

Introduction

One of the most intriguing question in chemical oceanography is why Dissolved Organic Carbon (DOC) accumulates in oligotrophic surface water (Santinelli 2015).

The Mediterranean Sea (hereafter MedSea) can be considered as a natural laboratory, where the main biogeochemical processes leading to DOC accumulation in surface stratified waters can be investigated. The MedSea features DOC concentrations and distribution similar to those observed in the oceans, and DOC accumulation is observed moving eastward in correspondence with a decrease in the Heterotrophic Prokaryotes Abundance (HPA) (Santinelli et al. 2012).

In this study, biogeochemical parameters, collected along a west-to-east section of the MedSea in March-April 2018 during the transMed oceanographic cruise MSM72 (Fig. 1), are analyzed to get insights into the main processes involved in DOC accumulation.

DOC, absorption and fluorescence of DOM (CDOM and FDOM) and abundance of heterotrophic prokaryotes, nanoflagellates and viruses were measured along a West-East section crossing the entire MedSea basin.

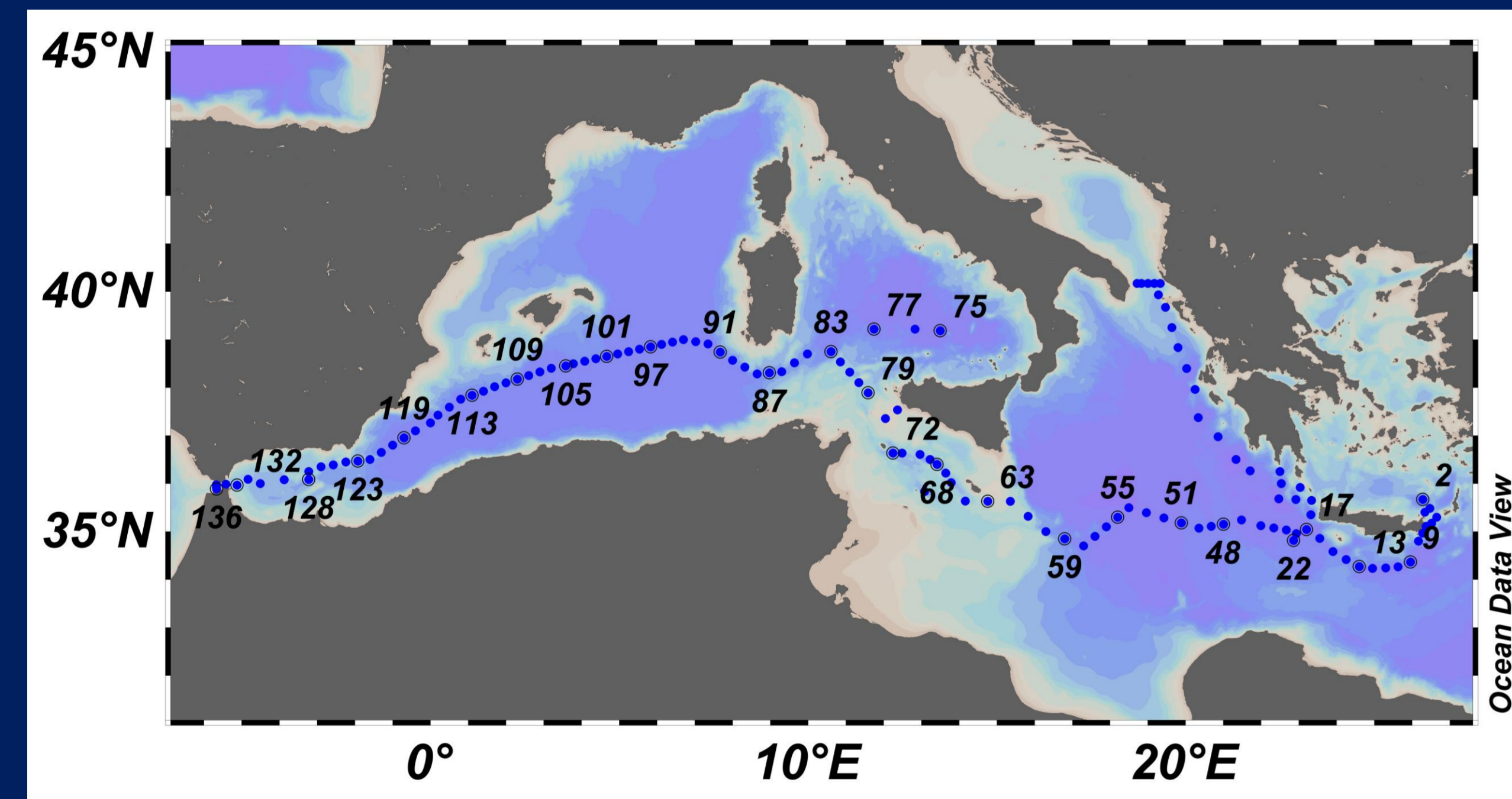
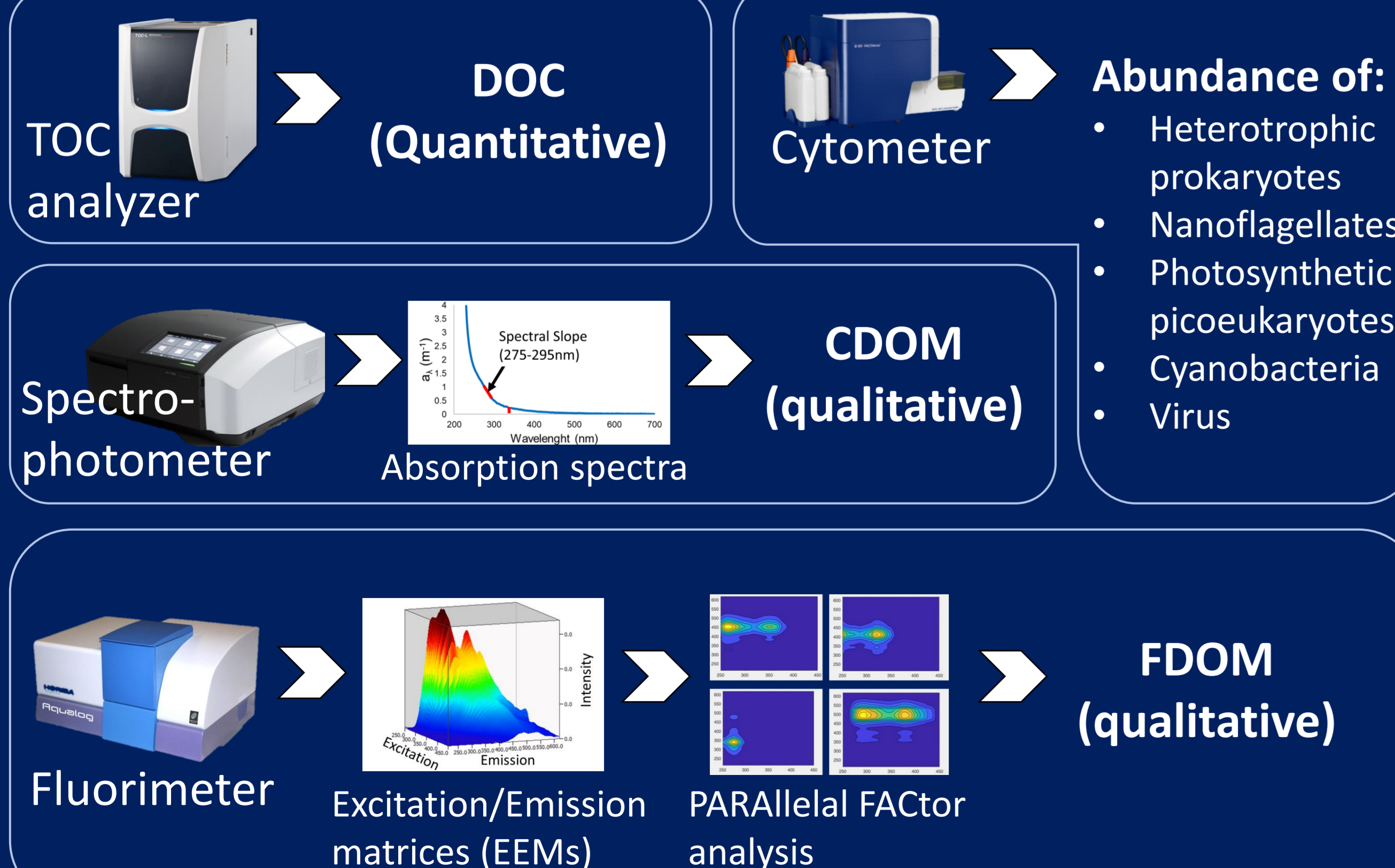


