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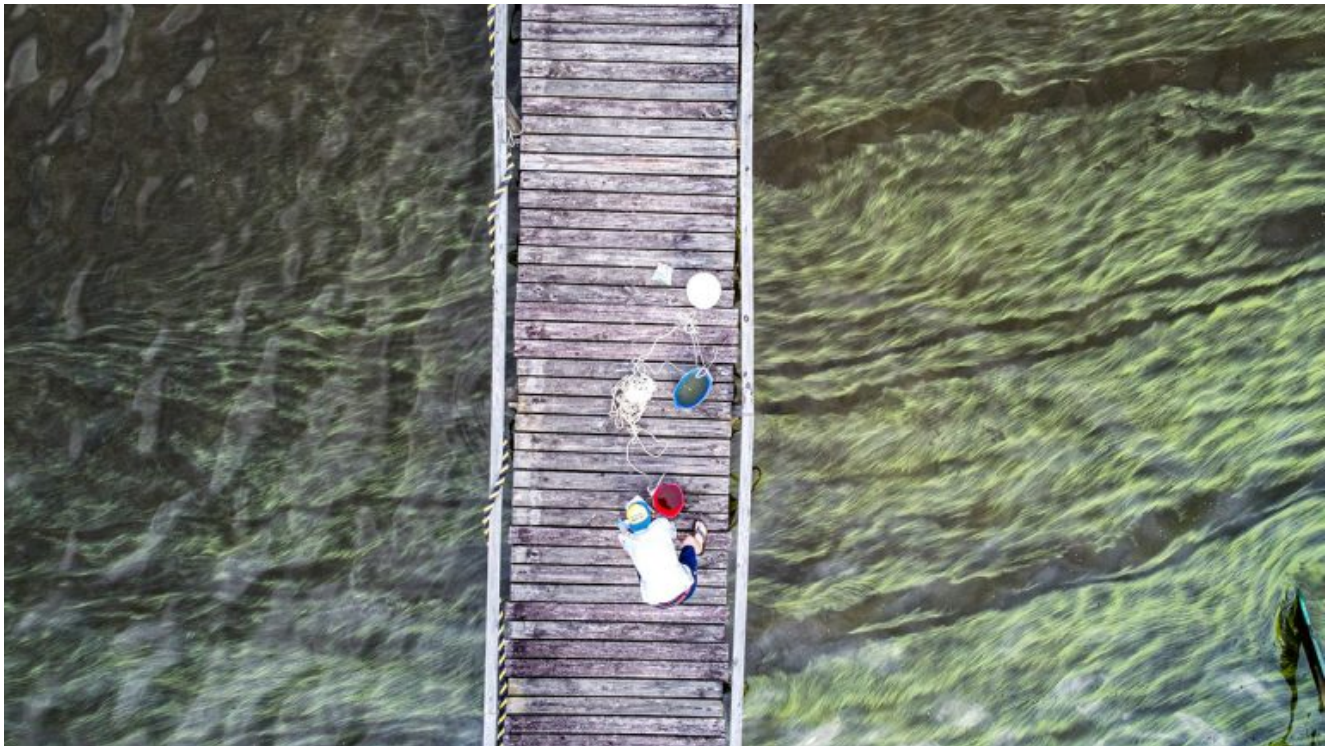
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NC at a crossroads in dealing with water quality challenges

08/24/2021 by [Lena Beck](#)



An algal bloom on the Chowan River is visible from above. Photo: A.Loven/UNC

This is the first in a multipart special reporting series on coastal water quality.

It's a windy day in October, warm enough for just a T-shirt, and the Neuse River shimmers in the sunlight. As Katy Hunt approaches the bank, however, a foul smell hits her nostrils. And from the dock, she can see the cause: thousands upon thousands of dead, rotting fish.

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A fish kill occurs when algae bloom and then die. The decomposition of the algae depletes oxygen levels in the water. Fish suffocate in their own habitat, and some will jump onto riverbanks in one last futile attempt to breathe. Most fish kills in the Neuse River last a few days at most. But October 2020 saw the area's longest fish kill in decades, lasting an entire five weeks. For Hunt, the Lower Neuse Riverkeeper for Sound Rivers, the sight was disheartening. Every few days she'd walk out onto the dock to check. From there she saw thousands of pale fish floating by like a funeral procession.

"You'll see lots of little whitish-silver things floating along the surface and washing up by the shores," Hunt said.

