

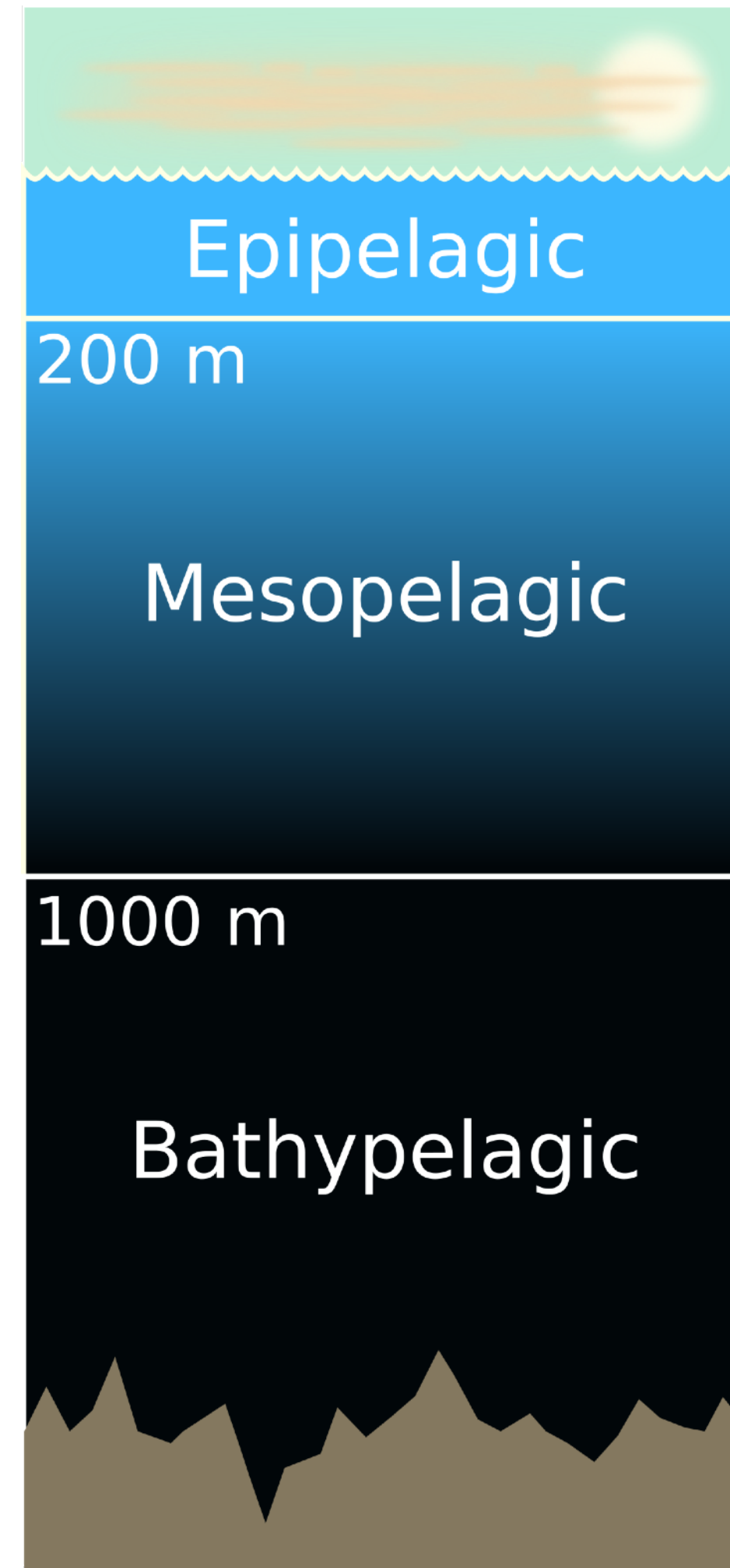
Typology of Plankton Communities seen by *In Situ* Imaging in the First 500 m of the Global Ocean

T Panaiotis, M Babin, T Biard, F Carlotti, L Coppola, L Guidi, H Hauss, L Karp-Boss, R Kiko, F Lombard, AMP McDonnell, M Picheral, A Rogge, AM Waite, JO Irisson, L Stemmann

Computational Plankton Ecology (COMPEX) team
Laboratoire d'Océanographie de Villefranche (UMR 7093)
Sorbonne Université

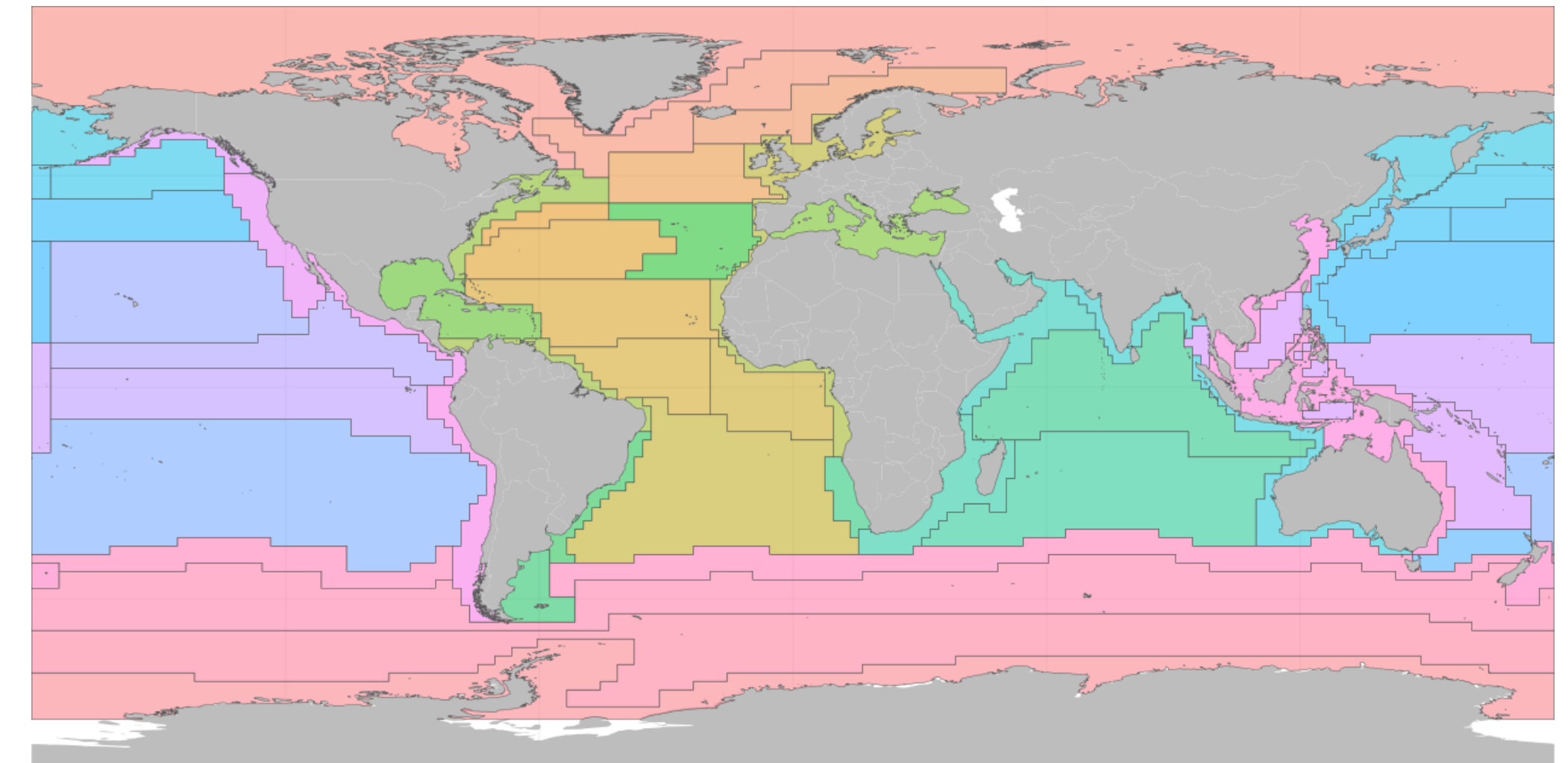
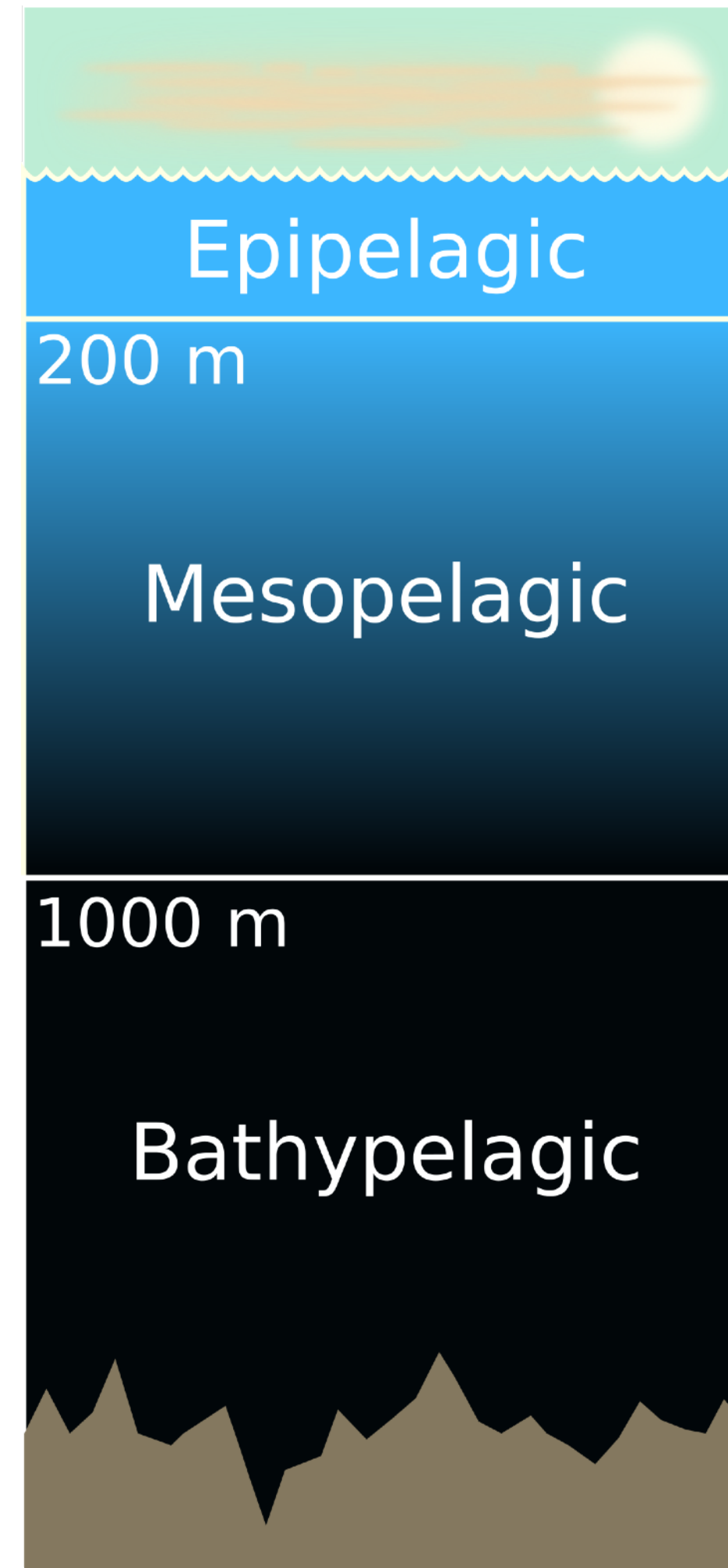
Ocean Biogeography

- Vertical partitioning

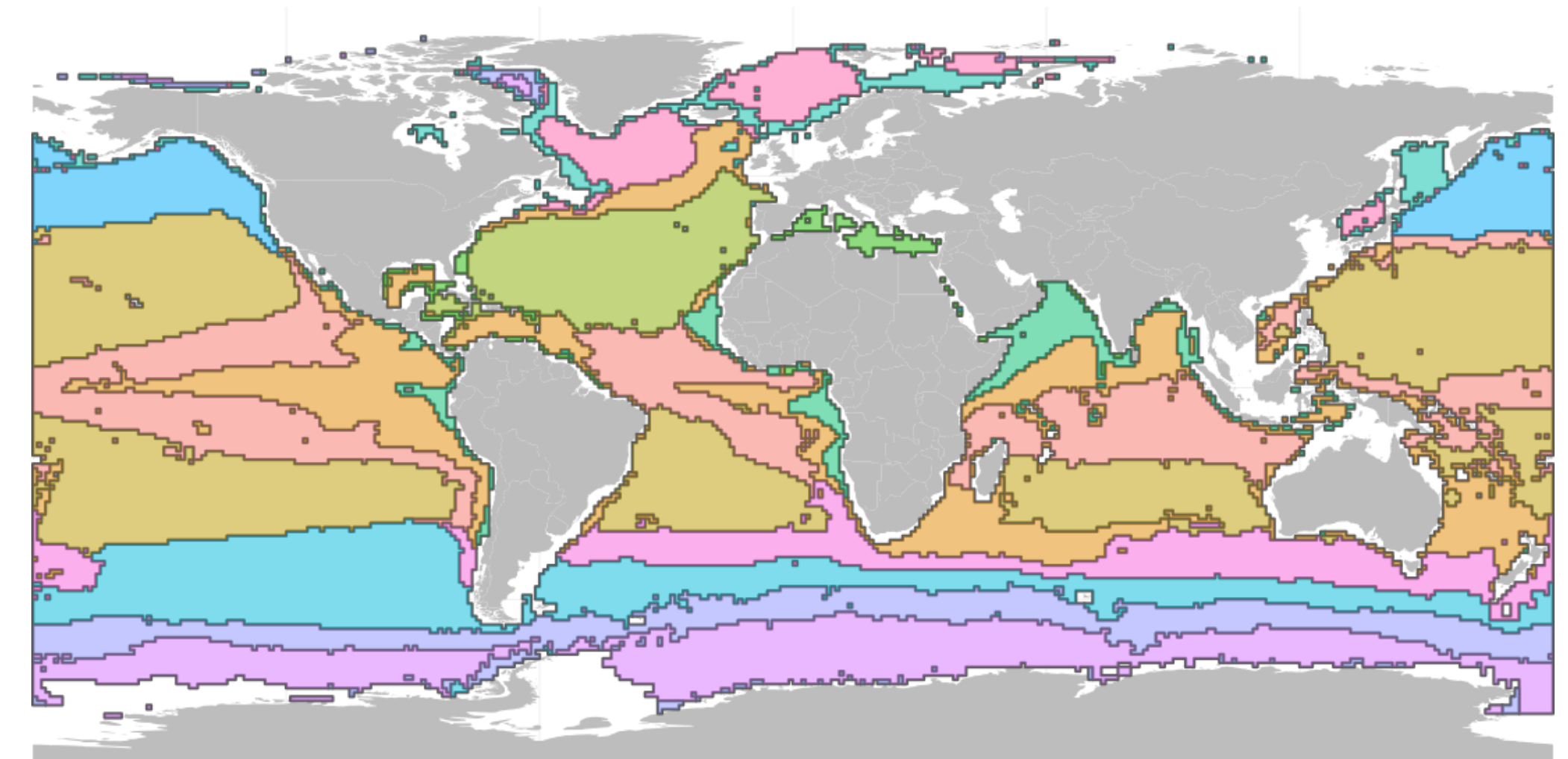


Ocean Biogeography

- Vertical partitioning
- Horizontal partitioning
 - Longhurst provinces (Longhurst 1995)
 - Mesopelagic provinces (Reygondeau et al. 2018)
 - Latitudinal bands



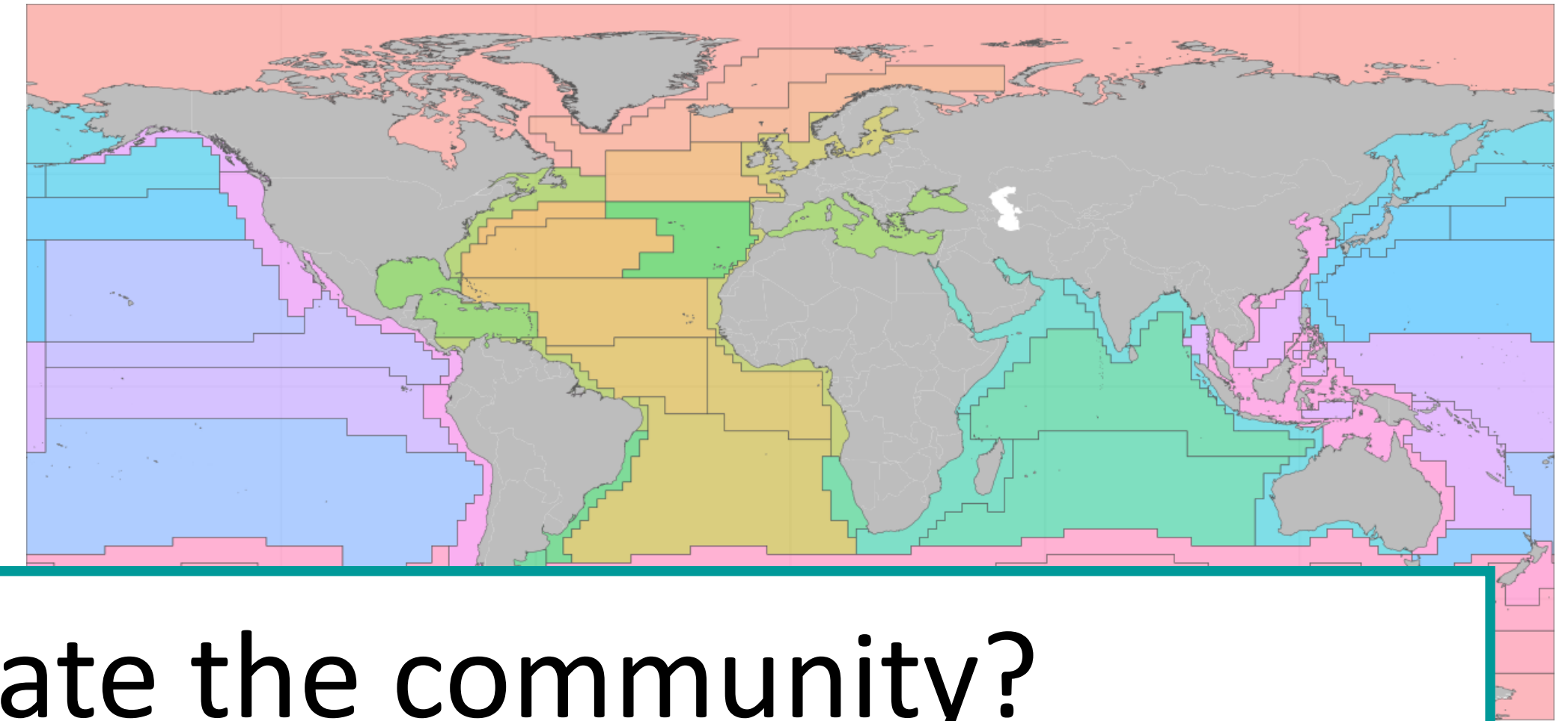
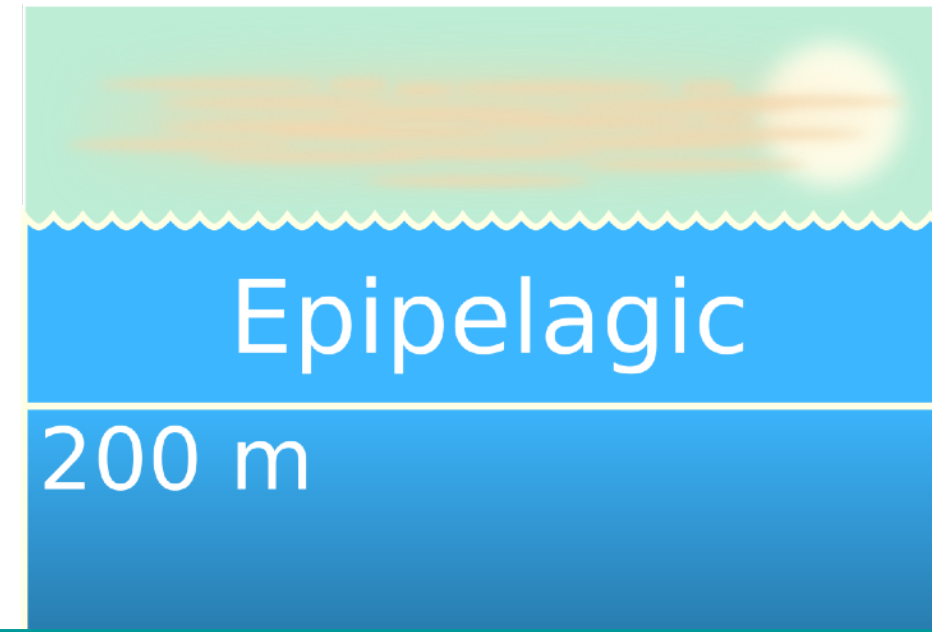
Longhurst Provinces



