Biogeosciences Discuss., 7, C4492–C4495, 2010
www.biogeosciences-discuss.net/7/C4492/2010/

Biogeosciences Discussions

Interactive comment on "Impact of ocean acidification and elevated temperatures on early juveniles of the polar shelled pteropod *Limacina helicina*: mortality, shell degradation, and shell growth" *by* S. Lischka et al.

Anonymous Referee #2

Received and published: 22 December 2010

General comments:

This manuscript describes an interesting study on the effects of elevated CO2 and temperature on juveniles of the Arctic pteropod Limacina helicina. Pteropods are key components of many marine ecosystems which, due to their aragonitic shell, are vulnerable to ocean acidification. This is a particularly timely manuscript in light of the need to acquire data and knowledge on the response of pteropod early life stages to global change. So far, only adult Arctic pteropod's response to global change has been investigated. The study of overwintering Arctic juveniles is particularly interesting as it

is a critical period with lower aragonite saturation state and lower food supply. Impacts of a 29 days incubation, under 4 pCO2 conditions (180, 380,750 and 1150 μatm) and 3 temperatures (3, 5.5 and 8°C), on the mortality, shell preservation state and shell increment/extension are presented in this manuscript. The authors demonstrate that the main parameter affecting the mortality is the temperature whereas the parameter affecting the shell is the pCO2. There are few points (described below) that need to be clarified. One of the points of the experimental approach open to criticism is that the experiments were performed on starving organisms (see specific comments: discussion). The results presented are generally interesting, well presented, and are based on a relatively robust experimental approach. The discussion of the results provides some new ideas, but a deepened interpretation of the results would be welcome to reinforce the manuscript.

Specific comments:

Abstract:

l-3: The authors should indicate that the undersaturation is expected locally and less than 1 month per year.

Introduction:

p-8181, l-3: A reference would be useful.

p-8181, l-21: Comeau et al. 2010a, also report on shell dissolution of live pteropods.

Materials and Methods:

p-8182, l-10: What were the proportion of organisms damaged by the collection at 300m? What was the density of pteropods (organisms per trawl)?

p-8182, l-14: What was the minimum acclimation time of the organisms?

p-8183, l-9: Why did you use these temperatures?

p-8183: Were the incubations performed in the light or dark?

p-8187-l-1-3: To my point of view, this classification is not clear. For example, the shell in stage III-4 seems more damaged than the shell in stage IV-1. In contrary in your 19 levels scale, the shell in the stage III-4 are classified "less damaged" than the shell in stage IV-1. How do you think it could impact the results presented?

p-8187, l-19: Why didn't you measure all the organisms? The results exposed would be much stronger.

Results:

p-8189, l-7: Was the mortality higher at pCO2 350 μatm at each temperature or only at one temperature?

p-8189 (part 3.3 and 3.4): Did you find a relation between one of your measured parameters and the aragonite saturation state (with or without taking into account the temperature)?

Discussion:

p8190, l-9-11: This is my major concern as I do not think that pteropods are totally starving at this time of the year. Indeed even if the phytoplankton concentration is reduced, pteropods are general suspensivor which can also feed for example on organic particles. Hence, the conclusion on the effect of temperature on the mortality of pteropods might be mislead by this parameter. It is probable that pteropods which are fed (even a little) would exhibit much lower mortality rates than the one reported in your manuscript. It would also be interesting to discuss what would be the impact of a higher temperature on the food availability (higher or lower phytoplanktonic population....) in the part 4.2.

p-8191, l-5: Did you measure the oxygen concentration at the end of the experiment? Low oxygen concentration would explain a part of the mortality.

P8194, l-7: The pteropods used by Orr et al. 2005 are from the Subarctic Pacific.

P8194, l-12-22: Did you check if this difference is not only due to the fact that for similar CO2 levels, the aragonite saturation state is higher at higher temperature?

Interactive comment on Biogeosciences Discuss., 7, 8177, 2010.