ECOTIP

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An introduction to East Greenland's functional structure:

An epibenthic community assessment and their associated traits and drivers.

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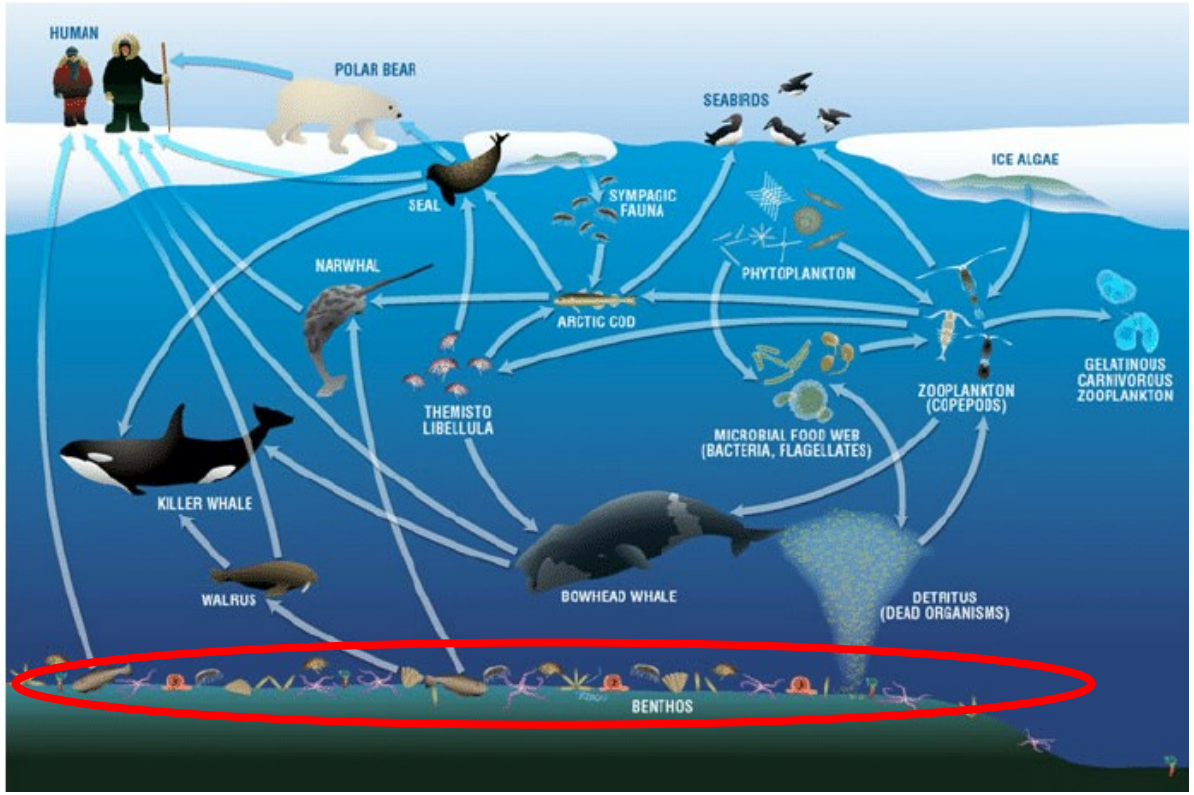
The Arctic's Unique Ecosystem

- A unique ecosystem that is of **global importance**
- **Highly productive** and **interconnected**