Reygondeau mesopelagic Provinces

Ocean Biogeography

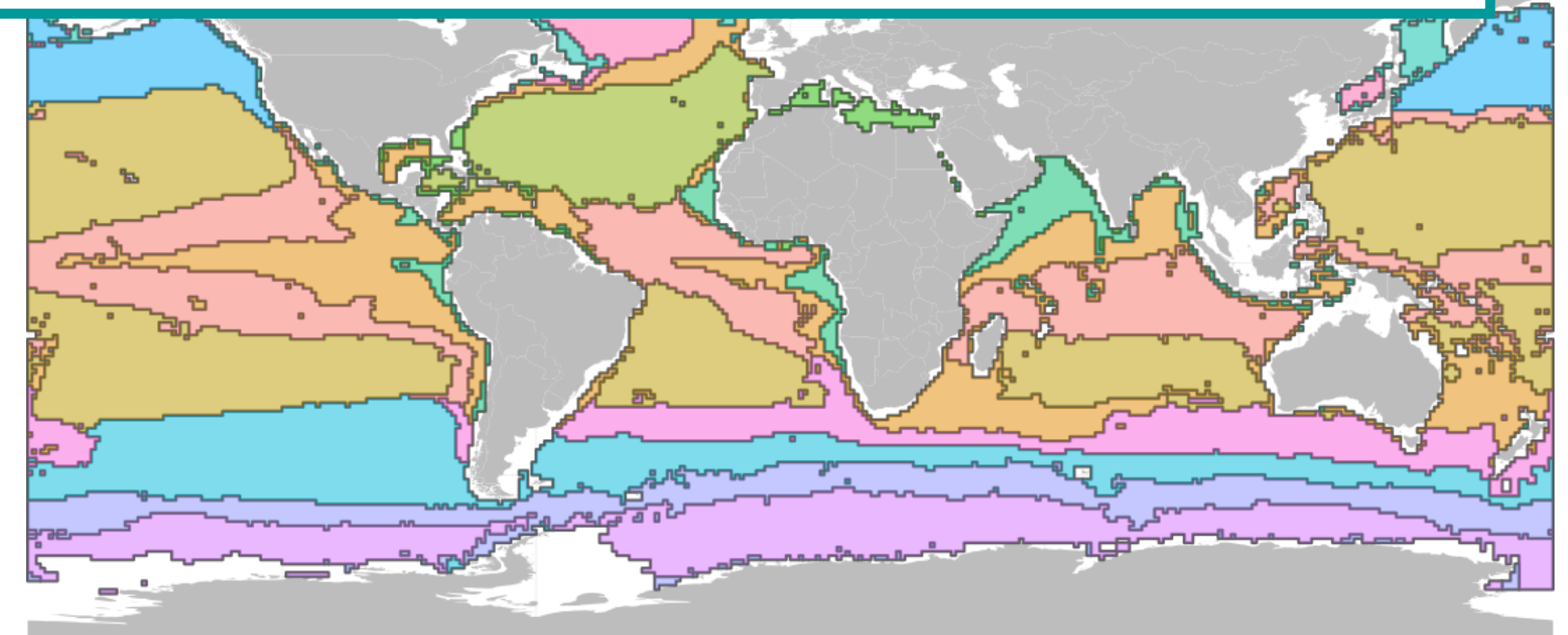
- Vertical partitioning



Which plankton groups dominate the community?

Which geographical partitioning is relevant to describe plankton?

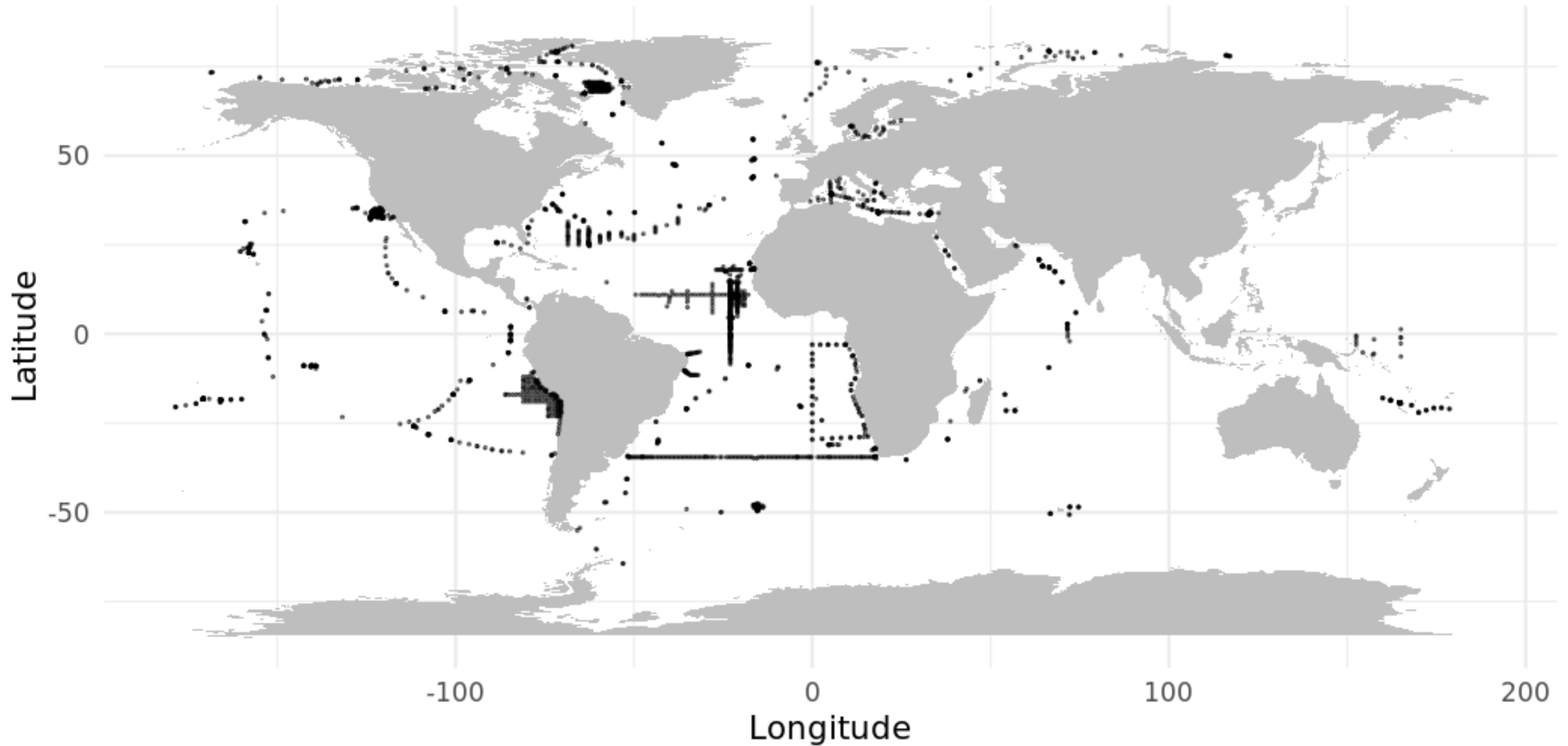
- Mesopelagic provinces (Reygondeau et al. 2018)
- Latitudinal bands



Reygondeau mesopelagic Provinces

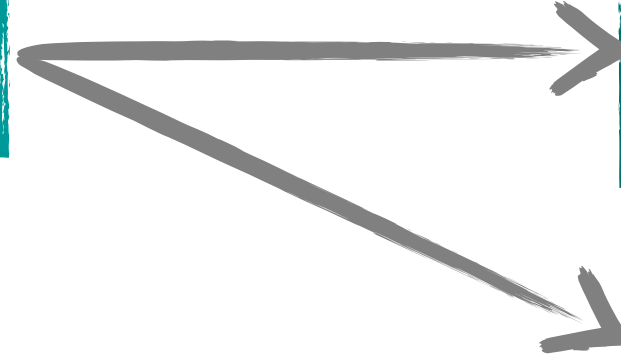
Data

2800 samples distributed worldwide



Data

UVP



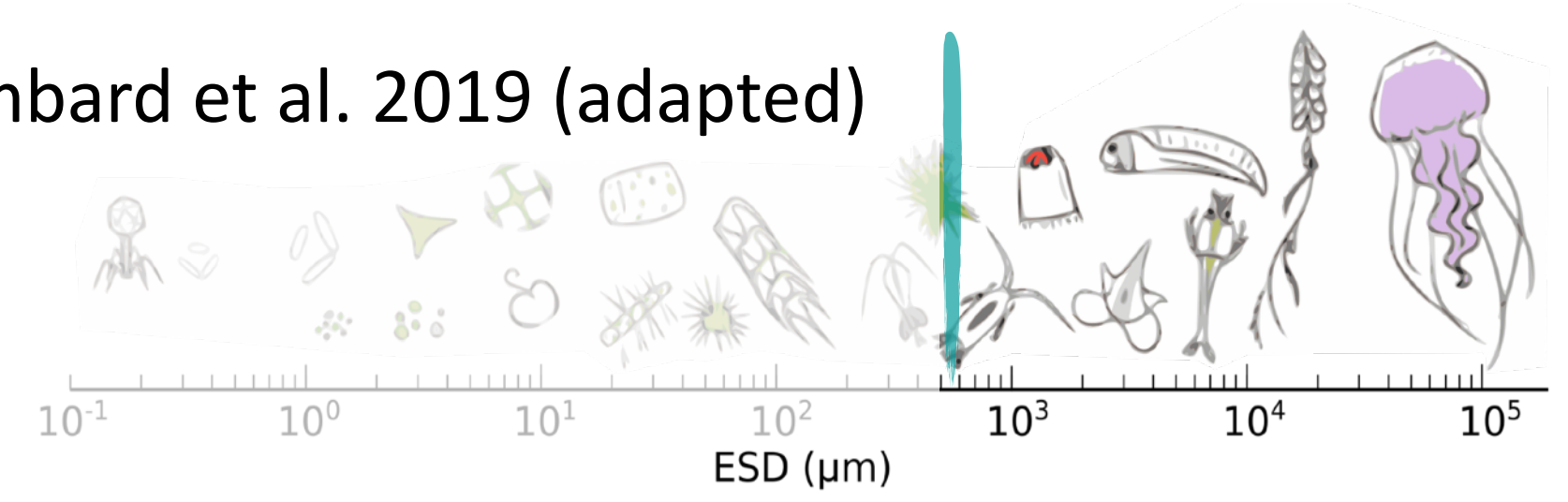
Biotic data

plankton concentrations (28 taxa)

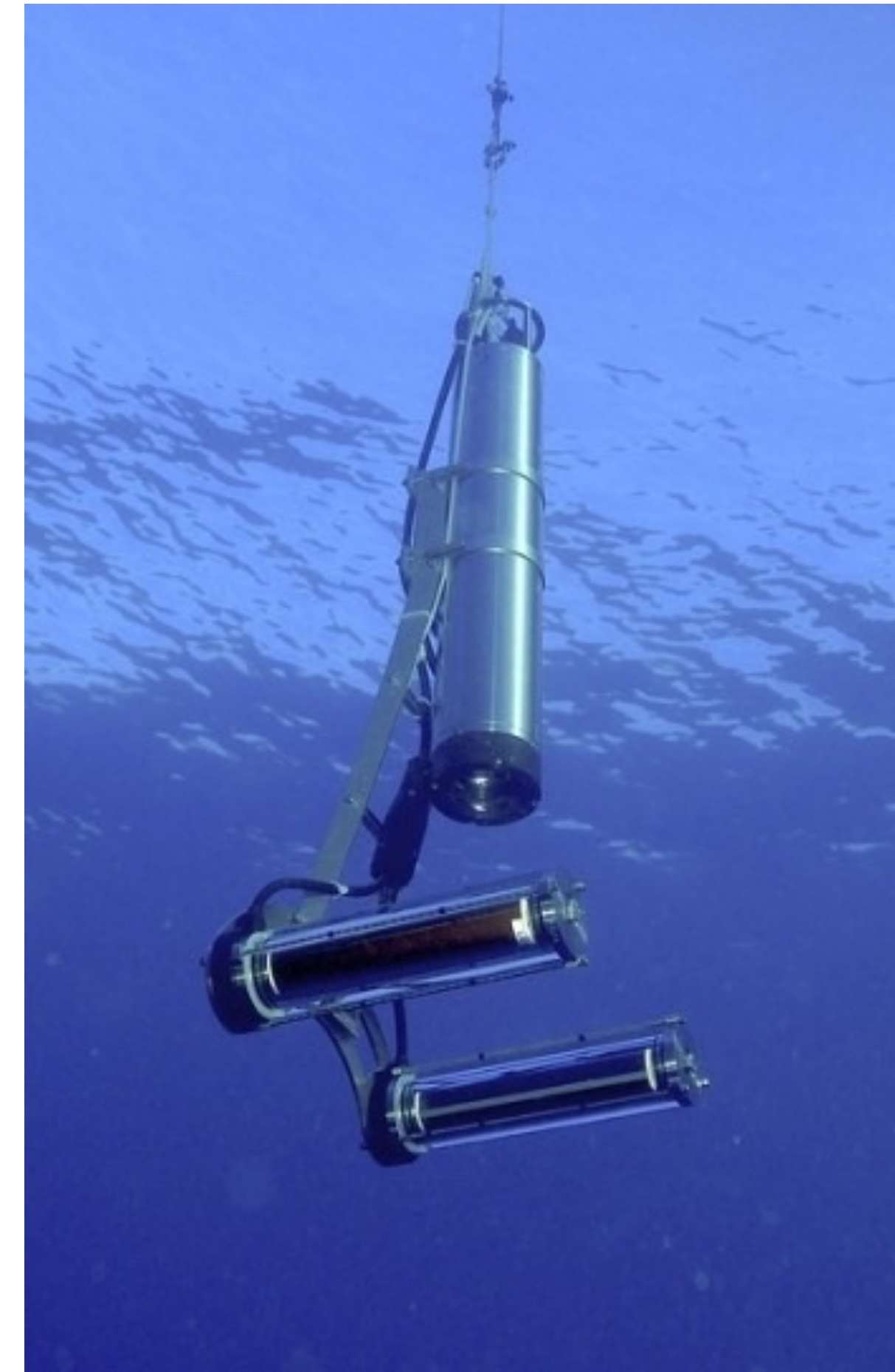
marine snow and bulk concentration

Abiotic data

Lombard et al. 2019 (adapted)



