ABC
Rovaniemi

Plankton key findings and information gaps

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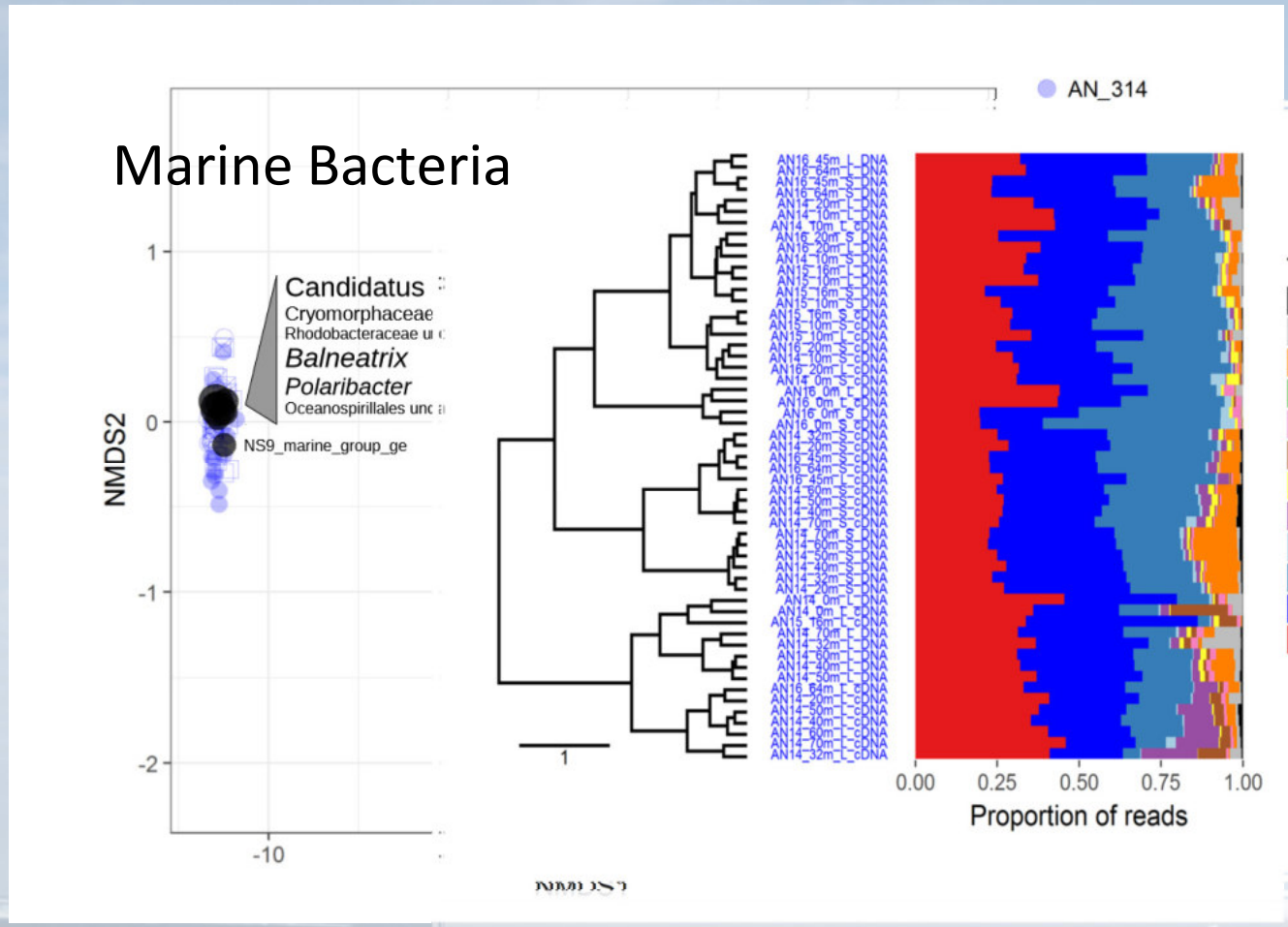
The Arctic is rich in endemic species:

Living in the Arctic year round requires specific adaptive traits

Same is true for microbial species.

Three years of August data, from one station off Cambridge Bay in



Same is true for phytoplankton & other microbial species.

Example: Novel cryptophyte

BAFFINELLA FRIGIDUS GEN. ET SP. NOV. (BAFFINELLACEAE FAM. NOV., CRYPTOPHYCEAE) FROM BAFFIN BAY: MORPHOLOGY, PIGMENT PROFILE, PHYLOGENY AND GROWTH RATE RESPONSE TO THREE ABIOTIC FACTORS

Daugbjerg, Niels; University of Copenhagen, Department of Biology Norlin, Andreas; University of Copenhagen, Department of Biology Lovejoy, Connie; Laval University, Biologie (in press, Journal of Phycology 2018

