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Interactive comment on "Species interactions can shift the response of a maerl bed community to ocean acidification and warming" *by* Erwann Legrand et al.

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Review of the manuscript by LEGRAND et al. entitled "Species interactions can shift the response of a maerl bed community to ocean acidification and warming", submitted to Biogeosciences.

The study by Legrand et al. assessed the metabolic responses of a range of species associated to maerl beds (incl coralline algae, grazers and epiphytic fleshy algae), as well as the metabolic responses of the maerl assemblage to changes in seawater carbonate chemistry and temperature across two climatic seasons. The authors found complex interactions among experimental factors and seasons on the species and

community metabolism. The coralline algae exhibited responses which were expected under CO2 perturbation experiments, but importantly, the study documented significant changes to grazers' metabolism and enhanced epiphytic algal biomass under CO2 enrichment. Although ecological interactions were not directly assessed, changes in the metabolic responses of the experimental species are assumed to influence species interactions. Based on these results the authors were able to propose that ocean acidification and warming will have considerable impacts on the functioning of maerl beds.

I read this manuscript with great interest and believe the authors have done a comprehensive and thorough study. Most studies in the field of impacts of climate change on marine systems focus on responses of one or two species, generally within the same taxonomic group, and it is refreshing to see that this study took a step forward and assessed the impacts at the community level during two climatic seasons. Individual responses focussed on a range of response variables, incl chlorophyll (for the algae), net production, respiration, net calcification (light and dark), and excretion for the grazers. In combination with the assemblage's responses, this allowed the authors to discuss some potential ecological implication such as shifts in species composition, competition, carbon storage, etc. The Methods are generally well described and provide enough detail so that other researchers can repeat the experiments. Methods are appropriate for ocean acidification research.

Main comments: I have two main comments to the paper. First, seasonal effects on both the individual and assemblage responses were not fully explored or discussed in the m/s. One of the strengths of this m/s is that it was conducted in two different climatic seasons, but how the strength of the responses varied between seasons was not clear. I would suggest that the authors include a section where this comment can be fully addressed.

The statistical analyses seem to be well executed, however, I would argue that because there were significant interactions between treatments (OA, temp, and season), there is a need to conduct further statistical analyses within treatment combinations, as in several instances, the main factor was significant, but in fact it was only significant for one or the other season, or under a particular treatment combination. For example, in line 213, "R was significantly reduced by the high temperature condition in the winter, whereas an increase in R was observed in the summer." This statement is fine, but is not actually supported by a statistical analysis as Table 3 only provides p values for the main effects. This issue is also evident 216-219. Underwood (1997; Experiments in Ecology: Their Logical Design and Interpretation Using Analysis of Variance, Cambridge University Press) provides information on this topic. These new analyses could be included as supplementary material.

There are some statements that are not supported by the experiments. Although the authors demonstrated changes in algal and grazer metabolisms, species interactions among those organisms were not examined experimentally. E.g. Line 251. "Our study demonstrates that the response of maerl bed communities to increased temperature and pCO2 conditions is a complex function of direct effects of climate variables on species physiology and shifts in species interactions". Reword this statement.

Minor comments: âĂć Unclear why chla was measured on dead Lithothamnion. Provide a brief justification in section 3.3. âĂć Line 90: In general avoid single-sentence paragraphs. âĂć Line 237: ".. having positive effect". Was this effect significant? âĂć L260-280: This is a very long paragraph, try breaking it into two. âĂć 285-305: This is also a very long paragraph. âĂć 291: Ordonez et al. (Ordonez Alvarez et al. 2014 Effects of ocean acidification on population dynamics and community structure of crustose coralline algae. Biological Bulletin 226, 255-268.) also found a failure in recruitment of tropical CCA and importantly documented shifts in species composition.

âĂć Line 303: "However, the present findings do not support this idea, because a decline in Gl was observed under high pCO2 despite high". Short et al (2014) paper dealt with minute algal turfs which may have altered the thickness of the diffusive boundary layer on the coralline algae. The macroalgae investigated in the present study were much bigger and may interact in many different ways. It is perhaps very difficult to

generalise the impacts of epiphytic algae on coralline algae given the diversity of algae in marine systems. Perhaps a line or two addressing this would be useful.

âĂć Pages 14-15: Grazing responses may also be altered by changes in seaweed allelopathic compounds, brought about by changes in composition, quantity, or in the magnitude/potency of the allelopathic interactions. A recent study showed that the potency of allelopathic interactions towards a tropical coral was intensified under ocean acidification conditions (Del Monaco et al. 2017 Effects of ocean acidification on the potency of macroalgal allelopathy to a common coral. Scientific Reports 7, 41053). May be worth adding this potential mechanism as drivers of changes in species interactions in response to acidification and warming.

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