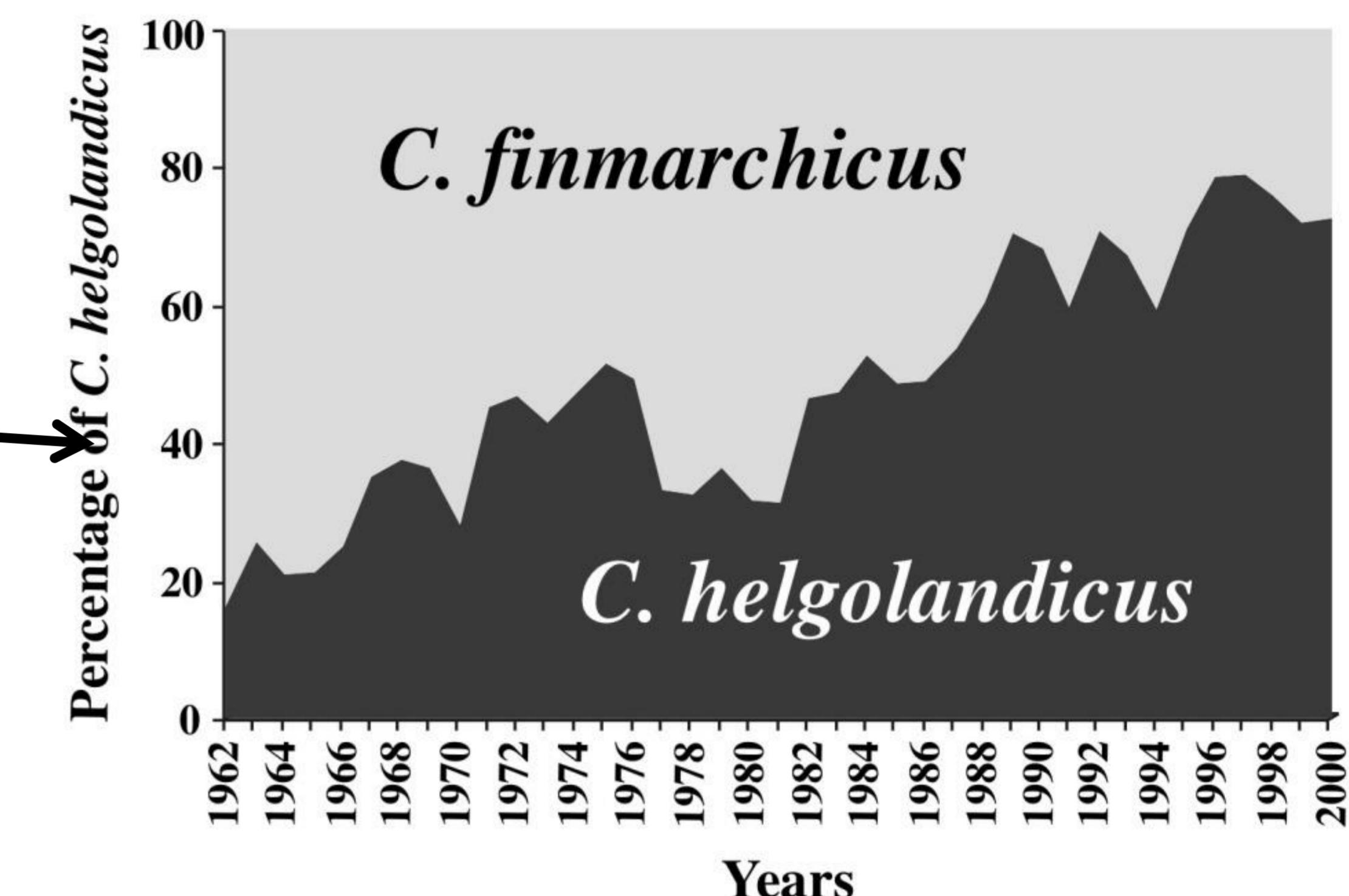
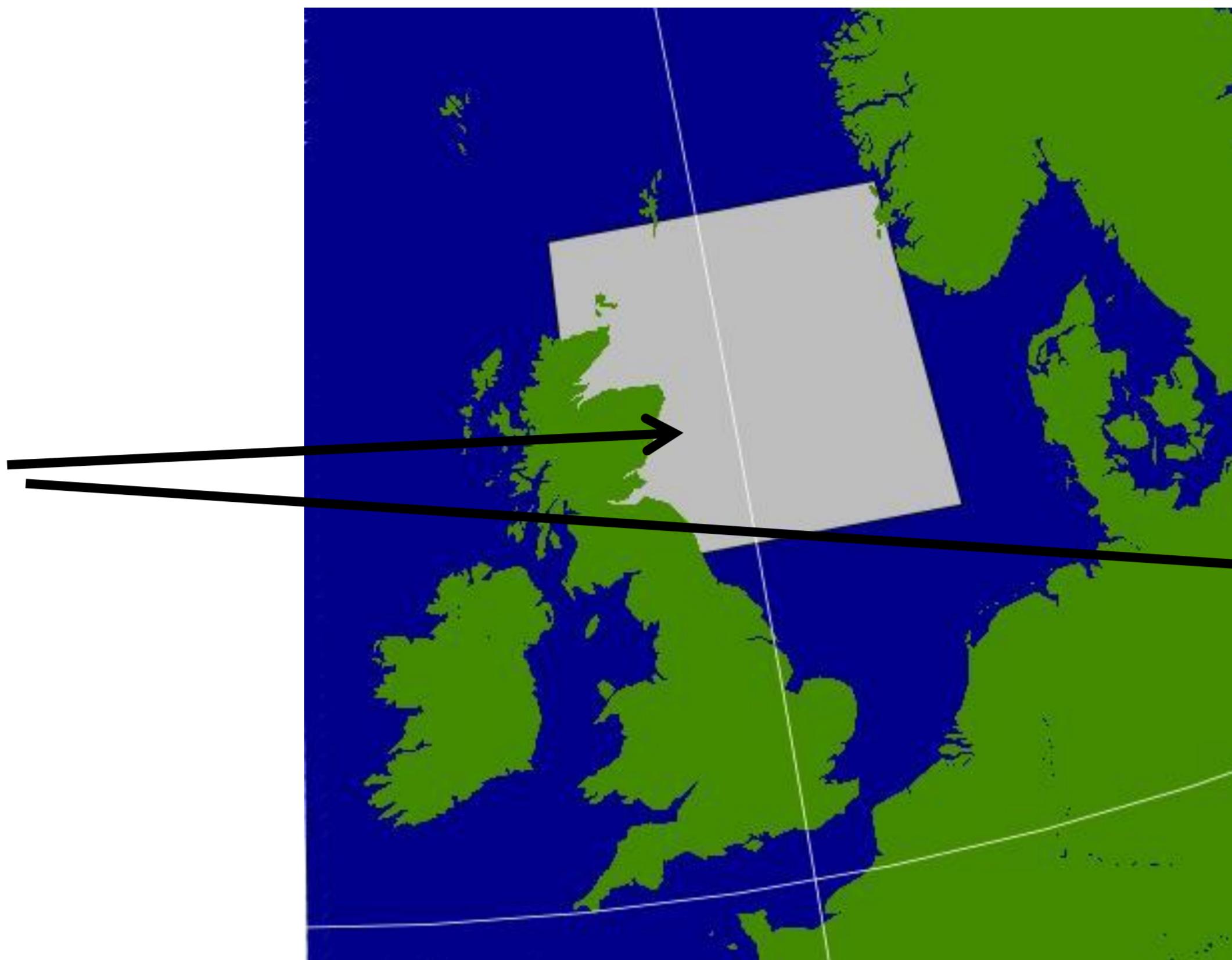


