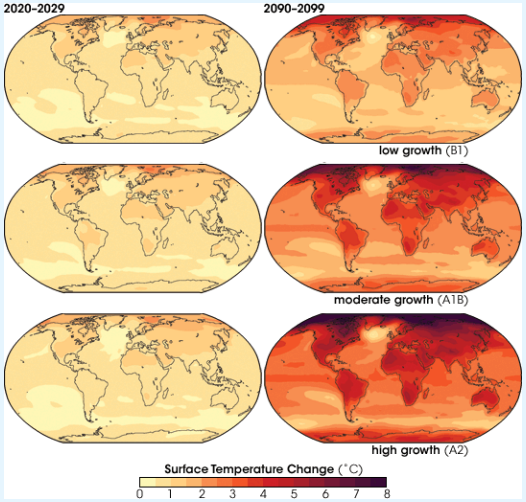
CLIMATE CHANGE AND TROPHIC CASCADES: NATURAL SELECTION



Edmund M. Hart
Department of Zoology
University of British Columbia

Climate change

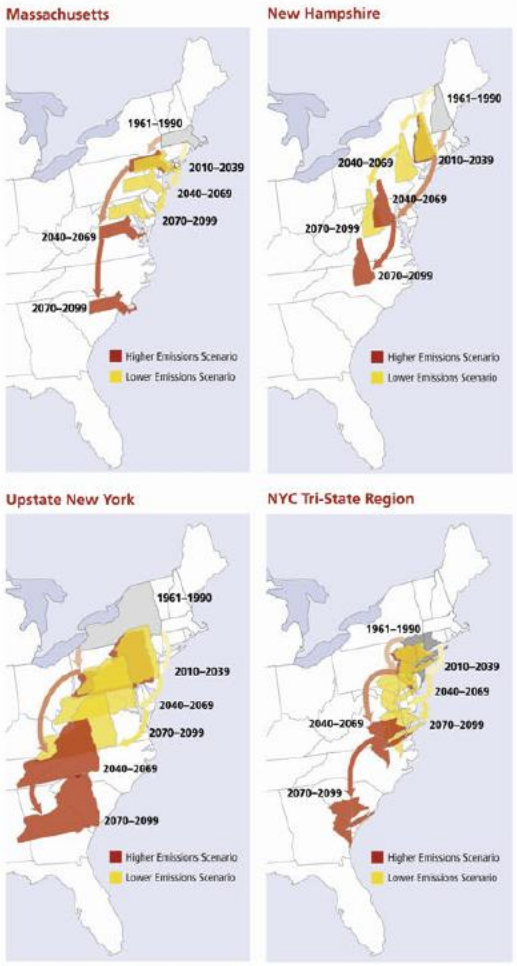
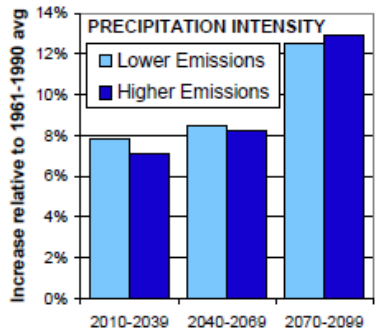
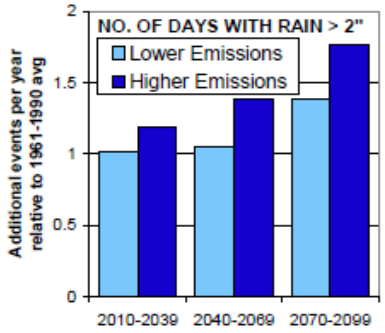
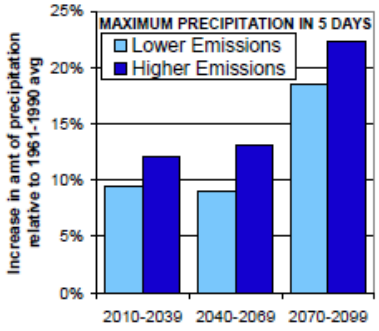


Figure 4: Projected climate "migrations" for several states and regions in the Northeast, based on average summer heat index, under the lower- and higher-emissions scenarios. Based on the average of the GFDL, HadCM3 and PCM model projections.







