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Where to overwinter? The detail in the *Calanus hyperboreus* lipids

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Resilience and Recovery in Aquatic Systems

Ecosystem tipping points in open ocean polar ecosystems

Lipid rich ecosystem

Lipid rich copepods – base of the food web

Any threats at the base of the lipid rich food web can cause imbalance and - in worst case tip the ecosystem from the current state to another unknown state

No resilience no recovery

ECOTIP

Lipid rich copepods – case study - *Calanus*

Highly specialized life history trait

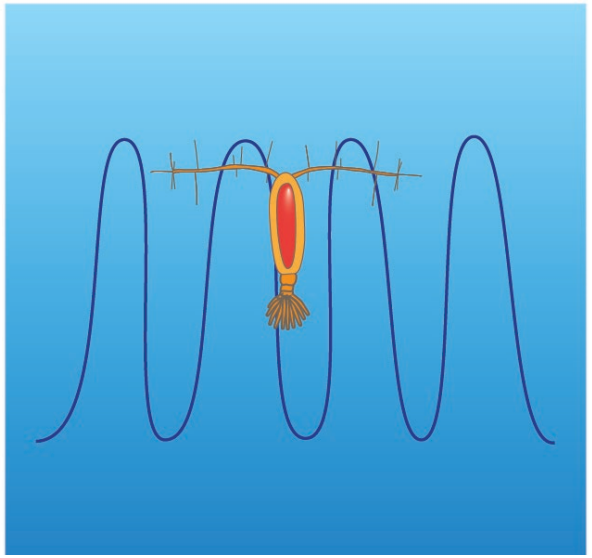
- Lipid accumulation in preparation for diapause
- Lipids are Wax esters (WE)
- Descent to great depths – torpid for up to 9 months

Function of the lipid sac:

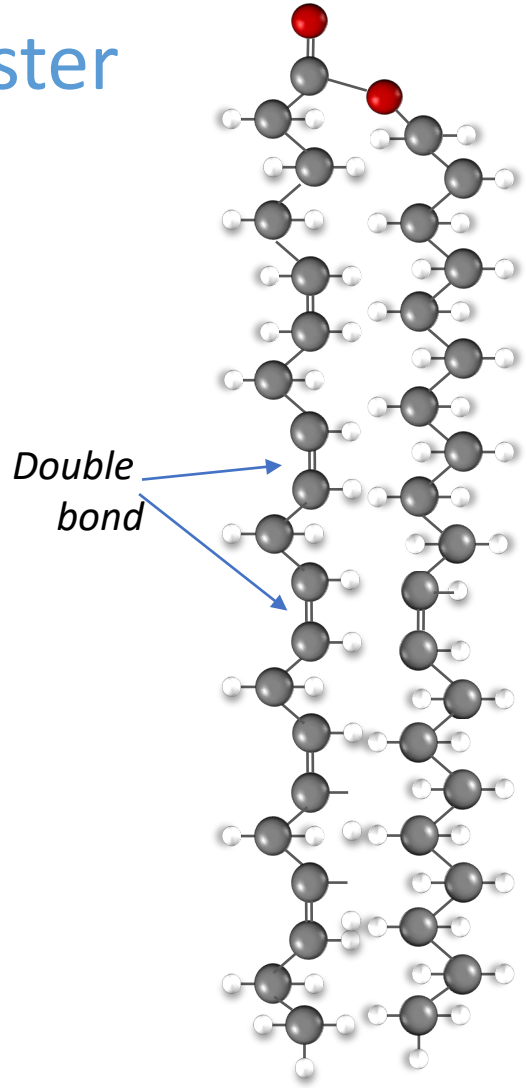
- Energy reserve for period of unfavourable conditions
- Start reproduction in spring – dev. gonads and eggs
- Buoyancy control – WE have the specific physical properties that they compress with ↓Temp↑Pressure