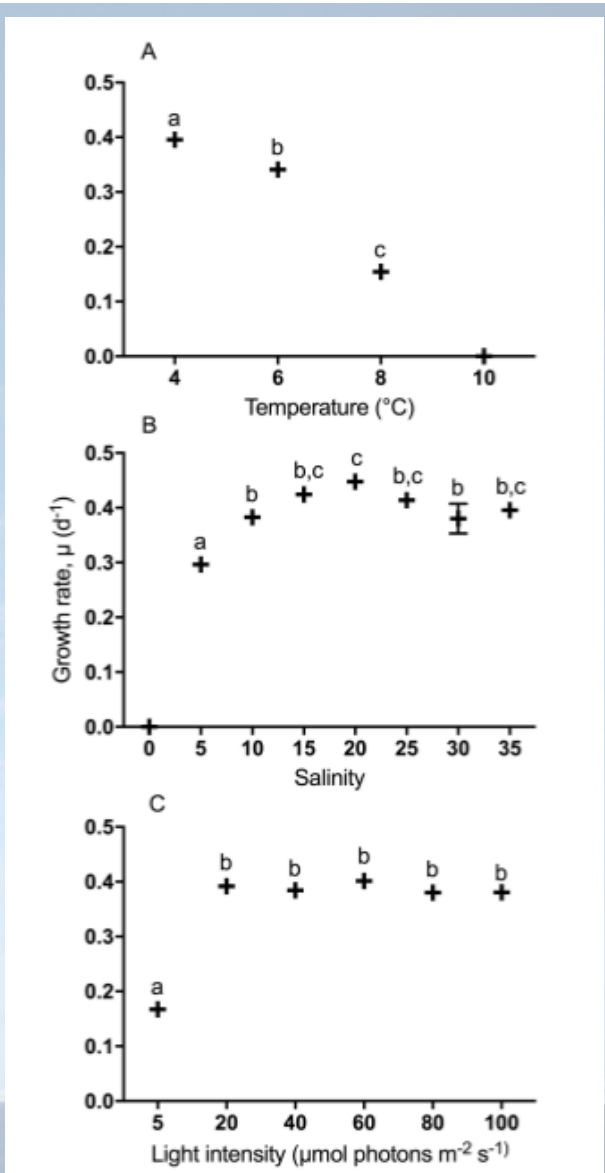


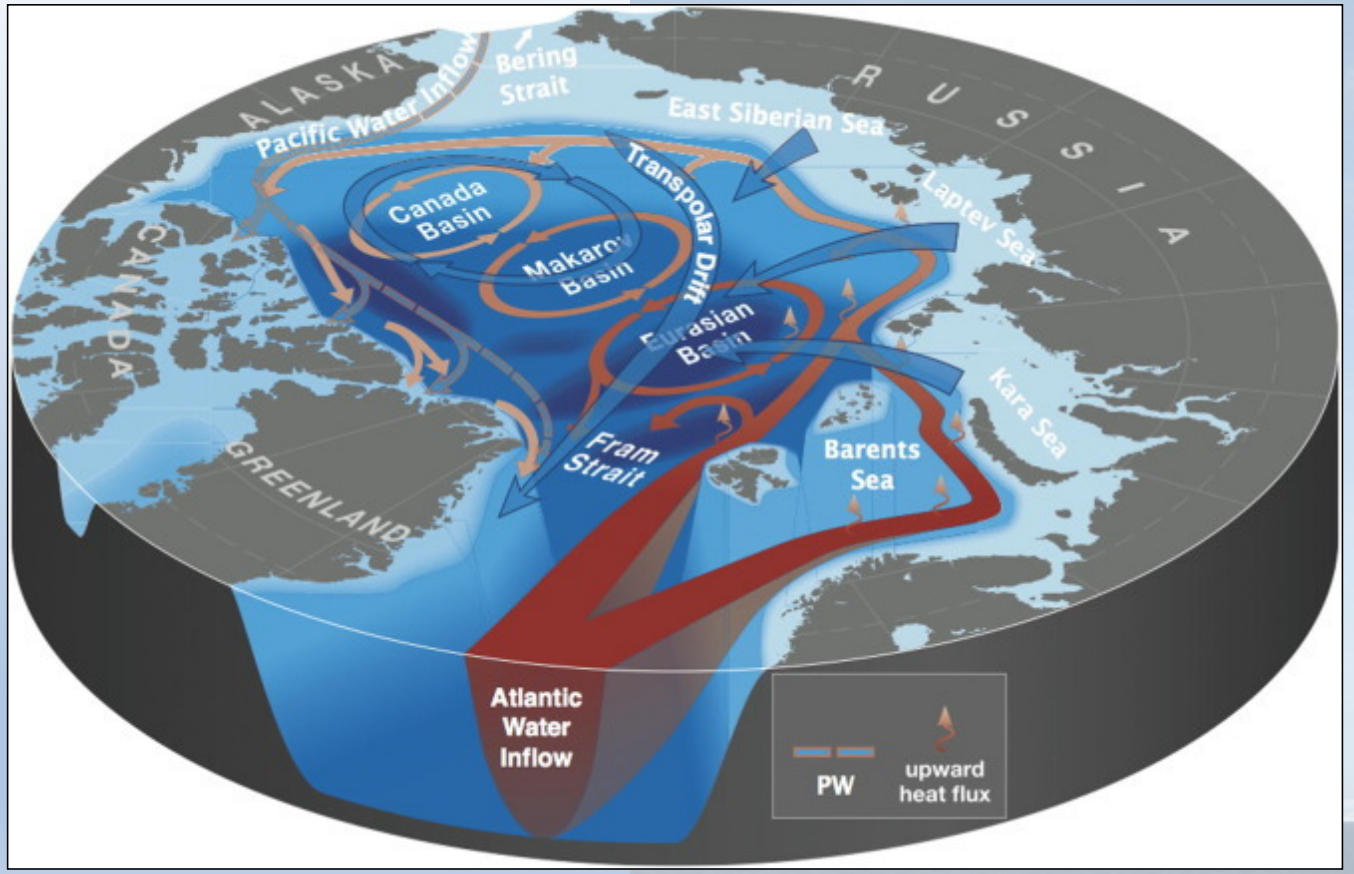
Figure 9

Reasons the Arctic might be rich in endemic species:

1) Physical Oceanography:
Inflows: Atlantic Water, Pacific Water, Rivers.
Outflows: Fram Strait, N. Baffin Bay

