

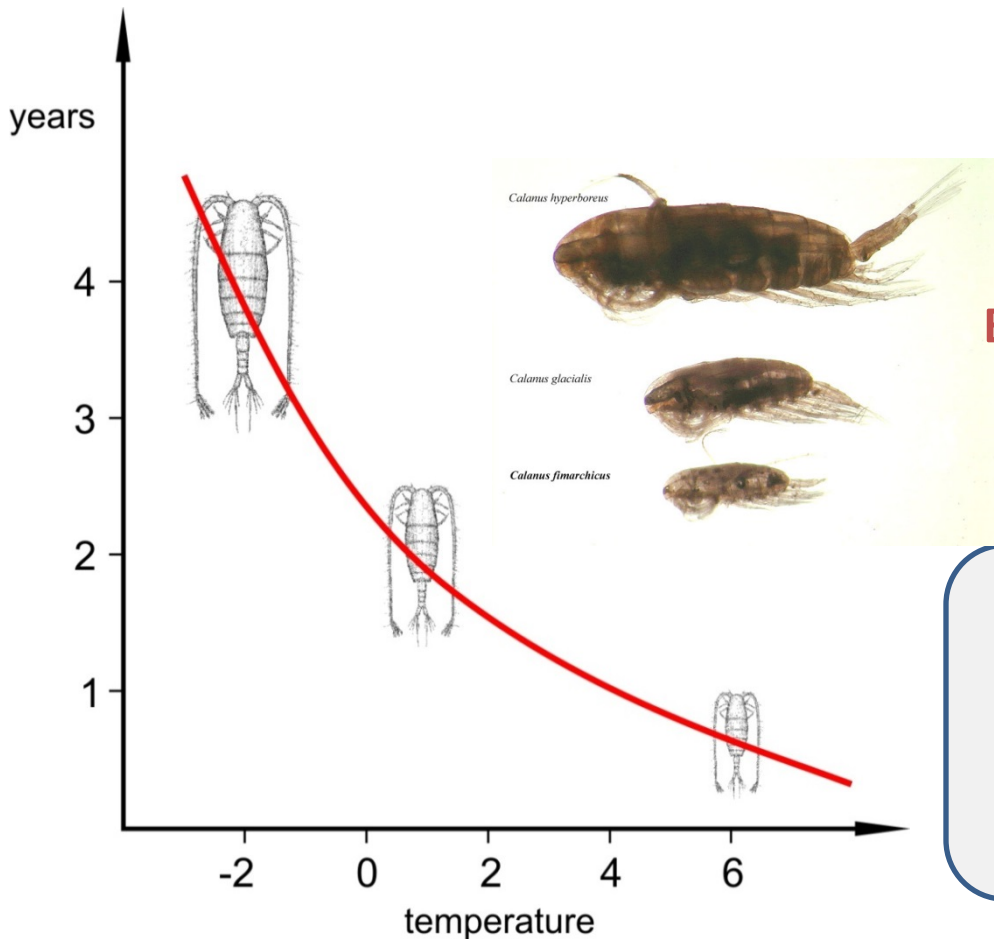
Declining size - a general response to climate warming in Arctic fauna? (DWARF)

Principal Investigator: dr hab. Maria Włodarska-Kowalczuk



SIZE - crucial feature of biological structures

- shapes an organism and ecosystem functioning (e.g. energy flows in food-webs)

