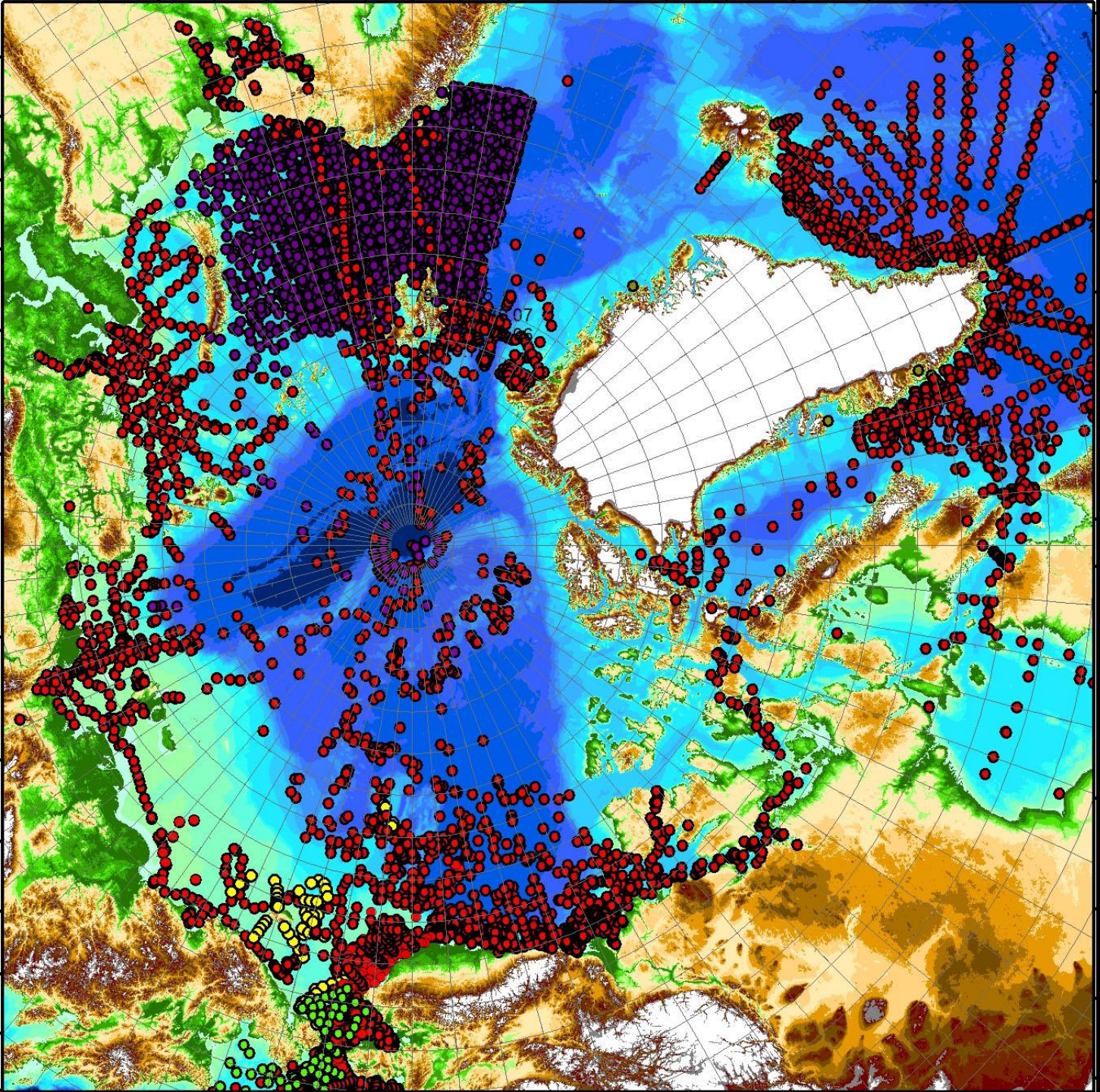
Understanding pattern & change in the Arctic: can we get there from here?

Russell Hopcroft,
Ksenia Kosobokova

The Problem

- Increasing desire to know the “status” of the Arctic: IF it is changing, WHAT will it look like in the future
- There are two fundamental requirements for this:
  1. we know/understand baseline patterns
  2. we need consistent time-series observations