2) Long Residence times

3) Light Limitation



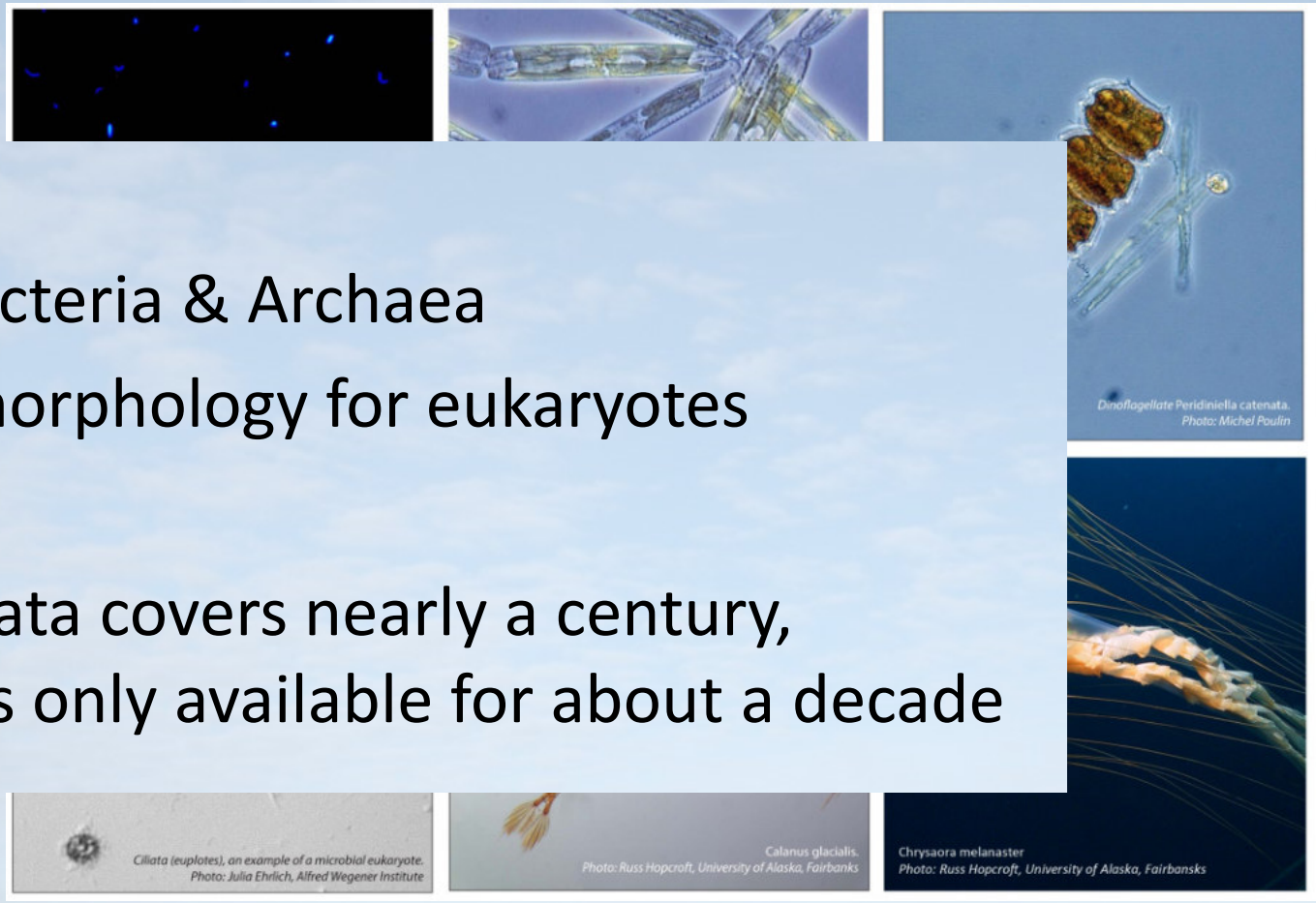
Wassmann *et al.*, The contiguous domains of Arctic Ocean advection: Trails of life and death. *Progress in Oceanography* **139**, 42-65 (2015).

State of Arctic Marine Biodiversity Report (SAMBR)

***Need for a framework to monitor biodiversity in the Arctic (CBMP)**
***The Arctic Council regions adopted by member nations**
***Based on dominant physical oceanographic processes**

http://www.caff.is/marine/marine-monitoring-plan

Full spectrum of planktonic life: 0.2µm to 2⁺m



Microbes :

Molecular for Bacteria & Archaea

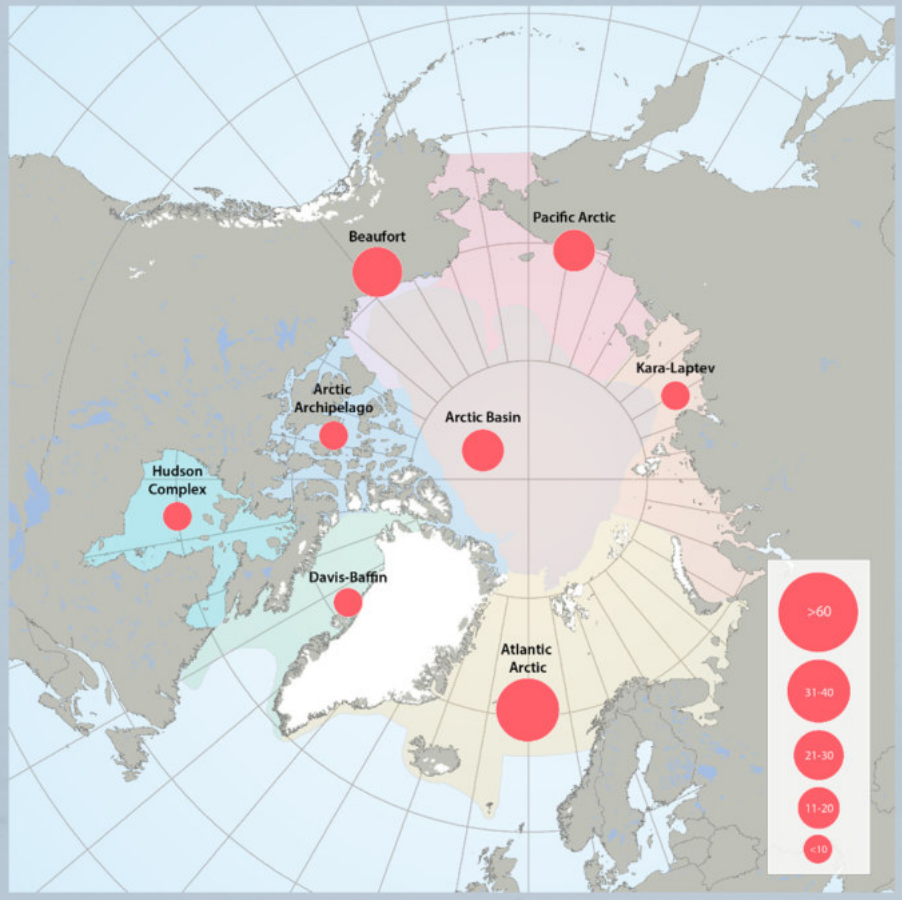
Molecular and morphology for eukaryotes

Metazoans:

Morphological data covers nearly a century,
Molecular data is only available for about a decade