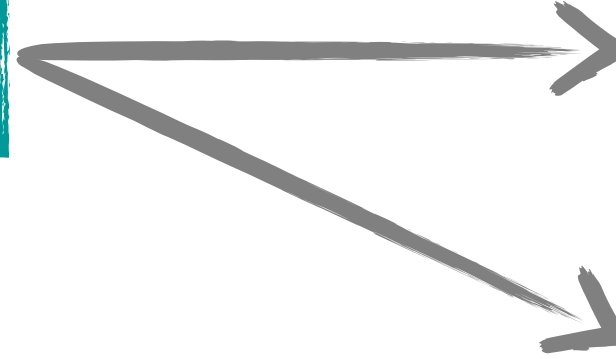
UVP



UVP deployment

Data

UVP



Biotic data

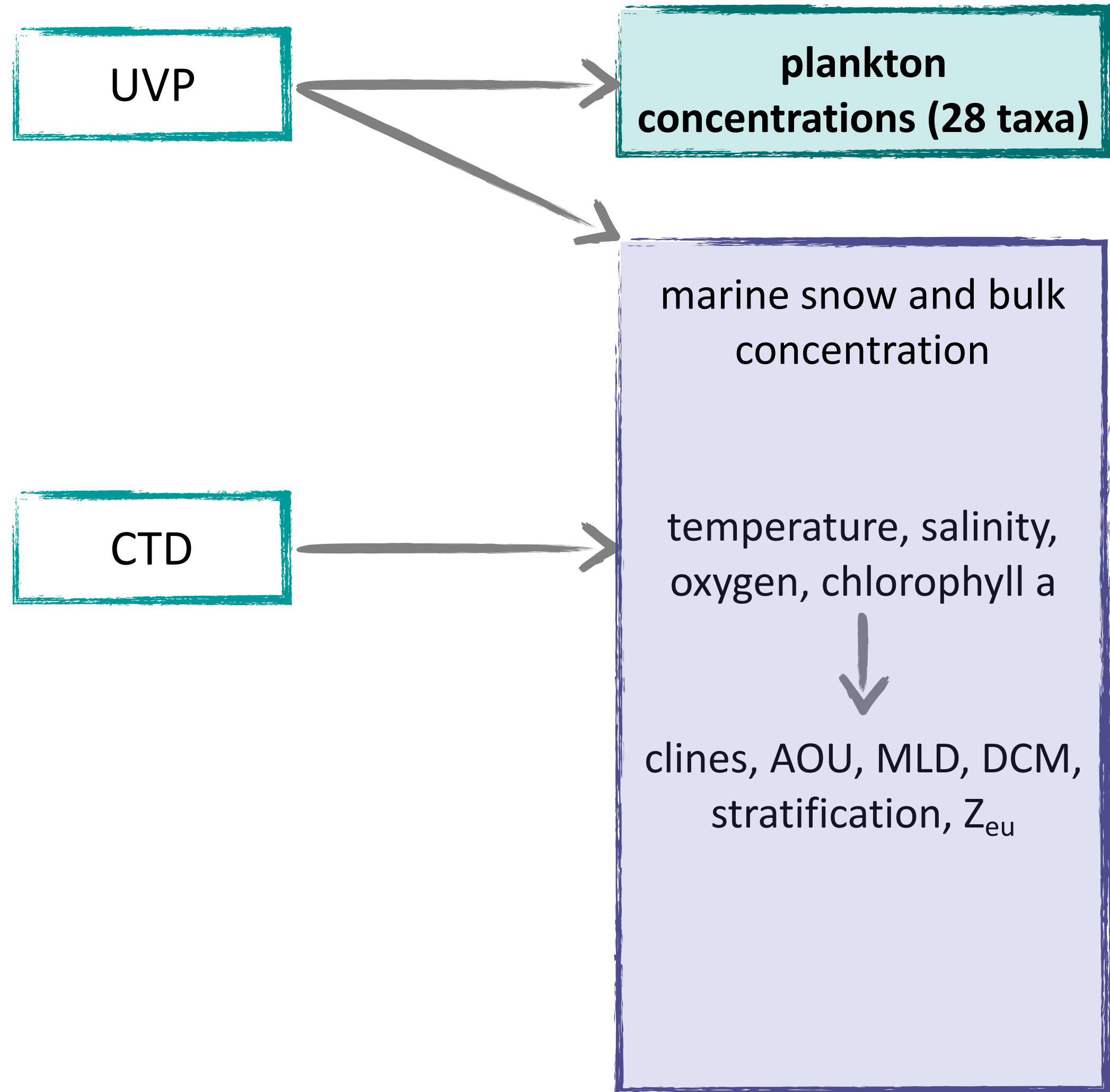
plankton concentrations (28 taxa)

marine snow and bulk concentration

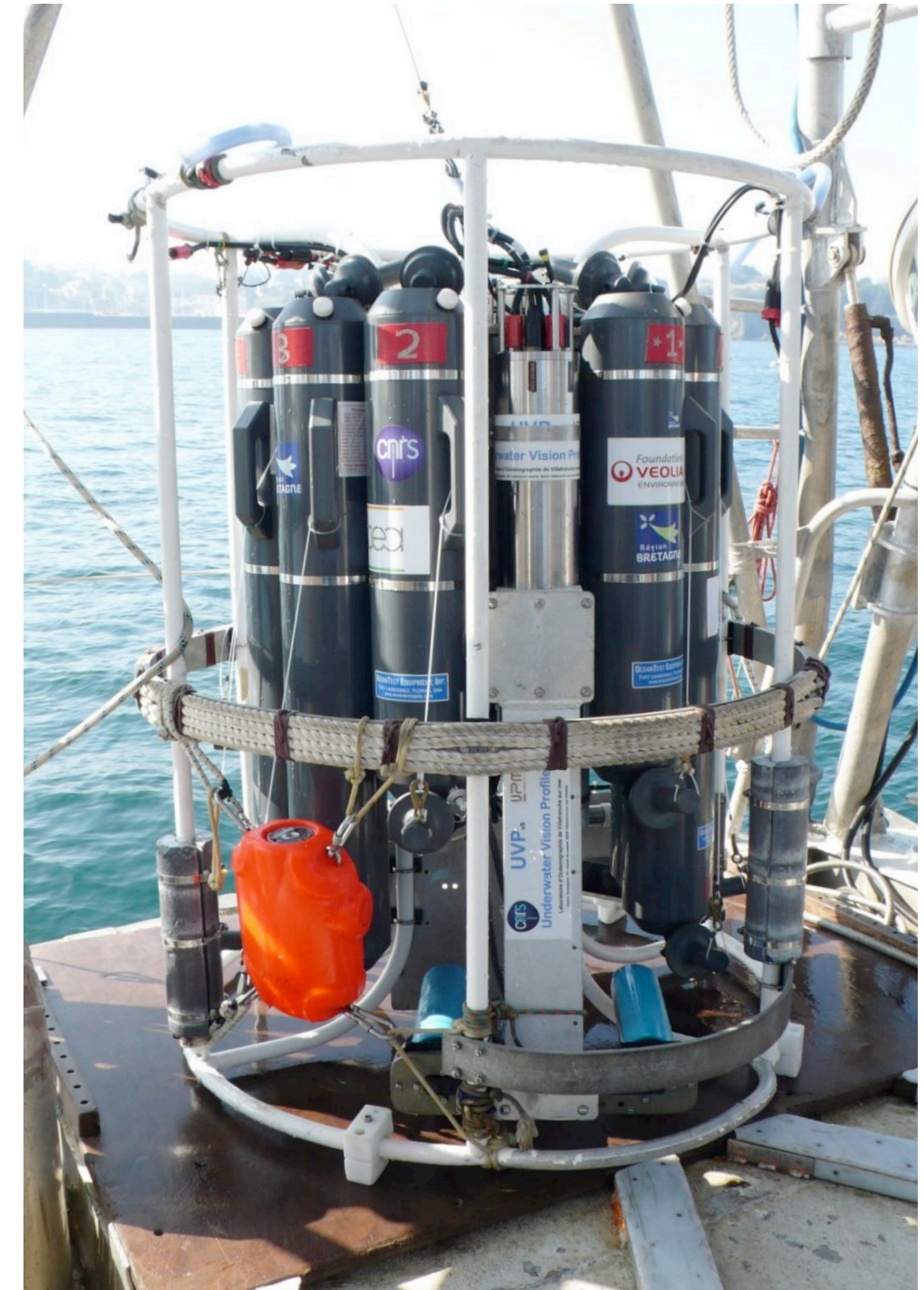
Abiotic data

Data

Biotic data

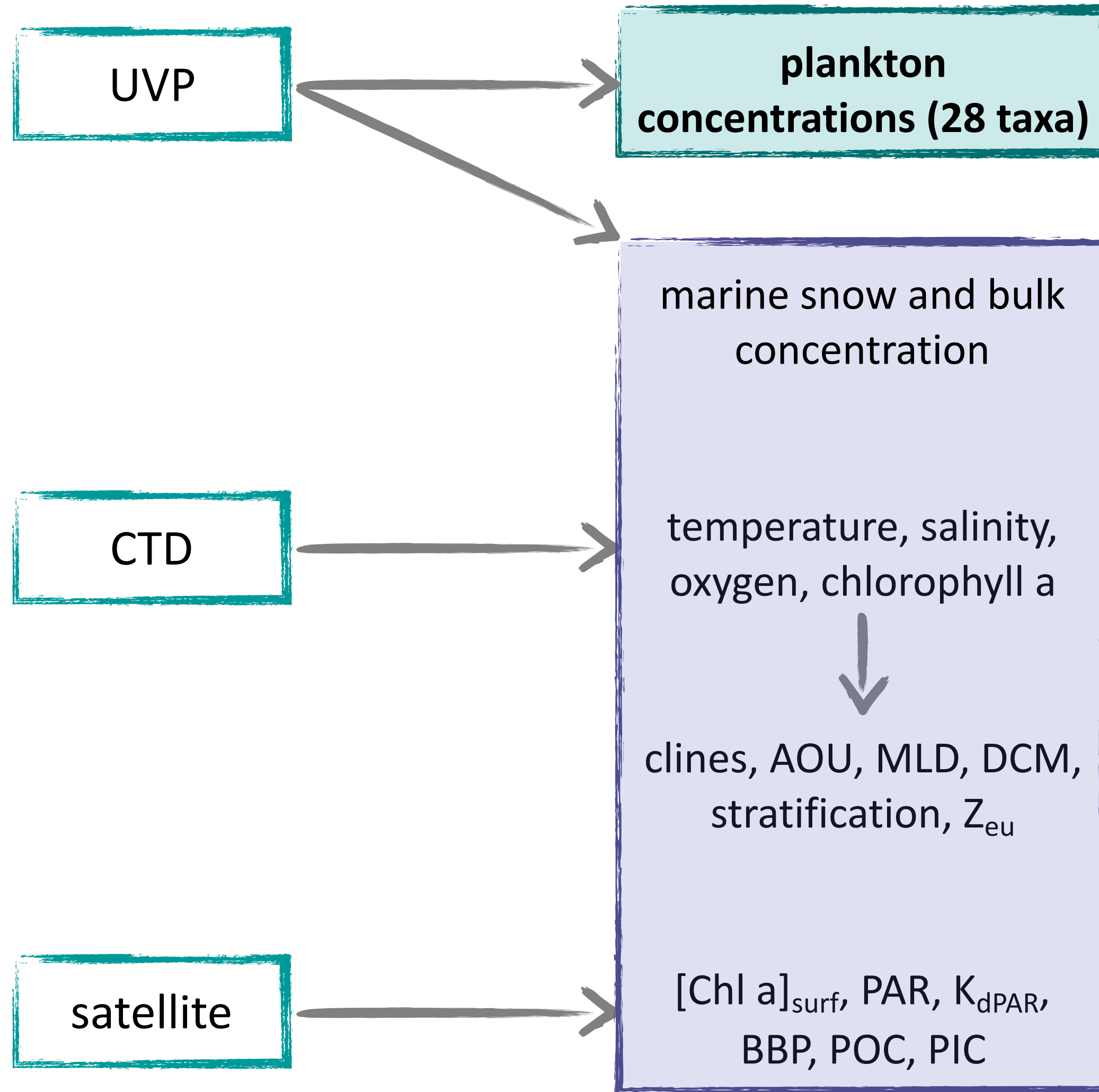


Abiotic data



UVP on a rosette equipped with a CTD

Data



Biotic data

plankton concentrations (28 taxa)

marine snow and bulk concentration

temperature, salinity, oxygen, chlorophyll a

clines, AOU, MLD, DCM, stratification, Z_{eu}

[Chl a]_{surf}, PAR, K_{dPAR}, BBP, POC, PIC

Abiotic data



Dynamic definition of epipelagic layer



Epipelagic layer

Upper mesopelagic layer

Q1 = 49 m
med = 85 m
Q3 = 121 m

2795 profiles

Max between pycnocline and
 Z_{eu} (Reygondeau et al. 2018)

1863 profiles

500 m

Description of plankton communities

Layer-wise

Plankton concentrations

Community level

Relationship among organisms and with environment

Broad plankton communities types

Communities geographical distribution

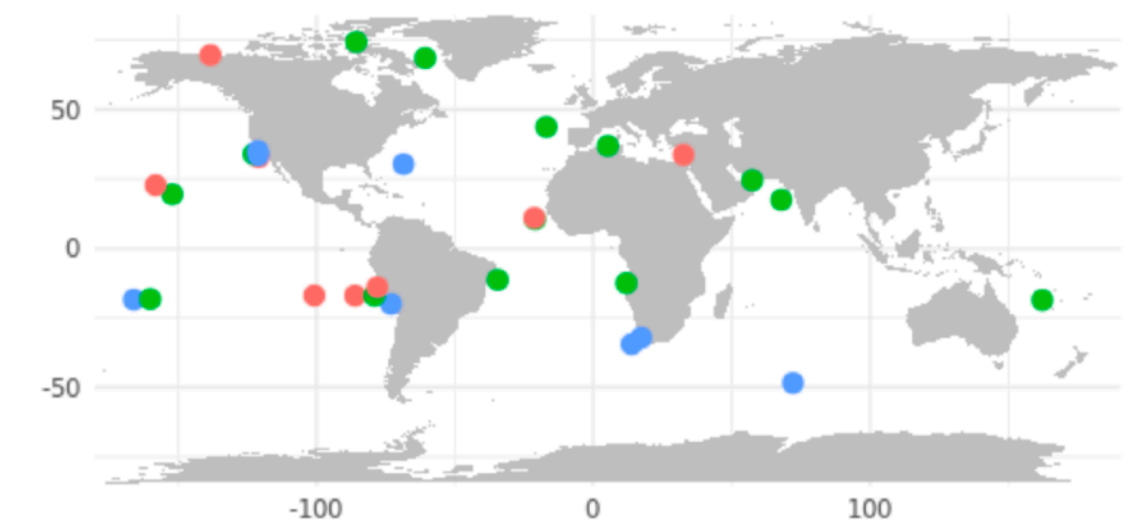
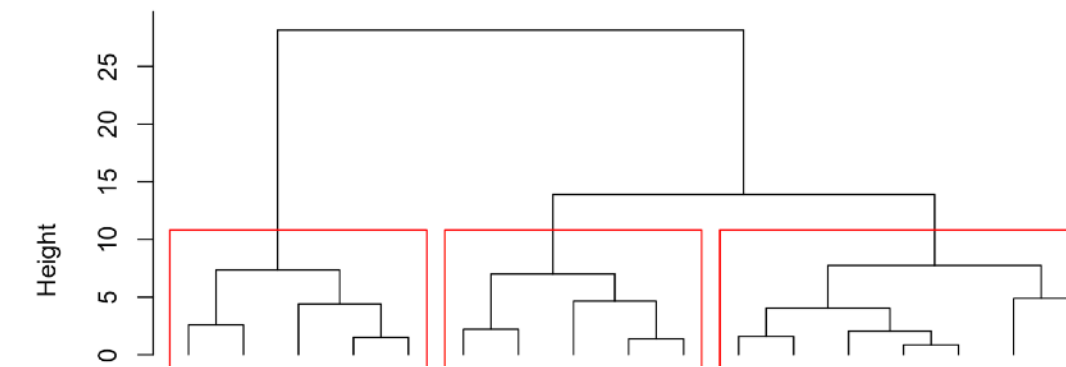
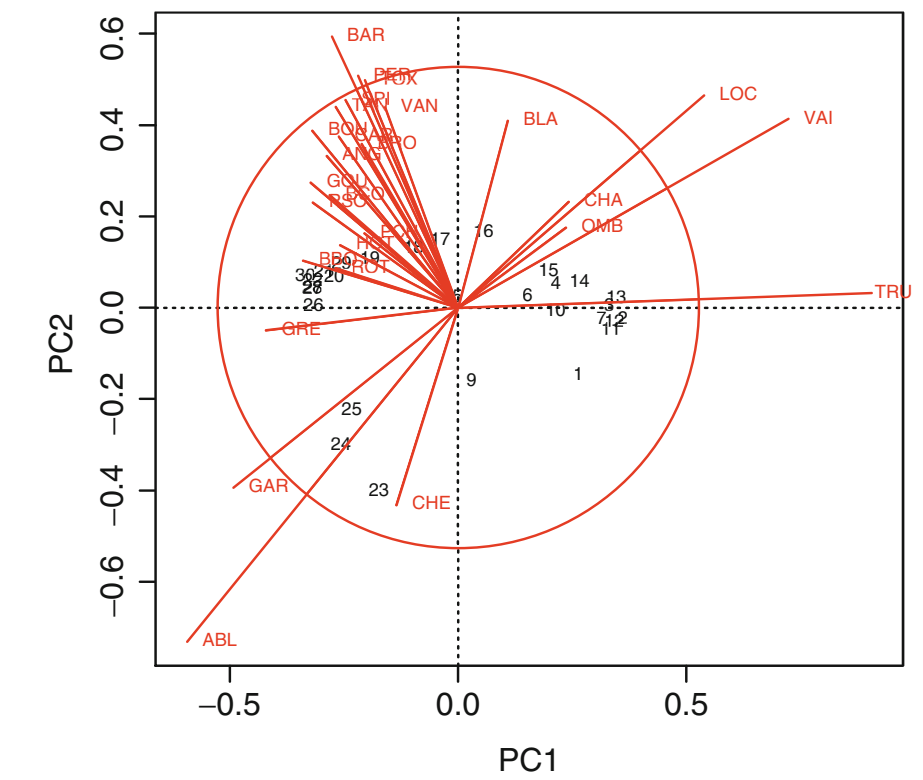
Hellinger's transformation

