South Carolina Task on Harmful Algae Group

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S.C. TASK GROUP ON HARMFUL ALGAE

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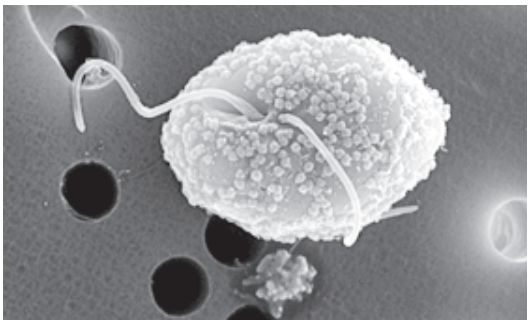
Massive "Red Tide" in Bulls Bay

On a routine aerial survey for leatherback sea turtles, SCDNR wildlife biologist Tom Murphy noticed something odd about the water in Bulls Bay, a popular fishing and clamming area about 35 miles north of Charleston, S.C. The water around Bulls Bay, which is located within the Cape Romain National Wildlife Refuge, is classified as "Outstanding Resource Waters" — the highest water quality designation according to the S.C Department of Health and Environmental Control and the International Association of Fish and Wildlife Agencies. But on April 29, 2003 Murphy witnessed a massive bloom of *Heterosigma akashiwo* that extended from inside the bay to about five miles offshore. "I've been flying the South Carolina coast for 28 years and never saw a large algal bloom until last spring," said Murphy. "The scale of the bloom was impressive."

The color of the water was a dark reddish-brown, and the bloom covered an area of over 80 square miles. These types of blooms, which can reach densities so high that the water becomes discolored, are commonly referred to as "red tides" and occur regularly in many of the world's estuarine regions. This bloom was the second harmful algal bloom documented in South Carolina offshore waters. The first, a *Karenia brevis* bloom, was transported by the Gulf Stream from the west coast of Florida in 1988-1989.



NOAA/NOS Marine Biotoxins Program

Heterosigma akashiwo belongs to a class of marine and freshwater phytoplankton known as raphidophytes. Largely understudied, raphidophytes are single-celled, flagellated, golden-brown algae. Three of the four genera belonging to the marine raphidophyte family are found along the South Carolina coast: *Heterosigma*, two species of *Chattonella*, and *Fibrocapsa*. *H. akashiwo* blooms have been identified in Puget Sound (Wash.), Chesapeake Bay (Md.), Japan, and now here in South Carolina.

Murphy immediately called Task Group member Fred Holland (NOAA) who notified Alan Lewitus (USC, SCDNR), also a member and director of the S.C. Algal Ecology Lab (SCAEL). Lewitus then dispatched Jason Kempton and others from the lab to investigate. Kempton, a wildlife biologist with SCDNR, was one of the first responders to the scene. "We got

the phone call, packed up the boats, and went out right away," said Kempton. *H. akashiwo* abundance measured nearly 95,000 cells per milliliter, classifying this event as a very dense algal bloom. Murphy spotted about 10,000 dead fish, but the fish could have died from exposure to low salinity waters or gills clogged by the bloom, and not necessarily toxicity from the algae. By the next day, the bloom started to dissipate, and it resulted in no human health effects or reason to close fishing and shellfish grounds.

Kempton's crew collected 61 water and sediment samples from inshore tidal creeks and offshore waters. Sediment samples were taken because *H. akashiwo*, as well as most of the HAB species found in S.C. waters, are known to transform into dormant cysts, which sink to the bottom only to resurface when conditions are favorable for germination and colonization.

Ideal water temperatures for *H. akashiwo* blooms are 59-77 degrees Fahrenheit—the water temperature in Bulls Bay was 73 degrees. Salinity also is a factor in the germination of *H. akashiwo* cysts: Surface salinity during the bloom was 21.9 practical salinity units (psu), which is far less than the average of 35 psu for the area, and perfect for the growth of this particular algae.

The *H. akashiwo* bloom coincided with an unusually wet spring preceded by drought conditions. The Bulls Bay area received an extra two inches of rain during March and April when compared to the standard 30-year average for the same months. Another factor in the bloom formation was the release of fresh water from the Santee Dam to control water levels of other rivers and lakes after heavy rains. The mouth of the Santee River is located north of Bulls Bay. The increased fresh water input from the dam release, combined with an unusually rainy spring, lowered the overall salinity in the bay. Low salinity combined with warm water temperature created perfect conditions for the *H. akashiwo* bloom.

While *H. akashiwo* blooms are known to cause fish kills worldwide, the Bulls Bay event may be the first time that this harmful alga has been associated with a fish kill on the east coast. It is important to note that this alga is not the same species responsible for last year's manatee deaths in Southwest Florida—that event was caused by the toxic alga, *Karenia brevis*.

Whether or not *H. akashiwo* actually produces a toxin remains to be seen. Researchers with the NOAA/NOS Marine Biotoxins Program immediately performed a receptor binding assay for brevetoxin on the Bulls Bay bloom samples, and the results showed no evidence of brevetoxin. However, there are many proposed ways that *Heterosigma* can have a lethal effect on fish, and this is a very active area of research at the SCAEL and the NOAA/NOS Marine Biotoxins Program.

In addition to the bloom's association with a fish kill, SCAEL research discovered some harmful effects of *H. akashiwo* on the southeastern oyster, *Crassostrea virginica*. In one study, oysters were exposed to water samples taken from the Bulls Bay bloom, laboratory cultured *H. akashiwo*, and clean seawater. The researchers found that exposing oysters to high cell densities of *H. akashiwo* resulted in significant cellular damage to the liver, decreasing one of the oysters' natural defense mechanisms. The study also raises questions about long-term effects of *H. akashiwo* exposure on the reproductive ability of oysters, as the damaging effects continued even after a 7-day recovery period in clean seawater.