MOTIVATION

The zooplankton species *Calanus finmarchicus* and *C. helgolandicus* are shifting north as oceans warm

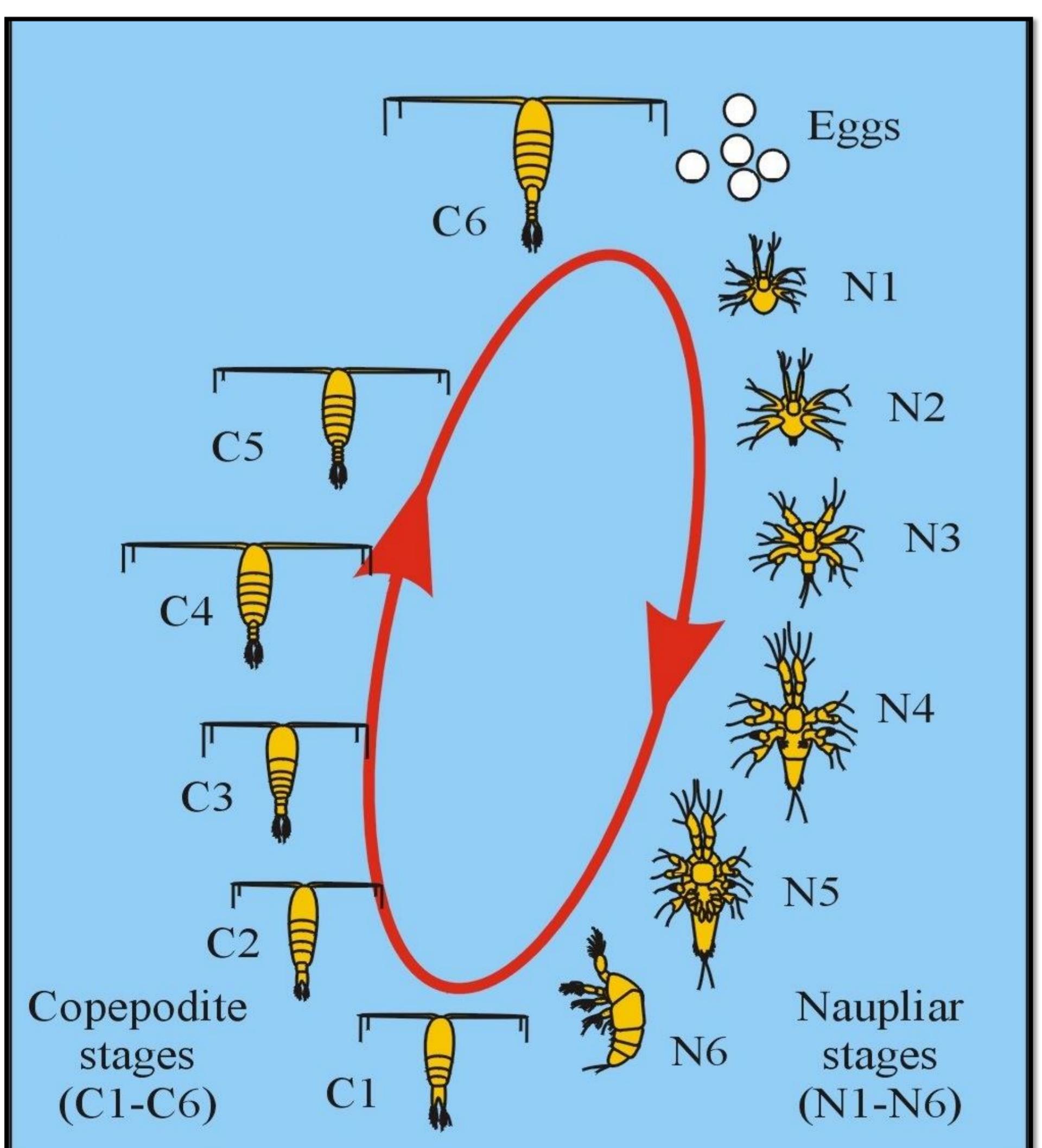
C. helgolandicus replacing *C. finmarchicus* in the North Sea