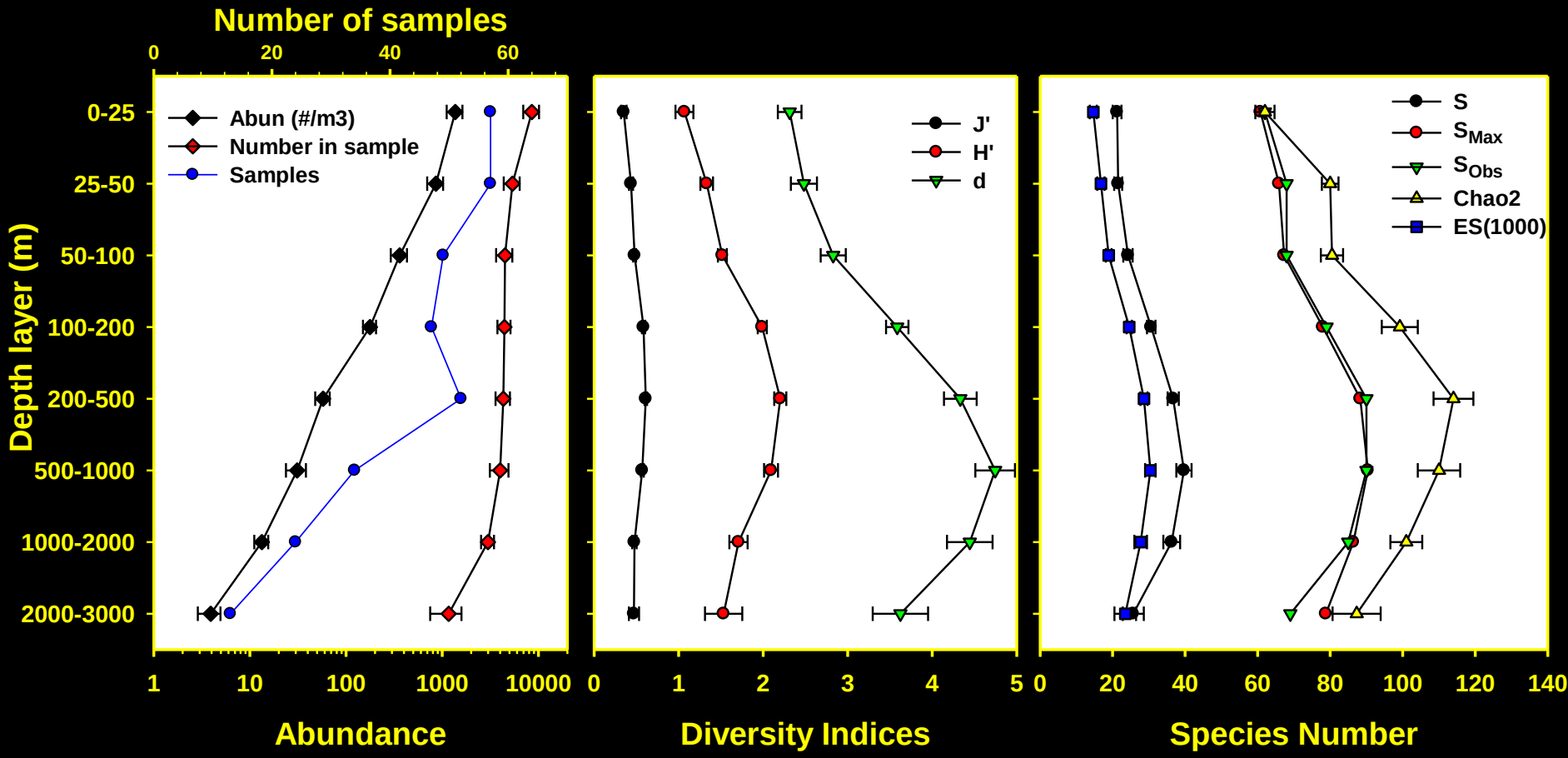


Data consolidation

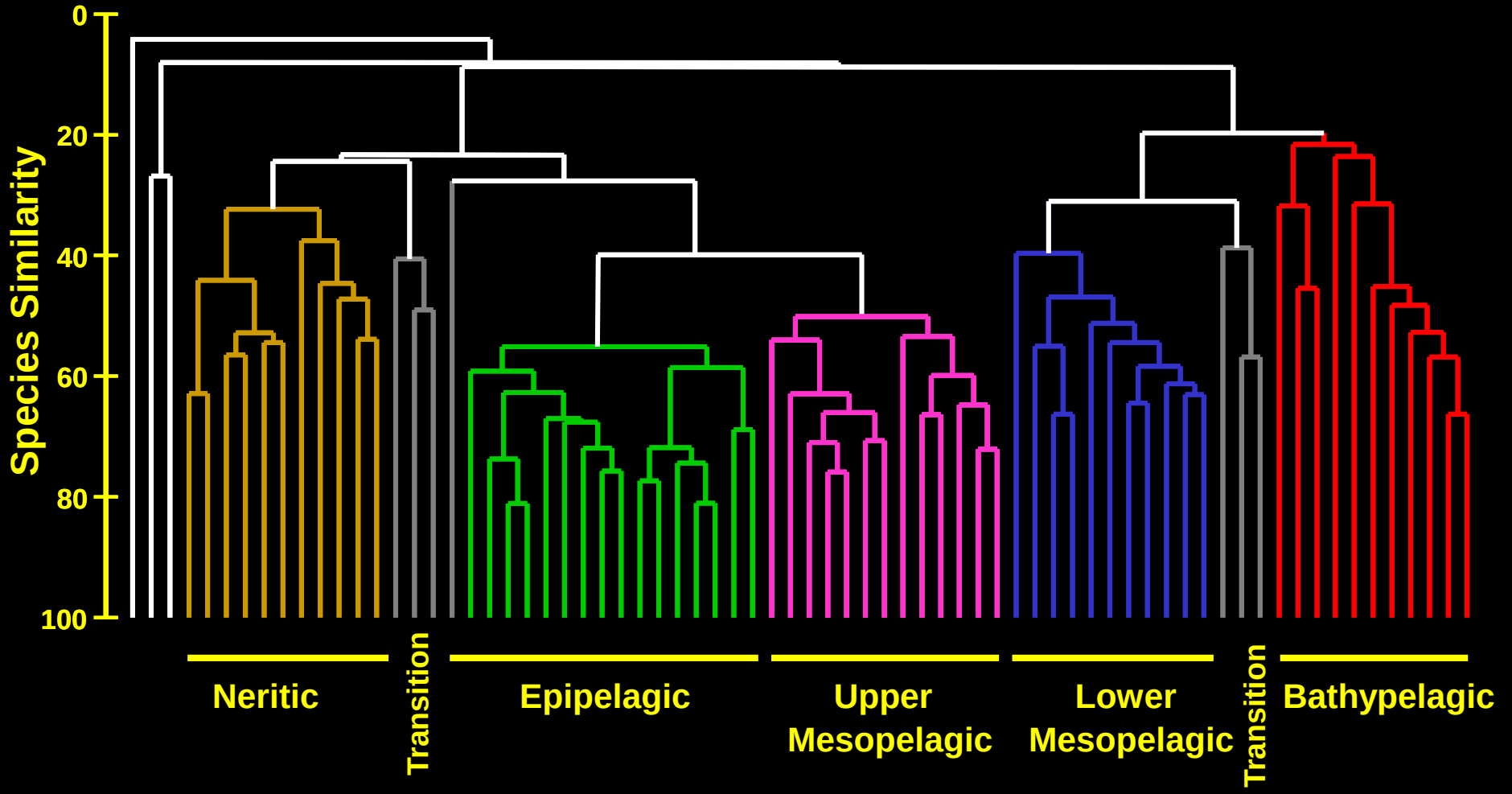
CoML CBMP

Caveat: that Greatest biodiversity data density in Pacific-Arctic

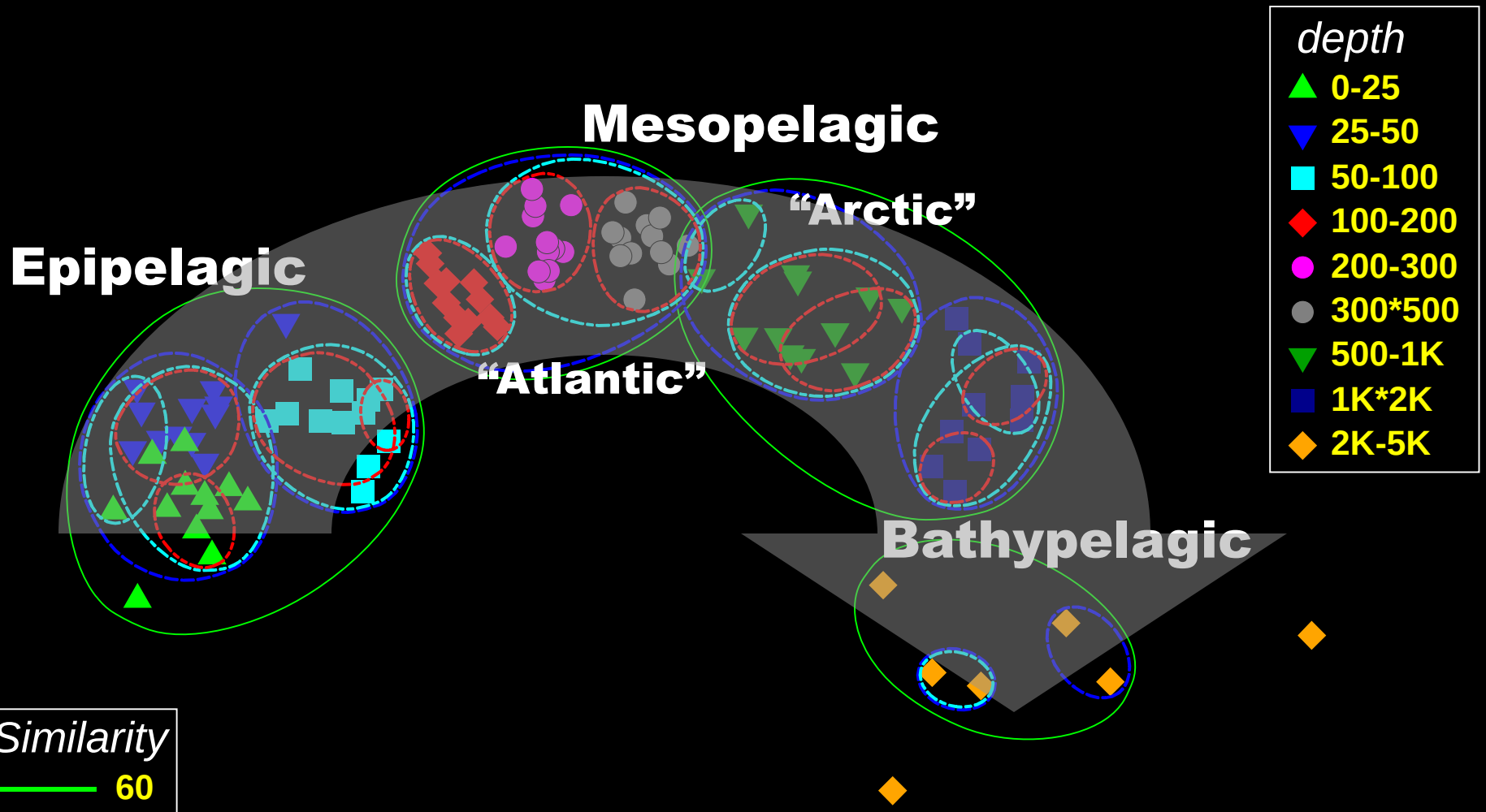
Through CoML, we now understand biodiversity in the basins *based on consistent methods*



