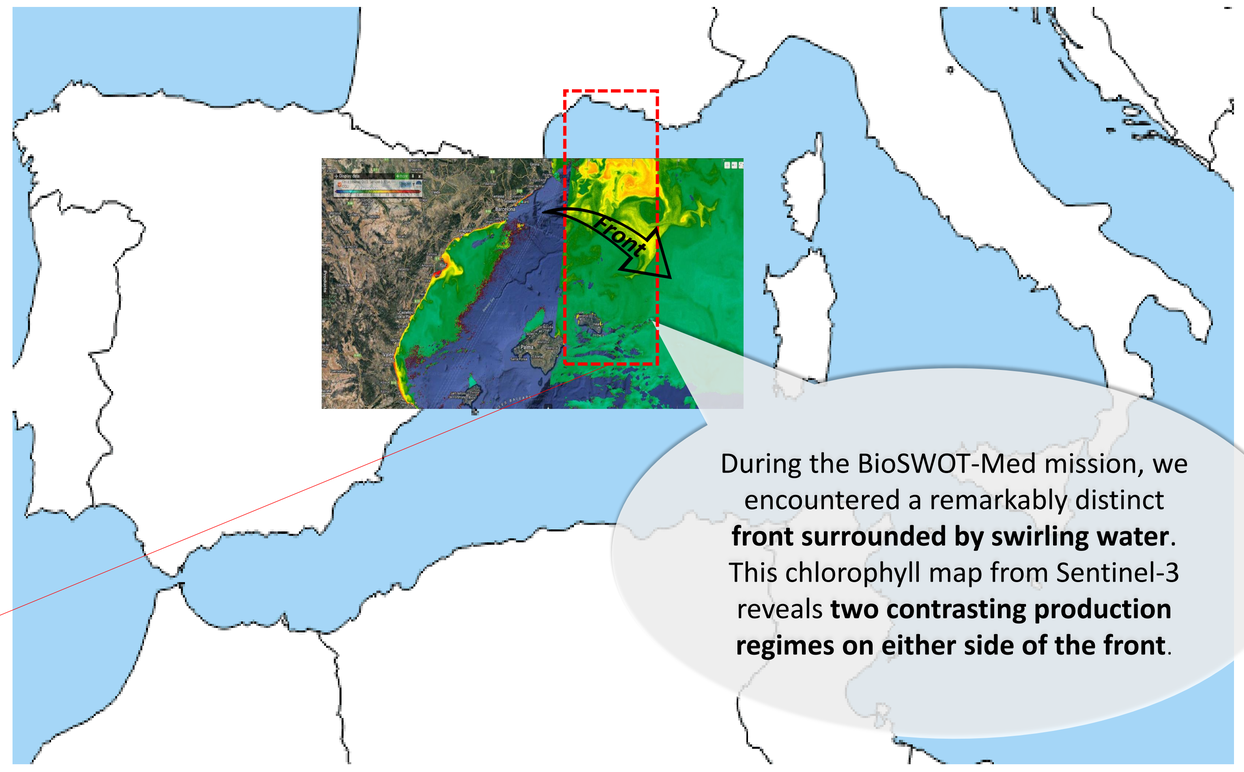
The BioSWOT-Med campaign

Looking for the fine-scale physical-biological coupling in the NW-Mediterranean sea

L.Oms, A.Doglioli, G.Grégori, F.d'Ovidio, A.Bosse, E.Pulido, F.Carlotti, M.Lescot and BioSWOT-team.



During the BioSWOT-Med mission, we encountered a remarkably distinct **front surrounded by swirling water**. This chlorophyll map from Sentinel-3 reveals **two contrasting production regimes on either side of the front**.

SCIENTIFIC PROJECT

In the ocean the life is a complex story driven by the chaotic behavior of water, and today the underlying processes remains poorly understood

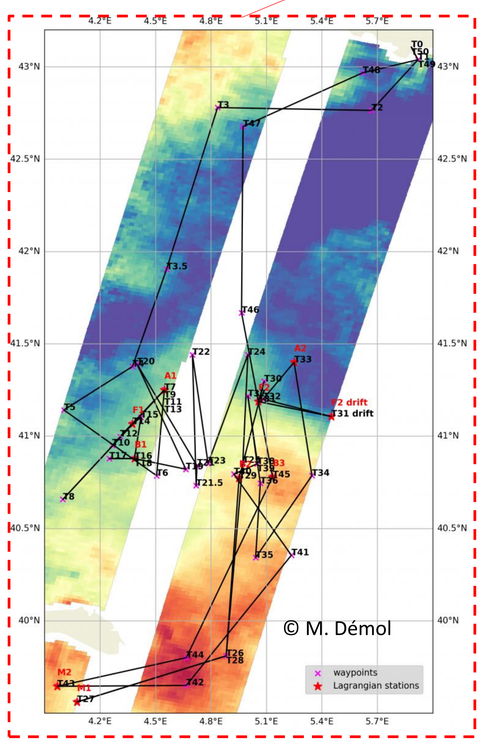
What are the physical and biogeochemical specificities associated with fine scales? Could fine-scale explain the plankton biodiversity and distribution?