We review their biological and ecological differences to influence provide a rigorous empirical basis for future modelling studies



Potential ecosystem impacts if *C. helgolandicus* is not a full replacement for *C. finmarchicus*

LIFE CYCLE

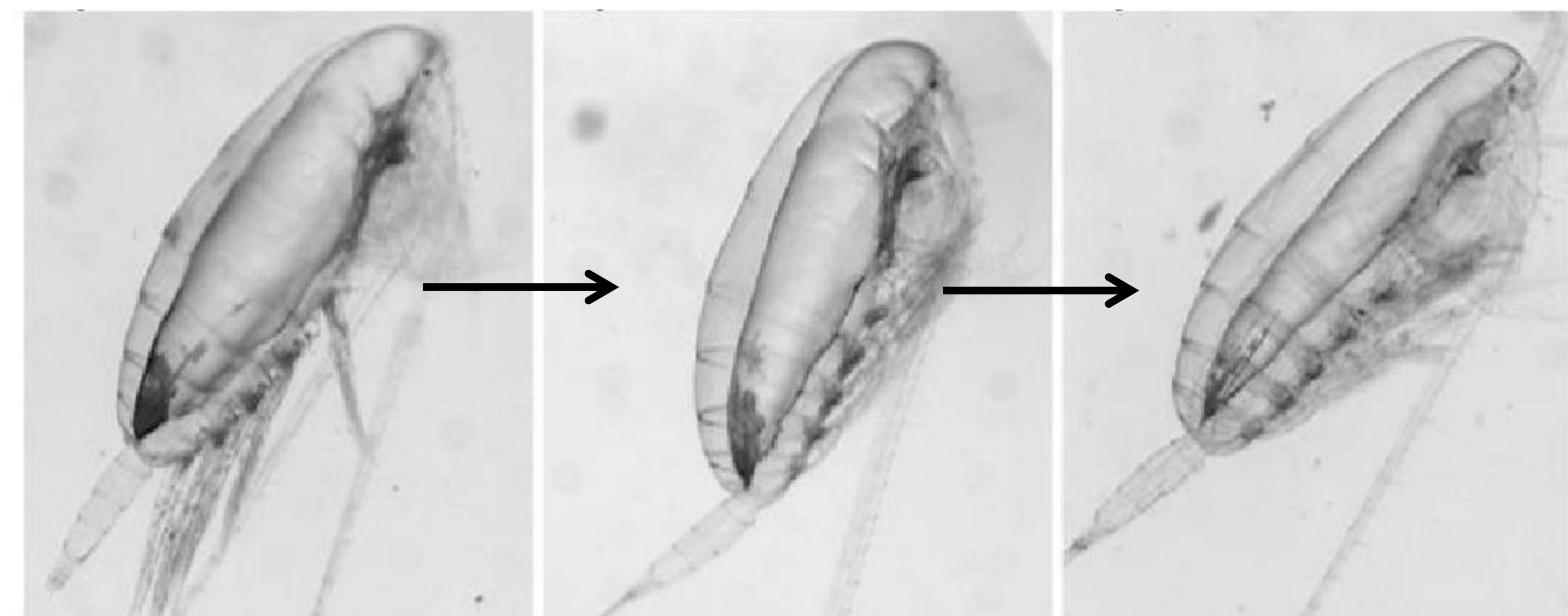


Diapause:

A lengthy period during winter when *C. finmarchicus* lives in deep waters (mostly at stage CV) with low respiration rates.

Lipid reserves play a key role in diapause: as an energy reserve and an enabler of buoyancy regulation

