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Carbon dioxide is threatening our fisheries

By MICHAEL RICHARDSON

SINGAPORE — Since the industrial revolution began over two centuries ago, the oceans have absorbed an estimated 500 billion tons of carbon dioxide. This is about a quarter of the total amount spewed into the atmosphere as the burning of coal, oil and natural gas gathered pace and agriculture replaced forests.

As a result, the basic chemistry of seawater is being altered on a scale scientists say has not occurred for at least 20 million years. Moreover, it is happening at a rate not seen in the last 65 million years.

Does it really matter? More specifically, will it affect future food security in a world where 1 billion people already rely on fisheries for their primary source of animal protein and another three billion depend on the sea to meet at least 15 percent of their protein needs?

This is a pressing question for Japan where fish has long played an important part in the national diet.

When carbon dioxide enters salt water, it makes the upper layer of the ocean more acidic. Since 1750, ocean acidity has increased by 30 percent. If we continue at this rate, it will record a 150 percent rise by the end of the century. In addition, as carbonic acid intensifies in seawater, calcium carbonate used by marine organisms to build shells, plates and skeletons, including coral reefs, is diluted.

Global fish stocks are declining in many areas due to over-harvesting, marine pollution and habitat destruction. A study commissioned by the United Nations Environment Program and presented to the international climate change conference in Cancun, Mexico, earlier this month warned that fisheries face new threats from ocean acidification.

The study called for more extensive research on the impact this will have on catches of fin fish and shell fish, as well as fish farming. Aquaculture is the world's fastest-growing food source and last year produced half of all the fish consumed by humans. It is seen as a panacea for dwindling wild fisheries. However, the fish meal used in aquaculture comes from wild

stock.

As the oceans acidify, marine scientists are observing another alarming trend, falling oxygen content. A study of the tropical ocean published earlier this year found that zones without enough oxygen for fish and other marine animals to survive expanded by 4.5 million square kilometers between 1960 and 2008, an area about half the size of the United States.

A lowered oxygen level can be a significant constraint on the growth of marine life because it takes a lot of energy to extract oxygen from water. Daniel Pauly, a biologist at the University of British Columbia in Canada, predicts that the drop in the ocean's oxygen combined with acidification will reduce the global fish catch by 20 to 30 percent by 2050.

Tropical reefs provide shelter, food and breeding grounds for an estimated 25 percent of fish species and account for as much as 12 percent of the global fish catch. These coral reefs are built from calcium carbonate over many centuries. Yet they are among the most vulnerable forms of marine life to more acidic seas and warming waters.

One of the most severe episodes of coral stress hit reefs in Southeast Asia and the Indian Ocean this year. It was the latest of several major episodes of mass bleaching over large reef areas in different parts of the world in the past 20 years. Since then, the number and frequency of these die-backs have increased. If the trend continues, it may disrupt the slow process of reef recovery.

There have been five mass extinctions in Earth's history and corals provide clues about what happened and why. They have been around for most of that time and they readily fossilize, thus providing a record.

Very little is known about the first mass extinction. But in the wake of the following four, reefs disappeared for millions of years long after adverse climatic conditions returned to benign levels.

Dr. J.E.N. Veron, former chief scientist at the Australian Institute of Marine Science and author of numerous books on coral reefs, says that only a few decades ago he thought it ridiculous to imagine that reefs might have a limited life span as a consequence of human actions.

Today, he warns that if the concentration of carbon dioxide in the atmosphere and sea continues to rise, acidification will have a widespread impact by 2050. Different species of coral, coralline algae, plankton, and mollusks will show different tolerances, and their capacity to calcify will decline at different rates.

But, he wrote recently, "they will all suffer from some form of coralline osteoporosis. The result will be that corals will no longer be able to build reefs or maintain them against the forces of erosion." Veron added that what were once thriving coral gardens supporting the greatest biodiversity of the marine realm would become "red-black bacterial slime, and they will stay that way."

His warning is a reminder that although the costs of action to curb carbon dioxide emissions may be high, the costs of inaction may be even higher.

Michael Richardson is a visiting senior research fellow at the Institute of Southeast Asian Studies in Singapore.

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