Calanus hyperboreus females
Photo: Sigrun

Function

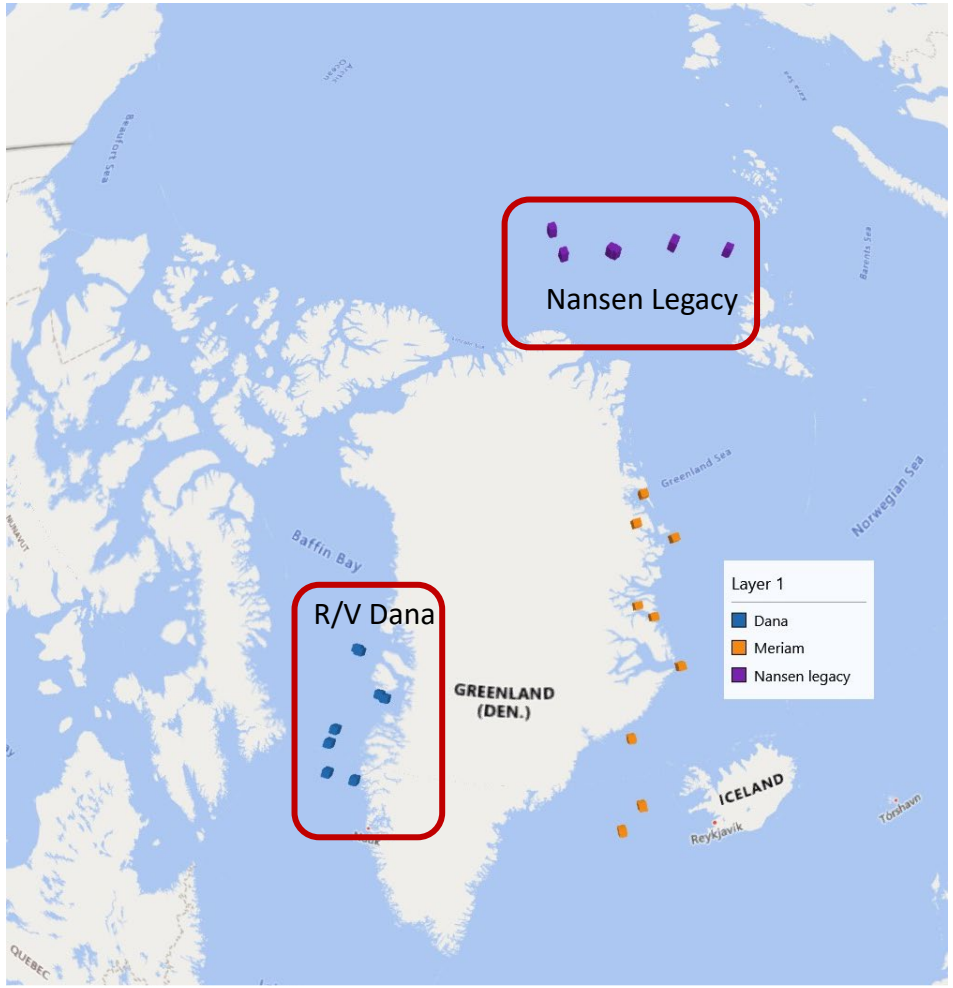


Wax ester



acid 20:5ω3 | alcohol 20:1ω9 | 40 C 6 DB

Wax ester is the key adaptation to the life history trait compressibility (thus buoyancy) is dependent on the saturation level of the wax ester – more double bonds higher unsaturation



How sensitive is this life history strategy to climatic changes?

Changes in

Salinity, Temperature and food environment

Field

- West ~~and East~~ of Greenland and the Nansen and Amundsen basins in the Arctic Ocean
- Intact wax esters of the Arctic copepod *Calanus hyperboreus*

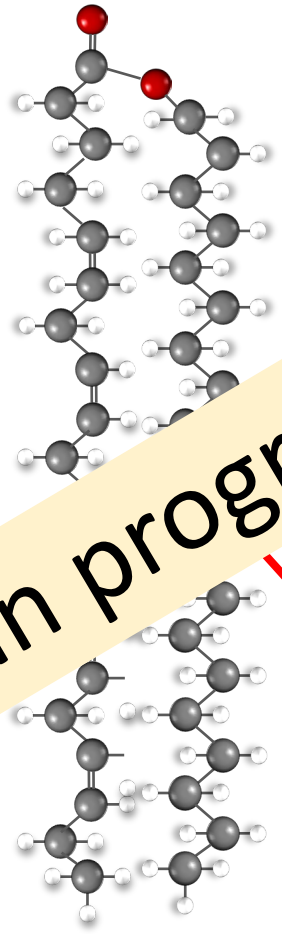
The overarching questions is there a relationship between wax ester structure and the overwintering habitat at which the copepod parks?