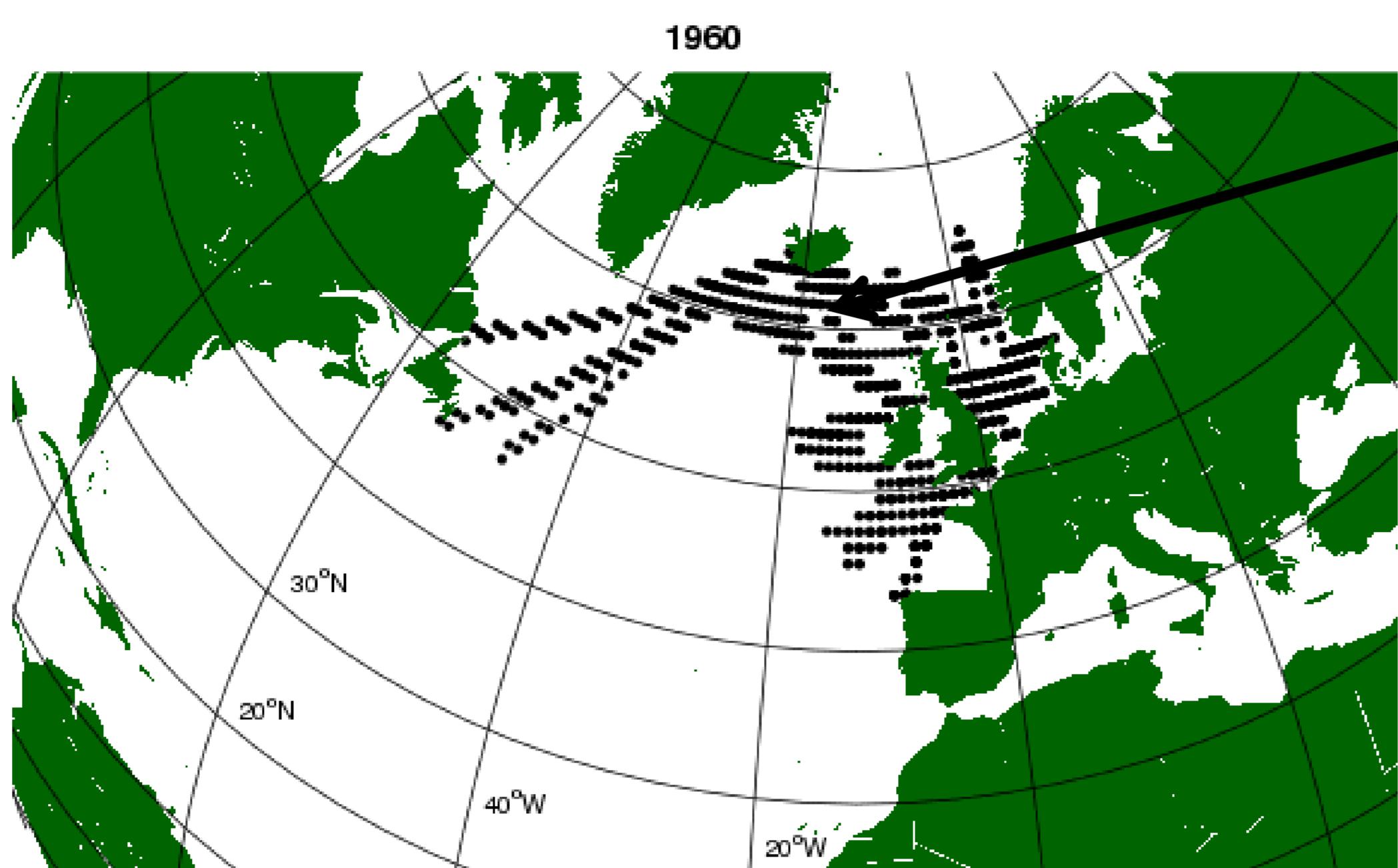
Open question: How important is diapause for *C. helgolandicus*?



Decrease in lipid sac volume as diapause progresses (Perrin et al. 2012)

