Ocean Acidification Stations

Full Length Article Online:

http://ocean.si.edu/ocean-acidification

Black Station: History

- Ocean acidification is sometimes called “climate change’s equally evil twin,” and for good reason: it's a significant and harmful consequence of excess carbon dioxide in the atmosphere that we don't see or feel because its effects are happening underwater. At least one-quarter of the carbon dioxide (CO_2) released by burning coal, oil and gas doesn't stay in the air, but instead dissolves into the ocean. Since the beginning of the industrial era, the ocean has absorbed some 525 billion tons of CO_2 from the atmosphere, presently around 22 million tons per day.

- At first, scientists thought that this might be a good thing because it leaves less carbon dioxide in the air to warm the planet. But in the past decade, they’ve realized that this slowed warming has come at the cost of changing the ocean’s chemistry. When carbon dioxide dissolves in seawater, the water becomes more acidic and the ocean’s pH (a measure of how acidic or basic the ocean is) drops. Even though the ocean is immense, enough carbon dioxide can have a major impact. In the past 200 years alone, ocean water has become 30 percent more acidic—faster than any known change in ocean chemistry in the last 50 million years.

- So far, ocean pH has dropped from 8.2 to 8.1 since the industrial revolution, and is expected by fall another 0.3 to 0.4 pH units by the end of the century. A drop in pH of 0.1 might not seem like a lot, but the pH scale, like the Richter scale for measuring earthquakes, is logarithmic. For example, pH 4 is ten times more acidic than pH 5 and 100 times (10 times 10) more acidic than pH 6. If we continue to add carbon dioxide at current rates, seawater pH may drop another 120 percent by the end of this century, to 7.8 or 7.7, creating an ocean more acidic than any seen for the past 20 million years or more.

Red Station: Possible Solutions

Experts create first legal roadmap to tackle ocean acidification 'hotspots'

Stanford Report, May 26, 2011

Ocean acidification, a problem usually associated with global greenhouse gas emissions, is also caused by coastal pollution and other local sources that can be managed under existing laws.

In a report published in the May 27 edition of the journal *Science*, a team of marine scientists and legal experts provided the first roadmap for local communities to combat ocean acidification by applying federal and state laws and policies – from the U.S. Clean Water Act to municipal zoning regulations. "Coastal communities don't need to wait for a global solution to fix a local problem that is compromising their marine environment," said co-author Meg Caldwell.

Harmful impacts

Studies point to carbon dioxide emissions as the primary reason why the ocean has become more acidic in recent decades. But]freshwater inputs, pollutants and soil erosion can acidify coastal waters at substantially higher rates than atmospheric CO_2 alone.

Seawater acidification reduces the ability of marine creatures to create shells and skeletons, harming everything from commercial oyster beds to coral reefs, the authors said. They cited Puget Sound, Chesapeake Bay and other coastal regions where livelihoods and lifestyles have been damaged by acidic "hotspots" – patches of ocean water with significantly depressed pH levels. The lower the pH, the more acidic the water.

"Since an acidification hotspot can negatively impact a community, its causes need to be tackled quickly," said co-lead author Melissa Foley. "We identified practical steps communities can take today to counter local sources of acidity."

Solutions

To address the problem in the United States, the researchers recommended that coastal communities first turn to the federal Clean Water Act, which directs state governments "to ensure that precipitation runoff and associated pollutants [which can increase acidification] are monitored, limited and consistent with the sustainable functioning of aquatic ecosystems."

To comply with the act, seaside communities can reduce runoff by implementing stormwater surge prevention and coastal buffer zones, maintaining intact wetlands and improving water treatment, the authors said. "In many cases, federal funding is available to help local governments complete these kinds of projects," they wrote.

The authors also recommended controlling coastal erosion – "a classic function of local and state governments and one that could markedly benefit coastal ecosystems by reducing nutrient and sediment loading of water," they wrote. "Such coastal inputs may be enriched with fertilizers and, if unchecked, can further increase acidification in estuaries and coastal waterways."

Other recommendations included the adoption of local zoning policies that reduce runoff and carbon dioxide emissions, along with enforcement of existing federal emissions limits on pollutants such as nitrogen oxide and sulfur oxide, which can contribute to local acidification.