The large algal blooms that cause these massive fish kills are a result of nutrient pollution. The pollution, said Hunt, is directly attributable to human activity.

Because of anthropogenic nutrient pollution, fish kills in the Neuse River are essentially an annual event. But waterways across the entire state are grappling with the consequences of excessive nutrient inputs. As North Carolina accommodates a growing population, the state's waters are paying the price. North Carolina stands at a crossroads between finding ways to mitigate nutrient pollution damage, or seeing it get worse and worse.



Lower Neuse Riverkeeper Katy Hunt collects water samples earlier this month to test for *E. coli* at Broad Creek off the Neuse River near a wastewater treatment plant. Photo: Sound Rivers

‘Too much of a good thing’

The presence of nutrients in the water isn't inherently bad. In fact, nutrient cycling is a normal part of ecosystem function. Nitrogen and phosphorus are essential contributors to plant growth and the entire food chain depends on these nutrients. But the Earth supplies its own nitrogen. Human activity has doubled the amount of usable nitrogen in the world, and this excess can wreak havoc on ecosystems.

“It sounds so strange, because nutrients are a good thing,” Hunt said. “Except we all know the old adage that too much of a good thing is a bad thing. And that’s very much the case for the Neuse River.”

Often, we see the results of this nutrient excess in the form of an algal bloom.

How many nutrients is too many? That, said Dr. Nathan Hall of the University of

North Carolina Institute of Marine Sciences based in Morehead City, depends on what the water is used for.

“The cutoff point really depends on what you’re worried about,” Hall said. For example, seagrasses are especially sensitive to nutrient levels because the resulting algae will block their access to light. Without light, seagrass cannot grow. By contrast, recreational swimmers aren’t as sensitive to higher nutrient levels. “We’re not squeamish about swimming around in some water that’s a little bit green or brown — up to a point,” Hall said.

North Carolina does not have an official threshold for what constitutes too many nutrients. There is, however, a limit on how much chlorophyll-a is in the water. Chlorophyll-a is the pigment that gives algae its green color. Chlorophyll-a is essentially a measure of how much algae is in the water, which by extension, says something about nutrient levels in the water. The official level for North Carolina’s slow-moving waters like sounds and estuaries is 40 micrograms per liter.

“Forty is about where you can really start to notice the water’s green,” Hall said.

Waterways that contain more chlorophyll-a than this get placed on the state’s 303(d) list — the official record of all imperiled waters in the state. Once a body of water makes it onto this list, it sometimes stays there for decades.