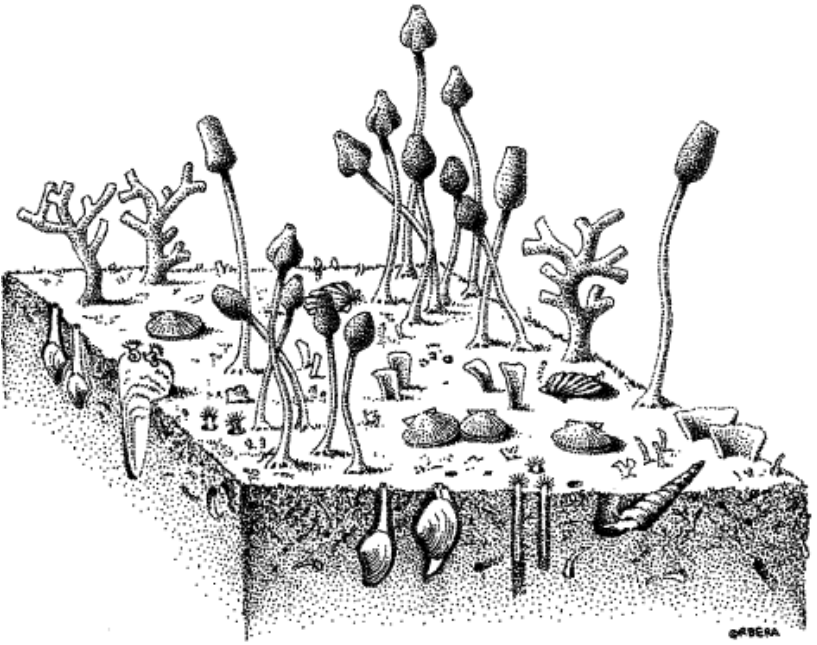


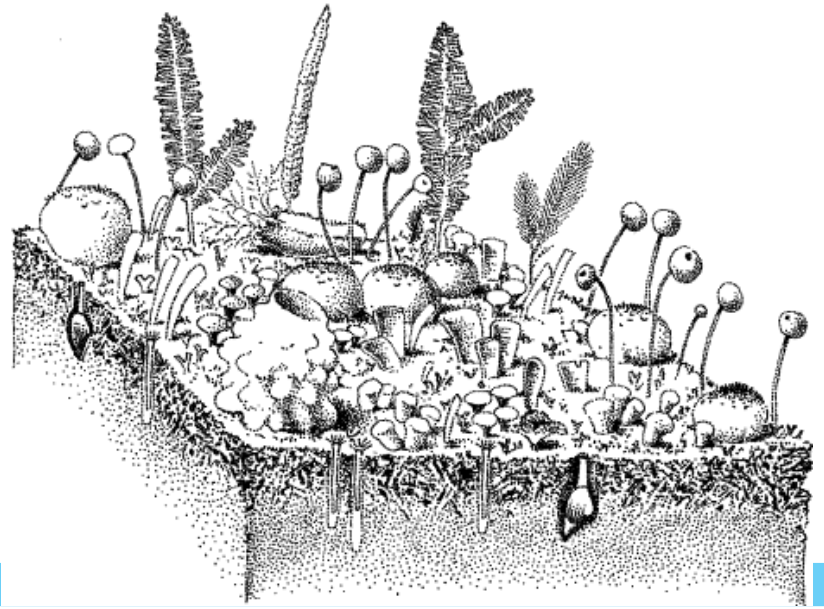
Darnis, 2012. A simplified Arctic food web.

Arctic Benthos

- Rich in **species diversity** and **abundance**
  - A current record of > 4,000 Arctic macro- and megabenthic species

West Greenland macrobenthos on R/V Dana, Armitage, 2021.





Ecosystem Functioning

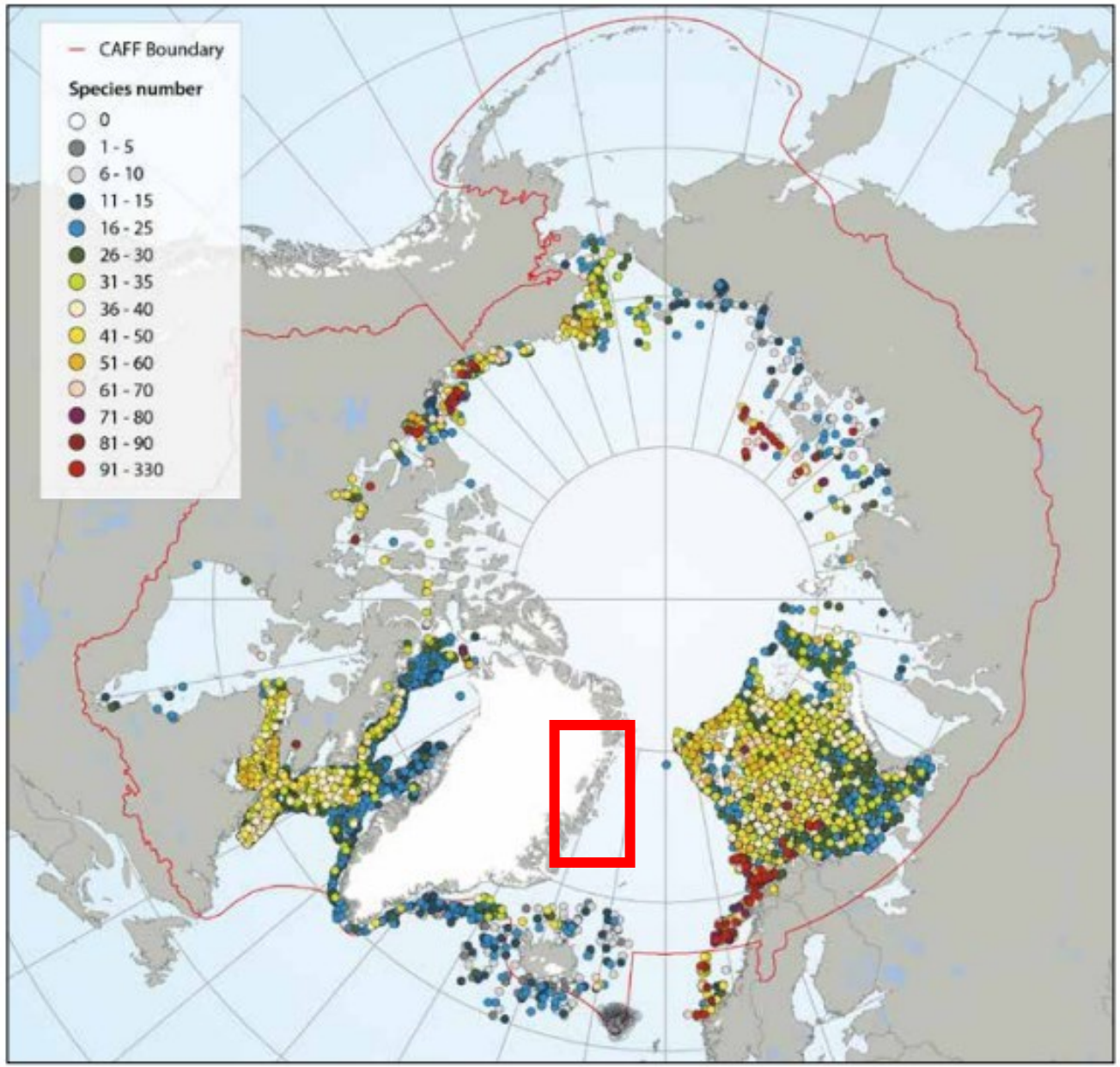
- **Benthos are important for ecosystem functioning**
  - Nutrient cycling
  - Carbon sequestration
  - Important role in food-web