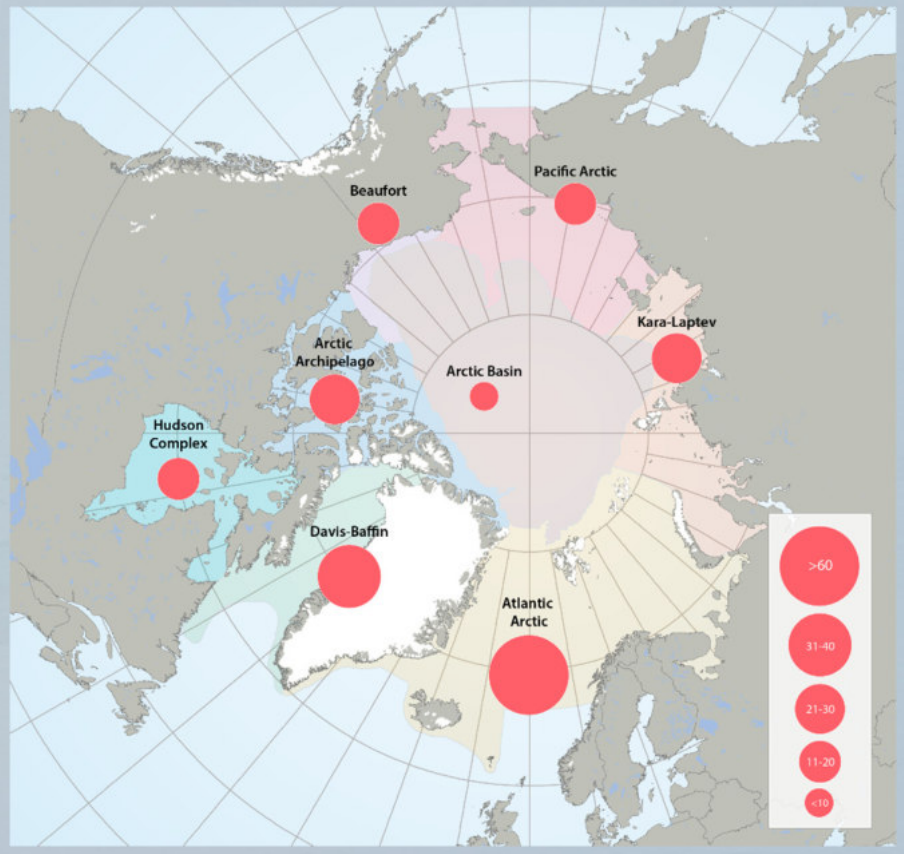
Approach

- Spatial data coverage
- Temporal coverage
  - seasonal
  - interannual/long-term
- Taxonomic resolution/quality
- Gaps



Map of high throughput sequencing records from the Arctic Marine Areas. (2016)

Map of records of phytoplankton taxa using



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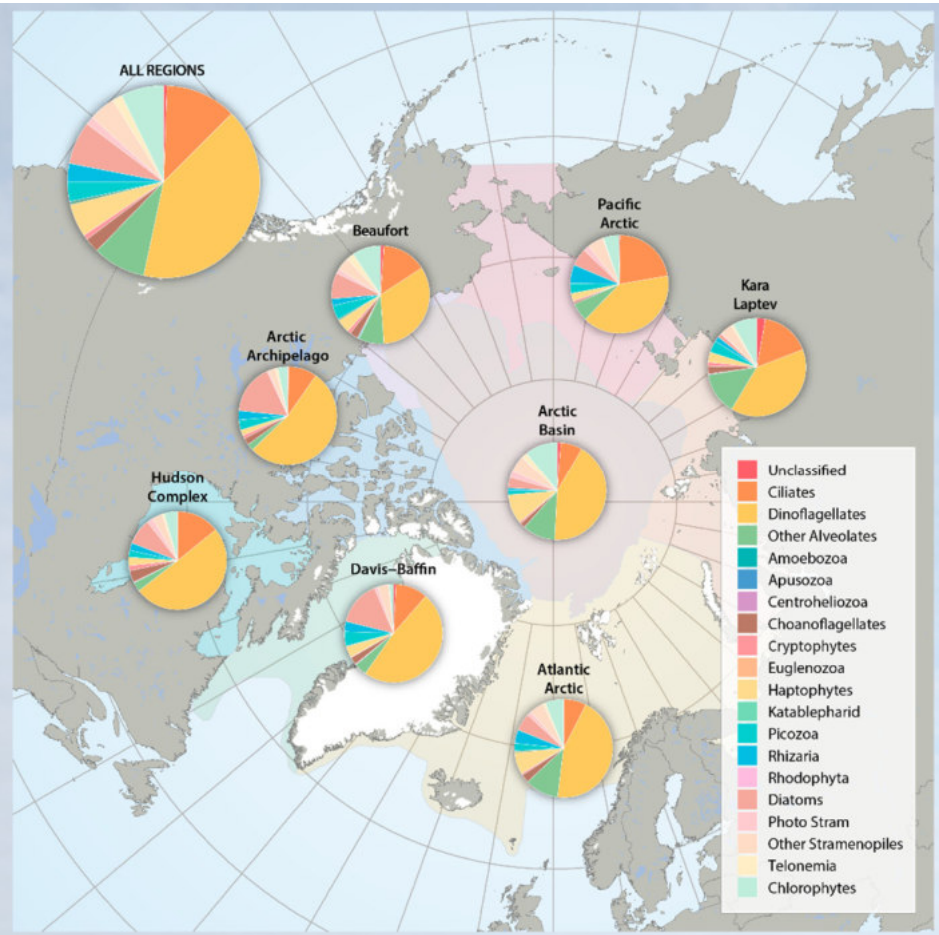
Conservation of Arctic Flora and Fauna



Relative abundance of major eukaryote taxonomic groups found by high throughput sequencing of the small-subunit (18S) rRNA gene across Arctic areas.

