

COSTS OF OCEAN ACIDIFICATION

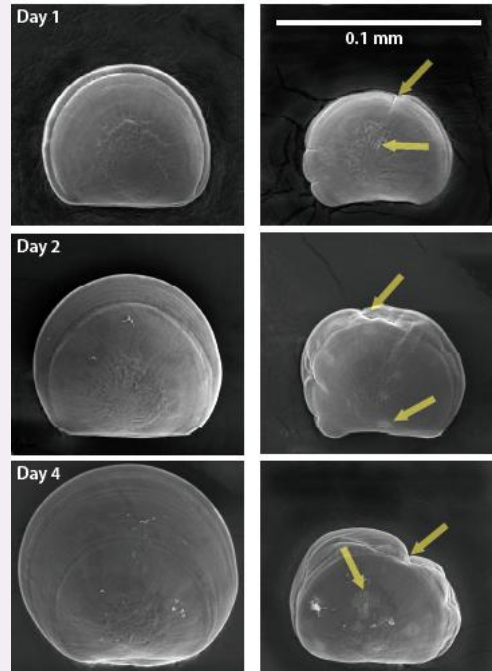
"Ocean acidification - it is the silent storm. It can't be heard, it can't be felt, it can't be seen, but scientists are measuring it."
 --Carol Turley, Plymouth Marine Laboratory, UK

Based on experiments conducted from 2009-2012, NOAA scientists concluded that the commercially important red king crab and Tanner crab stocks were likely to be harmed by pH levels decreasing below current levels of 8.0 to of 7.5pH caused **100% mortality of juvenile red king crabs**: one of the most commercially valuable Alaskan fisheries. (Source: Long et al, 2014; <http://adfg.alaska.gov>)



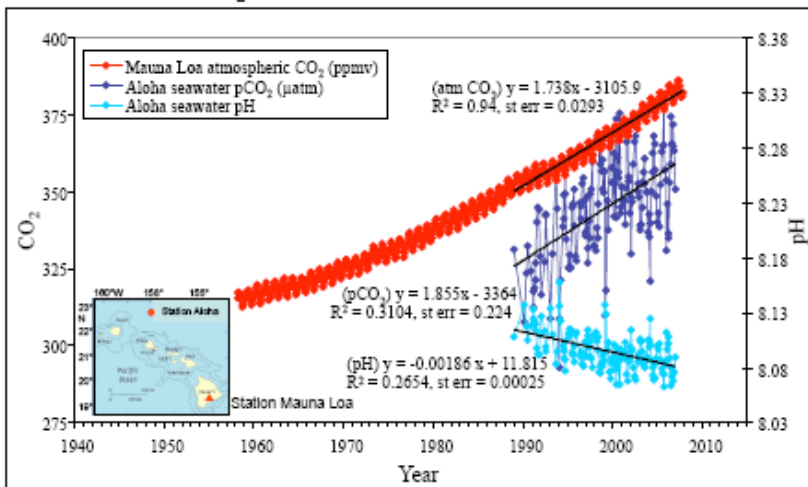
The report issued in January 2015 by the Maine Commission to Study the Effects of Coastal and Ocean Acidification warned that a broad range of shellfish are threatened, including lobster, crabs, oysters, mussels, clams, scallops, sea urchins, northern shrimp and periwinkles. **About 87 percent of the value of Maine's fisheries landings are organisms that produce shells, the report notes, and they are most impacted by more acidic waters, often making it difficult for them to form shells.** (source: <http://goo.gl/cOb8IC>)

Oyster larvae reared in low pH waters at days 1, 2 and 4; compared with healthy larvae on the left.



Shellfish larvae are extremely sensitive to acidified, corrosive waters during the first few hours after fertilization. (source: OSU Brunner/Waldbusser)

CO₂ Time Series in the North Pacific Ocean



Total Value of Species Vulnerable to OA Based on 2010 US Catch is over \$2 Billion

(source: <http://seafoodhealthfacts.org>)



