Prescribed stats (seasonal climatol.)	Bi-variate (PHY + N) + adjustment scheme	No
IBI/GLO SEAMLESS	Stochastic Ensemble Filter	4D ensemble-based (space + time)	Full state vector	Ensemble spread
MED CMEMS	3DVarBio	Prescribed stats	Multivariate (PHY+N+P)	No
MED SEAMLESS	SEIK	3D ensemble-based	Multivariate (PHY+N+P) or Full state vector	Ensemble spread
BAL CMEMS	None			
BAL SEAMLESS	LESKTF & Hybrid Filter LKNETF	3D ensemble-based	Multivariate (Chl+ 3 phytoplankton variables) or Full state vector	Ensemble spread
ARC CMEMS	DEnKF/EnKS	3D ensemble-based	Full state vector	Ensemble spread
ARC SEAMLESS	DEnKF/EnKS updated	3D ensemble-based	Full state vector + BGC model parameters	Ensemble spread

- Observability of the target indicators in the 3D CMEMS MFC systems (D3.4), Brasseur et al., Deliverable report of project H2020 SEAMLESS (grant 101004032.). doi: 10.5281/zenodo.7584865

odessa.webp

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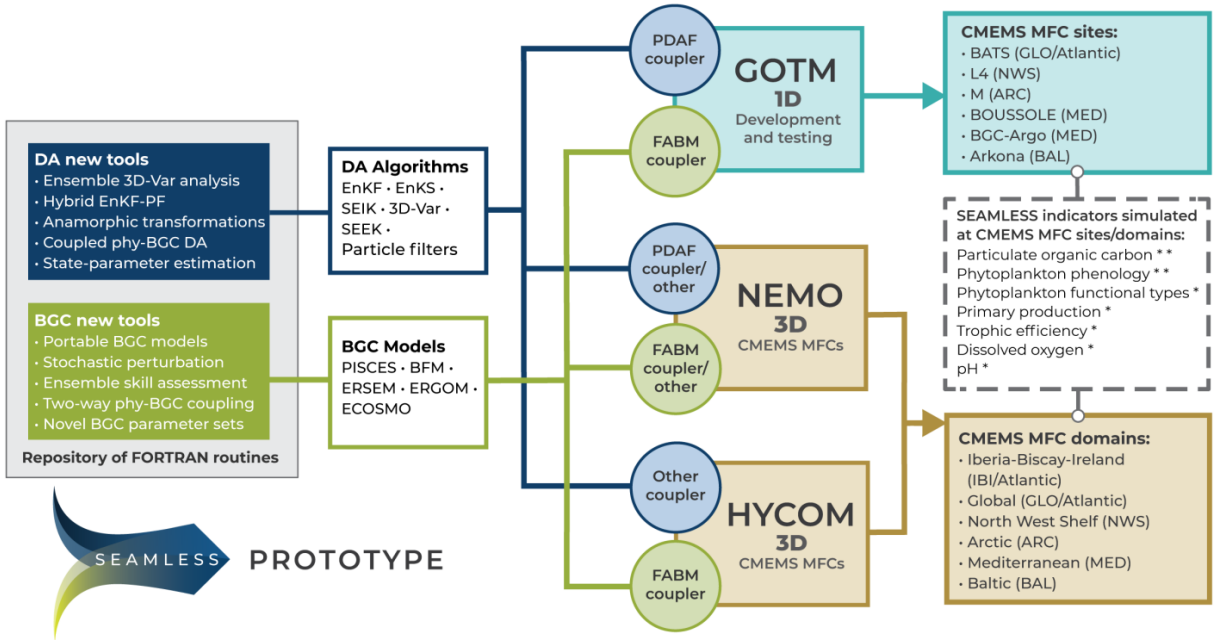
SEAMLESS Prototype



Copernicus Marine Service

COPERNICUS MARINE SERVICE
BALTIC SEA MFC
Until 31 Dec. 2024
Contract 21002L2-COP-MFC BAL-5200