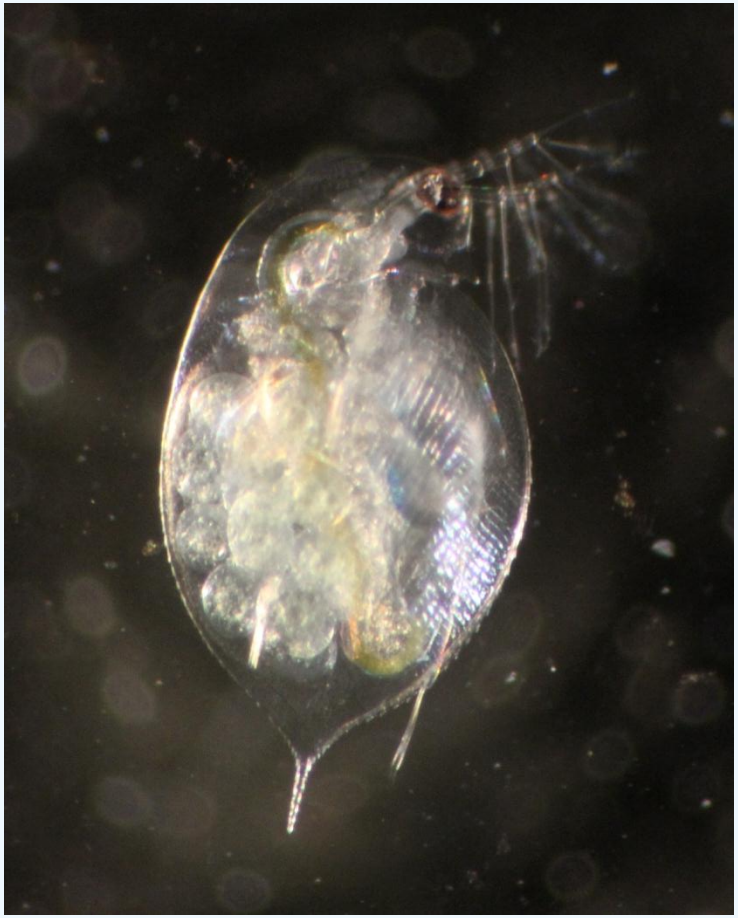
Natural selection

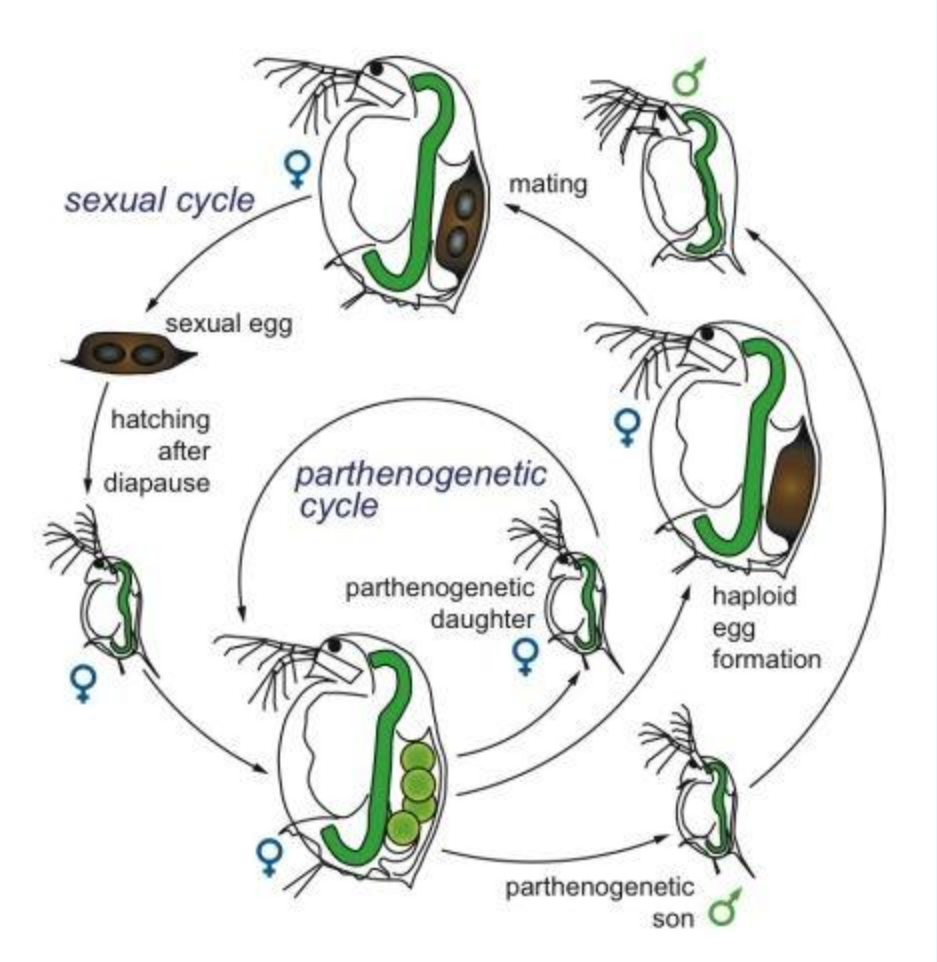
Question

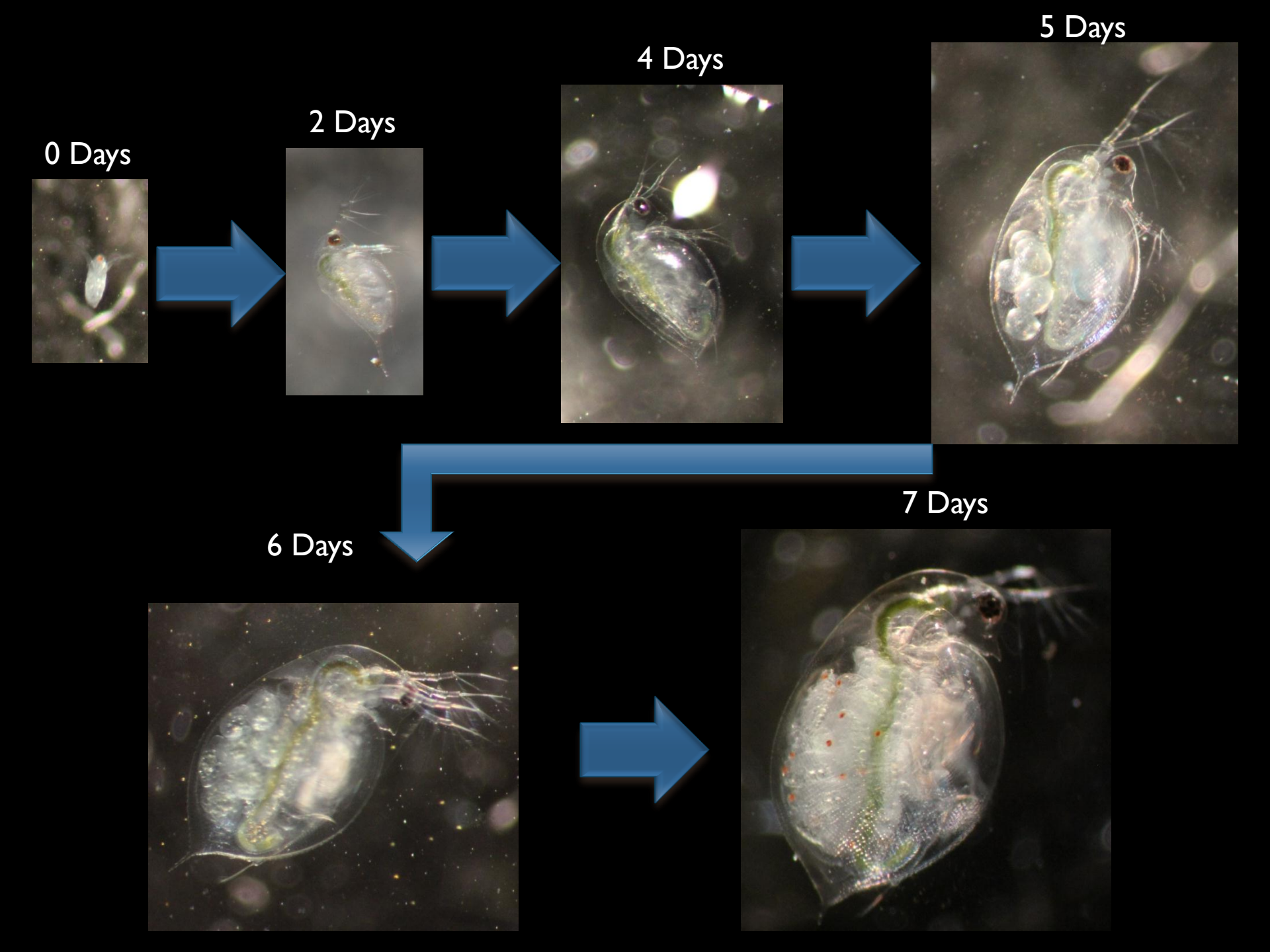
Are trait changes in response to climate change genetically based or phenotypically plastic and what are potential selective agents?

