Climate change threat to mussels' shells

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Perna viridis mussels. Credit: Wikipedia

The world's mussel population could be under threat as climate change causes oceans to become increasingly acidic, scientists have discovered.

In a new paper published today (Wednesday 24 December) in the Royal Society's journal *Interface*, researchers from the University of Glasgow describe how mussels' shells become more brittle when they are formed in more acidic water.

The world's oceans are becoming increasingly acidic as they absorb some of the atmospheric carbon dioxide which contributes to climate change. The water reacts with the carbon dioxide to form carbonic acid, which is gradually lowering the pH of the oceans. Scientists expect the pH of the world's oceans to have dropped from 8 today to 7.7 by the end of the 21st century.

Mussels' shells are composites of calcium carbonate and organic material created by the mussels through a process known as biomineralisation. Mussels draw bicarbonate ions from seawater and use proteins in their bodies to make crystals of calcium carbonate to form their two-layer shells. The shell's outer later is composed of calcite and the inner layer is made of aragonite. In more acidic water, there are less bicarbonate ions available for the mussels to make their shells.

The research team, led by Dr Susan Fitzer of the University's School of Geographical and Earth Sciences, housed common blue mussels in laboratory tanks. The researchers controlled and altered the temperature and pH levels of the water in the tanks to simulate four different types of ocean waters at levels of acidity projected to occur in the coming decades. Ocean conditions were also simulated as closely as possible by changing light levels over time to mimic the changing of the seasons.

Dr Fitzer said: "What we've found in the lab is that increased levels of acidification in their habitats have a negative impact on mussels' ability to create their shells.

"We worked with colleagues in our School of Engineering to examine the toughness of the shells of the mussels in the more acidic water against those in control conditions. What we found was that the calcite outer shells of the mussels past a certain threshold of acidity was stiffer and harder, making it more brittle and prone to fracture under pressure, and the aragonite inner shell became softer.

"This could mean that mussels growing in the wild in the future could be more vulnerable to attack from predators, as well as from the effect of ocean forces. As blue mussels are commonly used for human consumption, it could also have an effect on the yields of mussels available for the fishing industry.

"However, we also found that the effect on the mussels' shells was reduced when the temperature of the water was increased by 2°C. This might suggest that the mussels are reverting to ancestral evolutionary mechanisms to mitigate the effects of increased acidity.

"We're planning to continue our research in this area in the future and expand its scope to look at the effects of more acidic water on the shells of other marine organisms including oysters and abalone."

The paper, titled 'Ocean acidification alters the material properties of Mytilus edulis shells', is published in the *Journal of the Royal Society Interface*.

More information: *Journal of the Royal Society Interface*, rsif.royalsocietypublishing.or … .1098/rsif.2014.1227

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