Biogeosciences
Discussions

Interactive comment on "Shifts in the microbial community in the Baltic Sea with increasing CO$_2$" *by* K. J. Crawfurd et al.

Anonymous Referee #1

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Crawfurd et al. present a study on the effect of increased CO2 on different planktonic members including different photoautotrophs and the total bacterial community. One of the main differences of this study compared to other ocean acidification studies seems that there were no nutrients added in this study to avoid an overstimulation of primary production. The dataset is comprehensive and particularly looks at changes in grazing and lysis under the different CO2 treatments. The data presented are an important contribution to understanding the dynamics in microbial communities under increasing atmospheric CO2 concentrations. My main criticisms here are that when I look at the figures, to me it seems as if overall shifts in the microbial community structure (or more precisely changes in the abundances of selected plankton members) do actually change in all the mesocosms but that changes are more pronounced in the 'high CO2' treatments. This means that 1) the title is misleading, and 2) parts of the interpreta-

tion and discussion of the data are misleading. However, this fact is not discussed at all in this manuscript. Unfortunately, the authors omit any discussion of factors other than the two that they investigated. For example, what about the changing temperature during the experiments; it ranges from 8-15 deg C, but this isn't discussed anywhere. They also omit any discussion about any differences between the mesocosms and the surrounding waters and what the differences could mean (as far as I can see from the Suppl. figures, there are differences). Further, I find it stunning that the total phytoplankton doesn't vary that much over the different mesocosm treatments (Fig. 1). The authors do not acknowledge or discuss this anywhere. The authors mention that no nutrients were added to the mesocosms to "resemble the natural bottom-up environmental conditions." Although I can understand why the authors did not add nutrients, however, I doubt that this resembles the natural environmental conditions over a period of six weeks. By enclosing the water masses, the 'natural' nutrient supply, which is either horizontally or vertically, is cut off. But this discussion might also have to be carried out across the different companion manuscripts on these mesocosm experiments submitted to the special issue in BG. But no matter how this discussion turns out, the authors should discuss it in this manuscript. Maybe it is reason, for example, why the start and end abundances of the experiments are sometime quite similar while changes happened in between. The discussion section could benefit from a bit more 'discussion' rather than just the listing of other articles. How do the results you present actually fit into the literature and what does it mean for your data when other studies have shown certain effects (also see comments below). Further comments: In general, several sentences and paragraphs are quite lengthy and not easy to understand (all the way to not understandable at all). The introduction is lengthy and repetitive in some places and could be condensed. Throughout the manuscript, the numbers of the mesocosms are used, e.g. M1 or M3. This is very confusing especially in the discussion. Could be exchanged for LOW1 or HIGH2 or something that designates a treatment to that number, especially since M1 and M5 seem to be replicates, as well as M6 and M7, and M3 and M8.

- what are the 'failed' experiments, are they 'samples lost'? or outliers?

- p2, l3: salinity in the Baltic Sea ranges from near-freshwater to near-full seawater, I wouldn't necessarily call it extremely low salinity implying a negative effect, especially since it varies a lot throughout the Baltic Sea

- p2, l6: "We examined the effects of ocean acidification in the microbial community during…" Do you mean on the community structure or on the carbon export or on primary production rates? Please specify in the abstract.

- p2, l25: the threats don't face the marine ecosystems but the marine ecosystems face the threats

- p3, l2-9: This paragraph doesn't fit here and disrupts the flow. I would place it to where you describe your experiments.

- p3, l10-12: reads awkwardly, split into two sentences

- p3 l26- p4, l3: this is repetitive

- p4, l20: which key knowledge, it's not clear from this sentence

- p4, l24: delete the 'top-down control'

- p5 and following: the experimental set-up could be made much clearer, maybe use a sketch for this

- p5, l23: nitrate, phosphate, silicate and ammonium are per definition (dissolved) inorganic nutrients

- p7, l1-2: Pico III and Pico I do not have comparable cell sizes; one is about 1 micrometer and the one is about 2.9 micrometer in diameter, maybe you meant Pico II and III?