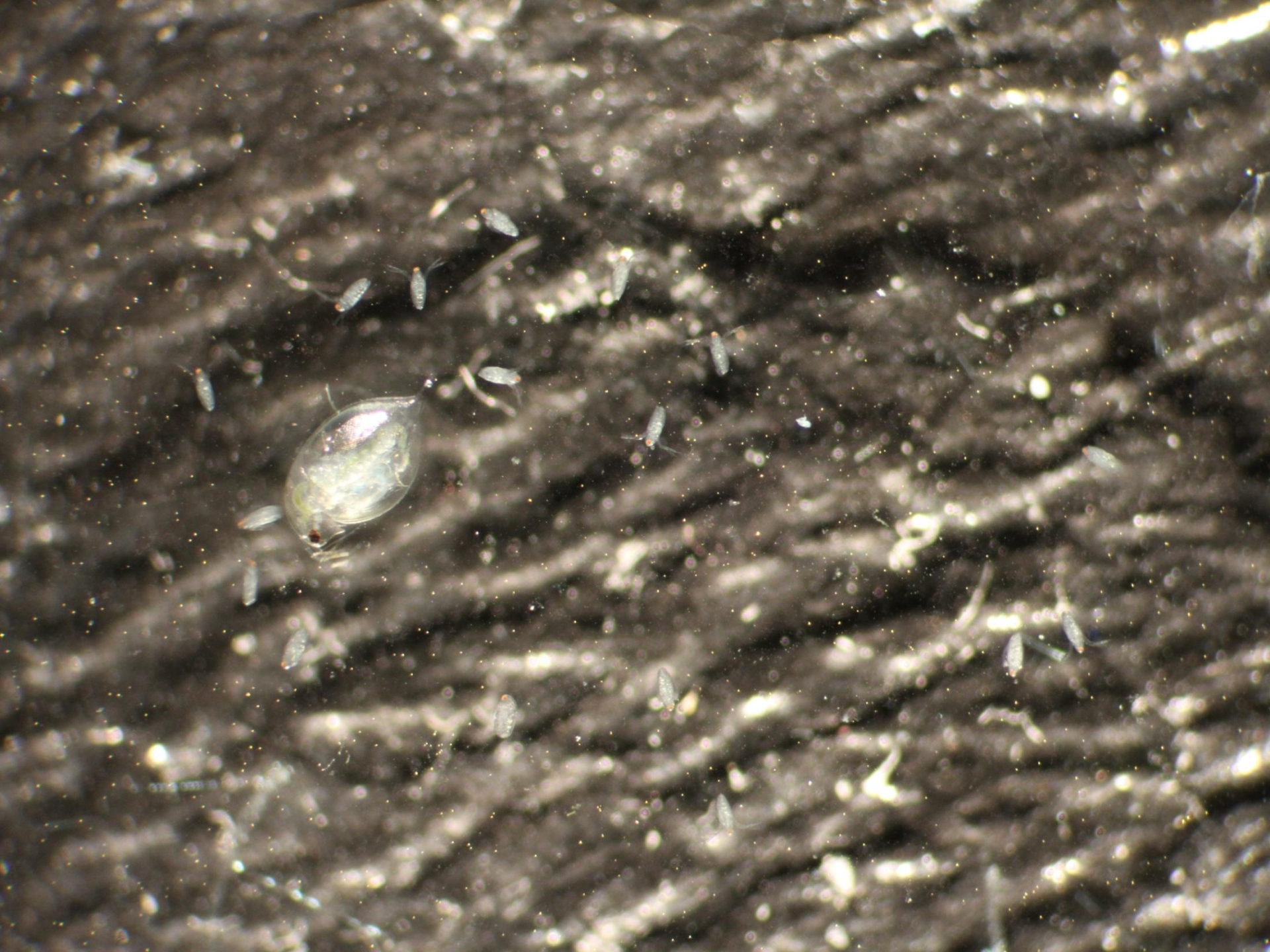
Natural selection

Daphnia pulex



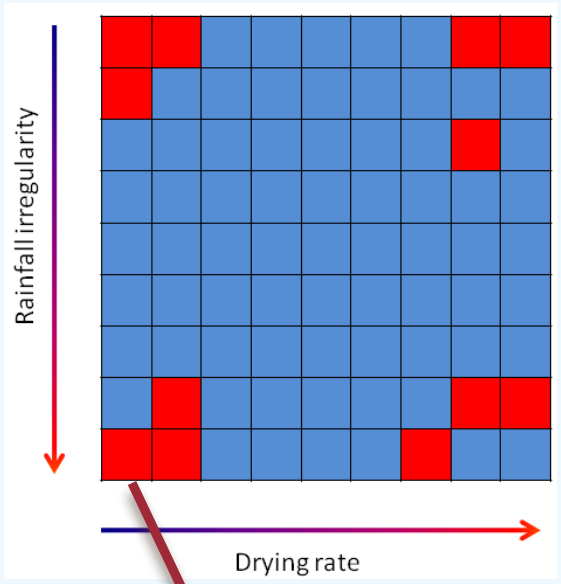


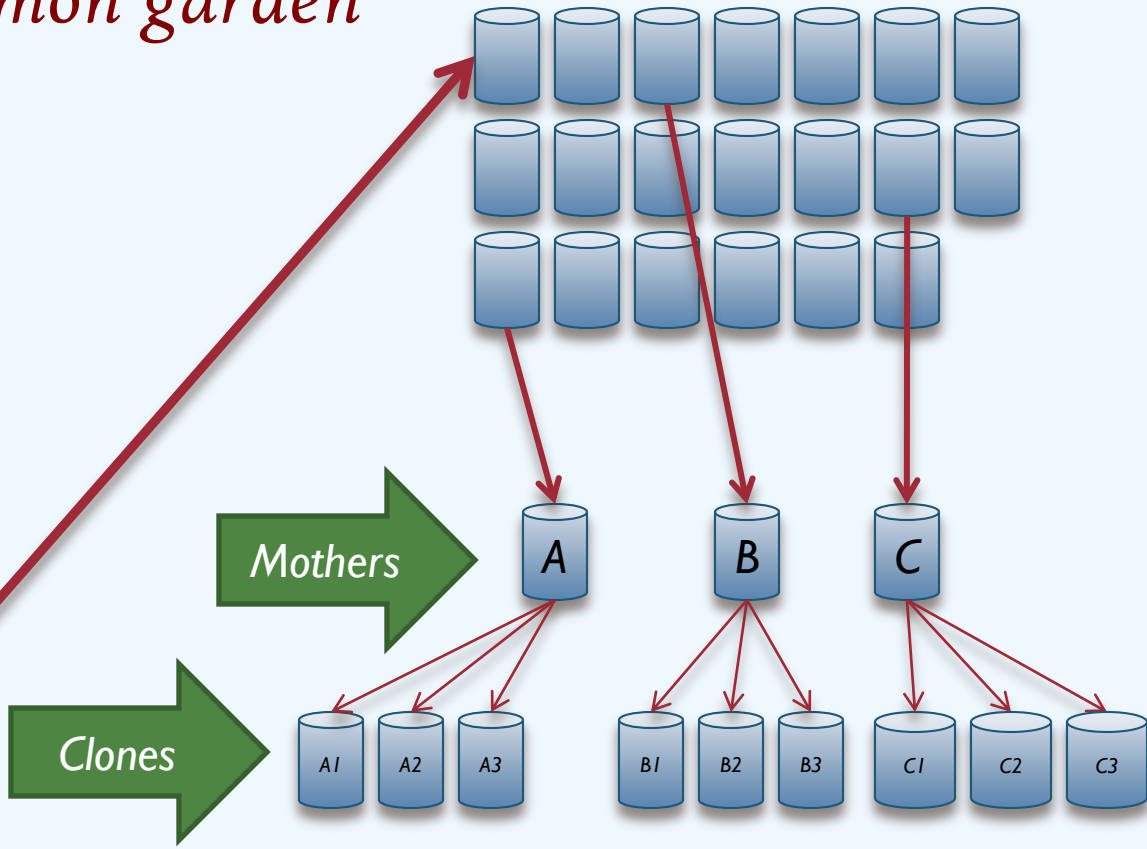

0 Days
2 Days
4 Days
5 Days
6 Days
7 Days



Natural selection

Common garden





Natural selection

Common garden

- 14:10 Light:Dark cycle
- 18°:24° Day:Night temp cycle
- Fed *Nannochloropsis*
- Photographed every other day from Jan 1st 2011 to Feb 14 2011

Natural selection

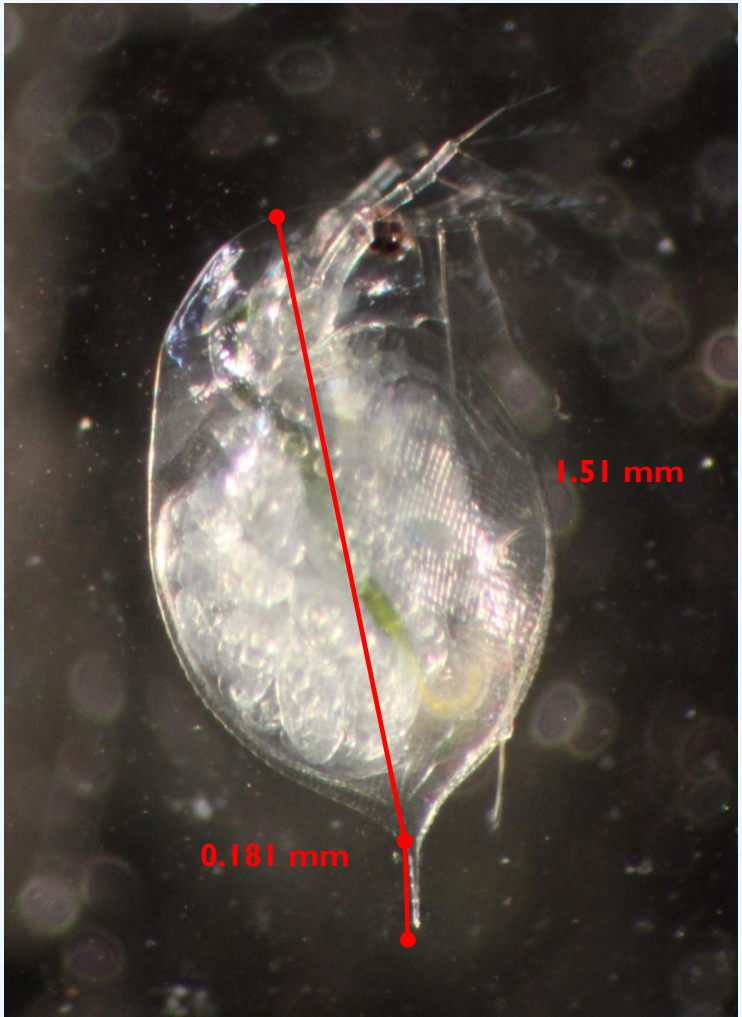
Trait measurement

Trait	Type	Method	Frequency
Spine length	Morphological	Measured from photo	Every other day
Body length	Morphological	Measured from photo	Every other day
Total length	Morphological	Measured from photo	Every other day
Head width	Morphological	Measured from photo	Every other day
Clutch size	Life-history	Counted live born young	Every occurrence
Clutch number	Life-history	Counted live	Every occurrence
Growth rate	Life-history	Calculated from photographs	Once per individual
Intrinsic population growth rate (r)	Life-history	Calculated via life table analysis of individuals	Once per pond