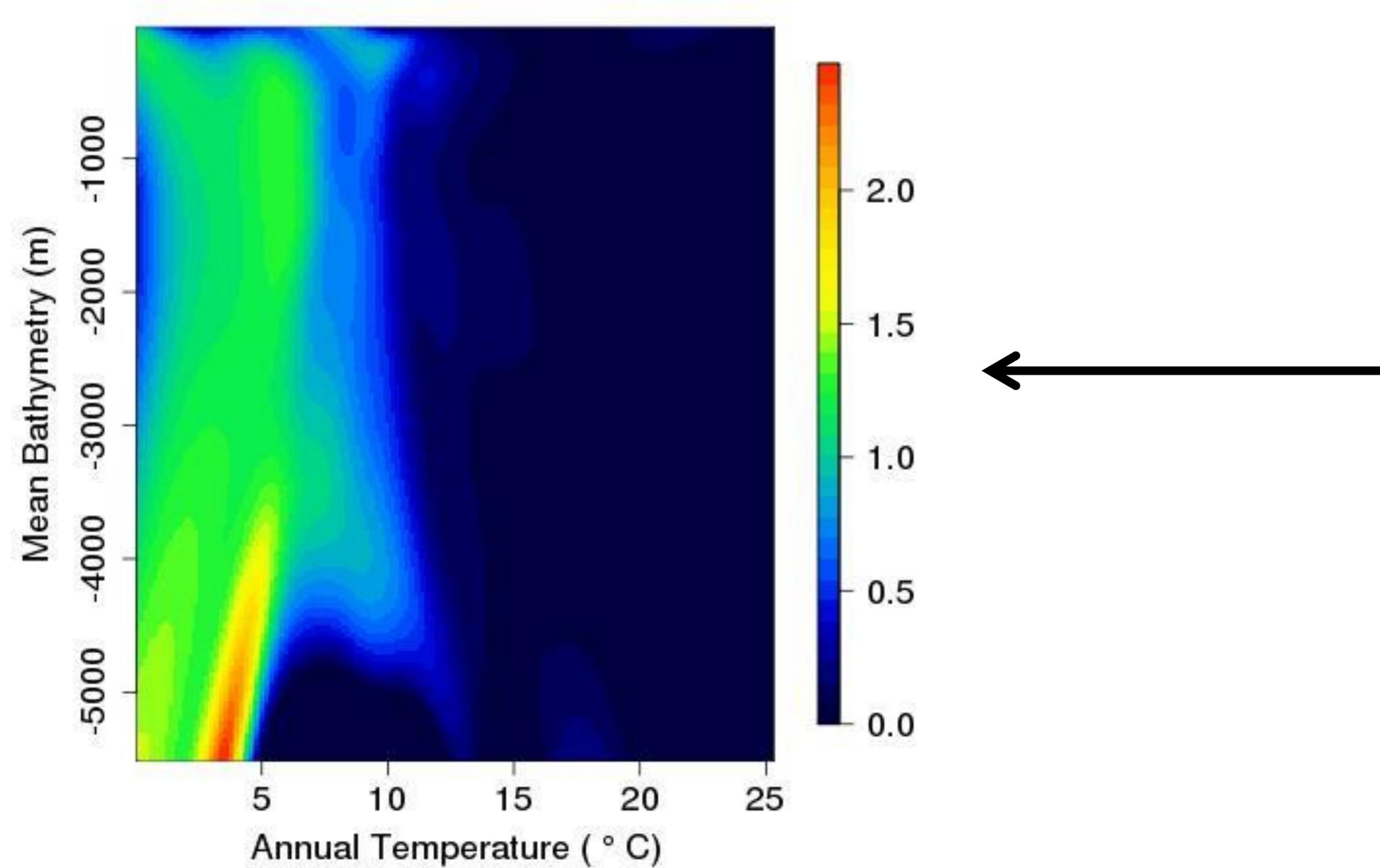
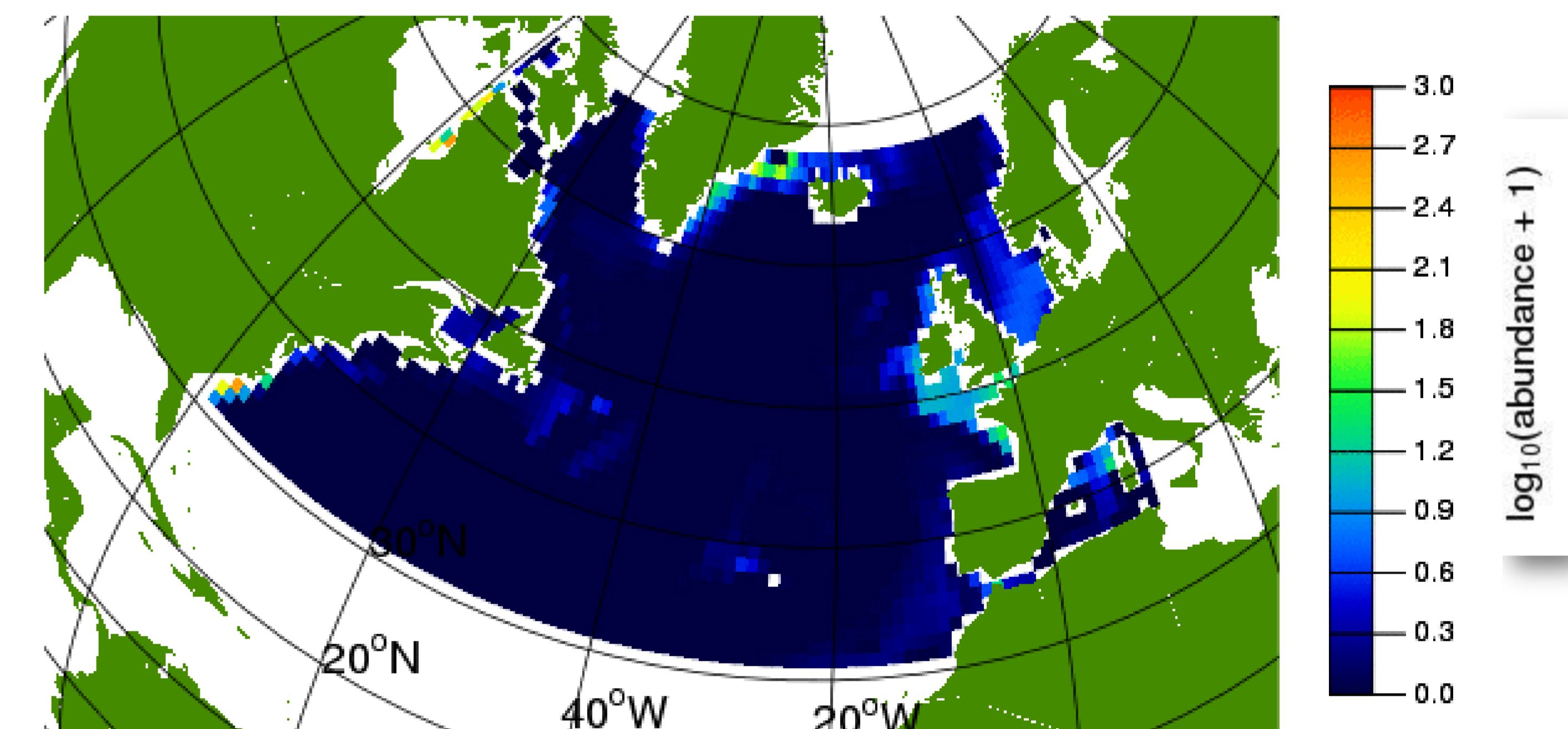
BIG PICTURE

Continuous
Plankton Recorder
has been recording
abundance data of
both species since
1959



