

Resilience by diversity: Large intraspecific variation in climate change responses of an Arctic diatom

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Motivation & Objective

- The potential for adaptation of phytoplankton to future climate is often extrapolated from responses of single strains of a representative species which have been in lab-cultures for years
- Phytoplankton species and even local populations have been shown to exhibit large intraspecific diversity^{1,2}
- Increasing evidence also shows that cells of different populations of the same species differ in their reaction norms^{3,4}
 - How different is the plasticity of different individual strains within a single diatom population in the Arctic?
 - And could the selection of diverse ecotypes influence and increase the adaptability of a species to climate change?

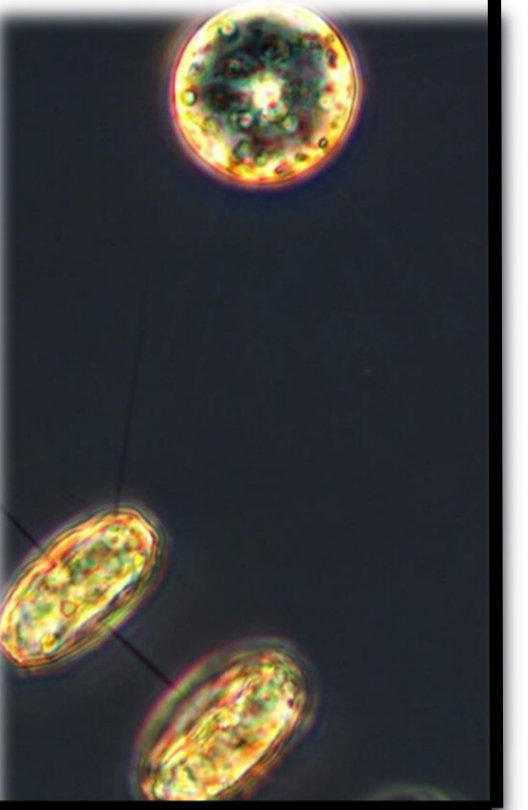
Experimental Setup

- 1) Incubation experiment with natural phytoplankton community in Svalbard (Kongsfjord, 79° N) under conditions representing present and future environment*

➔ For details see Poster by Clara Hoppe!