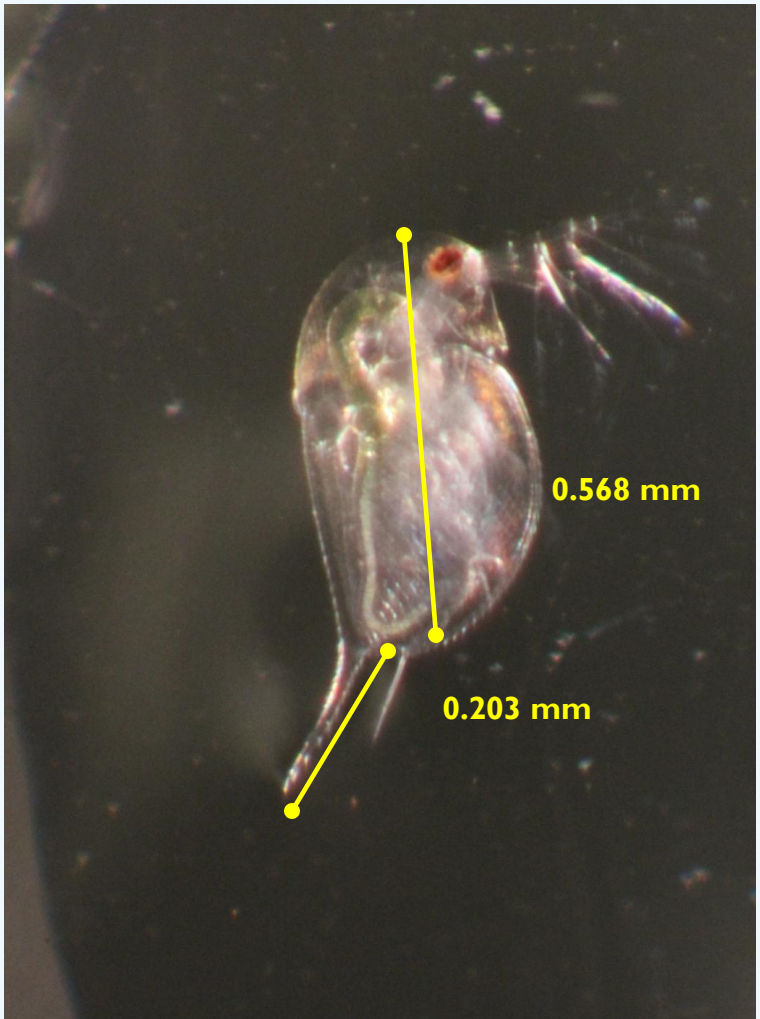
Natural selection

Trait measurement

Adult *Daphnia pulex*

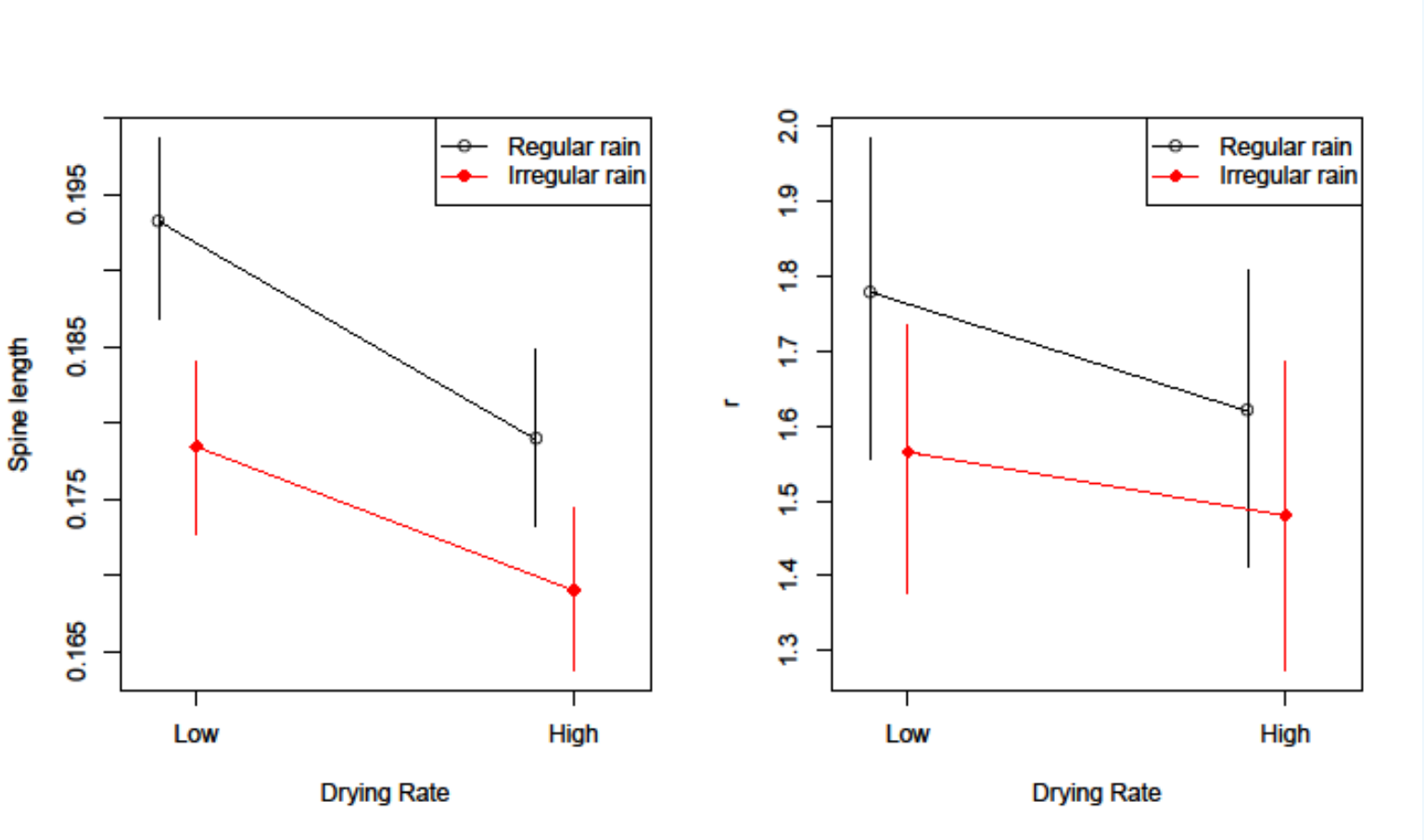


Neonate *Daphnia pulex*



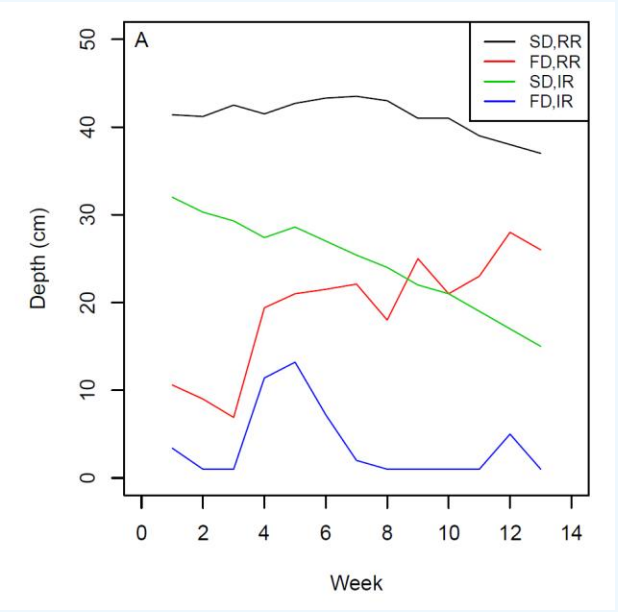
Natural selection

Analysis of traits



Natural selection

Analysis of traits

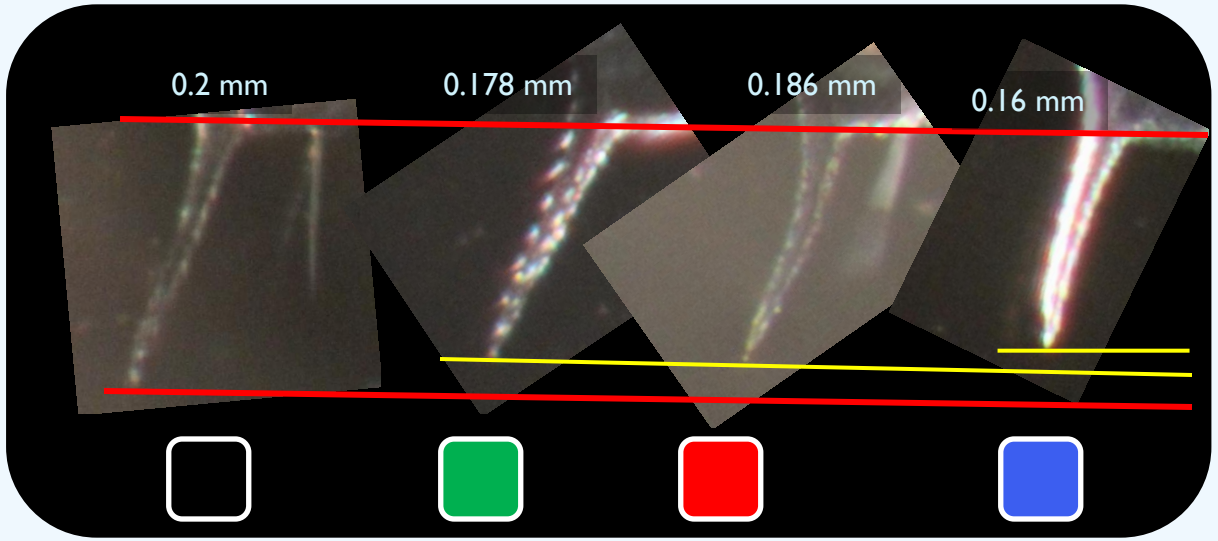


Low drying rate
Regular rainfall

Low drying rate
Irregular rainfall

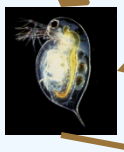
High drying rate
Regular rainfall

High drying rate
Irregular rainfall



Natural selection

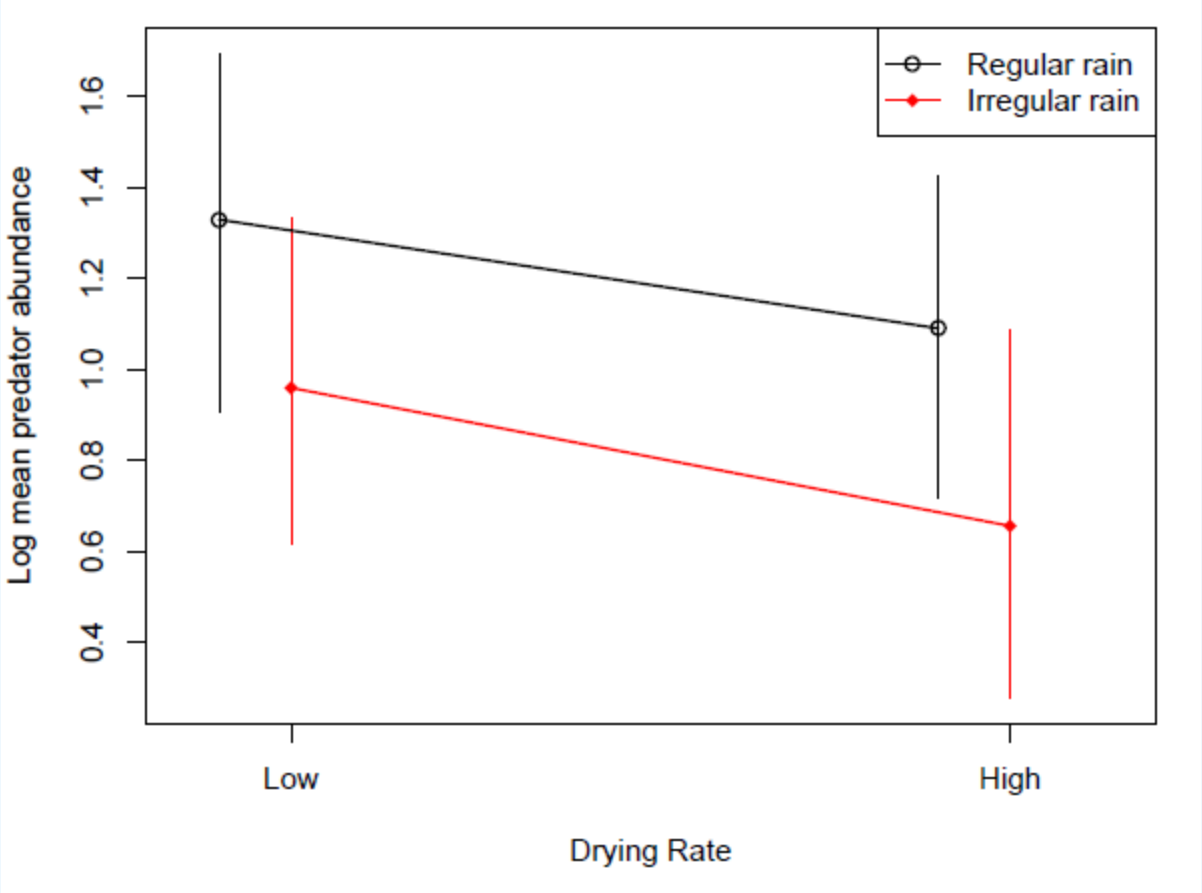