Copepod WE

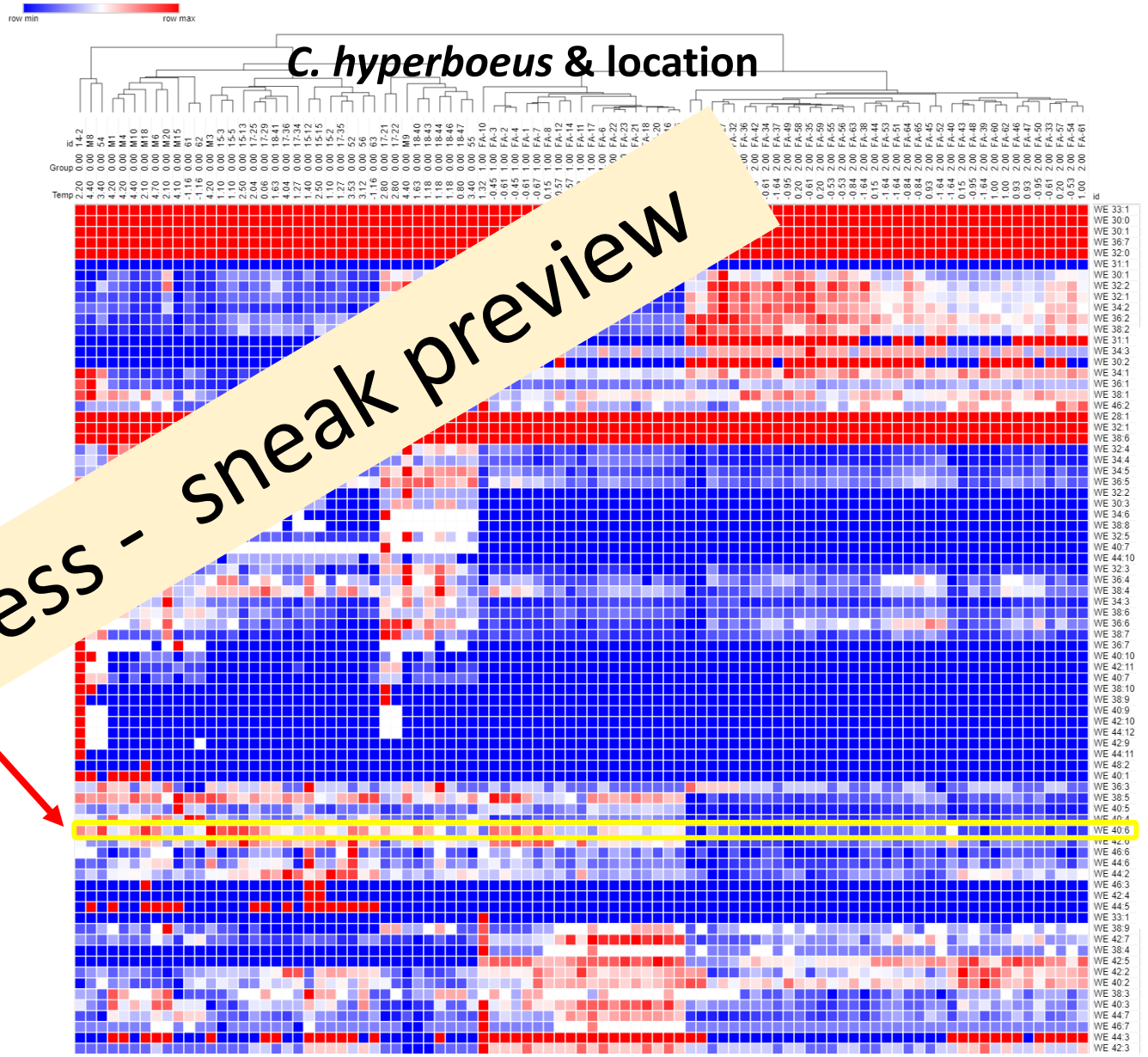
78 combinations

28 – 46 C

0 - 12 double bonds



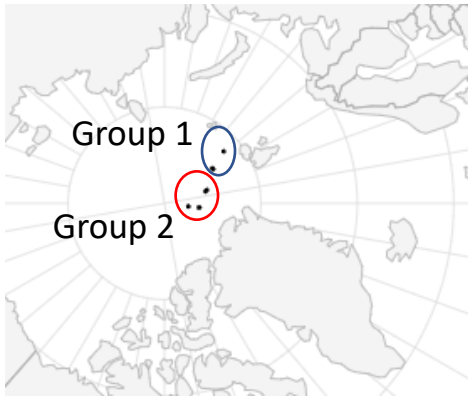
WE 40:6



Work in progress - sneak preview

