DWARF
VP1 – Terrestrial fauna

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Close collaboration with

Martin Svenning - *WP 2 – Limnetic fauna*

Dag Hessen - *WP 6 – Database and literature survey – genome-, cell- and body size and temperature*

Two ecological rules

1. Bergmann's rule = body size increase towards colder areas *(In ectotherms often called **Bergmann clines**)*

It refers to ***phenotypic variation observed in the field***,
i.e. combined effect of **micro-evolution** and **phenotypic plasticity**
(on any environmental differences)

Bergmann clines are common in nature, but it doesn't "rule",
In particular in terrestrial ectotherms we also find the opposite pattern;
i.e. "***Converse Bergmann clines***" .

Two ecological rules

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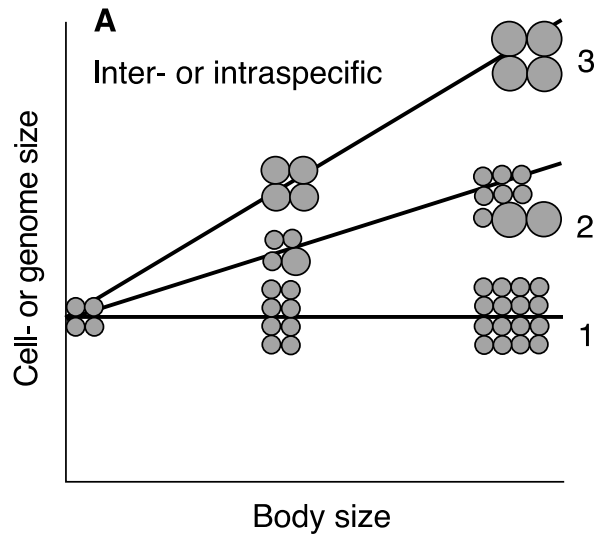
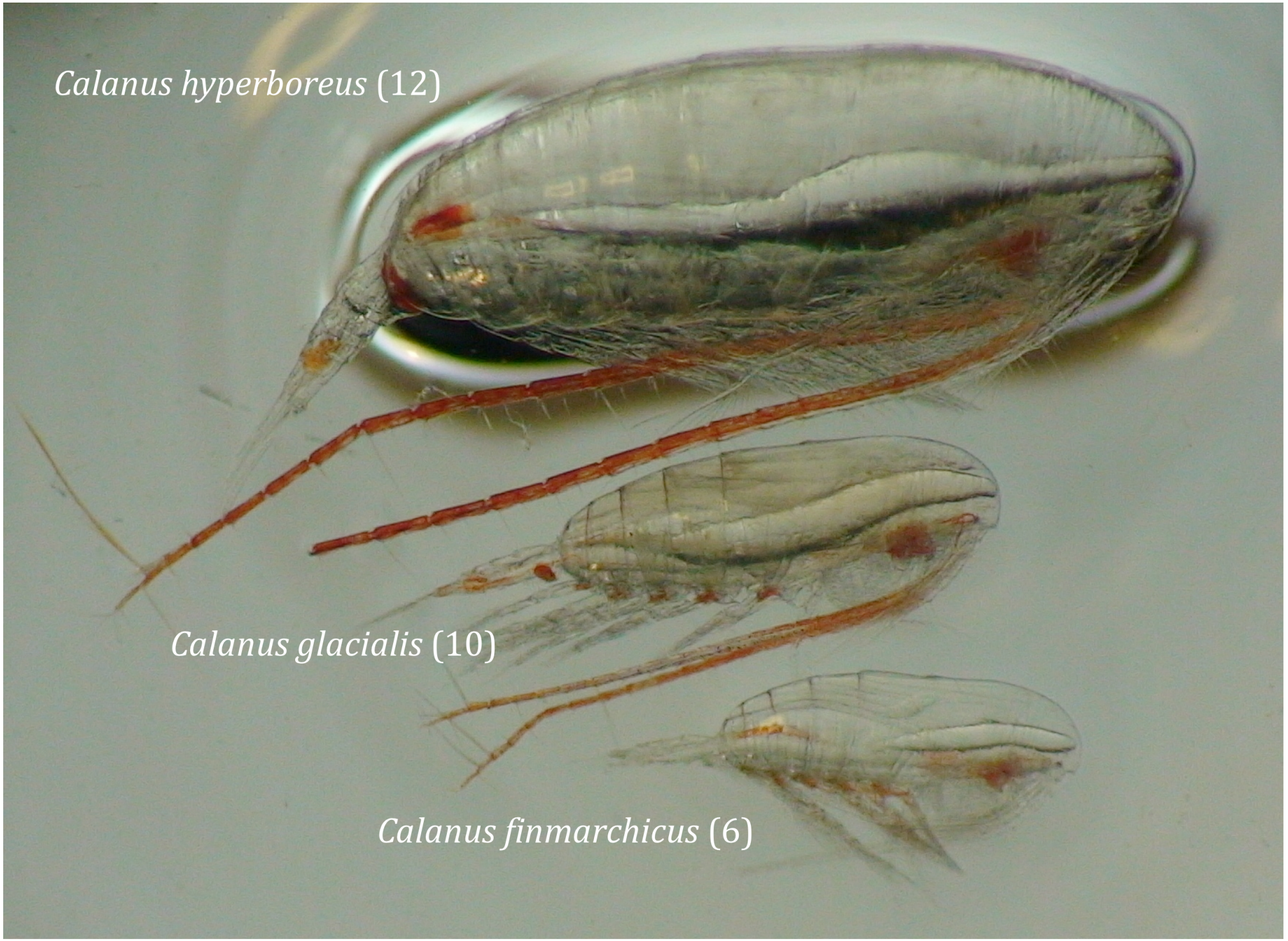
2. Temperature-size rule (TSR)= ectotherms grow larger if kept at lower temperatures;