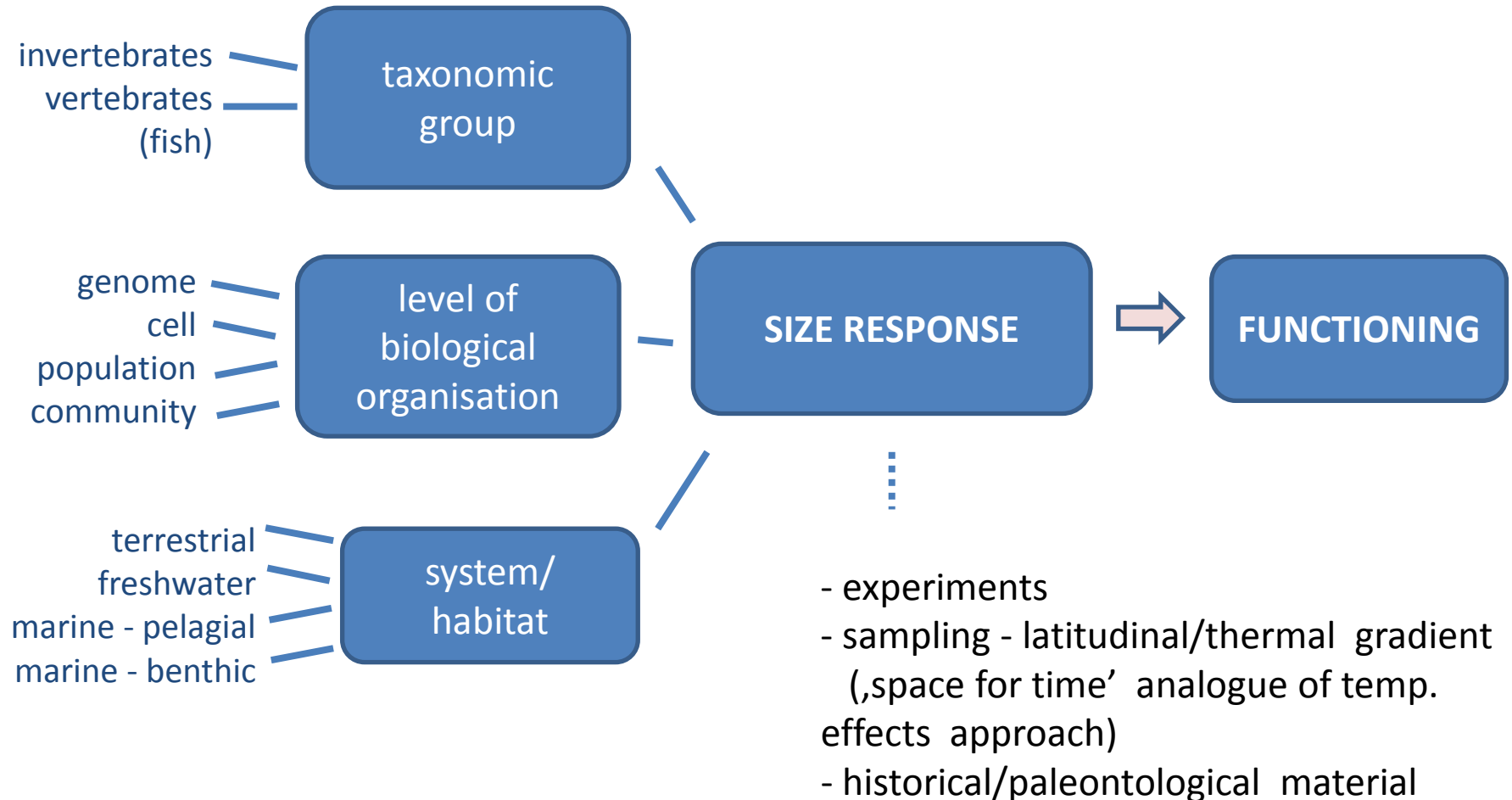


low temperature – long life, large size
Bergman's rule – the higher latitude, the larger size

Declining size – predicted as the third universal response to climate warming (alongside changes in phenology and species distribution)

Gardner et al. 2011, Trends Ecol Evol

Hypothesis: Elevated temperatures will induce size reductions in a large range of high latitude ectotherms.





WP1 Leader:
Prof. Hans P. Leinaas
University of Oslo

habitat: terrestrial

faunal groups: springtails (Collembola) and true insects

- approx. 60 spec. recorded from Svalbard
- small invertebrates less than 3mm
- live in the soil but also under rocks
- important in decomposition and nutrient cycling processes



Photo © SJ Coulson



Photo © A. Fjellberg

springtail
furca



Hypogastrura viatica

TASKS:

- body-, cell- and genome- size distribution analyses of populations sampled across sites ranging from southern Norway to north-east Svalbard
- experimental studies – comparison of thermal reaction norms of animals originated from Svalbard and mainland Norway kept in experimental conditions at selected temperatures



the dung fly
Scatophaga furcata



WP2 Leader:
Dr Martin A. Svenning
NINA Tromsø

habitat: limnetic

faunal groups: freshwater fish and crustaceans



Arctic char
Salvelinus alpinus

the only freshwater fish
species on Svalbard
also distributed on the
entire mainland of
Norway



Lepidurus arcticus



Mysis relicta



Gammaracanthus loricatus



Arctic char:

- sampling by gillnets and net-hauls
- body size, cell size and genome size analyses

Invertebrates:

