

Under-ice bloom: Temporal dynamics and biogeography of Arctic ice algae and phytoplankton



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Main components of the Arctic spring bloom



Open water phytoplankton

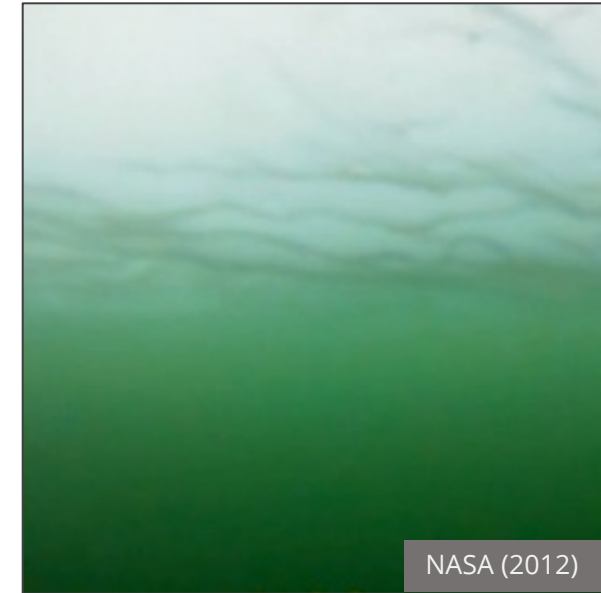
Main components of the Arctic spring bloom



Open water phytoplankton



Ice algae



Under-ice phytoplankton

- Invisible to satellite
- Underestimated by up to 10 times

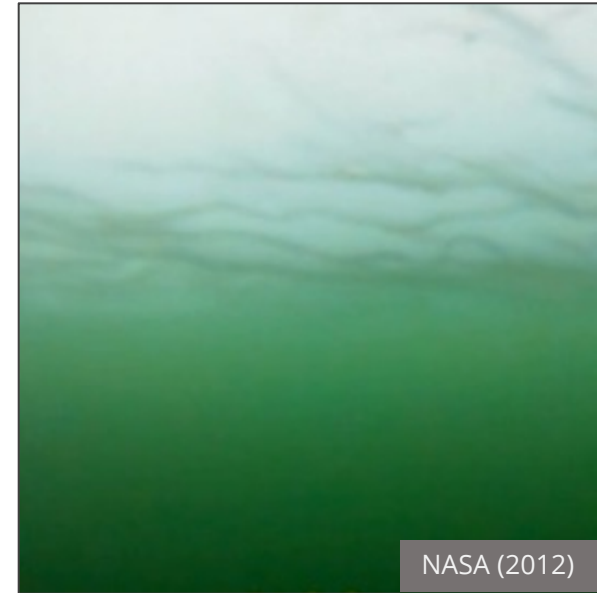
Main components of the Arctic spring bloom



