

## **OCEAN ACIDIFICATION: FREQUENTLY ASKED QUESTIONS**

### **What is ocean acidification?**

Each day the oceans absorb 22 million tons of carbon dioxide from the atmosphere, most of which comes from burning fossil fuels and cutting down forests. CO<sub>2</sub> reacts with seawater, causing it to become more acidic. Since preindustrial times the world's oceans have become about 30 percent more acidic. Here's how it works: CO<sub>2</sub> reacts with water (H<sub>2</sub>O) and forms a weak carbonic acid (H<sub>2</sub>CO<sub>3</sub>), which breaks up into hydrogen ions (H<sup>+</sup>) and bicarbonate ions (HCO<sub>3</sub><sup>-</sup>). The increase in hydrogen ions (H<sup>+</sup>) reduces the seawater *pH* (a *measure of acidity*). *Low pH means high acidity.*

### **What are the effects?**

Ocean acidification strips seawater of the materials that marine animals — such as corals, plankton and shellfish — use to build their shells and skeletons. This can stunt growth or cause deformations, often at a cost to the animal's overall health. For example, corals are growing about 16 percent slower than in the 1990s in Australia's Great Barrier Reef. Near-future levels of ocean acidification could become corrosive enough to erode the shells of some animals. Even animals that don't need to build shells — such as fish and squid — can be affected by changes in seawater chemistry. Ocean acidification can interfere with their behavior, metabolism, cardiac and respiratory functions.

### **What does it mean for fisheries?**

Oysters in the Pacific Northwest seem to be a warning of what's coming soon if we don't curb ocean acidification. Beginning about six years ago, shellfish hatcheries experienced a collapse of oyster production that was due in part to ocean acidification. Baby oysters in hatcheries and in the wild are already having difficulty surviving current seawater conditions. There are numerous effects on fisheries, including impaired growth and survival of shellfish; loss of essential nursery grounds such as reefs; and shifts in prey abundance. On the current path, ocean acidification will be detrimental to fisheries worldwide, with both economic and food-security impacts. Ocean acidification's impacts on oyster and other U.S. mollusk harvests alone could cause up to \$6.4 billion in losses by 2060. Ocean acidification also threatens the food security of billions of people worldwide who depend on marine fisheries as a primary source of protein.

### **The oceans will never become acidic, so why should we care?**

Seawater is naturally basic or alkaline, but ocean acidification is making it less so. The global oceans on average have already become about 30 percent more acidic since preindustrial times. What's important about the changes that are

occurring is that they're happening very rapidly due to human CO<sub>2</sub> pollution. Marine life has never been forced to persist in such a rapidly changing ocean environment.

### **How do we know what will happen — won't there be both winners and losers?**

Animals respond differently to ocean acidification, and it's difficult to predict exactly how ocean ecosystems will respond. Although there may be some winners, scientific research tells us that there will be far, far more losers. A thorough review of ocean acidification science found that organisms' responses to ocean acidification are overwhelmingly negative, harming growth, reproduction, calcification and survival. There will be so many losers that our oceans will fundamentally change if we don't act now to stop ocean acidification.

### **Won't sea life adapt since the oceans were more acidic in the past?**

Humans are changing ocean chemistry at a rate 100 times faster than anything experienced in tens of millions of years. Such rapid shifts in the distant history were linked to mass extinctions. While some plants or animals, such as jellyfish and algae, may adapt to more acidic oceans, they may not be the most appreciated, and ecosystems as we know them will likely be transformed. For example, corals are vulnerable to acidification, yet they are essential to coral reef habitats that support a wide array of other species. Many corals in the world are already at their threshold, so scientists predict that entire coral reef ecosystems may be lost within decades due to warming and acidification.

### **What kind of impacts are actually occurring in the oceans?**

Scientists have only recently started to look for impacts in the ocean, so this field of knowledge is still emerging. What we do know, however, is enough to cause concern. Corrosive waters are reaching shallow surface waters along the entire Pacific Coast during certain seasons, causing mass mortalities of oysters in the Pacific Northwest. Plankton in the Southern Ocean are building thinner and weaker shells, and the length of time and areas exposed to corrosive waters is expanding in Arctic areas. Coral reefs are growing more slowly in certain parts of the world due to acidification, and most of the world's corals are living in seawater conditions that are close to the threshold they can withstand. Estuaries, including Puget Sound and Chesapeake Bay, have naturally low pH that may be pushed over the edge by future levels of ocean acidification.

### **What can I do about ocean acidification?**

Although the problem is daunting, we can tackle it with national, individual and regional approaches.

First, urge the EPA to address ocean acidification through the tools available to it under the Clean Water Act.

Second, tell your state water agency to monitor and identify waters impaired by acidification. [Click here](#) for contact information.

Third, pledge to take one action per month to reduce your own carbon footprint. We'll remind you with some easy suggestions.

Even though ocean acidification is a global problem, we can be part of the solution. Through energy conservation measures alone, America can postpone harmful impacts of ocean acidification by decades while we work on clean-energy solutions globally.

***For more information, go to the Center for Biological Diversity's Endangered Oceans website at [www.EndangeredOceans.org](http://www.EndangeredOceans.org).***