

Interactive comment on “Sensitivity towards elevated $p\text{CO}_2$ in great scallop (*Pecten maximus* Lamarck) embryos and fed larvae” by Sissel Andersen et al.

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Reply to Anonymous Referee #1

The authors would like to thank Anonymous Referee #1 for useful comments and suggestions. Here are our replies:

1. General comments. AC: We agree that the discussion can be pushed a bit further, especially to look at implications for aquaculture and population conservation, to put the results into a broader context. However, one should be careful not to draw this too far, since experimental conditions can be very different from the natural environment and increase or decrease the sensitivity to a stressor compared to in a natural environment.

C1

2. Specific comments. Page 1, in section 1 - “Introduction”, line 25: “cause elevated CO₂ levels” – specify where the CO₂ levels are elevated. In the atmosphere? In seawater? That first sentence is a little awkward to read, although still understandable by the reader. AC: The first sentence will be changed, since Referee #1 finds it a little awkward.

Page 2, in section 2 “Materials and Methods”: even if it was described in details in the earlier paper (2013), it would be useful to have a brief mention of which seawater parameters were measured and how often, and which were indirectly calculated and how. This would help the understanding of Table 1. AC: A brief mention of which seawater parameters were measured and how often, and which were indirectly calculated and how will indeed be included in Material and Methods, page 2 or 3.

Page 3, line 29-31: “At day 3. . . ‘protruded velum’”. The whole sentence is confusing. Reconsider the grammar (coma?), or rephrase. Do you mean that larvae that have not developed the muscle to retract the velum would be identifiable after being preserved by the presence of a protruded velum? AC: Yes, we mean that larvae that have not developed the muscle to retract the velum would be identifiable after being preserved by the presence of a protruded velum. The sentence will be rephrased.

Page 4, section 2.3 “Statistics”: I am not the best at commenting on this, but the whole section could be made clearer, from line 15 onwards. E.g. what do you mean by “where Multiple Comparisons were too weak”? AC: We will try to clarify the whole section, and explain what we mean by “where Multiple Comparisons were too weak”.

Page 5, section 3.2, line 13: “day 3, $p < 0.000$ ” Is this an error? AC: Yes, this is an error. It should read $p < 0.001$

Page 6, line 4: You mention the coefficient of variation, but you did not mention this earlier in the method section. It would be worth to explain what it is and why you are using it earlier on. AC: We agree, and will explain what it is and why we are using it in the method section.

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Page 7, section 4.3, line 24-25: This last sentence seems like a repeat of what is stated two lines above regarding slower/delayed development– unnecessary, or maybe rephrase saying that (line 21) “The percentages of unshelled larvae at day 2 and larvae with a protruded velum at day 3 were significantly higher in the 1337 μ atm C2 group, which is most likely a result of delayed development caused by elevated pCO₂, is in accordance with the reports of slower development at elevated pCO₂ levels reported in the earlier study of great scallop larvae (Andersen et al., 2013a) and also in other bivalve larvae (Talmage and Gobler 2011; Kurihara 2008).”. In this order in my opinion, it is easier to read and follow the logic, and does not sound like you are repeating yourself. AC: Line 21-25 will be rephrased according to the suggestion made by Anonymous Referee #1

Page 8, line 12-14: so? You are just stating facts, but not trying to say more about it. AC: Line 14 will continue by stating that: The similar shell length at day 7 for the two larval batches suggests that their shell growth rate was similar. Andersen et al. (2013) showed that food availability did not affect larval shell growth the first 6 days after fertilization, supporting that feeding probably did not cause any difference in growth rate between the two larval batches.

Page 8, line 19: a reference regarding factors such as genetic variation or energy status would help back-up your explanation. AC: We will add references as suggested.

Page 9, line 14: “main bottlenecks in the recruitment process” - reference for this statement? AC: Reference will be added.

Table 1: Why do you only have AT data for intermediate pCO₂ only? How did you calculate the other parameters (CO₂SYS? What constants?). One of your aragonite saturation is below 1, how do think this could have affected shell development and growth? AC: In the table text we explain that “. . . mean salinity and total alkalinity based on two analyses per treatment at the start and the end date, (n=6); ** One mean was used for all groups” But the value can be given in all columns, as for salinity. Also, this

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(together with CO₂SYS and constants) will be clarified in the additional information that will be given in Material and Methods (as described above for Page 2, in section 2). The aragonite saturation below 1 can possibly add energetic stress to the larvae, since calcium carbonate dissolves at saturation below 1. However, the carbonate shell in live larvae is covered by a protein layer, and the effect may not be significant at 0.82. This will be added to the Discussion using proper references.

Figure 1: The colours used are not consistent between the header tanks and the exposure tanks. Also why are some exposure tanks drawn asides (left/right), and others superimposed (above/below)? Why not all aligned? AC: Colors between the header tanks and the exposure tanks will be corrected, and the exposure tanks all aligned, as there are no reasons why they are not.

Figure 5: In my opinion, the graphs would be more easily read if you used ‘day 2’, ‘day 3’ . . . etc directly on the graph rather than letter A, B, C. . . But this is just a personal preference. AC: We agree, and will change Figure 5 accordingly.

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