It refers to phenotypic plasticity;
Widespread across taxa, but little understood:
adaptive or non-adaptive?
Different mechanisms:..

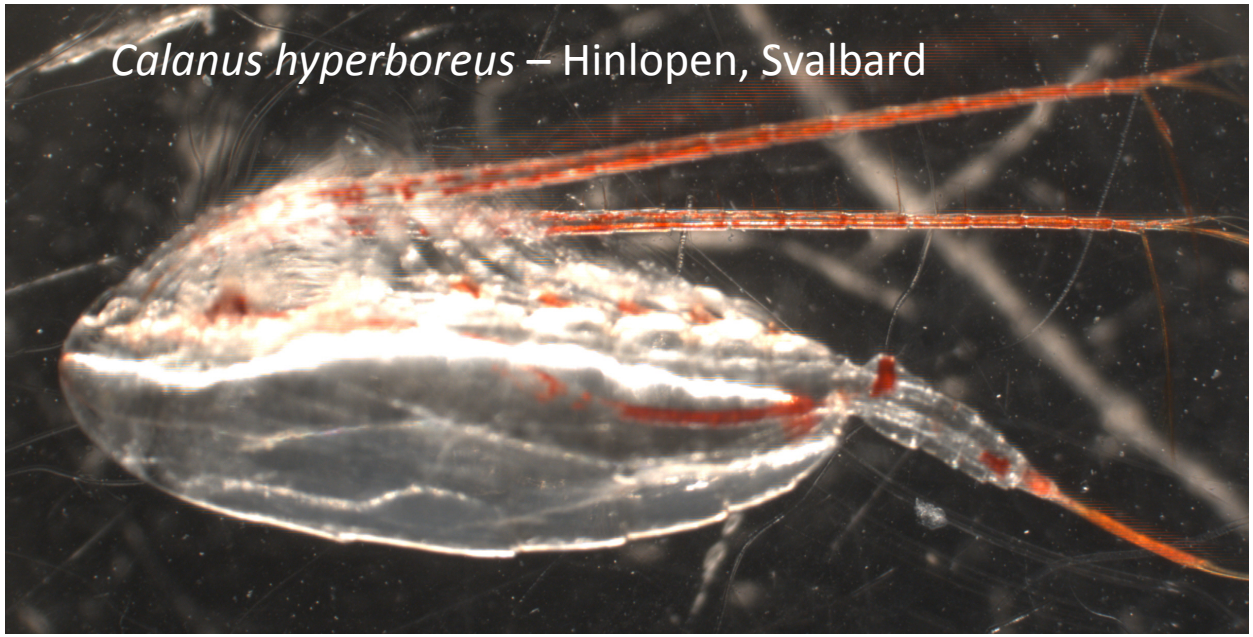
Temperature-size relations from the cellular-genomic perspective

