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Sea snails & prawns on front line of ocean acidification

Many shell-dwelling sea creatures are likely to be among the first to suffer as rising carbon dioxide (CO2) levels acidify our oceans, and it could put shellfish-loving humans at risk too.

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Oceans absorb about a third of the carbon dioxide we pump into the atmosphere each year, and the resulting acidification could change marine life forever.

‘As a result of the the uptake of atmospheric CO2 by the oceans, there is an increase in hydrogen ions which reduce the pH of the water, hence the term ocean acidification,’ said Dr Pippa Moore at Aberystwyth University, UK.

‘Some species will be winners and others will be losers,’ said Dr Moore, who is the coordinator of GLOBEF, an EU-funded project exploring the impacts of global environmental change on marine life.

Despite growing evidence that ocean acidification directly affects biodiversity, there wasn’t much research done about how it affects the interaction between different species before this project.

GLOBEF used volcanic vents off the coast of Isola Vulcano in Sicily as a type of natural laboratory. These vents emit CO2 and provide different degrees of ocean acidification the further you move away from them. Researchers use these as models to predict what our oceans may look like in the future.

GLOBEF investigated the effects of ocean acidification on the gastropod *Hexaplex trunculus*, a common Mediterranean sea snail.

> Sea snails are one of the animals affected as oceans become more acidic due to increased CO2 emissions. Image cr
> Sea snails are one of the animals affected as oceans become more acidic due to increased CO2 emissions. Image credit: Creative Commons/ H. Krisp

‘We saw molluscs that had thinner shells or ones that weren’t as developed,’ said Dr Moore. ‘The sex ratio was also skewed, with fewer females in the population, which was cascading down through the population and causing a reduction in individuals.’

Some species were completely absent near the vents, suggesting that they will have problems if ocean acidification continues.

‘What you see is that some species are missing,’ said Dr Moore. ‘You find echinoderms (star fish, sea urchins, etc.) a few hundred metres away where there is natural pH.’

One species that could be considered a winner from ocean acidification is algae. They could use the carbon dioxide-rich water during photosynthesis, which would mean they need less energy for growth, reproduction and defence.

But when one species adapts like this, a knock-on effect could be experienced throughout a marine ecosystem.

‘Research is showing there are changes in the interactions between marine life, with predator-prey and plant-herbivore interactions changing in response to ocean acidification,’ said Dr Moore.

Weakened crustaceans

Ocean acidification can also weaken the immune systems of crustaceans such as *Nephrops norvegicus*, also known as the Norway lobster or Dublin Bay prawn, which could have a profound effect on its survival.

‘As ocean acidification proceeds, it may force the health of the ecologically and economically important *N. norvegicus* to a tipping point,’ said Dr Anna-Sara Krång, project leader of CruCSChange, an EU-funded project aimed at understanding the combined impacts of climate change on marine organisms, such as the effect of ocean acidification and pollution on crustaceans.

‘While reduction of pathogens in lobsters was clearly affected by these stressors, we found no notable effects on growth, survival or hemolytic (red blood cell destroying) properties of the bacteria itself. Thus, we conclude that this predicted stress scenario is beneficial for the pathogen in its interaction with the host,’ said Dr Krång, who is based at the University of Gothenburg in Sweden.

‘This could impact lobster condition and biomass and may as well increase the risk for bacterial transmission to consumers.’

Left unchecked, implications from ocean acidification could also move up the food web while affecting global fish stocks and the industries that rely upon them.

‘Several crustaceans form the basis of valuable fisheries, like the Norway lobster, which is one of the commercially most important fishery species in Europe, providing around EUR 200 million each year,’ said Dr Krång. ‘Future deteriorating conditions for this and other valuable fishery species could have significant economic consequences to the fisheries sector.’

Ocean acidification

In the past, oceans have been able to keep the marine CO2 and pH value at a fairly stable level, but human-induced CO2 emissions have altered the ocean carbon cycle at a fast pace.

The increase of man-made CO2 emissions are leading to significant acidification at the ocean surface, as well as at intermediate and deep levels, according to research by the EU-funded CARBOCHANGE project.

‘In order to keep both the global warming and ocean acidification at bay in parallel, we must reduce CO2 emissions more strongly than to meet only global warming targets,’ said CARBOCHANGE project leader Christophe Heinze.

For more information www.carbochange.eu

> CO2 emissions are absorbed by the oceans which causes them to acidify. Image courtesy of CARBOCHANGE
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