

Interactive comment on “Impact of anthropogenic ocean acidification on thermal tolerance of the spider crab *Hyas araneus*” by K. Walther et al.

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The paper is well written and experiments appeared to have been carried out carefully. Collectively the authors have extensive list of publications and research experience in the area of temperature change and thermoregulation. This paper introduces some interesting data as to how increased levels of CO₂ may affect the physiology of crabs and ultimately their survival in different temperature regimes. I have a few comments/suggestions for improvement of the manuscript

1. Is it possible to standardize concentrations for reporting CO₂. Maybe to mMol or KPa?

2. The authors use projections for changes in CO₂ levels of ocean surface waters. Can

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they clarify what is meant by surface waters – how deep will these CO₂ levels extend? Will they only extend to depths where wind mixes up the waters, or will CO₂ be transferred to deep waters at upwellings?

3. Page 2840, line 15. Can the authors include a little more detail on the general biology of the species, what size does it grow to, what sort of habitat does it prefer, is it commercially abundant, etc.

4. Methods – did the authors have any problem with haemolymph clotting around the oxygen probes? The authors calculated heart rate by averaging values at each temperature step. Do the heart rates include averaging out any pauses in heart rate, or were calculations only made where heart rate was stable?

5. Why did the authors choose 25°C as an upper temperature range, when they report that these animals only experience upper temperature ranges of 18°C?

6. Page 2844 lines 22, and 27. Don't start the sentence with reference to a Figure.

7. Page 2846, line 3. What does rose “vaguely” mean?

8. Discussion. The discussion tends to repeat the results a little too often and simply compare the results obtained here with other species, without discussing why these changes in physiology occurred. It would be of interest if the authors could address why the increased CO₂ affected heart rates and PO₂ levels. For example, carbon dioxide has a narcotic effect on crabs, would this alter heart rates. How does acid-base imbalance affect heart rate, hemocyanin-oxygen binding and gas transport? Including some more of the control of these actual physiological mechanisms would enhance the discussion.

9. The critical ranges for cutoff and changes in heart rate lie above the 18°C maximum that the animals experience in the natural habitat, so are they realistically going to affect the animals in their natural environment?

10. The authors only maintained the animals in each CO₂ concentration for 24h before

experimentation. I wonder if they were able to repeat the experiments after a longer step-wise acclimation period of weeks or even months, if they would obtain different results? Is it possible the animals could acclimate to and compensate for increased CO₂? This is an important consideration since the reported increases in CO₂ are going to take place very gradually over the next 100 years or so.

11. In the final paragraph the authors suggest that ocean acidification could narrow thermal windows. Have the authors considering carrying out thermal preference experiments to see if such acidification could alter thermal preference regimes and thus distributions of these crabs?

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