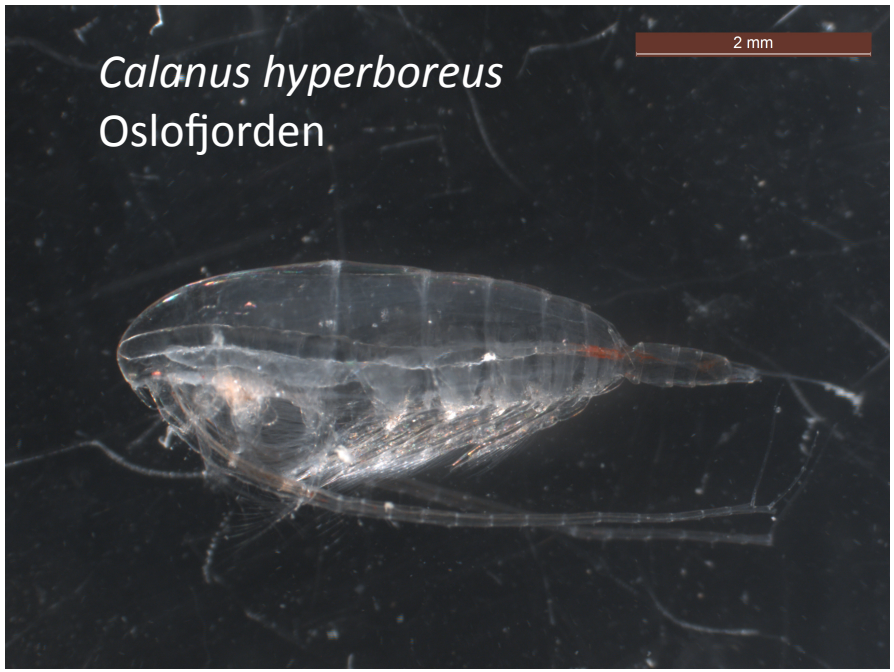
Hessen, Daufresne and Leinaas: *Biol. Rev.* (2013)




Calanus hyperboreus (12)
Calanus glacialis (10)
Calanus finmarchicus (6)

Body- and genome size of *Calanus* species along climate gradients





	Arctic (Svalbard)		S- Norge	
Calanus	length (mm)	Genome C = pg	length (mm)	Genome C = pg
glacialis	3.4 (± 0.04)	10.2 – 12.5	2.5 (± 0.03)	8.5
hyperboreus	6.8 (± 0.18)	10.5	5.0 (± 0.12)	9.2

Studies of terrestrial ectotherms in the field and in laboratory experiments

A) Phenotypic variations along latitudinal gradients

Field sampling coordinated with the limnetic part

Relate body size clines to latitude, climate exposure, phylogeny and ecosystem types (incl. terrestial vs. aquatic)

B) Thermal adaptations

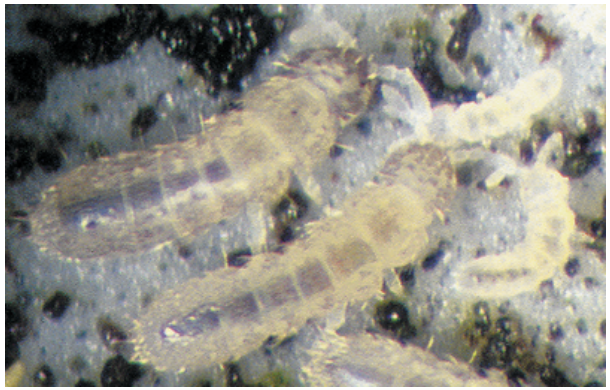
Comparison of con-specific populations from contrasting climate, in “common garden experiments” – to disentangle micro-evolution from phenotypic plasticity

WP 1 – Terrestrial fauna

Two focal arthropod groups:

1) Collembola (springtails)

Hypogastrura *viatica*



Folsomia *quadrioculata*

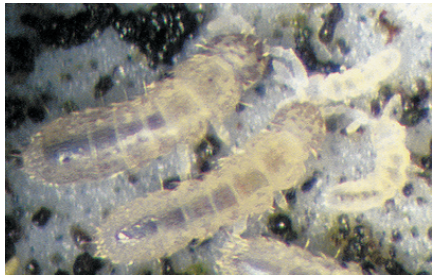
2) Dung flies (Diptera)