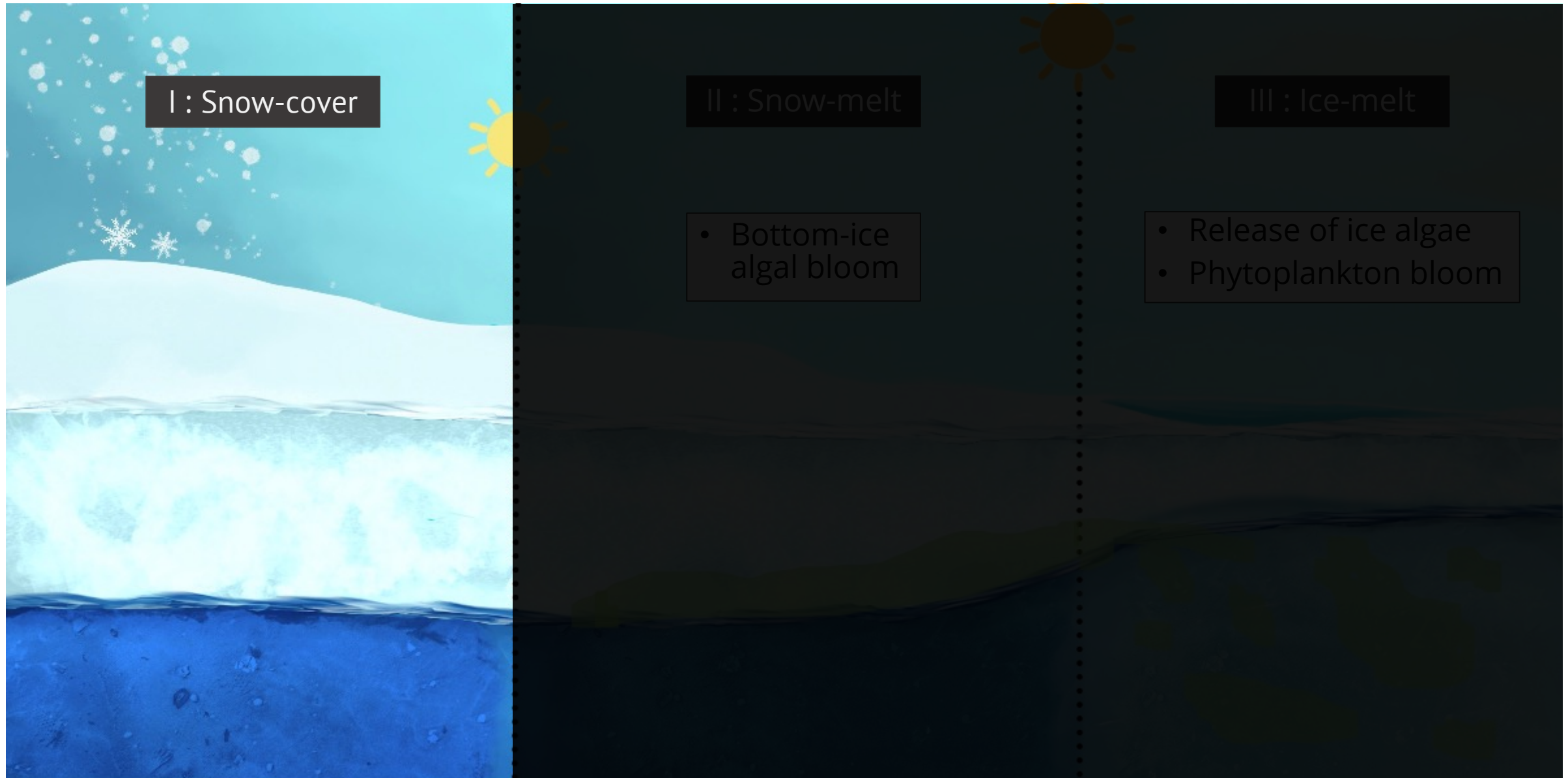
Open water phytoplankton

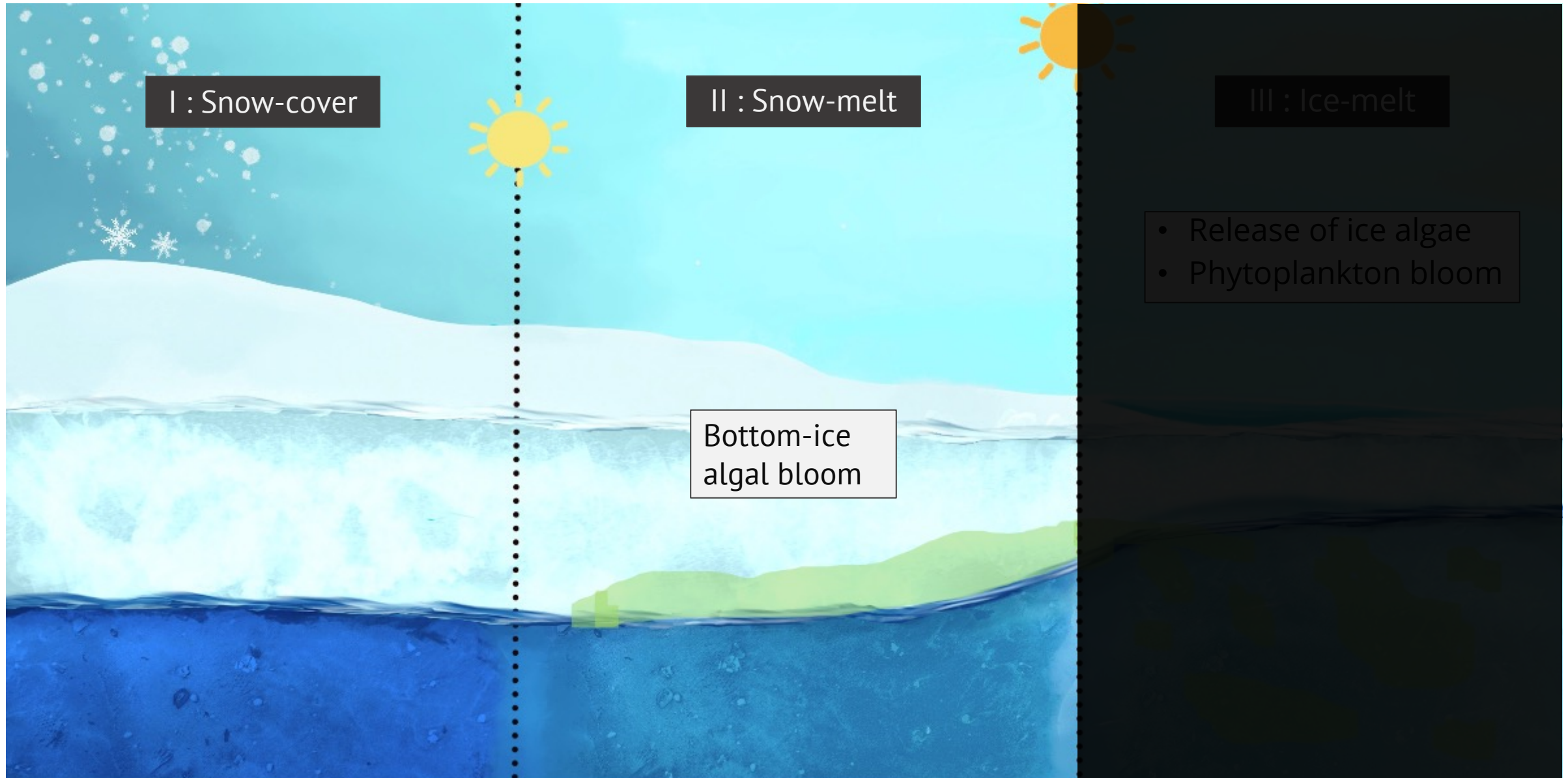


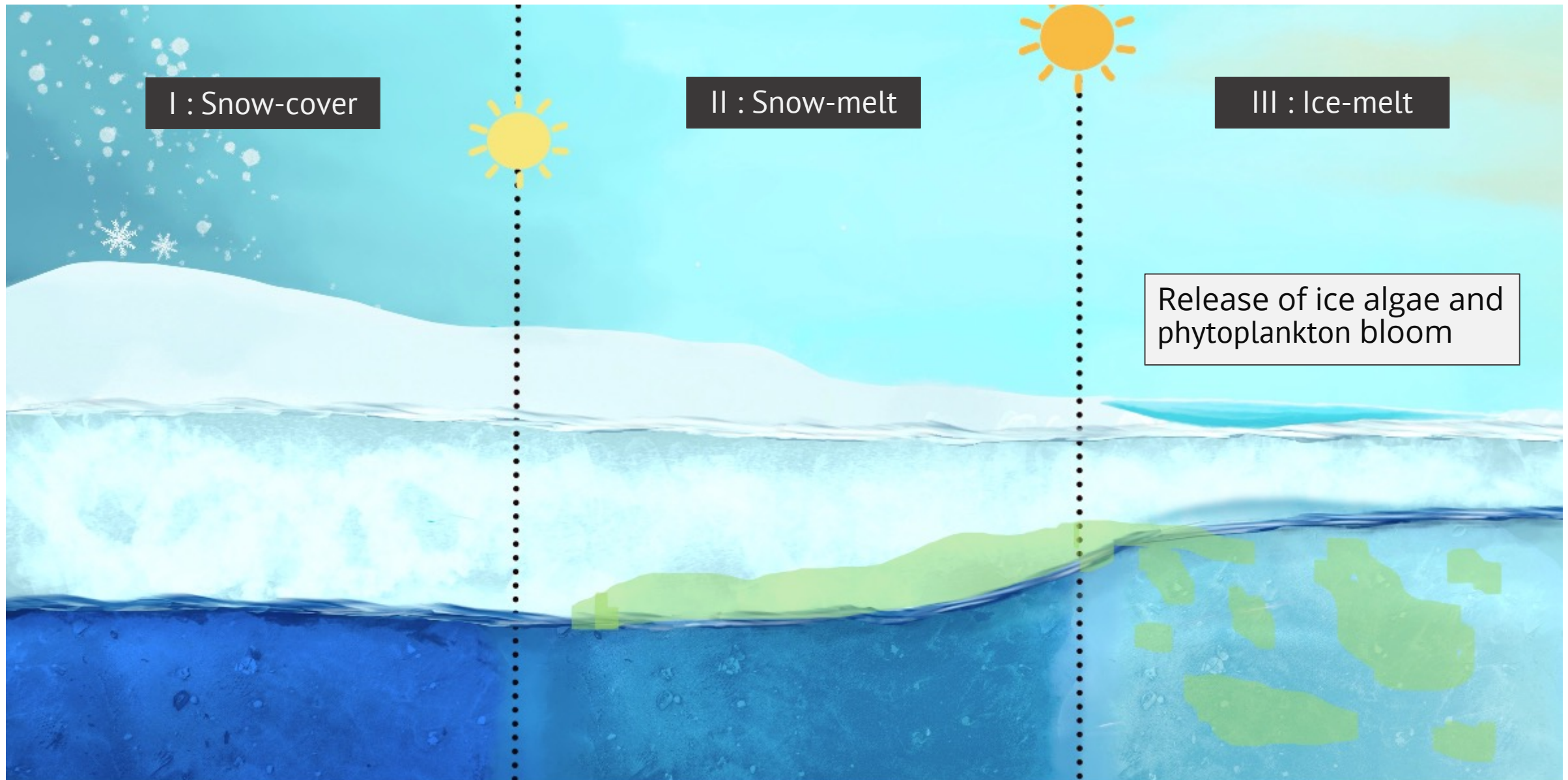
Ice algae



Under-ice phytoplankton

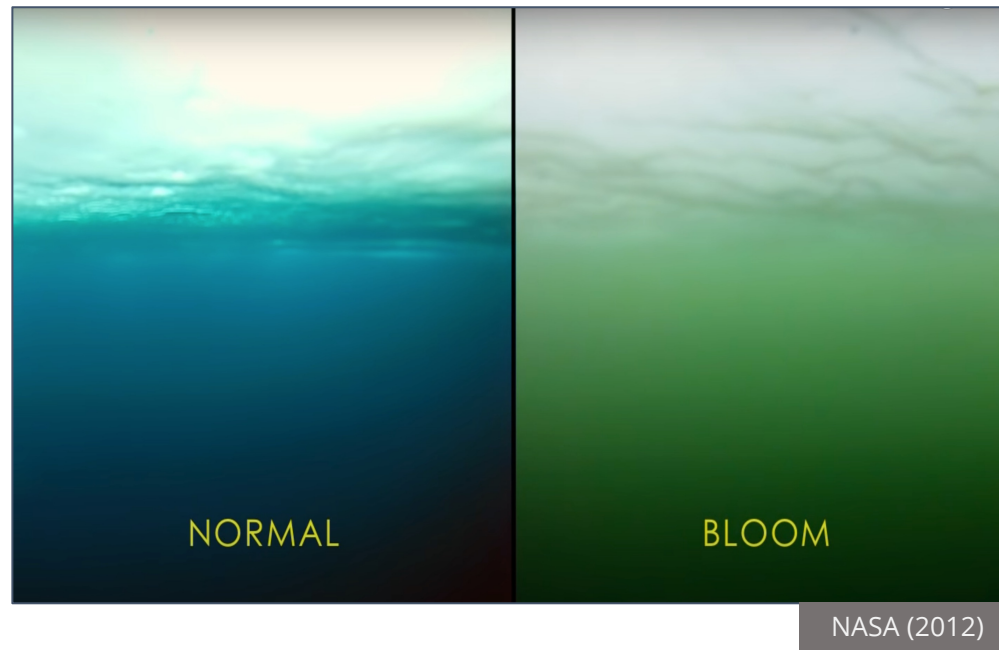


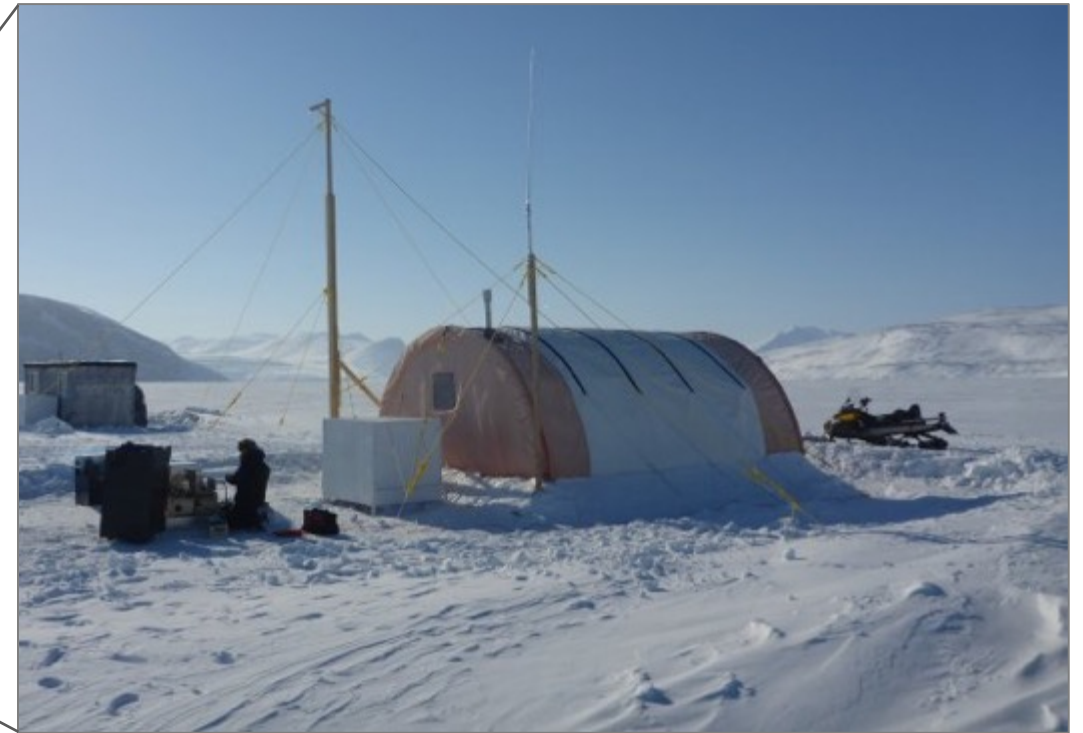




Research Question 1

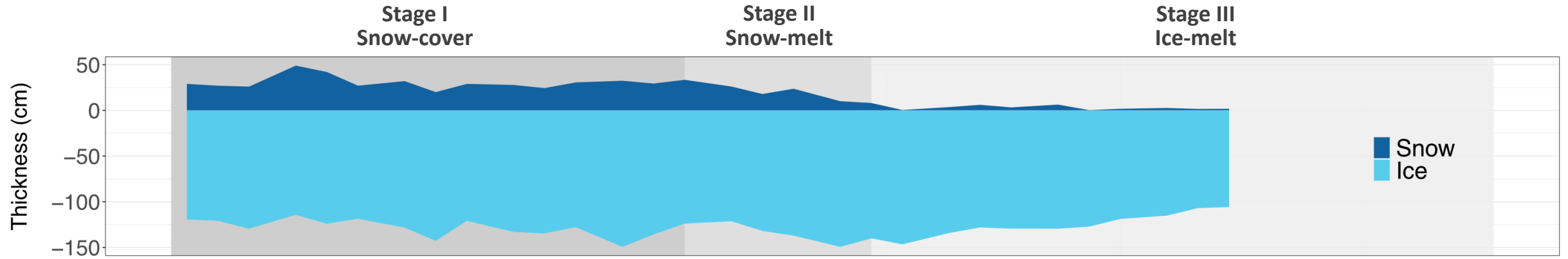
How do the ice algae and phytoplankton communities evolve throughout the bloom?