C. hyperboreus WE

Groups
1 Nansen Basin – Fem
2 Amundsen Basin- Fem



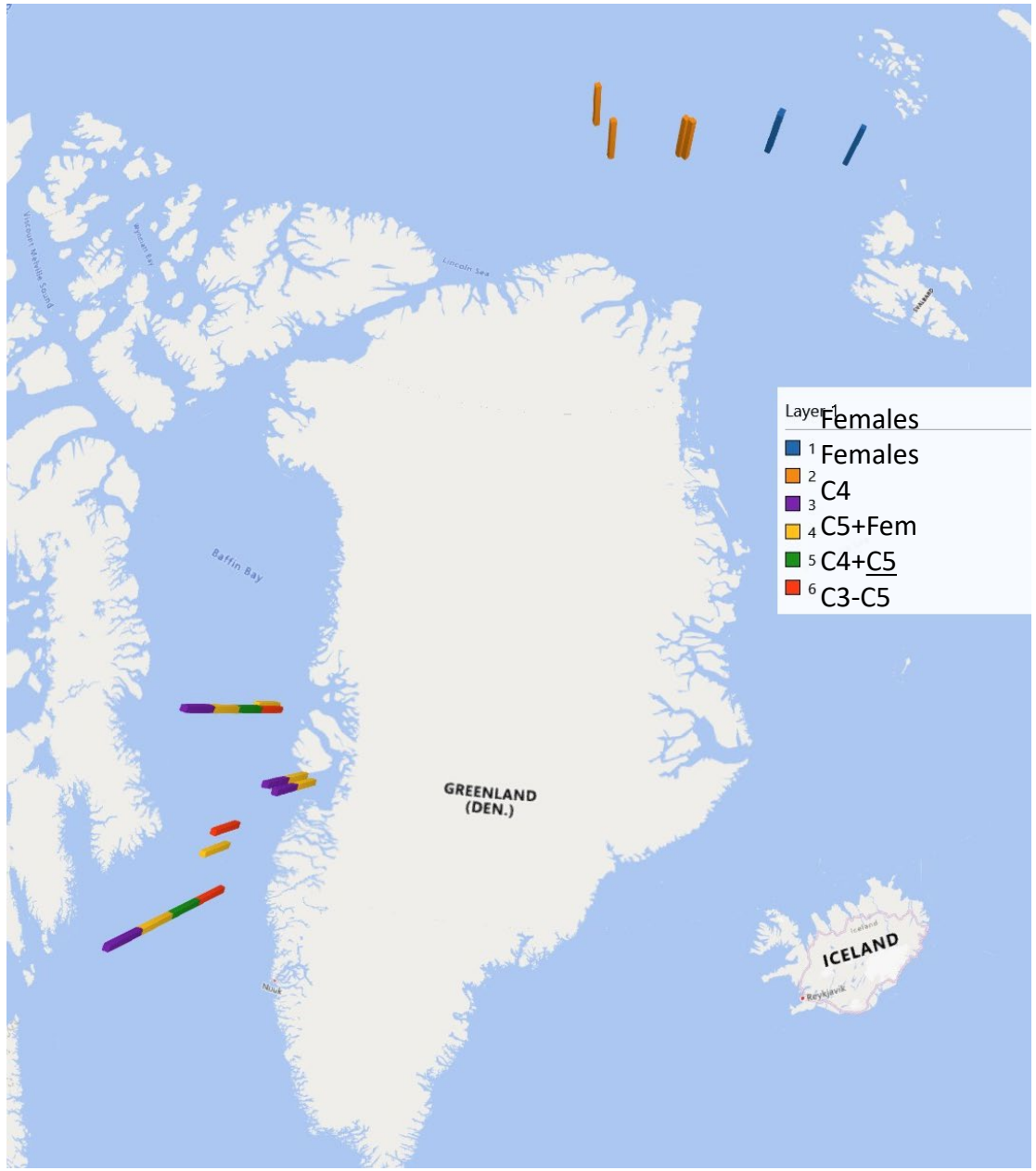
3 WGr. Stage C4
4 WGr. Stage C5 & Fem
5 WGr. Stage C4 + C5
6 WGr. Stage C3-C5

