Dead Zone Fix Not a Dead Issue

Scientists debate how best to revive the Gulf of Mexico's oxygen-starved waters

Every summer, death stalks the waters of the northern Gulf of Mexico. A New Jersey–size swath of sea becomes depleted of oxygen, suffocating millions of crabs and other denizens of the sea floor. In 1999, the federal government diagnosed the cause of this seasonal dead zone: The hypoxia arises largely because of nitrogen pollution from the fertilizer-drenched farms in states along the Mississippi River. Two years later, the government released a plan to reduce nitrogen runoff and revive the gulf. Now a new government report says that because the original diagnosis was wrong, the costly prescription will fail.

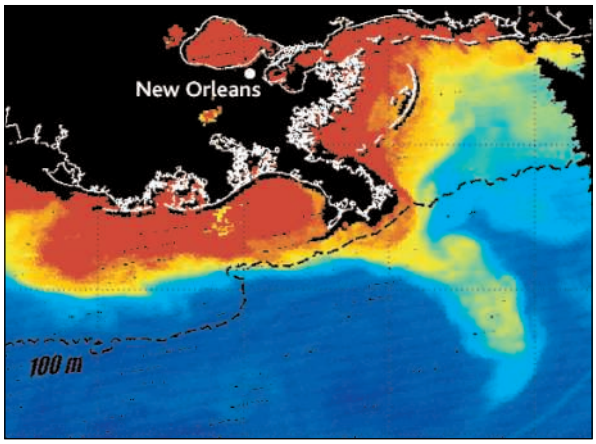
Released last month to little public notice, the controversial report, issued by the Atlanta office of the U.S. Environmental Protection Agency (EPA), places increased blame for the dead zone on phosphorus pollution from factories and cities along the Mississippi River and recommends focusing the cleanup on phosphorus as well as nitrogen. Farm-industry groups seeking to delay the national plan have seized on an early draft of the report that challenged the use of any nitrogen reduction. Marine scientists have given the report, which has not yet been peer reviewed, a cooler reception. "I think it has some really serious deficiencies," says Donald Boesch, president of the University of Maryland Center for Environmental Science.

Scientists agree that factories, cities, and farms in the Mississippi River watershed have jacked up both phosphorus and nitrogen levels in the river. Each spring, those nutrients pour into the northern Gulf of Mexico and trigger blooms of phytoplankton, minuscule plants that float in the water. That sets off population booms in zooplankton, the tiny animals that consume them. Then sea-floor bacteria, which feed on dead zooplankton and their waste, multiply wildly and use up oxygen in the bottom waters.

In 1999, the National Oceanic and Atmospheric Administration (NOAA) released a comprehensive assessment of the causes and consequences of hypoxia in the gulf. It concluded that phytoplankton growth in the dead zone was primarily limited by the availability of nitrogen. Relying on that report, a state-federal partnership, the Task Force on Gulf Hypoxia, developed a national action plan with a single overarching goal: reduce nitrogen coming down the Mississippi River by 30% by 2015.

That prescription seemed simplistic to Howard Marshall, a veteran water-quality scientist at EPA's Atlanta regional office who was assigned to help implement the plan. By reexamining available data on dissolved nitrogen and dissolved phosphorus concentrations, Marshall and other EPA scientists determined that the lower Mississippi River contained a large excess of dissolved nitrogen relative to dissolved phosphorus. Although growing phytoplankton need more nitrogen than phosphorus—they usually accumulate the nutrients at a 16:1 ratio—the amount of nitrogen so exceeded the quantity of phosphorus that the latter nutrient had most likely limited the growth of phytoplankton there, the EPA group concluded. The same also held true for the northern gulf in the spring, when the dead zone typically forms, according to the group. "Wouldn't it be better to reduce phosphorus and starve the bastards?" Marshall asks.

That's "pretty naïve," argues biogeochemist Robert Howarth of Cornell University, who chaired a National Research Council committee in 2000 that examined hypoxia in coastal oceans. Last week, Howarth, Boesch, and Donald Scavia of the University of Michigan, Ann Arbor, sent EPA a letter criticizing the new report. They argue, for example, that the nutrient ratios in water don't necessarily reveal what's available to phytoplankton, because phosphorus is resupplied from organic debris in the sediment.



Enough already. Excess nutrients from the Mississippi River cause phytoplankton blooms (red and yellow) near the river's mouth.

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But other oceanographers who have seen the report say that the EPA team has a point. "There's been this focus on nitrogen as the major culprit, even though we knew from early on that phosphorus played a role," says biological oceanographer Steven Lohrenz of the University of Southern Mississippi in Hattiesburg. And oceanographer Michael Dagg of the Louisiana Universities Marine Consortium in Cocodrie, who's worked in the gulf since the 1980s, says that Marshall "has done an extremely important service by scrutinizing these issues as intensely as he did. It should have been done 10 years ago."

Indeed, several recent lines of evidence support the idea that phosphorus can control phytoplankton growth in the gulf. In results presented in January at the American Geophysical Union's Ocean Sciences meeting, James Ammerman of Rutgers University and colleagues reported that nitrogen-to-phosphorus ratios greater than 380 occurred over the entire Louisiana continental shelf in the spring and early summer of 2001, indicating that phosphorus supplies may well constrain the plants' growth. Moreover, adding phosphorus but not nitrogen stimulated phytoplankton growth in bottles containing seawater from many of those locations. And phytoplankton from much of the shelf had high levels of an enzyme that they turn on to scavenge phosphorus when supplies are tight.

Overall, the data suggest that "there's this huge slug of water going into the gulf that's phosphorus-limited at its fresh end and nitrogen-limited at its salty end," says coastal ecologist Hans Paerl of the University of North Carolina, Chapel Hill. What remains unknown, he says, is how much phytoplankton growth at the fresh end contributes to hypoxia.

At last week's meeting of the gulf hypoxia task force, farm-industry interests lobbied to redo the NOAA-led science assessment and delay expensive efforts to reduce fertilizer runoff from farms. EPA's Ben Grumbles, acting assistant administrator in the Office of Water, says the task force is "committed to doing an independent peer review" of the new EPA report, and that the reviewers should include "fresh faces" who weren't involved in the 1999 NOAA assessment. But he emphasizes that the agency plans to continue its efforts to cut nitrogen pollution while exploring how to cut phosphorus. For the gulf, that may be just what the doctor ordered.

–DAN FERBER

Published by AAAS