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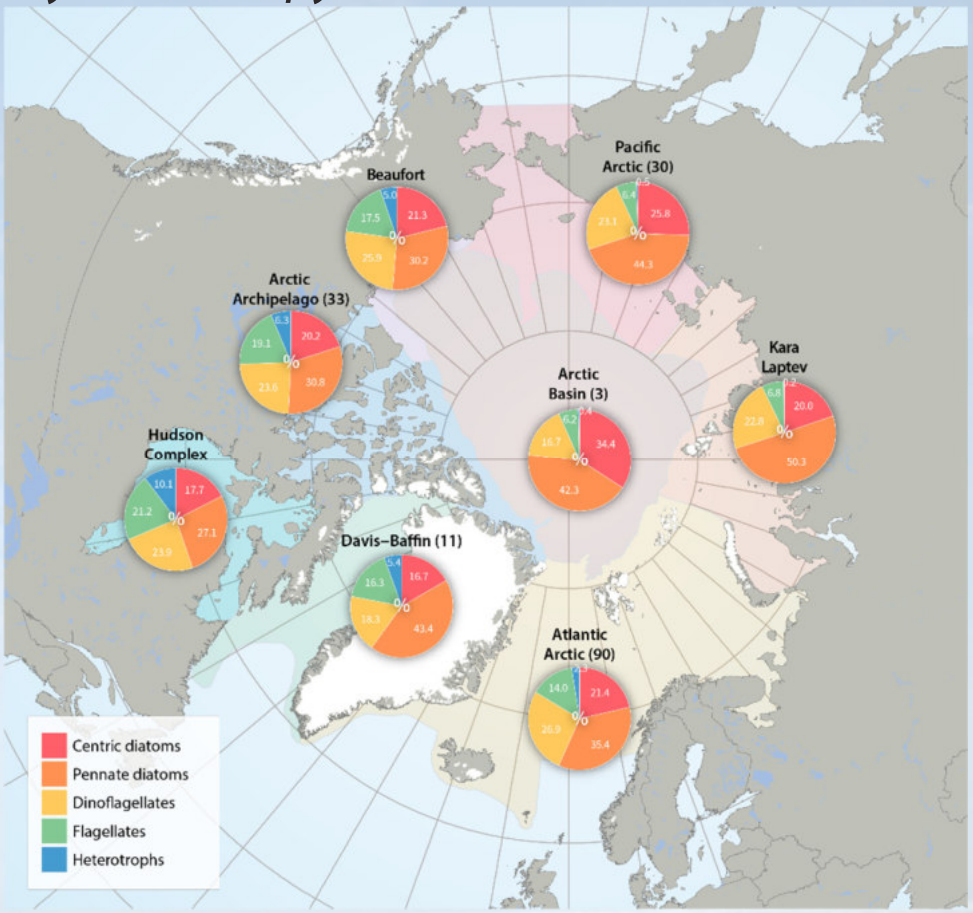
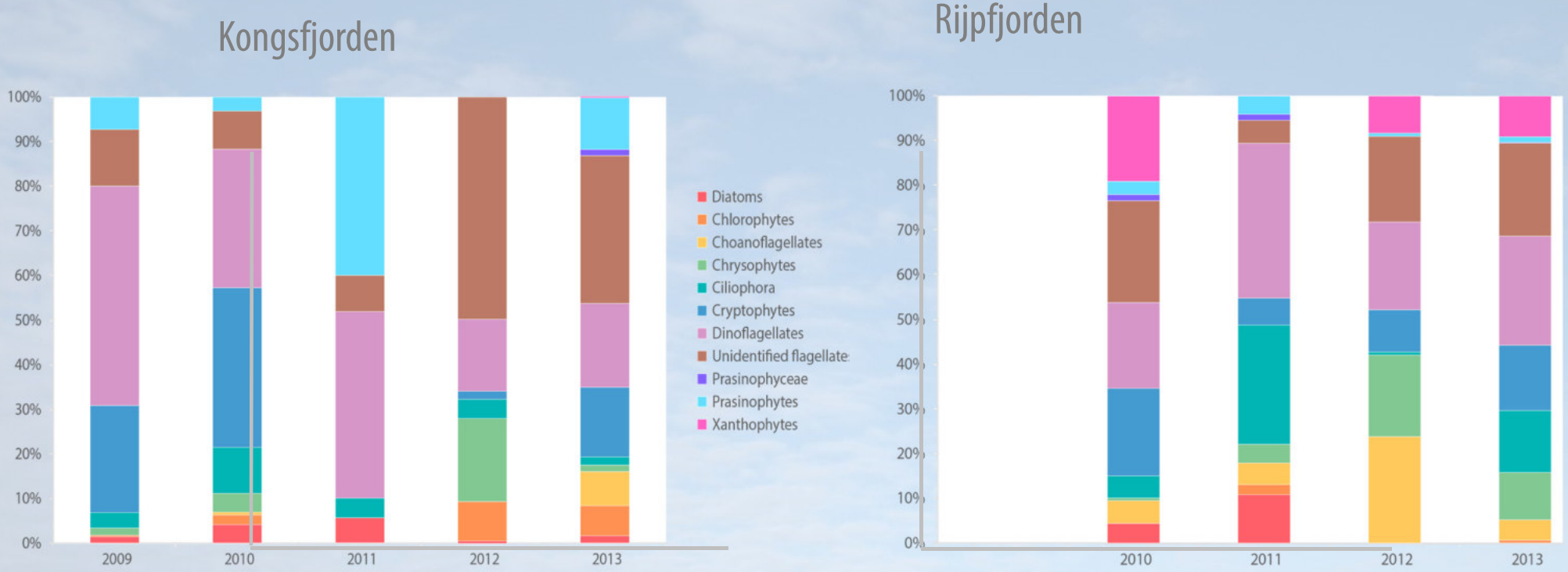
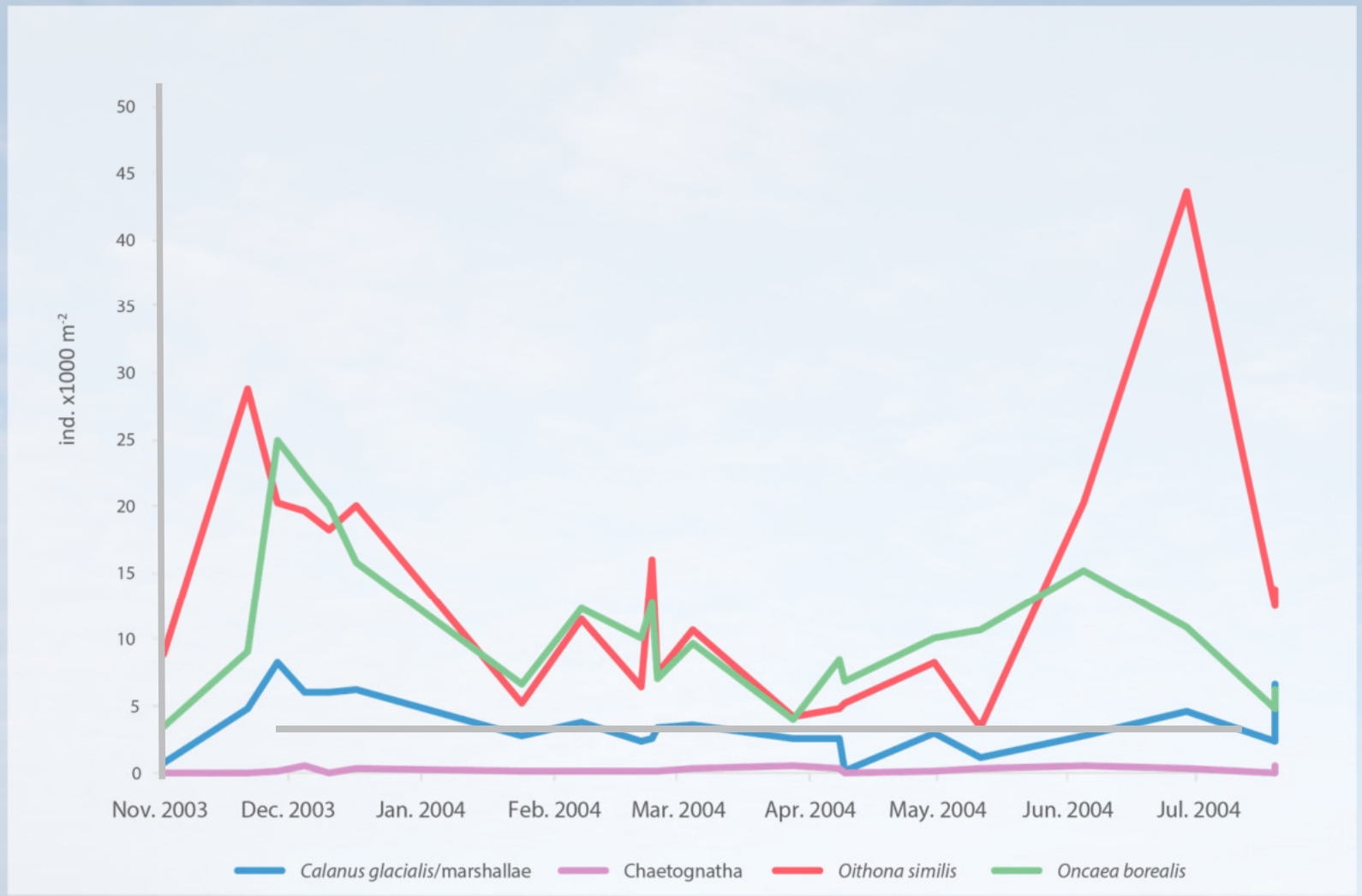
Relative abundance of major eukaryote functional groups found by microscopy.