- Anthropogenic and climate induced disturbance can **alter community structure** impacting ecosystem processes.

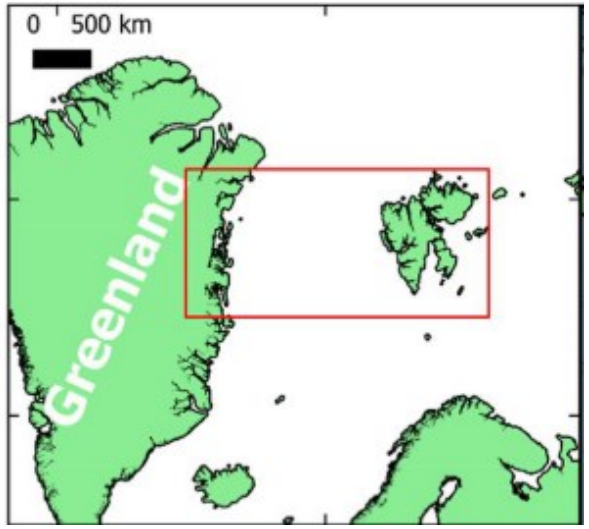
Various epibenthic assemblages. Image Ref: Gili *et al*., 2006

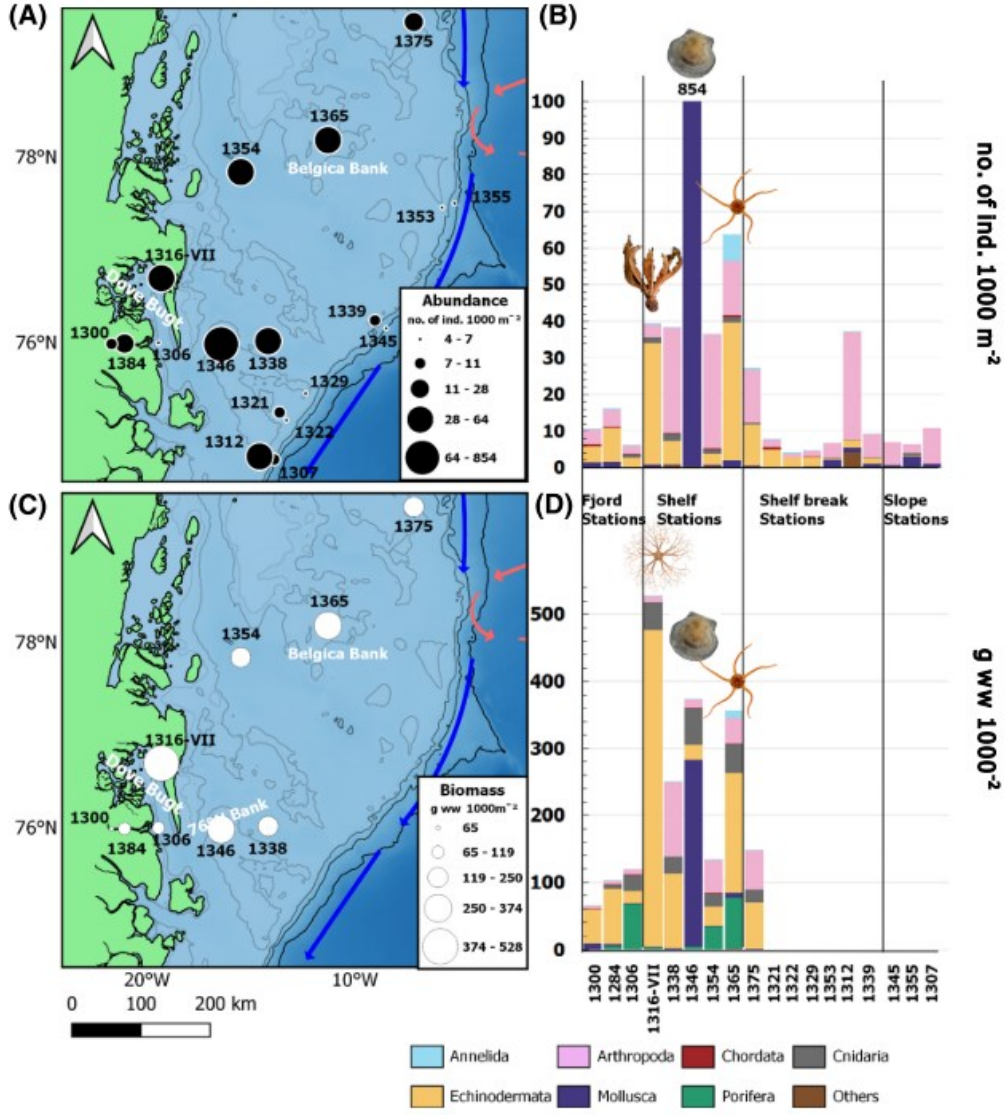
Monitoring efforts

- **Climate change** and **anthropogenic activities** are affecting benthic communities.
- Still **lacking reference data** in some areas.
- Even fewer **trait analyses** for **Arctic benthos**.



CAFF, 2018. Number of benthic species in circles across 7,322 trawl stations