European Commission

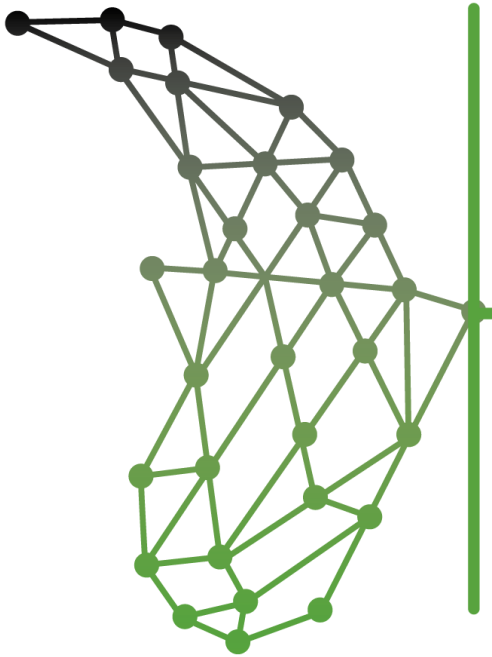
NECCTON
NEW COPERNICUS CAPABILITY FOR TROPHIC OCEAN NETWORKS

Organizing a training-session for OceanPredict Task-Teams in May/June 2023

ACADEMY

Next generation of ocean scientists and assimilators

OceanPredict
Advancing the science of ocean prediction



NECCTON

NEW COPERNICUS CAPABILITY FOR TROPHIC OCEAN NETWORKS

This project has received funding from Horizon Europe RIA under Grant Number 101081273

Partners

1	MOi	FR
2	BB	DK
3	NERSC	NO
4	UoL	BE
5	IFREMER	FR
6	OGS	IT
7	NIOZ	NL
8	BSH	DE
9	CLS	FR
10	CMCC	IT
11	HEREON	DE
12	DTU	DK
13	HCMR	GR
14	LOB	ES
15	EII	ES
16	UU	NL
17	MINDS	GR
18	IMAR	PO
19	CNR	IT
20	CNRS	FR
21	SU	FR
22	UKMO	UK
23	PML	UK

Advisory board

Prof Katja Fennel
Dalhousie University, CA

Prof Frank Muller-Karger
University of South Florida, USA

Dr Fraser Davidson
Fisheries and Ocean Canada

Dr Jason Link
NOAA

Dr Craig Donlon
European Space Agency

Key-facts

- Programme: EC's Horizon Europe
- Duration: 4 years project (Jan 2023-Dec 2026)
- Partners: 23 (21 beneficiaries, 2 UK associates)
- Budget: 10M Eur (8.5 M from EU; 1.5 M UK)
- PI: S Ciavatta (MOi); PM: J Heard (PML)
- Project Officer: Gisèle Van Bunnen (HADEA)

This project has received funding from Horizon Europe RIA under Grant Number 101081273

Vision and overall objective

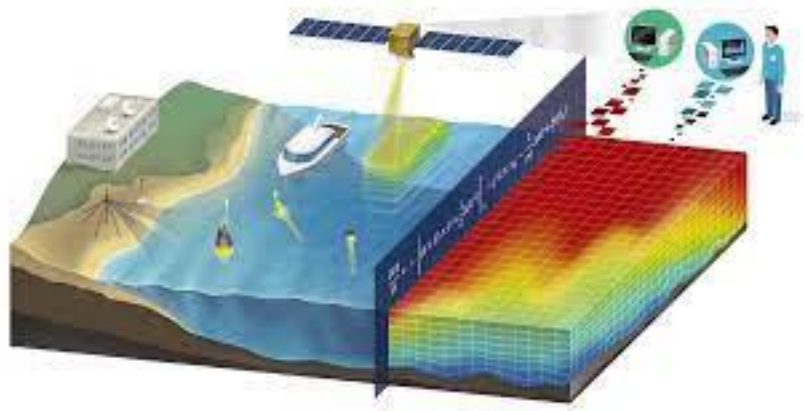
Vision: advancing ocean biodiversity conservation, supporting food-security and informing European policies through the next generation of marine ecosystem prediction systems