Scatophaga *furcata*

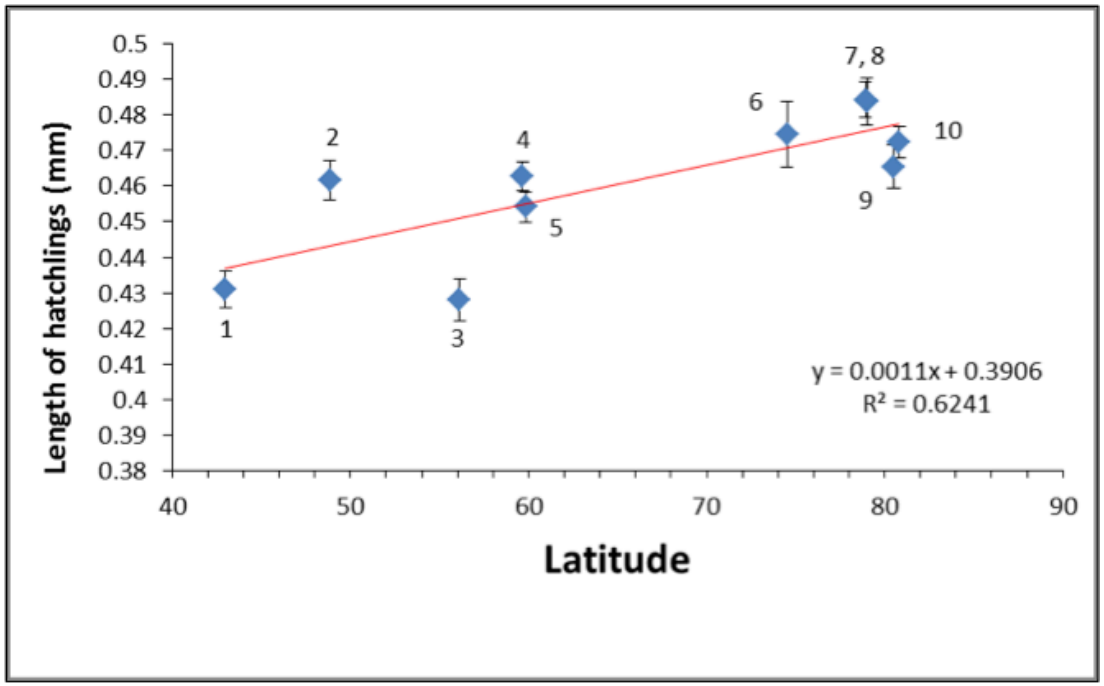
Collembola: Life history traits (growth, development, reproduction, survival)