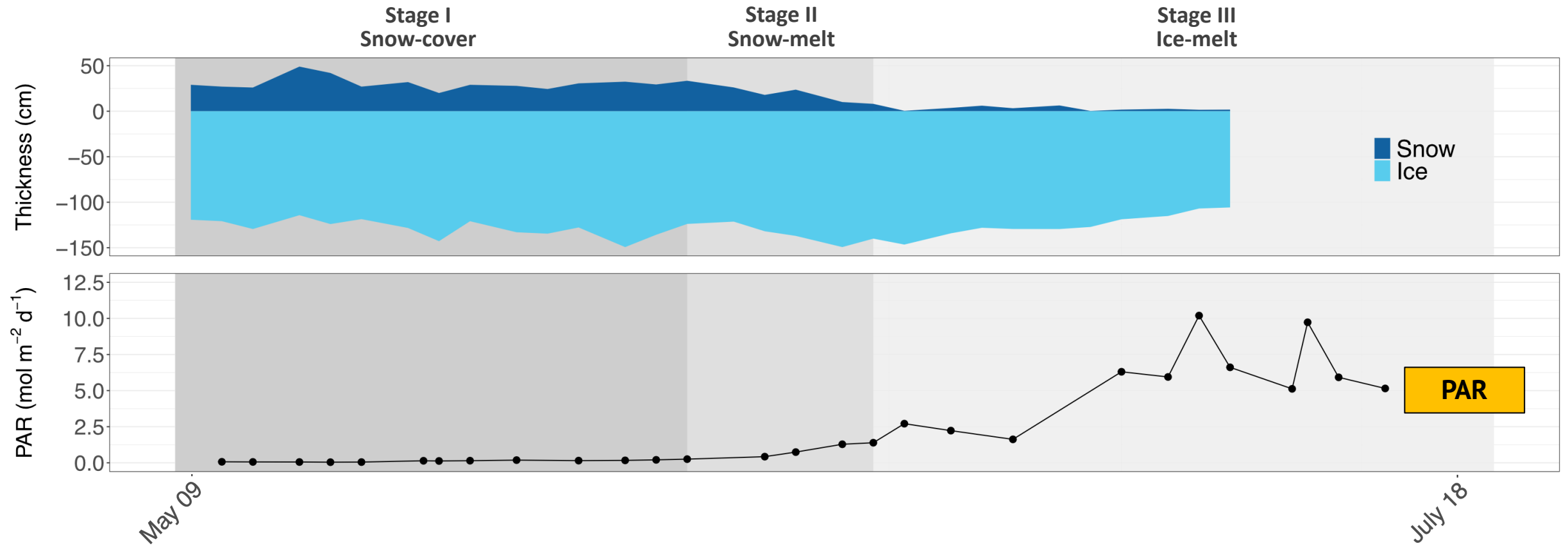


GreenEdge 2016 Ice camp

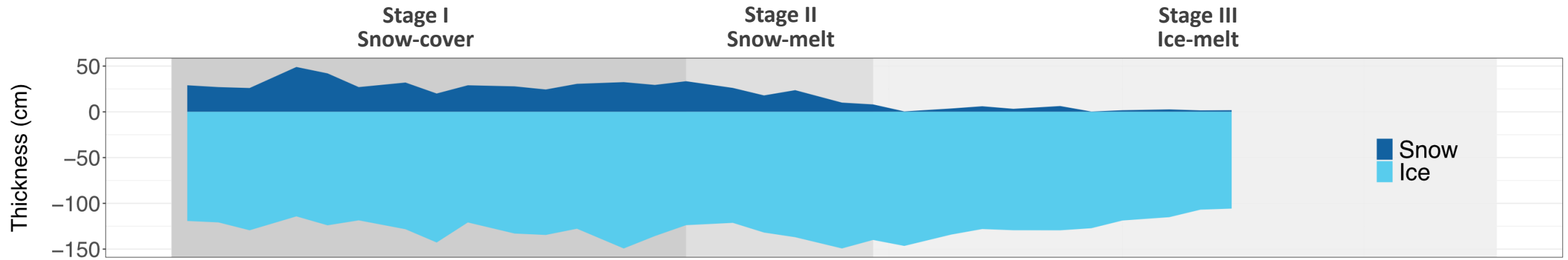
Environmental conditions



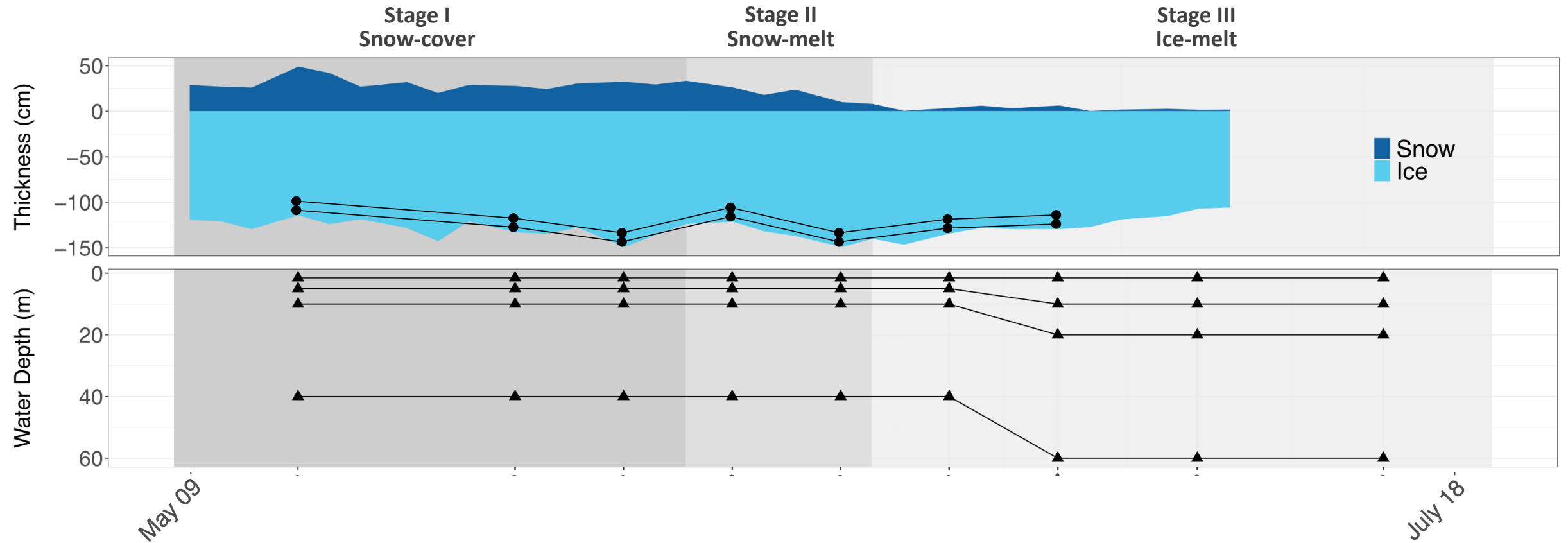
Environmental conditions



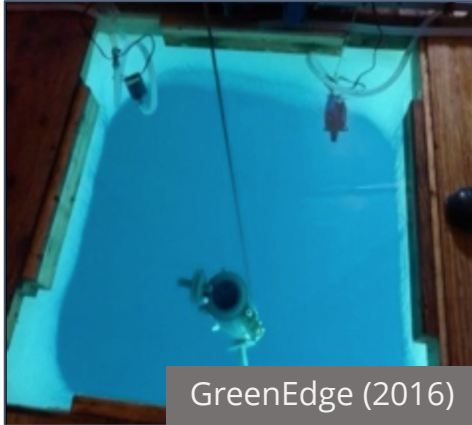
Ice and water sampling depths



Ice and water sampling depths



Metabarcoding of ice and water samples



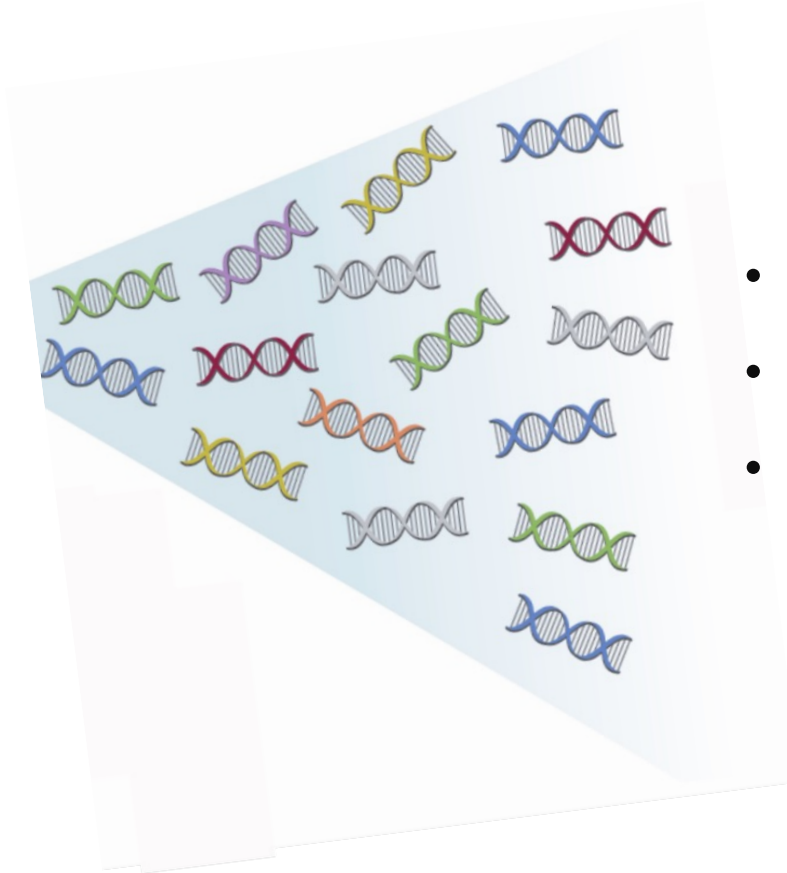
GreenEdge (2016)

Phytoplankton



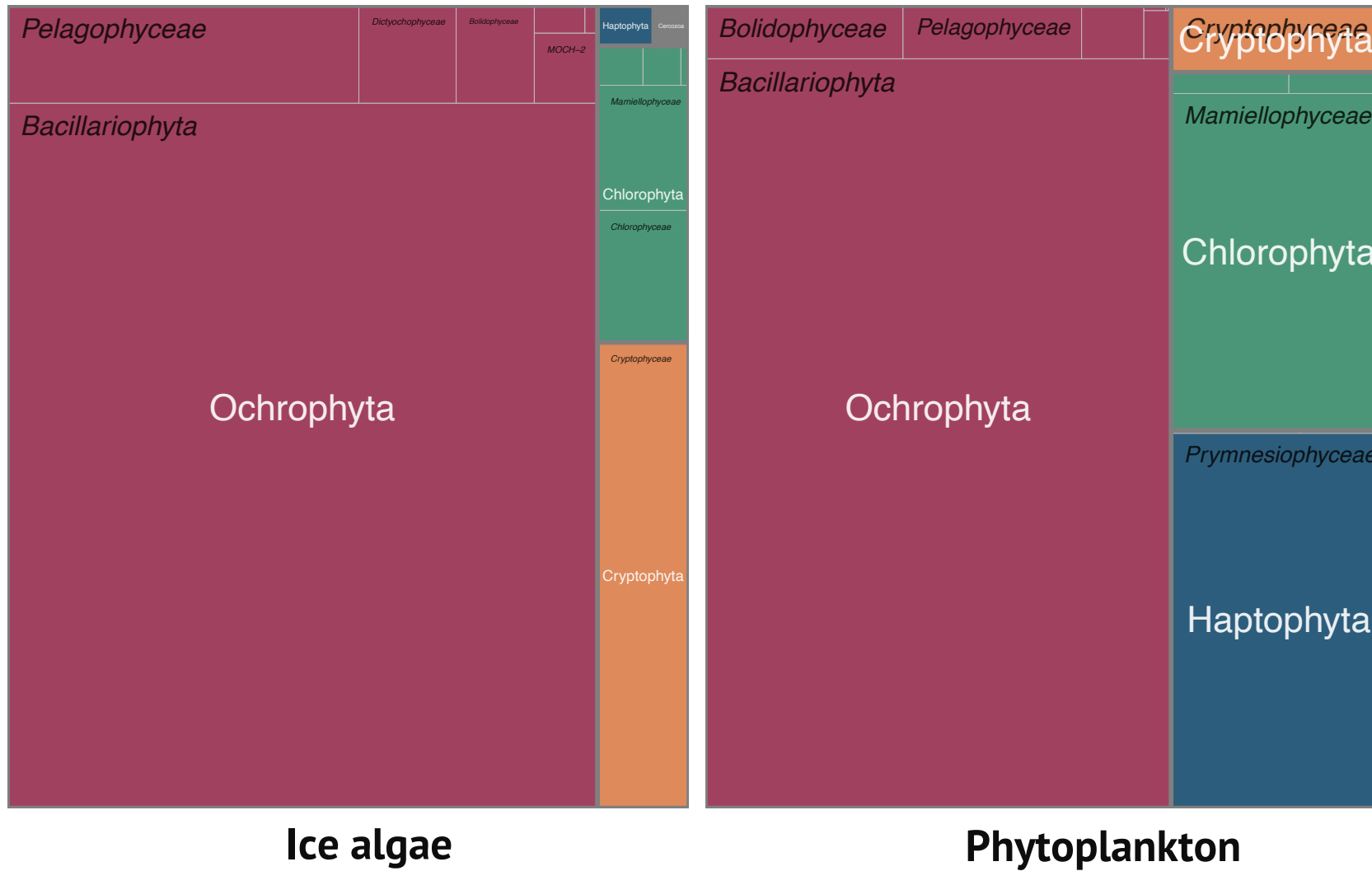
GreenEdge (2016)

