Seaweeds shelter calcifying marine life from acidifying oceans

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Seaweeds create a chemical microenvironment at their surface, providing refuge for calcifying organisms that are at risk from decreasing oceanic pH, shows new research published in the journal

Functional Ecology.

CO_2 in the atmosphere dissolves directly into seawater, lowering the pH and making it increasingly acidic. Kelp and other seaweeds are ecosystem engineers that shape their physical and chemical surroundings. They soak up CO_2 during the day through photosynthesis and thereby temporarily increase the pH level of seawater.

Physiological ecologists from the Institute for Marine and Antarctic Studies at the University of Tasmania studied the most common and widespread kelp in the southern hemisphere, *Ecklonia radiata*, focusing on the chemical microenvironment that develops at the surface of their blades, called the diffusive boundary layer (DBL).

Using kelp blades from the Tinderbox Marine Reserve, a wave-sheltered area in the south of Tasmania, the team conducted laboratory experiments to measure the characteristics of the DBL under different light and water flow conditions.

They showed that, in slow flow, kelp create a microlayer above their blades with much higher pH levels than in the surrounding seawater.

"With the increasing risk of ocean acidification, small calcifying organisms such as bryozoans, tube-forming worms, small molluscs or crustaceans living on the blades might be able to better cope with this phenomenon", says Dr. Fanny Noisette from the University of Tasmania.

Bryozoans and tube-forming worms are filter-feeding organisms, contributing to the control of planktonic populations. Moreover, they can form colonies on a variety of different surfaces, from rocks to sandy sediments to the hulls of ships providing hard habitats and shelter for juveniles of other species.

These and other calcifying organisms are especially vulnerable to ocean acidification as it prevents them from forming and/or repairing their shells or skeletons. Kelp blades may be able to provide a temporal relief from these corrosive and harmful conditions.

Noisette adds: "Some invertebrates are very small in their early life stages and could also find shelter in these microenvironments shaped by kelps. Larvae, for example, are usually not able to regulate their internal pH and are more sensitive to decrease in seawater pH. By settling on the blades in their early stages of development, they might be able to temporary alleviate stress or train for the harsher conditions that await them in the open ocean."

Associate Professor Catriona Hurd, also with the university, said the study adds to growing evidence that seaweed communities could mitigate the negative effects of ocean acidification and help coastal ecosystems adapt to global changes.

"Seaweeds not only influence the pH at the microscale as described in this study, they may also help larger animals including clams, oysters and crabs to overcome the effects of ocean acidification. It is now well known that the pH below seaweed canopy is generally different from the surrounding water", concludes Hurd.

Fanny Noisette and Catriona Hurd (2018) 'Abiotic and biotic interactions in the diffusive boundary layer of kelp blades create potential refuge from ocean acidification' is published in *Functional Ecology* on 21 March 2018.

More information: Noisette F, Hurd C. Abiotic and biotic interactions in the diffusive boundary layer of kelp blades create a potential refuge from ocean acidification. Funct Ecol. 2018;00:1–14. doi.org/10.1111/1365-2435.13067