Analysis of covariates



Detrital / bacterial food source

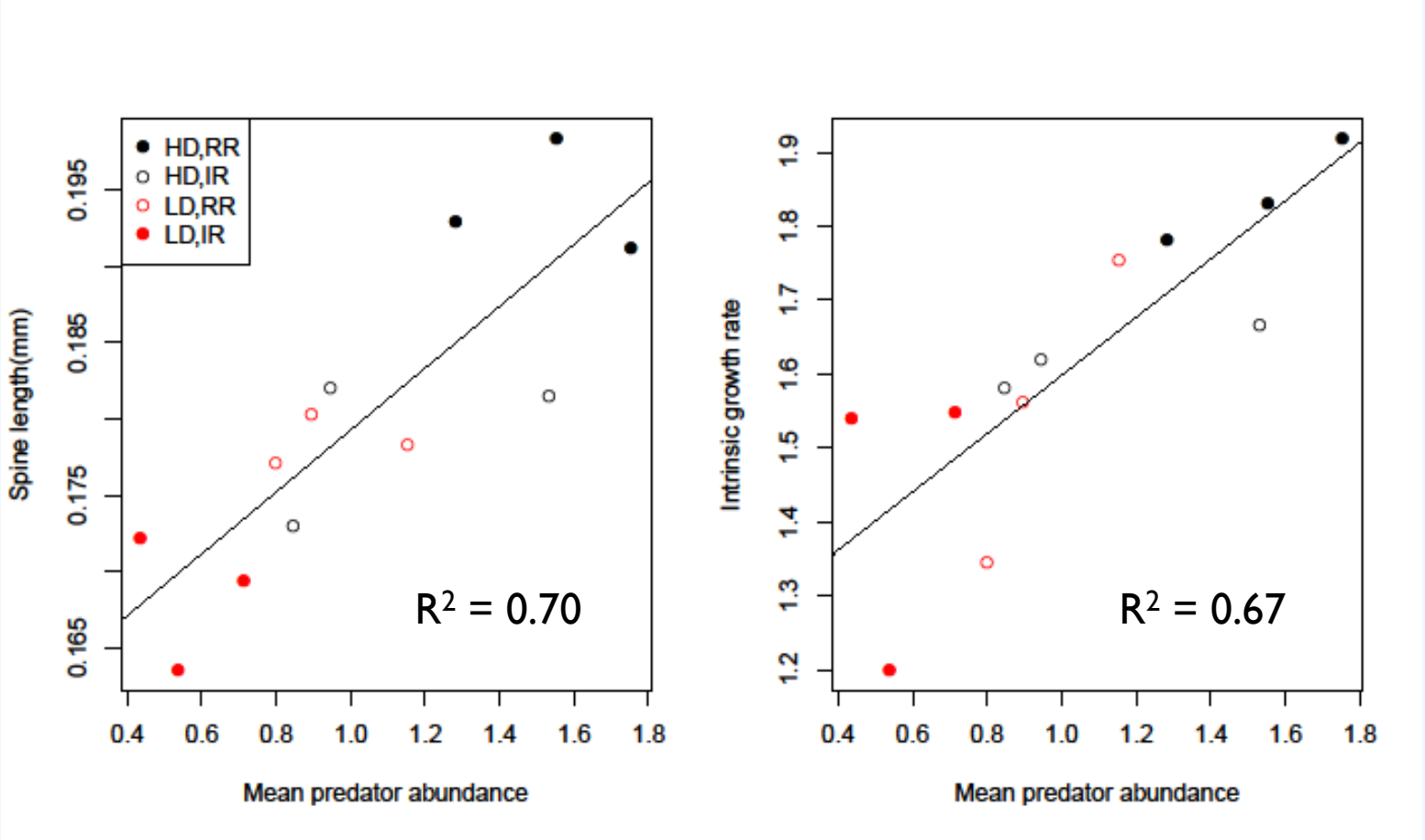
Natural selection

Analysis of covariates



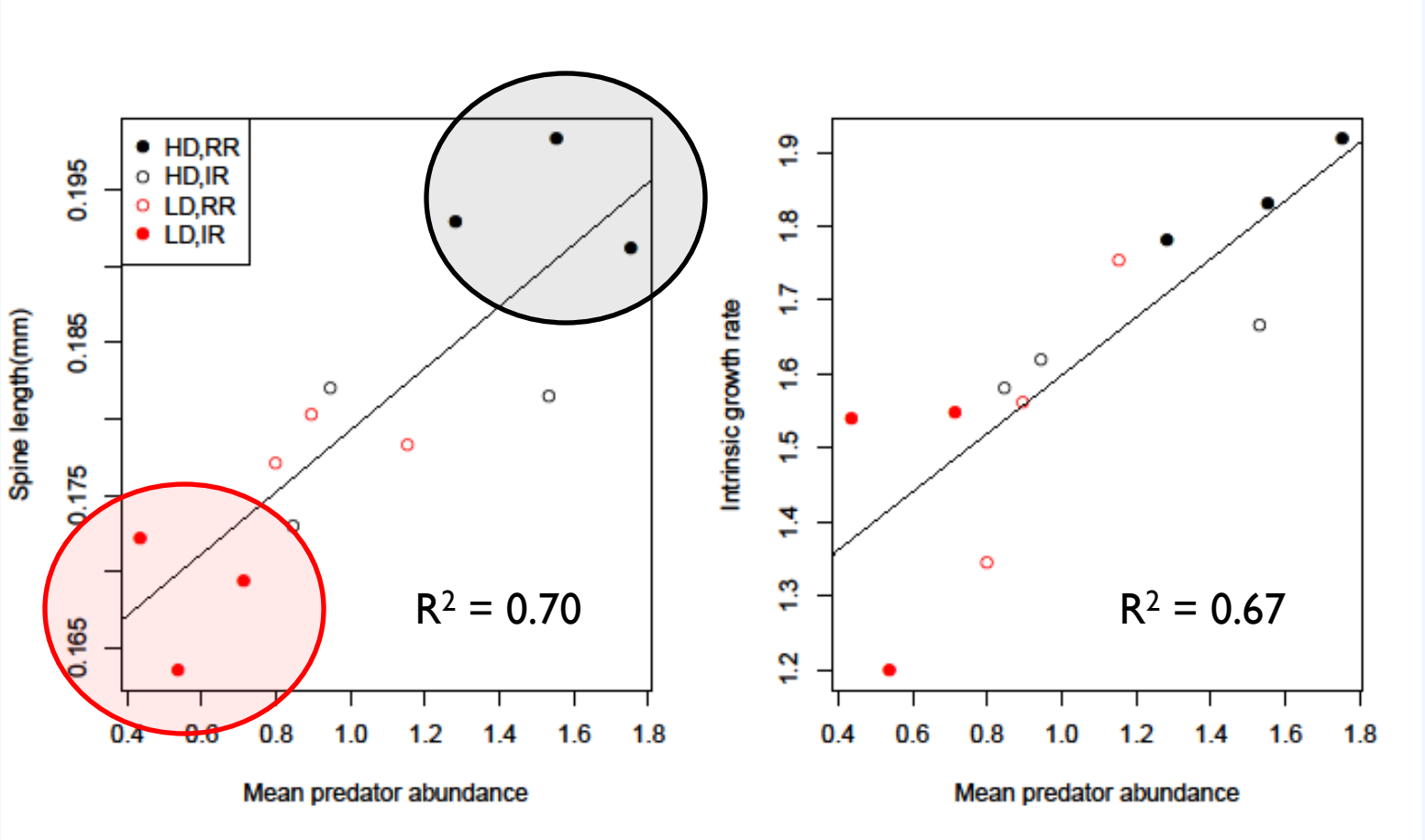
Natural selection

Analysis of covariates



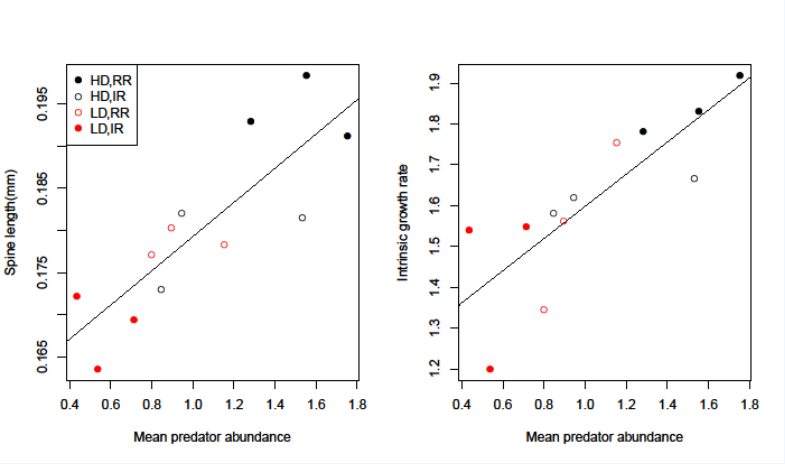
Natural selection

Analysis of covariates



Natural selection

Covariate residual ANOVA



Tail spine residuals ANOVA

	d.f.	F-val	p
Drying	1	2.75	0.13
Rainfall	1	0.79	0.39
Residual	9	-	-

Intrinsic growth rate residuals ANOVA

	d.f.	F-val	p
Drying	1	0.18	0.67
Rainfall	1	0.23	0.65