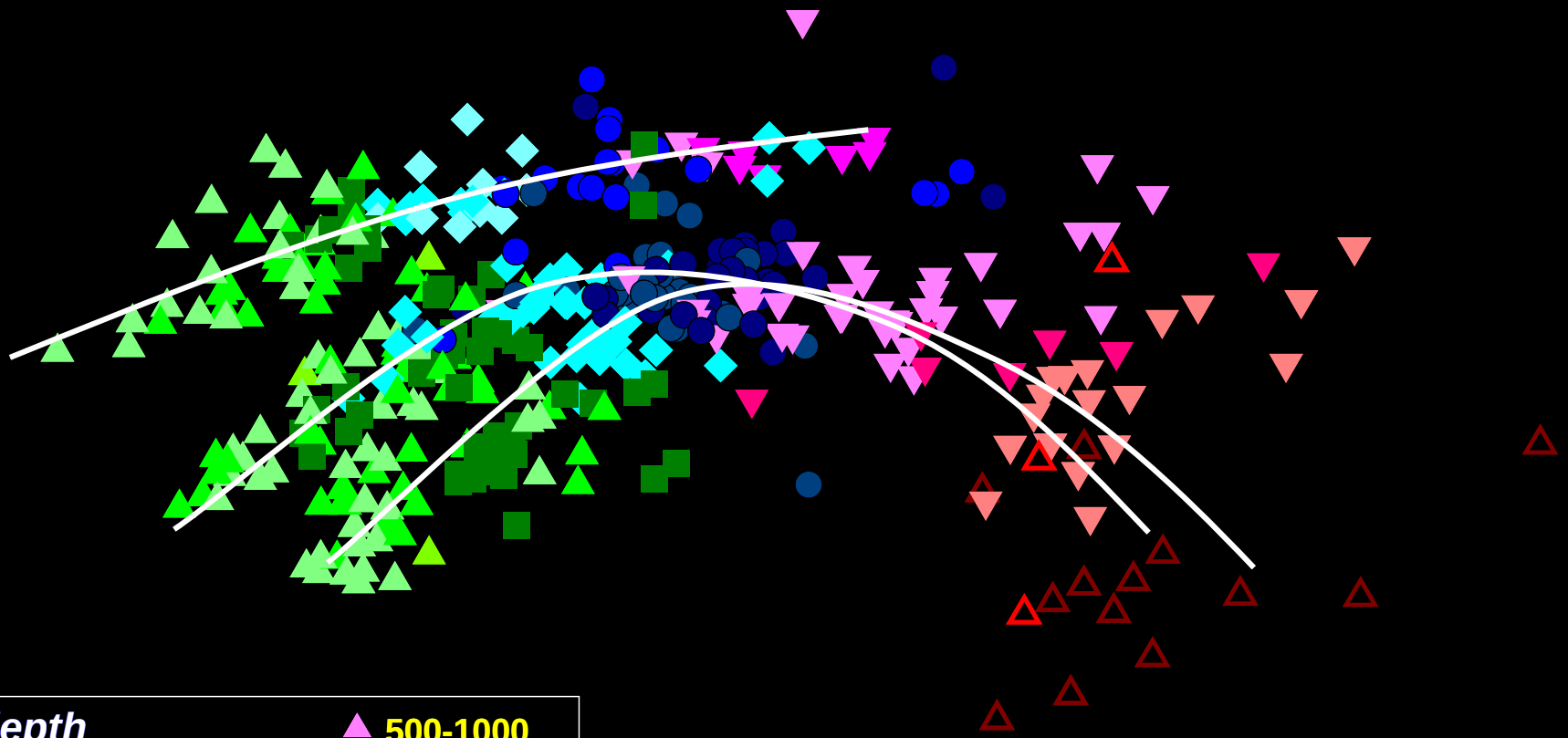
Community patterns: hierarchical clustering of Bray-Curtis Similarity coefficient



Multidimensional Scaling Projection



Patterns hold for entire Arctic with some regional variation



(e.g. from 3 cruises)

