Phytoplankton response to warming and CO_2 increase during the 1st indoor mesocosms experiment

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Question: How do warming and CO_2-increase affect phytoplankton embedded in a natural food web?

Method: Indoor mesocosms (1.4 m^3, see Fig. 1)
Factorial combination of
–2 temperatures (9 & 15° C)
–2 CO_2-levels (446 & 1012 ppm – see Fig. 2)
–3 times replicated
Duration: 24 d

Material: Autumn plankton from the Western Baltic Sea taken on 19 October 2012 (for dominant phytoplankton taxa see Fig. 3)

Fig. 1: Mesocsosm facility at GEOMAR Kiel

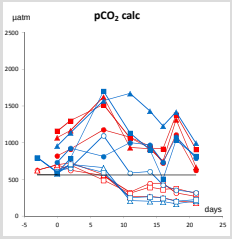

Fig. 2: Time course of CO_2 in warm and cold mesocosms

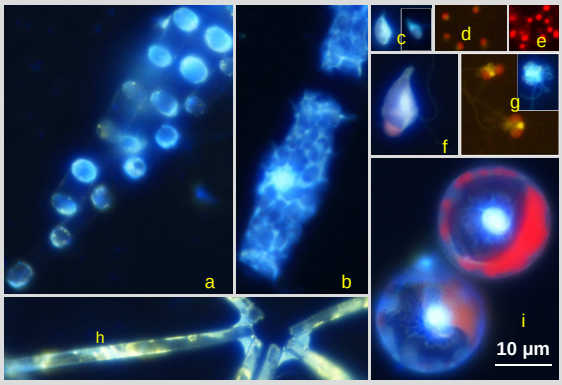

Fig. 3: a) *Skeletonema marinoi*, b) *Ceratulina pelagica;* c) *Helmiselmis* sp.*;* d) *Nannochloropsis* sp.; e) *Synechococcus* sp.**;** f) *Teleaulax amphioxeia*; g) *Chrysochromulina simplex; h) Thalssionema nitzschioides*; i) *Thalassiosira nordenskioeldii*

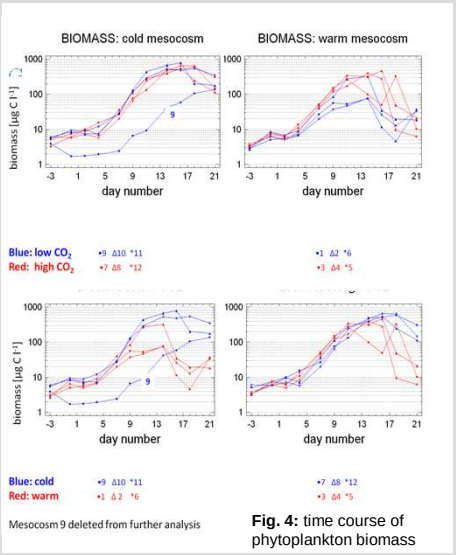

Fig. 4: time course of phytoplankton biomass

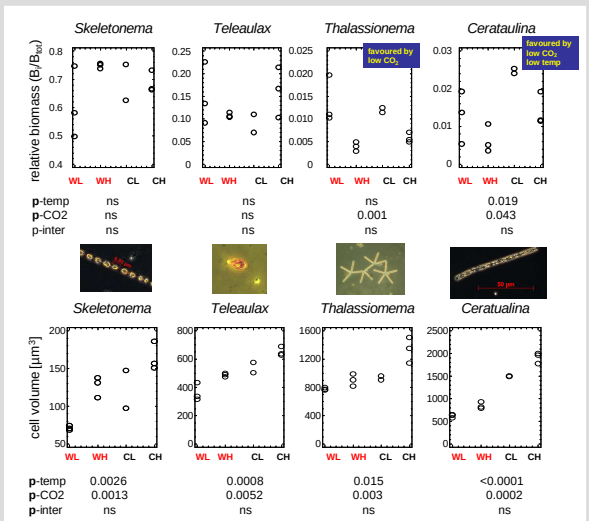

Fig. 5: reponse of relative biomass (top) and cells size (bottom)

Time course of phytoplankton biomass (Fig. 4)

- divergence between temperature treatments
- no divergence between CO_2 treatments
- mesocosm 9 light failure just after start - excluded from further analysis

Taxonomic composition (Fig. 5 top)

- no response of dominant spp. *(Skeletonema, Teleaulax)*
- response by some rare spp. *(Thalassionema, Ceratulina)*

Cell size (Fig. 5 bottom)

- warming makes cells smaller
- more CO_2 makes cells larger

Phytoplankton biomass and seston stoichiometry, means over time (Fig. 6)

- **biomass:** more at lower temp. at higher temp. positive CO_2-effect
- **C:N & N:P:** no temp. and no CO_2-effect
- **C:P:**
- significant temperature effect (lower at higher temp.)
- marginally insignificant CO_2-effect

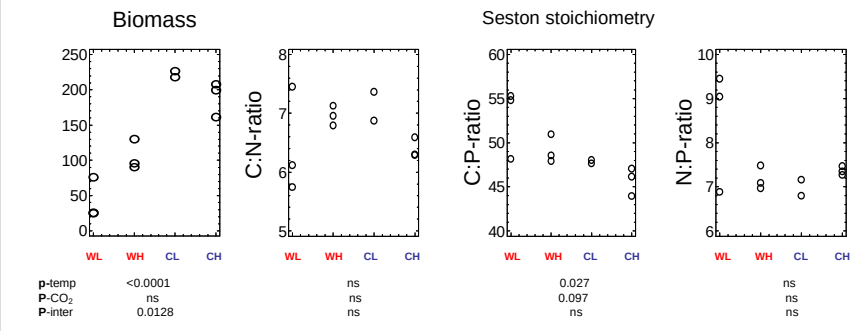

Fig. 6: Phytoplankton biomass (calculated from cell volumes) and seston stoichiometry, means of entire experiment

Conclusions: temperature effects as expected, subtle CO_2-effects in some of the ressponse variables
Indication of slight CO_2-limitation of phytoplankton?

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