

## ***Interactive comment on “Deformities in larvae and juvenile European lobster (*Homarus gammarus*) exposed to lower pH at two different temperatures” by A.-L. Agnalt et al.***

**Anonymous Referee #2**

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### General comments

This paper constitutes new information in a very timely topic of interest. The questions and scientific approach are clear, though the chemistry of the seawater should have been tested before proceeding with the experiments. This unfortunately led to the absence of a clear control for the study, leaving out valuable information. However, given the authors extensive background working with the study species, the absence of exoskeletal abnormalities from her long-standing experience allows some valuable conclusions to be made. The authors have made efforts to be upfront and clear about the lack of control pH, but may also benefit in greater clarity by including the pH information in the data tables.

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### Specific comments

7584 - Temperature treatment choice – you mention the importance of warming temperature in combination with OA, yet I understand the high temperature treatment you chose is the optimum temperature for homarid crustaceans. I'm not sure this addresses the question of how future levels of temperature and OA affect lobster larvae at relevant temperature levels. Please describe how and why the study temperatures were chosen.

7587 line 4 – It is unclear how many replicate larvae were measured per treatment per stage. This type of information is important to allow replication of your experiment for verification of findings, particularly when there is some question about the control missing. It is also necessary for understanding claims later in the paper attributing some significant differences to low replication versus experimental treatment.

7588 – Regarding the statistical analysis, I understand that there were multiple (number unclear) replicate larvae sampled from each kreissel per treatment per stage. How did you treat replicates (kreissels and larvae within kreissels) within the ANOVA design in this study? Your replicates would be the 2 kreissels in each of the 6 treatments, with replicate larvae from each kreissel nested within each treatment combination. This would necessitate a nested ANOVA analysis unless there is no effect of kreissel within each of the treatments which could be checked with Cochran's test (see, for example, Underwood 1997).

7589 line 4 – You conclude that the lack of significant difference in CL between ambient and high pCO<sub>2</sub> treatments overrides that of the low-replicate significant difference between medium and high pCO<sub>2</sub>. However, the ambient treatment provided higher pH conditions in the beginning of the experiment and more variability in pH overall. The effect of variable pH versus constant pH is emerging now in OA research. It may be worth considering that the difference in conditions (variable ambient pH versus stable medium pH) itself could be responsible for the difference between medium and ambient

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results, rather than the different sample sizes.

7590 – How does the change in proportion of deformed larvae in 1 year juveniles compare with mortality? The decrease in proportion of deformed larvae in high pCO<sub>2</sub> may be related to higher mortality in high pCO<sub>2</sub> over the last 7 months, or higher mortality of already deformed larvae.

7591 line 11 – I do not feel it is appropriate to say that within the control group no larvae were deformed as there was no real control in this study. It is clear that the main author is very experienced with this species, there is no evidence from the present study on which to base this statement due to the ambient water pH variability. There is also a study by Keppel et al. (2012) not referenced in this paper which discusses effects of OA on larvae of the American lobster. There are few studies specific to this taxa and acidification, and there is much to be learned by comparing what is known about related species.

Minor comments

7584 - How frequently were water samples taken for chemical analysis?

7584 line 10 – The actual pCO<sub>2</sub> wasn't reported for the control here. While it is well discussed why this was different from expected elsewhere in the paper, it is important to include this information when reporting values for all treatments.

7584 line 12 – It is unclear how the gas was controlled at experimental pCO<sub>2</sub>; did you bubble a premixed gas, or mix CO<sub>2</sub> from a gas cylinder with ambient air? Or bubble CO<sub>2</sub> and air separately?

7603 table 1 – please include a column for the control pCO<sub>2</sub> treatment

Technical corrections

7584 Line 25 - HgCl<sub>2</sub> typo

7584 Line 26 – pH closed bracket

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7587 line 20 'describen' should read 'described'

1593 line 19 – missing word: "The new exoskeleton..."

7604 Fig 4 – missing 's' at end of Homarus

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Interactive comment on Biogeosciences Discuss., 10, 7579, 2013.

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