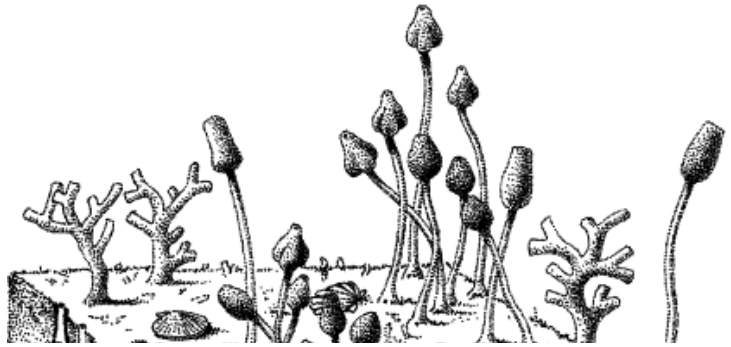




Map of East Greenland, the study site, and sampled stations. Taxonomic composition of epibenthic invertebrates at eighteen locations in Northeast Greenland from 33 combined Campelen and Agassiz trawl samples collected during 2015 and 2017. The numbers indicate the

Trait Approach

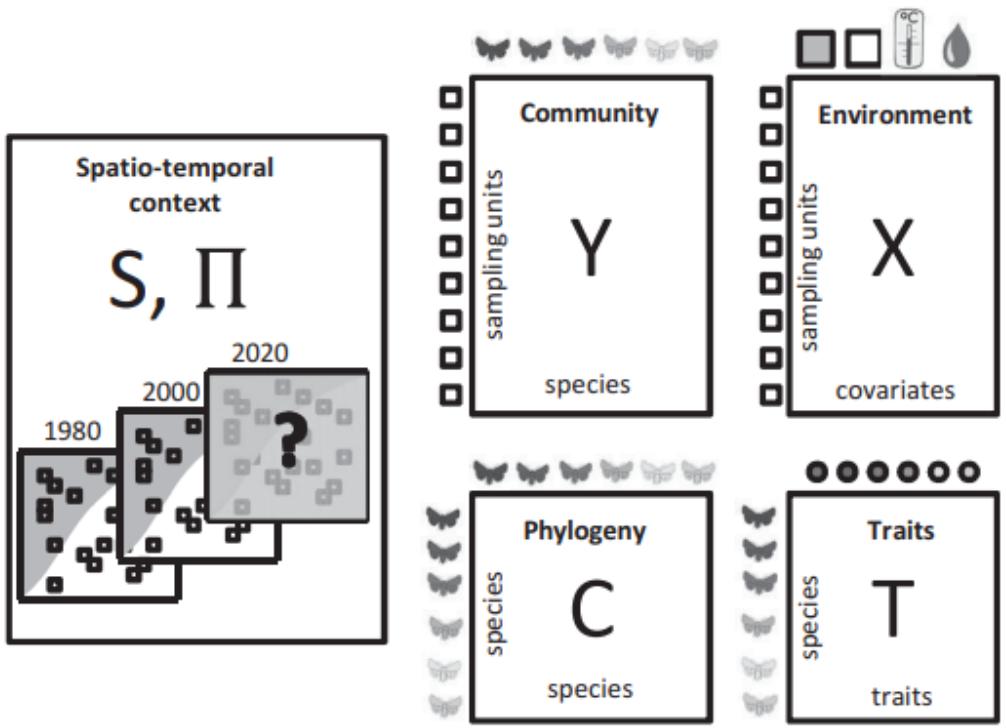
- Complementary to **species indices**
- Species are **highly diverse** in shape, form, and function
- Using traits can **link** species to the **environment** and **ecosystem functioning**.



