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

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RECOMMENDATION

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A recommendation of

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

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 [3]. 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.* [1]), 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

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

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

Appendix

Reviews by two anonymous reviewers, DOI: 10.24072/pci.ecology.100010