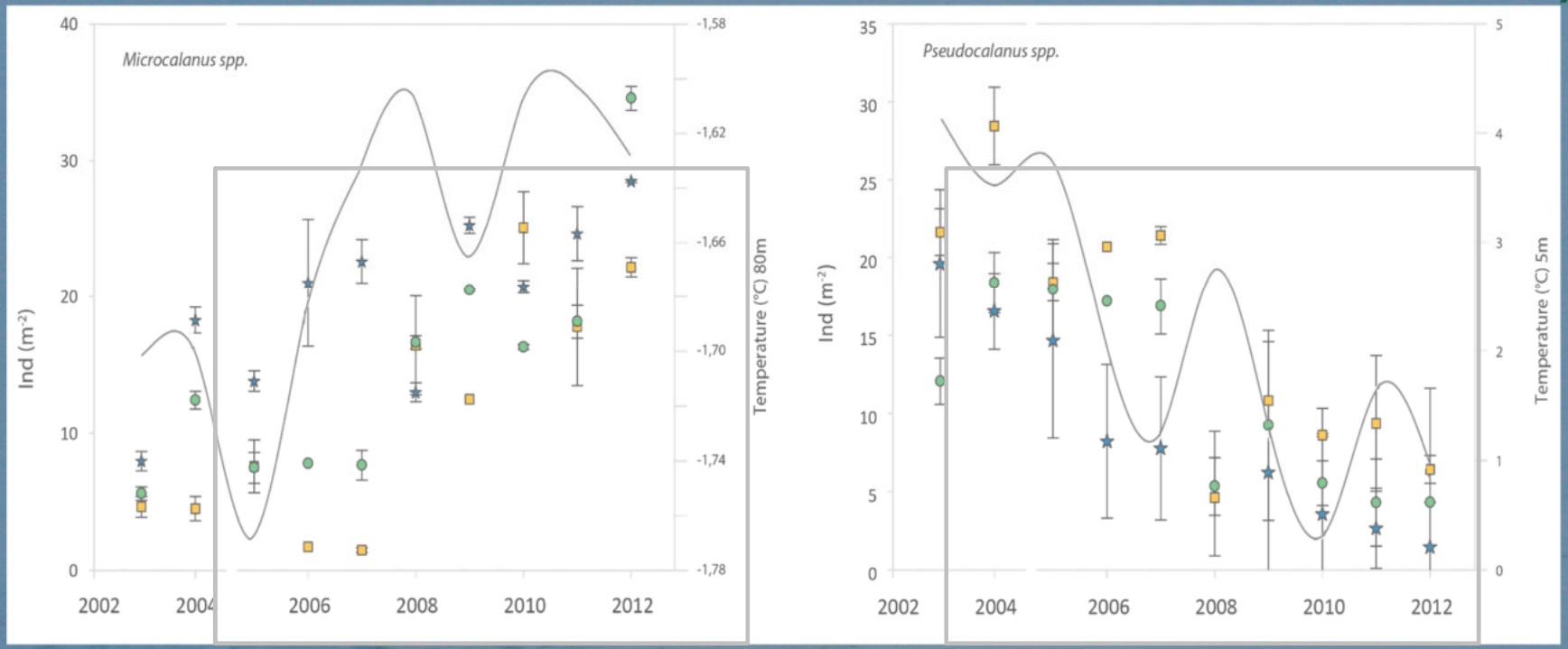


Interannual differences in taxonomic composition of phytoplankton during summer in a) Kongsfjorden and b) Rijpfjorden (Source: MOSJ, Norwegian Polar Institute).