Trait	Modality	Modularity	Function
Morphology	Skeletal R,E	SK1 Calcareous SK2 Siliceous SK3 Chitinous SK4 Cuticle SK5 None	Indicative of environmental quality and at-risk communities (ocean acidification/trawling/prey etc.). Related to Inorganic carbon sequestration (i.e. calcifying taxa contribute most)
Behaviour	Mobility R,E	MO1 None MO2 Low MO3 Medium MO4 High	Ability to avoid predators, find resources, dispersal capabilities or contribute to habitat complexity.
	Feeding habit R,E	FH1 Surface deposit FH2 Subsurface deposit FH3 Filter/suspension FH4 Opportunist/scavenger FH5 Predator FH6 Parasite/commensal	Production, nutrient cycling, trophic structure/ energy fixation or transfer. Good indicator of hydrological conditions.
	Zoogeography R	Z1 Arctic Z2 Arctic-boreal Z3 Boreal Z4 Cosmopolite	(i.e. Arctic, boreal, cosmopolite. etc.) Species distribution ranges; vulnerability and invasive species.
Life history	Larvae development R	LD1 Pelagic/planktotrophic LD2 Pelagic/lecithotrophic LD3 Benthic/direct	Nutrient recycling/productivity between pelagic and benthic zones, dispersion and recovery capabilities

Various epibenthic assemblages. Image Ref: Gili *et al*., 2006

Traits & the HMSC Approach



- Used to better understand **community assembly** through
  - Community **compostion**
  - **Environmental** covariates
  - Response **traits**
  - **Phylogenetic** relationships

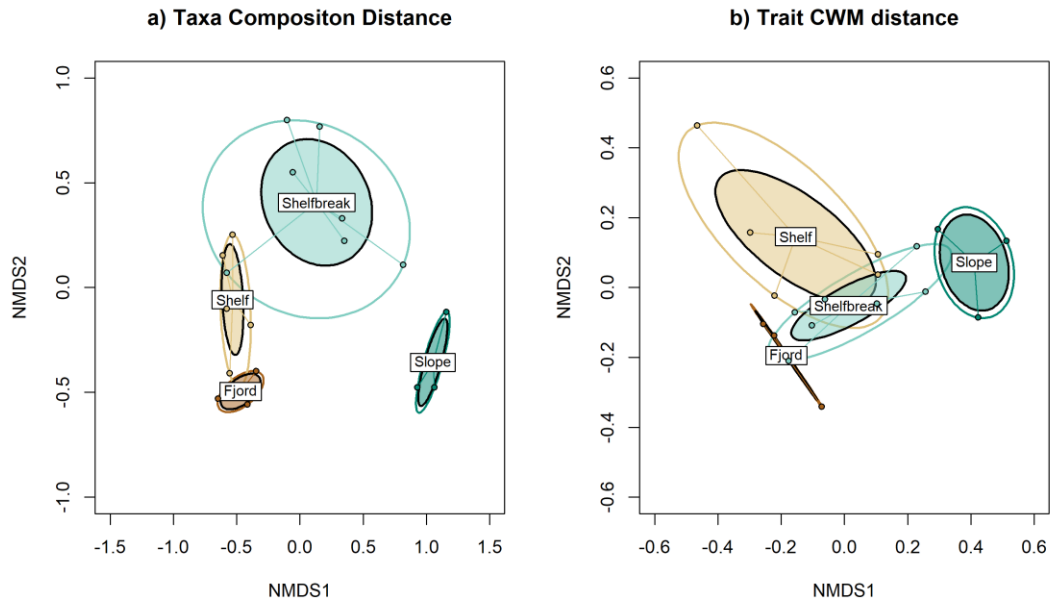
Aims:

Characterise epibenthic community assembly, functional structure, and investigate the drivers.