POLICIES & OCEAN GOVERNANCE & MITIGATION

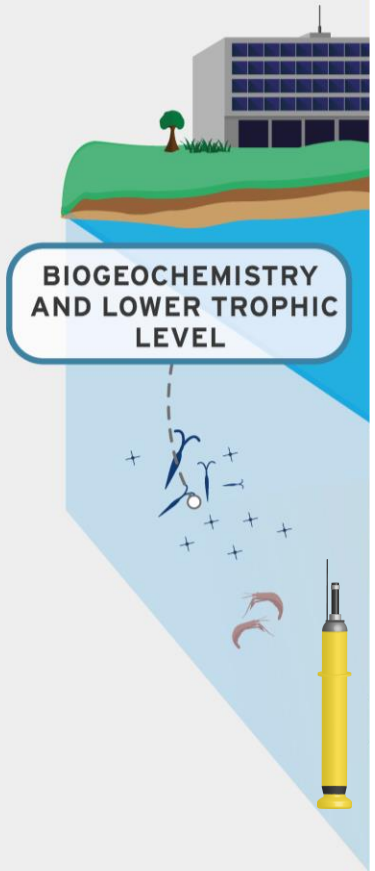
Marine Conservation & Biodiversity

MARINE FOOD

Overall objective: to enable CMEMS to deliver products that inform marine biodiversity conservation and food resources management, by fusing innovative ocean ecosystem models and new data.



CMEMS **BEFORE**
NECCTON



Co-design of case studies with stakeholders

POLICIES & OCEAN GOVERNANCE & MITIGATION

MARINE FOOD

OCEAN HEALTH

CLIMATE & ADAPTATION

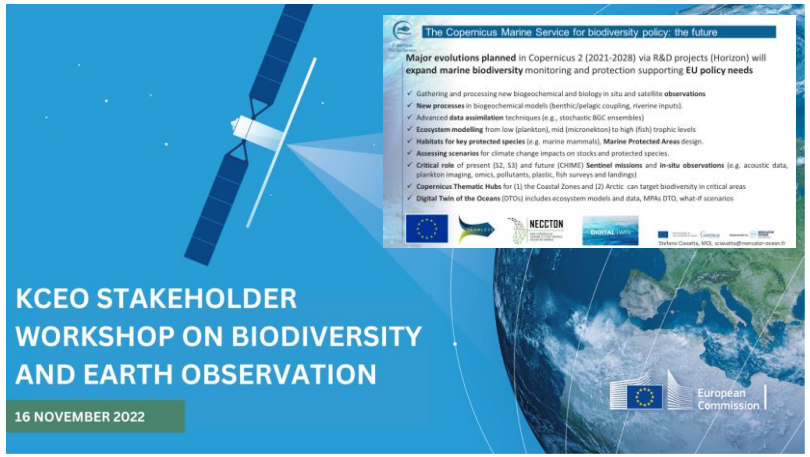
Stakeholder Expert Committee

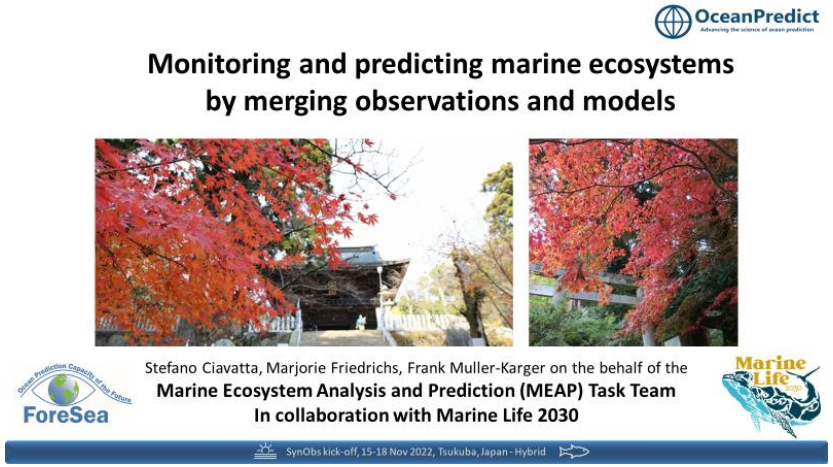
ID	Title	Co-design stakeholder
C1	Monitoring a Natura 2000 marine protected area in the Adriatic Sea	Blue World Institute of Marine Research and Conservation
C2	Ensemble of species distribution models to determine hot spots of aggregation supporting management plans and MPA definition in the Mediterranean Sea	FAO-GFCM
C3	Mapping sources of pollutants transported towards Mediterranean aquaculture farm areas	FAO
C4	Mapping the impact of fish trawling on functional biodiversity of the Black Sea	ICES FBIT
C5	Climate-smart MPA planning in the North West European Shelf	UNEP
C6	Ensemble model evaluation and projection of small pelagics in the Bay of Biscay	ICES WGEAWESS
C7	Monitoring plankton diversity and dynamics in the Parc Naturel Marin d'Iroise (PNMI)	Office Français de la Biodiversité (OFB)
C8	Monitoring pollution of marine protected areas surrounding Svalbard	IUCN
C9	Modelling and projecting fisheries potential in the Arctic Atlantic Ocean	ICES-WGINOR and ICES-WGIBAR
C10	Marine protected area monitoring and assessment in the Baltic Sea	HELCOM
C11	Impact of High Seas MPA on tuna stocks and fisheries: the example of the Phoenix Islands Protected Area (PIPA)	Pacific community (SPC), ISSF, IC, FAO
C12	Monitoring marine mammals in the Azores region	Azores Regional Directorate of Maritime Affairs
C13	Forecasting climate change impact on potential catches of open ocean large pelagic fish	Fish-MIP

