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Interactive comment on “Short and long term consequences of larval stage exposure to constantly and ephemerally elevated carbon dioxide for marine bivalve populations” by C. J. Gobler and S. C. Talmage

Anonymous Referee #2

Received and published: 17 January 2013

General comment: This manuscript looks at the effect of both static and fluctuating ocean acidification on the larval and early juvenile development of the bivalves *Mercenaria mercenaria* and *Argopecten irradians*. This is an impressive data set which supports many hypotheses suggested but not yet comprehensively supported in the literature. Using calcification, RNA:DNA ratios and growth measurements the authors find that the early larval stages of the two bivalve species are more sensitive to ocean acidification than the later larval and early juvenile stages. The fluctuating pH design of the experiment moves a step closer to mimicking the fluctuating nature of pH in es-

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tuarine and coastal environments and shows that exposure to ocean acidification at one life-history stage can have lasting negative effects on others. I would like to recommend the manuscript for publication in Biogeosciences and suggest only the minor changes below.

Specific comments: Methods: Excellent and robust delivery and measurement of CO₂. Section 2.6 – What was the purpose of transferring the juveniles out of the laboratory to the ranging pH environment for 12 days before transferring them to the stable environment? Perhaps include this. Results: Section 3.1 Line 22-23 – A. irradians veliger calcium uptake seems to decrease from 280 to 390 uatm but 390 to 750 uatm are the same. This should be made clearer. Also, the difference between veliger and pediveliger larvae could be made clearer i.e pediveliger larvae seem more sensitive to the elevated CO₂ level than the earlier veliger stage for this species (in terms of calcium uptake). Section 3.2 – For M. mercenaria, the results of the RNA:DNA ratios are reported for 280 and 1500 uatm, what happened at the other concentrations? Section 3.3 Line 9 – should this be 3, 6, 9 and 12 days? In the methods it says that they were switched until day 12. Discussion: There is not much written about 280 uatm. I know that this is important, showing that the current ambient CO₂ levels are already affecting bivalve species but this is not clear from the discussion of results.

Technical comments: Introduction: Page 2 Line 4 – Change ‘ecosystem’ to ‘ecosystems’ Line 17 – The meaning of the second part of this second is not completely clear/ does not quite flow with the start of the sentence. Perhaps modify. Methods: Section 2.4 – How many days were larvae reared before doing RNA:DNA ratios? I think this may be mentioned below but would be good to include it in this section. Section 2.5 Line 13 – Change ‘These’ to ‘The’ Line 19 – Insert ‘to’ after ‘larvae’ Line 22 – Was there a reason for using a different elevated CO₂ level for M. mercenaria and A. irradians? Results: Section 3.1 Line 9 – perhaps insert ‘on’ after ‘mercenaria’. Line 10 – ‘M. mercenaria day 10’ doesn’t quite flow. Perhaps move comma from after ‘10’ to after ‘larvae’ Discussion: Page 2 Line 1-2 – Change ‘growth of larval growth’ to ‘growth of larvae’.

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Line 7 – Should the full species names be used in this line since it is the first time that the species have been mentioned in this section? Line 11-12 – perhaps include a few more recent papers on the effects of OA on bivalve larval development from 2011 and 2012. Line 18 – Add the species in question. i.e. individuals of *A. irradians* Line 30 – perhaps change ‘exposure to 13 days 750 uatm CO₂’ to ‘exposure to 750 uatm CO₂ for 13 days’.

I would like to congratulate the authors on this very interesting and important manuscript.

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BGD

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