2D Stress: 0.12

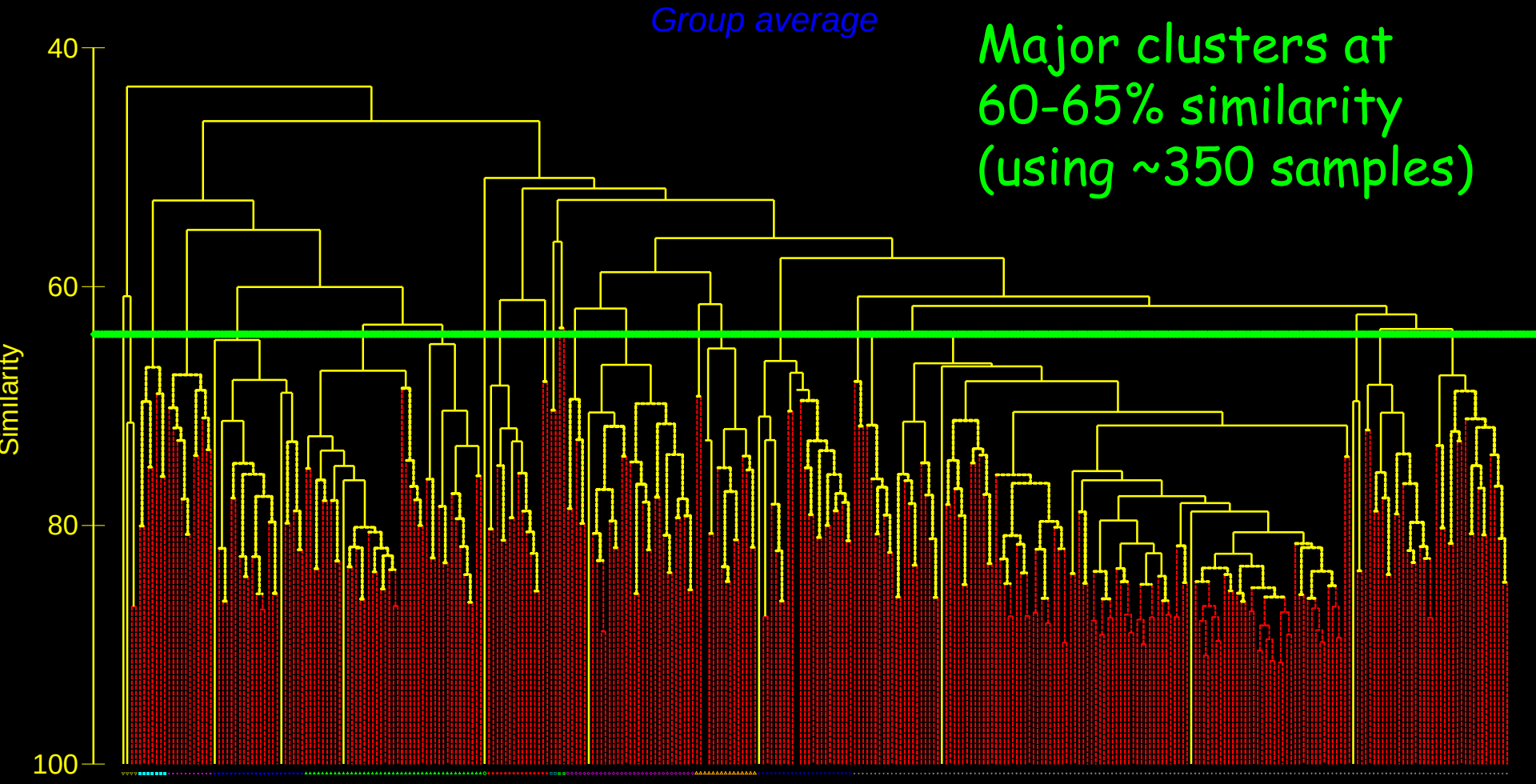
Basin communities are distinctive, but can we make progress on Arctic Shelves where interannual variability is high?


?
?
?
Pacific
Species
?
?
Atlantic
Species

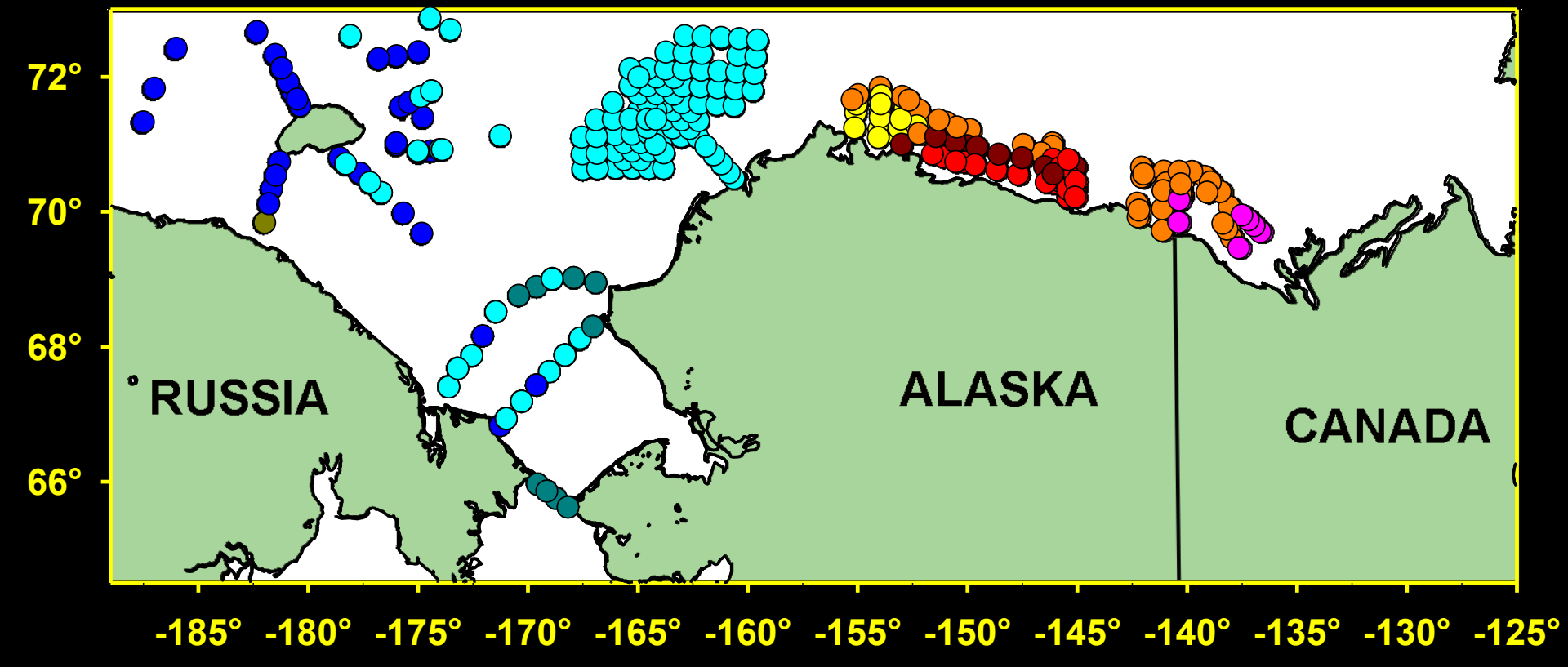
Chukchi & Beaufort Shelves

- Sampling from 2004-2014, ~Aug-Sept
- Consistent collection (vertical 150µm nets) with integration to bottom (or 200m)
- Consistent processing
- ~700 samples available for analysis (subset used)
- Community structure analyzed using Bray-Curtis similarity, subjected to Clustering and nMDS