Figure 1: study area and sampling stations

Methods



Objectives

Investigate DOC accumulation and microbial loop functioning across the Mediterranean Sea following the main path of the Atlantic water

Results

Moving from the Gibraltar Strait (Station 132) to the Cretan Sea (Stations 22) DOC accumulates in correspondence with a marked decrease in the abundance of heterotrophic prokaryotes (Fig. 2a), nanoflagellates (Fig. 3a) and viruses (Fig. 3b). Our data suggest that in the eastern MedSea, heterotrophic prokaryotes are not capable of metabolizing the accumulated DOC, leading to a malfunctioning of the microbial loop. The humic-like FDOM decreases moving towards East (Fig. 4a) while the spectral slope (CDOM indicator of molecular weight and aromaticity) increases (Fig. 4b), indicating a change in the quality of DOM going towards the eastern MedSea mainly driven by photobleaching processes and microbial degradation. A shift in the phytoplankton community going towards east is also observed with photosynthetic picoeukaryotes, abundant in the western basin, being replaced by small cyanobacteria (*Synechococcus* spp. And *Prochlorococcus* spp.) (Fig. 2b).

These observations can be explained by:

- Grazing or viral lysis
- Nutrient limitation
- Recalcitrance of DOM

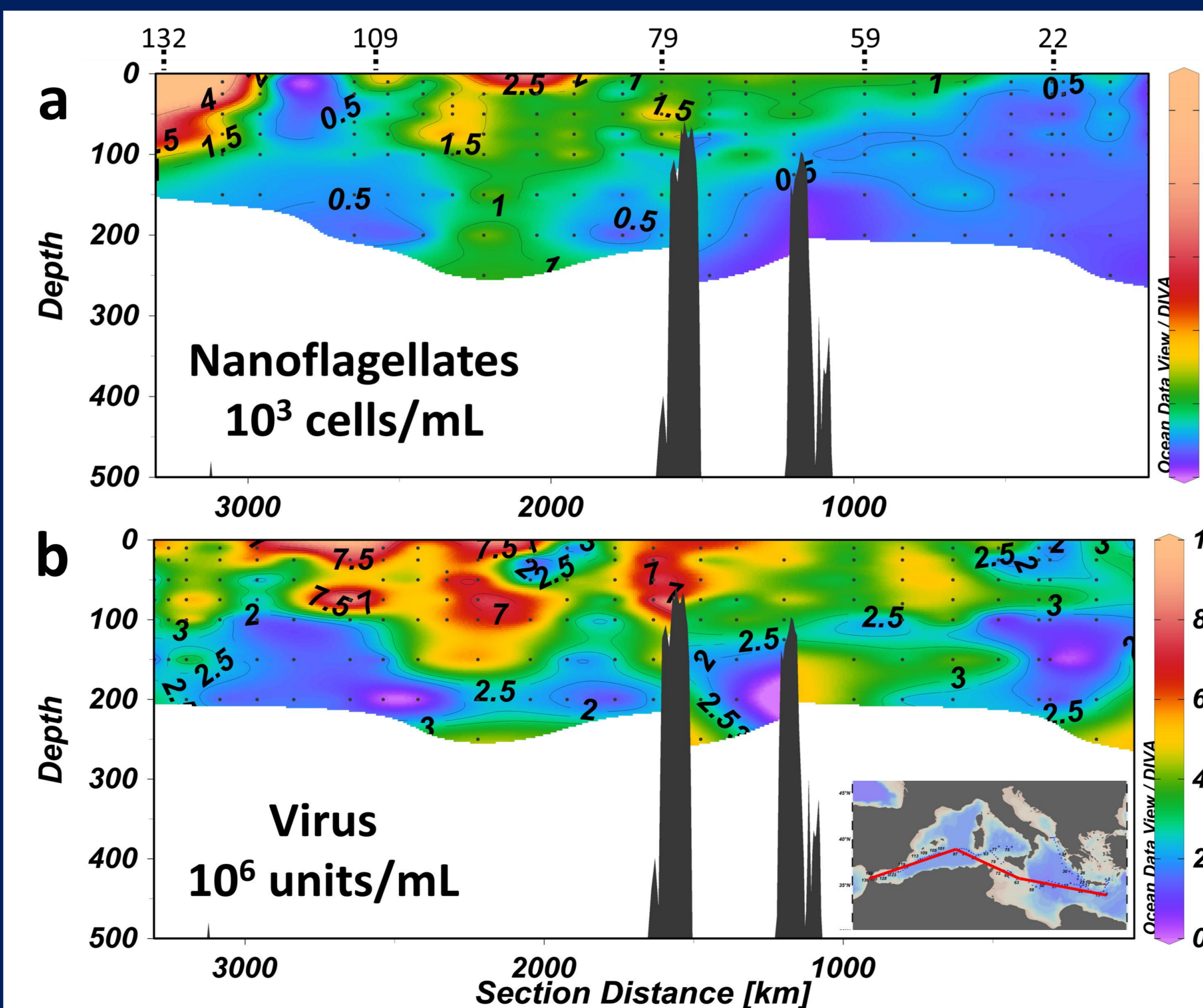


Figure 3: vertical distribution of nanoflagellates (a) and virus (b). The numbers on top refer to the stations along the section.

