THE EAST HAMPTON STAR
SHINES FOR ALL

What Else Is in Our Waters?

By Judith S. Weis
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This year there have been a number of fish kills and harmful algal blooms in the Peconics and Shinnecock Bay. In my previous "Guestwords" column, I discussed how these events were caused by excessive nutrients (primarily nitrogen) coming mostly from fertilizers running off from farms and lawns, and from human waste, coming in primarily in groundwater from septic tanks.

Algal blooms, stimulated by the nutrients, sooner or later die off and the dead cells sink to the bottom, where bacteria are stimulated to decompose them. The decomposition process uses up dissolved oxygen from the water. The overall phenomenon of excessive nutrients causing algal blooms that decay and use up oxygen in deeper water is called "eutrophication."

The decomposition of dead material is due to the activity of respiration by bacteria and fungiliving at the bottom. Respiration is a process that all living things do; the process uses up oxygen and at the same time releases carbon dioxide. This is the same as when we respire — we extract oxygen from the air and add CO_2 to it.

Most of what we hear about carbon dioxide these days has to do with its release when fossil fuels are burned and its role in producing the greenhouse effect or global warming. While the preindustrial value of CO_2 in the atmosphere was 280 parts per million, as of May 2015 it was greater than 403 ppm. About one-third of the CO_2 emitted into the air dissolves in the ocean, where the rate of CO_2 increase directly parallels its rate of increase in the atmosphere. The CO_2 that dissolves in the ocean reduces the amount in the air and thus the degree of warming it causes; however, it has effects on the chemistry and biology of the ocean. The dissolved CO_2 combines chemically with seawater to form carbonic acid, which releases hydrogen ions. The increased concentration of hydrogen ions causes the water to become more acidic, a process being called “ocean acidification.” The oceans have already become 20 to 30 percent more acidic than they were in preindustrial times.

One major biological effect of acidification is that it impairs the process of shell formation in organisms that make calcium carbonate shells — there is less carbonate available in the water that they can use. What kinds of organisms make shells out of calcium carbonate and are affected? Primarily mollusks, corals, and certain types of single-celled phytoplankton. These organisms are very important to the ecology of the ocean, and in the case of mollusks, important to us as seafood.

Growth rates of these organisms are reduced in acidified conditions, shell formation in the young larval stages is impaired, and in some cases existing shells can be weakened and eroded away.

Some of this is already happening. There have been failures of oysters in Pacific Coast hatcheries because upwelling of more acidic deeper water prevented their larvae from growing shells; this was an economic disaster for shellfish growers almost a decade ago and has since been averted by hatchery staff checking the acidity of the incoming water and adjusting it.

Pteropods (tiny planktonic snails) in the Pacific have shown a 30 percent greater incidence of shell dissolution over the past few decades. These pteropods are important food for young Pacific salmon when they migrate out of rivers into the ocean. Other effects that are being discovered involve impairment of the olfaction (smell detection) system of fishes so they cannot migrate properly or locate “home.”

Research on biological effects of ocean acidification is relatively new, and additional effects on other processes and other organisms are being reported in scientific papers every month.

This is happening in the ocean. What does it have to do with our local estuaries? Remember, when algae blooms decompose, not only does dissolved oxygen go down, but CO_2 is produced. This local source of CO_2 causes *additional* acidification in the estuaries and coastal waters, making the acidification greater than in the ocean and the problems worse. The combined impacts of warming, acidification, and low oxygen cause intensified effects. While environmental agencies routinely measure dissolved oxygen, the degree of acidity has not been routinely measured. Studies in Long Island Sound have shown that when the dissolved oxygen gets low (usually in late summer), the acidity is greater.

A recent study examining the vulnerability of different states of the U.S. to ocean/coastal acidification ranked New York as "vulnerable" due to its shellfish industry combined with its level of nutrient inputs and algae blooms. That rank for the state really is for Long Island, and Suffolk County in particular, where there are shellfisheries and shellfish aquaculture.

In order to make a difference in remediating acidification in the world's oceans, international action to curb CO_2 emissions will be necessary. However, here is a case where the old environmental slogan "think globally, act locally" really applies. Local and state action can reduce the additional acidification in coastal and estuarine areas by reducing nitrogen inputs. This would be a win-win situation, since it would at the same time relieve the more immediate effects of eutrophication (fish kills, harmful algal blooms) as well.

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