PCA

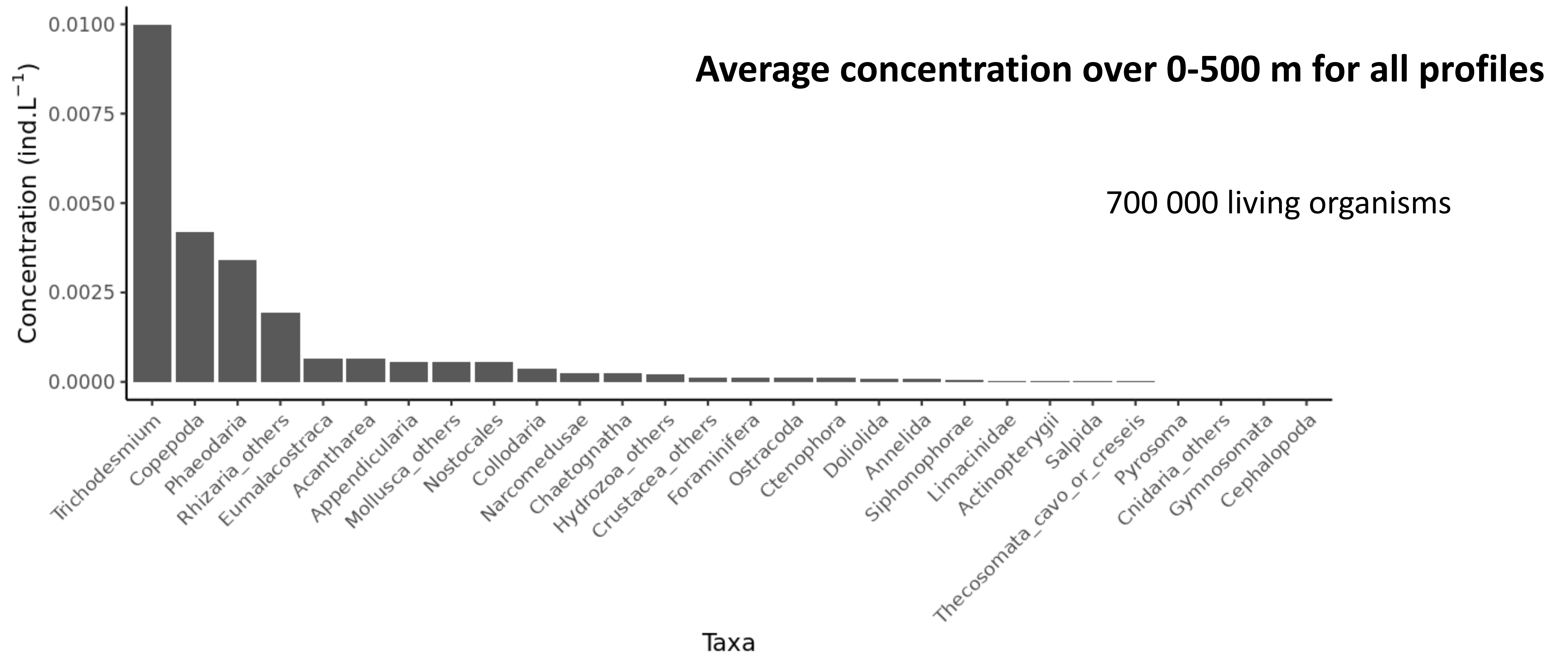
HAC

Map

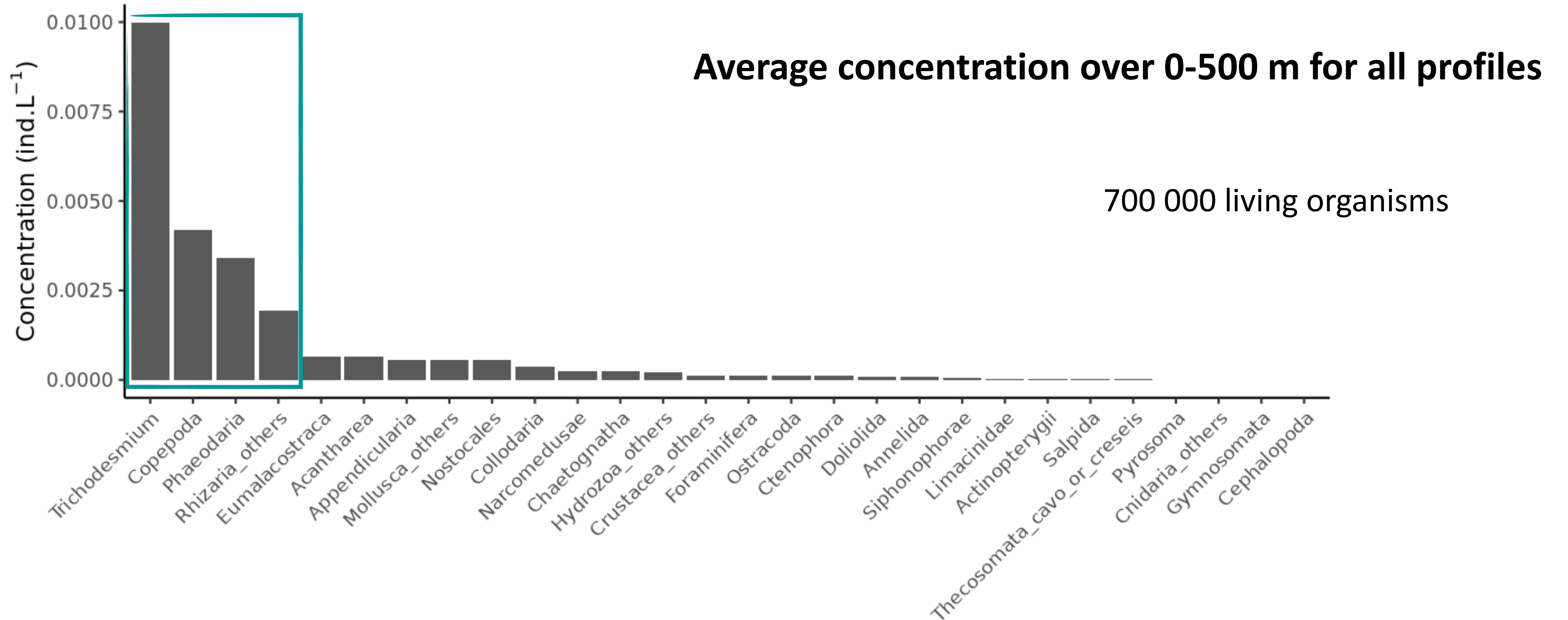
	Sp 1	Sp 2	Sp 3	Sp 4	Sp 5
Station 1					
Station 2					
...					
Station n					



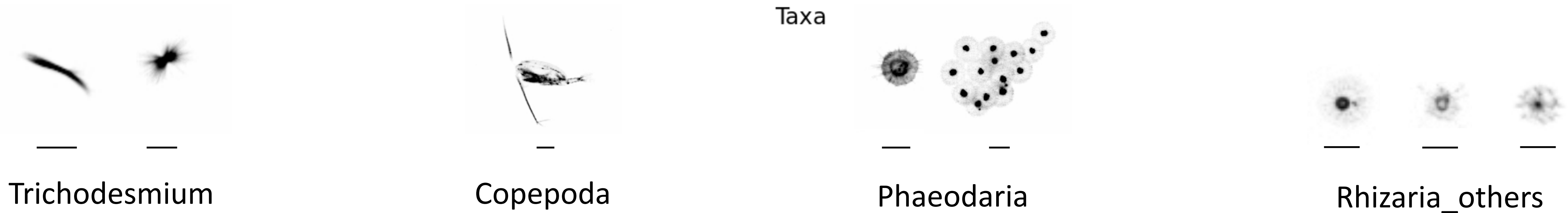
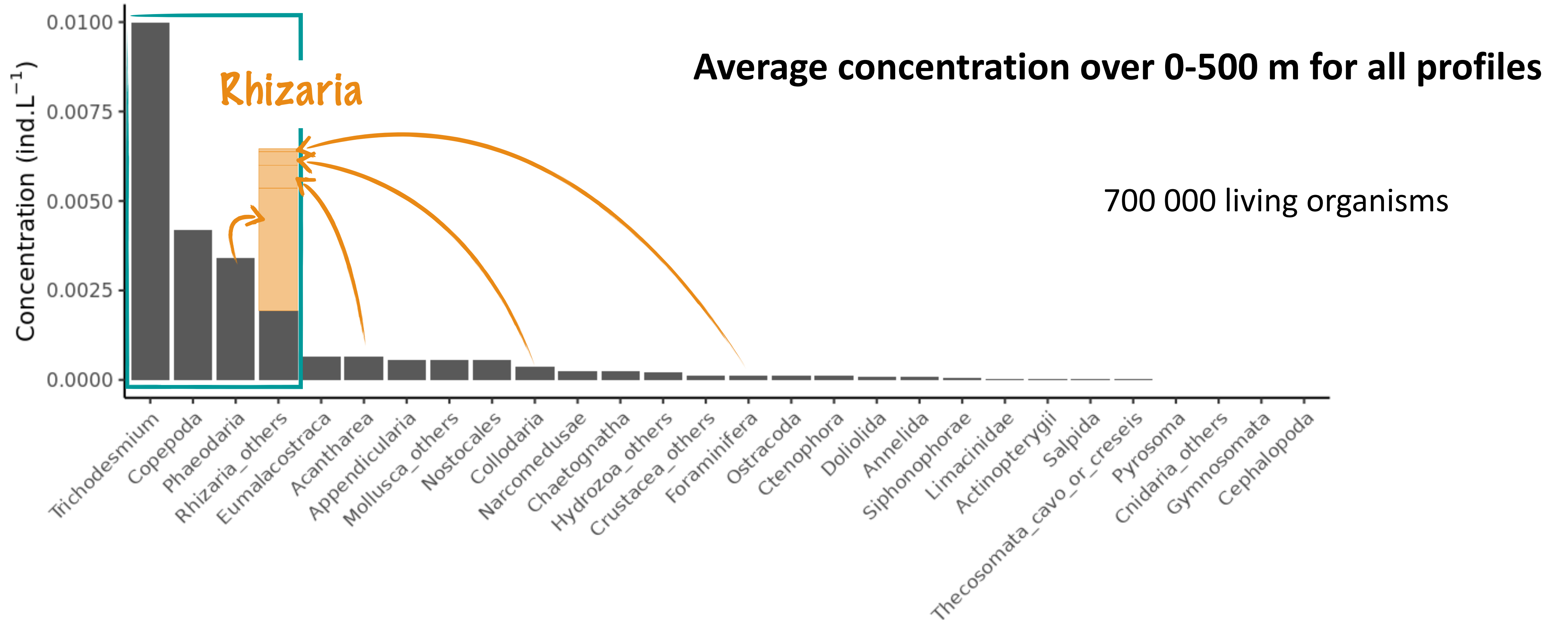
Plankton organisms seen by UVP



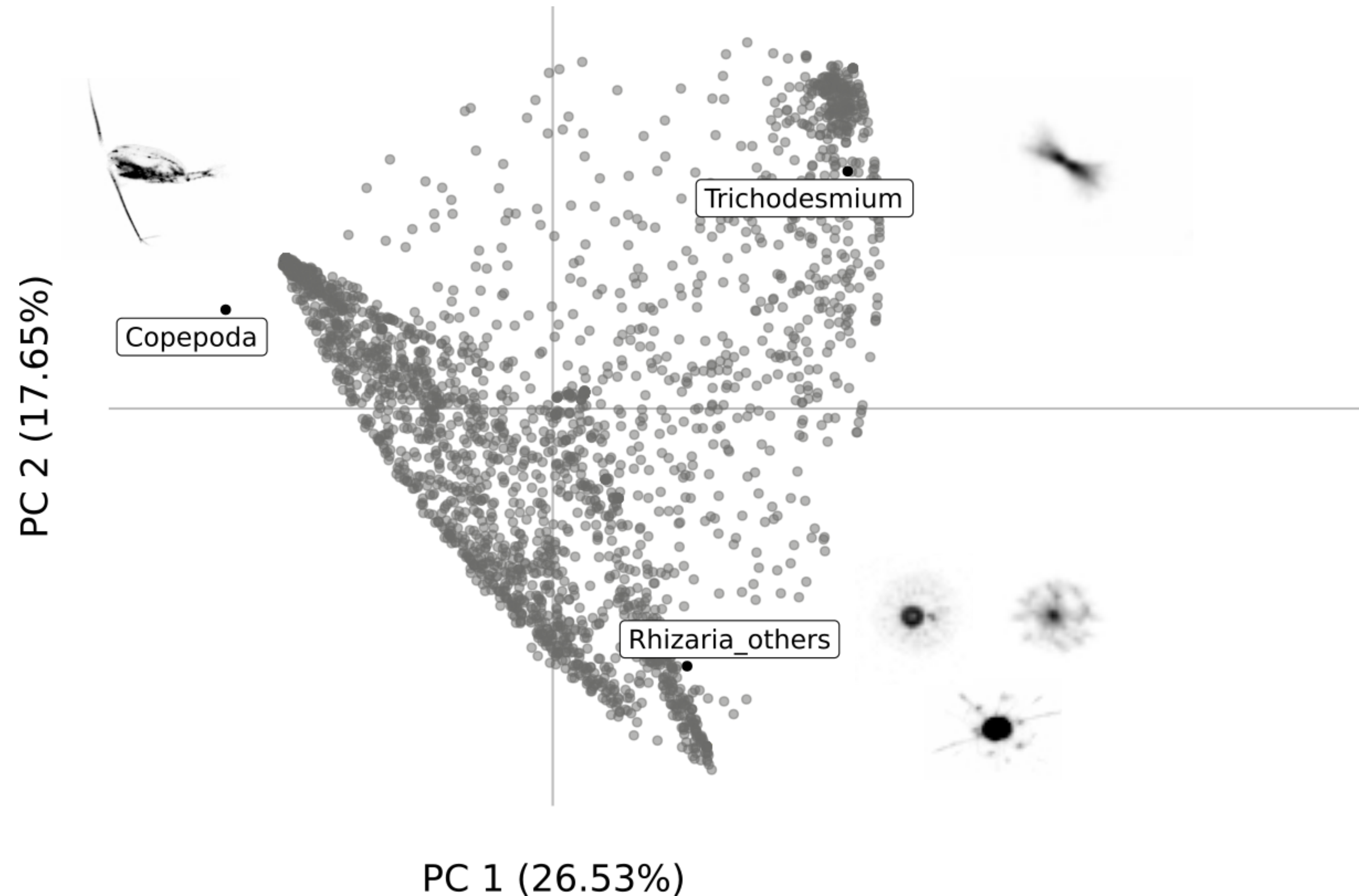
Plankton organisms seen by UVP



Plankton organisms seen by UVP

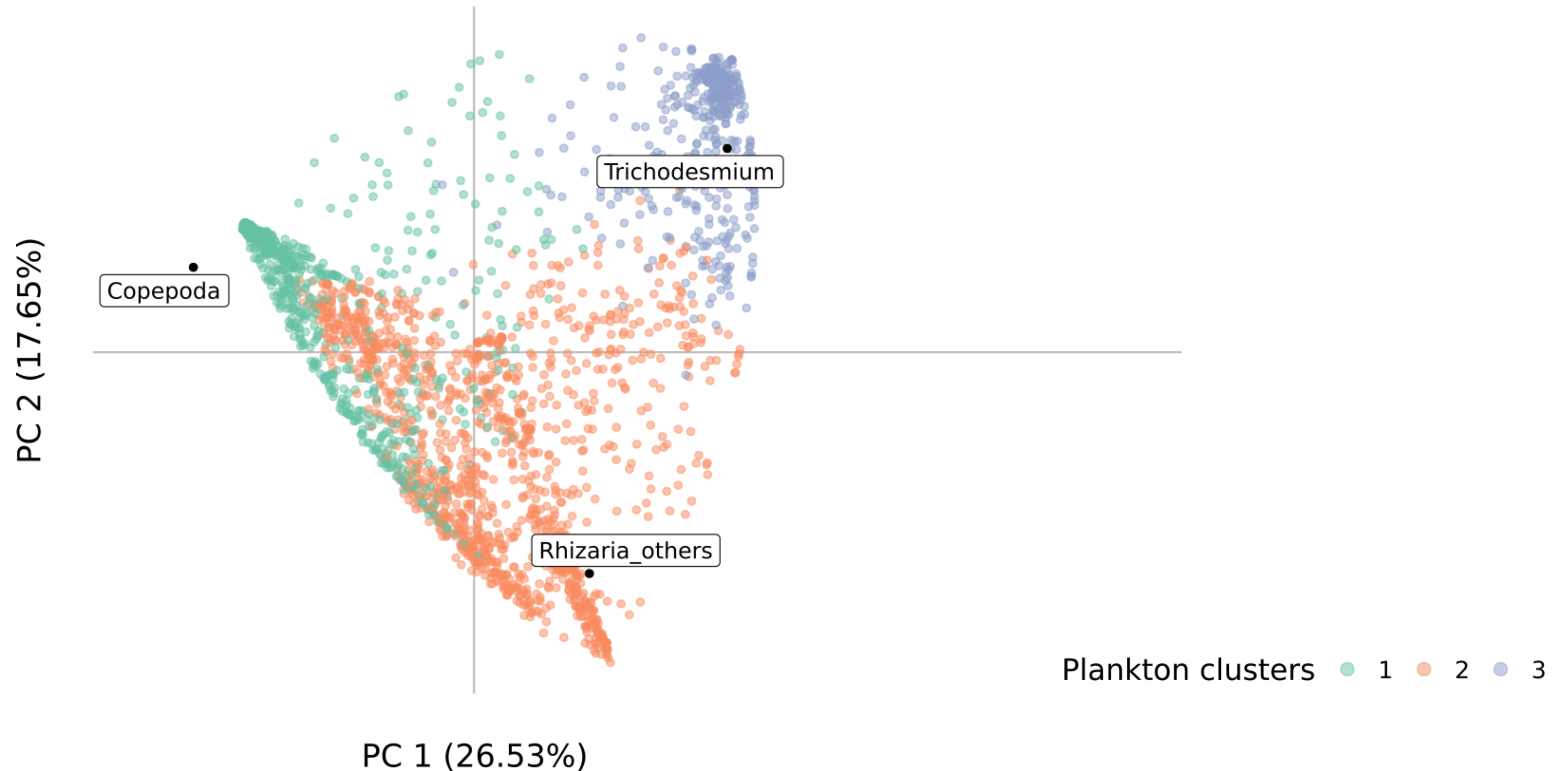


Description of plankton communities — epipelagic layer



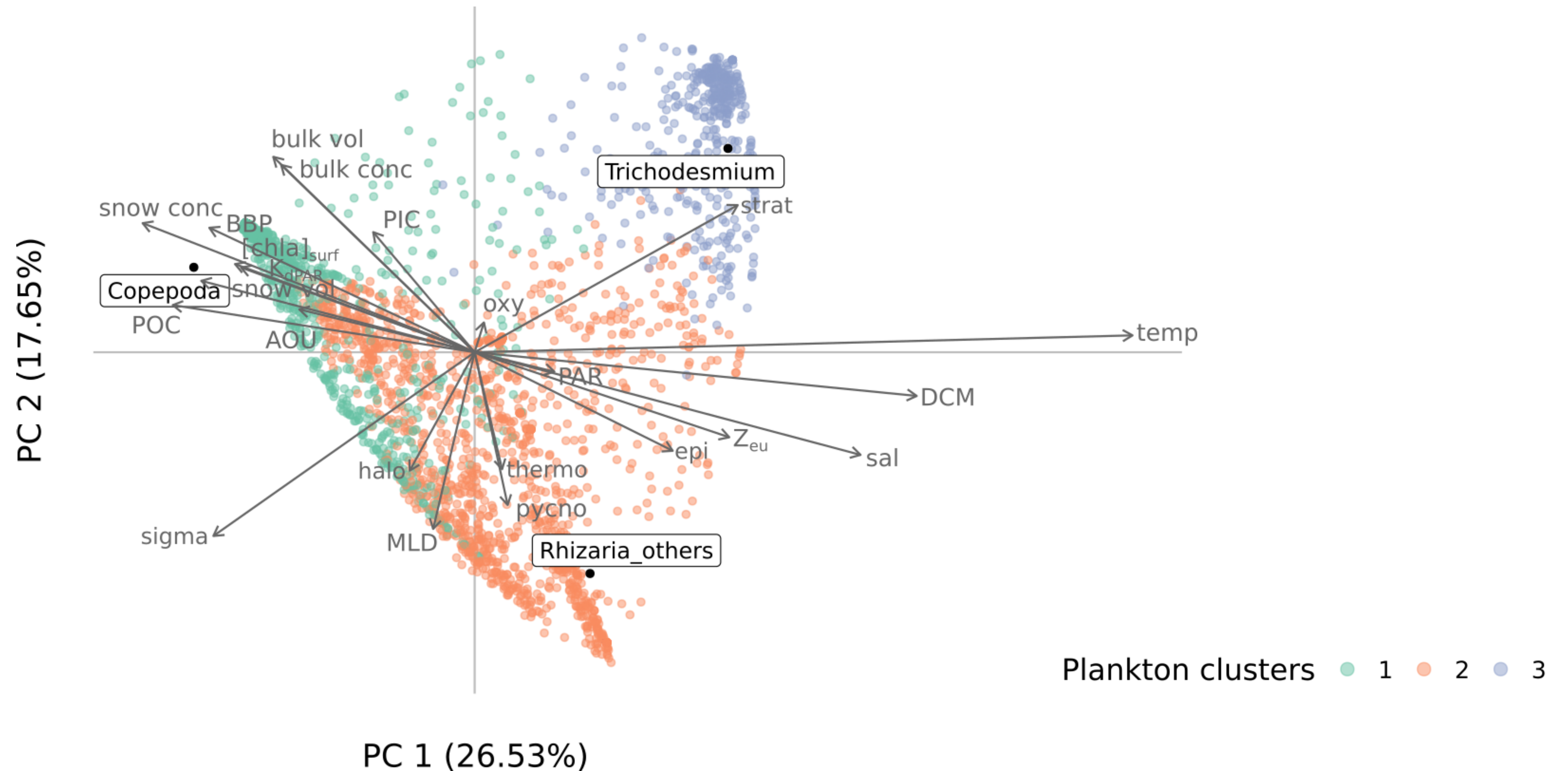
Projection of epipelagic stations on first two PCA axes, with taxonomic classes and environmental variables.