Thanks to numerous **multidisciplinary measurements** our campaign aims to unravel the secrets of viruses to zooplankton, improving our understanding on the intricate connection between physical and biological processes

MEASUREMENT STRATEGY

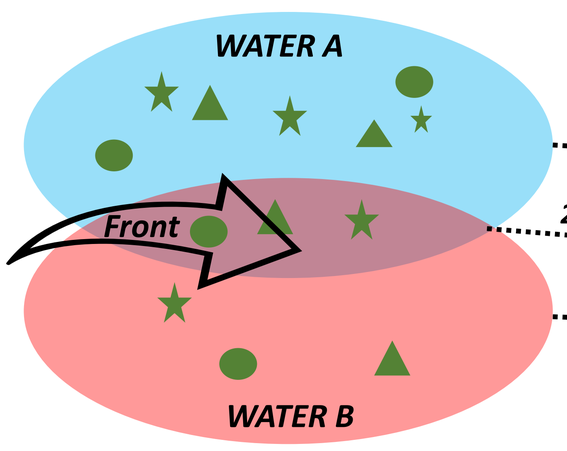
We employed **an adaptative lagrangian sampling** strategy and new methods to gather detailed measurements along SWOT satellite paths, achieving high-resolution data in both space and time

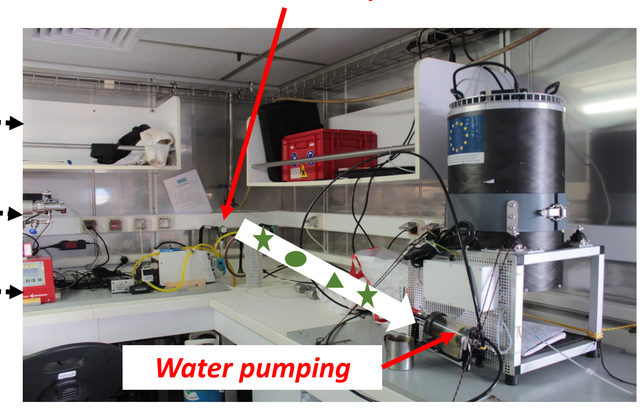
- Horizontal and vertical currents, mixing, nutrients and gases**, cytometry**, plankton nets, omics, incubations, megafauna observations…
- Autonomous platforms, satellite data (SWOT, Sentinel-3), SPASSO



THE BEGINNING OF HISTORY WITH FLOW CYTOMETRY…

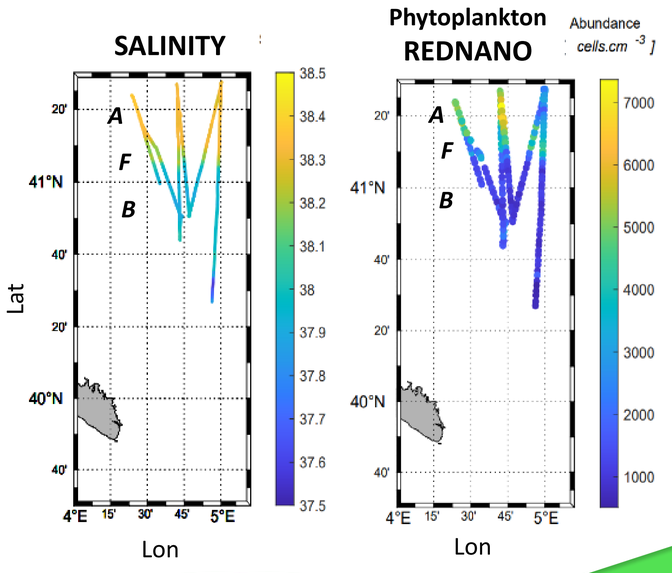
Community composition and biomass?



