# More acidic ocean could spell trouble for marine life's earliest stages

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Increasingly acidic conditions in the ocean—brought on as a direct result of rising carbon dioxide levels in the atmosphere—could spell trouble for the earliest stages of marine life, according to a new report in the August 5th issue of *Current Biology*, a publication of Cell Press. Levels of acidification predicted by the year 2100 could slash the fertilization success of sea urchins by an estimated 25 percent, the study shows.

" If other marine species respond similarly—and there's no evidence yet that they don't—then we're in trouble," said Jon Havenhand of the University of Gothenburg in Sweden. "The analogies are quite simple: we observed a 25 percent reduction in fertilization success at reduced pH, which is equivalent to a 25 percent reduction in the spawning stock of the species. Apply equivalent changes to other commercially or ecologically important species, such as lobsters, crabs, abalone, clams, mussels, or even fish, and the consequences would be far-reaching. It could be enough to "tip" an ecosystem from one state to another."

However, he emphasized, more data about the response of growing acidic conditions on more species is needed before any such extrapolation can be made.

Widely cited estimates show that the average level of acidity in the oceans has risen by about 25 percent in the last 150 years, since the advent of fossil fuel burning, Havenhand explained. The most recent data show that levels of ocean acidification predicted for the end of this century—about a three-fold increase over current levels—have already

been measured in some coastal waters.

More acidic surface waters eventually will sink to the bottom of the ocean, but it's a process that takes some 1,000 to 1,200 years. That long-term overturning circulation of the ocean has accommodated much higher atmospheric carbon dioxide levels in the past without resulting in the pH changes seen today. "The current problem is being caused by the rate of increase of carbon dioxide in the atmosphere, not the absolute level," Havenhand said. "To put it simply, the carbon dioxide is rising too quickly for the ocean's natural buffering system to catch up."

Earlier studies had primarily focused on the responses of adult stages of calcifying taxa including mollusks and corals to gross pH changes more relevant for the years 2200 to 2400. There had been scant evidence for the effects of ocean acidification on the very earliest life-stages (including fertilization) in marine animals, with most previous work examining pH changes far greater than those now tested.

They show that the upper limit of acidity levels predicted in the coming century—which have already been measured in some locations on the US West Coast—significantly reduce the swimming speed and motility of sperm from the sea urchin, Heliocidaris erythrogramma, leading to a 25 percent reduction in their fertilization success.

" We need to begin to respond globally to counteract the coming impacts of ocean acidification, an effort requiring at least as much global participation as current efforts to stem carbon dioxide emissions," Havenhand said. "I really hope I'm wrong about the broader implications of our work. However, the available evidence points to the conclusion that at present acidification is the biggest threat to the long-term viability of our ocean ecosystems and especially to key invertebrate species that maintain many of the marine ecosystems on which we rely for food, protection, and recreation."

Source: Cell Press