Description of plankton communities — epipelagic layer



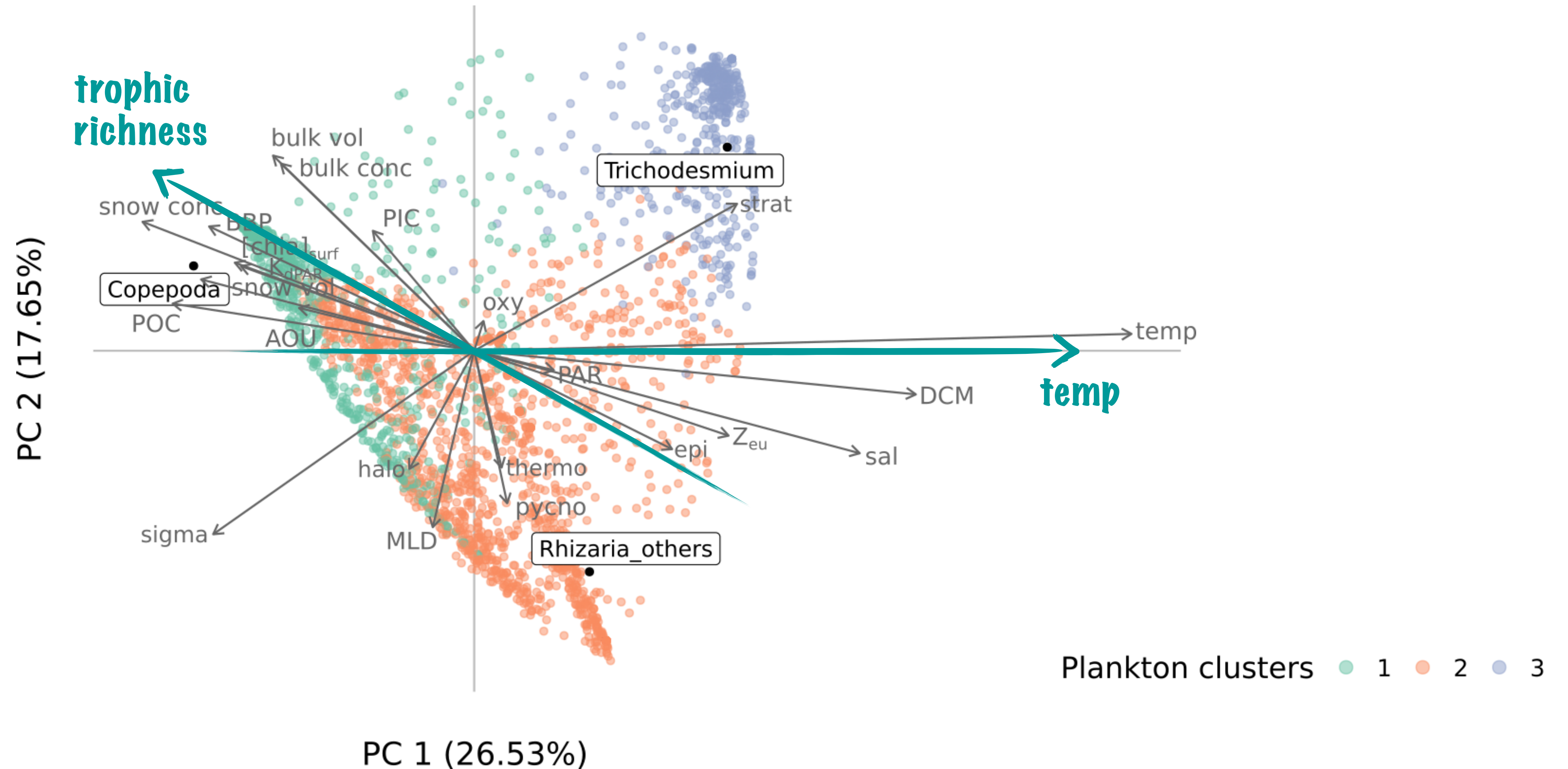
Projection of epipelagic stations on first two PCA axes, with taxonomic classes and environmental variables.

Description of plankton communities — epipelagic layer



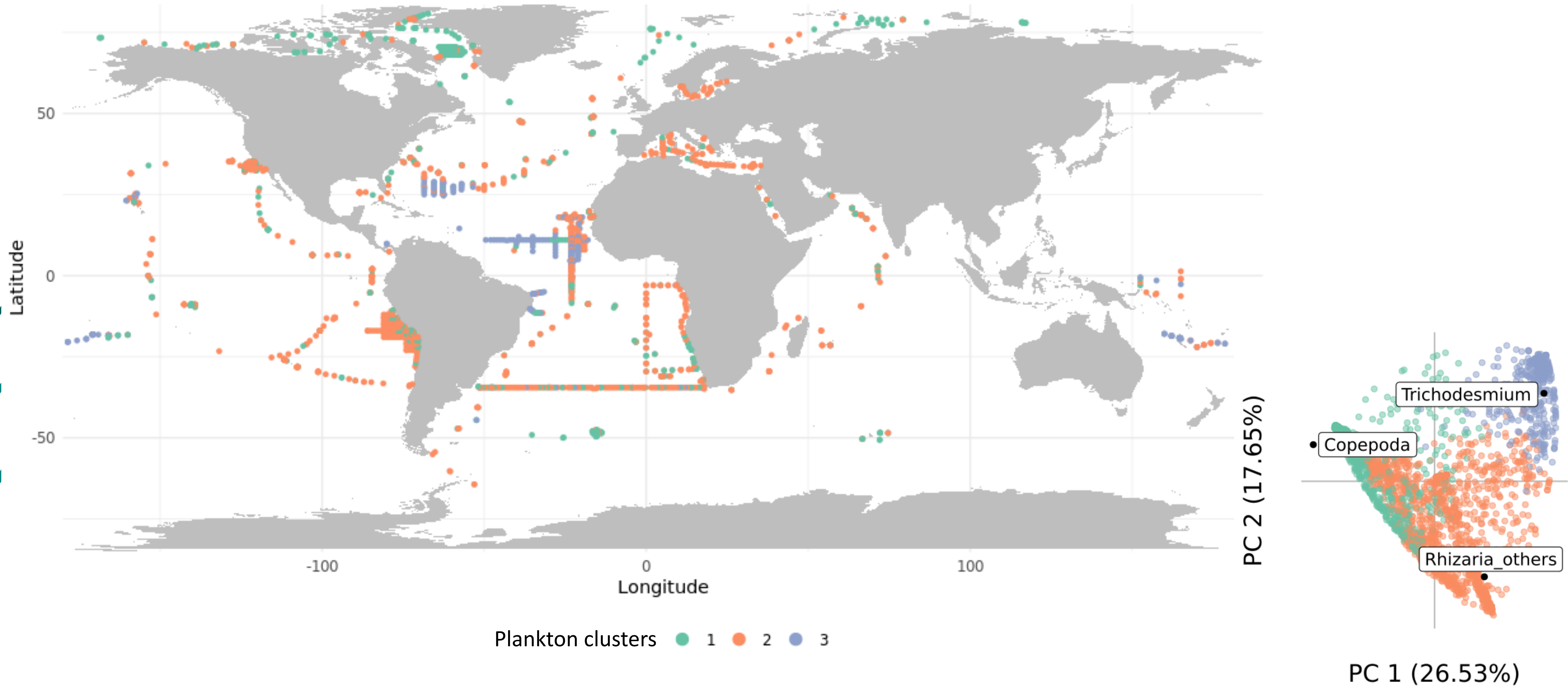
Projection of epipelagic stations on first two PCA axes, with taxonomic classes and environmental variables.

Description of plankton communities — epipelagic layer



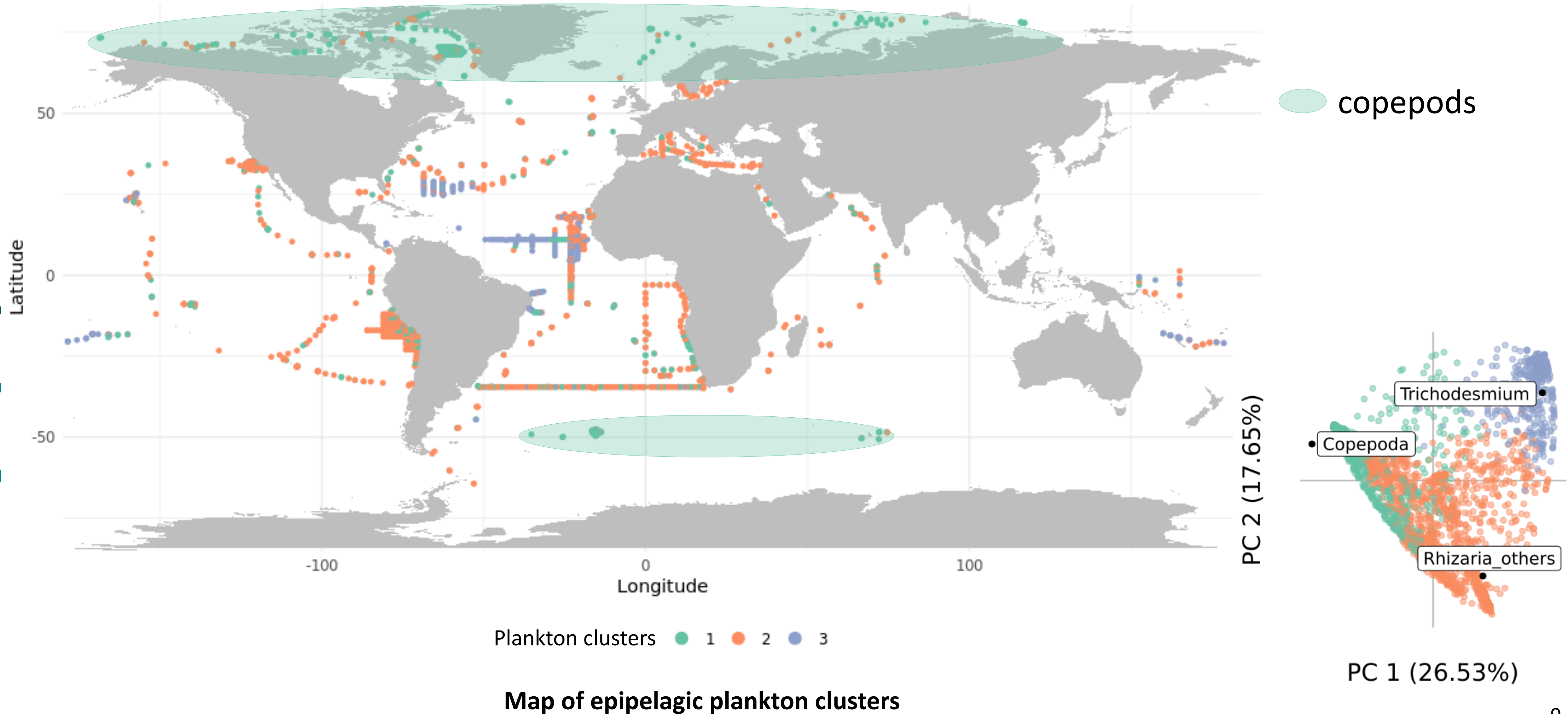
Projection of epipelagic stations on first two PCA axes, with taxonomic classes and environmental variables.

Description of plankton communities — epipelagic layer

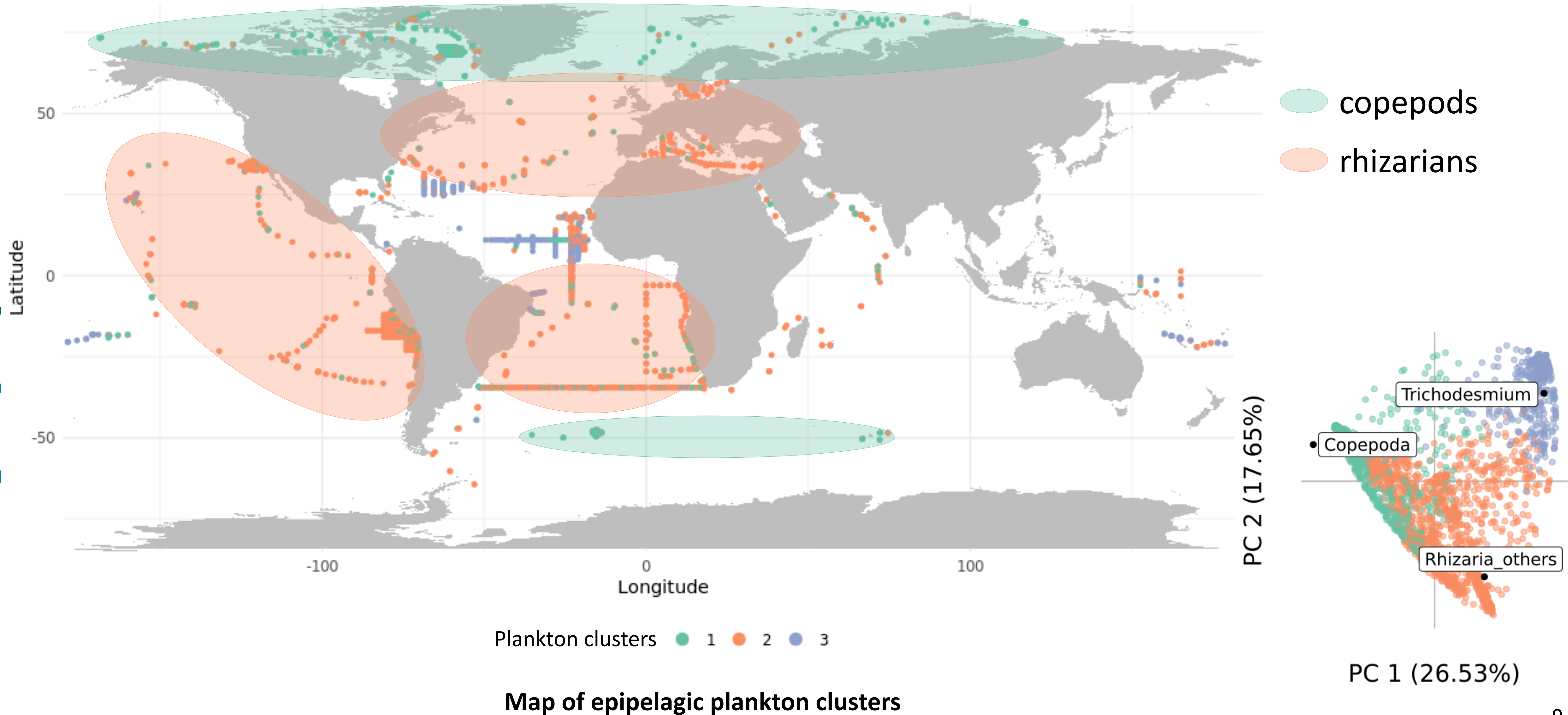


Map of epipelagic plankton clusters

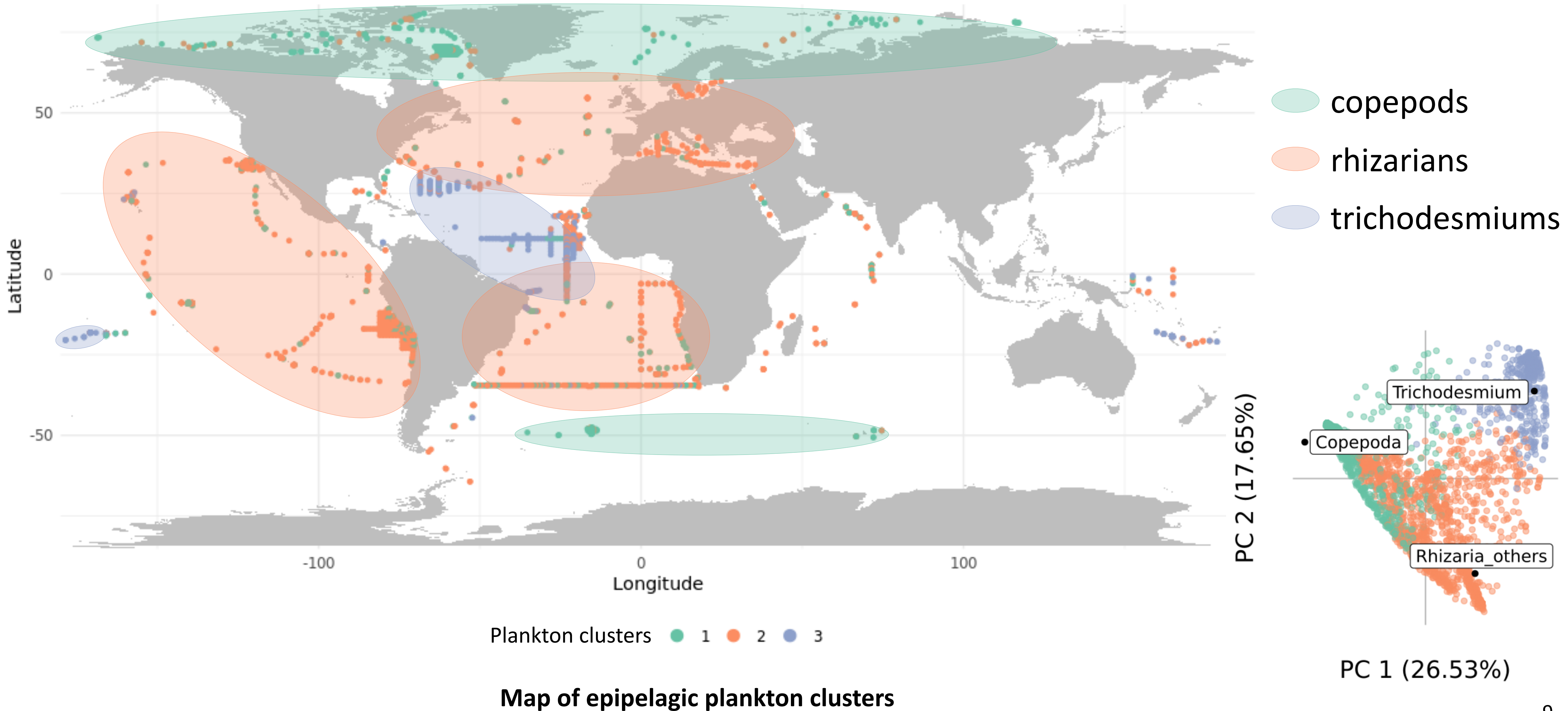
Description of plankton communities — epipelagic layer



