

Interactive comment on “Calcifying invertebrates succeed in a naturally CO₂ enriched coastal habitat but are threatened by high levels of future acidification” by J. Thomsen et al.

J. Thomsen et al.

fmelzner@ifm-geomar.de

Received and published: 25 September 2010

We thank both reviewers for their time to carefully read our ms and for their helpful comments. It is apparent that they devoted a lot of time and their suggestions are appreciated very much.

REFEREE 1:

Whole manuscript : we will re-organize the structure of the ms according to the reviewer's suggestions.

Specific comments:

C2999

Section 3.1: we will discuss Tunicliffe et al. 2008. We are currently also investigating local carbonate system variability in the Kiel Bay area in order to identify potential 'control' sites in which mussels are exposed to less challenging conditions. If we have identified these, we will use them in comparative growth / calcification studies.

Section 3.2: the reviewer raises a good point. We have thus conducted additional measurements using wild mussel from Kiel Fjord the end of August 2010 (N=15 mussels) using the same methods described in the ms. These mussels were actively calcifying, but again, EPF and haemolymph pH values were not significantly different. Thus our conclusions remain valid. We will replace the data from winter mussels with new data from the summer mussels. We will discuss models that suggest an altered carbonate speciation in the boundary layer between shell and EPF (e.g. Weiss 2010, Suzuki et al. 2009).

Section 3.3: Kiel Fjord surface pH is not much lower in the period when we conducted our experiments. The very high pCO₂ values are encountered between August to October, our experiment was running between May and July 2009. Control pCO₂ in this experiment was heavily influenced by the fjord conditions (ca. 500 μatm, see seawater chemistry in Table 2). We primarily compared field and experimental growth rates in order to show that the experimental animals were well fed. Some studies in ocean acidification research reported very low growth and calcification rates in mussels, which partly resulted in an insignificant correlation of seawater pCO₂ and calcification (Berge et al. 2007, Ries et al. 2009).

Section 3.4: a comparison of shell microstructure is only possible for animals of the same final size. This is why we chose similarly sized animals. However, the studied parts of the shell exclusively consisted of newly formed shell material in all cases.

Figures :

Figures 5 and 7: we will condense the information from figures 5 and 7 into one figure. The other figures should remain in the ms, as we believe they carry vital information.

C3000

REFEREE 2:

Specific Comments:

P5122 lines 15-22: we will expand this part a bit and define the different types of upwelling habitats. A detailed map of Kiel Fjord is available in Nikulina et al. 2008 (eEarth, 3, 37–49). We will refer to this map in the method section.

P5125 lines 10-13: the reviewer makes a good point. However, as the flow rates (+ algae supply) through the large replicate tanks were relatively high (100 mL min⁻¹) and the experimental animals were sufficiently spaced apart from one another within the replicate aquaria (>10 cm distance between mussels), we think that small vs. medium mussels can be considered independent from one another. As a one - factorial ANOVA yields the same results as the 2-factorial ANOVA we are inclined to go along with the current analysis. Considering that the main objective of the experiment was to demonstrate that very high rates of calcification are possible even under elevated pCO₂ when feeding designs are optimized, we think that the current analysis is robust enough to support the conclusions made in the ms. Titration of exact effect sizes will require further experimentation with more treatment groups and a higher level of replication. We will correct the formatting in Table 4.

P5128 section 2.6: we will modify this section to make it more accessible.

P5129 line 11: the information will be added.

P5131 Section 2.9: we will slightly expand the statistics section to clearly indicate which tests were used in what experiments.

P5132: this is correct. Interestingly, the ocean acidification community has not fully acknowledged the incredible variability in coastal systems. Some of us (FM, AK, MAG and others) are currently in the process of submitting a paper on current and future coastal carbonate system variability and its impact on benthic communities. We will thus only add 1-2 sentences on this matter in the current ms.

C3001

Technical Comments:

P5121 line16: we will change 'keystone species' into 'dominant species'

Figures and Tables: the labeling will be simplified and corrected.

Interactive comment on Biogeosciences Discuss., 7, 5119, 2010.

C3002