A structured mess

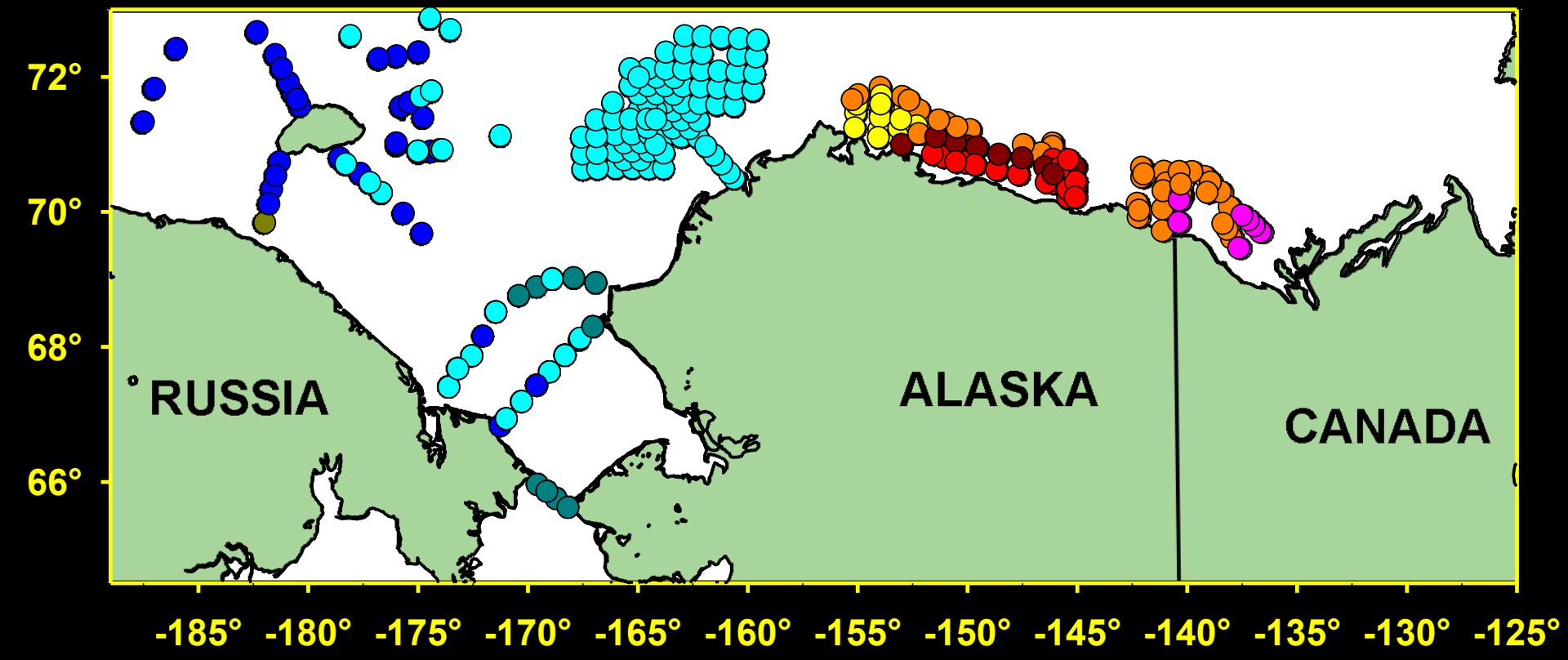


Chukchi & Beaufort Shelves



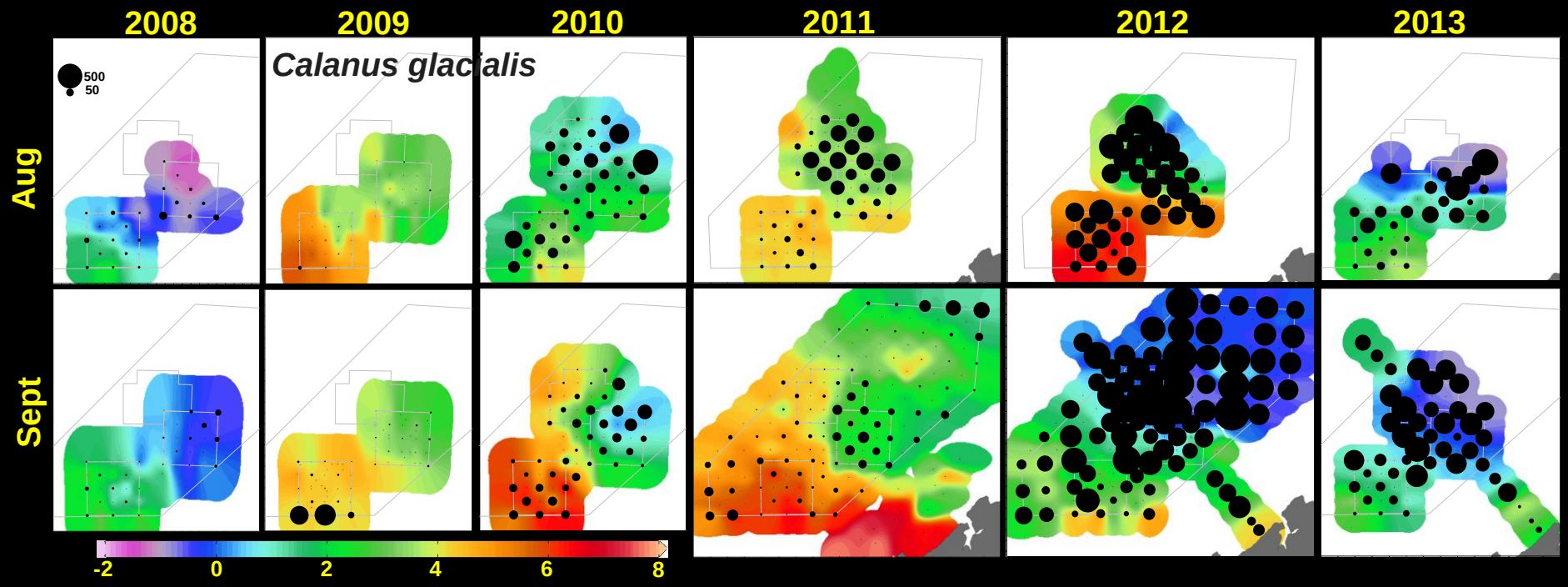
- Chukchi and Beaufort are distinct
- East Siberian is more like Chukchi than Beaufort

Chukchi & Beaufort Shelves



- Cross shelf & along-shelf patterns in Beaufort, with distinct communities from Mackenzie River
- Temperature & salinity explain up to 50% within-study

