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Biogeosciences Discussions

Interactive comment on "The metabolic response of thecosome pteropods from the North Atlantic and North Pacific Oceans to high CO_2 and low O_2" *by* Amy E. Maas et al.

Anonymous Referee #1

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"The metabolic response of thecosome pteropods from the North Atlantic and North Pacific Oceans to high CO2 and low O2" by Maas AE, Lawson GL, Wang ZA

General comments

This manuscript deals with the question whether thecosome pteropods that naturally experience high CO2/low O2 conditions in their North Pacific habitat show different physiological response as compared to congeners from the North Atlantic were such hypercapnic and low O2 conditions do not prevail in depth ranges of pteropods' occurrence. In a set of experiments with different treatment combinations and short-

term exposure of pteropods, the authors performed oxygen consumption measurements with eight different pteropod species from both ocean regions and tested their response to high CO2 and low O2 conditions. The only species that showed a change in metabolic response was Limacina retroversa from the North Atlantic. This species reduced metabolic rates in response to the combined treatment (high CO2/low O2) but not to high CO2 alone. The authors conclude that pteropods have mechanisms to cope with short-term CO2 exposure and their considerations should be taken into account in projections for pteropods under future ocean conditions.

This is important work that contributes to our understanding of different pteropod species physiology and their possible response to ongoing ocean change, i.e. ocean acidification and extension of oxygen minimum zones due to further ocean warming. A clear strength is the use of a variety of pteropod species naturally experiencing high CO2 / low O2 histories to give better insight into how these species are adapted to these conditions. Not only from this perspective but also owing to the fact that there are still many open questions especially with respects pteropods physiology, this is important work that I will like to see published. I have some minor comments and criticism, however, that should be dealt with prior publication. Mostly this applies to clarification with respect to replication of the experiments, mentioning of data in the text and respective tables, as well as some more information on the actual life stage of pteropods worked with.

Specific comments

Material and Methods

- Section 2.4: How many organisms were incubated per respiration chamber, how many replicates were possible to set up? Is N in table 4 the number of replicates? Please clarify. Please give also size ranges of different species incubated. Of what stage were the pteropods (all adults?)? If different stages, how could that affect results and conclusions drawn?

- L319: Size ranges of all species would be really helpful to see!

- Section 2.6: Assumptions proved in case of significant results found for L. retroversa?

Results

- Section 3.1: Please include information on the size ranges of the different pteropod species. Were all individuals of the same developmental stage?

- Section 3.2: This section needs some clarification with respects mentioning of geographical positions, temperatures. . . in the text and the respective table.

- L409/410: Can not find geographical position in table 2?

- L411: 250 or 209 m?

- L412: 110 or 130 m?

- L415: geographical position not found in Table 2?

- L417: 10–17°C?

- L421–425: How can I see that Clio pyramidata experienced these conditions (in Table1)?

- L427: 200 μmol kg-1 corresponds to what % air saturation O2?

- L428/429: Would it be possible to indicate the dominant hydrographic regimes in Fig. 1, would be helpful in connection with the sampling location of different pteropod species.

- L432/433: 400 or 385 m? geopgraphical position can not be found in Table 1.

- L437: below 5°C? I calculated 5.2°C?

- Could salinity be included in Table 2?

- L478/480: This sentence is unclear. According to Table 3, Ωar was never below 1?

And 1.2 is not under-saturated? Please clarify!

- L482: In situ values are meant here, right? Maybe indicate in the text, easier for the reader.

- Section 3.4: As indicated earlier, please clarify how many replicates were measured and how many individuals were incubated per chamber and experiment and species.

- L526: Fig 4 not 4A

Discussion:

The discussion is in general ok, but I miss some consideration relating to the specific life stage(s) these experiments were done on. Was it all the same life stages? If not, could that affect results and conclusions?

- L552/553: What stage of L. helicina was it? Could the high mortality also be associated with life cycle issues and less so with temperature, i.e. die off after reproduction?

- L617: How likely is it that O2 saturation below 10% resulted in a substantial difference compared to the results obtained at 10% O2 saturation? In other words, any idea where a critical threshold level could lie?

Figures:

In general, please next time indicate numbers of figures and tables directly on the page were figures and tables are shown. The way they are presented here led to a continuous turning around of printed pages and searching for a particular one.

Table 4

- Please include a size range for all different species

- Is N consistent with number of replicates?

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