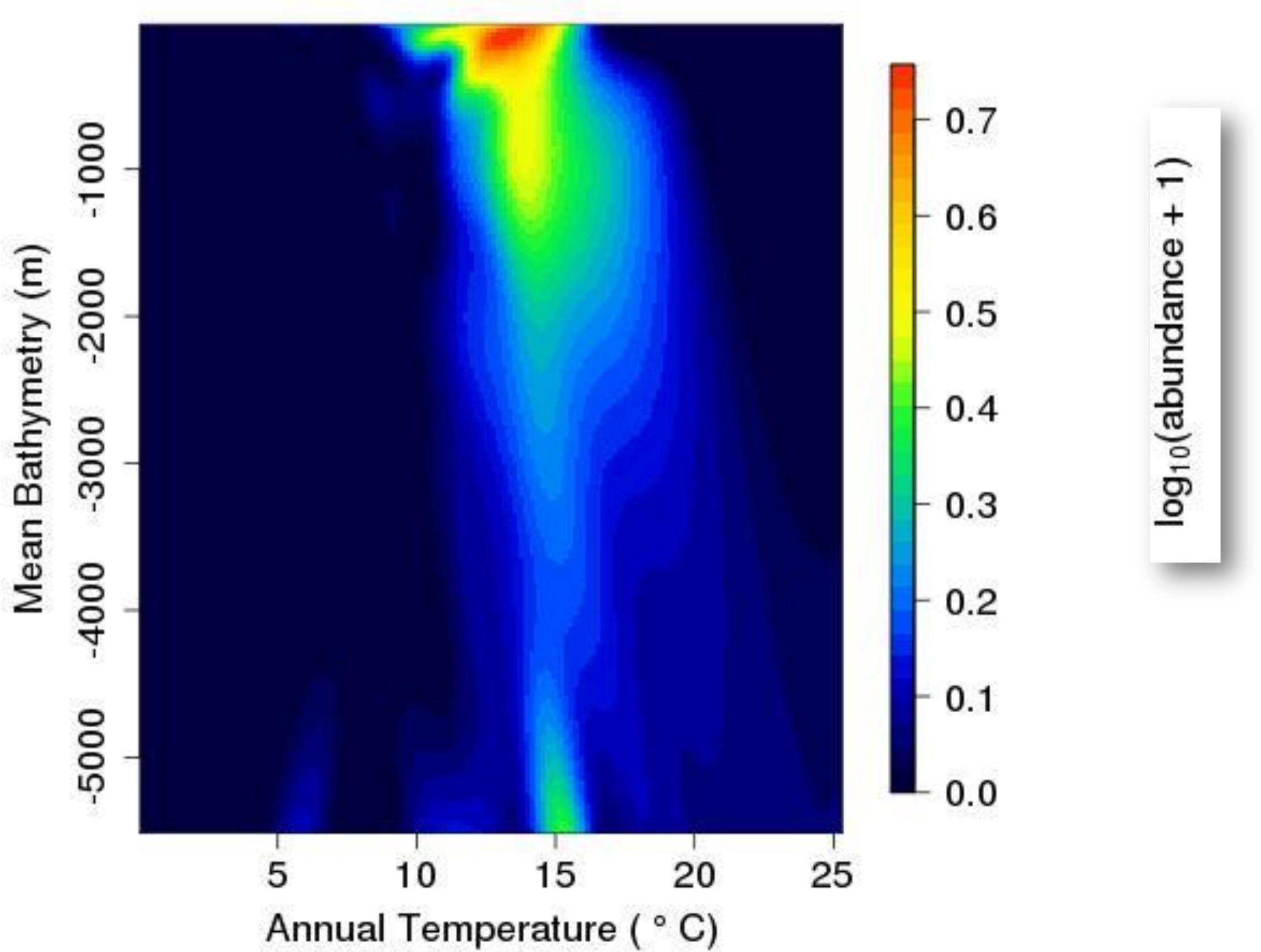
Devices towed on
merchant shipping
vessels

GAM models comparing
abundance of each species
with sea surface
temperature, salinity &
bathymetry successfully
reproduced broad scale
geographic distributions



