

STUDENT SHEET 5b

Arctic study shows key marine food web species at risk from increasing CO₂

A research expedition to the Arctic, as part of the Catlin Arctic Survey, has revealed that tiny crustaceans, known as copepods, that live just beneath the ocean surface are likely to battle for survival if ocean acidity continues to rise.

The study found that copepods that move large distances, migrating vertically across a wide range of pH conditions, have a better chance of surviving.

The increasing level of carbon dioxide in our atmosphere is changing ocean chemistry leading to seawater moving down the pH scale towards acidity. Some areas of the Arctic Ocean are already experiencing the fastest rates of acidification on the planet and, combined with sea-ice loss and warming temperatures, the impacts of climate change are likely to hit Arctic marine life first.

The study is published in the journal Proceedings of the National Academy of Sciences (PNAS) and was carried out by the University of Exeter and the Plymouth Marine Laboratory. The scientists observed that the natural range of temperature and acidity under the ice that copepods experience on a day-to-day basis corresponded to their responses to the ocean acidification conditions predicted for 100 years' time.

Dr Ceri Lewis (http://biosciences.exeter.ac.uk/staff/index.php?web_id=ceri_lewis) from Biosciences (at the University of Exeter) said: "Our study found that some marine animals may not be able to survive the impact of ocean acidification, particularly the early-life stages. This unique insight into how marine life will respond to future changes in the oceans has implications that reach far beyond the Arctic regions."

Found across the globe, copepods are one of the most abundant marine animals and are a vital food source for a wide variety of other marine life. Copepods can also act as bio-indicators, providing an early warning system for the health of the environment.

Until recently, it has been difficult to document what copepods and other marine life do when the Arctic Ocean is covered by sea ice, and more specifically what conditions they experience. The researchers, working alongside polar explorers as part of the Catlin Arctic Survey, camped in winter conditions on the Arctic ice at temperatures of -40 C, risking frost bitten fingers, in order to collect this novel data.

Dr Helen Findlay from Plymouth Marine Laboratory said: "Our



work has shown that life experience matters when it comes to surviving stressors. More studies are needed that link the natural environmental conditions to laboratory experiments. Ceri and I are planning to continue this line of work through a PhD student-ship next year."

An estimated 30% of carbon dioxide released by humans into the atmosphere dissolves into oceans. With carbon emissions set to increase, the world's oceans are likely to suffer from increased acidification in the coming years. This study reveals how these changes are likely to impact globally important species like copepods.

The study demonstrates that organisms with a limited natural habitat range are likely to suffer the most under changing climatic and oceanic conditions. Organisms with a wide natural range are likely to cope better.

Future studies will consider whether the type of habitat can be used to predict the vulnerability of different species to climate change.

The Channel 4 science correspondent, Tom Clarke, travelled with the team to the Canadian Arctic. View the Channel 4 piece at <http://www.channel4.com/news/acid-arctic-what-the-ocean-tells-us-about-climate-change>.

For further information about Exeter's collaborative work with PML see <http://www.exeter.ac.uk/research/inspiring/partners/pml/>.