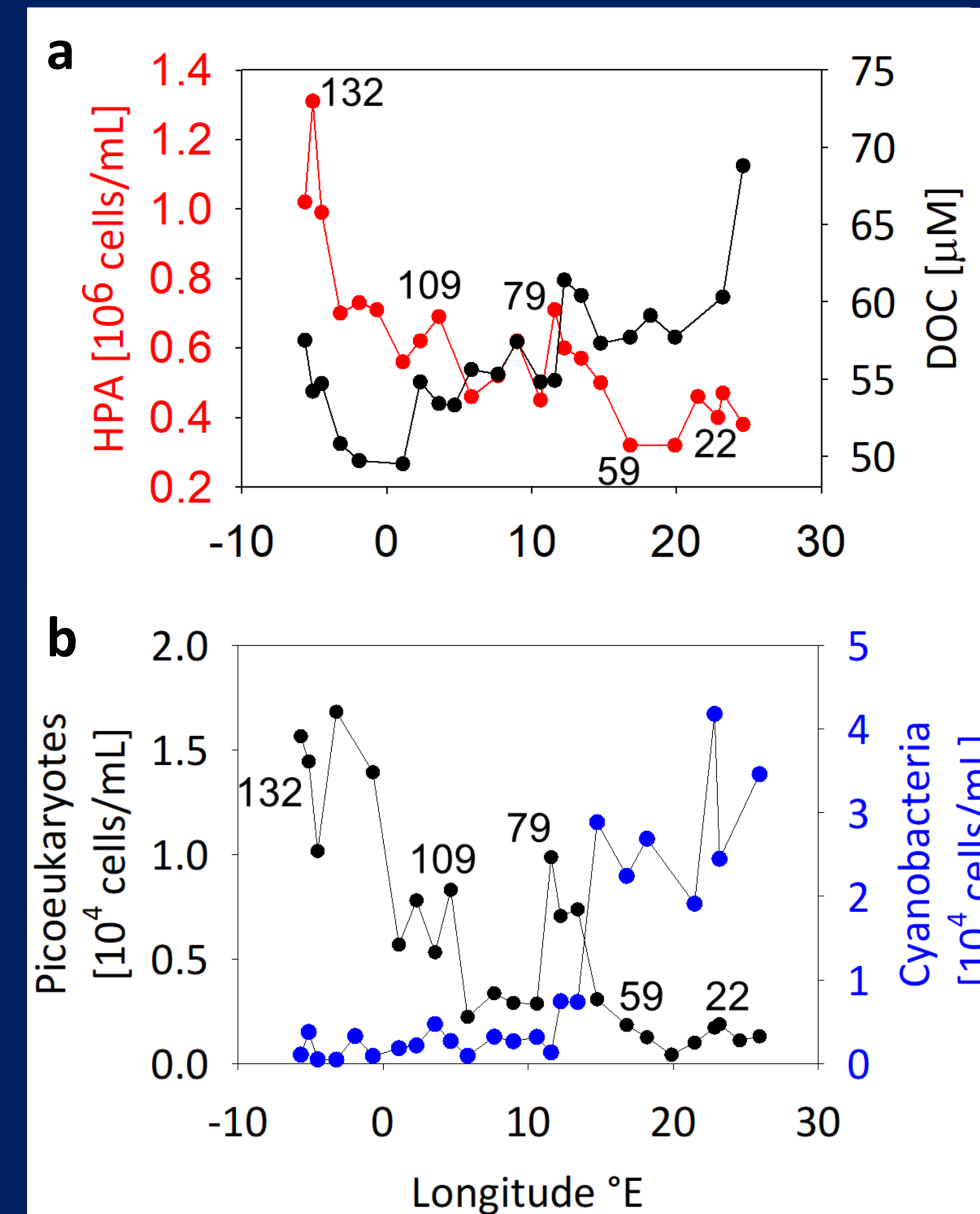


Figure 2: integrated average in the mixed layer of DOC and heterotrophic prokaryotes (HPA) (a) and photosynthetic picoeukaryotes and cyanobacteria (b). The numbers refer to the stations along the section.