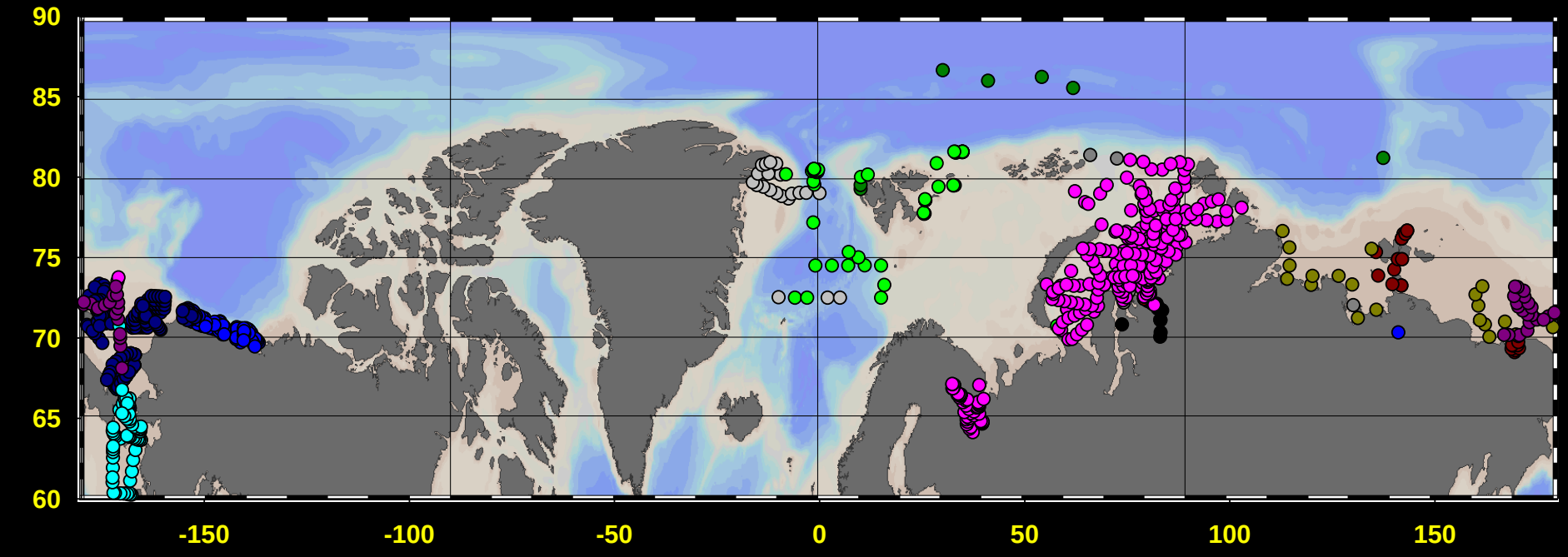
Caveat: interannual difference can be large, but needs to be less than regional differences e.g. the northeastern Chukchi



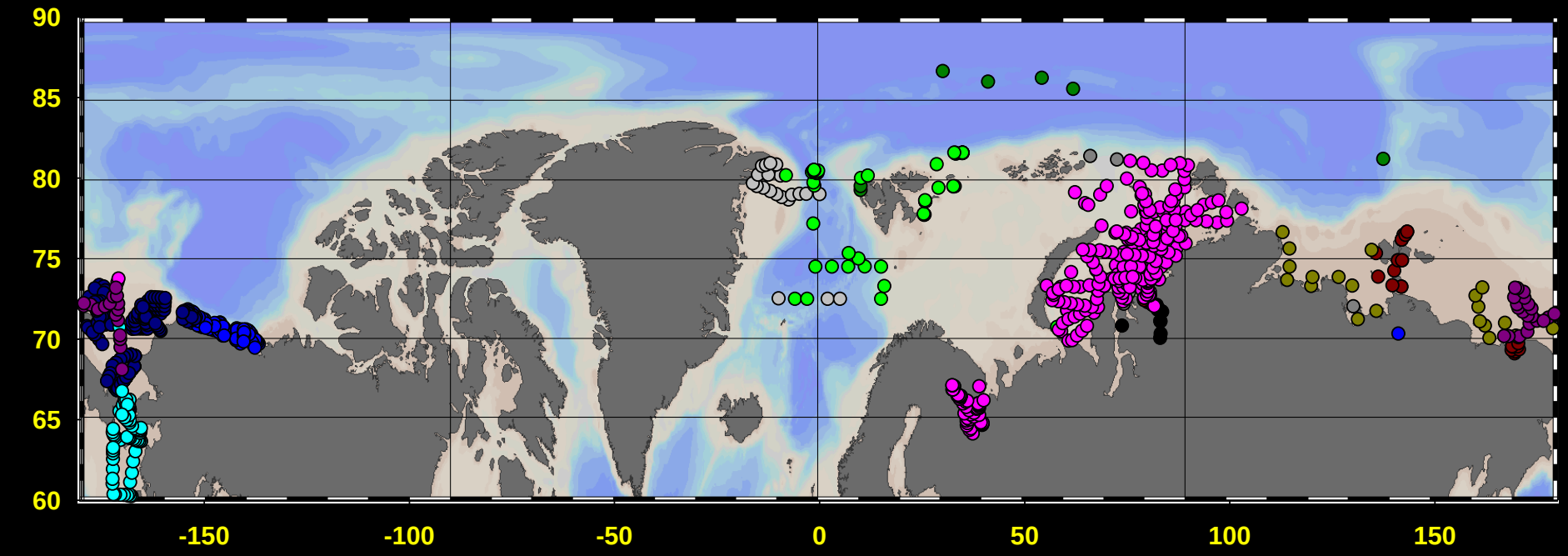
The Consolidation Challenge

- Collection gear is not standardized (mesh size)
- Taxonomic resolution and SKILL are variable (plus taxonomy itself has changed)
- Few long-term consistently sampled locations (improvement since ~2000)
- Most published works do not include raw data for reanalysis
- General reluctance to share
- ~925 samples for analysis (150-180 µm mesh) from 1930-2014

