

By Thomas Stone

Print Page

October 25, 2015 10:00AM

Ocean acidification endangers shellfishing industry

The problem of sea-level rise has, justifiably, received widespread attention, but the effects of climate change on the oceans also includes ocean acidification, ocean warming and ocean deoxygenation (loss of oxygen). These three ongoing factors will have grave effects upon the fishing and shellfish industries, not only in our region and along the American and Canadian coasts, but throughout the world. A recent U.N. report warns of the oceans of the globe becoming "hot, sour, and breathless" because of human activity.

Ocean acidification occurs as carbon dioxide (CO₂) from fossil-fuel burning builds in the atmosphere and is then mixed into the oceans. There, the CO₂ converts to carbonic acid and freed hydrogen ions raise the acidity (thus lowering the pH) of the oceans. This is already occurring, and as CO₂ continues to build in the atmosphere it will get worse.

As the ocean absorbs more and more CO₂, the ability of marine organisms to produce and maintain their shells — to calcify — is reduced. Calcifying species, such as oysters, clams, sea urchins, shallow water corals, deep sea corals, and calcareous plankton, will be most severely affected. NOAA already reports "near total failures of developing oysters in both aquaculture facilities and natural ecosystems on the U.S. West Coast" with acidification a "potential factor." Australian scientist and coral reef expert J.E.N. Veron states "...ocean acidification is potentially the most serious of all predicted outcomes of anthropogenic CO₂ increase."



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In 2013, the Massachusetts shellfishing industry landed \$466 million worth of shellfish and \$89 million of finfish. Of the \$466 million of shellfish, 72 percent (\$337 million) came from scallops; 16 percent (\$72 million) from lobster and crabs; and 12 percent (\$57 million) from clams, oysters, whelks and mussels.

A 2004 report from the Donahue Institute at UMass stated that the commercial seafood industry added \$1.5 billion to the Massachusetts economy. With so much of the value from scallops alone, a collapse or decline of that fishery due to ocean acidification would have severe economic consequences for Massachusetts and our region.

Research published this year by Ekstrom and others in "Nature Climate Change" examined regional sensitivity and economic dependence on shellfish and found southern Massachusetts with the highest sensitivity due to having the highest shellfish revenues in the U.S., the second highest number of shellfish licenses and the fourth highest proportion of seafood revenues coming from shellfish. Understanding this, state Reps. Timothy Madden, D-Nantucket, Martha's Vineyard and Falmouth, and William Straus, D-Mattapoisett, have filed legislation this year to create a commission to study the effects of ocean acidification on locally important shellfish and marine resources.

Ocean acidification is getting worse with the oceans now about 30 percent more acidic than they were two centuries ago. Ocean pH has already declined by about 0.1 pH unit (a measure of acidity) and is expected to decline by 0.3 pH units by 2100. A recent report by British researchers describe ocean acidification as happening 10 times faster than at any time in the fossil record over the last 65 million years when it, ominously, preceded a mass extinction event. Ocean acidification is essentially irreversible over thousands of years so the only option is to prevent it. Some localized mitigation and adaptation may be possible.

Certainly, the fundamental effort needed in combating ocean acidification is to stabilize and then reduce CO₂ emissions. But some effects can be highly localized due, in part, to acidifying coastal pollution from wastewater and runoff. Even if we stop all fossil fuel emissions today, the atmosphere would still take centuries to recover, and as the ocean mixes very slowly it would take even longer.

On ocean acidification, oceanographer Dr. Sylvia Earle notes: "This is a sweet spot in time. Never before could we know what we know, never again will we have as good a chance as we now have to take action and make a difference."

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