Ice algae

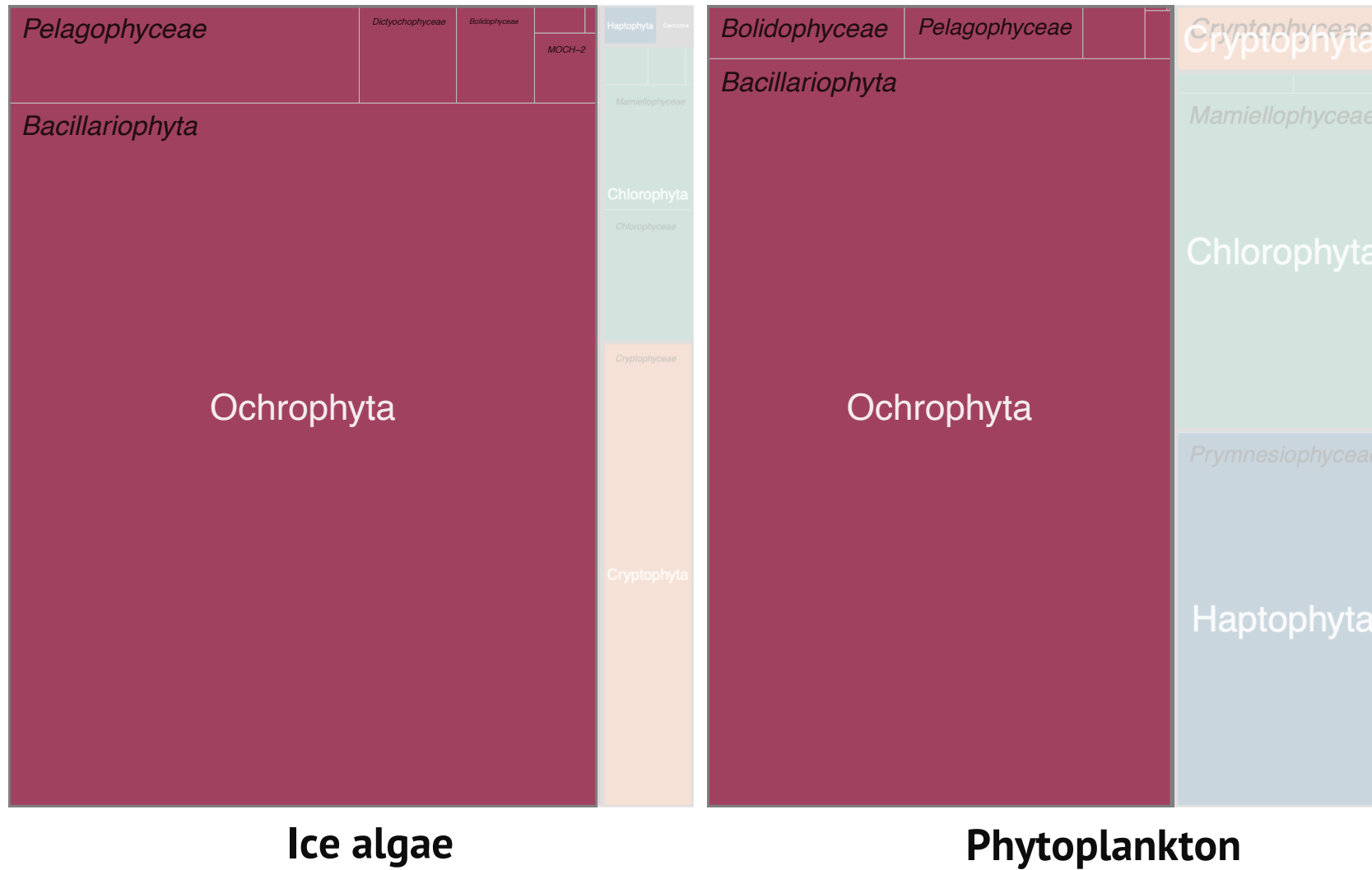


- 18S V4 rRNA
- Size fractionated
- ASVs assigned with PR²

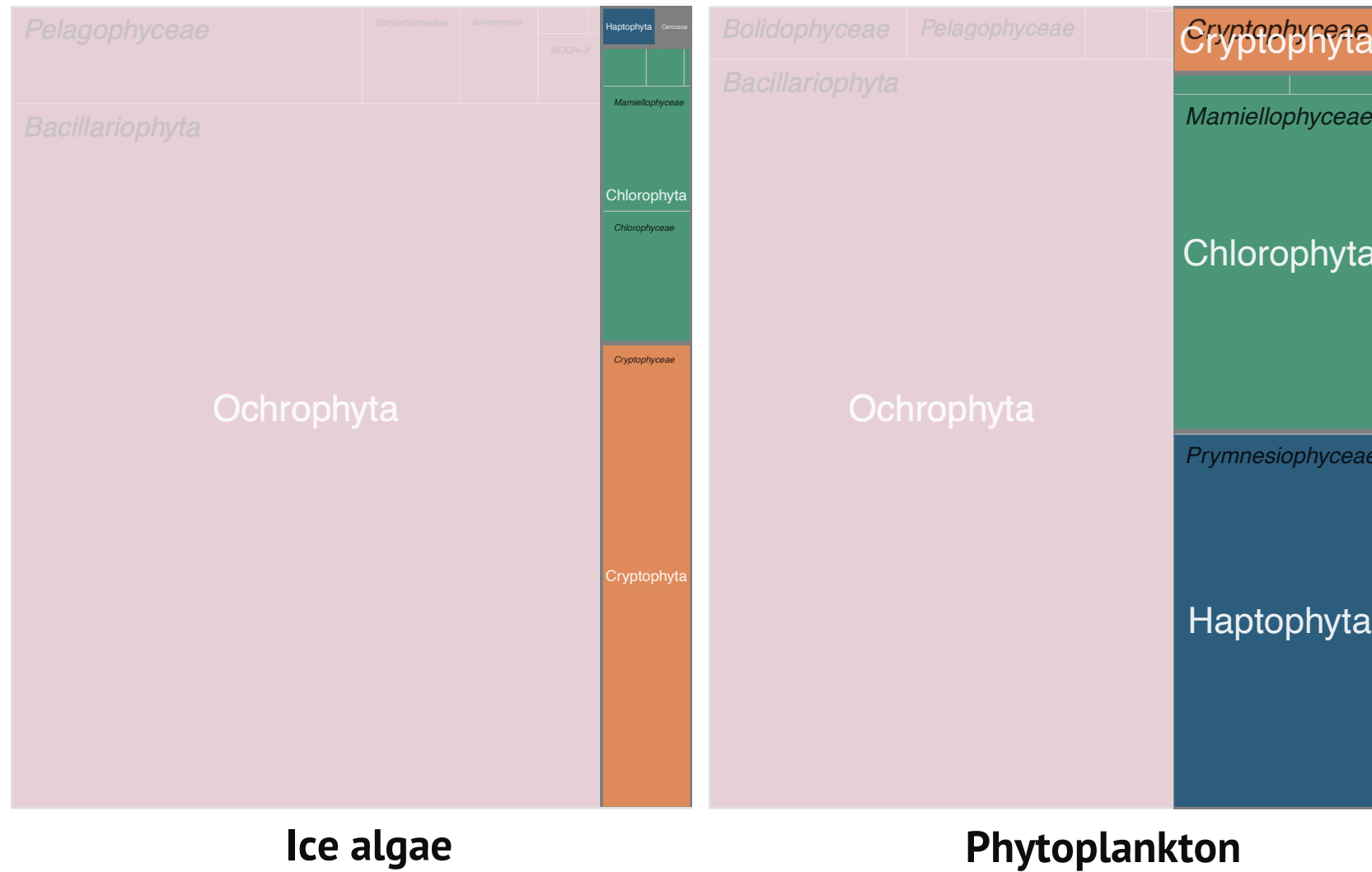
Overall community composition



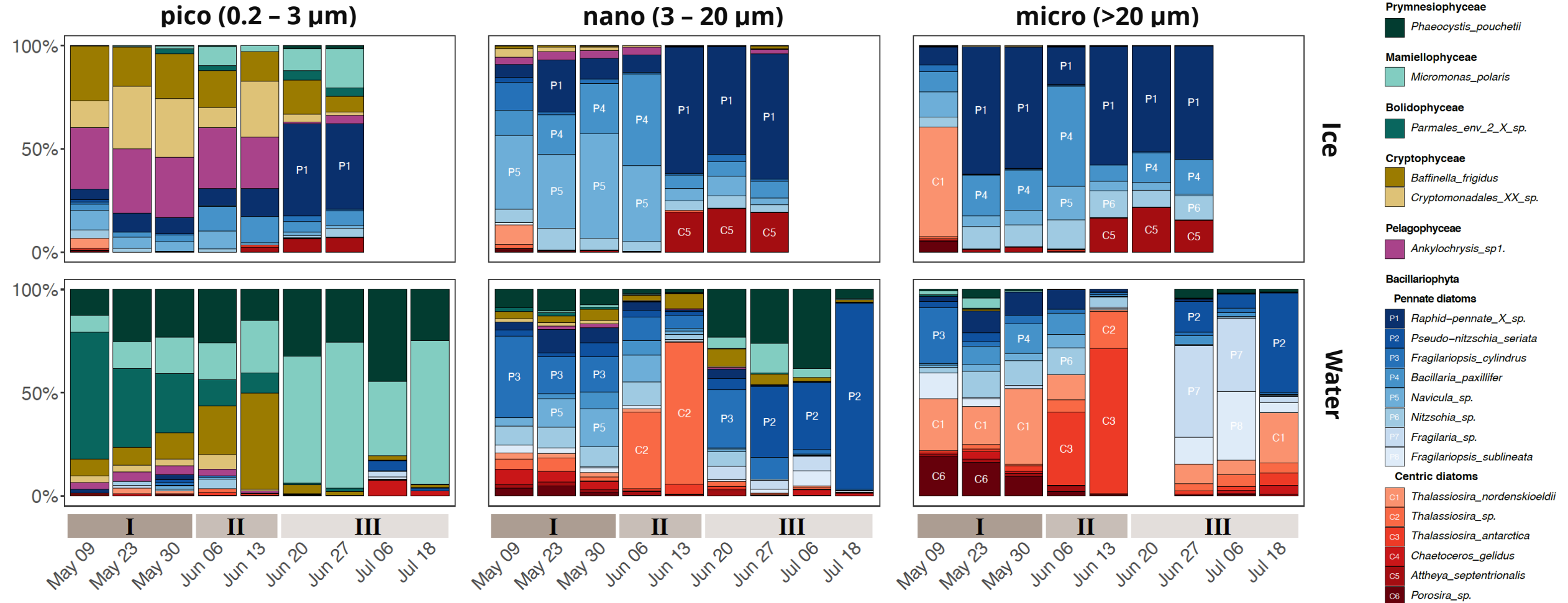
Both are dominated by diatoms



Contributions from Cryptophyceae, Mamiellophyceae, Prymnesiophyceae



Temporal evolution in ice and water



I : Snow-cover

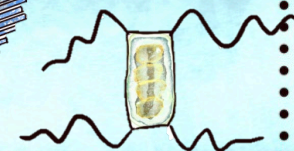
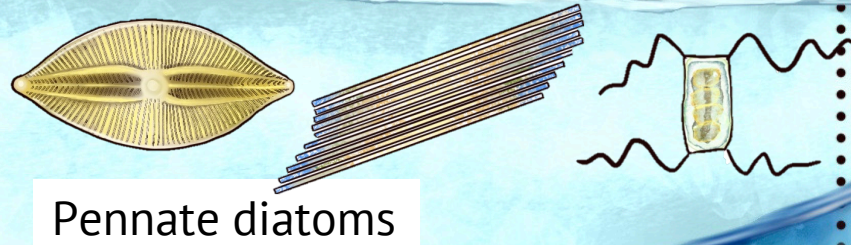
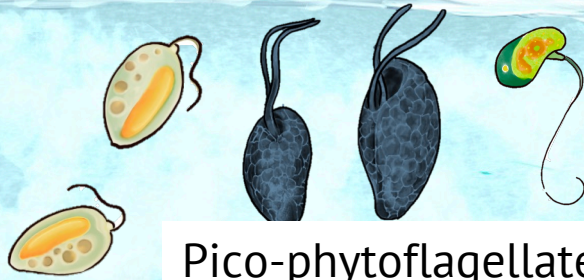
II : Snow-melt

III : Ice-melt

I : Snow-cover

II : Snow-melt

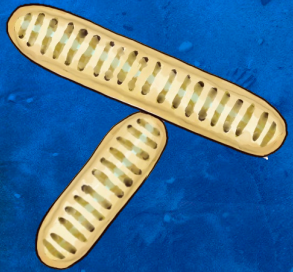
III : Ice-melt



I : Snow-cover

II : Snow-melt

III : Ice-melt



Pennate diatoms



Centric diatoms

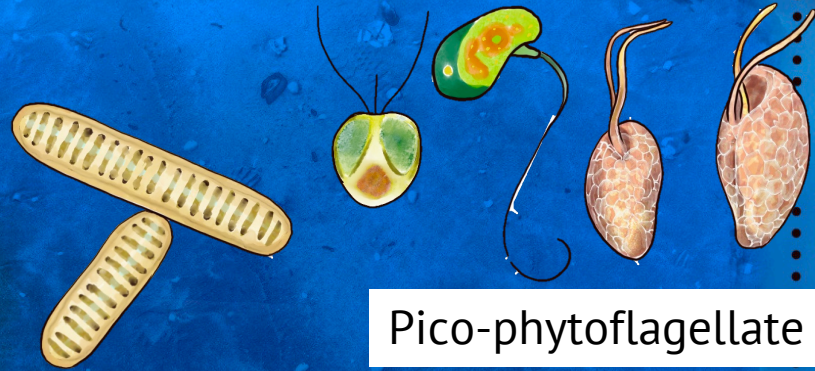


Pennate diatoms

I : Snow-cover

II : Snow-melt

III : Ice-melt



Pico-phytoflagellate

Pennate diatoms



Centric diatoms

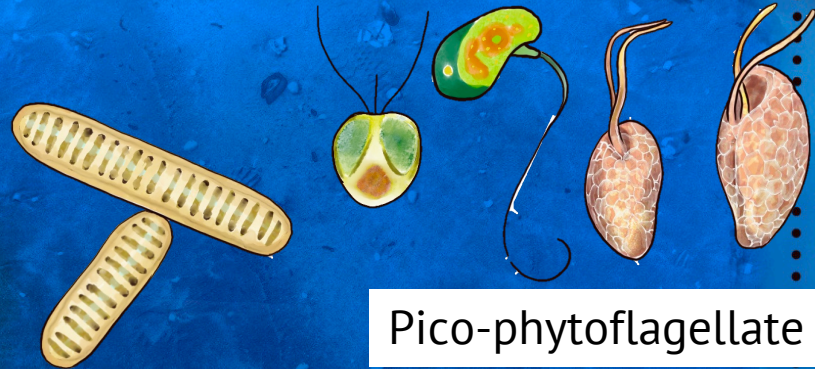


Pennate diatoms

I : Snow-cover

II : Snow-melt

III : Ice-melt

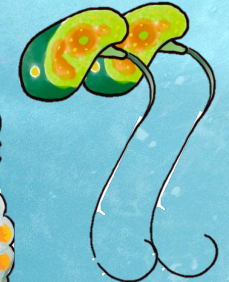


Pennate diatoms

Pico-phytoflagellate



Centric diatoms

Colonial
P. pouchetii*M. polaris*

Pennate diatoms

Research Question 2

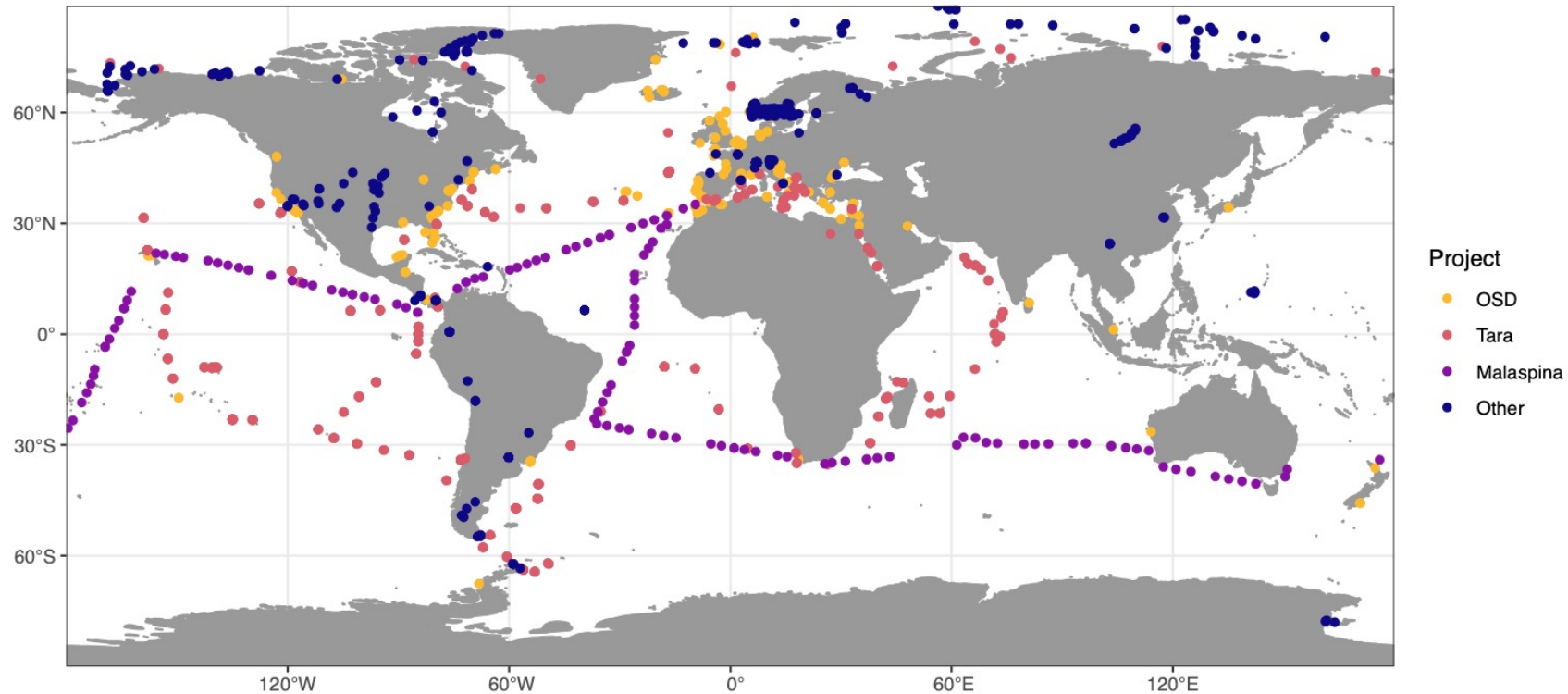
What are the biogeographical distributions of key algal taxa?