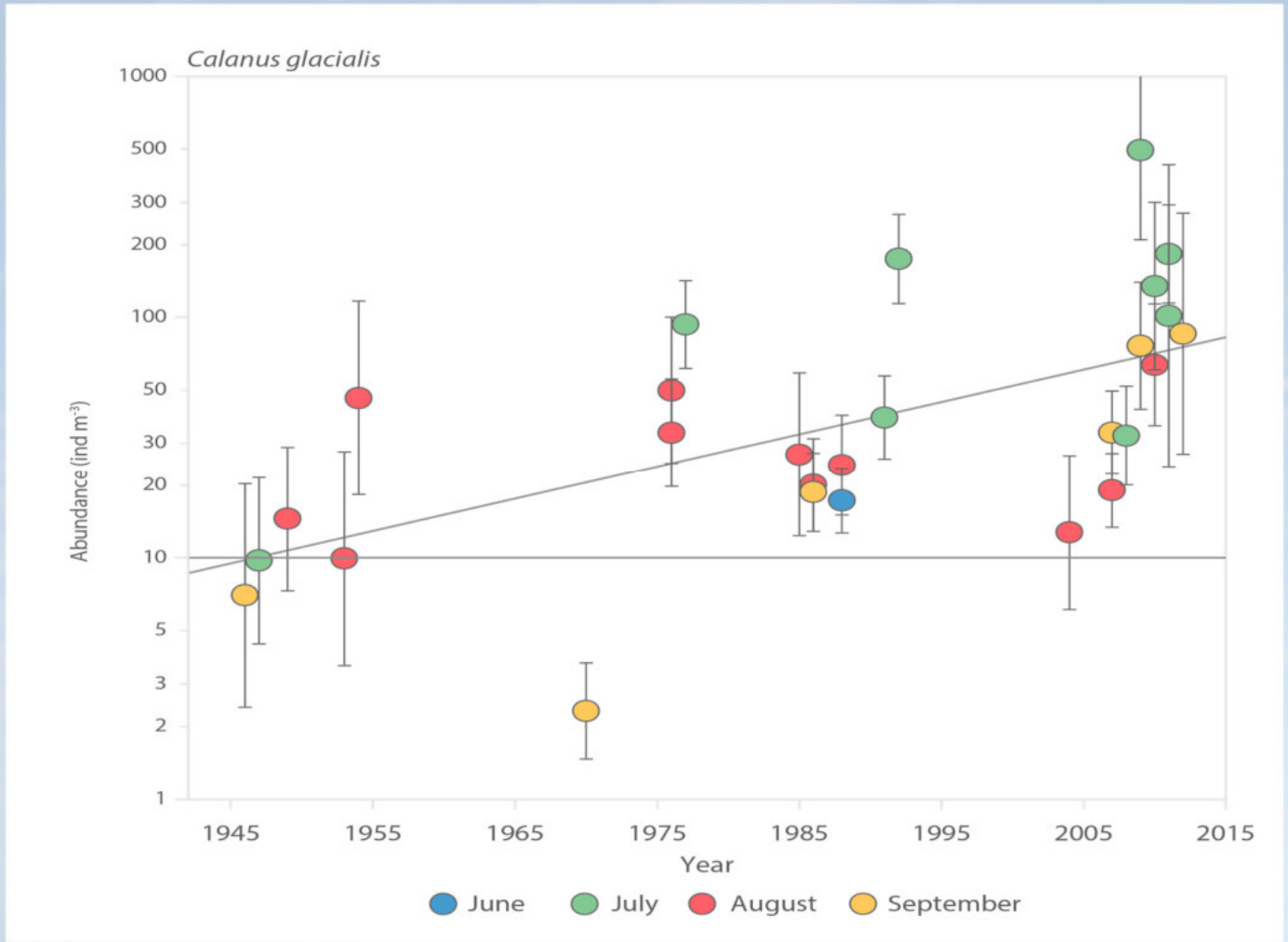


Seasonal time series of the major zooplankton in Franklin Bay, Canada.

Data kindly provided by Gerald Darnis

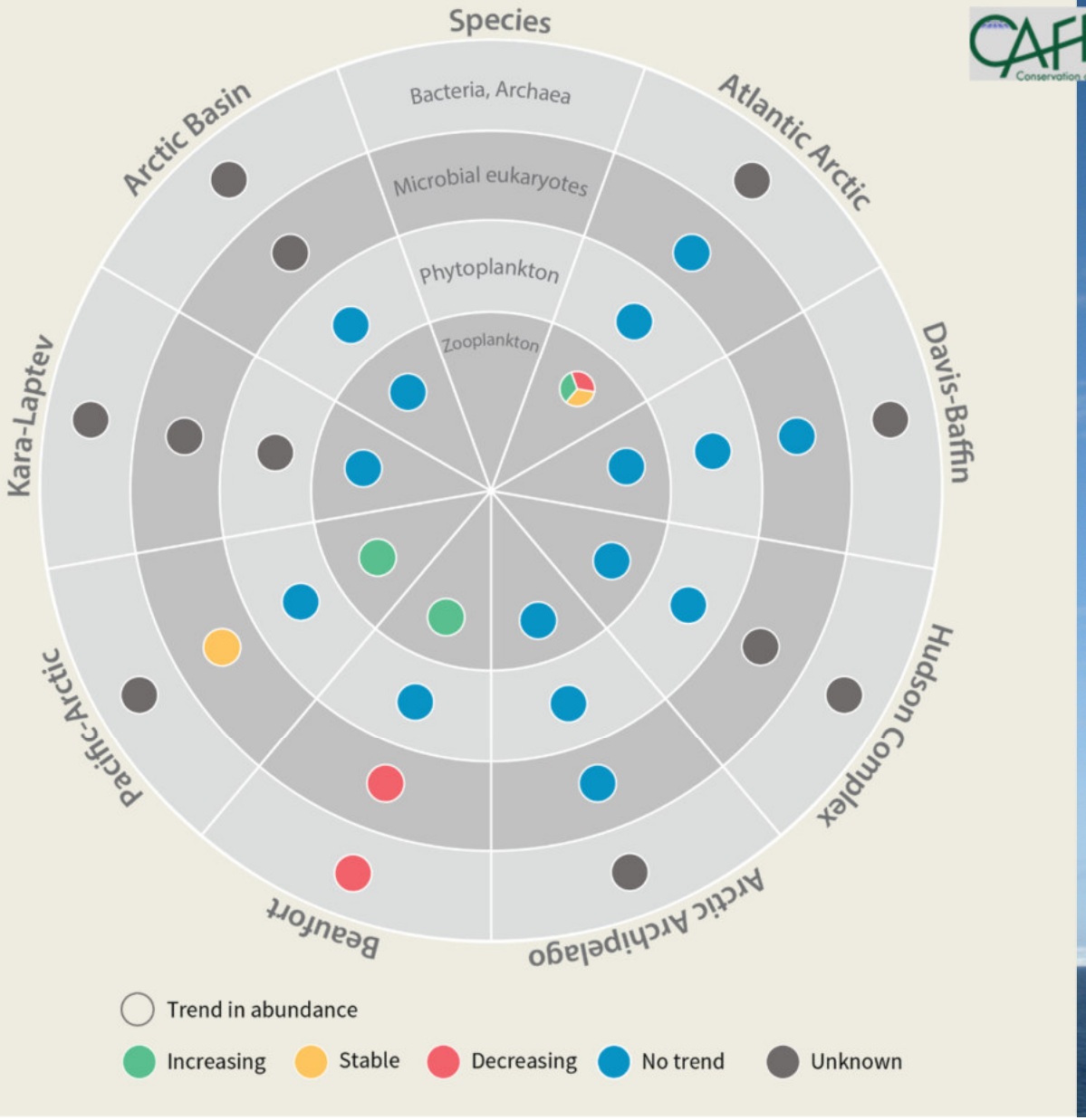


Temperature and copepod abundance in Zackenberg, northeastern Greenland. Temperature is measured at 80 m for Microcalanus and 5 m for Pseudocalanus (after Arendt et al. 2016).



