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Interactive comment on “Net community production and stoichiometry of nutrient consumption in a pelagic ecosystem of a northern high latitude fjord: mesocosm CO₂ perturbation study” by A. Silyakova et al.

Anonymous Referee #3

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General comments.

This study reports the results of a large-scale mesocosm experiment on ocean acidification carried out in Kongsfjorden, West Spitsbergen, presenting the effects of CO₂ perturbations on net community production (NCP) and stoichiometry of nutrient consumption. This is a valuable study providing rare information at the community level of a high latitude ecosystem in response to CO₂ increases. The manuscript is well organized and written, however, it does not provide an integration of the information about the response of this system to CO₂ perturbations.

C5091

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Discussion Paper



As the NCP resulted from biological activities of phytoplankton, bacterioplankton, virus and zooplankton communities, the authors should also provide information about the dynamics of these communities in order to draw the general picture of effect of enhanced CO₂ in this experiment. It is not for readers to search for such information within the other manuscripts of the special issue, and make the relationship with the NCP and stoichiometry of nutrient consumption. Each paper should be independent, providing the integrated view of the results and experiment. In my point of view, it is necessary that the results presented in the present manuscript are clearly compared, in detail, with the results of other related studies (Brussaard et al., Piontek et al., Schulz et al., Tanaka et al. Engel et al., Sperling et al., and Niehoff et al.). For instance, one of the conclusions of this manuscript is that the rate of NCP and net stoichiometry varied during the experimental period and most likely reflected the specific sensitivities to CO₂ perturbation of the dominant phytoplankton groups (Page 11718, first lines). However, the authors did not go further to integrate other results. It is necessary to discuss these phytoplankton groups and their sensitivities to CO₂ perturbations, and the consequences for NCP and net stoichiometry in each phase of the experiment. This manuscript can be considered for publication, as a part of special issue, after major revision to provide integrated information about the response of this system to CO₂ increases.

Specific comments.

- It is better to mention in the title that the study was performed in mesocosms and not in situ waters of a northern high latitude fjord. Something like “ CO₂ perturbation and NCP and stoichiometry of nutrient consumption in pelagic mesocosms in a northern high latitude fjord”.
- It is necessary to provide the information about the water temperature and natural irradiance during the experiment as biological activities are also affected by these variables.

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- Page 11710, lines 6-7 and 10. Please mention irradiance transmission characteristics of TPU as well as of PVC for PAR, UVA and UVB.

- As there is a technical note to calculate the exact volume of each mesocosm, please specify if the mesocosms enclosed 45 m³ (P. 11710, line 7) or 50 m³ (P. 11707, line 5).

- Page 11710, lines 16-17. Please explain clearly the characteristics of “dead” volume in the bottom of the mesocosms. Why did this dead volume cause an initial decline in pCO₂ level, and why until t₈ but not earlier nor later?

- Page 11710, lines 21-23. Please explain how the experiment was divided into phases I, II and III. Is this in relation to the peaks of biomass?

- Page 11710, lines 24. Please add the information about nutrient addition, concentrations, type of nutrients and the basis for adding such quantities in t₁₃.

- Page 11713, lines 6-8. Please explain why, to calculate C:N and C:P utilization ratios, you plotted the cumulative NCP against a cumulative difference in N and P uptakes for each period.

- Page 11714, lines 1-6. It is mentioned that the CO₂ equilibrated with the water in the “dead” volume by t₈ and, so, NCP of phase I was discussed only from t₈ to t₁₃. Please explain firstly how this CO₂ equilibrium occurred in the “dead” volume (if it is completely dead). Secondly, please describe the Chl a peak in Phase I in days 6 and 7 (Fig. 2) and characterize phytoplankton community before nutrient addition (this is missing because the authors start their explanation from t₈).

Moreover, it is open to question why the calculation of NPC did not start from t₄, when Chl a started to accumulate (even if CO₂ added was not yet in equilibrium with the “dead” water).

- If there is information about sediment trap data reflecting the amount of settled C, N and P at the bottom of the mesocosms, please add these data as they help interpret

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the fate of the three Chl a peaks during the three Phases of the experiment.

- Page 11717, line 15. Please note that Brussaard et al. 2012 is not mentioned in the reference list.

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C5094

