

July 20, 2004

Carbon Dioxide Extends Its Harmful Reach to Oceans

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Emissions of carbon dioxide, the main culprit linked to a warming climate, also pose potential risks to the oceans, new research suggests.

The oceans have absorbed vast amounts of carbon dioxide released in the industrial age and have measurably changed, chemically and ecologically, as a result.

In water, carbon dioxide forms carbonic acid. The buildup of the gas, mainly in the shallow layers of the oceans so far, is reducing the natural alkalinity of seawater, new studies show. In tank tests, such conditions can interfere with the reef-building ability of corals and shell production in some mollusks and tiny plankton.

The most important new research on the marine impact of carbon dioxide is described in two papers in the current issue of Science.

One study, analyzing 72,000 seawater measurements, found that the oceans absorbed about 476 billion tons of carbon dioxide from 1800 to 1994, or nearly half the total amount released in that span by worldwide burning of coal, oil and other fossil fuels, and cement production.

The second paper concluded that the gas is causing changes in water chemistry that could expose corals, mollusks and drifting plankton to conditions that dissolve calcium carbonate, the building block of reefs and shells.

This paper said that if concentrations of carbon dioxide in the atmosphere and shallow ocean layers rise as projected over the century, "the delicate balance of marine planktonic species could undergo significant shifts" with unknown repercussions.

The authors said they have already measured a substantial expansion of layers in the seas in which conditions have shifted from those that foster shell and coral growth to those that cause such materials to dissolve.

The studies are the culmination of five years of analysis of data collected through the 1990's by several world-spanning oceanographic surveys. The lead authors on both papers were Dr. Christopher L. Sabine and Dr. Richard A. Feely, oceanographers at the National Oceanic and Atmospheric Administration's Pacific Marine Environmental Laboratory in Seattle.

Dr. Sabine said the carbon dioxide measurements confirmed that the oceans have been "performing a tremendous service for humankind" by sopping up so much of the gas and thus slowing its accumulation in the atmosphere. But he and Dr. Feely said this service appeared to be coming with an unanticipated cost: potentially profound impacts on ocean chemistry and biology.

Several experts not involved with the new studies said they showed the remarkably broad influence of carbon dioxide emissions.