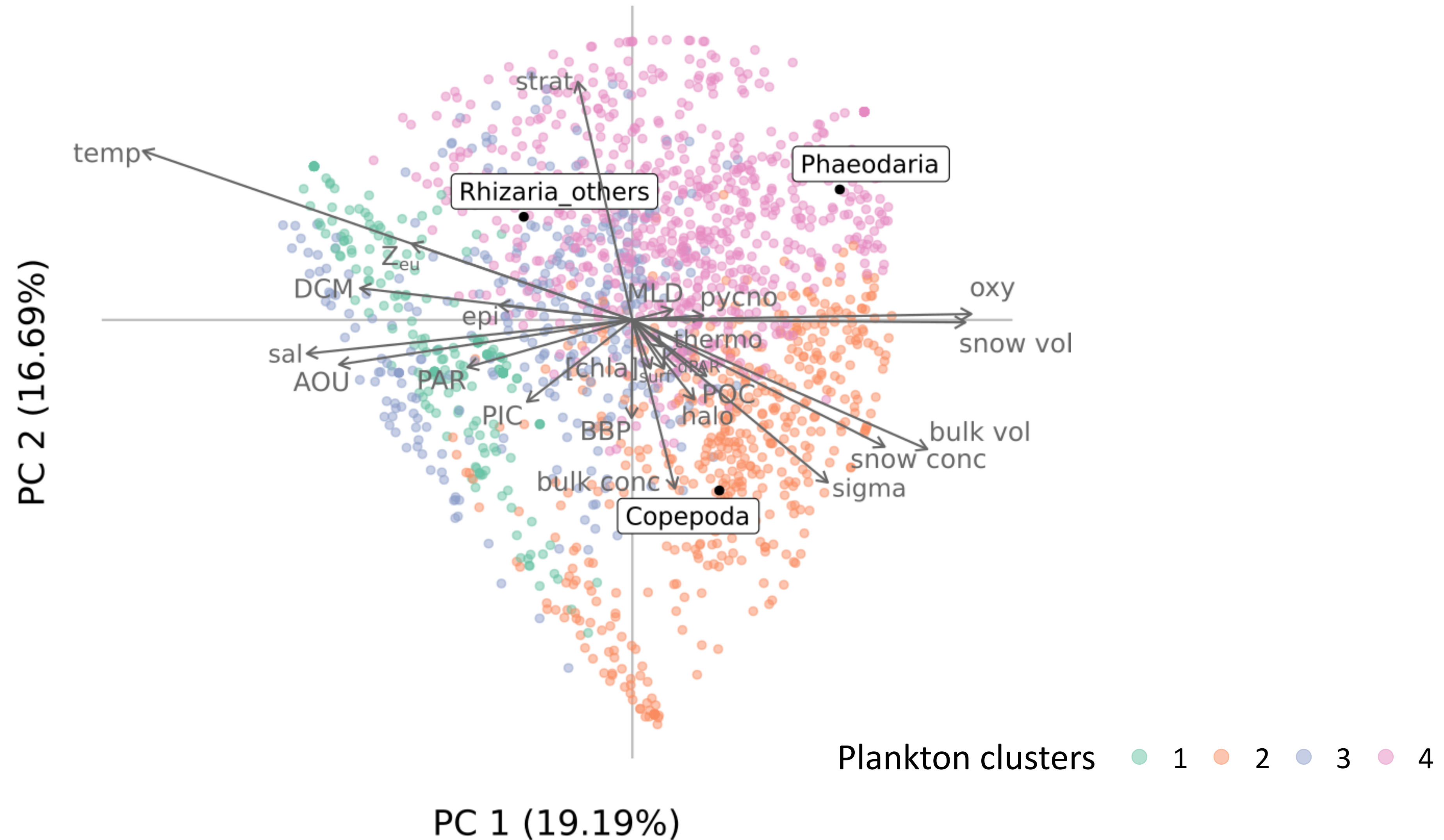
Description of plankton communities — epipelagic layer



Description of plankton communities — epipelagic layer

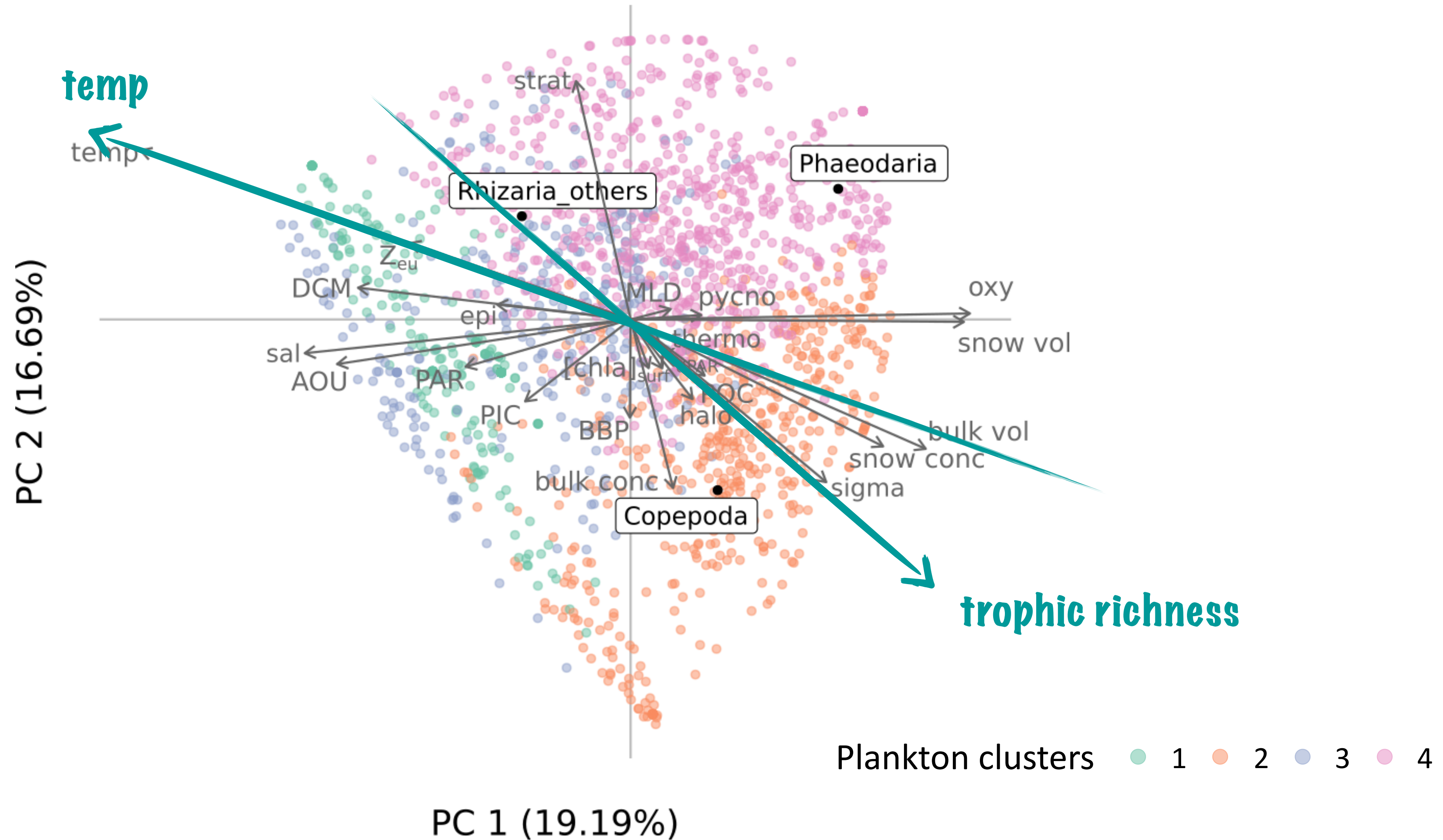


Description of plankton communities — upper mesopelagic layer



Projection of mesopelagic stations on first two PCA axes, with taxonomic classes and environmental variables.

Description of plankton communities — upper mesopelagic layer



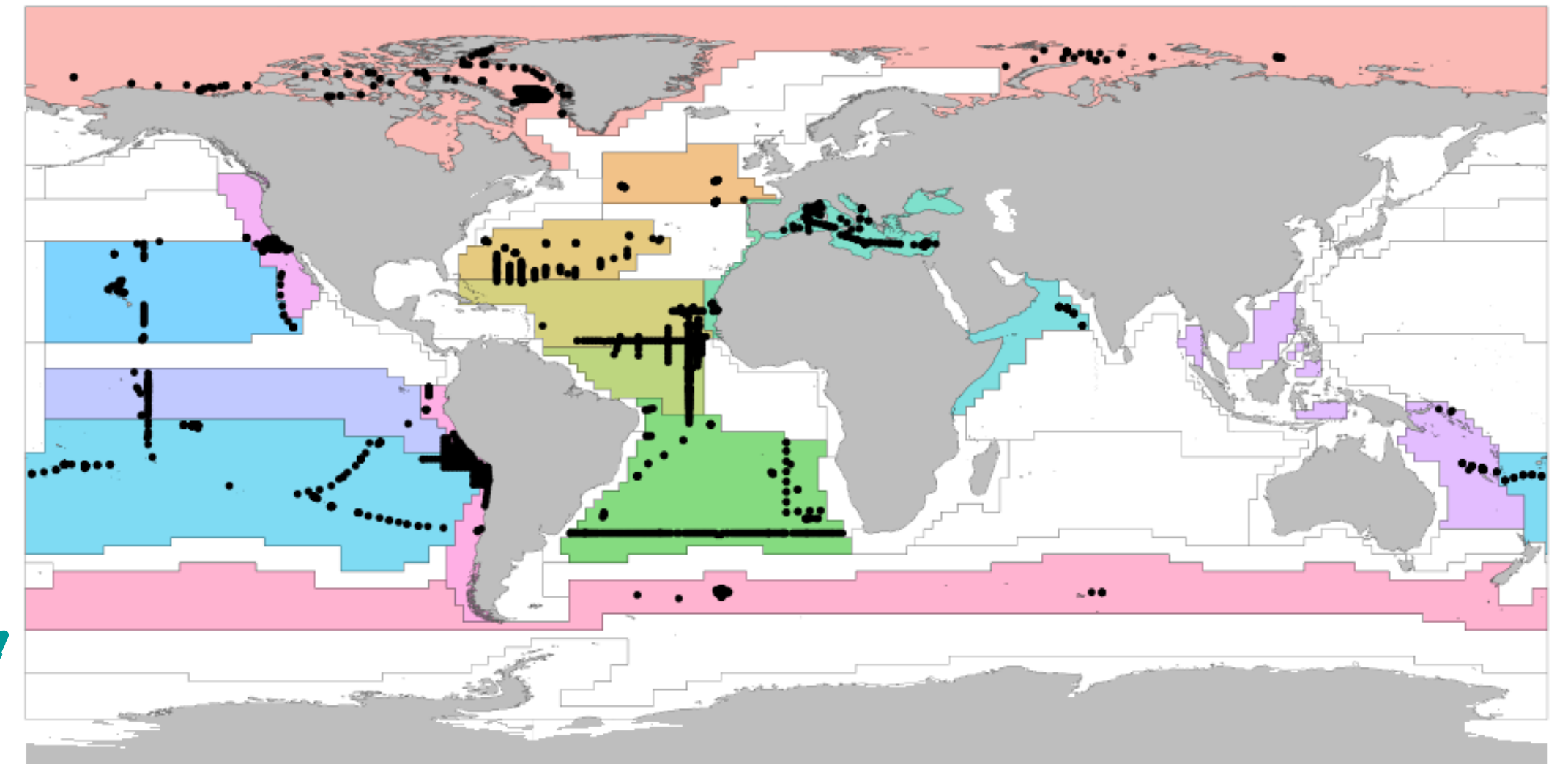
Projection of mesopelagic stations on first two PCA axes, with taxonomic classes and environmental variables.

Comparison among regionalisations

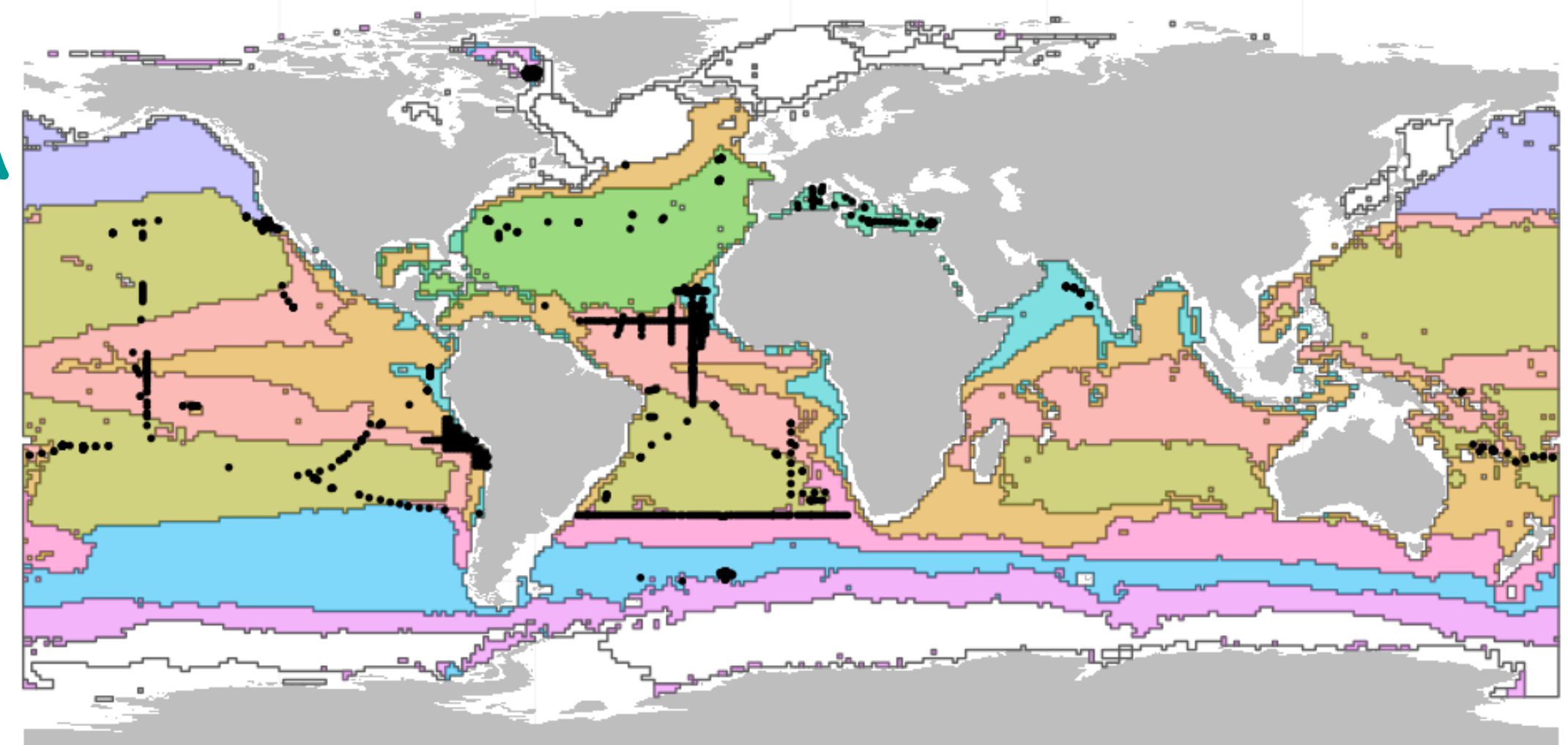
Layer-wise

Quantify the part of variance explained by:

- local and immediate environment from *in-situ* data
- latitudinal bands
- climatology-based regions
- a maximal model
- a null model



Longhurst provinces (epipelagic layer)