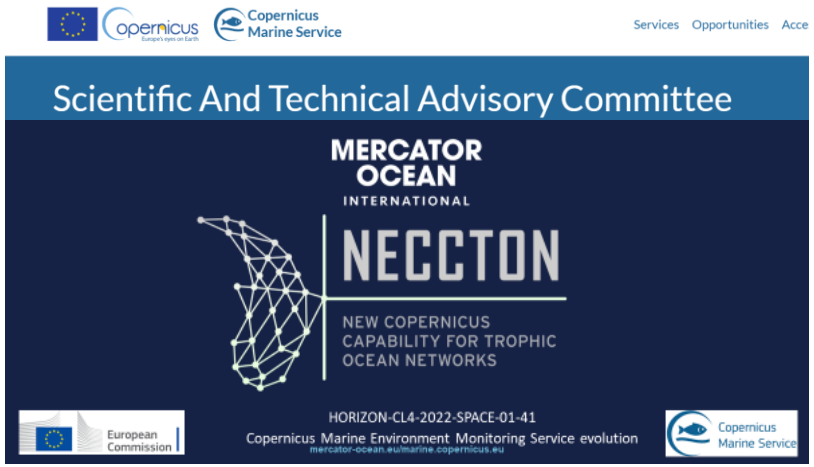
Stakeholder workshop – 27-28 June 2023

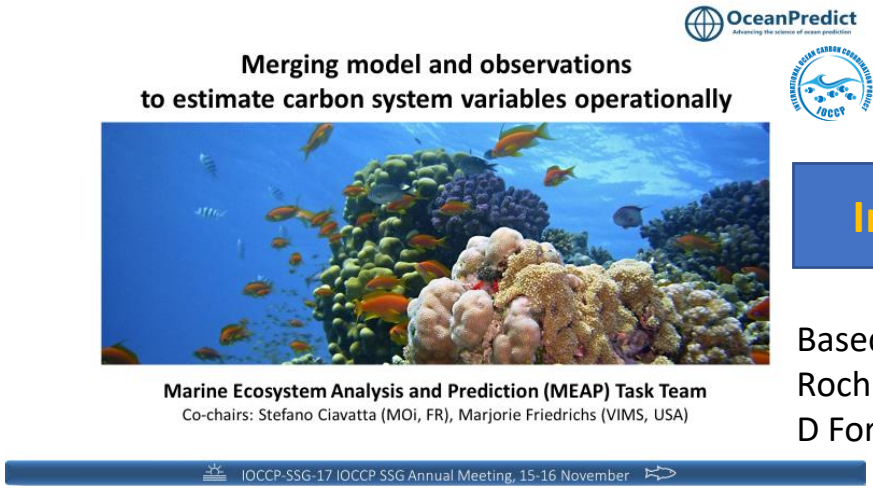
Scientific/network/impact highlights of MEAP members

- **Remarkable engagements of stakeholders and working groups**









Impact!

Based on results by A Rochner (U Exeter) & D Ford (Met Office)

IOCCP will run an intercomparison between carbonate products from floats and ships

Issues and questions

- Big push for marine Carbon Dioxide Removal (mCDR) techniques with large inflow of private sector $$ is happening; big challenge is Measurement, Verification and Reporting of the resulting carbon credits
- Contribution of MEAP-TT to the Ocean Prediction DCC: MEAP members in steering committee?
- Improvable communication between ForeSea and MEAP-TT
- Improvable collaboration with Marine Life 2030
- Perhaps need to revise the list of members and guarantee engagement of members
- Looking for opportunity for in-person meeting