- p7, l4: was this conversion factor used for all organisms or just the Synechococcus? There are studies that clearly show that the carbon density changes with cell

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volume with the density being lower at higher volumes (see Verity et al. 1992 L&O or Menden-Deuer and Lessard 2000 L&O) If the same conversion factor was used for all organisms, this would likely bias the results significantly

- p7, l11: why not use the term total prokaryotes, because this is what it actually is, and not the heterotrophic prokaryotes which clearly should not include Synechococcus or other photoautotrophic organisms (the 10% argument is not correct here in my opinion)

- p7, l15: final concentrations of what, molar? micromolar? micrograms per kg?

- p11, l19: the R^2 is 0.49 in the figure and the regression line doesn't seem like it would be 0.98 either

- p11, l22-25: this part is hard to read. Please rephrase.

- p12, l3: wasn't the start of the mesocosm day -5 or day 0 rather than day 13?

- p12, l5: the decline following what?

- p12, l20: there is no such thing as net abundance; you can have net rates but not net abundances (also check throughout the manuscript)

- p12/13: "This may have stimulated the gross growth in M3 as compared to M1 (day 19; Fig. 3b) for a longer period in the high fCO_2 mesocosms, this accompanied by higher losses at low CO_2 resulted in a positive correlation of net growth rates with fCO_2 (Fig. 3e, $R^2 = 0.71$) and almost 2-fold higher net abundances at day 21 (Fig. 3a) correlating with fCO_2 (Fig. 3h, $R^2 = 0.84$)." I have honestly no idea what this sentence means. It is unnecessarily long and confusing. Further, the 'net abundances', please see comment above, and maybe either CO_2 or fCO_2 treatments could be used consistently throughout the manuscript

- p13, l13-17: unnecessarily long and confusing sentence

- p14, l25: what are "CO_2 days"?

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- p18, l17-19: How do the authors infer a bacterial production rate of about 0.6 dˆ-1 when grazing is about 0.3-0.5 dˆ-1? Is that due to a net positive growth in bacterial abundance? If so, it would be good to mention here. Otherwise the reader might assume steady state as I did here.

- p18, l27: "Also Pico II showed positively correlated net growth rates with CO2 enrichment, but somewhat later into phase I (days 12-17) due to reduced losses." Awkward start of the sentence, maybe: "Net growth rates of Pico II correlated positively with CO2 enrichment. . . . ."

- p20, l25-28: these are mainly results and then one other article is mentioned; but what does this now mean for your data? Do you think that TEP production was a factor regulating the abundances in your study? the actual discussion is missing

- p21, l9-11: This comes out of the blue. How did you examine this?

- p22, l2: ". . . has a very different physiology,. . ." different from what?

- p22, l17: DOC could have come also from sloppy feeding?

- p23, l17: do you mean remineralization of organic matter rather than nutrients?

- p23, l22: "multiple other factors"? Please name them here.

- Fig. 2: Instead of calling it the 'total prokaryotic phytoplankton', just call it what it is, the Synechococcus population

- Fig. 2: How is the p<0.1 indicated? Is it possibly also the category 'p>0.05'?

- I don't see any 'f' in this figure (and some of the following figures).

- What are the black dots here and in other plots (and I don't mean the single asterisks)?

- Fig. 2: panel b here and in following figures: I understand why the authors want to present the data together, but the plots are really obscured this way and it makes it hard for the reader to discern any data from them. I would suggest to split them into

two panels

- Fig. 2: Here and following figures, what do you mean by "otherwise no data is a zero"?

- Fig. 6: The legend says that linear regression statistics are provided in the plot, however, I couldn't see a p value.

- Fig. 10: the grazing rate and lysis rate are both loss rates; nevertheless, one of them is presented on a negative scale while the other is presented on a positive scale. I find it confusing.

- Suppl. Table S1: What are the units here?

- Suppl. Table S2: What are the units here?

- Fig. S1 and S2 legends: the upper layer is mentioned here but the measurements are from the total water mass, i.e. 0.3-17 m rather than 0.3-10 m

- Fig. S2: panel f is missing

- Fig. S3 and S4 please use the proper symbol for micromol and not umol

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