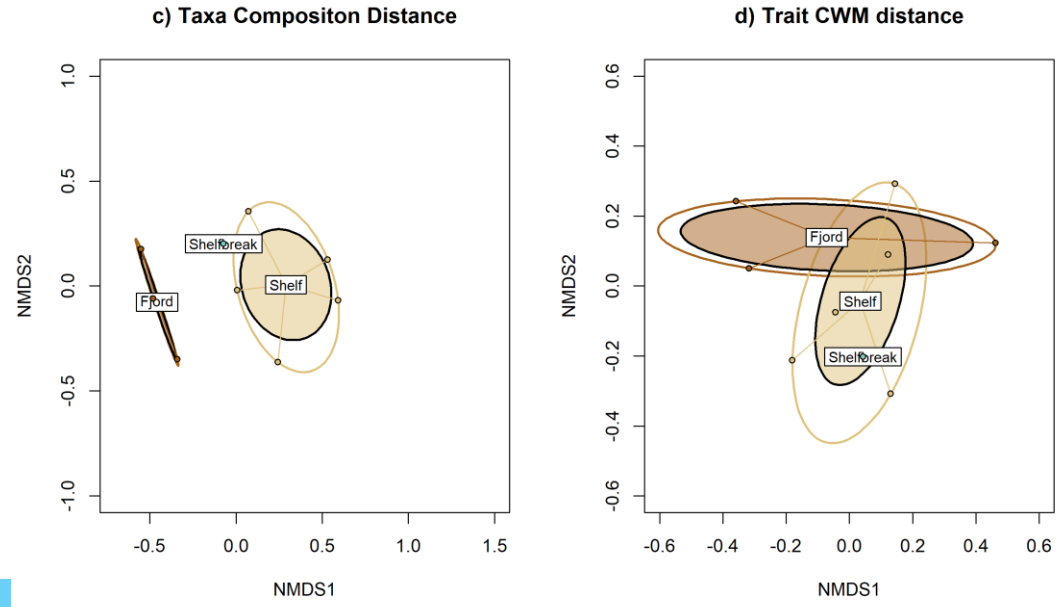
Results: Community composition

Distinctive compositions of **taxa** and **trait** groups across the continental shelf area.

