

## ***Interactive comment on “Variable metabolic responses of Skagerrak invertebrates to low O<sub>2</sub> and high CO<sub>2</sub> scenarios” by Aisling Fontanini et al.***

**Anonymous Referee #2**

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General comments The topic of the present work is interesting and the authors try to make a correlation between the obtained data and the environmental characteristics of habitats. However, my concern is the period of exposure to particular stressors, which may determine and the range of tolerance of marine invertebrates to environmental changes. For example it is reported (page 8, line 43) that invertebrates from this ecosystem which showed little or no mortality in the presence of both stressors, reflects the range of conditions in the habitats these organisms occupy. However, mortality is depended on several factors including reproduction period, body size, etc. Moreover it is depended on the period of species exposure to stressors. Also, a key point for the species to withstand stressful conditions for long term is their ability to keep a stable energy turnover since. Such metabolic responses and patterns determine and their

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thermal limits. Even more some species live at the edges of their range of thermal tolerance. Thus long-term experiments might help further not only in estimating species' ability to withstand stressful conditions but to make a better correlation with the future climate projects. I consider that the authors should take into their consideration the above points and to reconsider the interpretation of some obtained data. I agree with author's statement about the complexity of stressors and the challenge of predicting how global stressors will affect marine ecosystems in the future.

Specific comments Page 2, line 8. This metabolic control...could be changed to The involvement of metabolic processes in the regulation of the pH in coastal water is..... Page 2, line 15. ....although the combined stress from depleted O<sub>2</sub> and high CO<sub>2</sub> is likely to provide a significant challenge to coastal invertebrates and less mobile species... could be changed to although the synergistic effect of O<sub>2</sub> depletion and CO<sub>2</sub> accumulation is likely to provide a significant challenge to coastal invertebrates and mostly to sessile species. Page 2, lines 24-26. There are many invertebrates tolerant to hypoxia (e.g. mussels). Thus the authors should be focused on these species which rather are less tolerant (e.g. benthic invertebrates). Page 2, line 37. I would prefer synergistic instead joint Page 2, line 38. ..future levels of what I consider that the two last paragraphs should be reorganized and rewritten in such a way so the firstly the authors to be reported at several hypotheses and secondly at their aims Methods and Materials 1. Merge the two first paragraphs 2. Make clear, when saying history, whether the reported environmental characteristics are long lasting. It is very important since species experiencing such environmental changes in their life cycle may have adapted to such environmental changes by developing the corresponding cellular and physiological mechanisms. 3. Report which of the examined rocky species are exposed or not to air because of tide. The latter characterizes sessile species tolerant to hypoxia. 4. Change Metabolic response to Metabolic rate or Oxygen consumption. Metabolic responses usually is referred when we examine the metabolic patterns (e.g. enzyme activities, metabolites etc) 5. Page 5, line 8. For the readers describe briefly the physiological meaning of term respiration index. 6. Page 5, lines 15-21. The exper-



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imental procedure for determining the oxygen consumption should be written in details. For example chamber volume, was it the same for all species examined? Also report the temperature, salinity and pH of water. It is very important to report the period (hours) of experimental procedure since under a particular level of PO<sub>2</sub> metabolism shifts from aerobic to anaerobic and this point is species depended. 7. Page 5, line 23. Ratio of what? Results 1. Respiration. Report the consumption of oxygen rate for each examined species and give possible differences between each other. 2. Give more information the differences or not for the oxygen consumption for each species at each treatment 3. In general the results should be rewritten in such a way so to be more clear what is happening in each species at tested treatments and whether differences were recorded from species to species. Table 3. In the column day it is marked 3/6, 3/5 etc. In the legend it is reported pooled data where we had 3 and 6 days. Thus the number 4, 5 2 what do they mean.

Discussion Page 7, lin e 29-30. It is unclear what the authors report. Page 7, line 32-33. It is very important to report whether such changes in pH regard fluctuations or permanent changes. In the first case the organisms face waves of such changes and how long such waves last. Page 7, line 36-37. Community of what? Rewrite the sentence (line 37-39), since it is unclear what it is meaning. Page 9, line 16. Responses ...which responses? Page 9, line 1-2. Do you know how long these events last? Is it an acute environmental change or long-term change? Page 9, line 10. It could be nice if the authors could support such adaptive responses, genetically determined, by reporting differences from individuals of the same species but from different populations habitating environments differing in the tested abiotic factors. The observed responses in the present work may regard phenotypic plasticity which may be observed and in individuals from populations living in other environments when treated similarly.

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