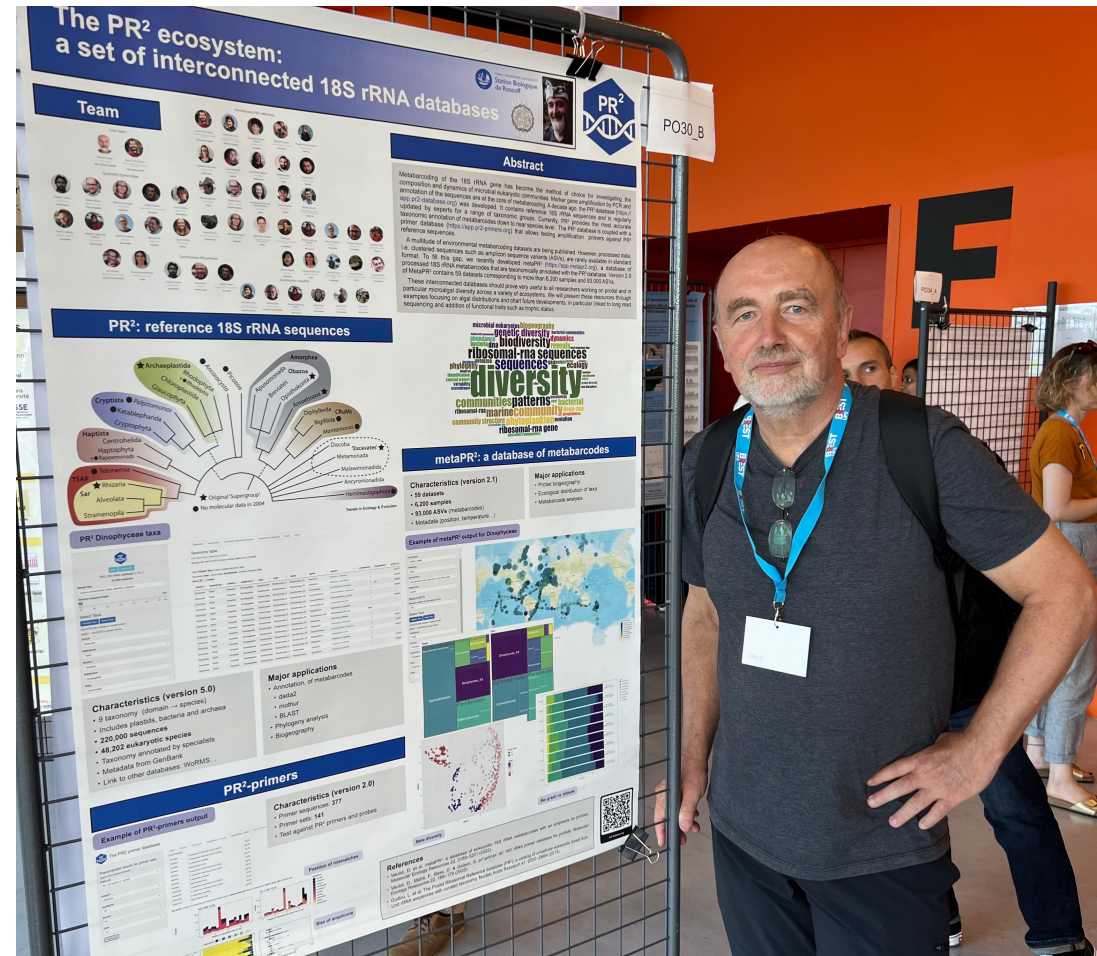
Metabarcoding samples in metaPR²

A database of processed 18S rRNA (V4 and V9) metabarcodes

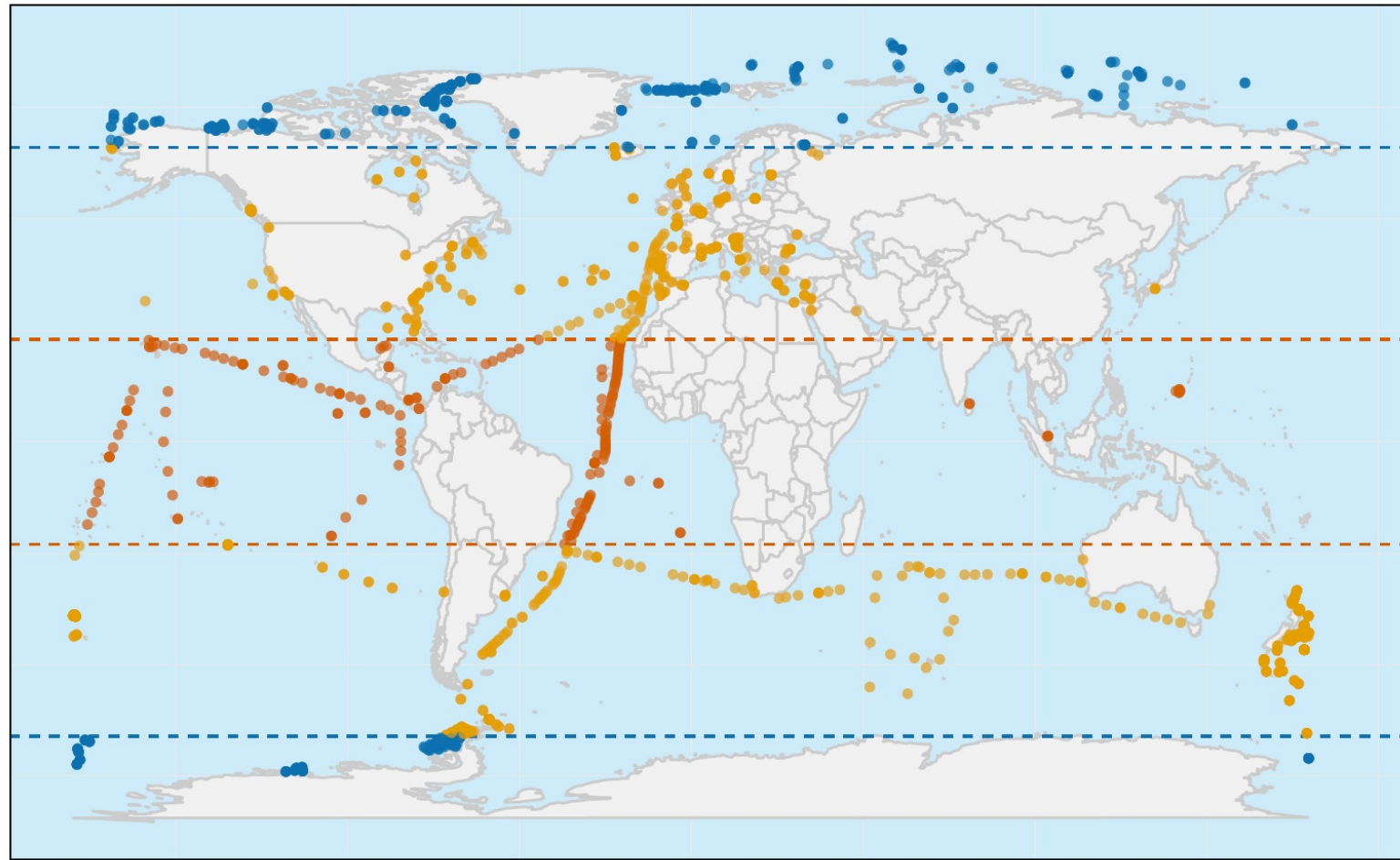
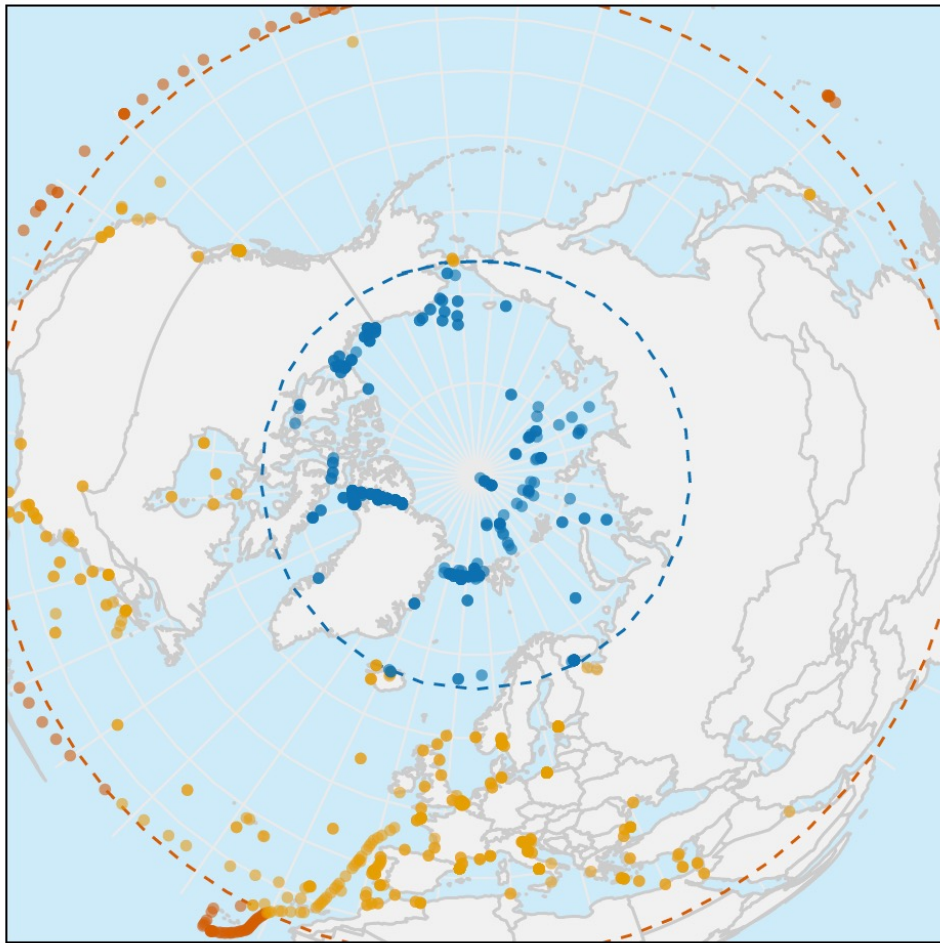
59 public datasets comprising 5800 samples and 92,000 ASVs



