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Acid Ocean Meets Clean Water

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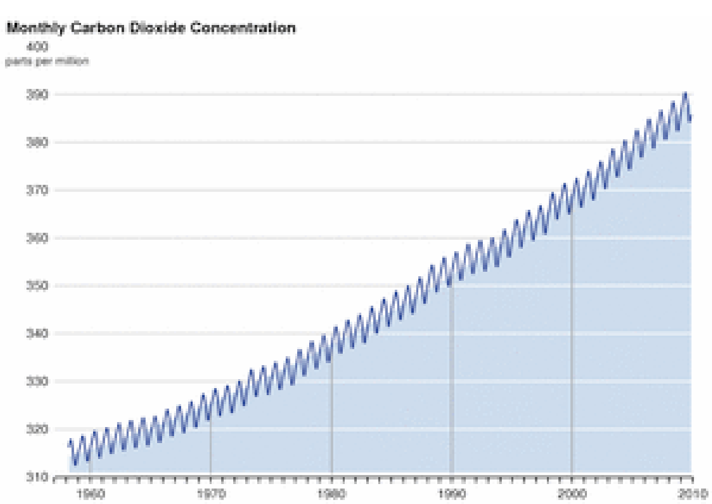
The Environmental Protection Agency (EPA) has already announced its readiness and willingness to use the Clean Air Act to regulate greenhouse gas emissions. Now comes word that it is at least considering using the Clean Water Act to do the same.

It doesn't follow that either will actually be used to limit the emission of carbon dioxide and other greenhouse gases; legislation is pending in House and Senate that seek to address that very issue, and more precise instrument is clearly preferable to a blunt one. But the Clean Air Act decision followed a 2007 Supreme Court finding that carbon dioxide is a pollutant; and when the EPA published a federal register in March seeking public comment on the use of the Clean Water Act, it did so following a suit brought by the Center for Biological Diversity.

Whereas greenhouse gas emissions are most often associated with climate change, the CBD suit sought to address the role of CO2 in what is known as ocean acidification.

Now, whatever you might choose to believe about the role of carbon dioxide in affecting, or not affecting, Earth's climate, the fact of the matter is that concentrations of atmospheric CO2 are rising. Witness, by way of graphic illustration, yon Keeling Curve:



Approximately one-third of the carbon dioxide that is emitted is absorbed by the ocean. According to a 2009 study in the journal Nature, in 2008 the global ocean absorbed approximately 2.3 billion tons of carbon dioxide, and today contains approximately 150 billion tons of carbon, one third more than in 1990.

That's yay for us, because the more CO2 the ocean absorbs, the less reaches the atmosphere (although there are signs that the rate at which the ocean is able to absorb that CO2 is slowing down as the seas warm). And some ocean life might benefit from a little extra carbon dioxide: some cyanobacteria, for example, may undergo enhanced photosynthesis.

But as the ocean absorbs more CO2, it becomes slightly more acidic: the pH of ocean surface waters has decreased by about 0.1 since the industrial age began, and under current emission scenarios is predicted to decrease an additional 0.3 or so by the end of the century, from a pre-industrial level of 8.2 to 7.8. (Recourse to high school chemistry textbooks shows that the ocean isn't actually acid under this scenario, simply more acidic - or, if you like, less basic).

Why might this matter? The primary concern of many researchers is that a decrease in ocean pH results in a decline in the availability of carbonate ions, which are vital component of the calcium carbonate shells and skeletons of a variety of marine species, including corals, urchins, oysters, clams and mussels. In a low-carbonate ocean, such animals experience greater difficulty in forming their skeletons and shells, and those structures are likely also to prove thinner, less robust and ultimately vulnerable to dissolution.

This study, for example, found that pteropod shells began to dissolve in seawater with a pH equivalent to the level predicted for the end of the century, and numerous other studies have found similar results with other calcifying organisms. Other predicted and observed impacts on organisms include a reduction in the dissolved iron that is vital for marine phytoplankton, and even fish larvae no longer being able to “smell” predators.

There are still many uncertainties about the biological and physical impacts of ocean acidification, and even some studies in which some calcifying organisms appear to buck the trend of the majority.

But as this article, which quotes Richard Feely of the National Oceanic and Atmospheric Administration, makes clear, the potential ramifications are considerable:

> Feely said the oceans’ acidity levels were higher than they’d been at any time in the past 20 million years. Based on “pretty good” evidence, Feely said, previous high acid levels in the oceans have caused mass extinctions of marine plants and animals, which can take 2 million to 10 million years to re-evolve. “The decisions we make now, over the next 50 years, will be felt over hundreds of thousands of years,” he said.