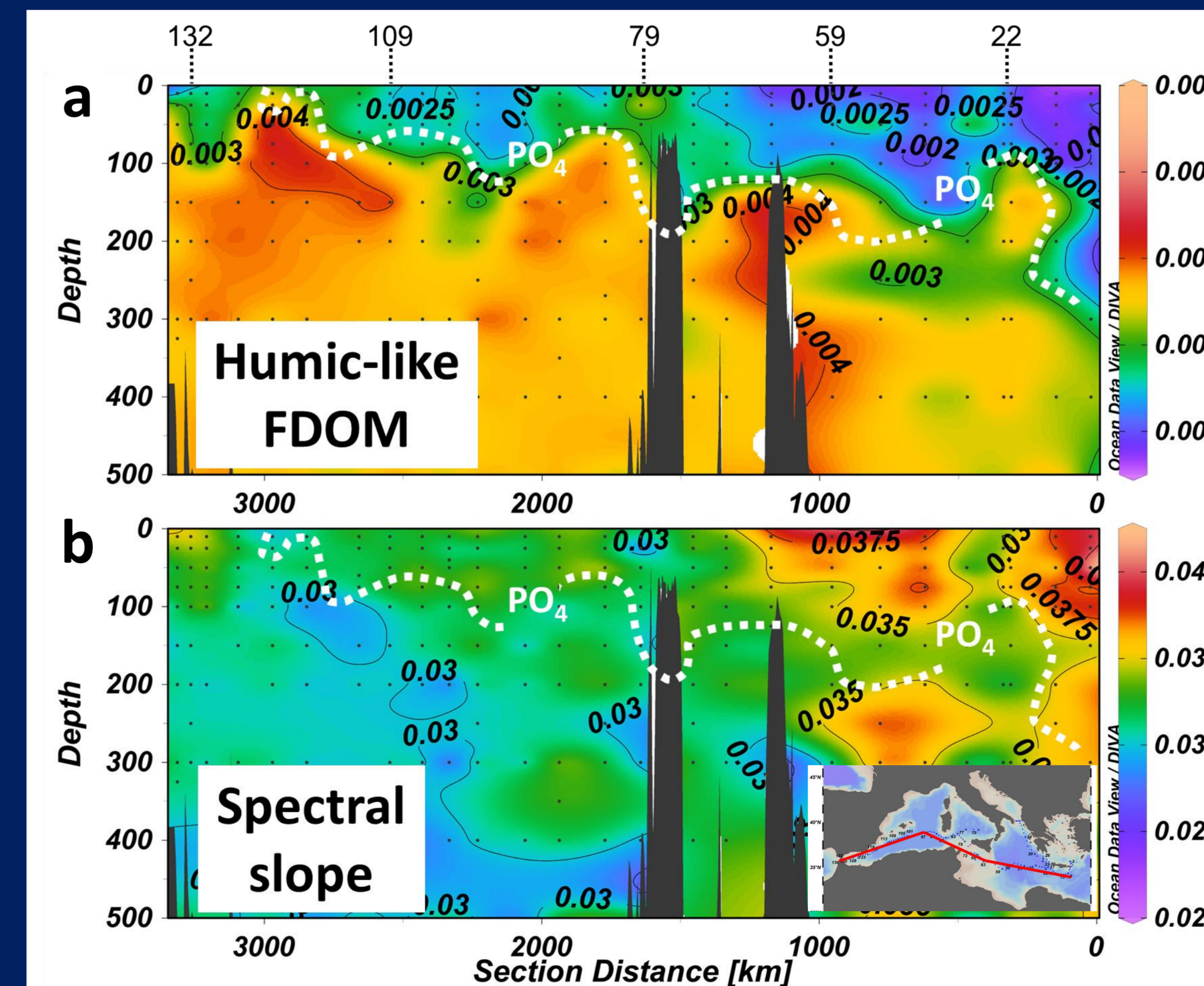


Figure 4: vertical distribution of FDOM (a) and Spectral slope (b). The dotted white line represents the nutrient line (phosphate, PO₄). The numbers on top refer to the stations along the section.

Main remarks

Going towards the eastern MedSea:

- DOC accumulates
- Abundance of heterotrophic prokaryotes, grazers and viruses decrease indicating a malfunctioning of the microbial loop
- Dominance of cyanobacteria
- Change in DOM optical properties

Our hypothesis is that DOM accumulation is due to its increasing recalcitrance driven by:

- Photobleaching processes
- Microbial reworking
- Change in phytoplankton communities

Future perspectives

- How will DOM respond to climate changes?
- Use our data to implement biogeochemical models
- Use of the -omics approach to identify the metabolic pathways explaining DOC accumulation