Arctic Ocean – group 2 specific
- Short and more saturated

WGreenland – short but unsaturated

WGreenland and group 1 specific
Longer and unsaturated

Arctic Ocean– group 1 and partly Group 2 specific- longer and mixed unsaturation



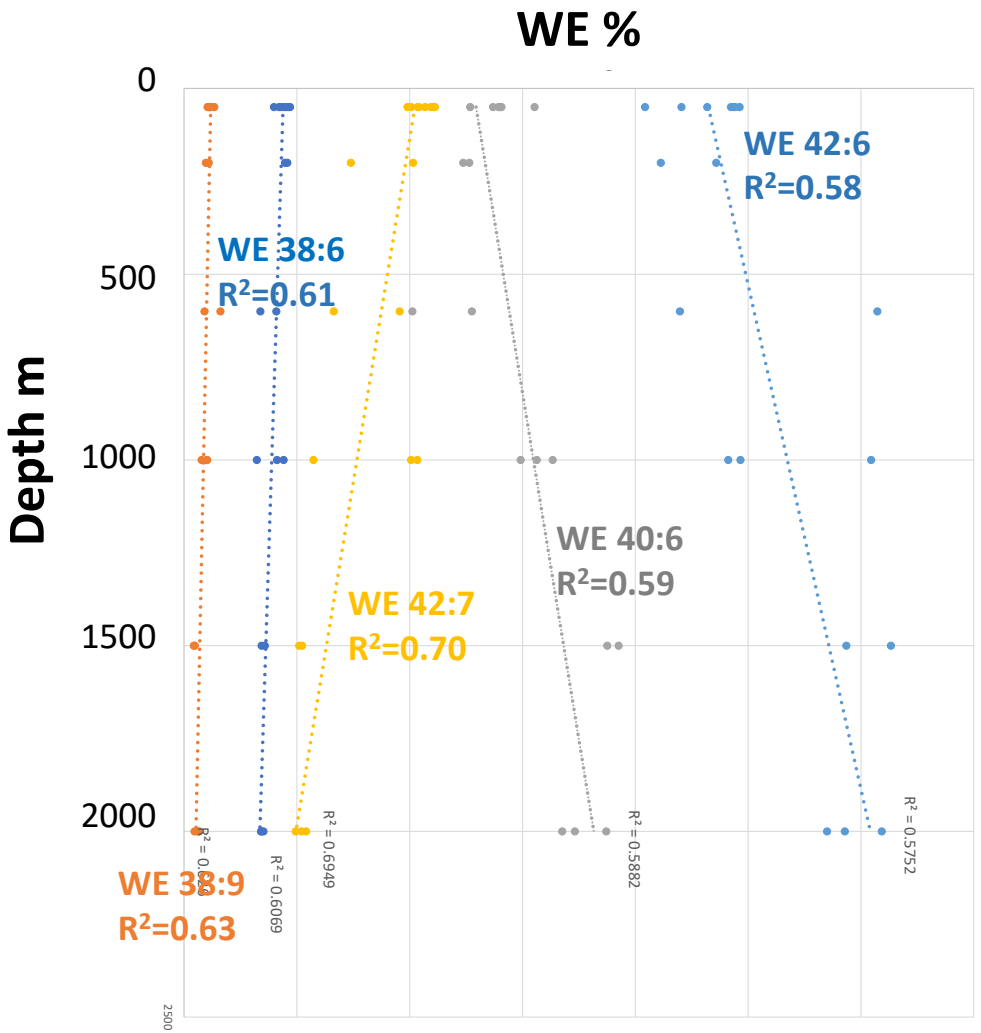
Statistical analyses to be done

Include the East Greenland data for completion

Soup of WE in the lipid sac, so have to reduce data with e.g. PCA

- **Size of lipid sac!**
- Stages
- Depth
- Temperature
- Density
- Seasonality

Depth and saturation



Not so clear cut

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So far we can conclude:

- Yes, there is something very interesting in the wax ester structure that separates groups
- It is not yet clear what determines the WE structure
  - Stages? Food source? Depth? Temp.

- Fun puzzle --- so stay tuned!!