Abundance of the copepod Calanus glacialis *in the Chukchi Sea, 1945-2012 (after Ershova et al. 2015b).*

Trends in **Plankton** across Arctic Marine Areas



Report Summary (1)

- Functional and taxonomic diversity Arctic microbes is vast and **underappreciated.**
- Half of the World Ocean phytoplankton species have been reported in the Arctic.
- Phototrophic, heterotrophic and mixotrophic Eukarya include **species restricted to Arctic and Polar waters.**
- Plankton **species shifts will be the first sentinel sign of overall ecosystem change.**
- More Information relevant to ecosystem-based management of oceanic areas is needed

Report Summary (2)

- **Species** distributions in the Arctic are **linked to physical oceanography** and specific water masses.
- The lack of taxonomic information from bulk zooplankton and chlorophyll sampling impedes our ability to assess ecosystem changes
- Species-specific information is essential for monitoring community changes driven by climate.
- Arctic governments proposing year-round research stations should consider sites with access to the sea.

Gaps and Recommendations

- **Standardized protocols:** sample collection, preservation
- **Harmonize:** taxonomy of microscopic and genetic analyses
- Ensure: **data sharing**, **publicly-accessible national data center**s..
- **Train Taxonomists :** species-level analyses, include molecular techniques.
- **Promote plankton monitoring programmes** in Canada, the United States and Russia.
- **Support ongoing monitoring** in Greenland, Iceland and Norway.
- **Develop** species indexes and **identify water masses & indicator taxa**
- **Identify emerging threats:** Ocean Freshening & Acidification, Shipping

Promote: Political & Public engagement, including local & indigenous stakehoders.

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Rovaniemi

Plankton

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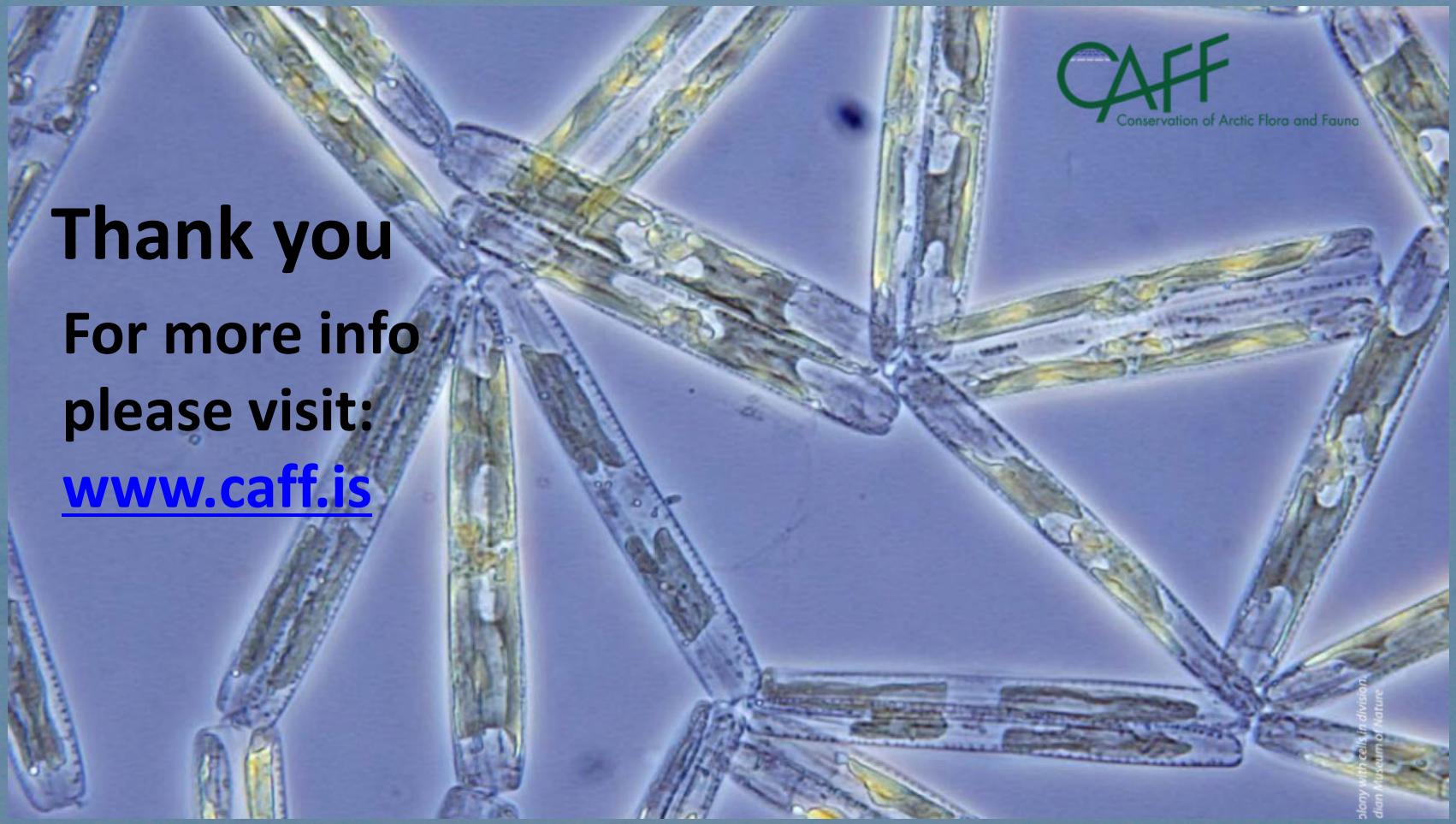
Ian Salter (Faroe Islands)
Guðmundur Guðmundsson (& Ástþór Gíslason) (Iceland)
Michel Poulin (Canada)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State of the Arctic Marine Biodiversity Report: Plankton

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Bearded seal. Photo: Audunn Rikardsen

Biogeography of Arctic Cryptomonad

Noramalized abundances of OTUs corresponding to species in 18S data from the Tara Oceans project against the latitude of each station. Spearman correlation coefficients, and associated P-values, for the relationship between abundance and latitude for the Northern and Southern hemispheres