First cut at a pan-arctic shelf analysis

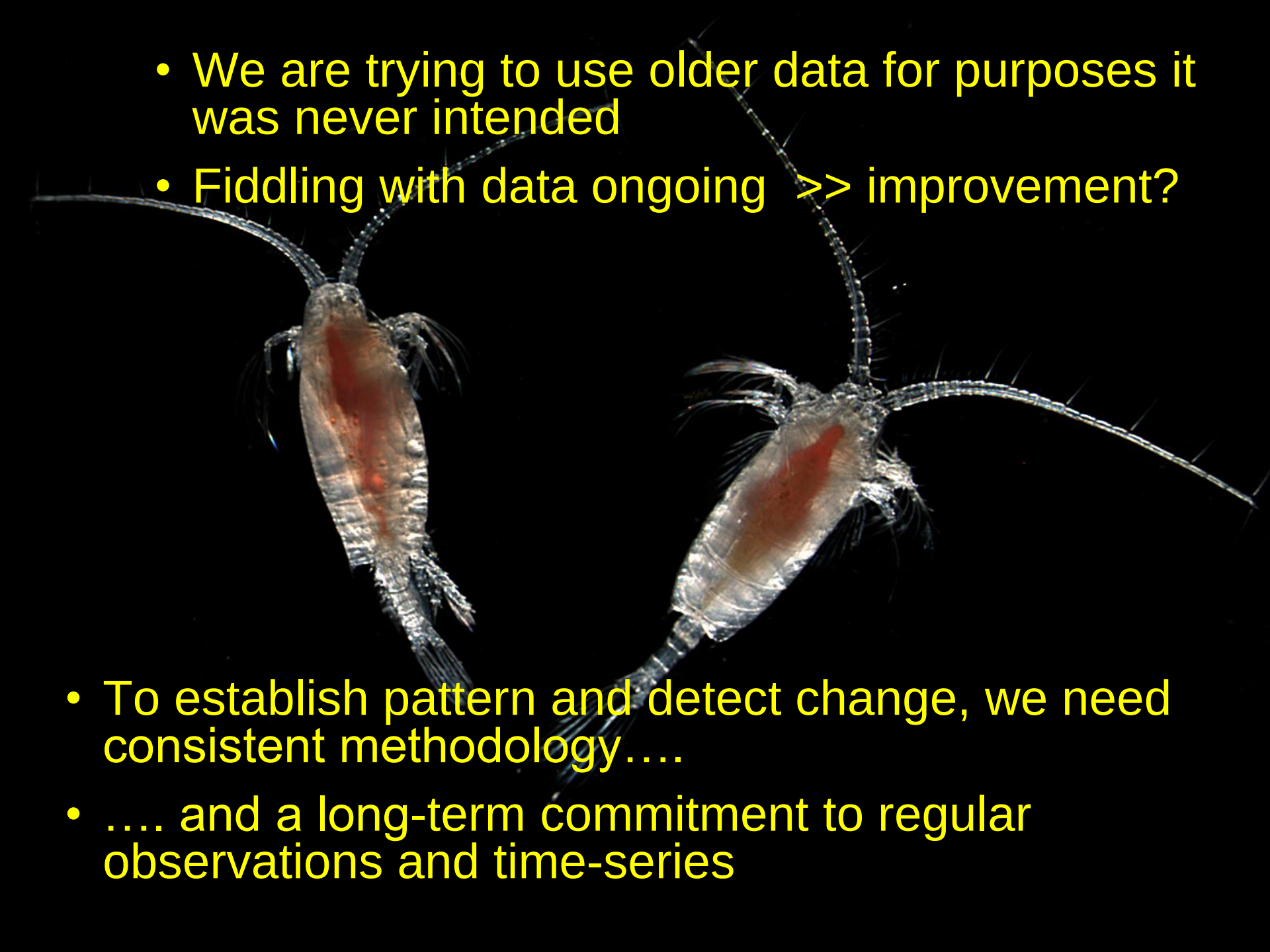


- ***Clusters at 35% similarity suggest major differences between regions?***



- Although we can't rule out differences do exist….
- most clusters are heavily confounded by the source of the data (most scientist work regionally)
- Different data sets have different 'quality'
- Collections are seldom archived for re-analysis

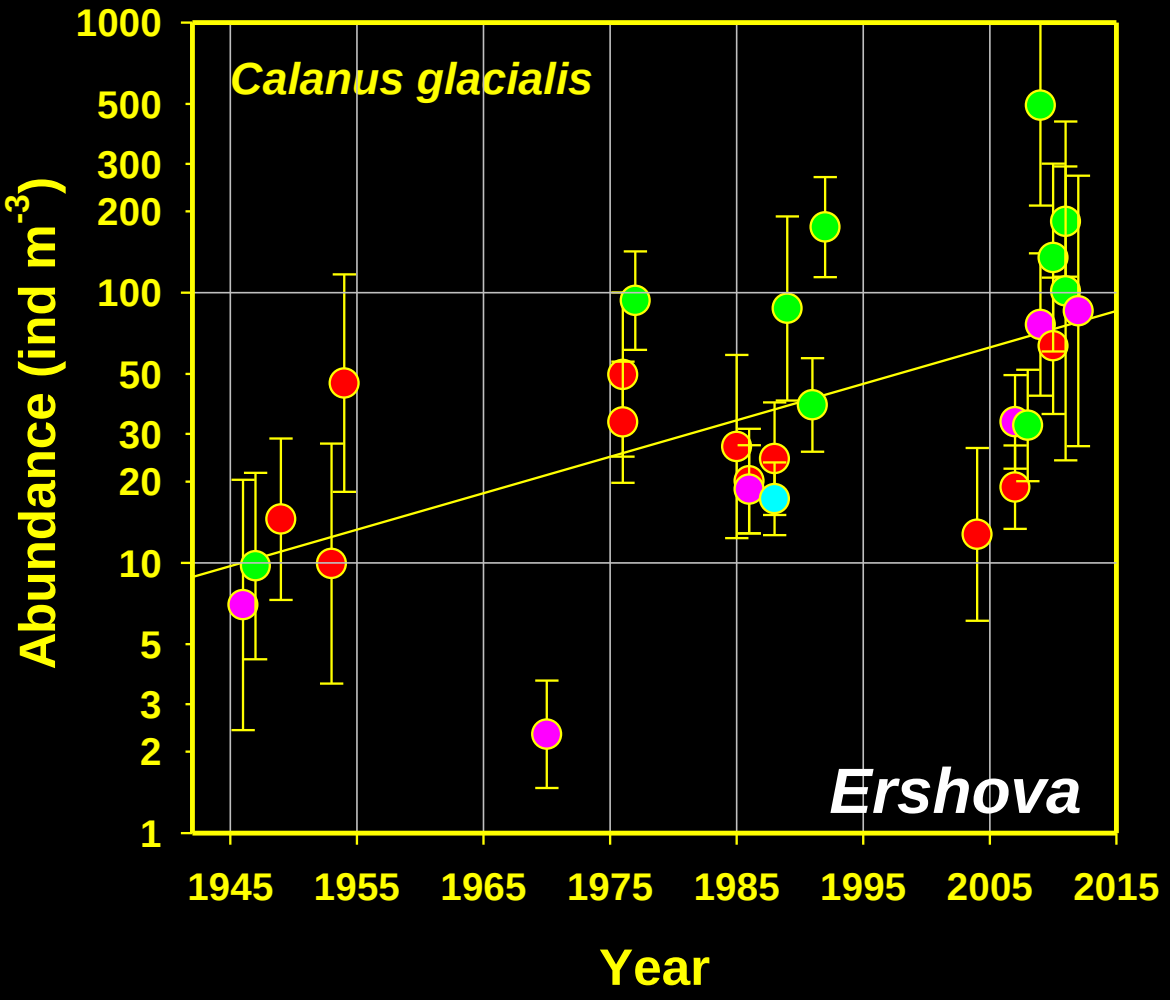
Change often happens by shuffling sibling species, so a lack of taxonomic detail (or latter reduction) has major consequences for defining regions and detecting regions and change



- We are trying to use older data for purposes it was never intended
- Fiddling with data ongoing >> improvement?

