Fish learn to cope in a high CO2 world

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Some coral reef fish may be better prepared to cope with rising CO_2 in the world's oceans – thanks to their parents.

Researchers at the ARC Centre of Excellence for Coral Reef Studies (CoECRS) today reported in the journal *Nature Climate Change*, encouraging new findings that some fish may be less vulnerable to high CO_2 and an acidifying ocean than previously feared.

"There has been a lot of concern around the world about recent findings that baby fish are highly vulnerable to small increases in acidity, as more CO_2 released by human activities dissolves into the oceans," says Dr Gabi Miller of CoECRS and James Cook University.

"Our work with anemone fish shows that their babies, at least, can adjust to the changes we expect to occur in the oceans by 2100, provided their parents are also raised in more acidic water."

"Human activity is expected to increase the acidity of the world's oceans by 0.3 to 0.4 pH by the end of this century, on our present trends in CO_2 emissions," co-researcher Prof Philip Munday says.

"Previous studies, and our own research, have shown that growth and survival of juvenile fish can be seriously affected when the baby fish are exposed to these sorts of CO_2 and pH levels," he says.

"However when we exposed both parents and their offspring in more acidic water we found that the anemone fish, at least, were able to

compensate for the change" says Dr Miller. Whether this effect lasts all their lives, remains to be seen." she adds.

How parent fish actually pass on this ability to deal with acidity to their offspring is still a mystery, says Prof Munday. "The time interval is too short for it to be genetic adaptation in the normal sense. However, it's an important parental effect that we need to factor in as we assess the vulnerability of the world's fish stocks to the planet-wide changes in ocean chemistry that humans are now causing."

Based on evidence from past major extinction events, scientists have long feared that the acidity caused by the release of high levels of CO_2 could cause havoc among sea-life, especially those which depend on calcium to form their bones and shells. New research has also shown that higher CO_2 levels can cause the nervous systems of some marine species to malfunction.

The recent increase in ocean acidity due to human activity in releasing carbon – about 0.1 of a pH unit over the last half century – is thought to be steeper even than in any of the past major extinctions, which eliminated between 70-90 per cent of marine species.

"What this research shows is that some species, at least, may have more capacity to cope than we thought – which could help buy time for humanity to bring its CO_2 emission under control," Prof Munday says.

However Dr Miller cautions that anemone fish are particularly hardy by nature, and may not be typical of all fish in the ocean. "They are definitely not the 'canary in the coal mine', as they have quite a large ability to cope with changed conditions anyway," she says. "We need to extend these studies to other types of fish, especially those which humans rely on for food."

Both scientists warn that the major impact on ocean acidification is likely to be on the corals themselves, and the reefs which they form, which in turn provide the habitat for small fish such as the anemone fish. The fate of the world's reefs under a high human CO_2 regime remains highly uncertain, they caution.

Their paper 'Parental environment mediates impacts of elevated CO_2 on a coral reef fish' by Gabrielle M. Miller, Sue-Ann Watson, Jennifer M. Donelson, Mark I. McCormick and Philip L. Munday appears in the online issue of the journal *Nature Climate Change*.

The team will present a paper on their work to the 12th International Coral Reef Symposium, Cairns, Australia on July 13, 2012.

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