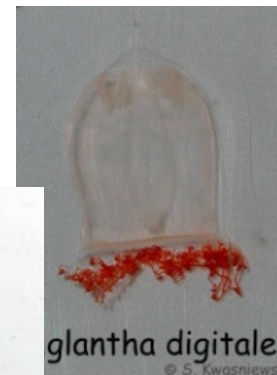
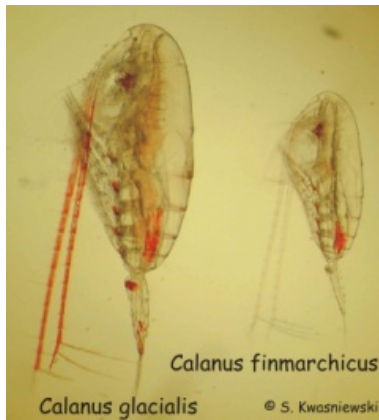
- body size, cell size and genome size analyses in populations across the geographic range of occurrence
- 2-3 species will be raised under two different temperature regimes, and analysed for the same parameters,
- deep-sequencing will be performed on populations with contrasting cell- or genome size to reveal the underlying drivers for genome expansion or reduction.

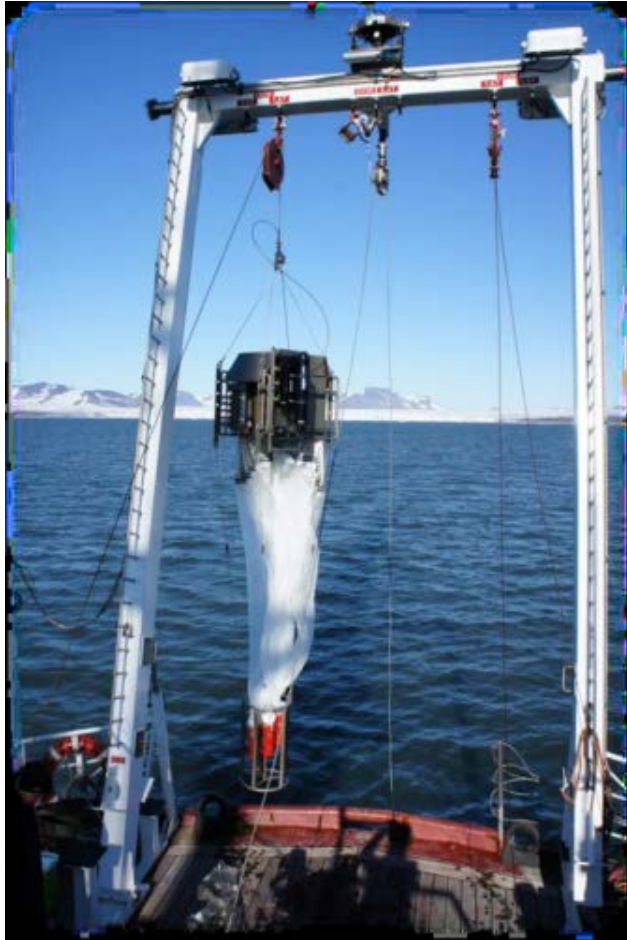


WP3 Leader:
Dr Sławek Kwaśniewski
IOPAN, Sopot

habitat: marine- pelagic
faunal groups: mesozooplankton

- planktonic invertebrates
- dominated by Copepoda
- key element of marine food webs (a trophic link between primary producers and marine birds, fish and benthos)





Multi-net (MPS)

- size/biomass structures of mesozooplankton communities - based on MPS sampling/direct measurements and indirect methods- LOPC surveying
- relationships between the taxonomic and size/biomass structures and the environmental variables
- effects of varying size structures on pelagic food webs and matter and energy fluxes



Laser Optical Plankton Counter (LOPC)- high-resolution automatic measurements of plankton biovolume spectra



