Peer Community In Ecology

Evaluating physiological responses of a kelp to environmental changes at its vulnerable equatorward range limit

Matthew Bracken *based on peer reviews by 2 anonymous reviewers*

Aline Migné, Gaspard Delebecq, Dominique Davoult, Nicolas Spilmont, Dominique Menu, Marie-Andrée Janquin and François Gévaert (2019) Photosynthesis of Laminaria digitata during the immersion and emersion periods of spring tidal cycles during hot, sunny weather. Missing preprint_server, ver. Missing article_version, peer-reviewed and recommended by Peer Community in Ecology.
https://hal.sorbonne-universite.fr/hal-01827565

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Understanding processes at species' range limits is of paramount importance in an era of global change. For example, the boreal kelp *Laminaria digitata*, which dominates low intertidal and shallow subtidal rocky reefs in northwestern Europe, is declining in the equatorward portion of its range [1]. In this contribution, Migné and colleagues [2] focus on *L. digitata* near its southern range limit on the coast of France and use a variety of techniques to paint a complete picture of the physiological responses of the kelp to environmental changes. Importantly, and in contrast to earlier work on the species which focused on subtidal individuals (e.g. [3]), Migné et al. [2] describe responses not only in the most physiologically stressful portion of the species' range but also in the most stressful portion of its local environment: the upper portion of its zone on the shoreline, where it is periodically exposed to aerial conditions and associated thermal and desiccation stresses. The authors show that whereas *L. digitata* possesses mechanisms to protect it from irradiance stress at low tide, these mechanisms are not sufficient to prevent damage to photosynthetic pathways (e.g., reduction in optimal quantum yields of photosystem II). This species experiences severe heat stress associated with mid-day low tides during the summer, and the cumulative damage associated with these stresses is likely associated with the range contraction that is currently underway. Given the important role that *L. digitata* plays as food and habitat for other organisms, its loss will have cascading impacts on community structure and ecosystem functioning. Understanding the mechanisms underlying these declines is essential to understanding

the impacts of climate change on species, communities, and ecosystems.

References:

[1] Raybaud, V., Beaugrand, G., Goberville, E., Delebecq, G., Destombe, C., Valero, M., Davoult, D., Morin, P. & Gevaert, F. (2013). Decline in kelp in west Europe and climate. PloS one, 8(6), e66044. doi: [10.1371/journal.pone.0066044](https://dx.doi.org/ 10.1371/journal.pone.0066044)

[2] Delebecq, G., Davoult, D., Menu, D., Janquin, M. A., Migné, A., Dauvin, J. C., & Gevaert, F. (2011). In situ photosynthetic performance of Laminaria digitata (Phaeophyceae) during spring tides in Northern Brittany. CBM-Cahiers de Biologie Marine, 52(4), 405. doi: [10.21411/CBM.A.C9EE91F](https://dx.doi.org/ 10.21411/CBM.A.C9EE91F)

[3] Migné, A., Delebecq, G., Davoult, D., Spilmont, N., Menu, D., Janquin, M.-A., and Gevaert, F. (2019). Photosynthesis of Laminaria digitata during the immersion and emersion periods of spring tidal cycles during hot, sunny weather. Hal, 01827565, ver. 4 peer-reviewed and recommended by PCI Ecology. [hal-01827565](https://hal.sorbonne-universite.fr/hal-01827565)

Reviews

Evaluation round #3

DOI or URL of the preprint: https://hal.sorbonne-universite.fr/hal-01827565
Version of the preprint: 2

Authors' reply, 31 January 2019

Dear Dr Bracken,

I have addressed your last comments modifying the text as you suggested.

Pages 2-3: "Species populating shallow areas experience an extremely variable environment and are particularly exposed to global warming (Pereira et al. 2015)..." has been rephrased as "Species living in shallow nearshore and intertidal habitats experience an extremely variable environment and are particularly exposed to the impacts of climate change (Pereira et al. 2015). As foundation species, kelps can help to mitigate the negative effects of climate change (e.g., by providing a damp, cool refuge at low tide [Burnaford 2004]) and therefore contribute to the maintenance of ecosystem function (Wernberg et al. 2010)." Thanks for the reference to the Burnaford (2004) paper, I did not find a better example of kelps ameliorating intertidal temperature stress for associated organisms.

Page 3: "Although multiple causes may have contributed to this decline, ocean warming has specifically been incriminated" has been rephrased as "Although multiple causes may have contributed to this decline, ocean warming appears to be an important factor."

Pages 3-4: A bit more has been written regarding what sets this work apart from previous studies (e.g., Delebecq et al. 2011). "This pattern was observed in the mid part of the kelp zone (which remains immersed even at low tide) and may be very different in the upper part of the zone (which emerges at low tide) where L. digitata is likely to be exposed to the most pronounced physical stress (Hanelt 1996)." "The present study aimed to describe the in situ dynamics of the photosynthetic performance of L. digitata sporophytes at their upper intertidal range limit, throughout a whole tidal cycle including an emersion period. The photosynthetic activity of thalli was measured at different tidal stages (during immersion and emersion) using pulse-amplitude modulated (PAM) fluorescence."

"Belt" has been replaced by "zone" throughout.

I have uploaded the new version in HAL server (where it must be checked).
I also upload it here.
I look forward to your decision.
Best regards,
Aline Migné
Download tracked changes file

Decision by Matthew Bracken, posted 30 January 2019

PCI Ecology decision on Aline Migné et al.: Photosynthesis of Laminaria digitata ...

