Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2017-135-RC2, 2017

Biogeosciences Discussions
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EGU

Interactive comment on "The regulation of coralline algal physiology, an *in-situ* study of *Corallina officinalis* (Corallinales, Rhodophyta)" *by* Christopher James Williamson et al.

E. Kennedy (Referee)

emma.kennedy@griffith.edu.au

Received and published: 21 June 2017

This is a great study into the geniculate coralline alga Corallina officinalis in a temperate rock pool environment with highly variable environmental conditions. The authors explored how the environmental fluctuations in light, temperature and carbonate chemistry affected the physiological processes of photosynthesis, respiration and calcification in this species, over a range of temporal scales. Large seasonal differences in all three factors led to higher net production in summertime driven mainly by light, while calcification rates were also highly variable and explained well by irradiance, and to a lesser extent carbonate chemistry and water temperature (R2=80). The alga performed

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well under environmental extremes caused during tidal emersion periods, partly due to its ability to use both CO2 and HCO3- in photosynthesis.

Results were in agreement with other studies of temperate corallines, e.g., Lithothamnion and Ellisolandia. Estimates of production, and calcification rates useful for parameterising models of future environmental change. Extreme conditions experienced at rock pool emersion could provide insights into how this algae will fare under a high CO2 world. The study was well written and I would recommend this manuscript for publication after addressing some minor edits.

General comments

Premise for the research is that important to get a baseline for climate change impacts (with climate change in the opening statement of the abstract, keywords and discussion) but this argument was poorly made, not discussed adequately or supported by citations. Statements about how climate change would affect the algal physiology were vague and repetitive (e.g, line 89-90, line 52-52, line 369-371) and climate change wasn't explicitly tested in the study design. Statements that this alga is facing any immediate threat from by climate change weren't supported and I remained unsure what the implications of the findings were in the context of climate change in the discussion (e.g. line 549). This is a great standalone ecophysiology paper and interesting within itself: I would suggest either elaborating on statements about climate change (e.g., OA changes predicted by 2100 < than what an intertidal rock pool dweller would experience over 24 hours (see Andersson & Mackenzie 2012) – so there could be a strong case made for extreme conditions experienced during rock pool emersion being equivalent to future conditions) – see Kwiatkowski et al. 2016 Scientific Reports paper which is also relevant - or else removing a lot of this, and making a simple case for the research in the importance of understanding physiology, which is perfectly fine.

Throughout the manuscript environmental variables were referred to as a 'stressors' – is this the right terminology? Maybe it is correct but I found this a confusing as I

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would expect irradiance is an environmental condition rather than a stressor: it elicits a physiological response but is necessary for life and in this context was being tested under realistic environmental conditions.

Methods need to be explained – I was unclear whether these measurements were occurring in one pool, or ten individual rock pools – or if the same pool was being returned to each season? This is important as volume, shape and location of pool could influence how quickly it heated up. Did the emersion duration change in different seasons? i.e. variability in the time period between beginning (in first hour) and end (last 1.5 hr) samples. Wouldn't variability in the duration of exposure have influenced findings? This wasn't clear.

I wasn't sure about how PC1 values were used to represent carbonate chemistry, although appreciate this is a great way to roll all the variables into one value – it might have been more meaningful (and easier for readers to follow) to choose one representative element, e.g., âĎęarag and use this to describe temporal trends – especially if the data are going to be used in future to parameterise future climate change response models (as suggested). E.g. Fig 4 boxplots are difficult to interpret in a meaningful way. Discussion: These experiments were all carried out at one north-west facing sheltered bay – maybe a little discussion about how representative the environmental conditions here might be across the entire species range, to put findings in context?

Specific comments

Line 121 – 122: specific why these sampling times were chosen- presumably to capture climactic seasons?

Line 124 – how many hours before low tide was the emersion period? How long was the emersion period? Table 1 is misleading as it describes tide times, not sampling times – maybe add sampling times to it? (see general comment)

Line 133 – Did you return to the same rock pool each season? How many incubations

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in each pool?

Line 137 – why only 5 water samples? Why not one from each of the ten rock pools?

Line 259 – why did you present a bar chart of daytime temperatures but not night time temperatures?

Line 267 – why were temperature and irradiance data presented in the main manuscript (Fig 1) but carbonate chemistry in the Supp. Mat?

Line 278-282 – explain what 'higher' PC1 means in terms of carbonate chemistry parameters.

Line 386 – couldn't the other predictors be removed and the between temperature and productivity tested? Otherwise find this interpretation hard to swallow as it goes against your findings.

Fig 4b – what happened to December? Consider revising Fig 4 and focussing on one representative carbonate chemistry parameter to describe temporal change in dynamics, rather than PC1 scores.

Technical comments

Line 171-173 – I understand what is meant here but had to re-read the sentence several times! Consider revising.

Line 110 – remove the word 'significantly'.

Line 89 – the interactions. . . are (not is)

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