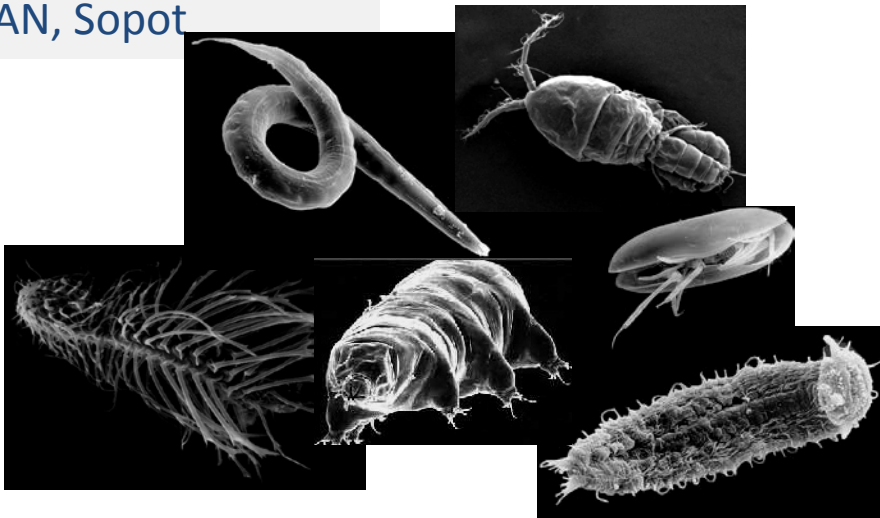
WP4 Leader:
Dr M. Włodarska
-Kowalczyk
IOPAN, Sopot

habitat: marine- benthic

faunal groups: meio- and macrozoobenthos (soft bottom)

Bryozoa (hard bottom, encrusting fauna)

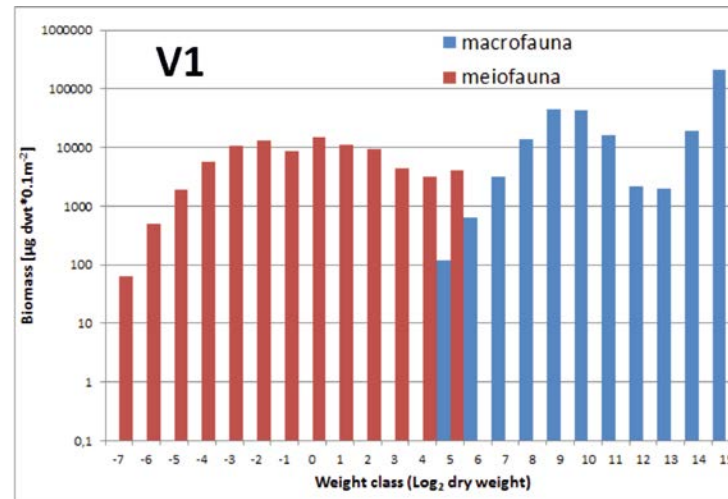
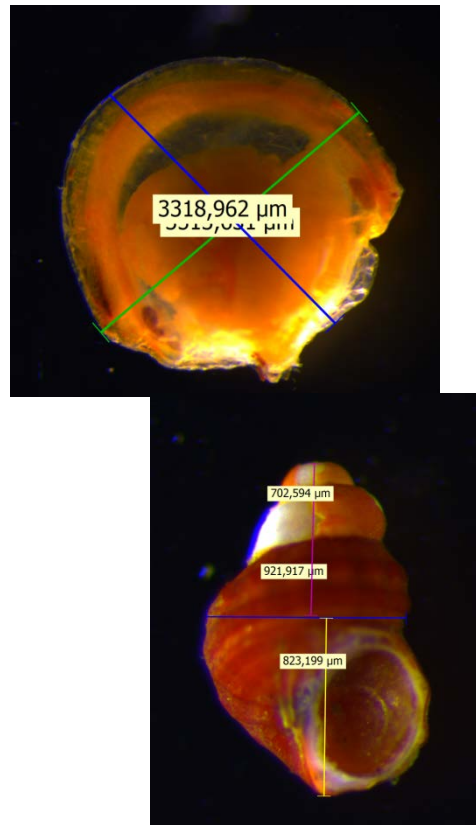
meiofauna
32-500 μm



macrofauna
500 μm – a few cm



- analyses of size structure of populations of selected macrofaunal species and of benthic communities across meio- and macrofauna
- What are implications of change in size structure on the functioning of the system (secondary production, respiration, bioturbation)





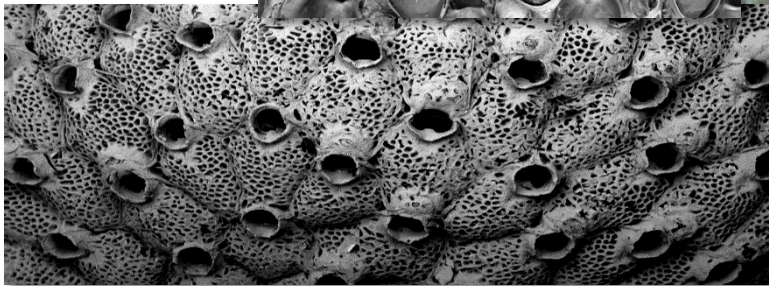
habitat: marine- benthic
faunal groups: meio- and macrozoobenthos (soft bottom)
Bryozoa (hard bottom, encrusting fauna)