Micro-evolution in trait mean and phenotypic plasticity

Paris
Pyrenees



Folsomia quadrioculata



Populations kept many years under identical conditions at the lab

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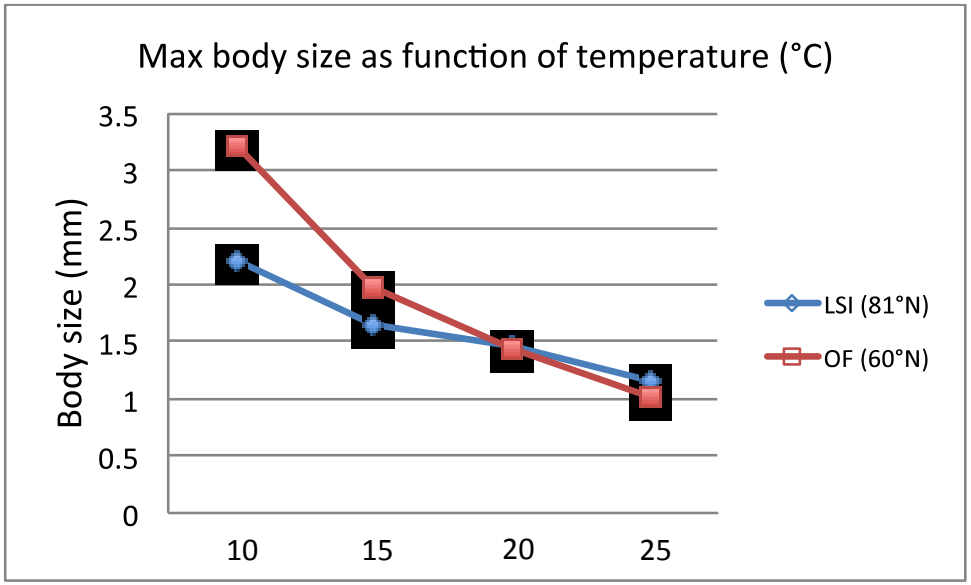
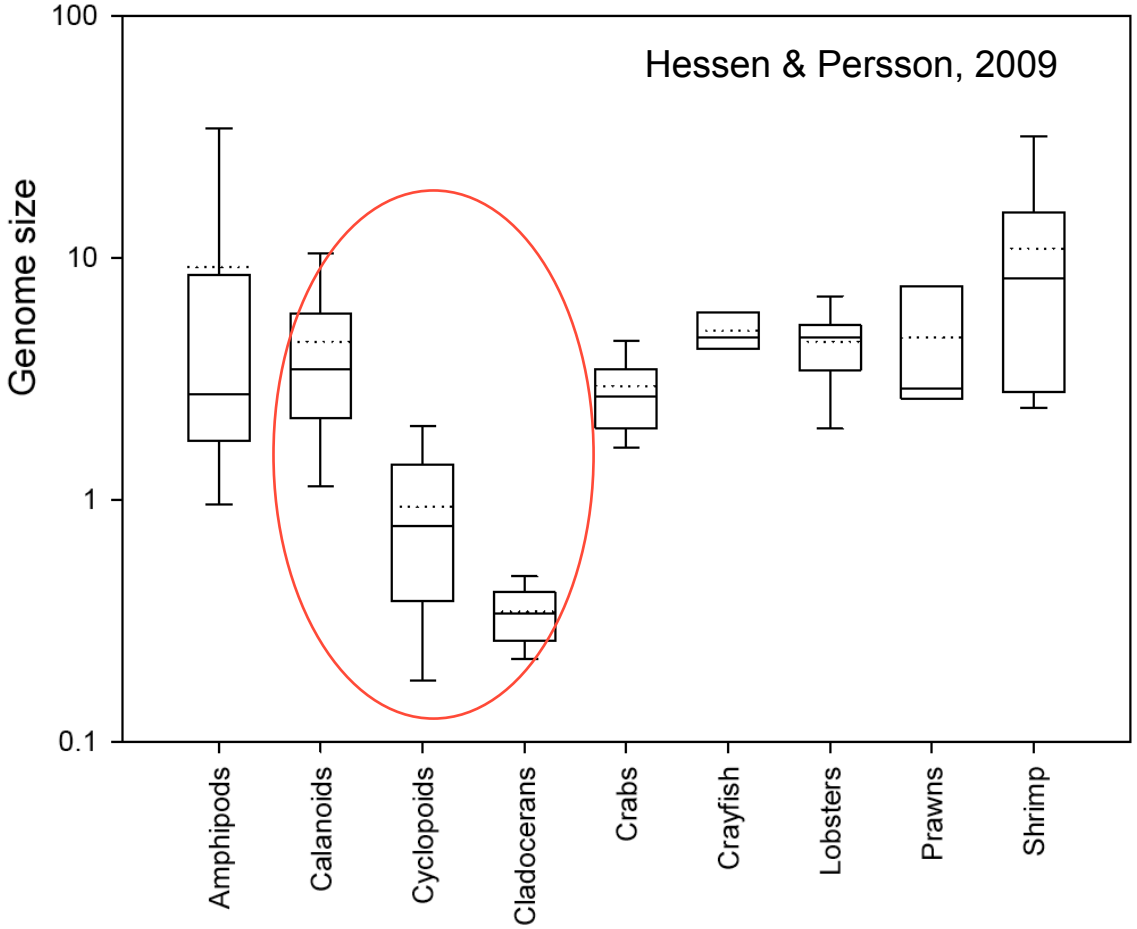
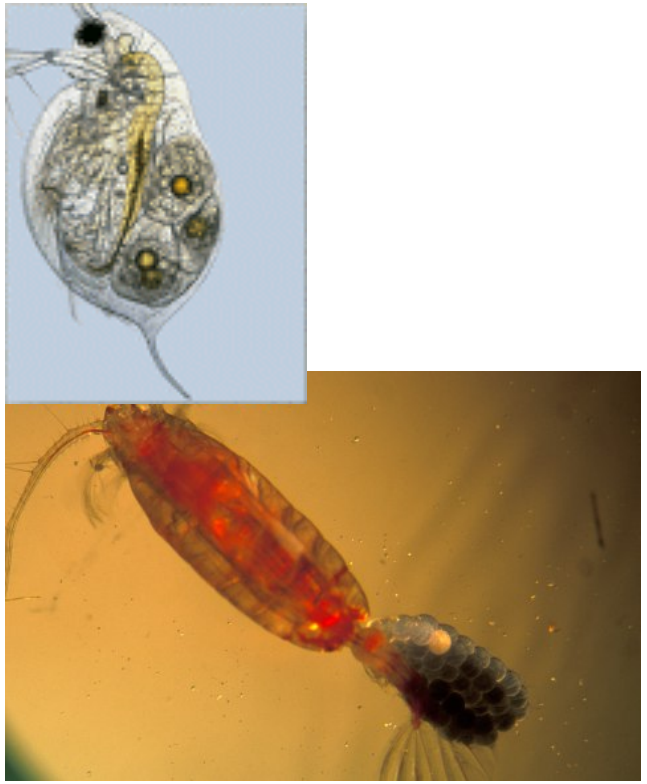