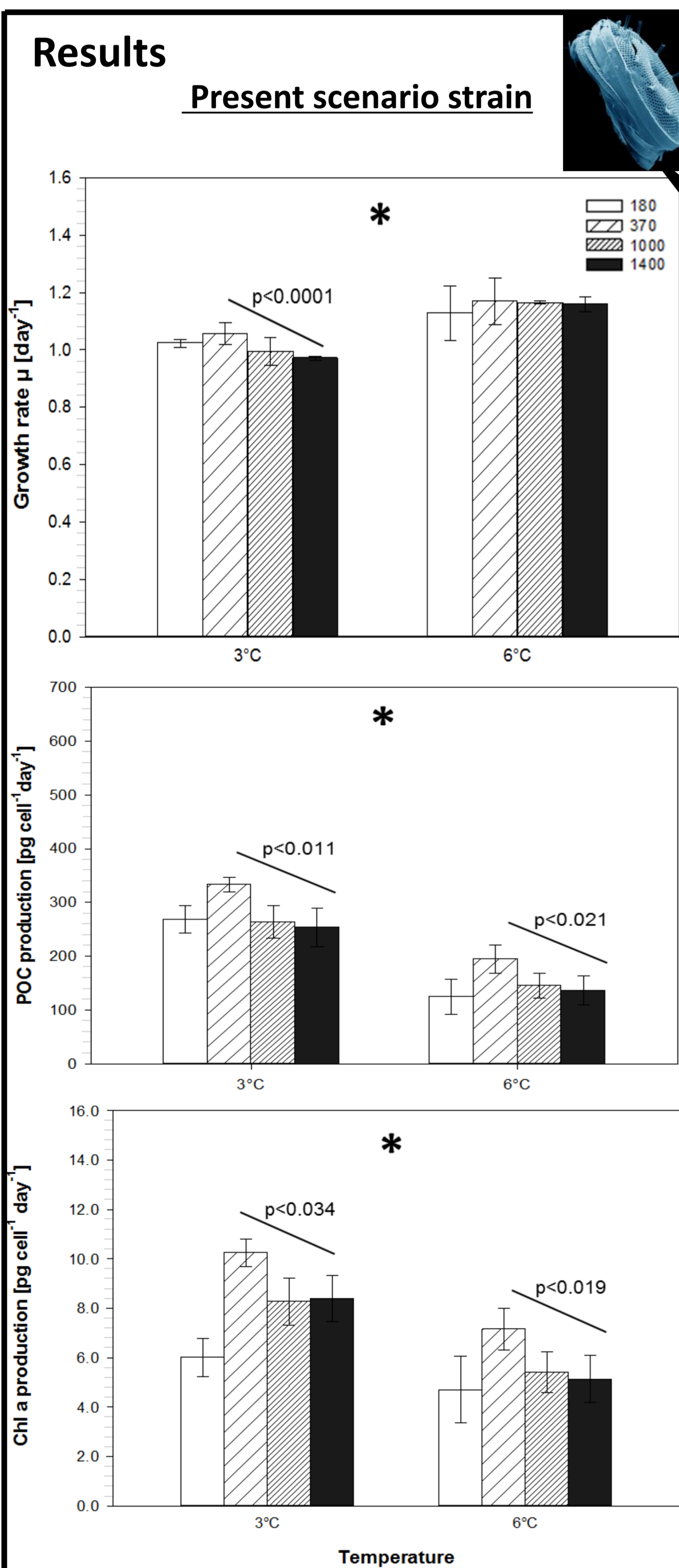


- 2) Single cell isolation of *Thalassiosira hyalina* from present day and future scenarios*



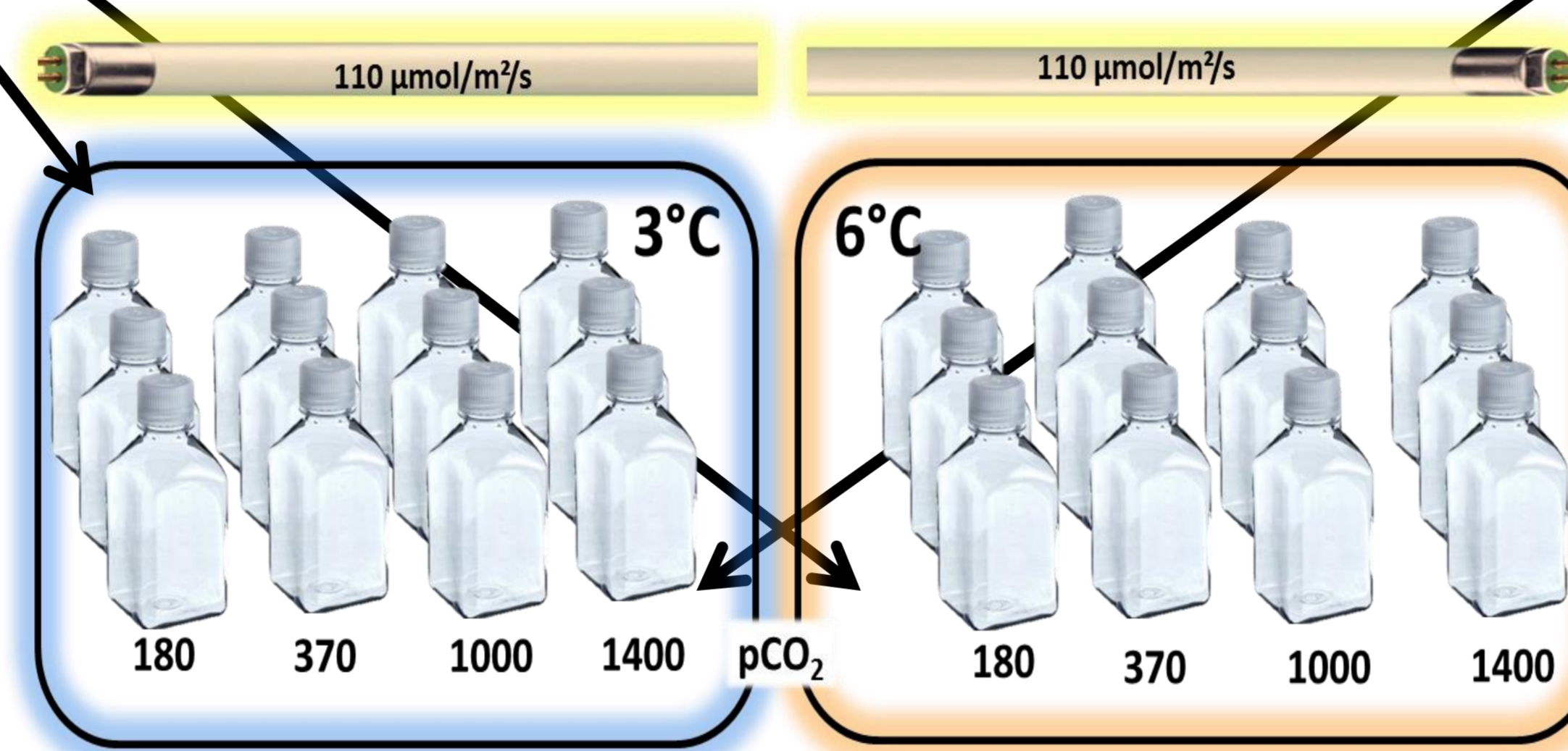
* Present: 3° C, 370 μatm CO₂, 30 μmol photons m⁻² s⁻¹
 Future: 6° C, 1000 μatm CO₂, 130 μmol photons m⁻² s⁻¹