Dear Dr. Migné,

I apologize - I'm still getting used to the PCI Ecology interface and missed the versions you uploaded as additional files. I saw the link to the revision (https://hal.sorbonne-universite.fr/hal-01827565) and an indication that no cover letter had been uploaded, but did not see the additional files at the bottom of the page. I think that you have done a solid job of addressing the reviewer comments, and I only have a few minor suggestions to add:

Pages 2-3: Currently reads "Species populating shallow areas experience an extremely variable environment and are particularly exposed to global warming (Pereira et al. 2015)..." I suggest "Species living in shallow nearshore and intertidal habitats experience an extremely variable environment and are particularly exposed to the impacts of climate change (Pereira et al. 2015). As foundation species, kelps can help to mitigate the negative effects of climate change (e.g., by providing a damp, cool refuge at low tide [Burnaford 2004]) and therefore contribute to the maintenance of ecosystem function (Wernberg et al. 2010)." Note that the Burnaford (2004) paper is just a suggestion off the top of my head. If you have a preferred example of kelps ameliorating intertidal temperature stress for associated organisms, you are more than welcome to include it either in place of or in addition to my suggestion.

Page 3: "Incriminated" probably isn't the best word for what you're describing. I suggest rephrasing this as "Although multiple causes may have contributed to this decline, ocean warming appears to be an important factor."

Pages 3-4: I would like to see a bit more here regarding what sets this work apart from previous studies (e.g., Delebecq et al. 2011). One key aspect of your work is that you are examining processes at the upper intertidal range limit, which is where L. digitata is likely to be exposed to the most pronounced physical stress.

Pages 3, 4, and throughout: I think that "zone" is a better term than "belt". It will make sense to a broader readership and reflects accepted terminology (e.g., Stephenson & Stephenson 1949).

Evaluation round #2

DOI or URL of the preprint: https://hal.sorbonne-universite.fr/hal-01827565
Version of the preprint: 2

Authors' reply, 30 January 2019

Dear Dr Bracken,

Thanks for your answer. I'm however surprised to read you did not find my cover letter indicating how the reviewers'comment were adressed as I uploaded it when I submitted the revised version of the manuscript.

I upload it again.

All the best, Aline Migné

Download author's reply

Decision by Matthew Bracken, posted 30 January 2019

PCI Ecology decision on Aline Migné et al.: Photosynthesis of Laminaria digitata ...

Dear Dr. Migné,

Many thanks for your revision, which I enjoyed reading. One important note: whereas I did not find any major issues with this revision, I specifically requested a line-by-line accounting of how you addressed the reviewers' comments. I would like to see a statement to this effect - e.g., as a cover letter accompanying your resubmission - so that I can evaluate your revisions. I also acknowledge that the online system can be a bit cumbersome, so I apologize for any difficulties. I have one minor suggestion to add: In your introduction, you make at least two references to "global warming". I suggest that you rephrase this to the more general "climate change".

All the best, Matt Bracken

Evaluation round #1

DOI or URL of the preprint: https://hal.sorbonne-universite.fr/hal-01827565/document
Version of the preprint: 1

Authors' reply, 10 January 2019

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Decision by Matthew Bracken, posted 09 November 2018

Revision needed

Dear Dr. Migné,

I have now received two reviews of the manuscript you submitted for consideration in PCI Ecology (Photosynthesis of Laminaria digitata over the immersion and emersion alternation of spring tides under sunny and hot weather). Both reviewers found a lot of merit in the contribution, but both also recommended revisions. I concur with their assessment, and would appreciate a revision that addresses their suggestions and concerns. In particular, one reviewer highlighted a need for more general information that describes the study in the context of ecology, in general, and nearshore ecology, more specifically. A broader beginning to the Introduction and summary statements in the Abstract and Discussion would help a lot. The reviewers have made many good suggestions. Accompanying your revision, please include a detailed description of how you have incorporated all of their suggestions and addressed their comments and concerns.

Best regards, Matt Bracken

Reviewed by anonymous reviewer 2, 19 October 2018

This is a nice study showing some of the physiological responses of the kelp Laminaria digitata to the challenges of emersion in a marginal northern habitat. The authors conduct careful measurements and relate their study design well to previous work and publications.

The study would be improved by better summary of the overall objectives and findings. As is, it gets into the technical details and results without adequate explanation of the relevance of this work to nearshore ecology in general. Summary statements in the Abstract and in the Discussion would increase the relevance and audience of this work. Additionally, some kind of overview statement in the figure legends would be helpful - the addition of "...showing that carbon flux during immersion is inhibited after periods of emersion.." (or something like that)

The layout of Figure 1 is great, allowing the reader to visualize the tidal cycle and the resulting temperature and PAR. However, this gets a bit complicated for the rest of the figures, and some thought should be given to how best to represent the data more clearly, and/or draw attention to the highlights of the findings as expressed in the graphic.

The timing of re-immersion measurements should be standardized and reported (in Table 1) as this may influence the ETR.

Water motion is an important determinant of NP. In the benthic chamber ”two pumps ensured the rapid and constant homogenization of the media.” How are you determining homogenization? Can you relate to a flow speed? Same with the air chamber: what was the rate of air movement? Are these values comparable to those in Delebecq et al.? This should be quantified explicitly, as these are important factors affecting the results and the comparisons to earlier studies.

Table 2 is confusing as in the legend NP is reported in units of 02 or C, but it is not clear how they might be compared.

Time is reported as 0: xx pm (E.g.0:40pm) - which is not a standard time denotation. Please convert.

The entire text should be reviewed by a native English speaker to correct grammar and improve clarity.

Reviewed by anonymous reviewer 1, 05 October 2018

Download the review