

Fish study backs N.C. scientist

Pfiesteria can become a killing organism, chemist says



JoAnn Burkholder in her lab in 2002. She has had to defend her work on Pfiesteria in light of other studies.

Staff File Photo by Shawn Rocco

CATHERINE CLABBY, Staff Writer

The poison produced by a controversial marine microbe that shut down North Carolina and Maryland waters in the mid-1990s has been identified, bolstering claims by an N.C. State University scientist that the organism is toxic.

After nine years of study, The National Oceanic & Atmospheric Administration announced Thursday that two species of Pfiesteria transform from harmless microbes into "toxic organisms that can cause estuarine fish kills."

The work could substantially vindicate NCSU ecologist JoAnn Burkholder, who helped discover the sometimes plant, sometimes animal in North Carolina waters in 1989. Burkholder and others blamed Pfiesteria for killing more than a billion fish in North Carolina estuary waters and in the Chesapeake Bay in the 1990s. She and others also argued that Pfiesteria endangers human health.

Burkholder's research has been divisive. Critics faulted her complicated early descriptions of the Pfiesteria (pronounced fis-TEAR-e-ah) life cycle and voiced repeated doubts that it spewed poison to attack fish prey.

The NOAA research, produced by chemist Peter Moeller, identifies a fleeting venom that Pfiesteria produce. Burkholder said it should put an end to much of the criticism against her.

"The past nine or 10 years have been difficult. I really would not have wanted to live them. But this is a great day," said the NCSU ecologist, long a hero to environmentalists and a hysteric to detractors in public health and science.

Burkholder critic Wolfgang Vogelbein remained skeptical Thursday that the toxic material plays an important role in the wild. The Virginia Institute of Marine Sciences researcher and others, including a NOAA microbiologist, have published conclusions that Pfiesteria kills fish by attacking them directly, and they blame mold for producing sores on fish in pfiesteria-tainted waters.

"As scientists we are supposed to be skeptics. That is our job," Vogelbein said, adding that studies in the wild are needed to confirm the findings.

In the mid-1990s, Burkholder angered state health experts, fishermen and farmers with claims that Pfiesteria blooms posed environmental and human health threats in estuary waters. When fishermen and boaters experienced memory problems and other ailments during a 1997 pfiesteria outbreak in Maryland, Congress staged hearings and poured research dollars into the topic.

A popular book, "And The Waters Turned to Blood," portrayed Burkholder as a crusader fighting the powers that be, infuriating her critics and winning her a fan base across the country. Burkholder has sparred with other scientists, faulting the award of research grants to others and sometimes refusing to share Pfiesteria samples, saying they were too expensive to produce.

A tricky find

Moeller, a chemist based in Charleston, S.C., on Thursday said Thursday that several chemistry studies confirmed that Pfiesteria produces a poison that kills fish. But it was tricky to find.

The organism makes fleeting poisons under specific conditions, when it is in the presence of certain metals and the metals are in certain charged states, Moeller said. Light can influence their production, as can temperature.

Moeller said he thinks that the toxins are "there and gone. I doubt they carry over into seafood," he said. He added that he thinks his findings bolster Burkholder's claims.

The chemist saw the toxin repeatedly killed tiny fish called sheepshead minnows in the laboratory. But he stressed that its true hazards won't be confirmed until it is studied in nature.

Burkholder has warned repeatedly that Pfiesteria is not only poisonous to fish, but also highly dangerous to people. She and a scientist she employed developed memory and learning problems after being exposed to the marine organism, in her former Raleigh laboratory.

Duke scientist Ed Levin found that Pfiesteria created brain damage in rats. Knowing the Pfiesteria chemical will allow him to confirm and expand those findings.

"This is really the key in terms of following up the work. We have the chemical to study the dose effect," Levin said. "This will take it a great leap forward."

Moeller said the cascade of effects needed to make the toxin, especially the presence of metals in the water where Pfiesteria appears, is consistent with Burkholder's assertions that pollution turns Pfiesteria toxic.

