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House of Representatives Standing Committee on Climate Change, Environment and the Arts
Inquiry into Australia's biodiversity in a changing climate

Question on Notice – Thursday, 16 August 2012

Hansard:

Mr JENKINS: I would like to turn now to ocean acidity. Is there a direct correlation to temperature?

Dr James: I do not know the chemistry well enough to answer that question. It is complex chemistry. I will not go there because I just do not know the chemistry well enough.

Dr Sheppard: We can take that on notice.

Mr JENKINS: I am interested in the dynamic nature. Given that you distracted me looking up what Gaia was I have been thinking about these things. It made me think that it is not simply that you plot it through here and it is 'Oh, yes, it has stayed long enough for us to study'. There is so much colour and movement going on, and that must mean that different bands of acidity are swirling around as well.

Dr James: Once again, it is not absolutely uniform across the globe. There are patches that are more acidic and patches that are less acidic. How that relates to the water temperature, the air temperature and the CO2 in the air is too complex for me to give an answer.

Mr JENKINS: That is fine.

CSIRO Response:

With respect to ocean acidity, there is not a direct correlation between temperature and acidification. Increasing atmospheric carbon dioxide (CO_2) and increasing surface water temperature will both cause an increase in the surface ocean acidity level (lower pH), however the temperature effect on ocean acidity is small compared to the effect of increased atmospheric CO_2.

This can be illustrated by calculating the size of the changes in ocean acidity with respect to changes in temperature and atmospheric CO_2 according to well established chemical principles, as shown in the following calculations:

Since preindustrial times, atmospheric CO_2 concentrations have increased from about 280 parts per million to current values of about 385 parts per million, as determined from measurements in the atmosphere and ice cores. Assuming that the average change in surface water temperature since preindustrial times is a 1°C increase, the calculated changes in the pH of surface waters which are in equilibrium with atmospheric CO_2 are:

(1) pH Preindustrial (280ppm atm CO_2): 8.175
(2) pH Present day (385ppm atm CO_2): 8.063
(3) pH Present day (385ppm) + 1°C warming: 8.048

Calculations (2) and (3) show that the 1°C warming causes a 0.015 decrease in pH, while calculations (1) and (2) show that increasing CO_2 alone causes a much larger decrease of 0.112 in pH (i.e. increased acidity). Taken together, these results show that the change in pH due to the change in CO_2 is much larger than the temperature related change.

The above calculations also assume the following seawater conditions which are commonly observed:
salinity: 35
initial temperature: 20°C
seawater alkalinity: 2,300 micromol/kg