Jessica Ericson

Institute for Marine and Antarctic Studies, Australia

Antarctic krill: Life is all about balance in a high CO2 world

Jessica Ericson [1,2,3], Nicole Hellessey [1,2,3], So Kawaguchi [2,4], Peter Nichols [1,3], Stephen Nicol [1], Nils Hoem [5], Patti Virtue [1,2,3]

[1] Institute of Marine and Antarctic Studies, University of Tasmania, Hobart, Australia; [2] Antarctic Climate & Ecosystems Cooperative Research Centre, Hobart, Australia; [3] CSIRO Oceans and Atmosphere, Hobart, Australia; [4] Australian Antarctic Division, Kingston, Australia; [5] Aker Biomarine, Norway

Ocean acidification is caused by sequestration of atmospheric CO2 into ocean surface waters, which increases ocean pCO2 and decreases ocean pH. Present day levels of atmospheric CO2 have reached 400 ppm, and are predicted to rise to 2000 ppm by the year 2300, equating to a decrease in ocean pH of up to 0.7 pH units.

Antarctic krill were reared for 11 months in a flow-through seawater system under five pCO2 levels (400, 1000, 1500, 2000 and 4000 ppm). We examined the effects of increased seawater pCO2 on the lipid and fatty acid composition, respiration rate, growth, mortality, intermoult period, haemolymph pH and maturity of adult krill.

Haemolymph pH decreased with increasing seawater pCO2 but it appears that krill were compensating for this decrease, possibly through the transport of bicarbonate ions into their extracellular space. Seawater pCO2 had no effect on the respiration rate and intermoult period of krill. Ovary maturation was delayed in female krill exposed to 4000 ppm pCO2, and subtle differences were also observed in the fatty acid composition at 4000 ppm.

Our research suggests that the adult life stages of krill have the capacity to tolerate levels of near-future acidification, when elevated pCO2 is assessed as a single stressor. However, the energetic costs of maintaining physiological acid-base balance over the long term are unknown, and previous studies have shown that krill embryos may be vulnerable to pCO2 levels predicted for the year 2100 and beyond.