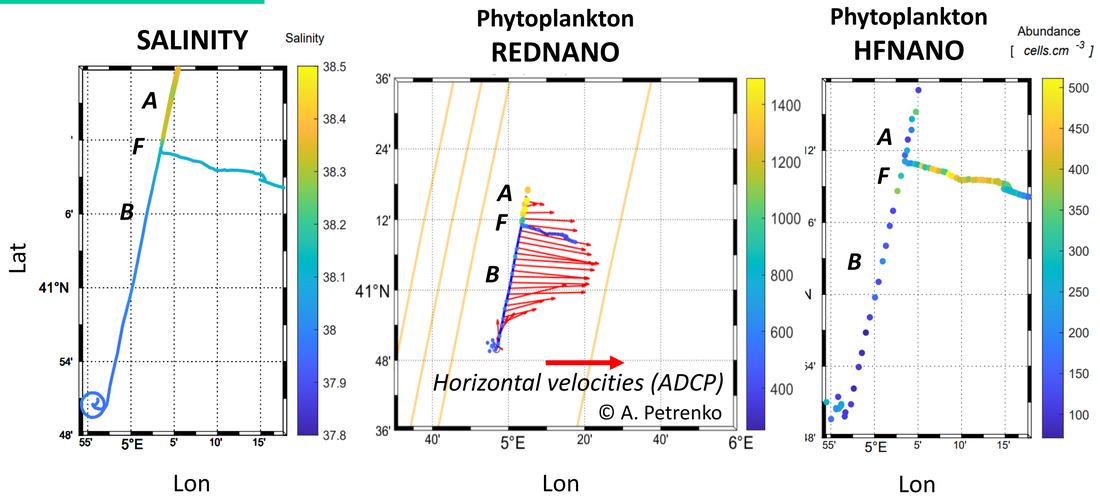


PRELIMINARY RESULTS

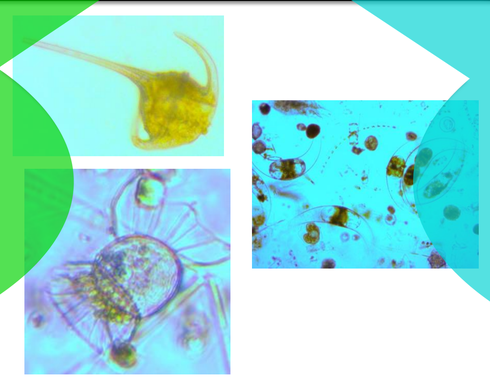
29 & 30 April 2023



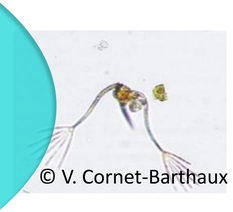
05 May 2023



We observed **that community distribution was correlated with salinity distribution** , but not in the same way for the different phytoplankton groups. And, we had the opportunity to sample the front at high resolution : for example, on May 5, we sampled precisely inside the front, where we observed a notable high abundance of an unusual phytoplankton group: HFNANO.



To deepen our understanding of events and uncover a more complete story, we will compare these cytometric data with **biogeochemical and physical data**. For example, by analyzing nutrient data, we can discern which water masses are the richest in nutrients, which could inform the cytometric observations. We will also have more complete data set in biology, with genomics and images.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MODELLING STRATEGY

A recent novel method, the **"growth-advection modelling"** (*Messié & Chavez, 2017*), is developed for fine-scale questions and represent a good complementary tool :

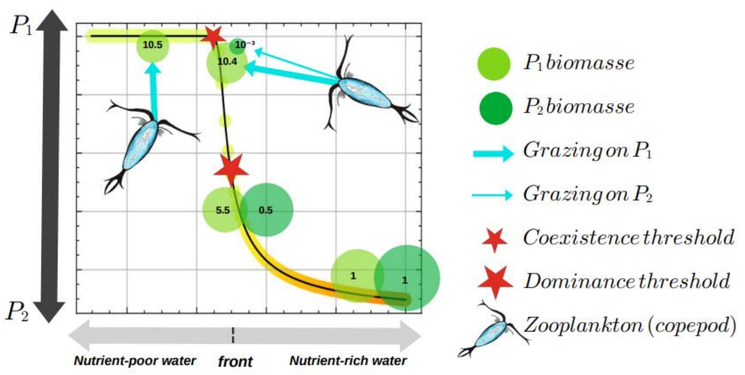
- **Community History Simulation:** It enables simulating phytoplankton community changes during transport, offering insights for comparing with in-situ data
- **Horizontal Transport Isolation:** It can isolate the effect of horizontal transport, allowing estimation of vertical process influence by difference

DEVELOP THE GROWTH MODEL

(L.Oms et al., in prep)

Objective: Create a simple NPZ model for studying community shifts influenced by water nutrient conditions in **the Phosphate-limited** Mediterranean Sea

Hypothesis: Smaller phytoplankton (P1) excel in nutrient competition, while larger phytoplankton (P2) excel in predator defense. Nutrient changes induce **community transitions** (*Flaten et al., 2005*).



The model indicates transitions from P1 to P2 based on the interplay between zooplankton grazing and phosphate nutrient supply

What next?

This model will be spatialized in 2D, and biomass calculations will be performed along Lagrangian trajectories

DOGLIOLI Andrea, GREGORI Gérald (2023) BioSWOT-Med cruise, RV L'Atalante, https://doi.org/10.17600/18002392

METADATA : BioSWOT-Med_metadata.pdf (osupytheas.fr)

Messié, M., & Chavez, F. P. (2017). Nutrient supply, surface currents, and plankton dynamics predict zooplankton hotspots in coastal upwelling systems. *Geophysical Research Letters*, *44*(17), 8979-8986.

L.Oms, A. Doglioli, G. Grégori, M. Messié, JC. Poggiale, Modelling phytoplankton community in the oligotrophic seas. Will be submited to *Ecological Modelling*

Flaten, G. A. F., Skjoldal, E. F., Krom, M. D., Law, C. S., Mantoura, R. F. C., Pitta, P., ... & Thingstad, T. F. (2005). Studies of the microbial P-cycle during a Lagrangian phosphate-addition experiment in the Eastern Mediterranean. *Deep Sea Research Part II: Topical Studies in Oceanography*, *52*(22-23), 2928-2943.