Task Group scientists and their teams will continue to work in Bulls Bay, sampling water and sediment, conducting environmental

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South Carolina Task Group on Harmful Algae

The S.C. Task Group on Harmful Algae publishes this newsletter three times a year to share knowledge about harmful algae and communicate activities of the task group. Interested constituents include elected and appointed officials, natural resource managers, public health organizations, and the general public. Comments regarding this or future issues are welcomed. Subscriptions are free upon request.

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S.C. Algal Ecology Lab

Lab contributes to HAB knowledge, launches new Web site

The South Carolina Algal Ecology Lab (SCAEL), based in Charleston, S.C., was created to understand the ecology and impacts of harmful algal blooms (HABs). Through monitoring, event response, basic research, and a new Web site, the SCAEL contributes greatly to the growing information on HABs.

Directed by Task Group member Alan Lewitus, the SCAEL is affiliated with the S.C. Department of Natural Resources Marine Resources Research Institute (SCDNR-MRRI), the University of South Carolina's Belle W. Baruch Institute for Marine and Coastal Sciences, and the Hollings Marine Laboratory. Additional partners include local, state, and federal agencies, as well as educational facilities.

The SCAEL employs several talented research specialists who work on everything from collecting and analyzing samples to the life cycles of algal species, molecular probe development, and data management.

The lab also has a fish kill and algal bloom response team to investigate potentially harmful algal blooms in South Carolina. Scientists with the SCAEL routinely monitor South Carolina waters, but citizen involvement in reporting a fish kill and/or an algal bloom helps scientists get a head start on examining a HAB event.

The SCAEL recently launched a Web site developed by Patrick Brown, Ph.D., a research specialist with Belle Baruch. Brown worked with SCAEL researchers Sabrina Hymel and Alan Lewitus to create and design the site. Aside from maintaining the Web site, Brown studies the relationships of raphidophytes (a family of golden-brown algae) to one another and to other algae, as well as what role algal viruses play in controlling HABs.

The Web site includes links to current research, recent publications and presentations, employee's education backgrounds and research interests, along with information on the three different research facilities and a myriad of affiliated organizations. Visitors also can view a South Carolina Harmful Algal Bloom map that documents HABs from 16 different species.

One particularly useful feature available on the Web site is an algal bloom and fish kill reporting form for citizens. Lara Mason, harmful algal bloom and fish kill coordinator, receives the form and notifies a response team that immediately investigates the event. After assessing the situation and collecting samples, the SCAEL collaborates with other state and federal agencies, including the S.C. Department of Health and Environmental Control, SCDNR, and the NOAA Marine Biotoxins Analytical Response Team, to implement appropriate environmental and human health safety precautions. All information collected is also incorporated into a comprehensive database of HAB information.

Another exciting feature of the site is Habweb, an on-line discussion group for taxonomists, physical oceanographers, and graduate students. And for teachers, students, and the young at heart, there is a "Fun with Algae" section with a maze, jokes, and songs about algae. Future plans for the site include classroom exercises and sources for readily available algal cultures.

Through the new Web site, monitoring, event response, basic research, publications, and their close interaction with the S.C. Task Group on Harmful Algae and the Southeast Phytoplankton Monitoring Network, the SCAEL continually provides information to scientists and the public in an effort to promote a better understanding of HABs. To learn more about the SCAEL, visit http://links.baruch.sc.edu/scael.

See a bloom or fish kill in South Carolina?

Contact Lara Mason, SCDNR harmful algal bloom and fish kill coordinator, at 843-953-9077, or visit **http://links.baruch.sc.edu/scael** and click on "See a Bloom?" in the upper left-hand corner. The SCAEL will investigate immediately.

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experiments, and trying to determine what, if any, toxin is associated with *H. akashiwo*. A Real-Time Remote Monitoring platform, developed by Howard Glasgow at North Carolina State University, will be placed in the bay, which will complement existing sampling, as well as provide an early-warning system for rapid response to future blooms.

Information and Resources

Web sites

S.C. Algal Ecology Lab: http://links.baruch.sc.edu/scael

NOAA's Marine Biotoxins Program: http://www.chbr.noaa.gov/CoastalResearch/Whois.htm

NOAA Coastal Services Center's Harmful Algal Bloom Project: http://www.csc.noaa.gov/crs/habf

Florida Marine Research Institute, featuring "red tide" information: http://www.floridamarine.org

Centers for Disease Control and Prevention, Health Studies Branch: http://www.cdc.gov/nceh/hsb/

Ecology and Oceanography of Harmful Algal Blooms (ECOHAB) Program: http://www.redtide.whoi.edu/hab/nationplan/ECOHAB/ECOHABhtml.html

Publications

Harmful Algae News. The Intergovernmental Oceanographic Commission (IOC) newsletter on toxic algae and algal blooms, Tim Wyatt, Editor: http://www.ioc.unesco.org/hab/news.htm

Harmful Algae. Sandra Shumway and Theodore Smayda, Editors-in-Chief: http://www.elsevier.com/locate/hal

Nature Out of Balance video and educational guide. Covers types of HABs and their effects on water quality and human health. Order from N.C. Sea Grant at http://www.ncsu.edu/seagrant

The Pfiesteria Files, documentary video co-produced by MD Sea Grant and MD Public Television. Order from MD Sea Grant at http://www.mdsg.umd.edu

International Directory of Experts in Harmful Algae, an IOC publication: http://ioc.unesco.org/hab/data.htm

S.C. Task Group on Harmful Algae Web Site Now On-line at www.scseagrant.org/schab.htm

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