Residual	9	-	-

Natural selection

Analysis of covariates

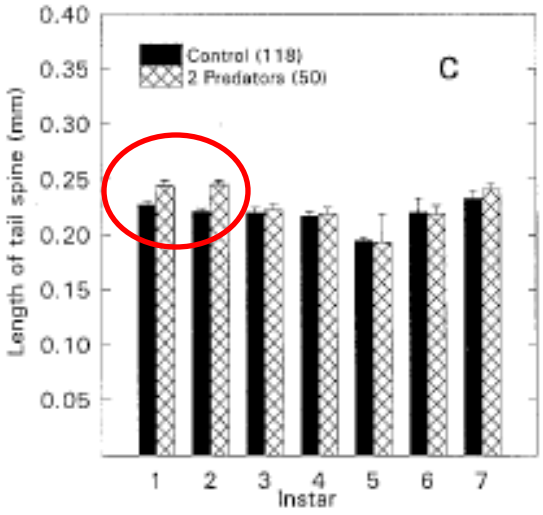


Fig. 3a–c. Mean length of tail spine in individuals of **a** clone A and **b** clone B. Same experiments as in Fig. 2. *Vertical error bars* represent standard errors. **c** Clone A in the experiment with extract of both predators. *Parentheses* enclose number of individuals per instar

Leuning 1992

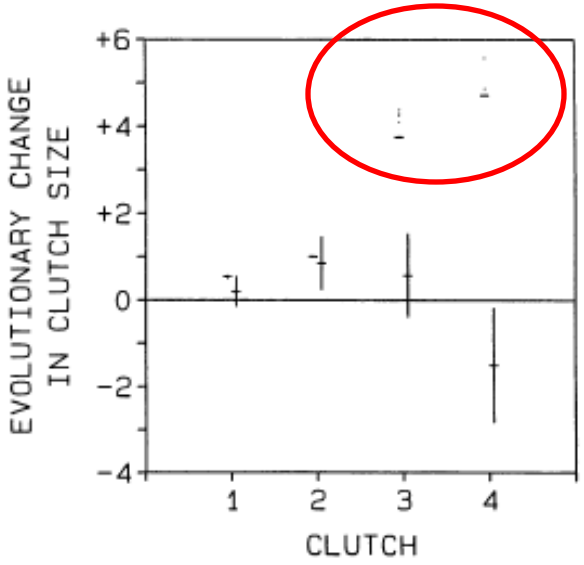


FIG. 5. Evolved changes (±2 SE) in clutch size for clutches 1–4 during seven weeks of clonal reproduction in control populations (solid bars) and in populations with *Chaoborus* predation (dotted bars). Refer to Table 1 for statistical summary.

Spitze 1991

Natural selection

Conclusions

- 1st instar tail spine length and r show a genetically based change in trait means.
- More variable habitats have lower predator abundance
- Trait response is due to climate change, but mediated through that reduction in predator pressure.
- Lab results from earlier selection experiments can be useful in making predictions

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