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Interactive comment on "Decoupling salinity and carbonate chemistry: Low calcium ion concentration rather than salinity limits calcification in Baltic Sea mussels" *by* Trystan Sanders et al.

Anonymous Referee #1

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I would like to congratulate the authors for this complete study that incorporates both field and laboratory experiments. The study, in general, is well-written and does not show important methodological failures. However, I have some specific comments and doubts that I would like authors could respond to.

The information provided in the introduction is sufficient to understand the necessity to perform this research. However, I recommend the authors to try to re-order the paragraphs, because there are some paragraphs that are totally disconnected from the others making it difficult to follow the storyline. For example, the paragraph starting

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at L98, in my opinion, would fit better at the beginning when the authors explain the study system.

Specifically, at L51 and following it would nice that authors explain more about the ecosystem function of the study species. Authors only make a small notification about that, surely there are studies about the ecological importance of this species and the formed-beds along the Baltic Sea.

Also, I would like to know if the authors have information if these ecosystem functions change along the gradient (salinity), and if the abundance of this species is sensitive to the gradient informed. This information is interesting to highlight the effects of environmental changes on the different Baltic sea mussel populations.

L131: what is based on the diet supply used? Is it based on field measurements, previous feeding rates reported. Please, add a reference.

L142: Authors pointed out that they use 1600 animals by experimental replicate. The authors did monitor the oxygen availability in the aquarium. I am worried that this animal density could affect the oxygen supply to the experimental aquarium, or change the pH conditions as a product of mussel respiration. The experimental replicates were bubbled while both experiments lasted?

L150 and following: Why the duration of both experiments was not the same? How authors can avoid the time accumulated effects of living in stressful environments. Even if the authors calculated a rate (by day), it is not comparable. I think that this an important issue to discuss as to compare both experiments as the results can be under or overestimate. The authors measured the calcification rates at the end of each experiment, right? This was no clear to me.

I understand that due to experimental limitations, the volume of the replicates had to be different. However, the final density (mussels ml-1) is too different to compare between both laboratory experiments. This is an issue to discuss in terms of denso-dependency

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potential effects on the results observed.

L190 and following. Suddenly, the authors show that a field experiment was also performed. However, nor the introduction or abstract is pointed out. In my opinion, this is a stronghold of this study. Please, try to incorporate this information in the last paragraph of the introduction, as well as in the abstract.

About the field study, the authors collected the laboratory experimental mussels in Ahreenshoop, however, the authors also performed field experiments in the other two extra sites. I understand the objective of this, but this is not explained in the manuscript.

Authors, in the field experiment, estimated calcification rates from the reported SL-CaCO3 relationship. I understand, that this is a unique relationship developed for a specific mussel population. However, after reading the introduction where authors pointed out that there are important differences along the salinity gradient. So, in my opinion, this relationship should be different among mussel populations. This could have important effects on the results. Indeed, why authors did not use the same methodology of the laboratory experiment, could improve the comparison of results.

Authors, in the laboratory experiment, show how they burned shells in order to eliminate organic matter from the shells in order to provide CaCO3 data and estimate calcification rates. Were there differences in the organic matter among populations? This is so important, as many previous studies have shown how marine calcifying organisms show different organic matter concentrations under different environmental conditions (lab or field). If authors could show this data would be very interesting to understand another potential factor affecting calcification rates. Indeed, shell organic matter (periostracum and inter, intra-crystalline organic matters) has a shell protection function under corrosive environments, but also as a substrate to favor crystallization and biomineralization processes.

How many times Chl-a was measured during the field experiment?

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I do not have major comments on the results section.

The discussion section is clear and also identified the major limitations of the study which is appreciated. Results are broadly discussed from many points of view, however as it was pointed out above, I miss a discussion of other potential causes that could determine the results. Indeed, biomineralization processes not only incorporate CaCO3 precipitation but they incorporate the secretion of periostracum/shell organic matter which has an important function on biomineralization. Also, the entire biomineralization process is energetic expensive because of the secretion of these shell organic compounds. It would be nice the authors develop this idea as potential causes of the results observed in order to complete the discussion section. If authors can show shell organic matter by treatment, this could help a lot to understand the results. Indeed, this could be a future research topic to develop. In addition, some methodological limitations of the study (pointed out above) such as denso-dependency are not discussed in the discussion.

FIGURES AND TABLES.

I suggest changing the order of figures, first showing the environmental conditions of field study sites, and then the results of calcification rates.

In table 1, I noticed that there are important differences in pH conditions among experimental treatments, how could affect the calcification rates?

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