The PR² ecosystem PO30_B



Label metaPR² samples by latitude



● Polar

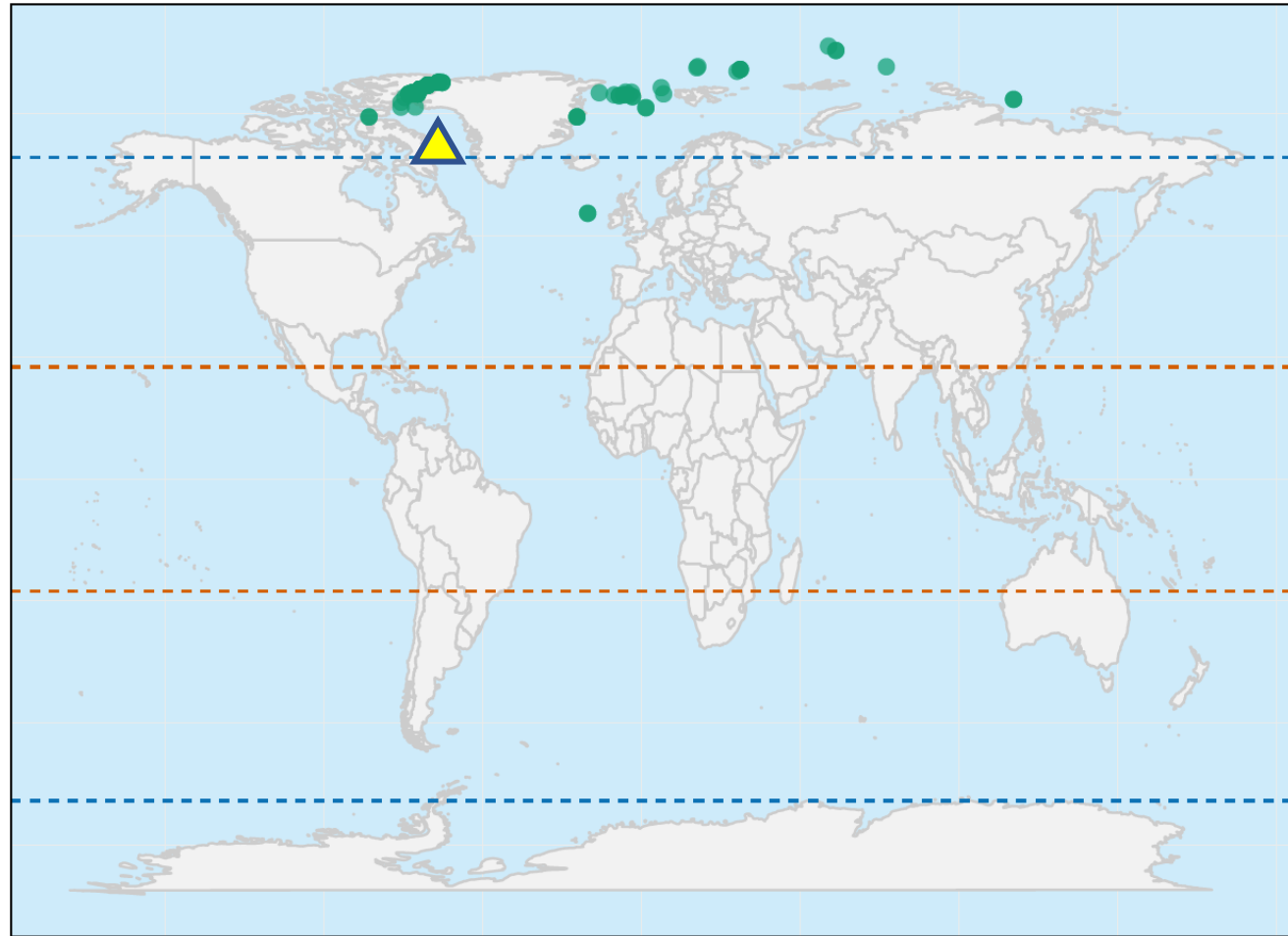
● Temperate

● Tropical

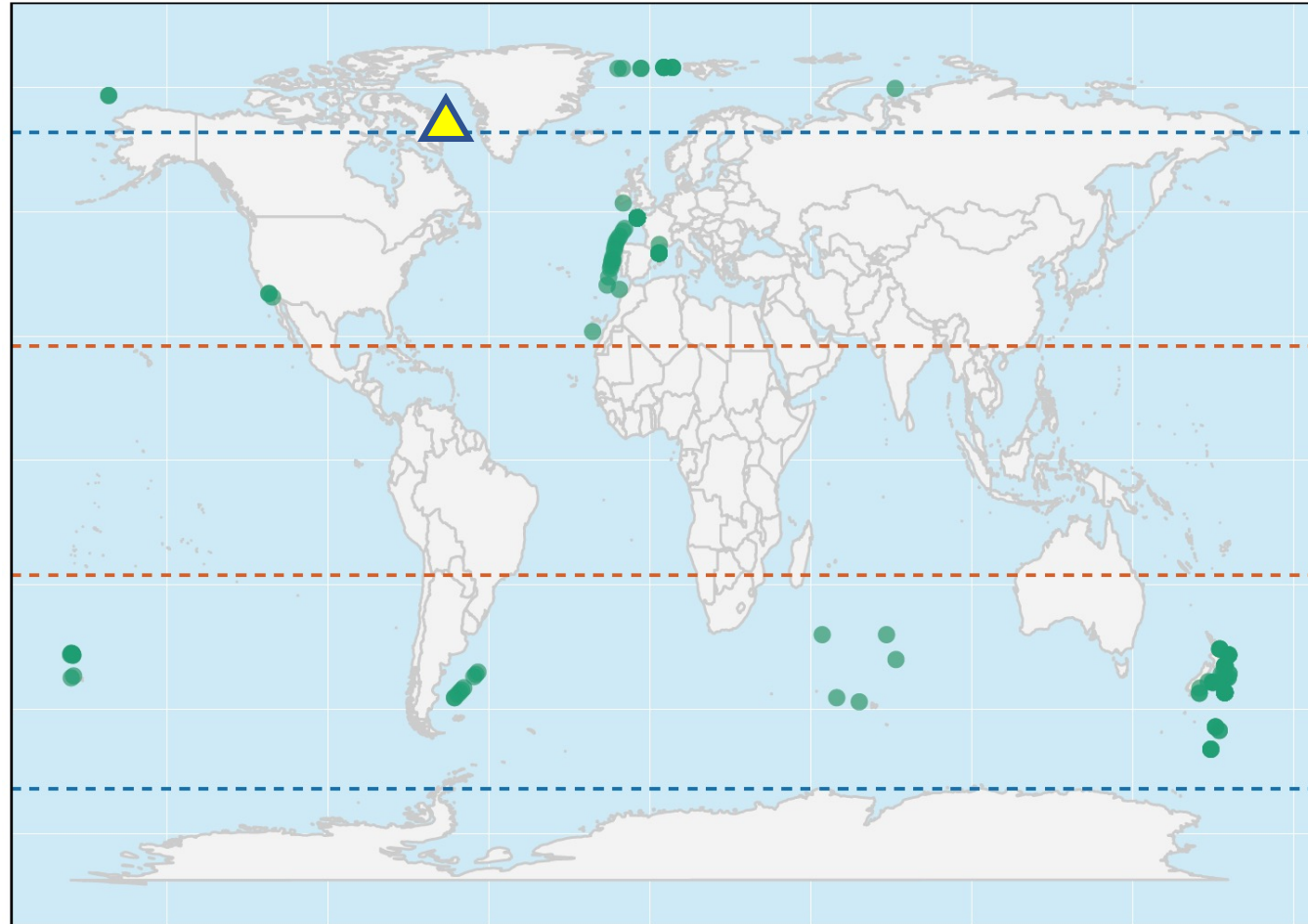
Determining the biogeography of our ASVs

Biogeography	ASV occurrence in samples
Polar	> 90% Polar
Polar-temperate	> 90% Polar + Temperate
Temperate	> 90% Temperate
Cosmopolitan	Polar, Temperate, Tropical > 0% each