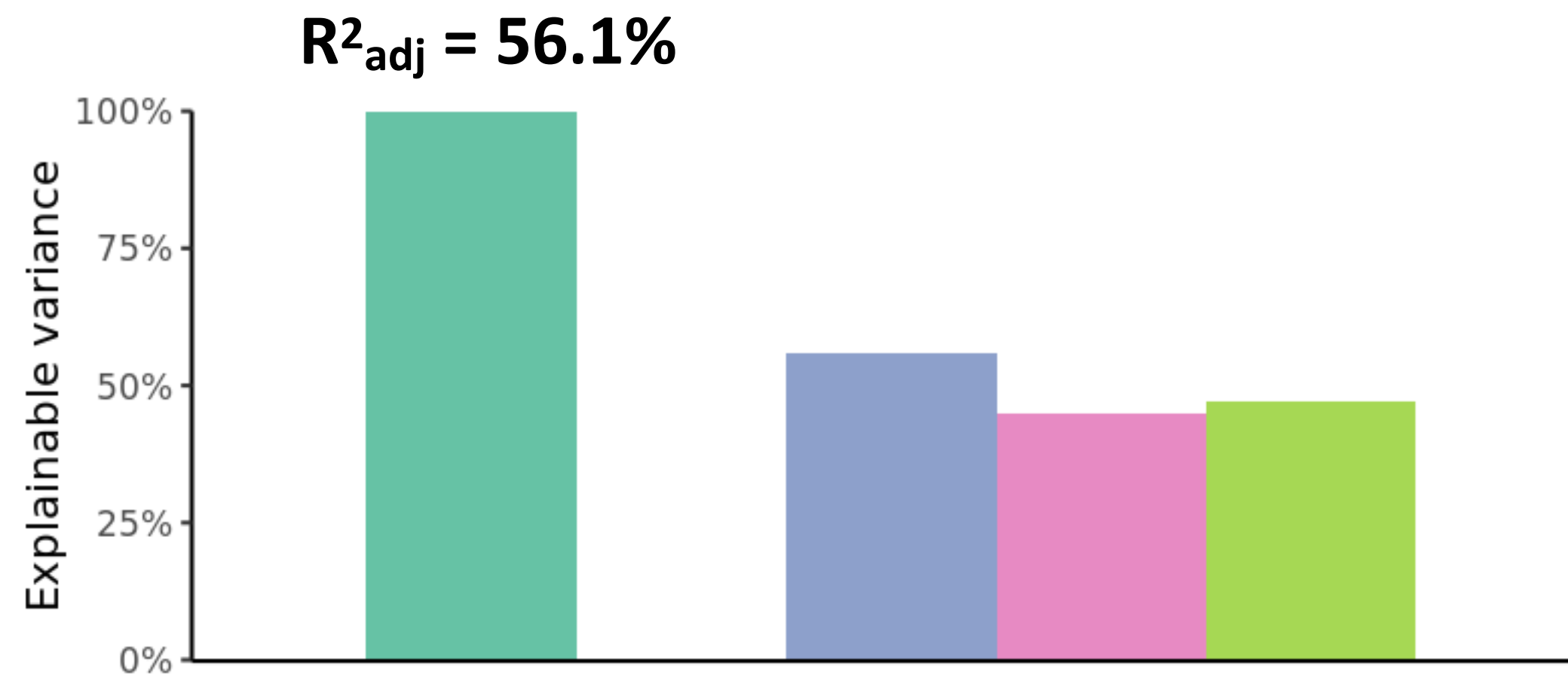


Mesopelagic provinces (Reygondeau et al. 2018)

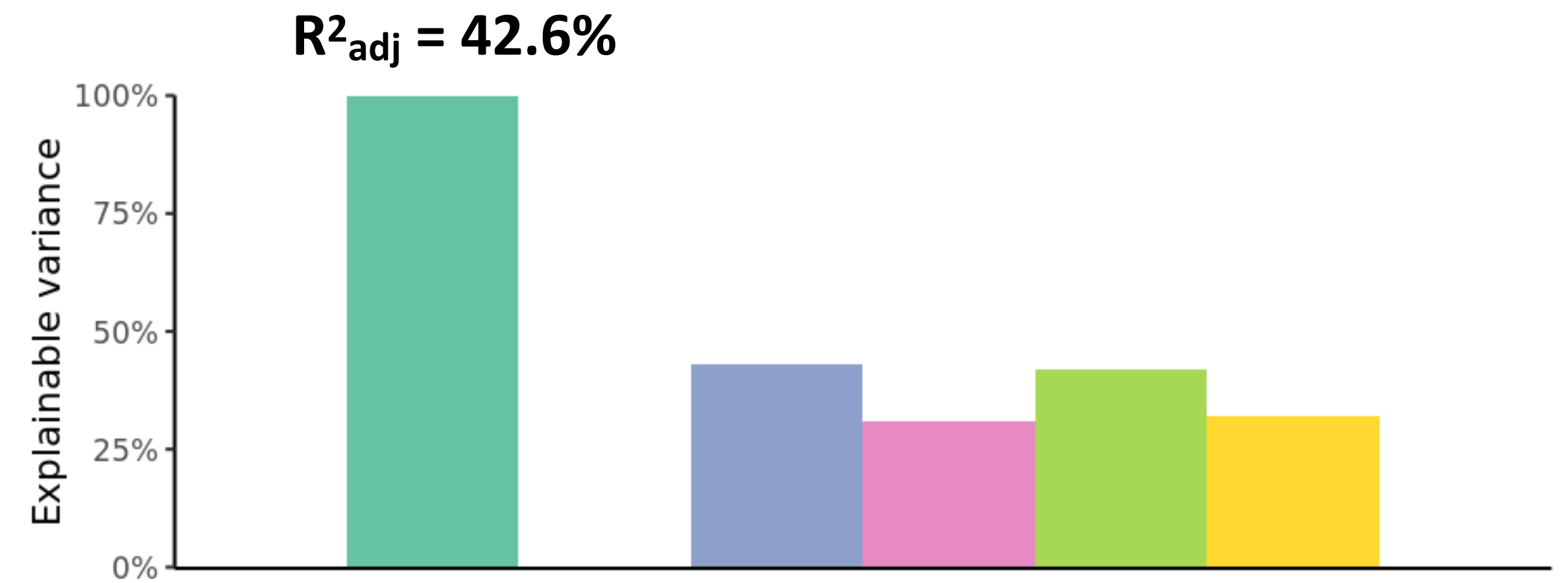
Same approach to test seasonal and circadian cycles effects

Comparison among regionalisations

Epipelagic layer



Upper mesopelagic layer



Part of plankton data variance explained by each partitioning.



