

Interactive comment on “Experimental assessment of the sensitivity of an estuarine phytoplankton fall bloom to acidification and warming” by Robin Bénard et al.

Anonymous Referee #1

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General comments:

The manuscript by Benard et al. describes the results from a mesocosm experiment that was designed to investigate the responses of a natural phytoplankton community to warming and acidification. The authors observed a clear stimulation of phytoplankton growth by temperature whereas acidification had no or only a minor effect. Although many experimental studies have been conducted in recent years to investigate phytoplankton responses to warming or to acidification little is known about combined effects. The data provided by this study are thus potentially valuable and interesting. However, important information is lacking in the current version and need to be included and

C1

discussed to improve the value of this manuscript.

The set-up of the experiment was designed to keep pH in the acidified mesocosms constant, yielding a decrease of pH after the bloom. This differs to the natural environment where a phytoplankton bloom can substantially modify (increase) pH. It also differs to the earlier mesocosms experiments that the authors reference in their discussion. I suggest that the authors discuss implications of the differences in the set-up of experiments.

Nutrient concentration and irradiance are main factors controlling phytoplankton growth in seawater. The authors should assess how these factors may have affected cell growth and primary production. This includes:

1. Add a drawing of the set-up and placement of mesocosms and treatments within the container. Containers often bear the risk of self-shading, which would need to be considered.
2. Please give absolute values for irradiance instead of %shading. What was the light:dark cycle? Since primary production measurements were carried out over 24h, some incubation hours will have been in the dark if natural sunlight was applied. It is important to inform about the potential role of dark respiration during the incubations. Since light intensity has been shown to co-affect phytoplankton responses to acidification and warming, it is absolutely necessary to show and discuss the light climate in mesocosms and incubations.
3. It is important to consider that net primary production was measured. Hence, responses to warming and acidification may not only be related to photosynthetic production but also to respiration processes. Please discuss.

Given that the authors did not add nutrients to the natural seawater, the strong increase in biomass (from 10 to up to 30 $\mu\text{g/L}$ Chl a in one day) after incubation is very surprising. What could have limited phytoplankton growth in situ? Please discuss.

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There was a strong drop in pH prior to the acidification treatment on day -3. What may have been the reason for this drop?

Specific comments:

Line 87: add diameter and height of mesocosms

Line 99ff: add total duration of the experiment to the description

Line 104: give value for initial pCO₂

Line 113ff: Add total amount of volume sampled from the mesocosms each day

Line 166: Was there no replicate incubation? Was the error within treatment assessed?

Line 171: Give irradiance values

Line 202: pCO₂ was $1340 \pm 150 \mu\text{atm}$ on day -3; why was the value so high?

Line 211: 'The three nutrients displayed a similar temporal depletion pattern following the development of the phytoplanktonic bloom.' I disagree the nutrients in the warm treatments were clearly reduced much faster.

Line 217: 'Chl a concentrations were below $1 \mu\text{g L}^{-1}$ just after the filling of the mesocosms, and averaged $5.9 \pm 0.6 \mu\text{g L}^{-1}$ on day 0' If Chl a increased that much regardless of treatment; light limitation or exclusion of zooplankton probably had a major influence of phytoplankton development and should be considered in more depth.

Line 327: The citation of Bach et al 2017 is not accurate as that study didn't determine carbon fixation

Figure 3: Wasn't the Chl a accumulation (day 0 to Chl a max) not much higher in the warm control?

Figure 5 g, f: same axis labelling different figure. . . please check.

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