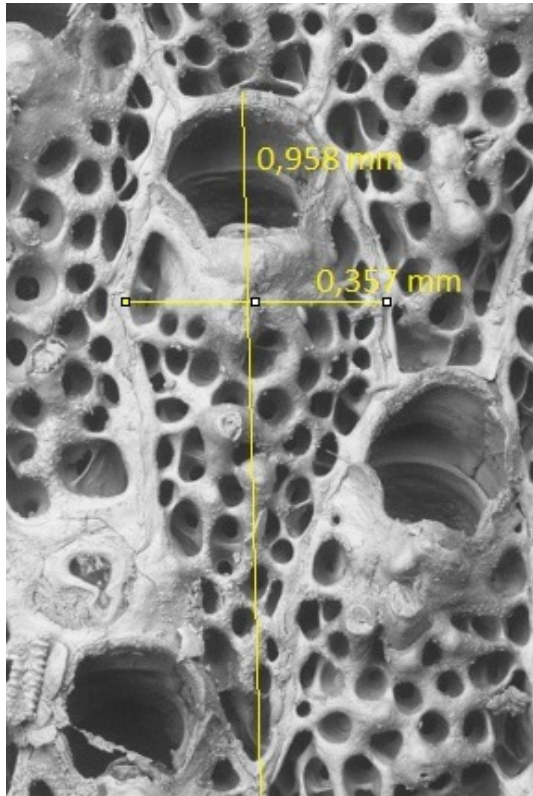
Bryozoa – calcifying, colonial fauna

WP4

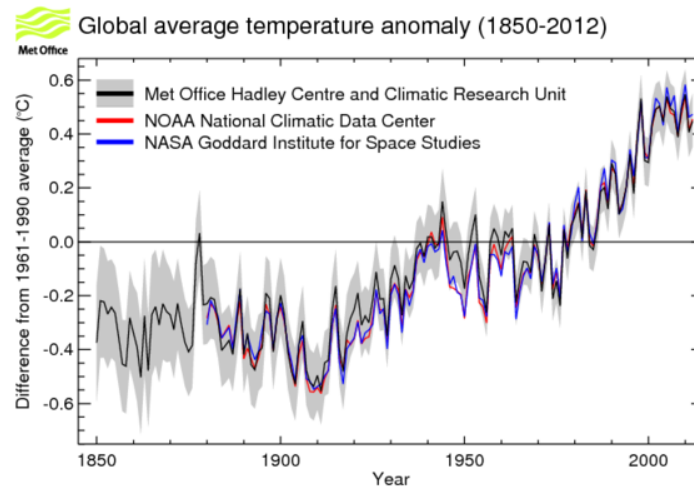
Bryozoa-

Dr Piotr Kukliński
IOPAN, Sopot





- bryozoan zooid size as an indicator of environmental (temperature) variability
- analyses of historical (museum) collections-samples from Svalbard (starting from the beginning of of XXth century)

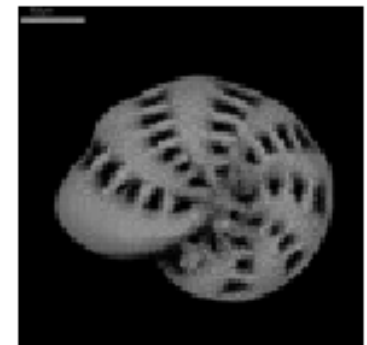


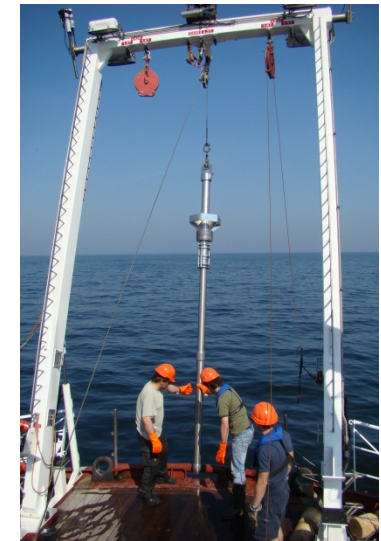
habitat: marine- benthic -paleo
faunal groups: Foraminifera

Foraminifera - excellent indicators of paleoenvironments:

- very numerous (several hundreds or thousands of ind. per 50cm³)
- very diverse - 3000-4000 recent species
- leave excellent fossil record.