Dr. Nathan Hall. Photo: UNC

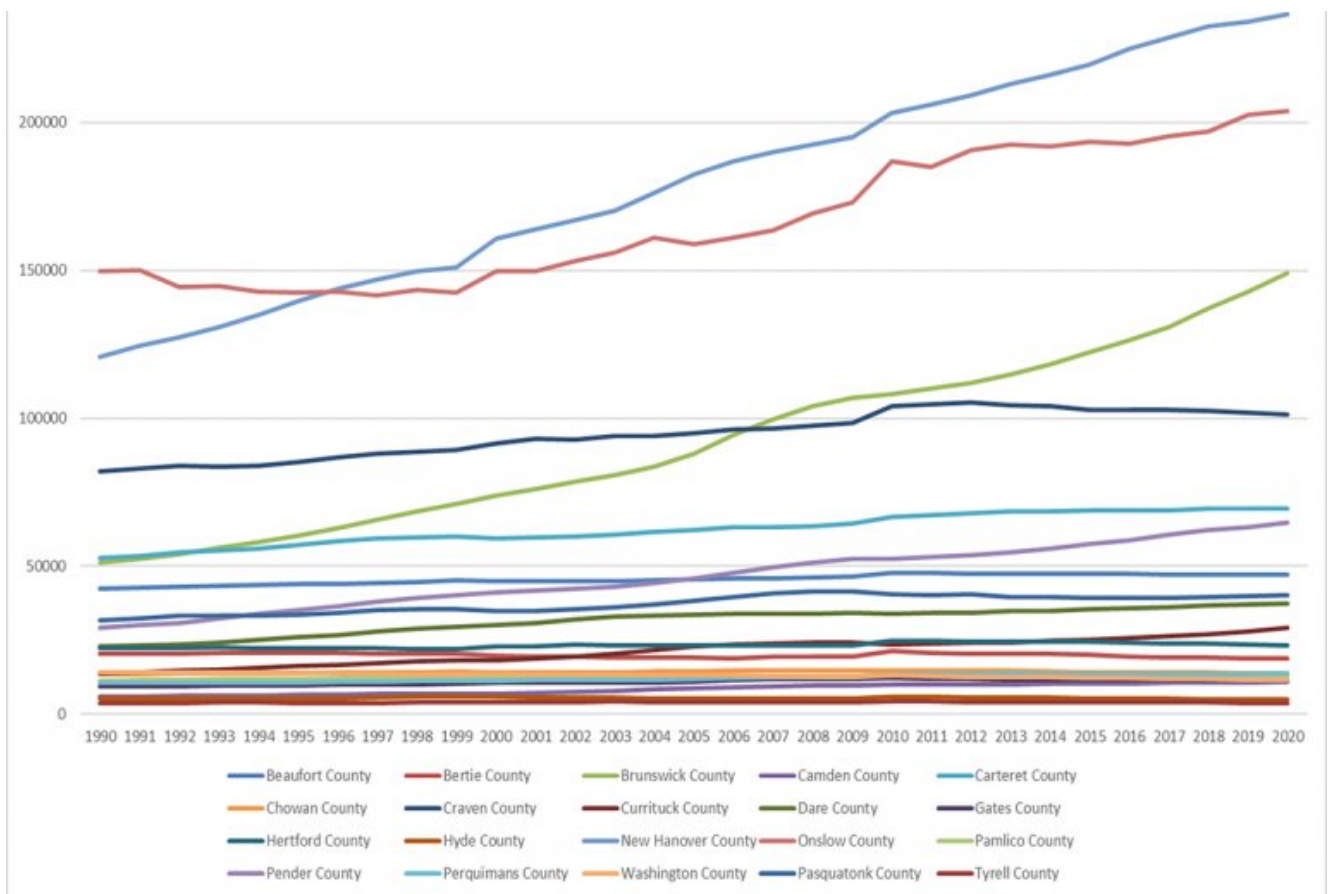
Nutrient inputs into waterways, or “nutrient loading,” is regulated for waters that are considered nutrient-sensitive. Sensitivity is defined as being highly reactive to nutrient inputs. In other words, the physical conditions of the water facilitate a nice habitat for algae — things like slow water turnover and shallow depths. For example, the Neuse River is considered nutrient sensitive.

But where do the excess nutrients come from? In short, human activity. These inputs come from the fertilizer that people put on their lawns, as well as large-scale agricultural operations. They come from wastewater and sewage. A lot of these pollutants are carried into the watershed by stormwater runoff. That is, when it rains, the water washes pollutants across impervious surfaces and into watersheds. The ground is usually very good at filtering nutrients out of the water, but developed areas include high levels of impervious pavement, which don’t allow water to penetrate the ground. Impervious surfaces are things like roads, driveways and sidewalks.

All of this is compounded by climate change. When storms get worse and rainfall increases, more nutrients are flushed into the watershed. If storms are followed by dry periods, water flow slows down and allows algae to prosper. Due to the influence of stormwater runoff on nutrient transport, nutrient pollution can be exacerbated by the number of people living in the watershed.

North Carolina’s total population has been increasing for decades. In 1990, the state population was 6.65 million, according to the U.S. Census Bureau. By 2020, that number had climbed to 10.44 million. When compared to the rest of the country, North Carolina is the state with the ninth highest population.





Population trends in North Carolina's 20 coastal counties, 1990-2020. Graph: Carolina Demography

Not every county in the state has experienced growth — some counties bear the increase in population more than others. For example, the five-weeklong fish kill in the Neuse River last October occurred just outside of New Bern in Craven County. The population of Craven County was 82,096 in 1990, and in 2020 it reached 101,233. That's an increase of nearly 20,000 people.

And while not every coastal county experienced growth in the past three decades, Craven County wasn't the only one to grow substantially. New Hanover County, for example, has increased by 115,649 people in 30 years, nearly doubling its population.

This information comes from [Carolina Demography](#), an organization nested within the Carolina Population Center at the University of North Carolina Chapel Hill. According to Melody Kramer, director of communications and business development, it's hard to make predictions about the future of the state's population. But projections from the department indicate that the state will gain

about a million new residents every 10 years for the next few decades.

This could spell trouble when it comes to nutrient pollution.

