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Effects of ocean acidification and temperature rise on shell growth of Serripes groenlandicus

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The combined trends of ocean warming and acidification are expected to have significant effects on benthic calcifying invertebrates with serious consequences for community structure and marine ecosystem functioning. As atmospheric CO_2 equilibrates with the surface ocean, cold oceans display the highest CO_2 solubility and thus, the strongest decrease in seawater pH. Additionally, polar regions will be the first to experience an undersaturation of surface seawaters with respect to aragonite, a calcium ion cluster used by marine molluscs to build their shells.

From the first such study in an Arctic bivalve we report CO_2 and temperature effects on acid-base regulation and shell growth performance of the circumpolar Greenland Smoothcockle *Serripes groenlandicus* from an Arctic fjord in Svalbard (79°N, 12°E). Adult *S. groenlandicus* were incubated for nine weeks at three and four different CO_2 levels (control, 750, 1120 and 3000 ppm), respectively, and three different temperatures (1, 4 and 7°C). Acid-base status was analysed in intra- and extracellular compartments. Shell growth and morphology were monitored by combined light and fluorescent microscopy. Under control CO_2 treatments, shell growth was positively correlated with temperature, but this temperature effect was compensated for by a slightly negative effect of elevated CO_2 in all treatments. Finally, shell growth and shell morphology resulted significantly different under 3000 ppm CO_2. In conclusion, *S. groenlandicus* is likely to be susceptible to elevated CO_2 levels owing to the CO_2 induced uncompensated extracellular acidosis, which parallels the observed disturbance of shell growth.