WP5 Leader:
Joanna Pawłowska
IOPAN, Sopot

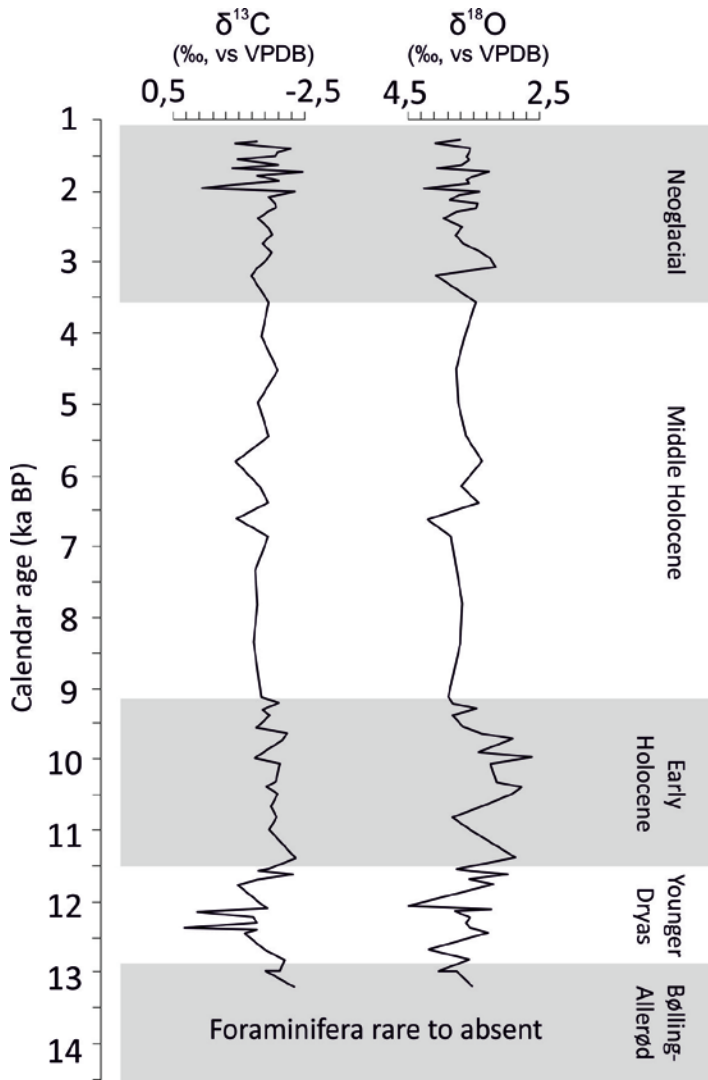
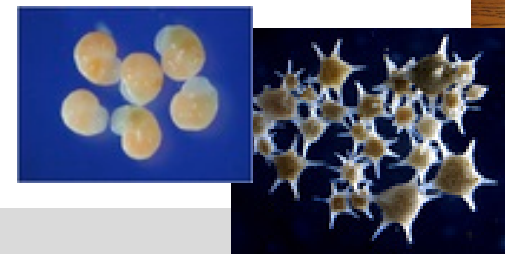




MATERIAL:
Three sediment cores spanning the Holocene (~ 12 kyr)

TASKS:

- Assessment of size structure of benthic foraminifera assemblages
- Analysis of size distribution in dominant foraminiferal species
- Assessment of foraminiferal test size as paleoenvironmental proxy





WP6 Leader:
Prof. Dag Hessen
University of Oslo

- Analyses of data in animal genome database (www.genome.com; 4972 species)
- Comparison of genome size in fish and invertebrates for phyla covering wide thermal gradient in their distribution (taxa selected based on literature survey on species distribution)



WP7 Leader:
Prof. Jan Marcin
Węśławski
IOPAN, Sopot

- Integration of the project research;
 - synthesis of the results;
 - formulation of the conclusions
 - recommendations for science-based management in the Arctic under the climate change
- Dissemination of knowledge:
 - publications in scientific journals, including the DWARF synthesis paper
 - conference presentations
 - popular science book
 - cooperation with schools – set of lessons scenarios downloadable from the project web-site



Big Fish Eat Little Fish, Peter Bruegel the Elder, 1557