"What this highlights is that there are environmental cues. I think this plays together with those observations," Moeller said.

In North Carolina, there has not been a Pfiesteria outbreak since 1999. Burkholder has proposed that Hurricane Floyd, which caused massive flooding in Eastern North Carolina in 1999, flushed the organism from waterways. Moeller's research now suggests that environmental conditions may also have been altered by the storm.

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A history of Pfiesteria

1989: Two N.C. State scientists, JoAnn Burkholder and Edward Noga, discover a fish-killing dinoflagellate in the Pamlico River. They say the "phantom algae," which can change into at least 19 different forms, poisons fish and attacks their flesh.

1991: The organism's presence is confirmed in other North Carolina rivers. Burkholder names the organism "Pfiesteria."

1992: Burkholder's and Noga's findings stun the scientific community. Only when the NCSU researchers capture the algae's rapidly changing forms under high-speed film and another well-known scientist later replicates the study do other scientists believe them.

1994: Research on Pfiesteria is delayed when NCSU scientists, including Burkholder, become ill after exposure to the organism's toxins. Officials at NCSU say they want to build a protective containment facility before continuing research on dinoflagellate specimens.

1995: Multiple fish kills result in millions of dead fish over the summer. Many of the fish have open sores on their skin, a sign of Pfiesteria. Burkholder believes hog waste that runs off into rivers might have unleashed the lethal dinoflagellate. State officials declare an unprecedented health warning for the lower Neuse River, and advise people not to swim, fish or come in contact with waters where Pfiesteria has been detected. The state puts up nearly \$600,000 to study Pfiesteria.

1996: A feud erupts over the distribution of research funds by the N.C. Sea Grant College Program, in which Burkholder asserts that funds are going to less qualified scientists. Burkholder also complains that state public health leaders are denigrating her work and credentials. Meanwhile, a fish kill in the New River wipes out at least 1 million fish and is attributed to two dinoflagellates, including Pfiesteria, with links to nutrient pollution. A Duke University researcher finds that Pfiesteria causes serious learning and memory impairment in rats.

1997: A book, "And The Waters Turned to Blood," is published about Burkholder and the Pfiesteria saga in North Carolina. The book is highly critical of the N.C. Department of Environment, Health and Natural Resources, and gets wide national media attention. A research team at NCSU and two other labs isolate one of the toxins secreted by the Pfiesteria organism. NCSU says it is planning a \$1 million research center at Centennial Campus devoted exclusively to Pfiesteria, which is now raising health concerns across the Mid-Atlantic coast. Additional schisms arise between Burkholder and state public health officials, who are accused of mismanaging investigations into Pfiesteria.

1998: An Environmental Protection Agency scientist based in RTP finds the first evidence that Pfiesteria may cause long-term health problems in people. The scientist found vision problems among 14 North Carolina fishermen who were exposed to fish-kill waters. Two state public health officials are reassigned for being overly-skeptical that pfiesteria can cause harm to people. But a scientific panel headed by then UNC-Chapel Hill public health dean Bill Roper finds little long-term injury among people exposed to coastal North Carolina waters where Pfiesteria has been found.

2000: Burkholder announces the discovery of a second type of Pfiesteria. Both, she says, thrive on waste from hog lagoons and both secrete the same toxin.

2002: Three scientific papers question some of the dramatic, early descriptions of Pfiesteria, including its ability to make a neurotoxin -- the feature that made it a human health risk. Burkholder accuses dissenting researchers of gaining federal funding to study pfiesteria by saying they could unmask a toxin but failed to deliver.

2006: Federal researchers say mold and not pfiesteria is responsible for fish kills in the 1990s, and that the mold poses no threat to people.

2007: A federal scientist says he has found that Pfiesteria does, indeed, produce a toxin when the right conditions are present, including sunlight, metals, and a certain water temperature.

-- Compiled by News Researcher Brooke Cain