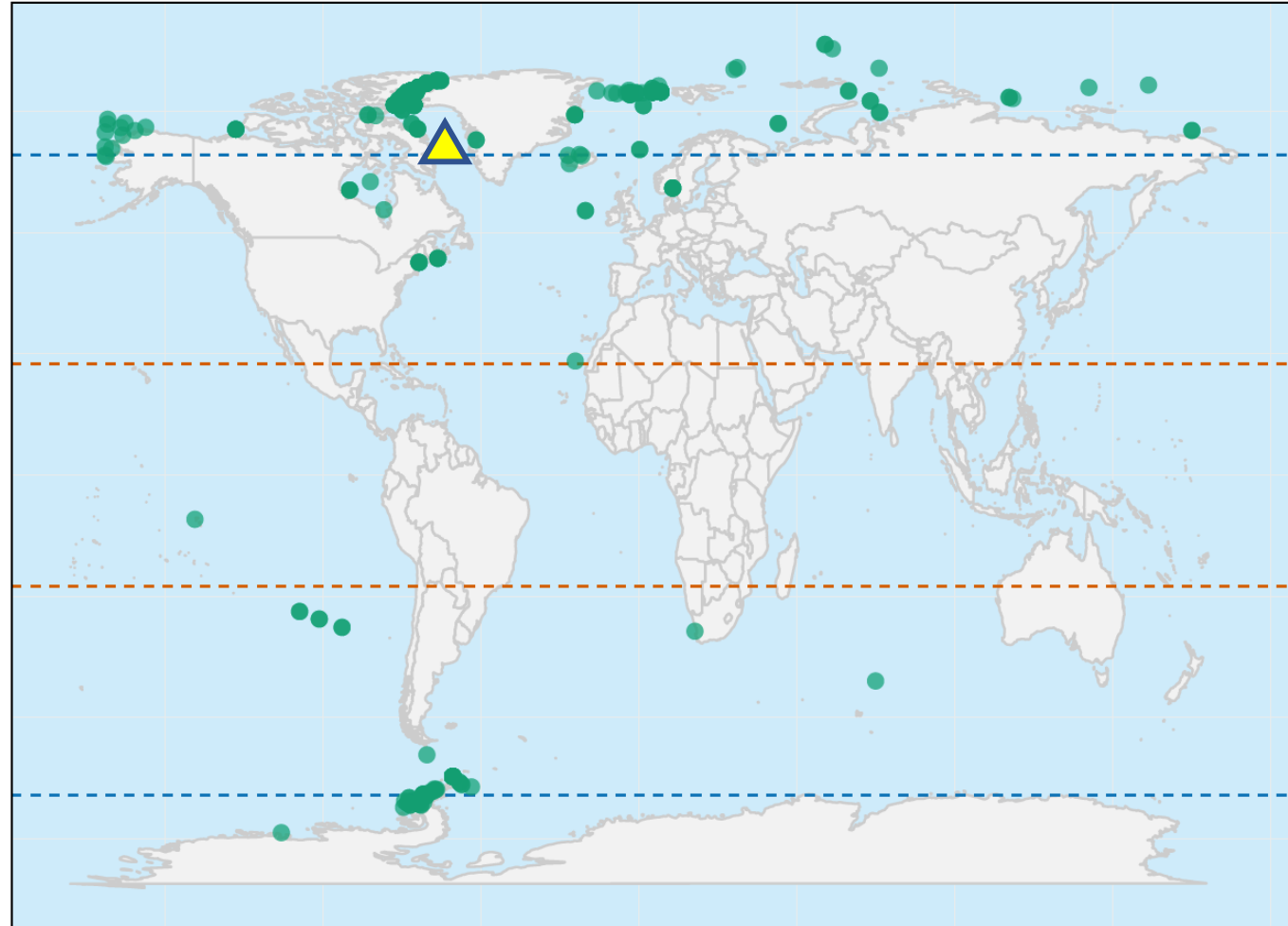
Polar ASV



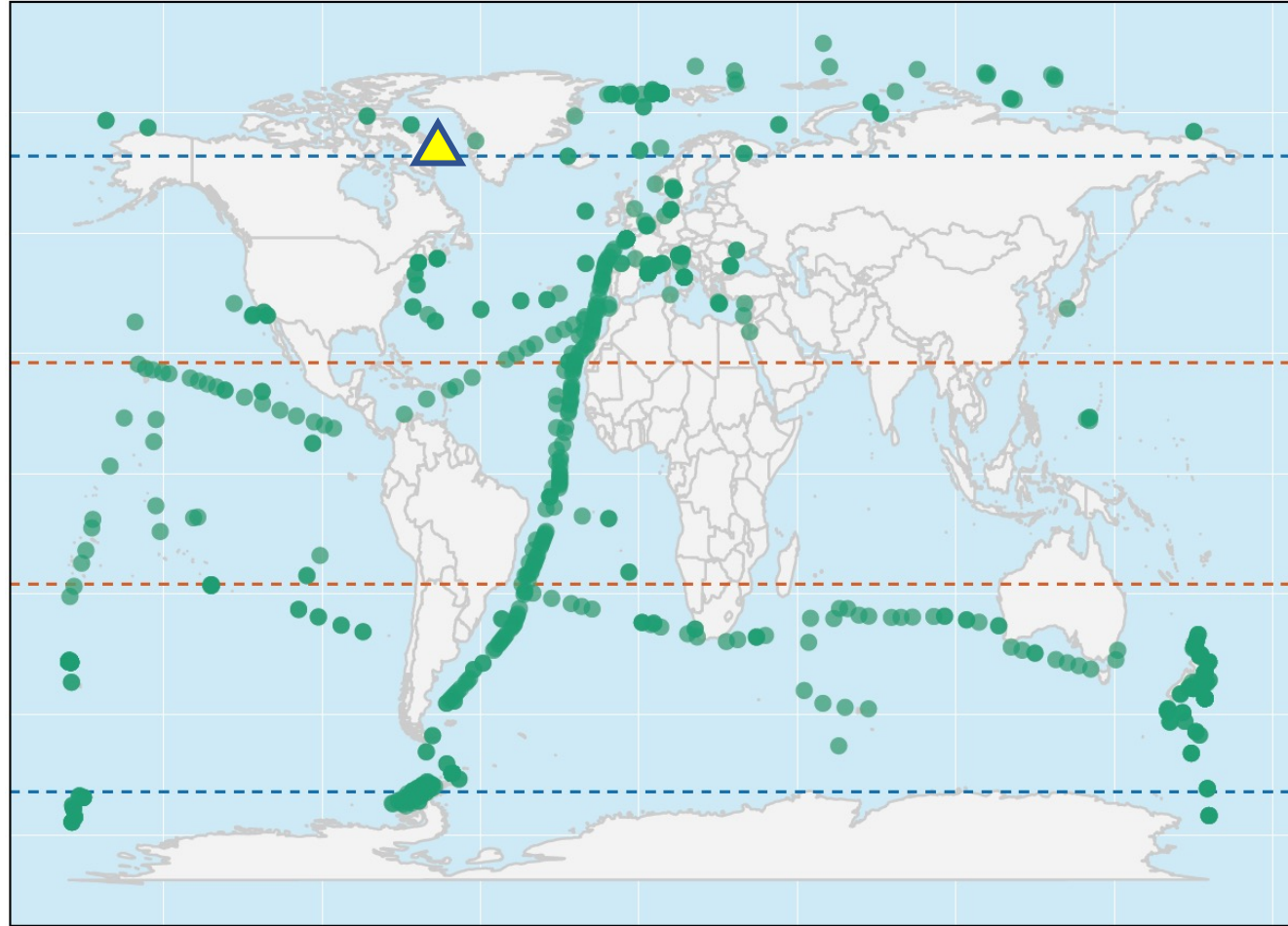
Temperate ASV



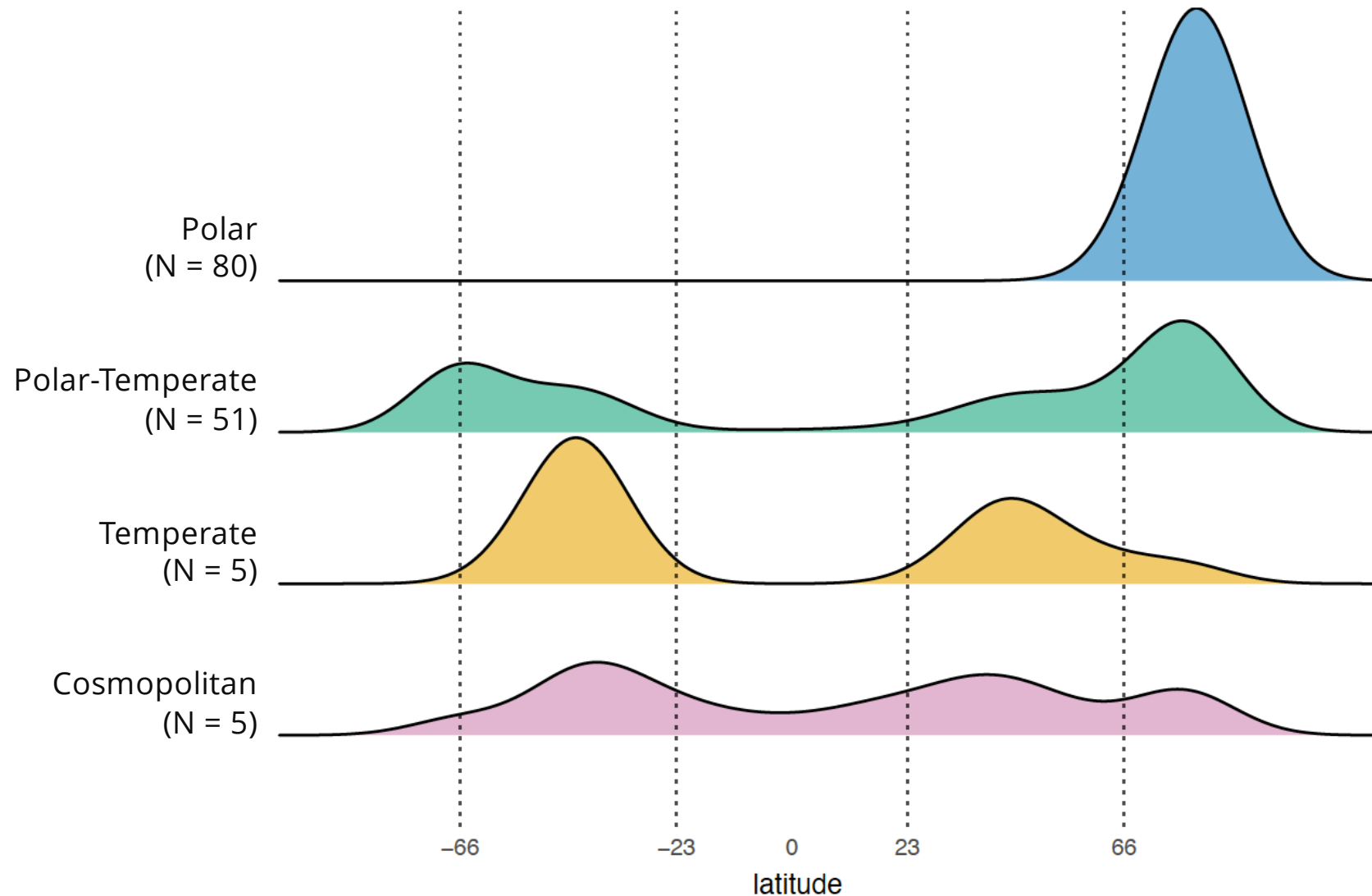
Polar-Temperate ASV



Cosmopolitan ASV

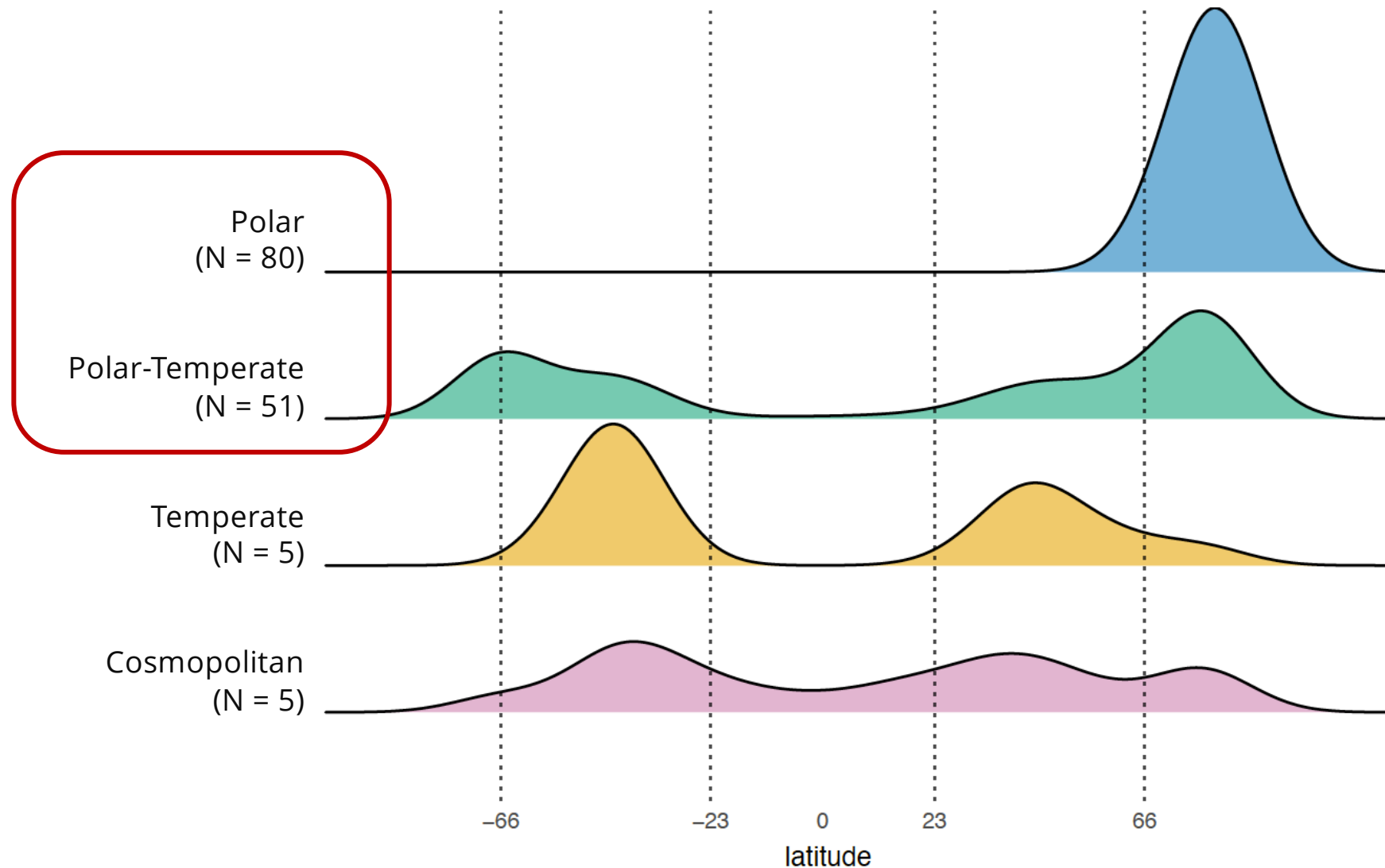


Biogeographical distribution of this study's ASVs (N)

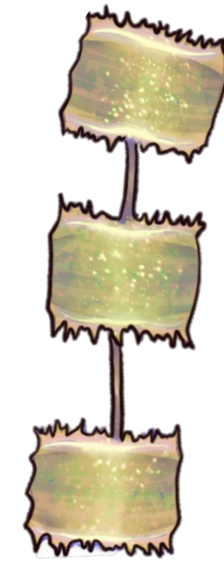
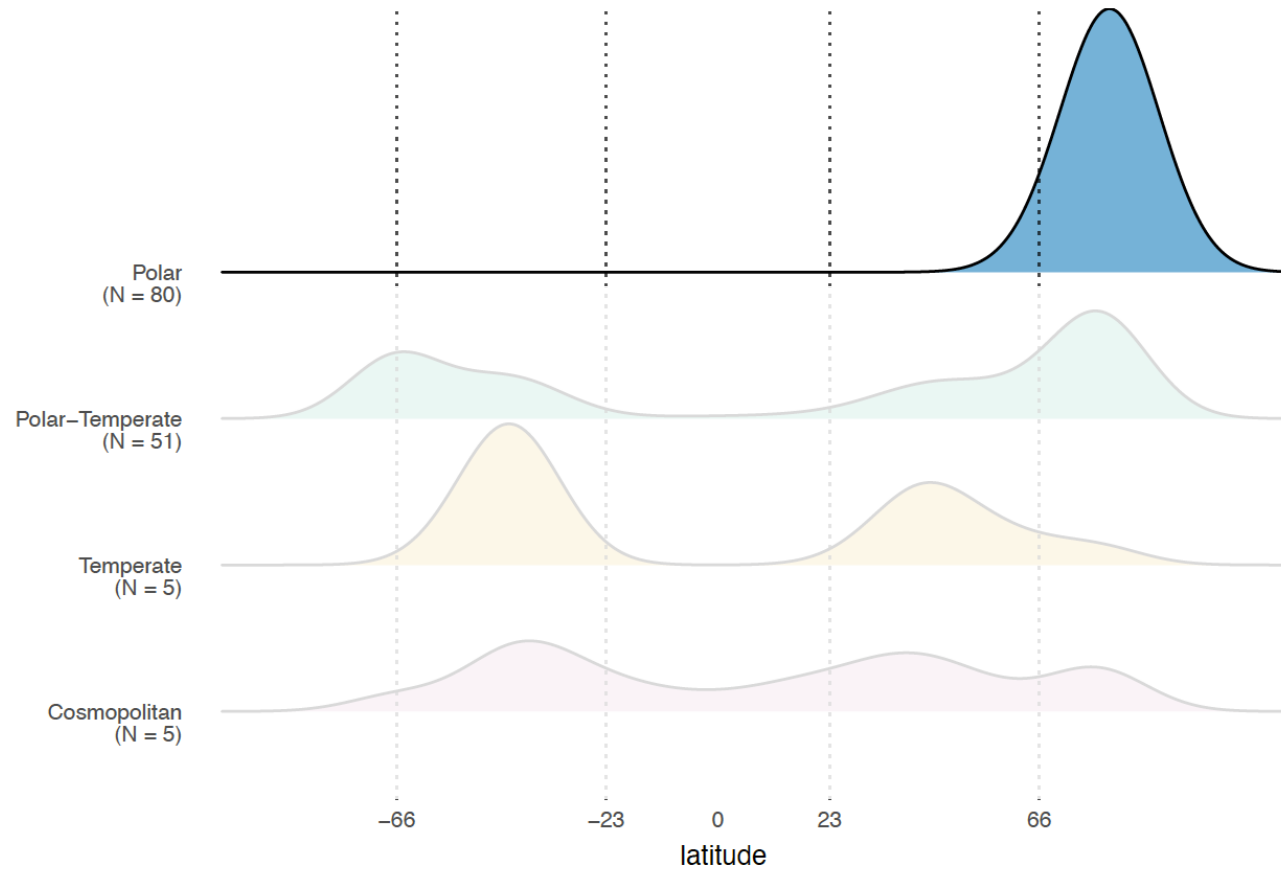


Biogeographical distribution of this study's ASVs (N)

>85% of
DNA reads



Biogeographical distribution of this study's ASVs

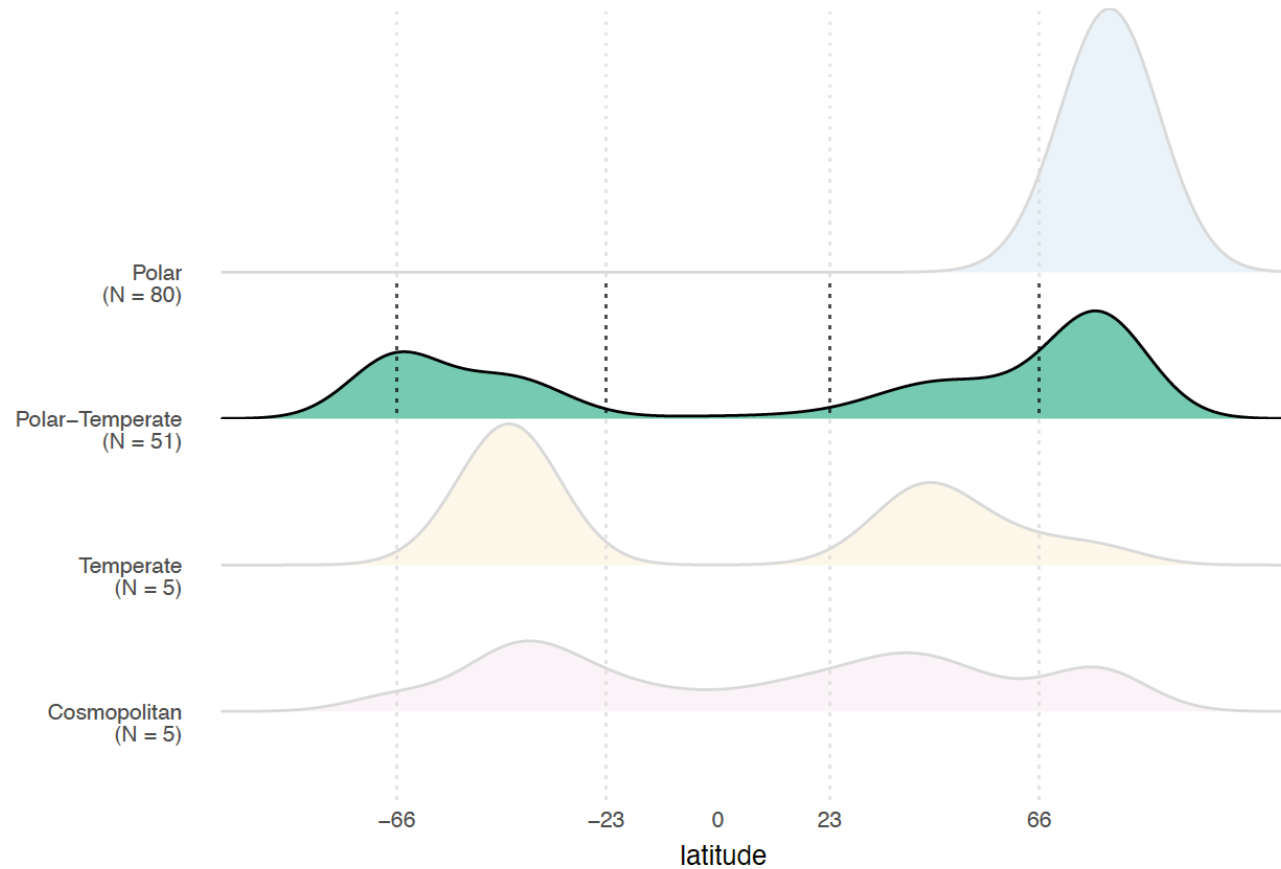


Thalassiosira spp.