Results



BSi production was much lower in the present scenario strain and declined at higher pCO₂ (data not shown)

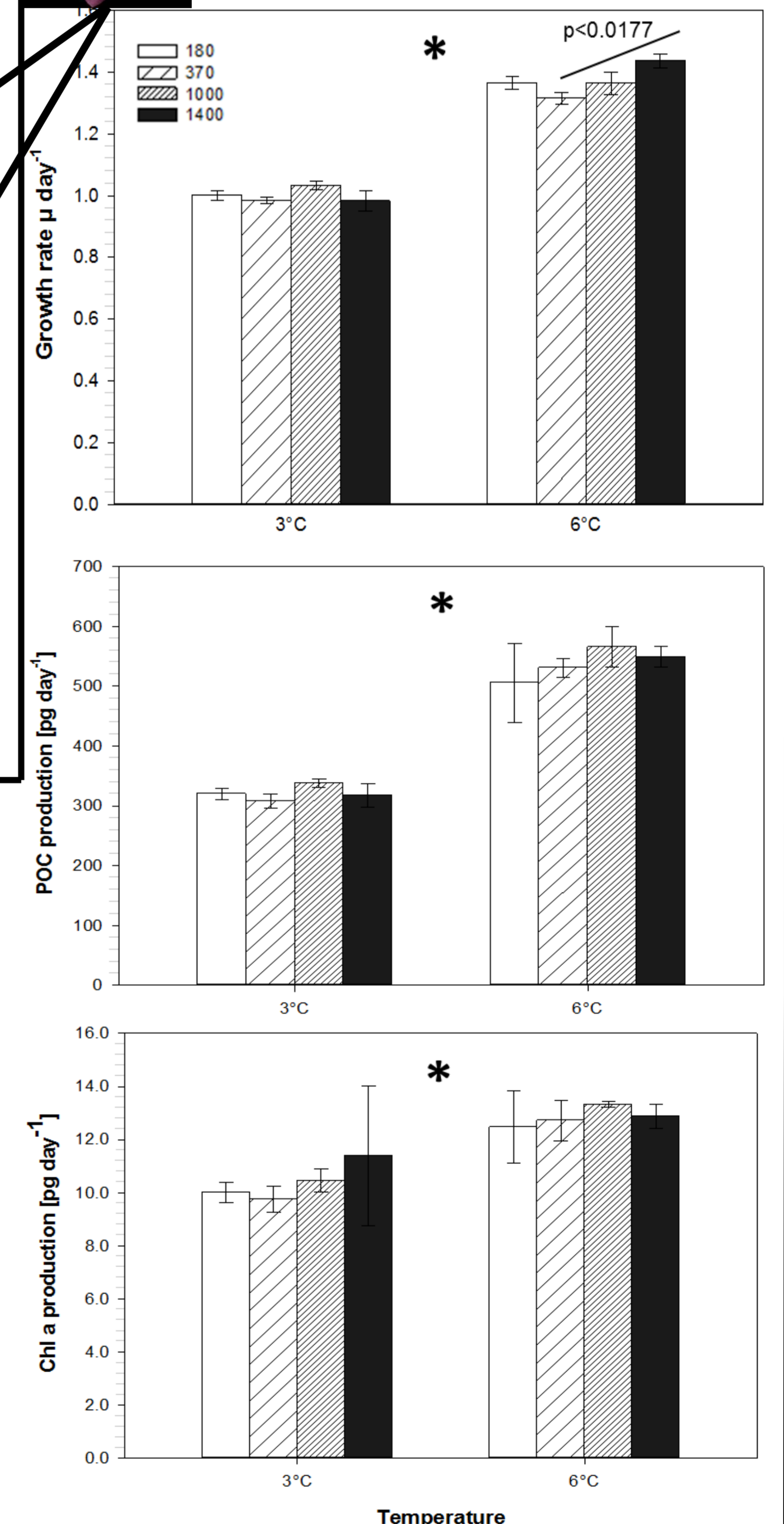
3) Incubation experiment with pre-acclimated monocultures of *T. hyalina* strains from both scenarios



- Although acclimated to each experimental condition, both strains continued to perform best under the conditions they had been isolated from
- Selection may have favored these ecotypes within the respective treatment in the community incubation
- Response plasticity within a single population is at least as large as the here presented results

Legend: * denotes a significant difference between the average of temperature treatments (two-way-ANOVA, α=0.05), tilted lines mark significant trends (by regression analysis) between 370 μatm and 1400 μatm with the shown p-value

Future scenario strain



BSi production in the future strain was very high with a negative trend at higher CO₂ only at 6°C (data not shown)

Conclusions

- Within a single species, optimal environmental conditions can differ greatly
- The observed strain responses corresponded to the previous selection environments
- Intraspecific variability and the selection of coexisting ecotypes is an underestimated source of species' plasticity under changing environmental conditions
- Species-wide inferences from single strain experiments should be handled with great care