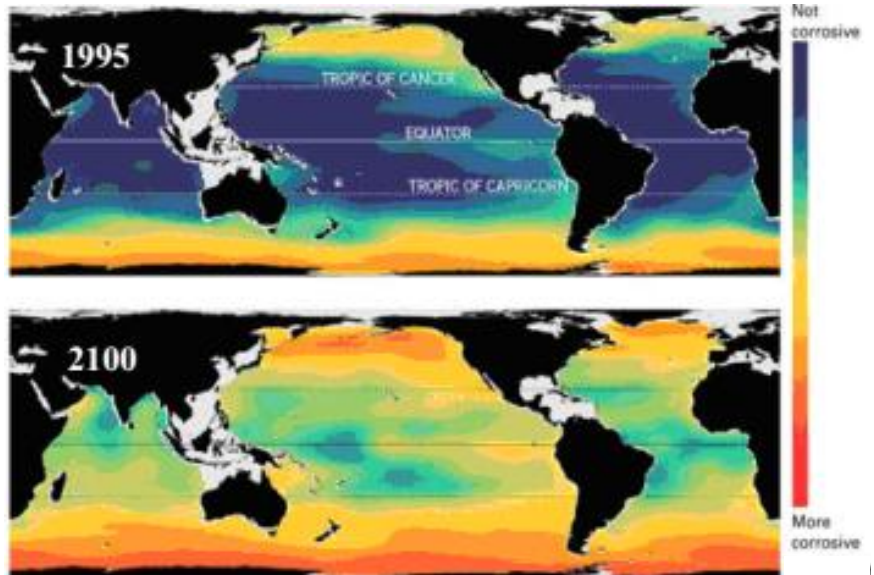
Next Steps:

- Funds to understand impacts and help coastal communities and seafood producers adapt
- GAO recommends studies: mitigation and adaptation <http://goo.gl/GAz1YH>
- Funds for breeding studies to identify genetic lines that can tolerate corrosive conditions



What a More Acidic Ocean Means for Marine Life

The oceans are arguably our world's most valuable assets. In addition to providing a home for a wide range of plants and animals, the oceans also provide food and jobs for millions of people throughout the United States and the world. The oceans have moderated Earth's climate for millennia by absorbing atmospheric carbon dioxide. Today, the chemistry of the ocean is changing at an unprecedented rate—ocean waters are absorbing more carbon dioxide than they have in at least 650,000 years. The ocean is now 30% more acidic than it was before the Industrial Revolution. If fossil fuel use and deforestation continue at present rates, it is predicted that the ocean will experience another 100 - 150% increase in acidity by 2100. The current rate at which ocean acidification is occurring will likely have profound biological consequences for ocean ecosystems within the coming decades. The rate of change in ocean acidity is so great that many marine organisms will probably not be able to adapt quickly enough to survive these changes. Research into the short- and long-term ecological implications of ocean acidification is in its infancy and significant research investment is essential to assess the magnitude and severity of the acidification threat to marine life, including economically lucrative commercial fisheries.



(image: National Geographic Maps)

Value of US Seafood in Money and Jobs, 2012

US Seafood Industry 2012 (boat to plate):

Sales Impact: \$140.66 billion

Employment Impact: 1.27 million jobs

US Recreation Fisheries Economic Impact:

Sales Impact: \$58.42 billion

Employment Impact: 380,898 jobs

These numbers represent what is potentially at risk without good research to prepare for ocean acidification (source: NOAA <http://goog.gl/q0Bcc8>)

Organisms affected by Acidification



Image: NOAA

Reef-building corals provide food and shelter for commercial fish species

Plankton are the basis for a number of marine ecosystems and provide nearly 50% of the world's oxygen.



Image: oxygentimerelease.com



Image: sunsetmarineresort.com

US fishery landings for calcifiers such as mussels, clams and scallops were valued at \$675 million in 2006 alone.

What is Ocean Acidification?

Ocean acidification is the process whereby the ocean is becoming more acidic because it is absorbing large quantities of carbon dioxide, nitrogen and sulfur from the atmosphere. Today, the overwhelming cause of ocean acidification is fossil fuel carbon dioxide released to the atmosphere by humans.

Why Should We Care?

Ocean acidification is harmful to plankton, corals, shellfish, fishes and marine ecosystem structure. Decreasing carbonate concentrations in seawater make it more difficult for marine life to build their skeletons and shells. More acidic oceans cause increased dissolution and erosion of skeletons and shells, which compromises the survivability of organisms that depend on these structures for protection.

Web Resources

- <http://globaloceanhealth.org>
- <http://iaea.org/ocean-acidification>
- NSF: <http://goo.gl/JGNFpa>