Podcast Transcript: Community Science Aids Harmful Algal Bloom Research

[Theme music]

Ashley Ahearn (AA): You're listening to Environmental Health Chat – a show from the National Institute of Environmental Health Sciences that explores the connections between our health and our world.

I'm Ashley Ahearn.

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AA: George Bullerjahn remembers the first time he saw a harmful algal bloom. It was in the western part of Lake Erie.

George Bullerjahn (GB): And really, it looked just like somebody had just tossed green paint in the water. And it was a thick scum that covered the surface. It had a really dense, gooey appearance. And it's really quite remarkable to see. It's not a pleasant sight. But it's… you can't miss it.

AA: Dr. Bullerjahn has been studying harmful algal blooms for decades. He's an emeritus professor of biological sciences at Bowling Green State University and, he's the director of the Great Lakes Center for Fresh Waters and Human Health, which is co-funded by NIEHS and the National Science Foundation.

Many of us have seen algal blooms – in ponds, lakes, or the ocean. In fact, there are historical accounts of harmful algal blooms dating back to ancient China. But the term "algal bloom" is kind of a catch all phrase, Bullerjahn says, because the blooms aren't all made up of algae.

GB: And so, they can be bacteria like the cyanobacteria we deal with in Lake Erie. They can be dinoflagellates, like you see off the coast of New England or in the Gulf of Mexico. But basically, a harmful algal bloom is whenever you get a large growth of these organisms, and in most cases, these organisms produce toxic substances.

AA: Drinking water or eating fish or shellfish that have been exposed to a harmful algal bloom can cause serious health effects or even death.

For example, eating seafood contaminated by toxins from algae called *Alexandrium* can lead to paralytic shellfish poisoning, which can cause paralysis and even death. The algae *Pseudonitzschia* produces a toxin called domoic acid that can cause vomiting, diarrhea, confusion, seizures, permanent short-term memory loss, or death, when consumed at high levels.

Bullerjahn studies harmful algal blooms that occur in freshwater, sometimes called cyanoblooms, due to their blue-green color. These blooms can contaminate drinking water and cause gastrointestinal illness and liver damage. He and his team are exploring some key questions that could help keep the public safe:

GB: What are the environmental drivers, which promote the formation of a bloom, promote the persistence of a bloom, and then its decline? What are the best methods for detecting toxins,

detecting cyanobacteria, so that both scientists and the general public can be best informed as to the toxin's presence?

AA: And he and his colleagues have come up with some pretty creative methods to monitor bloom activity in the Great Lakes…They've teamed up with ship's captains.

GB: It's an absolutely wonderful collaboration. And we've had a very good relationship with the charter boat captains. So, what they do is when they take clients out fishing, they get a two-meter integrated water sample as they're heading out to their fishing grounds.

AA: The program was started more than a decade ago in partnership with Ohio Sea Grant. The captains send the samples to a lab at Ohio State where they're analyzed for nutrients, toxins, chlorophyll, and to identify the algae present. These samples augment the samples Bullerjahn and his colleagues gather each week to give a more complete image of algal bloom patterns in Lake Erie.

GB: And at the same time, what's even better is that the captain's got six fishermen that have hired him and are kind of watching them do this, and then they start to wonder, okay, what the heck are you doing? And he tells them and shows them data sheets from prior trips and the total data set, and then they're a little bit educated about these blooms. So, the charter boat captain is getting samples for us to give us a really broad picture of the bloom and at the same time, they're educating people about the problem of harmful algal blooms. So it's just fantastic.

AA: But Bullerjahn's community engagement reaches beyond charter boat captains. He and his colleague, Mike McKay, also developed a collaboration with the U.S. Coast Guard. They wanted to better understand the full lifecycle of algae throughout the year. So, they asked the Coast Guard if they'd gather samples from the icebreaking ships that keep the commercial shipping lanes of Lake Erie open during the winter months.

The young Coasties – many of whom enlist with high school degrees – also get something out of the deal: a taste of college-level science.

GB: We can teach them online, we can go to the ship when we collect samples and give them some lectures on basic biology, and their lab will be grabbing water for us and processing samples for analysis. And it's worked really, really well. And we've had a couple students actually go on to college and graduate. And so this affords them something that they never would have imagined could be available to them, and we get good samples and good data. And getting a sample from the winter is really, really difficult.

AA: So what are we learning from the samples and data Bullerjahn and his team are collecting? Harmful algal blooms are increasing in frequency and intensity in the Great Lakes and along our coastlines. There are many different reasons for these changes, but we humans are partially to blame.

Climate change is raising water temperatures – creating ideal conditions for algae – and shifting weather patterns in the U.S., Bullerjahn explains. And storms that churn up nutrients in lakes and along ocean coastlines can also make for better feeding for algae and cyanobacteria.

GB: If you look at storms, episodic events and so forth, the West is drying up and the East is getting stormy, and we're in the Eastern half. So, we're seeing much, much more large rain events and that drives more nutrients into the lake. Because farmers are applying fertilizer to the

field – this is largely an agricultural problem – and then we have these big flashy events due to a three-inch rainfall that sends a whopping pulse of nutrients in the water, which fuels these bloom events. So that's becoming more common.

AA: Algae love the phosphorus and nitrates in fertilizers that are rinsed off farm fields during heavy rains.

But Bullerjahn says there are ways to reduce that runoff.

GB: We can control the nutrient tap by limiting how much nutrients are applied to the landscape, applying them at the right time, providing economic incentives for farmers to add technologies that keep nutrients on the field or on the landscape. There are technologies to do that. So, we can mitigate these problems by intelligent land use decisions.

AA: Ultimately, Bullerjan says, humans have made a mess of the Great Lakes before. But we managed to turn things around. Now, we need to reduce nutrient inputs into Lake Erie by 40 percent if we want to keep harmful algal blooms in check, he says. But that is possible with good policy, regulation, leadership, and community engagement.

GB: I'm old enough to remember when Lake Erie was declared dead in the 70s. And it was all written up in the Lorax, by Dr. Seuss, and all this. The lake got better. The lake was no longer dead. We fixed it once, we can do it again.

[Music comes up]

AA: With the help of good science and community engagement.

I'm Ashley Ahearn. Thanks for listening to Environmental Health Chat.