- To establish pattern and detect change, we need consistent methodology….
- …. and a long-term commitment to regular observations and time-series

However, all is not lost. On a species-by-species basis, it is possible to show systematic changes over time in regional historical data



Iceland & Norway ~1960, but species-level begins 1990

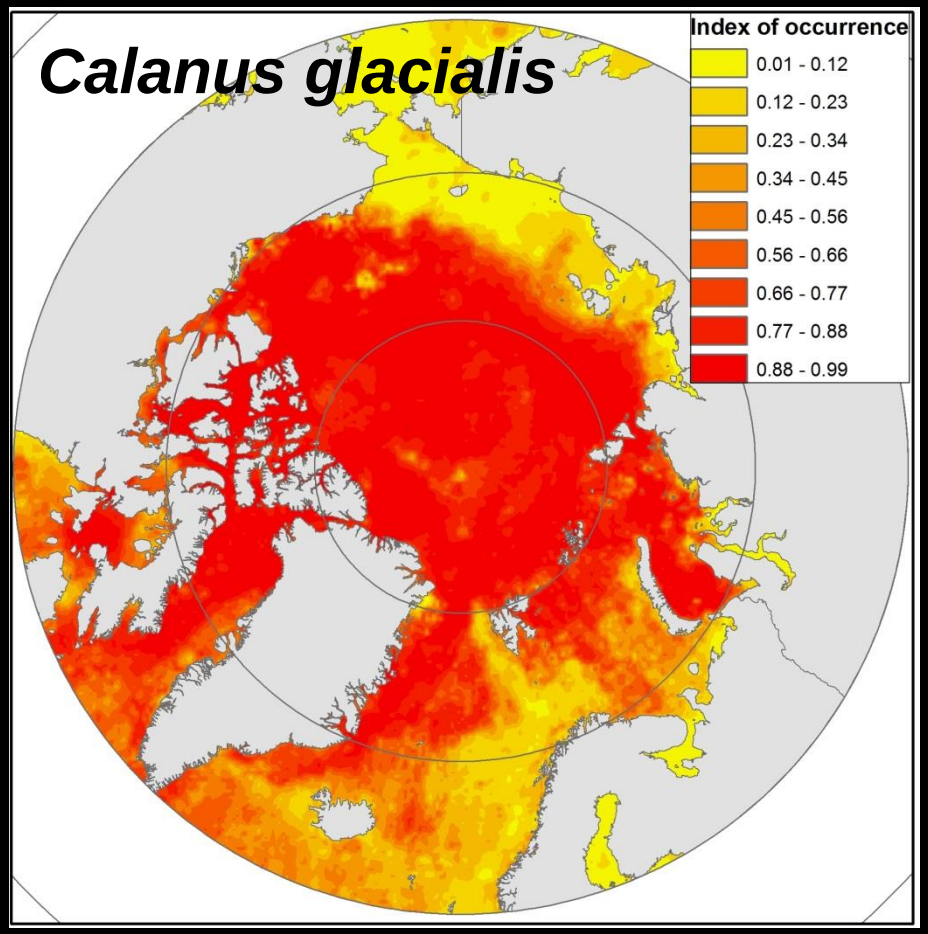
Greenland Fjords late 1990s

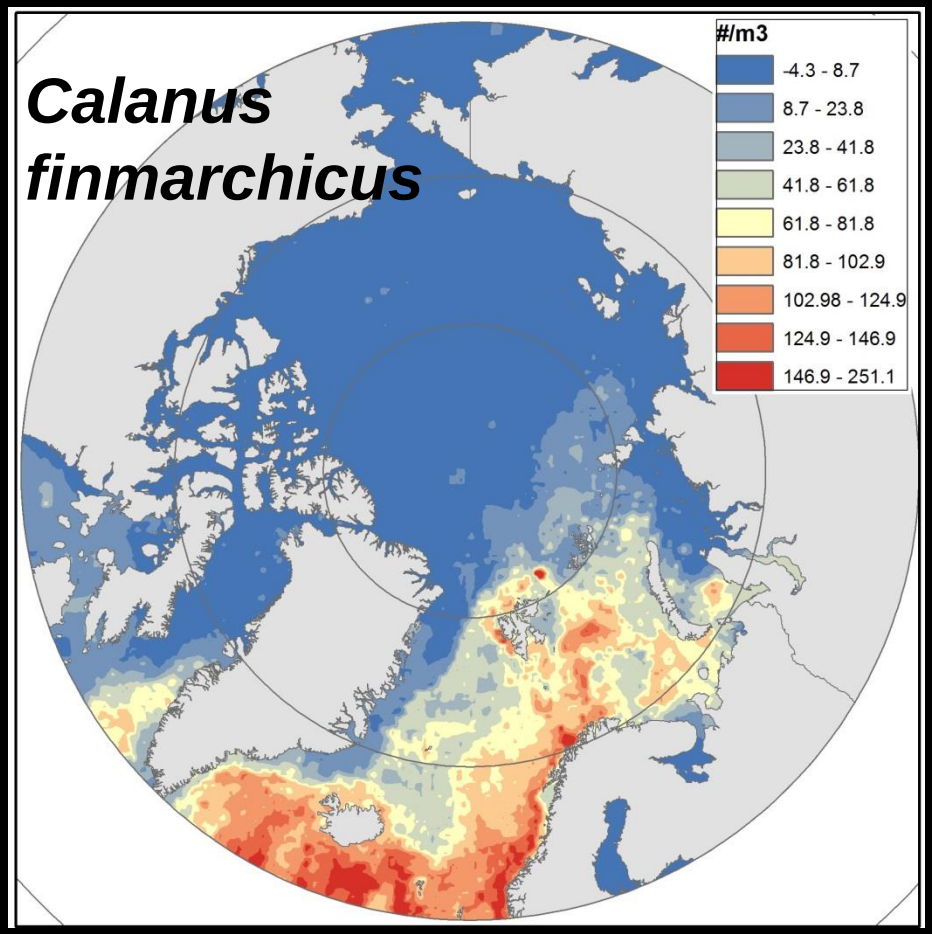
Svalbard Fjords

Faroe Islands

Canada Basin & Beaufort Sea *(in progress)*

GIS-based approaches to predicting contemporary species “niche” occurrence & abundance …… and predicting future based on climate models





Questions?