C. finmarchicus

Modelling reveals distinct
temperature and
bathymetry niches

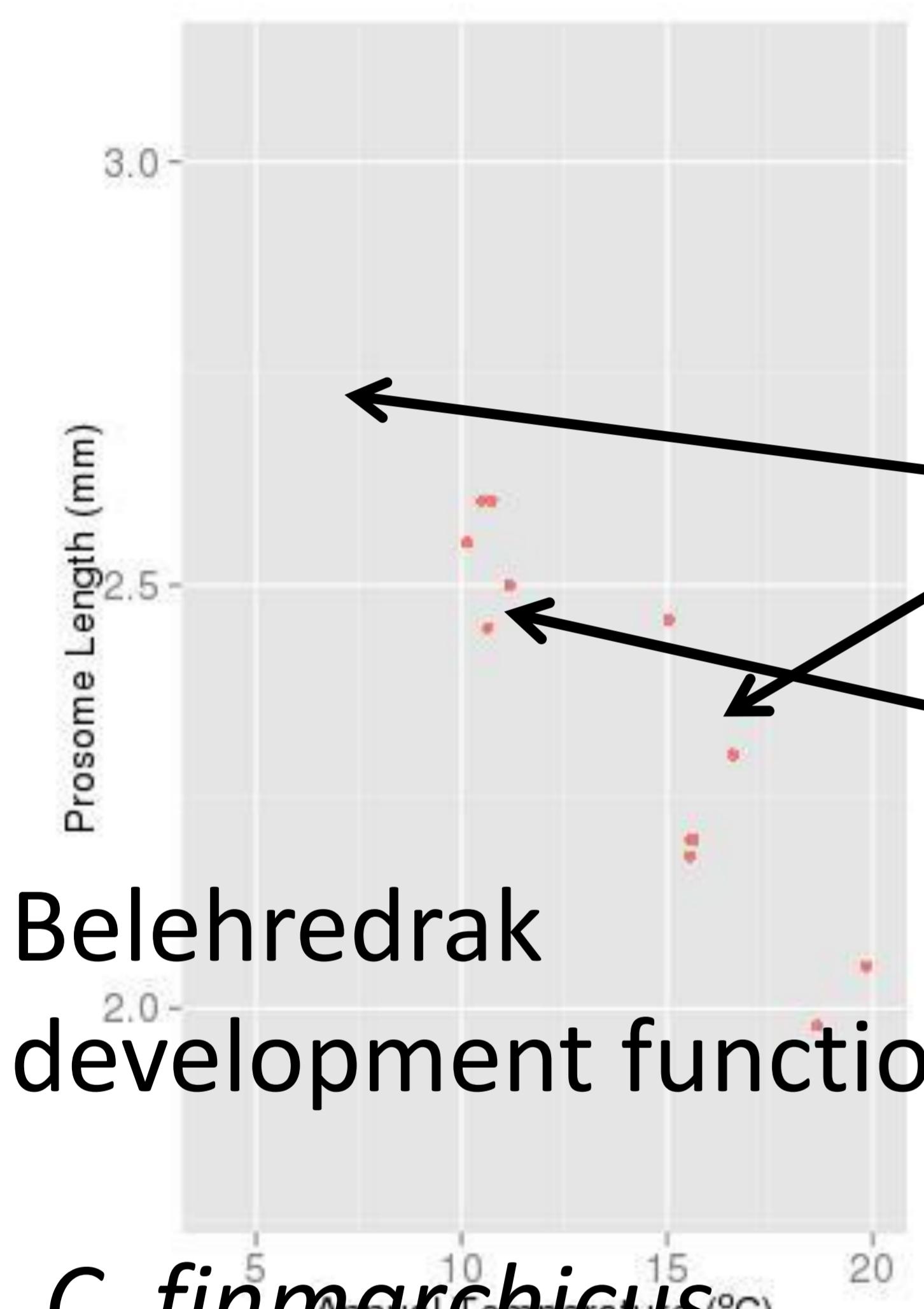


C. helgolandicus

DEVELOPMENT

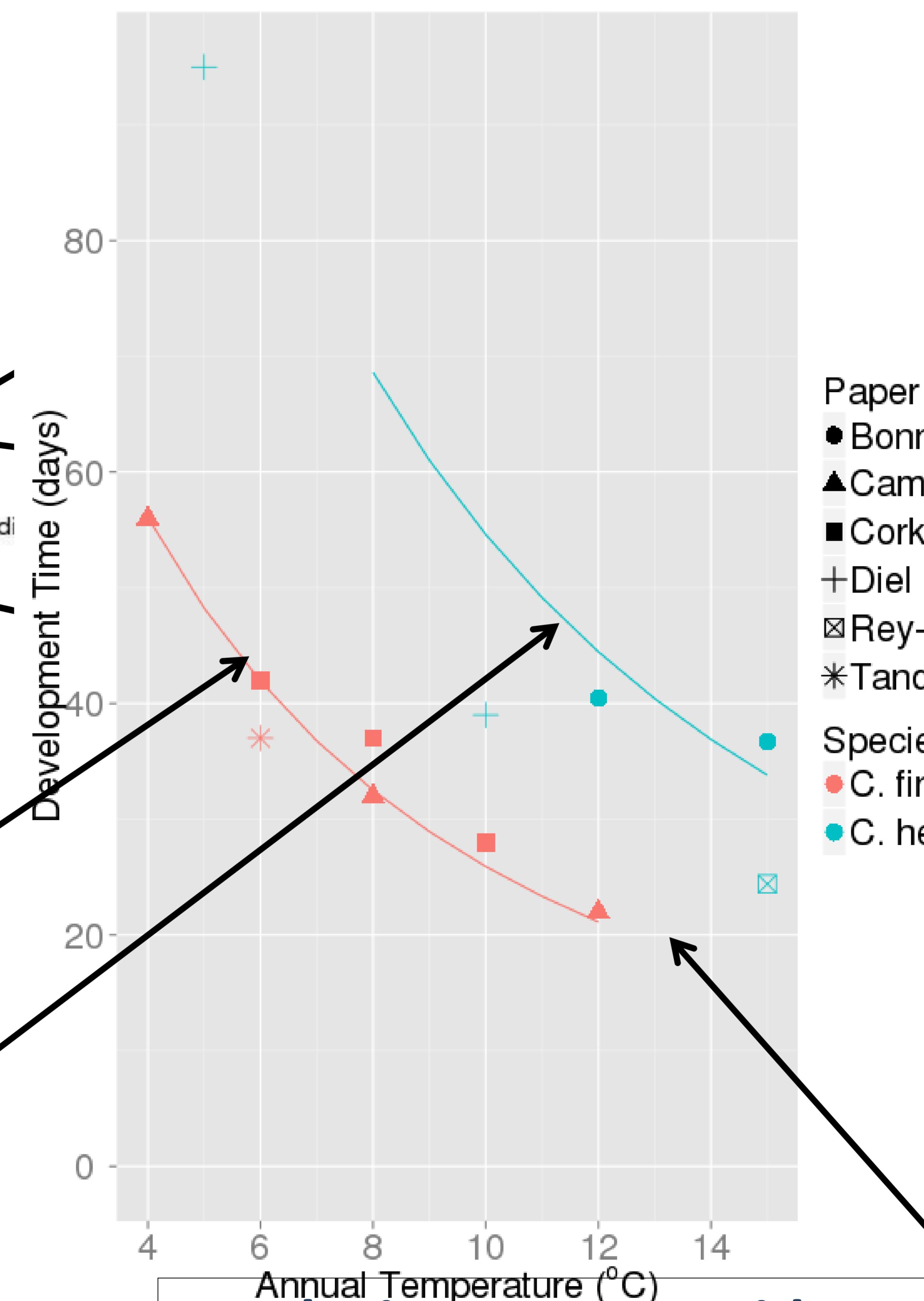
Relationship of development time with temperature under non-food limited conditions

