

The perils of reduced pH on sea urchin development

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Havenhand JN, Buttler F-R., Thorndyke MC, Williamson JE. 2008. Near-future levels of ocean acidification reduce fertilization success in a sea urchin. *Current Biol.* 18: R651-R652.

Anthropogenic increases in atmospheric carbon dioxide levels will lower the pH of the ocean in the coming years, gravely threatening the survival of many marine species. Previous studies have confirmed that ocean acidification impacts the adult stages of many calcifying organisms. However, there has been little study of the possible effects of ocean acidification on the more sensitive early development of important marine species. It is essential to determine the consequences of decreased pH on early life stages, as the survival of specific marine species, and of entire ecosystems, cannot be predicted without more information. This study considers the effects of decreased pH level on fertilization and development of the sea urchin *Heliocidarias erythrogramma*. Specifically, the authors determined the impact of reduced pH on aspects of sperm motility, fertilization success, and larval development success. The low pH (7.7) studied is expected to occur by 2100.

The authors exposed the gametes of sea urchins to seawater at two pH levels, a control pH of 8.1 and an acidified pH of 7.7, and looked at effects on sperm motility and developmental success over the next 24 h. Ocean acidification reduced fertilization success in the sea urchin *H. erythrogramma*, largely by reducing swimming speed. The sperm not only swam nearly 12% more slowly at the more acidic pH, but the percentage of sperm that swam at all (“sperm motility”) decreased by at least 16% (Fig. 1). Correspondingly, the percentage of sea urchin eggs that developed into cleaving embryos over the next 3 h dropped by about 20% in the acidic condition compared to the control condition, and there was an even greater impact on the proportion of swimming larvae seen after 24 h, which declined by more than 25% (Fig. 1). Overall, the study suggests that the acidification of seawater to levels predicted for 2100 will dramatically decrease fertilization success and impact subsequent development for eggs that are fertilized.

This study shows that it's not just calcifying organisms that are going to be affected by declining pH in the ocean. Without embryos and larvae, there will be no adults! Future studies

should consider the effects of reduced pH on the fertilization success of commercially important species, such as oysters and mussels, and consider how these changes will alter the structure of marine ecosystems.

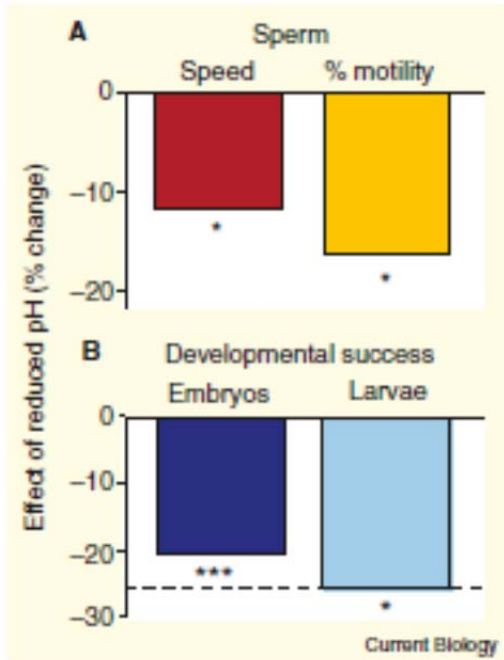


Fig. 1. Influence of reduced seawater pH (by 0.4 pH units) on sperm motility and fertilization success in the sea urchin *Heliocidaris erythrogramma*. Sperm speed was measured in mm sec^{-1} and sperm motility is the percentage of sperm showing activity. Developmental success was determined as % of embryos that were cleaving by 3 h, and the percentage that had become swimming larvae by 24 h.