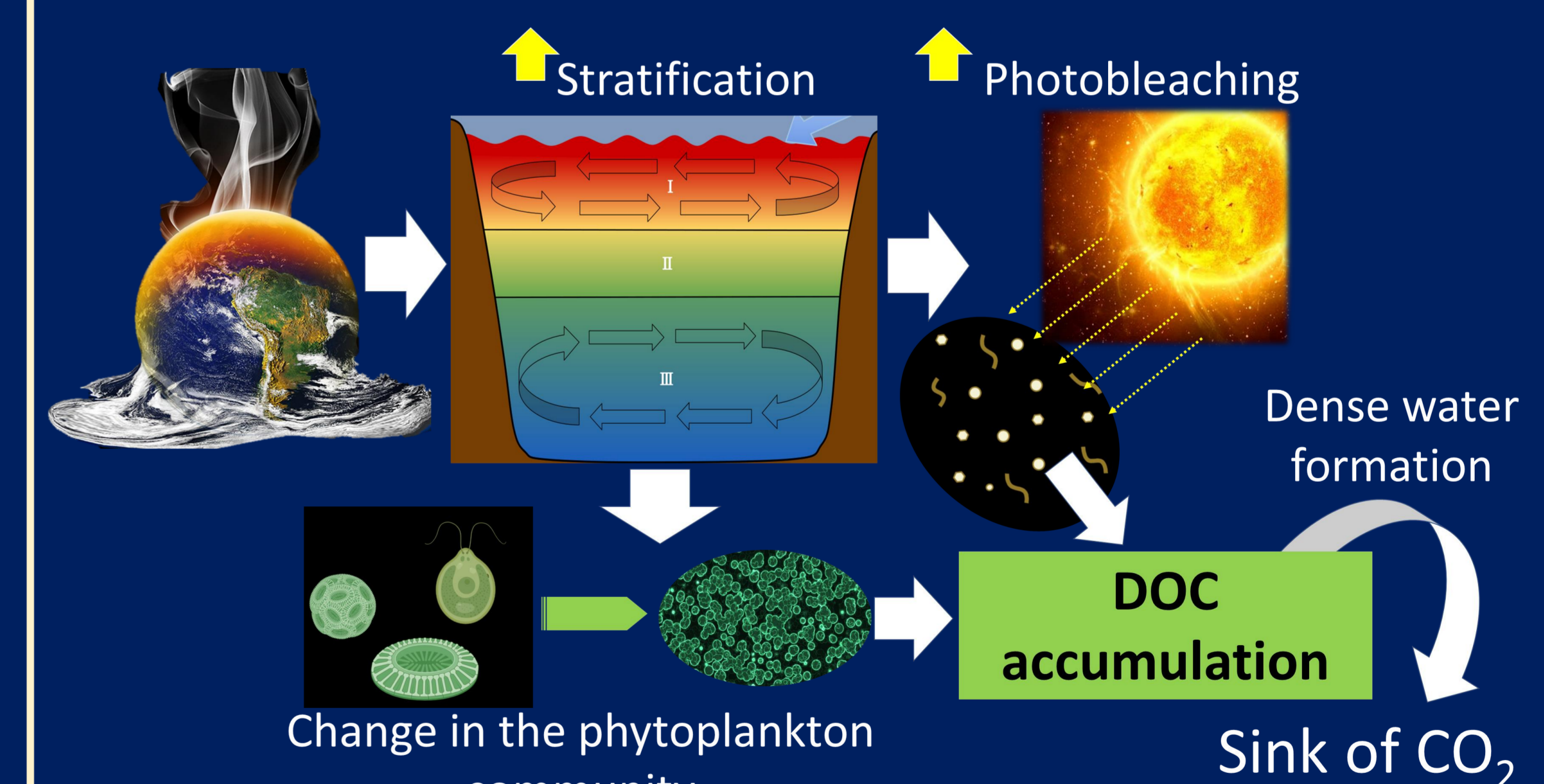


Figure 5: schematic view of the possible implications of climate change to the DOM pool.

Acknowledgements:

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References:

- Santinelli, C. 2015. DOC in the Mediterranean Sea, p. 579–608. In *Biogeochemistry of Marine Dissolved Organic Matter*. Elsevier.
- Santinelli, C., R. Sempéré, F. Van Wambeke, B. Charriere, and A. Seritti. 2012. Organic carbon dynamics in the Mediterranean Sea: An integrated study. *Global Biogeochem. Cycles* 26. doi:10.1029/2011GB004151.