Abundance

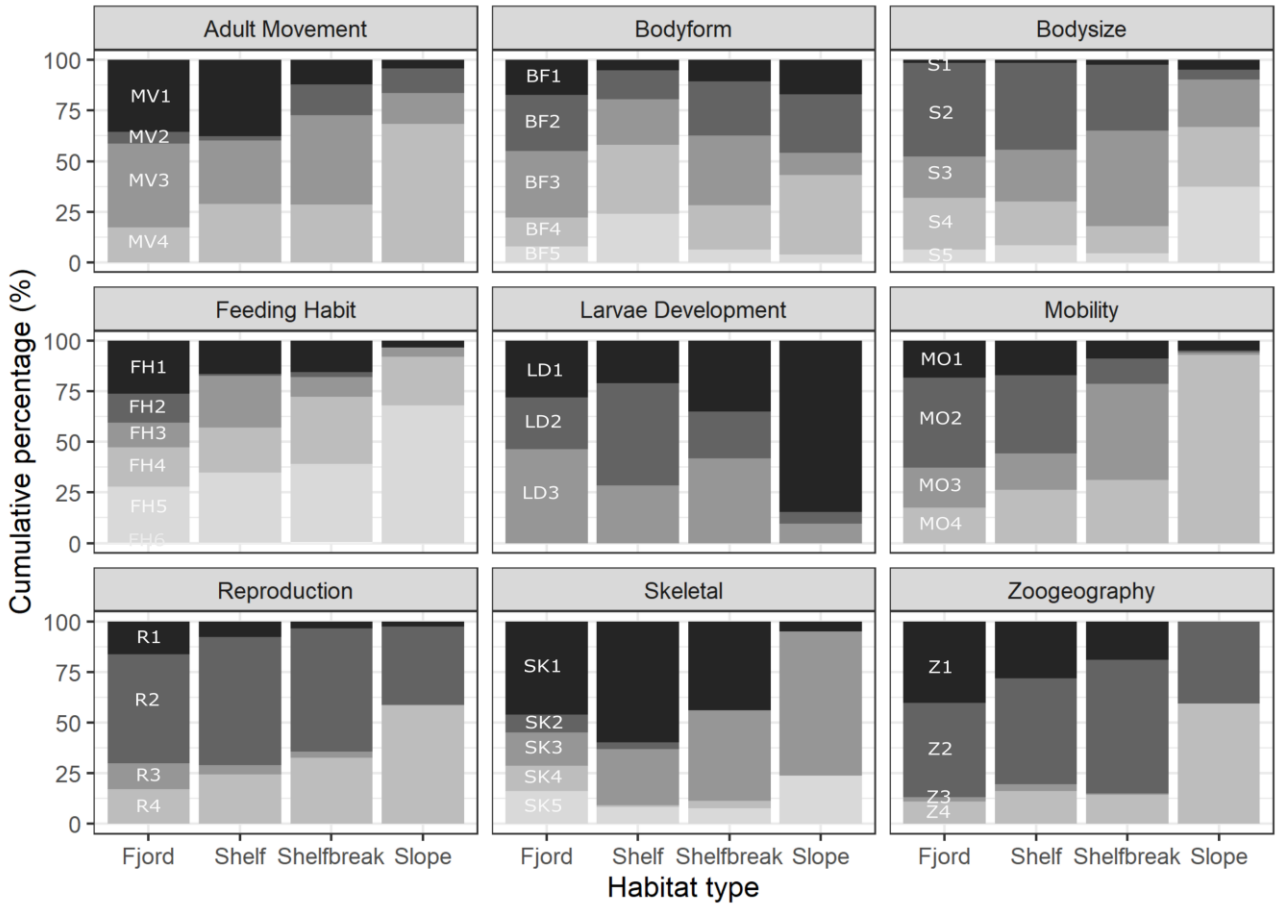


Biomass

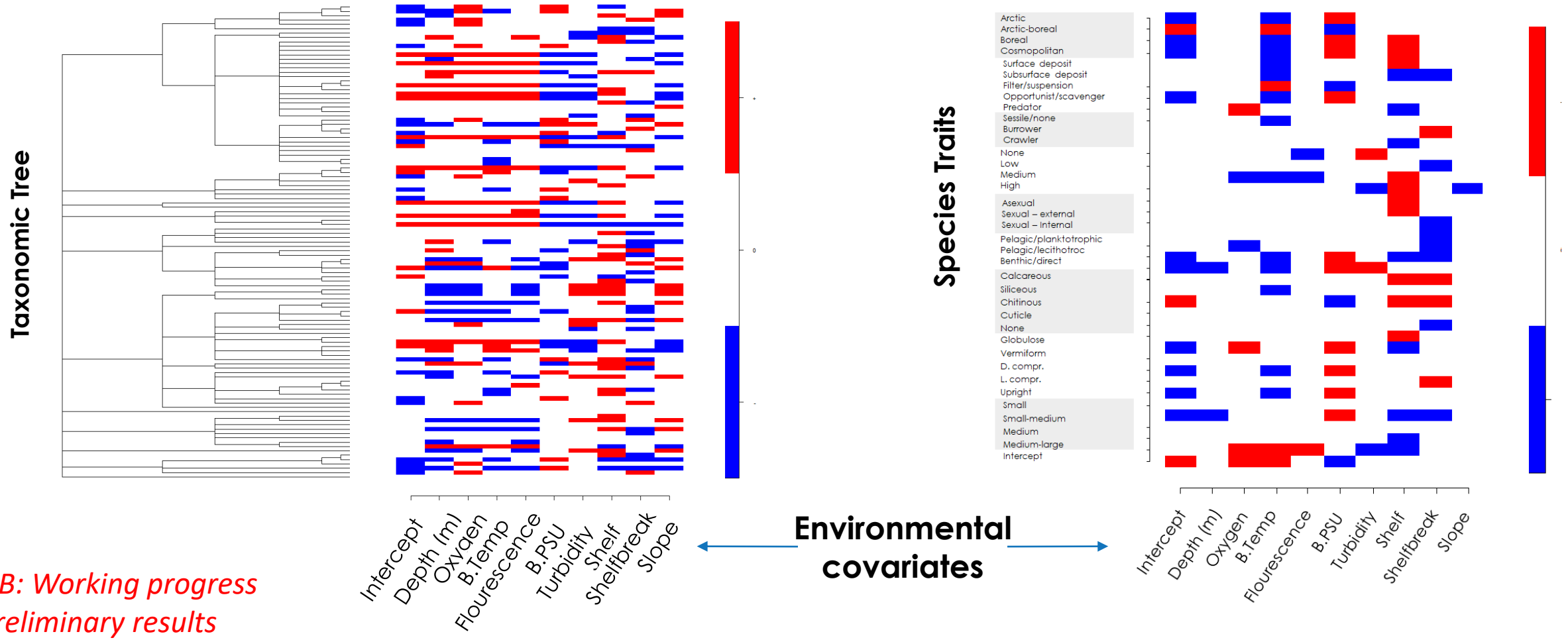


Spatial distribution of traits

There are **clear spatial patterns** in the trait groups across fjord to slope habitats.