Nordmarka, Oslo (60°N)

Vesle Tavleøy (81°N)

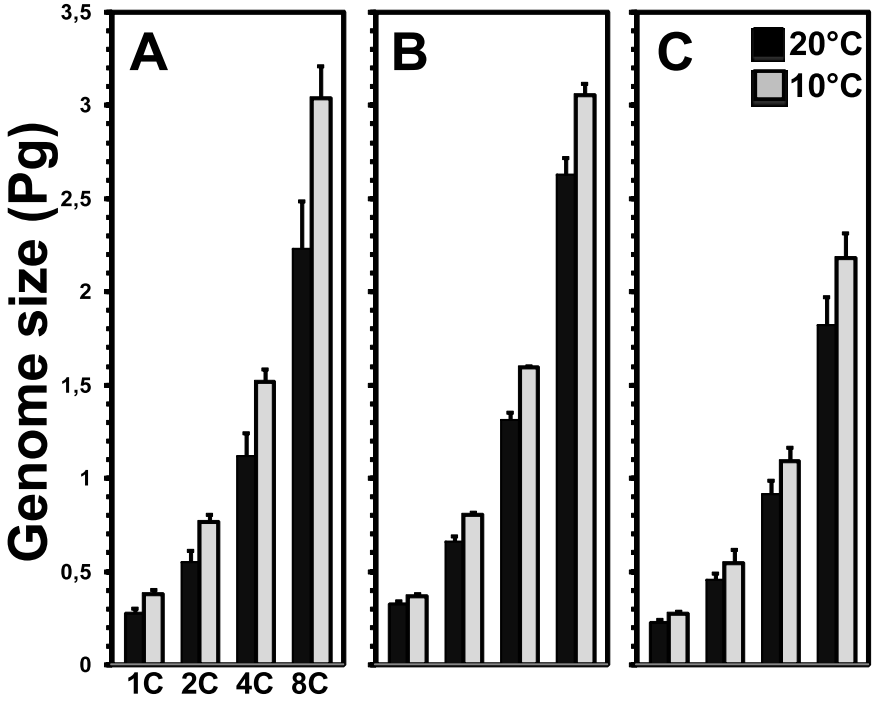
E.g. crustaceans: tremendous variability in genome size – but why?