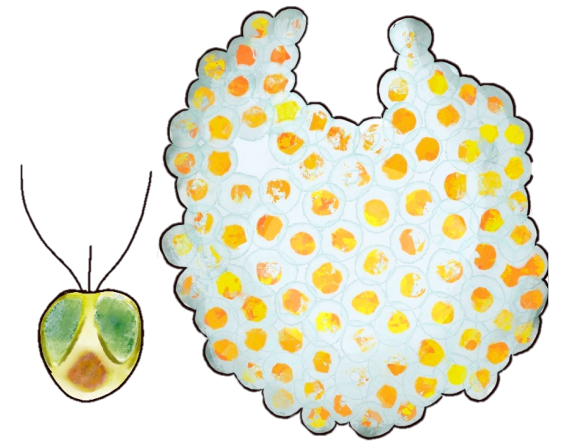


Baffinella frigidus

Biogeographical distribution of this study's ASVs



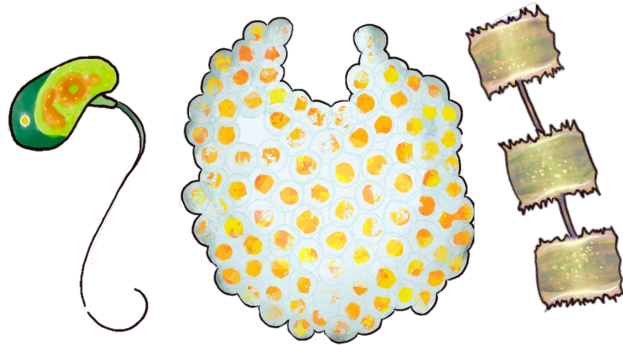
Micromonas polaris



Phaeocystis pouchetii

Summary of the under-ice bloom

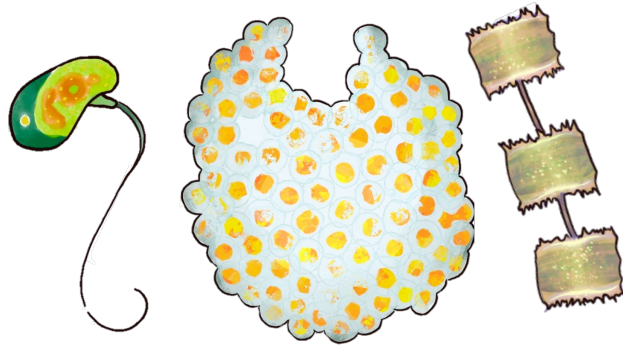
Summary of the under-ice bloom



Temporal dynamics

Dominated by pico-phytoflagellates
and diatoms (p-c-p succession)

Summary of the under-ice bloom



Temporal dynamics

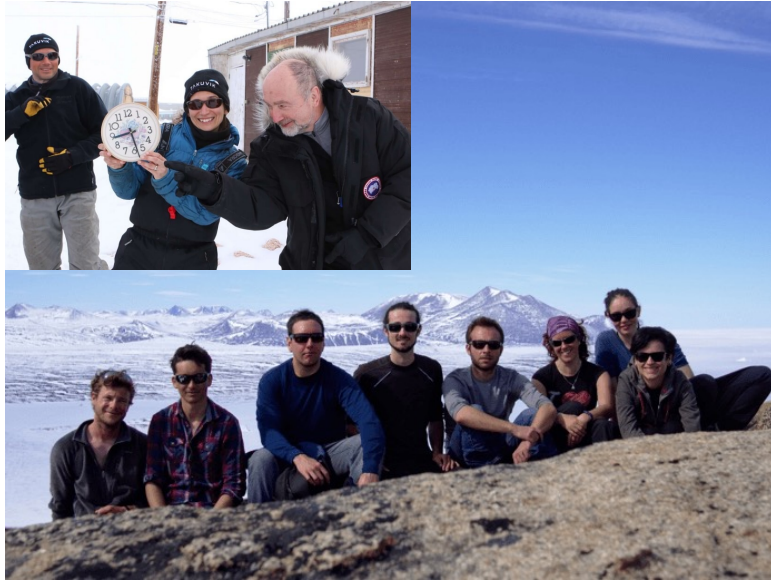
Dominated by pico-phytoflagellates and diatoms (p-c-p succession)



Biogeography

Mostly polar-restricted ASVs, but some of wider distributions

Acknowledgements



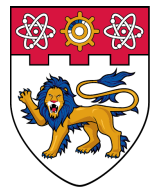
Green Edge Team



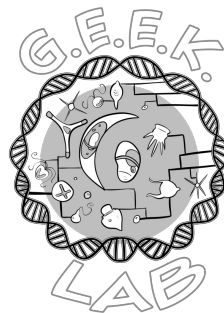
Geonomics and Ecology of Eukaryotes
GEEK Lab (NTU/Uio)



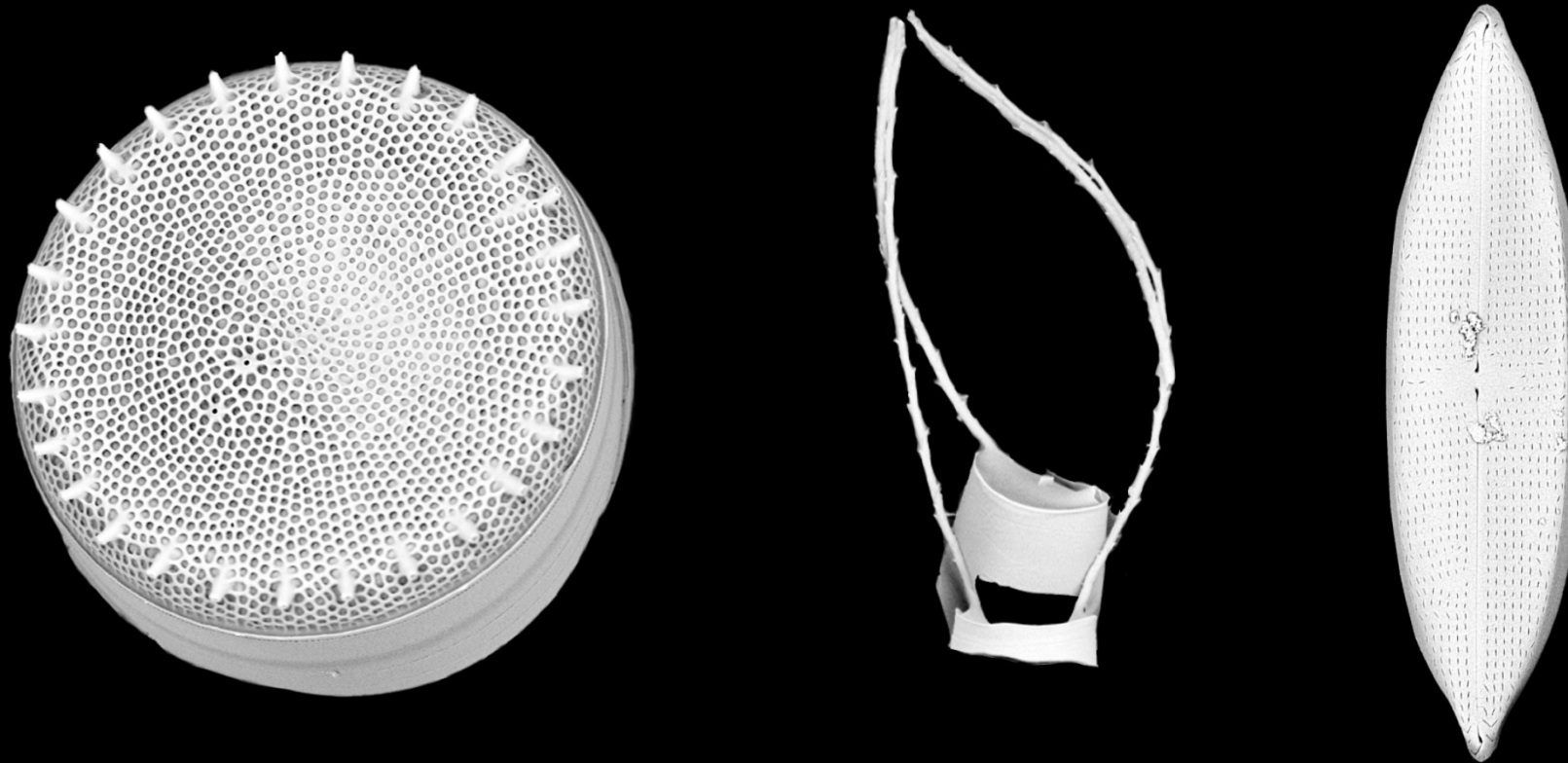
Roscoff Culture Collection,
Station Biologique de Roscoff



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**Station Biologique
de Roscoff**

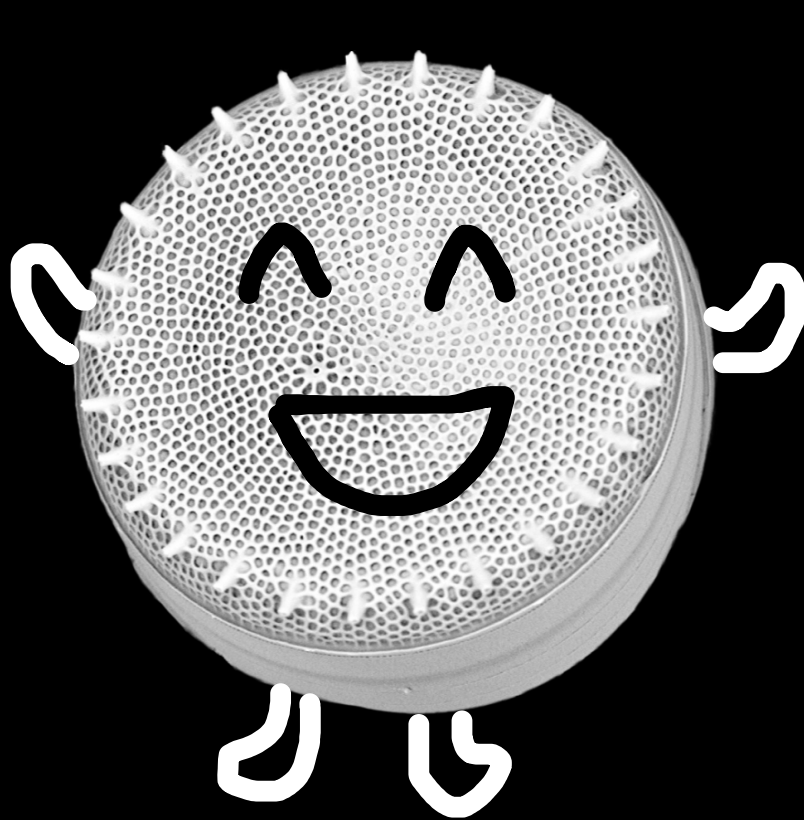


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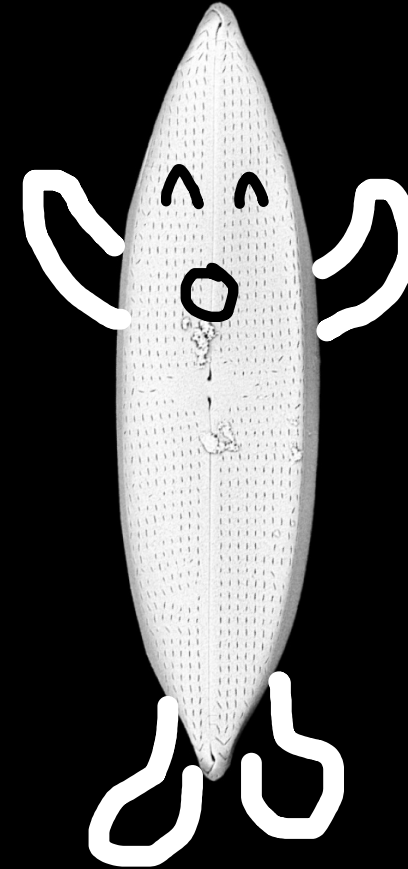
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Thank you!



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