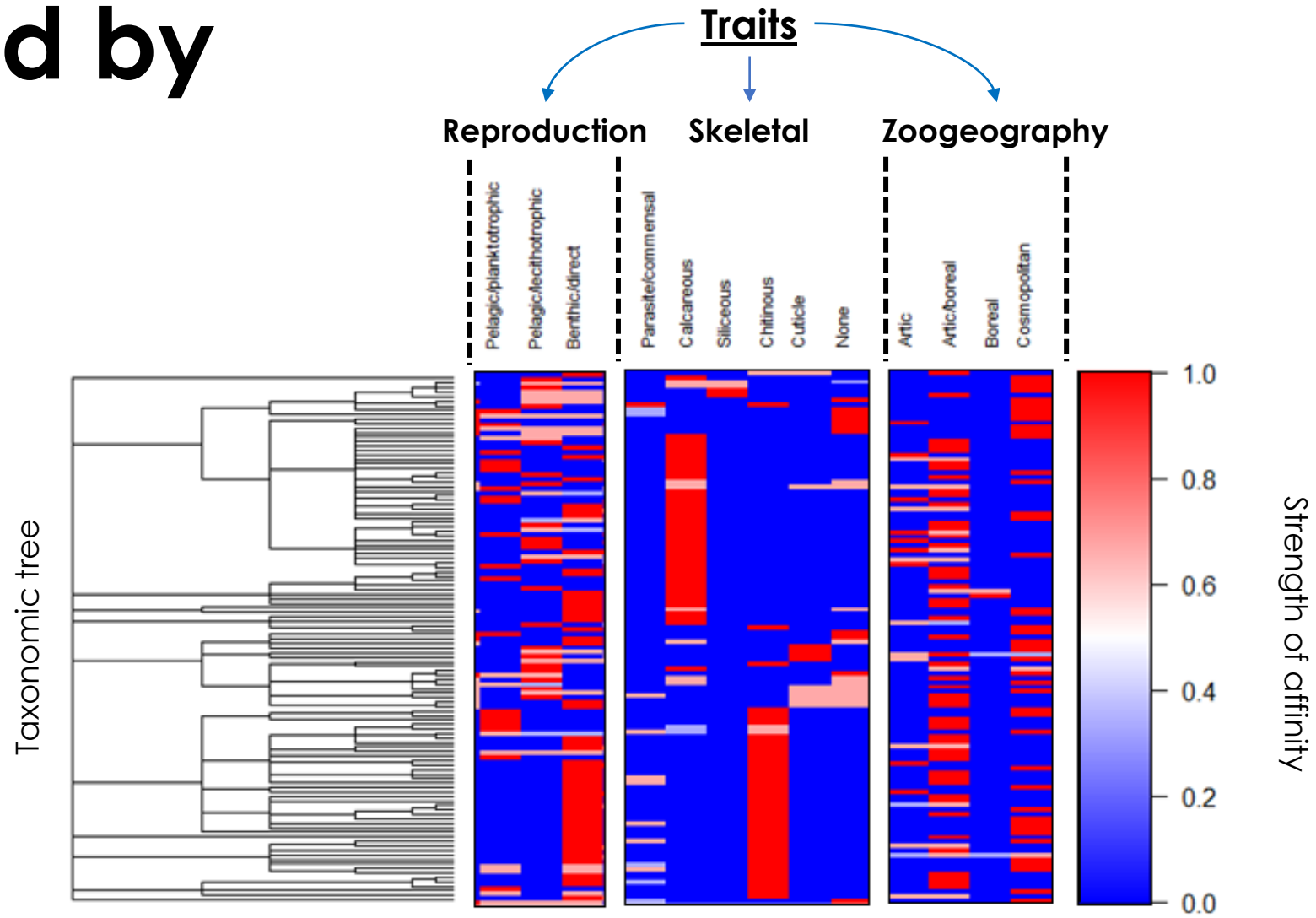
Community Assembly via the Environment



NB: Working progress
Preliminary results

Traits explained by taxonomic relatedness

Strong taxonomic signal in the data



Key take aways

- There are **clear spatial patterns** in the distribution of species and their traits.
- That **community assembly processes** is complex and is driven by a number of interconnected factors.
- That **traits are a useful tool** and that understanding how trait groups are distributed is important for understanding **Arctic ecosystem functioning and its vulnerability to climate change**.

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Thank you for listening

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