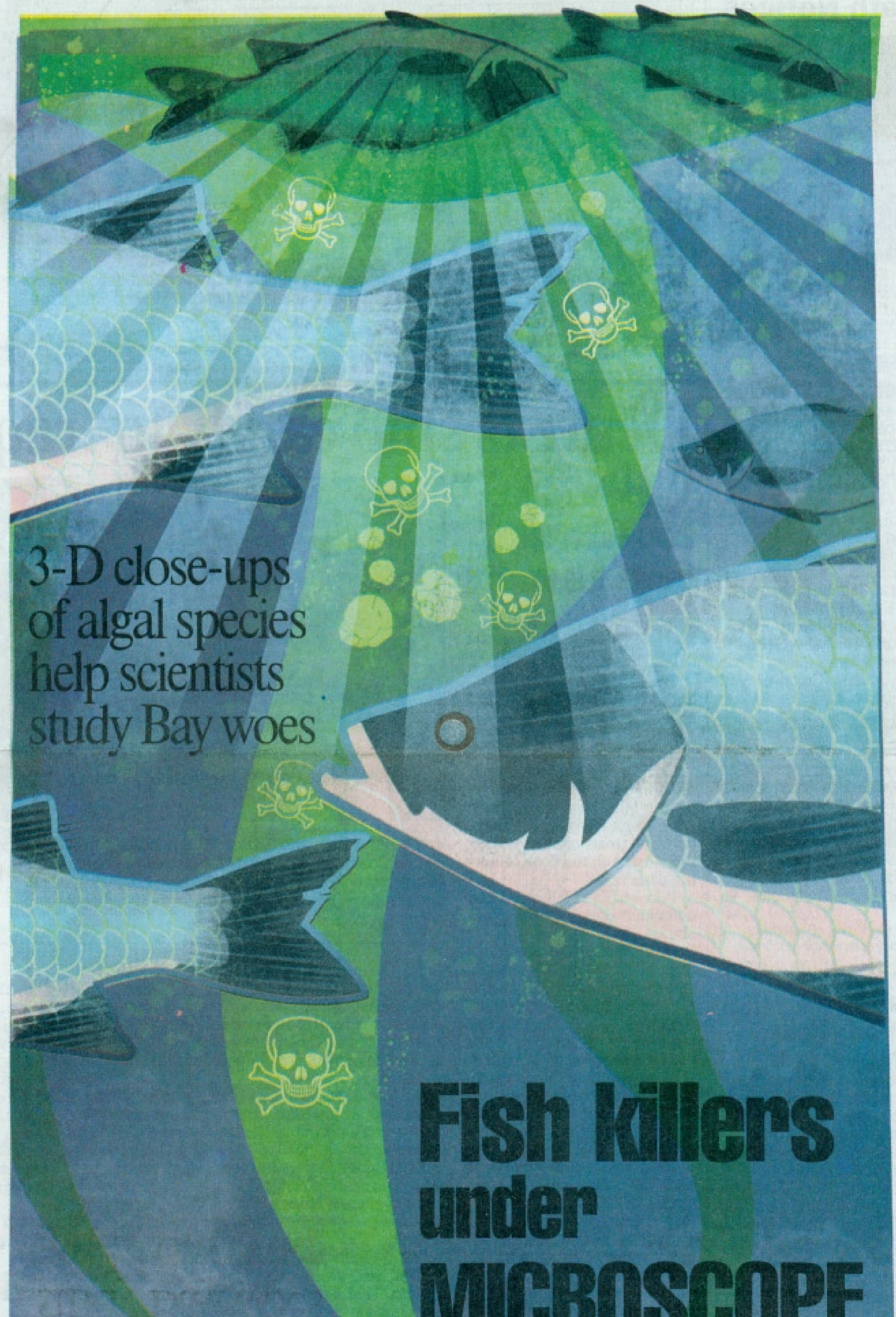

Linas Garsys/The Washington Times

3-D close-ups of algal species help scientists study Bay woes

Fish killers under MICROSCOPE

By Jen Waters
THE WASHINGTON TIMES

Scientists are one step closer to understanding the harmful algal blooms that plague the Chesapeake Bay. Digital holographic microscopy recently has provided a three-dimensional look at some of the microbes that have been wreaking havoc.