“The more people you pack into a watershed, the more nutrients you release, and particularly for nitrogen that’s true,” said Dr. Hans Paerl of UNC IMS. “But depending on how aggressive management of those issues is, it can be attenuated.”



Dr. Hans Paerl. Photo: UNC

As North Carolina continues to see population increases and development, Paerl said that there is an opportunity to build in an effective way as opposed to a harmful way. It’s imperative to the health of the water, especially considering that many of the state’s waterways have seen aggressive nutrient inputs for several decades.

“Now, the thing to keep in mind about all aquatic ecosystems is that they don’t improve overnight,” Paerl said. “So the sooner we have an aggressive nutrient

reduction management strategy the better.”

Paerl points to Lake Washington in Seattle as an example of how aggressive, proactive nutrient management plans can work. In the 1940s-1960s, Lake Washington began receiving increased amounts of secondary treated sewage as Seattle and its surrounding areas grew in population. This led to unprecedented levels of the nutrient phosphorus — 70 parts per billion in the 1960s. And while phosphorus levels are impossible to see with the naked eye, the resulting eutrophication (algae blooms) were evidence of impending catastrophe.

Seattle began an aggressive plan to divert sewage away from the lake and through treatment plants. It was superbly expensive (\$140 million in the 1960s) but also incredibly effective. The program was able to get phosphorus levels down to 16 parts per billion. Today, Lake Washington has infrequent problems with eutrophication, and water quality and clarity are high considering that the lake rests in the middle of the largest city in the Pacific Northwest.

Change has also shown itself to be possible in North Carolina. Last year’s five-week fish kill in the Neuse River was the longest one in decades. In the 1990s, however, there were a few of comparable length. This and other indicators of eutrophication alerted state officials to the need to decrease the levels of nutrient pollution into the river.

The Neuse Nutrient Strategy went into effect in 1997. It set up special rules and regulations to target nutrient sources like wastewater and agricultural runoff. This mandate was effective in decreasing the amount of inorganic nitrogen in the Neuse River.

“It has led to a reduction in nitrogen inputs from certain sources,” Paerl said. “But we’ve also seen changes in the watershed due to development and changes in agricultural activities and practices, urbanization, etc., that has led to an increase in organic nitrogen loading.”

While these regulations have made enormous strides in targeting some sources of nutrient pollution, there is still more work ahead.

“There’s still a lot of science that needs to be done in terms of understanding the linkage between where it’s coming from, and how reactive it is in our receiving waters,” Paerl said.

Paerl’s lab at UNC IMS operates the Neuse River Estuary Modeling and Monitoring Project, or [MODMON](#), in partnership with the North Carolina Department of Environmental Quality.

MODMON has been recording water quality data in the Neuse River since 1994. One of the things MODMON seeks to monitor is the total maximum daily load, or TMDL, of nutrients in the Neuse River. The TMDL is equal to the level of nutrients the river can accommodate while still meeting water quality standards.

According to Dean Carpenter, program scientist for the Albemarle-Pamlico National Estuary Partnership, or [APNEP](#), long-term water quality data sets are crucial for evaluating management decisions going forward. APNEP works with community partners to determine indicators of water quality within the river basins that feed into the Albemarle-Pamlico estuarine system, including the Neuse River.

“I talk often about monitoring and assessment: two pieces of the puzzle,” Carpenter said. Monitoring data creates a baseline that helps evaluate the effectiveness of management strategies, and points the way toward optimal solutions for the future.

“When you’re instituting management actions to support a healthier, in our case, estuarine system, you want to be able to track the condition of that resource,” Carpenter said.

‘In our hands’

So far, there have been no reported fish kills in the Neuse River this year. But, said Katy Hunt, the season of vulnerability is still young. Last year’s five-week kill ran through October, and it’s only August. While Hunt is no longer surprised by fish kills and other harmful effects of algal blooms, she hesitates to call them

inevitable. Humans cause them, and therefore they are in our hands.

“I think it is a kind of an unfortunate fact of life,” Hunt said. “But at the same time, we made it a fact. And we can change it.”



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About Lena Beck

Lena Beck is a graduate student at the University of Montana, pursuing a master's in environmental science and natural resource journalism. Originally from Oregon, she lived in Washington State for seven years where she wrote for the Seattle University Spectator and Seattle Magazine. She now lives in Missoula, Montana, where she researches and writes about sustainable food and agriculture issues.

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