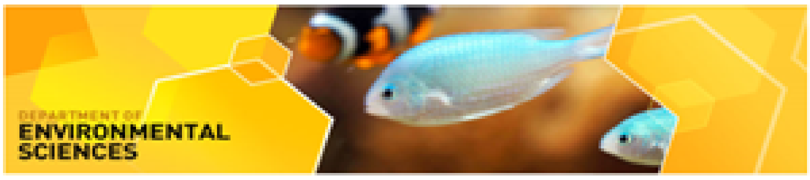

UNIVERSITY OF TECHNOLOGY SYDNEY

UTS MARINE BIOLOGY FACT SHEET

Topic: Ocean Acidification

Background:

Prior to the Industrial Revolutionof the late 1770s atmospheric CO_2 levels were around 280 ppm and scientists believe that the absorption and release of CO_2 by the oceans was in equilibrium. When CO_2 disssolves in seawater carbonic acid is formed; increasing atmospheric CO_2 (around 387 ppm today) means the oceans absorb more of this greenhouse gas which changes seawater chemistry resulting in a decrease in ocean surface pH or acidification. The biological impact of these changes are likely to be complex.

Fast facts:

- It's estimated that 30% of CO_2 from man made sources has been absorbed by the oceans, representing 1/3 of the storage capacity of the ocean surface.

- Plants and animals which produce calcium carbonate skeletons are known as **marine calcifiers** and include coralline algae, molluscs, many corals and crustaceans.

- Ocean acidification leads to a reduction in the abundance of **carbonate ions** in seawater which are essential for the formation of skeletons. This is expected to limit the growth and survival of calcifying organisms because they won't be able to form skeletons, making them more vulnerable to predators.

- Only a very tiny change in pH of sea water, (eg from pH 8.1 to pH 7.9) can lead to weakening and dissolving of calcified shells or outer parts of marine creatures.

- It is predicted some **non-calcifying primary producers** will be favoured by the increased availability of dissolved carbon dioxide - a building block for the formation of chemical energy through photosynthesis – and this will impact on marine biodiversity

- Calcite is the dominant form of calcium carbonate but coral skeletons are made of aragonite, which is more soluble. Aragonite saturation levels in tropical seawater are falling – from 4.6 to 4.0 over the last century – which means less is available for coral formation processes and, by 2080, if this rate continues, few areas of the pacific will have sufficient aragonite saturation to support coral growth.

Believe it or not?

Coccolithophores are tiny alga with calcified structures. Usually when they die they sink to the ocean floor and the CO_2 stored in their skeletons - through process of photosynthesis - gets locked up or sequestered. The White Cliffs of Dover in England, formed over millions of years, are testimony to this practice. However ocean acidification will weaken calcified structures, dissolving them, which will release more CO_2 into the oceans.

UTS:SCIENCE

Learn more: **Links/References**

1. J.E.N Vernon et al (2009) The coral reef crisis: the critical importance of <350 ppm CO_2. **Marine Pollution Bulletin** 58: 1428-1436

2. **Hobday AJ, Okey TA, Poloczanska ES, Kunz TJ, Richardson AJ (2006) Report to the Australian Greenhouse Office. Canberra, Australia.**

Web

Marine Climate Change Report Card CSIRO Dec 2009
European Project on Ocean acidification
Oysters and Urchins: Early Warning Agents SMH 2010
Reef Team Tries a Little Time travel to assess acid damage The Age 2010
Underwater lab first to chart climate change on reefs The Age 2010

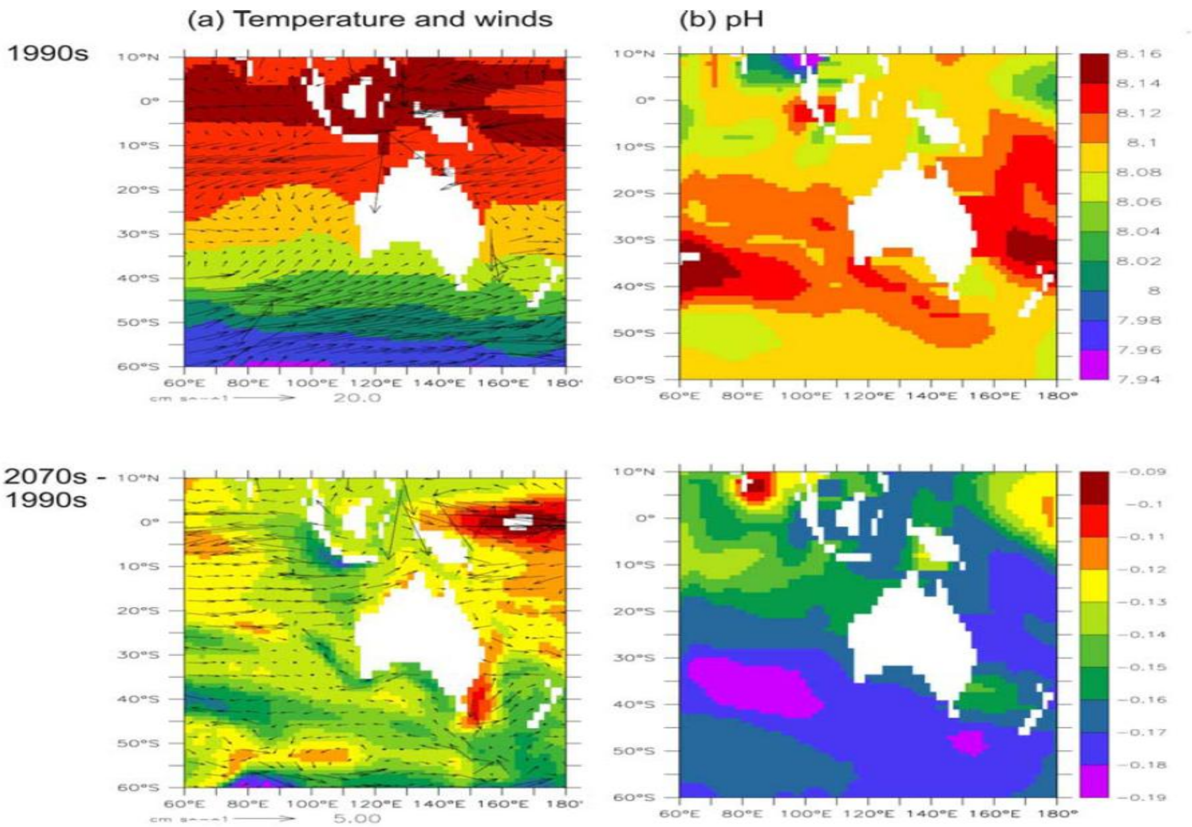

Figure 3-1: (a) Average Sea Surface Temperature and winds (°C) for the 1990s and the change in SST and winds between the 2070s and 1990s, and (b) Average pH for the 1990s and the change in pH between the 2070s and 1990s.

Above graphs (right) are extracted from Hobday et al (2006) to show projected changes in pH from 1990s to 2070s