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Increasing Ocean Acidification Is Tipping Fragile Balances within Marine Ecosystems

by Johanna Peace - Dec 1st, 2009

The increasing amount of carbon dioxide in the world's oceans is shifting fragile balances within marine ecosystems, and it could cause unpredictable changes for sea life ranging from corals to oysters to whales, scientists say.

One threat is from acidification — a chemical process that occurs when carbon dioxide from the atmosphere is absorbed into sea water, causing the water's pH level to drop.

As acidification increases, scientists now worry its effects on marine life may be more wide-ranging than previously predicted. In recent months, new threats to species and signs of shifting populations have raised alarm within the scientific community.

The Center for Biological Diversity (CBD) took one protective step this fall when it filed a petition to list 83 species of coral under the federal Endangered Species Act. The group seeks to expand on its successful 2006 petition to list elkhorn corals and staghorn corals as “endangered,” a landmark decision that marked the U.S. government’s first official recognition of climate change as an existential threat to a species.

Over the coming year, the National Oceanic and Atmospheric Administration, whose Coral Reef Watch tracks the health of corals worldwide, will review CBD’s petition and determine whether to assign “endangered” status to each of the 83 species on the list.

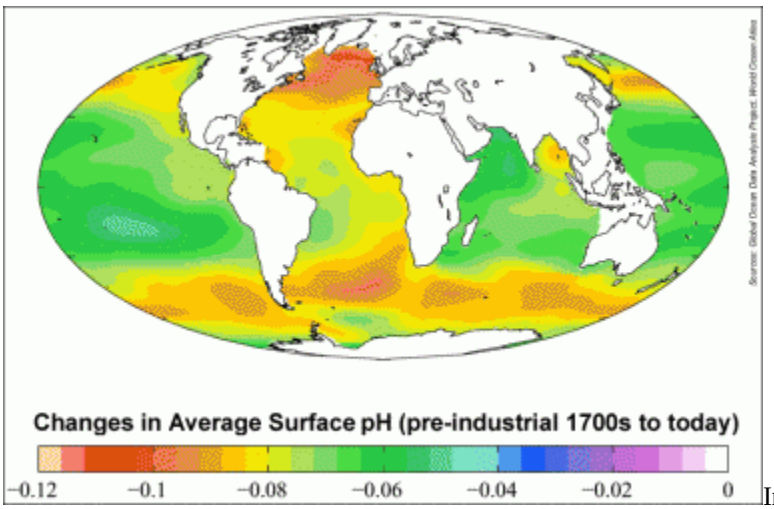
Ocean Acidification Threatens Coral Reefs

Falling pH levels are particularly harmful for calcifying organisms such as coral and shellfish, which have a harder time building and maintaining their calcium-based exteriors as the ocean grows more acidic.

A recent study of the changes in shellfish at different levels of ocean acidity found that the concentrations of CO2 likely to be found in oceans later this century decreased the chances of survival for young clams and scallops by more than 50%. The survivors also developed more slowly, suggesting their populations would be even more vulnerable to prey.

Since acidification happens at a rate parallel to the increase of atmospheric carbon dioxide — oceans absorb about one-third of CO2 — it's picking up pace. According to CBD oceans director Miyoko Sakashita, coral reefs are likely to be the first major ecosystems widely damaged by the effects of more acidic oceans.

"Within a few decades, global warming and ocean acidification threaten to completely unravel magnificent coral reefs that took millions of years to build," Sakashita said.



In fact, some ocean researchers fear that acidification will obliterate Earth's coral reefs in as few as 50 years. That's why they have begun to design cryogenically cooled coral preservation "arks" where polyps can be stored to stave off total extinction.

London Institute of Zoology researcher Alex Rogers explained:

"At the moment the concept we are actually looking at is to literally have a frozen ark for reef-building corals. So that essentially is a lab-based project to freeze the diversity of corals that can build coral reefs."

Rogers and his team hope to have coral arks operating within two years at the UK's Whipsnade Zoo and, eventually, at other locations worldwide. After collecting and freezing small samples of diverse coral species from the ocean, the scientists plan to construct propagation centers where new colonies and entire reefs can be re-built using the preserved coral tissue.

Other Potential Consequences

Corals aren't the only species likely to be affected by the ongoing acidification of the world's oceans. According to marine ecologist Joanie Kleypas, ocean acidification could affect ocean life forms ranging from tiny algae to giant whales in unpredictable ways.

For one thing, the ocean's falling pH will mean that sound travels faster underwater — a change that could either help or hinder the sound-based communication of marine mammals like dolphins and whales.

"It could be confusing to these mammals, making them think things are closer than they are," Kleypas said. "Or it could be good for them, helping them to communicate over longer distances."

And though a rising level of dissolved CO2 weakens the skeletons of calcifying creatures like coral, it may be a boon for other organisms that use the gas for photosynthesis. Certain species of sea grass, for instance, may use the extra CO2 to grow faster and stronger, eventually competing with retreating reefs for space.

It’s too soon to tell exactly what the impacts will be for some forms of marine life, scientists say. Damage to populations of the tiniest plants and creatures, whether through rising water temperature, greater acidity or loss of habitat, can spread through an entire food chain, throwing it out of balance.

Consider, for example, the tiny pterapod, a marine snail whose shell is affected by changing pH. The pterapod is an important food source for young salmon, mackerel, herring and cod, which are important food sources for larger animals and economic sources for humans.

“You’re shifting the whole balance of elements,” Kleypas said. “We can’t yet predict how marine communities are going to respond to that.”