By Carolyn Raffensperger

What The Ocean Dead Zones Tell Us

It's a bad time of year for the fish in the Gulf of Mexico, especially those that live near the mouth of the Mississippi River. Every summer, vast quantities of fertilizer run off the land in the upper Midwest, go down the Mississippi, and flow over the top of the salty gulf waters, which are denser and heavier. The fresh water on the surface forms a barrier to oxygen penetrating to the bottom layers of the ocean. The nitrogen and phosphorus in the fertilizer stimulate the growth of the phytoplankton that naturally grow in the top layer of the sea. When the phytoplankton die and sink, their decomposition uses up much of the remaining oxygen in that bottom layer.

Dissolved oxygen of 4-6 parts per million in water is considered normal. Below 4 parts per million, fish are having the equivalent of severe asthma attacks and have to move to waters where they can respirate more easily. Two parts per million is called hypoxia. In 2002 the gulf hypoxic zone reached a record 8,500 square miles, larger than the state of Massachusetts. But that record may be exceeded this year. Forty percent of U.S. commercial fish in the lower 48 states come from the Gulf of Mexico. This fishery is now threatened by hypoxia.

The irony is that the human food supplied by the oceans is jeopardized by land-based agriculture. More than one million tons of nitrogen, the major nutrient in the northern Gulf of Mexico, flows into the gulf through the Mississippi River system each year. About 56 percent of the nitrate load enters the Mississippi above the Ohio River, drained from key agricultural states like Iowa and Illinois.

In response to the burgeoning problem, Congress passed the Harmful Algal Bloom and Hypoxia Research and Control Act in 1998. The act required that the president, in conjunction with the states, submit a plan for reducing, mitigating, and controlling hypoxia in the northern gulf. In January 2001, President Clinton sent to Congress an action plan with the goal of reducing the size of the zone by cutting nitrate runoff by 30 percent by 2015. Runoff was to be reduced by improving farming practices, restoring wetlands capable of filtering nutrients, and promoting flood-control projects. In addition, EPA would increase monitoring of the hypoxic zone and the waters flowing into it, under an adaptive management regime.

Scott Faber, an attorney with Environmental Defense, listed additional benefits of the plan, including reducing demand for natural gas, helping combat climate change, and restoring endangered species habitat.

Unfortunately, wrangling over the plan has delayed action. As I write this in early August, the dead zone is already 5,800 square miles. Terry Stelly, a biologist with the Texas Parks and Wildlife Department, says that "increasing numbers of sharks have been found in recent years in the waters along the Texas-Louisiana border, near the edge of the dead zone. . . . Chances are good they [sharks] were looking for higher dissolved oxygen in the water." Three people have been bitten by sharks along the upper Texas coast this year. Texas has recorded only 18 shark attacks since 1980.

In yet more disturbing August news, another dead zone has formed off the Oregon coast, the second in three years. The Oregon hypoxic zone first appeared in 2002 and scientists thought it was a fluke. Jane Lubchenco, former president of American Association for the Advancement of Science, says, "When you see the same thing happening with this regularity, it suggests that something is fundamentally different. This is a significant departure from normal conditions and you have to wonder what's going on. This ocean system has changed, and we're paying attention." Scientists suspect that the Oregon zone is related to climate changes bringing cold, nutrient-rich, lower-oxygen Arctic waters down to the south, creating the same conditions of decomposition and oxygen depletion that occur in the gulf.

In a similar story, birds in the massive nesting sites of Orkney and Shetland in northern Scotland have had complete reproductive failure. Ornithologists are describing it as a collapse of an ecosystem. Michael McCarthy of the London *Independent* writes that on Shetland's southern tip, where 1,200 pairs of guillemots assembled to breed in the spring, not a single chick has been produced. Arctic terns, of which the last census in 2000 recorded 24,716 breeding pairs in Shetland, have produced no chicks at all in the south of the islands.

Why? The birds starved and were unable to support eggs or hatchlings. The reason seems to be global warming. The temperature of the North Sea has gone up by two degrees Celsius in two decades. The primary food of the migratory birds is the sand eel, a cold-water species that has moved closer to the Arctic in search of colder water.

Everywhere we turn, evidence is mounting that we are destroying the oceans. New research demonstrates that the oceans have been serving as industrial carbon dioxide sinks and have become acidified by the resulting formation of carbonic acid. The biological consequences of increased acidification include the inability of shellfish to make shells, since the chemical reaction of carbonic acid with calcium carbonate makes the calcium unavailable to the mollusc.

We are at a turning point. We can replace our destructive agricultural practices with sustainable farming and resurrect the dead zones. We can honor sustainable fishing practices. We can sign the Kyoto treaty and reduce our greenhouse gases. Or we can sing at the funeral of the oceans.

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