Because of the technology, researchers have identified the hunting tactics of two of the microbes associated with fish kills in the Bay and various waterways, says Robert Belas, professor of marine microbiology and microbial genetics at the University of Maryland Biotechnology Institute (UMBI) in Baltimore.

"This is the first step to understanding how red tides develop, what keeps them together and why they don't disperse," Mr. Belas says. "It ultimately might give us clues as to how to artificially cause them to disperse and remove the problem."

At the end of last month, the results of the study from UMBI and Johns Hopkins University in Baltimore were reported first in "Proceedings of the National Academy of Sciences." The study focused on the attack patterns of two dinoflagellates, or single-celled algae, called karlodinium veneficum and pfiesteria piscicida.

Both of the microbes are considered to create toxins that kill large numbers of fish, Mr. Belas says. Through digital holographic microscopy, he learned that pfiesteria piscicida uses a hunting tactic similar

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to that of a cheetah, which pounces on its prey. It captures small micro-organisms, or other algae, to survive, consuming them by using an extendible mouth. It is a voracious eater and will eat 10 times its weight a day.

In contrast, karlodinium veneficum is slower than pfiesteria piscicida and uses an ambush method to consume its prey, he says. It produces a toxin and uses a harpoonlike, barblike arm to capture its food.

This is the first time anyone has been able to distinguish these behaviors in dinoflagellates, Mr. Belas says. Along with Mr. Belas, Allen R. Place, professor of biochemistry at the UMBI, contributed to the research.

"This helps us understand how these large, dense dinoflagellates form and mature in the Chesapeake Bay," Mr. Belas says. "Now we need to learn how the microscopic behavior translates into a series of events in the Chesapeake Bay that can lead to fish kills and other problems for human beings and the environment."

In the past, it has been hard to study karlodinium veneficum and pfiesteria piscicida under a two-dimensional microscope. The organisms are very fast swimmers, Mr. Belas says. Dinoflagellates are only about 10 micrometers in size. One micrometer is about 1/30th the average width of a human hair.

"Looking at these microscopic organisms with a conventional microscope is exceedingly difficult," Mr. Belas says. "They move out of the field of view, going from left to right almost instantaneously."

Through digital holographic microscopy, researchers were able to acquire 2,000 images per second with greater depth of field, he says.