Broad scale differences



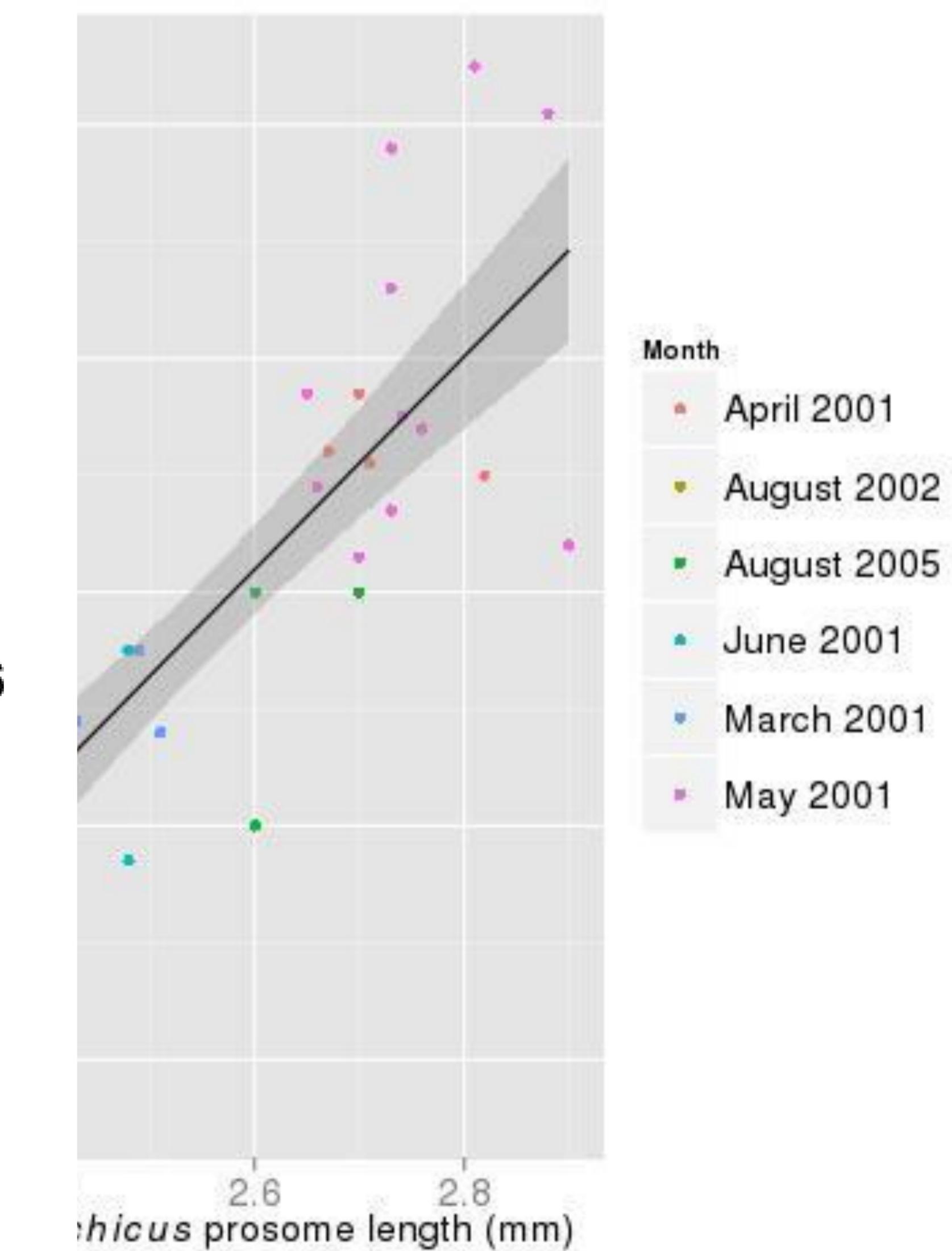
Belehredrak
development functions:

C. finmarchicus
(Campbell et al. 2001)



Conclusion: strong evidence
both species grow to the
same size under identical
environmental conditions

C. helgolandicus
(Bonnet et al. 2001)



Knowledge gap: What
happens here for *C.*
finmarchicus?

Conclusions

Evidence indicates that key differences between the two species is in the relationship of growth to temperature

Despite this, broad similarities exist. Under identical environmental conditions both *C. finmarchicus* and *C. helgolandicus* appear to develop to almost identical body size and have very similar lipid reserves. This has implications for our understanding of the ecosystem impacts of *C. helgolandicus* replacing *C. finmarchicus* in some regions as a result of climate change.

Funding