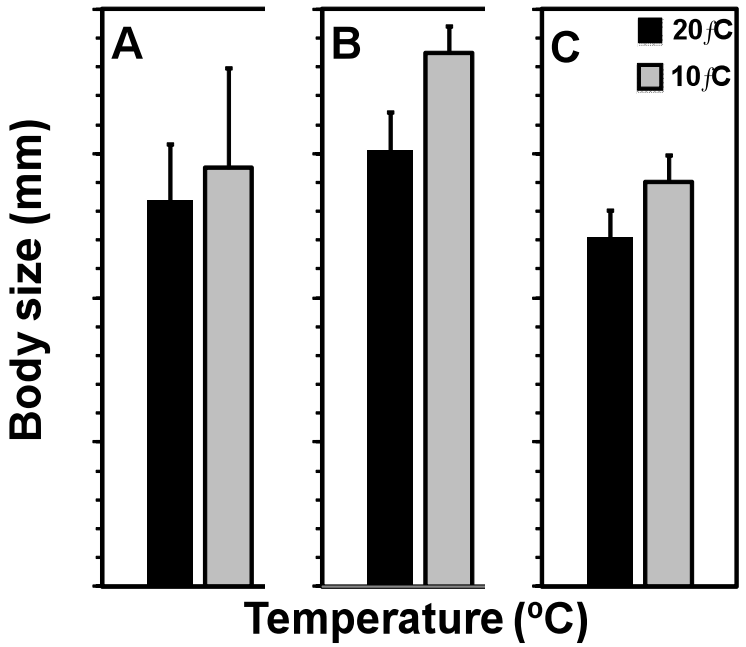


Daphnia genome -and body size at two temperatures

The same clone cultured at 10 and 20°C

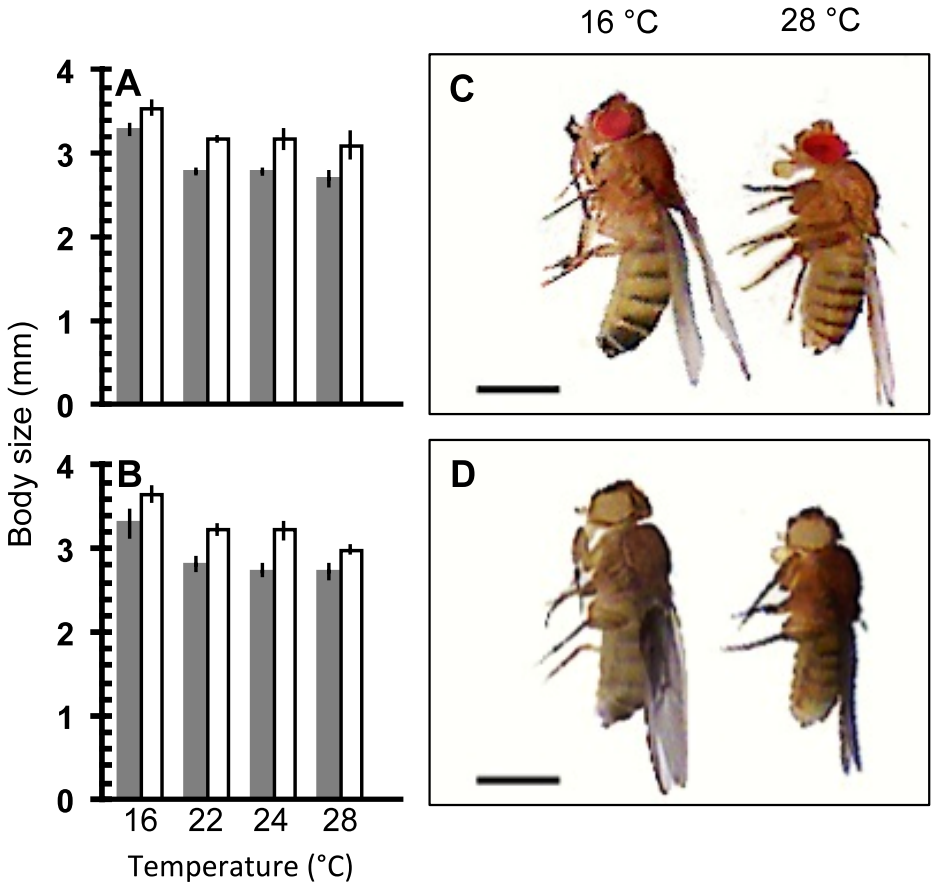


Genome size



body size

Drosophila: larger animals at lower temperature.
Mixed response in various tissues,
no genome size response,
but more polyploid cells at low temp



To do – within DWARF

- Sample selected terrestrial Collembola and insects, and aquatic invertebrates (Lepidurus, Mysis, Gammaracanthus, Copepods, Dapnia), and Arctic charr - from Northern Svaldbard to temperate areas (WP 1 & 2)

- Collect data on genome size, body size and temperature preferences (habitat) from existing data (bases) and DWARF to search for patterns (WP 6)

- Search for latitudinal (temperature-related) patterns in adult body size, cell size and genome size (Flow cytometry). – Effects of phylogeny, ecosystem and life history strategies

- Improve understanding of general underlying processes

- Predict consequences of global warming

Terrestrial systems of the high arctic

Polar deserts (cold and dry)

milder and more humid