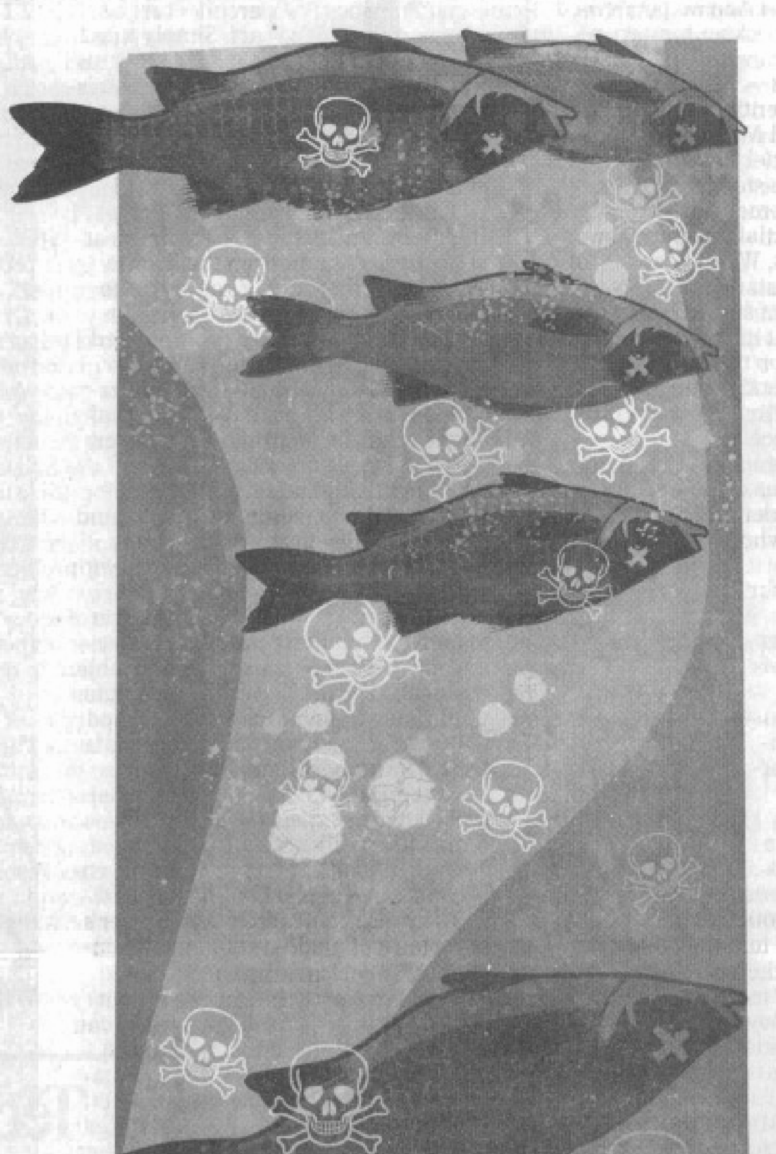
Jian Sheng, an assistant professor of mechanical engineering at the University of Kentucky in Lexington, is responsible for analyzing and following the thousands of organisms through digital holographic microscopy. He also has an adjunct faculty position at Hopkins University. As part of his doctoral thesis, he developed sophisticated software to track the micro-organisms. While writing his thesis, Mr. Sheng was a graduate student of Joseph Katz, the William F. Ward Sr. distinguished professor in the department of mechanical engineering at Hopkins.

"The knowledge gained from the previous methods is limited," Mr. Sheng says. "It is not complete. We tried to visualize the microbes' behavior and motion in their natural environment."

The three-dimensional advantage of digital holographic microscopy allowed for the ability to quantify the behavior of the microbes more accurately, Mr. Katz says. The study pushed the boundaries of holographic technology, marking the first time anyone implemented digital holographic microscopy to track the motion of thousands of particles simultaneously, he says.

"This type of approach will revolutionize microscopy," Mr. Katz says. "By knowing how the organisms behave in response to different stimuli, we may find better ways of dealing with the problem."

The problem of harmful algal blooms is increasing day by day, says Beth McGee, senior water quality scientist at the Chesapeake Bay Foundation, a nonprofit organization based in Annapolis. She has a doctorate in environmental science.



Linas Garsys/The Washington Times

"We're seeing more and more blooms of the toxic algae species in coastal water throughout the country," Ms. McGee says. "It affects the amount of nitrogen and phosphorous pollution that feed into coastal systems like the Chesapeake Bay and others. The harmful algae are an indicator that water quality seems to be getting worse."

Ms. McGee says she is thankful for the efforts of Hopkins University and UMBI.

"There are environmental triggers that work together to allow an algae bloom to occur," Ms. McGee says. "The study helps us to understand the ecological effects of the blooms on fish. The species they have been focusing on are direct fish killers."

The toxic micro-organisms have had a negative impact on the fishing industry and hampered people's ability to enjoy the water in the Northeast, says John Torgan, spokesman for Save the Bay in Providence, R.I. The nonprofit organization is working to protect Narragansett Bay.

"We need to get good scientific information on these critters and do whatever we can to mitigate the impacts," Mr. Torgan says. "The problem isn't limited to the Chesapeake Bay."