Plankton communities structure

Epipelagic

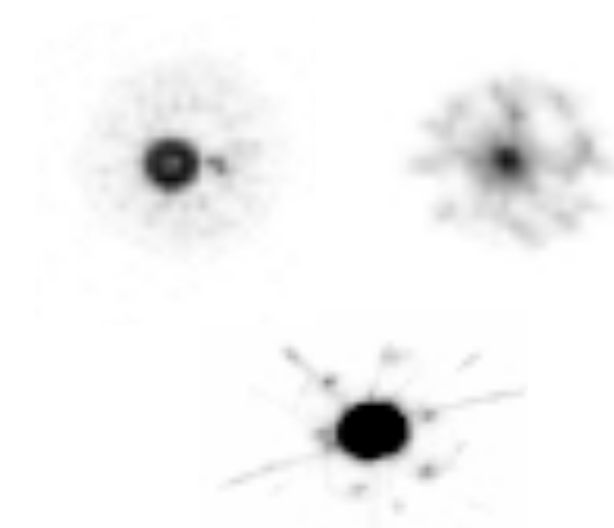
Copepoda



Trichodesmium



Rhizaria

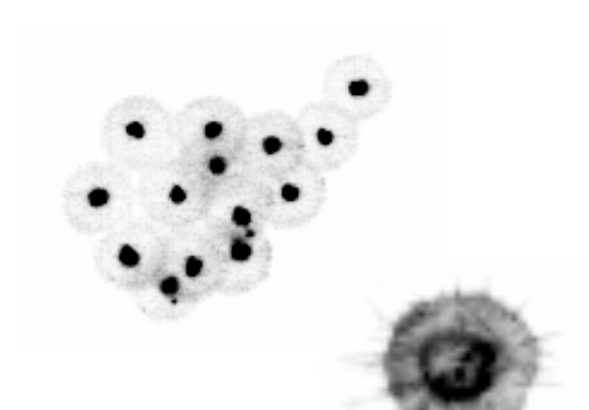


upper
Mesopelagic

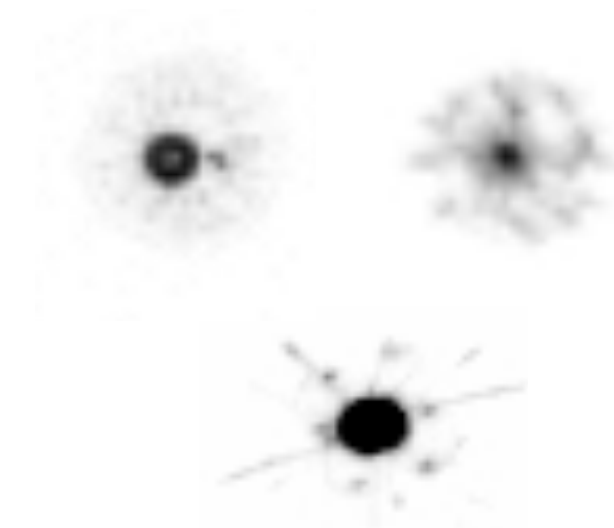
Copepoda



Phaeodaria



Rhizaria



Plankton communities structure

Epipelagic

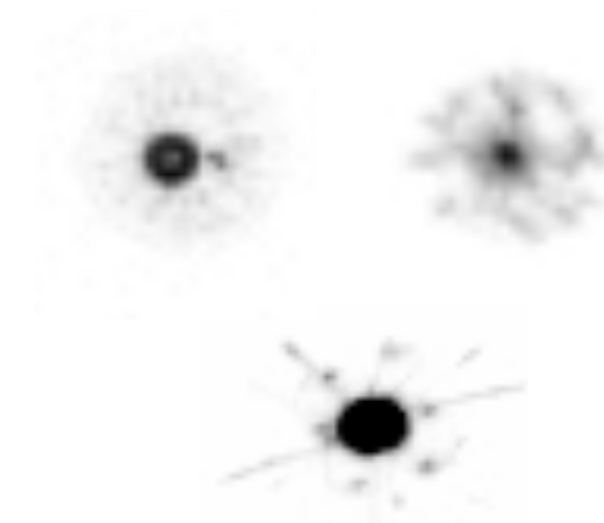
Copepoda



Trichodesmium



Rhizaria



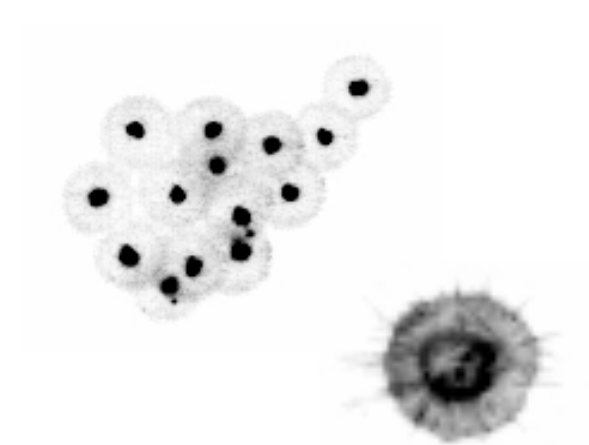
Stronger structure

upper
Mesopelagic

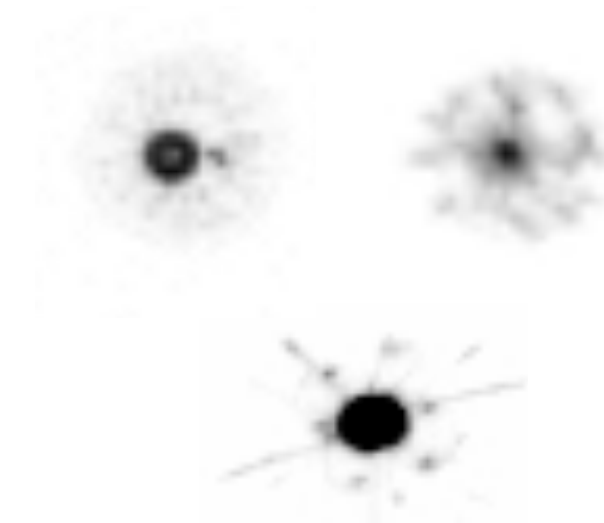
Copepoda



Phaeodaria



Rhizaria



Plankton communities structure



Epipelagic

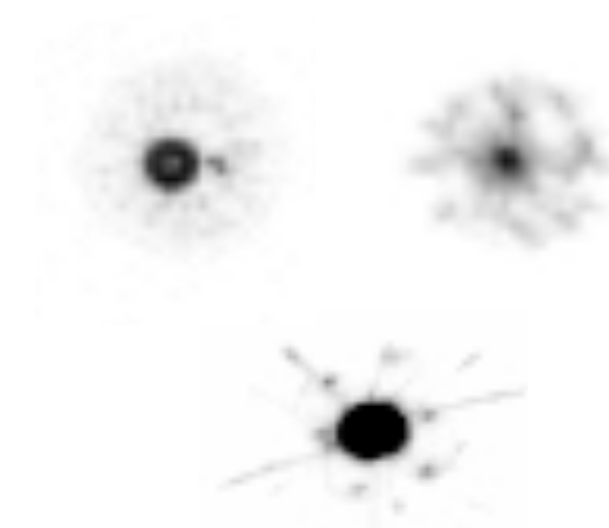
Copepoda



Trichodesmium



Rhizaria



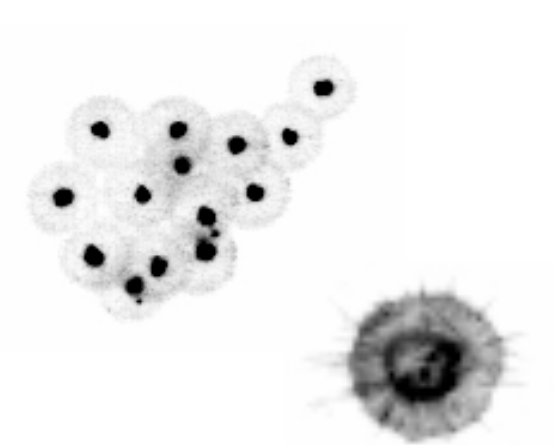
Stronger structure

upper Mesopelagic

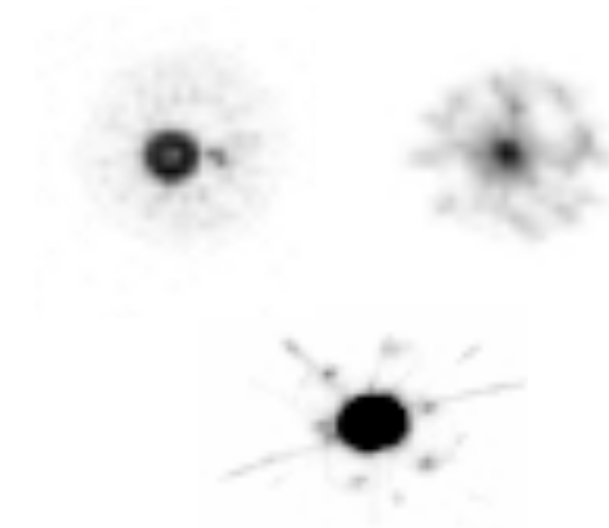
Copepoda



Phaeodaria

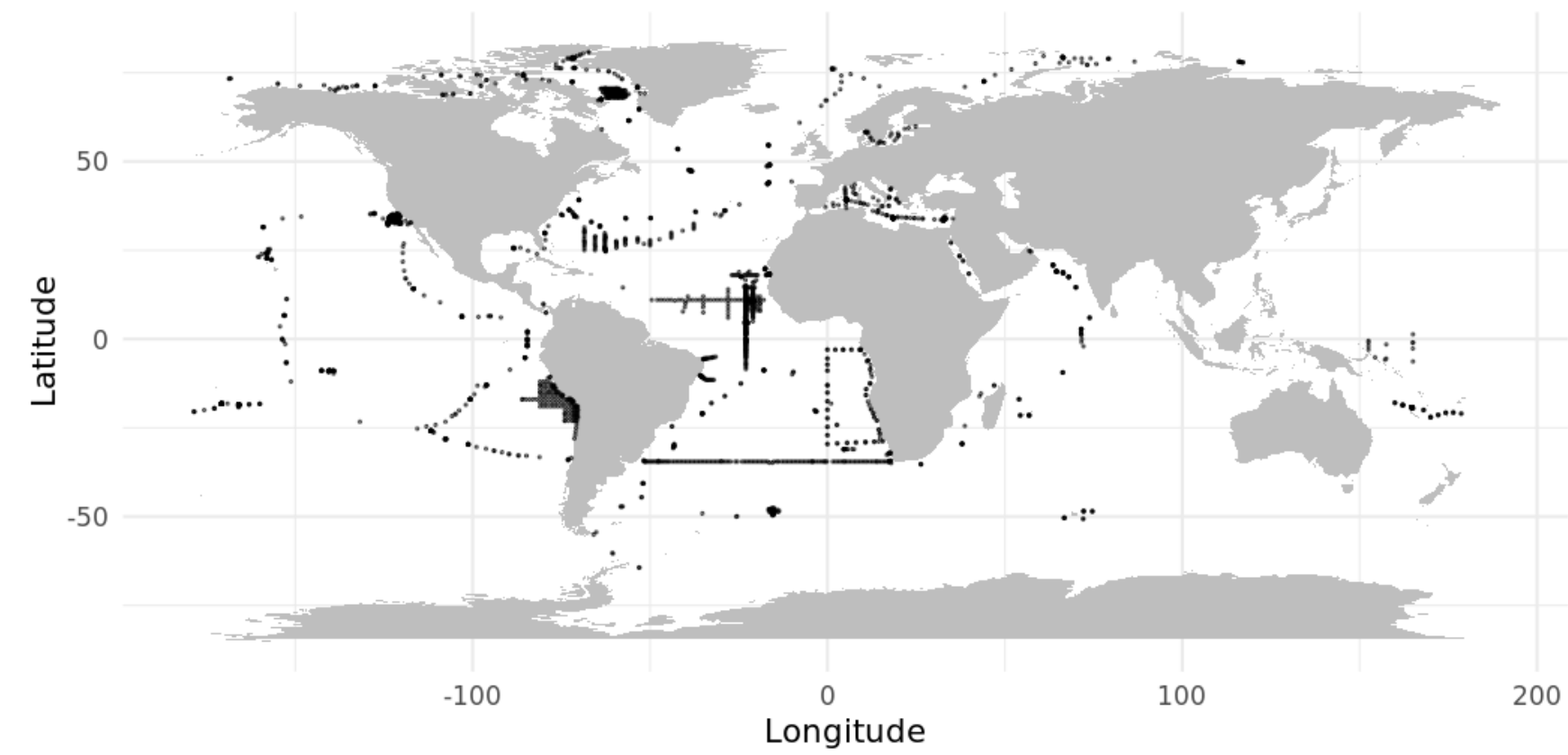


Rhizaria



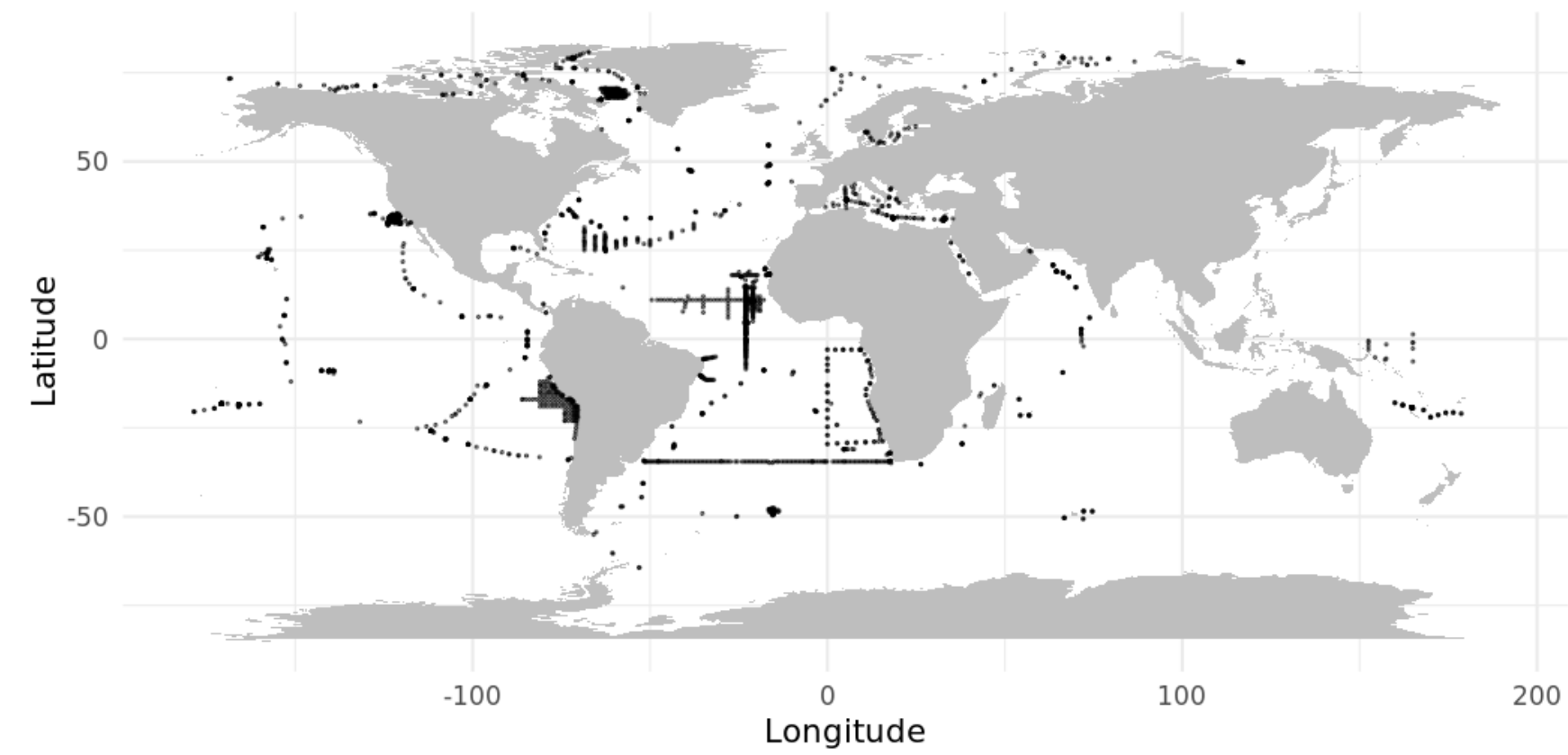
Next steps

- Improve data spatial and temporal resolution



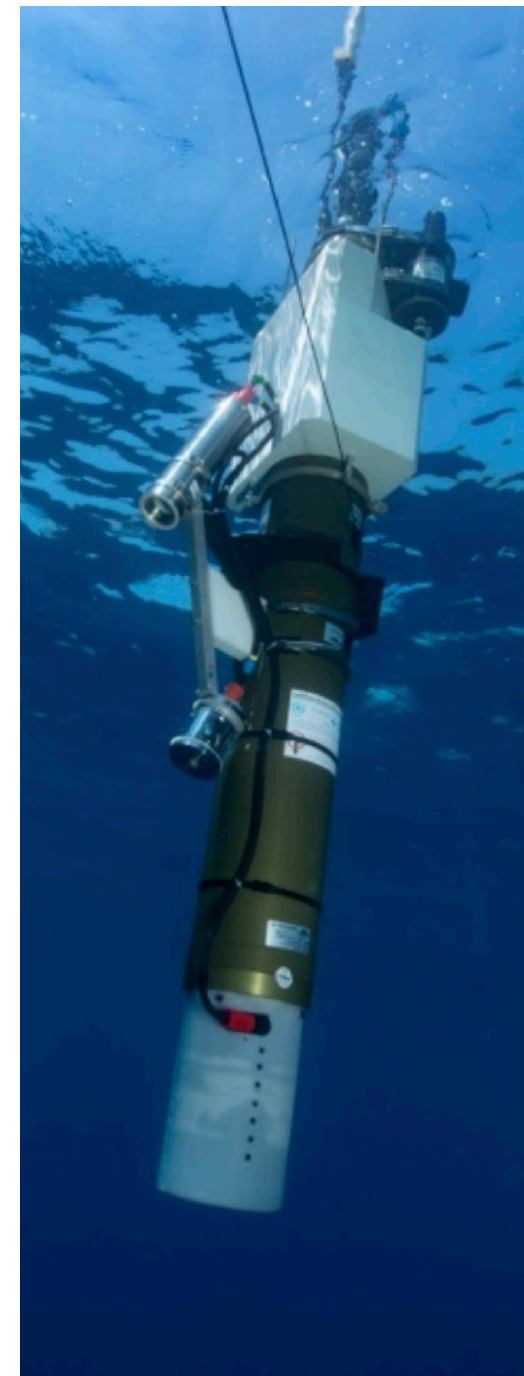
Next steps

- Improve data spatial and temporal resolution



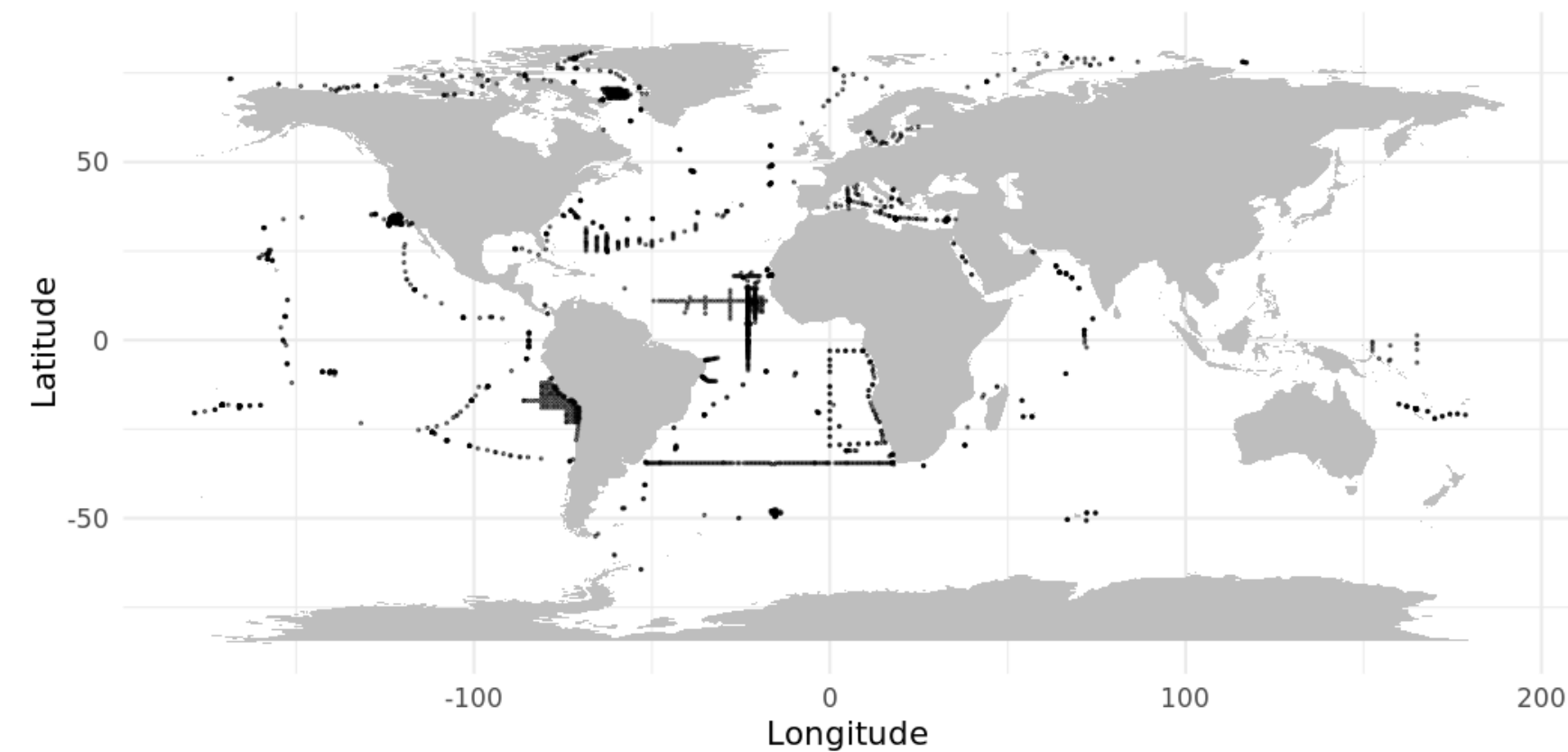
See Marc Picheral's presentation on Wednesday at 8:30

UVP6



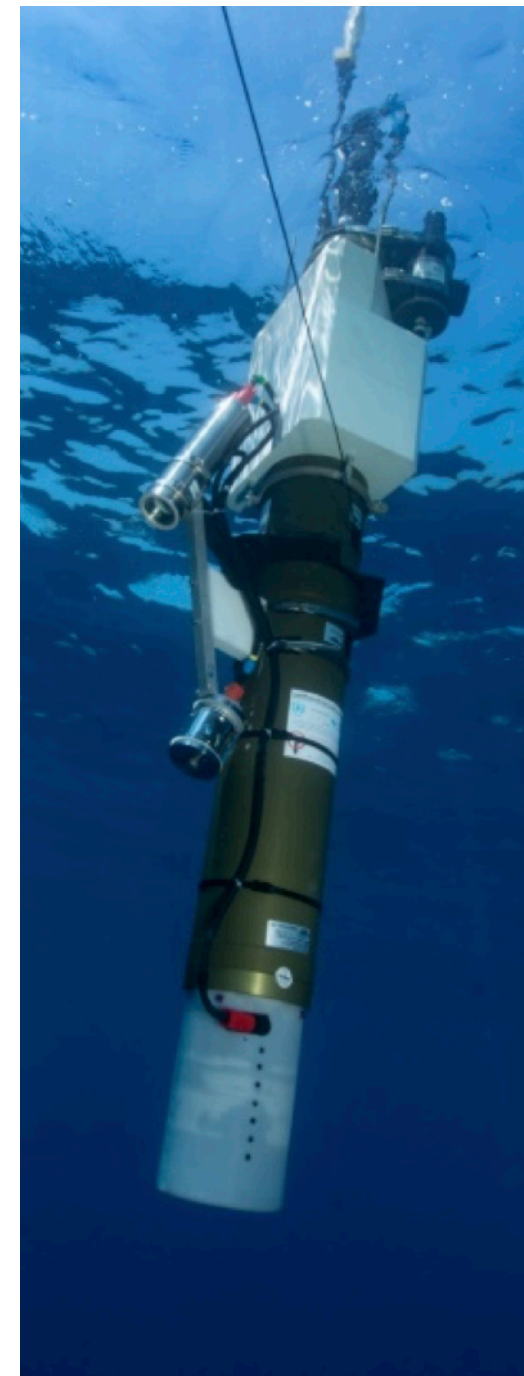
Next steps

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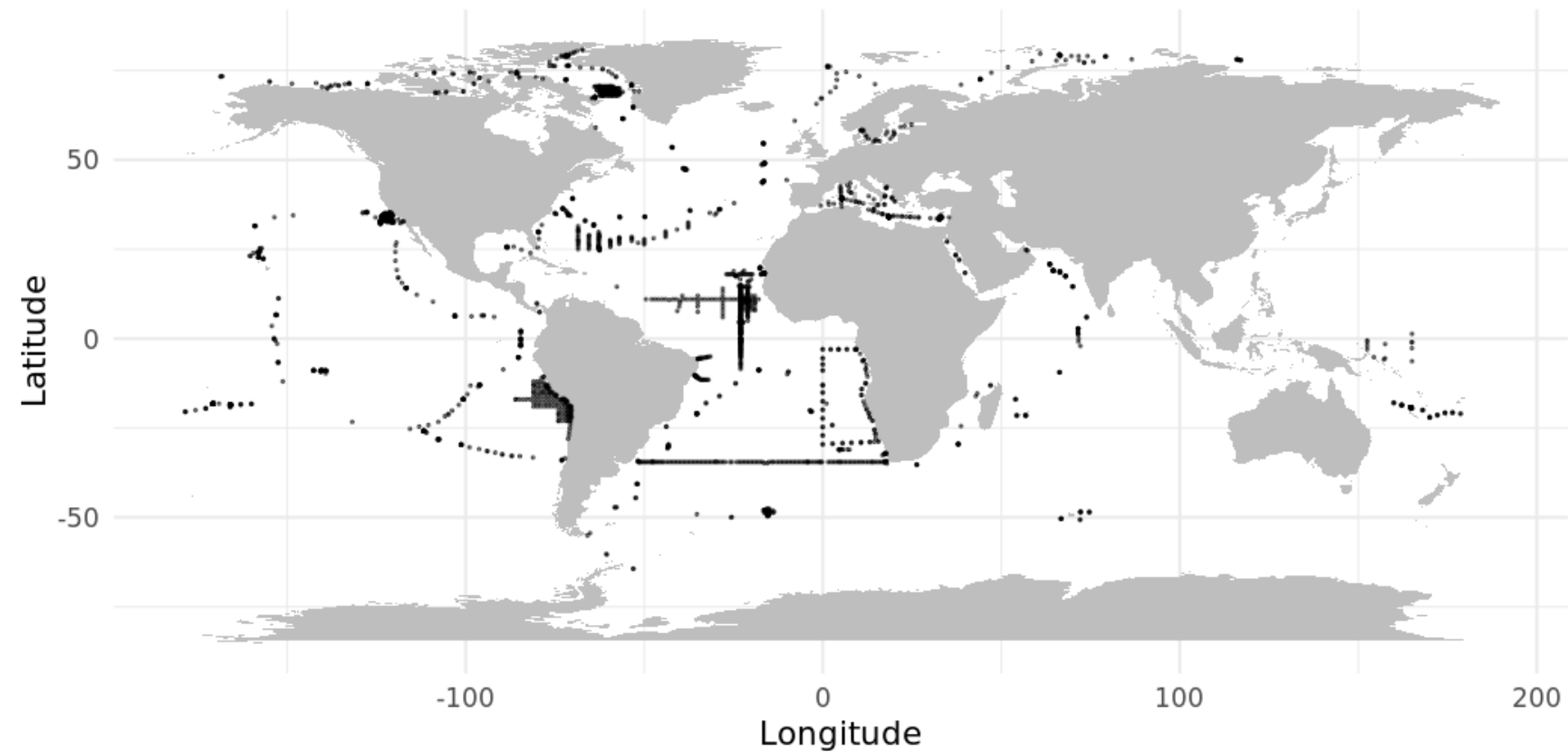
UVP6



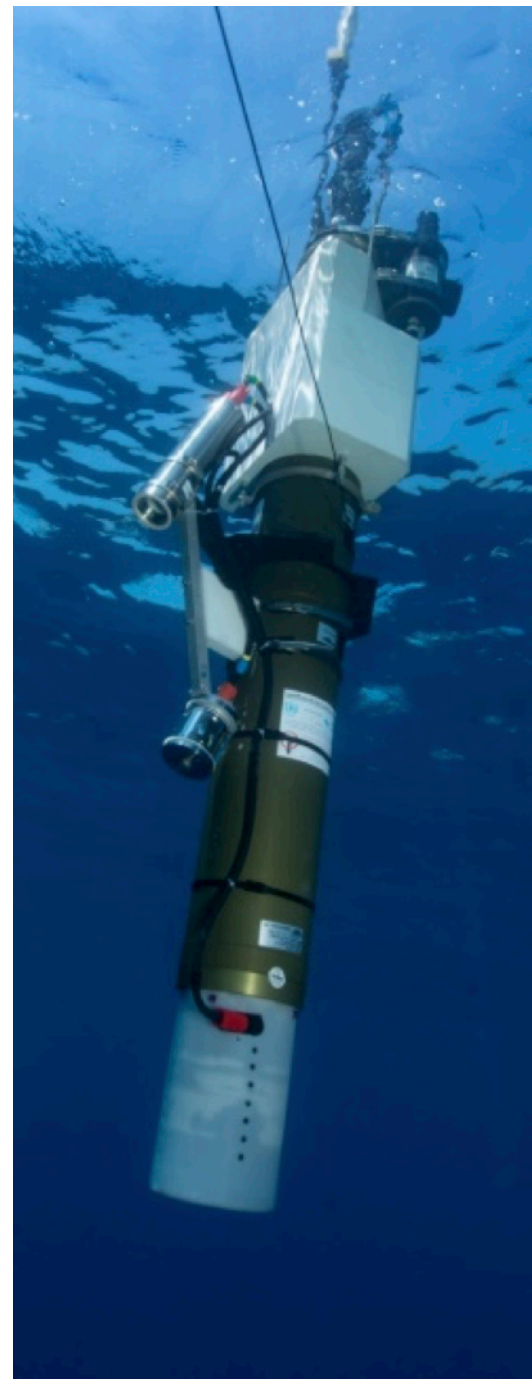
- Extrapolation of plankton communities distribution and biomass

Next steps

- Improve data spatial and temporal resolution



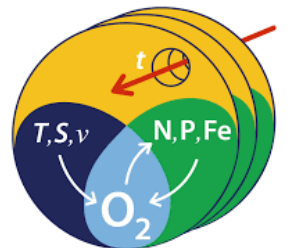
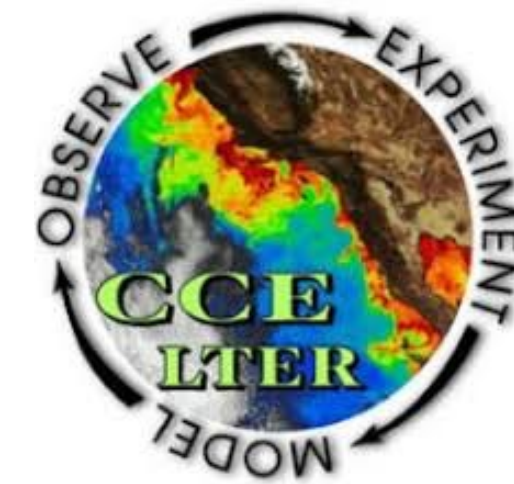
UVP6



See Marc Picheral's presentation on Wednesday at 8:30

- Extrapolation of plankton communities distribution and biomass

Thanks to all co-authors, cruise leaders, technicians and funders



SFB 754

