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S.C. TASK GROUP ON HARMFUL ALGAE

S.C. Sea Grant Consortium

Communications
Extension Program

S.C. Department of Health and Environmental Control

Bureau of Water
Bureau of Disease Control
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Site Visit Updates CDC

In August 2002, the S.C. Task Group on Harmful Algae hosted a site visit at the Hollings Marine Laboratory in Charleston, S.C. for Dennis Christianson from the Centers for Disease Control and Prevention (CDC). Mr. Christianson is the deputy chief of CDC's Health Studies Branch and project director for the grant titled, "Assessing risks of *Pfiesteria* and other toxic algal blooms in South Carolina coastal estuarine ponds." The CDC grant was initiated due to documented fish kills in three coastal residential community and golf course ponds on Hilton Head Island and Kiawah Island in spring 2001.

Researchers estimate there are at least 1,456 ponds on the South Carolina coast, including 136 on Kiawah Island and 748 on Hilton Head Island, the vast majority of which are brackish (estuarine). These ponds have been called "incubators" for harmful algal blooms (HABs): Analyses of samples show high levels of nutrients such as ammonium, nitrate, nitrite, orthophosphate, dissolved organic carbon and nitrogen, and silicate. The samples also contained insecticides, fungicides, herbicides, and fertilizers. In addition to this nutrient-contaminant medley, researchers found treated sewage effluent, which is commonly used as fertilizer on golf courses.

From April 2001 to May 2002, researchers collected 285 samples from 45 ponds and found nine harmful algal species present in 250 of the samples. Nearly half of the ponds contained harmful algae in "bloom" proportions, or where the species was a dominant or co-dominant member of the phytoplankton community. The species identified were *Chattonella* spp., *Fibrocapsa japonica*, *Heterosigma akashiwo*, *Karlodinium micrum*, *Katodinium rotundatum*, *Kryptoperidinium* spp., *Pfiesteria* spp., *Prorocentrum* spp., and *Prymnesium parvum*.

Retention ponds are constructed to contain and treat stormwater pollutants, thereby minimizing impacts of runoff on the environment. Retention ponds can also provide an aesthetically pleasing addition to the landscape. However, research suggests that these ponds as currently constructed may actually promote formation of HABs.

"I and CDC continue to be impressed with all of the South Carolina research efforts in toxic algae connected to the *Pfiesteria*-Related Illness Surveillance and Prevention cooperative agreement," said Mr. Christianson. With funding from the CDC, NOAA, and other sources, the S.C. Task Group on Harmful Algae is able to remain at the forefront of monitoring and research, human health surveillance and response, and public education about HABs. As coastal development continues to increase, the resulting human impacts on the environment require proactive resource management and planning to minimize adverse impacts on both ecosystem and human health.

Sea Grant, ECOHAB Fund S.C. “Red Tide” Research

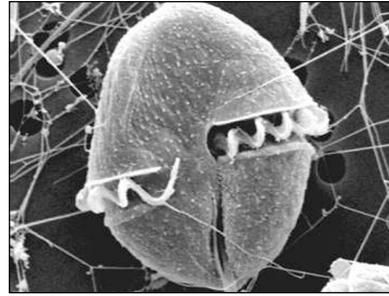
With the establishment of the S.C. Task Group on Harmful Algae in late 1997, research efforts on harmful algal blooms (HABs) in South Carolina waters has greatly increased. Although some discoveries of HABs are likely from such increased surveillance, the number of blooms documented from S.C. estuarine waters in the last few years has been much higher than expected. For example, the frequency by which dense HABs are routinely found in stormwater retention ponds may be unprecedented (see story on page 1). In contrast to the number of different HAB types observed in these brackish ponds, documented blooms in South Carolina’s tidal creeks have been dominated by one particular type—what researchers have tabbed the “S.C. red tide

dinoflagellate.” These tidal creek blooms have become an issue of concern for task group members. Observed in several S.C. tidal creeks from Georgetown to Hilton Head, these HABs reach densities high enough to discolor water, and appear throughout the spring and summer. In addition, recent findings indicate that these blooms may cause fish kills by depleting oxygen, and can directly cause physiological stress to oysters. Given their prevalence and potential to harm shellfish, the ecological and economic impacts of these newly observed blooms may be considerable.

Thanks to a grant from S.C. Sea Grant Consortium, task group investigators Alan Lewitus (USC’s Baruch Institute and SCDNR’s Marine Resources Research Institute [MRRI]), Jason Kempton (SCDNR/MRRI), and Jennifer Wolny

(SCDNR/MRRI) were able to conduct research on this HAB that advanced understanding of its identity. By using a combination of several microscopic and DNA-based analyses, the scientists discovered that there are at least two different species of dinoflagellates forming these blooms. The identity of one

has been confirmed as *Kryptoperidinium foliaceum*, but the other is an unidentified species in the genus *Kryptoperidinium*, and may represent a newly discovered species. The two



Kryptoperidinium foliaceum image courtesy of Howard Glasgow, Jr., N.C. State University

species look similar under standard microscope methods, so DNA-based probes are used to distinguish these species. DNA-based probes, the development of which is an ongoing part of this research, are essential for sorting out the distribution of each species and, ultimately, for understanding their ecology and potential harmful effects on natural resources.

The results of S.C. Sea Grant-funded research served as the basis for a follow-up study that was recently approved for funding by the ECOHAB (Ecology and Oceanography of Harmful Algal Blooms) program. ECOHAB is a joint program of the National Oceanic and Atmospheric Administration, National Science Foundation, Environmental Protection Agency, Office of Naval Research, and National Aeronautics and Space Administration. The three-year grant is titled, “Widespread *Kryptoperidinium* blooms in South Carolina estuaries: Improving detection, understanding why they

South
Carolina
Task
Group

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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form, and assessing their impact on shellfish.” The grant allots nearly \$400,000 to co-principal investigators Alan Lewitus and Amy Ringwood (SCDNR/MRRI), who will be joined by collaborators from Florida Marine Resources Institute (Karen Steidinger), Texas A&M (Peter Rizzo), and Virginia Institute of Marine Science (Deborah Bronk). The goals of this research are to:

- determine the identity of bloom organisms and their relationship to other dinoflagellates;
- develop molecular probes to allow accurate and efficient detection at the species level;
- determine the environmental factors, such as coastal development, that cause the blooms to form; and
- determine the effects of these blooms on shellfish resources.

The results from this research will be of interest to scientists worldwide because of the great need for sorting out the identity of *Kryptoperidinium* species.

In two recent international meetings (a workshop on “Molecular Probes for the Detection of Harmful Algae” in Galway, Ireland, May 2002, and the 10th International Conference of Harmful Algae in St. Pete Beach, Florida, October 2002), Jason Kempton gave contributed and invited oral presentations on comparing properties of these dinoflagellates. The feedback from the presentations has snowballed into a consensus among HAB experts that current classification schemes for this group of species are in disarray and need reevaluation. S.C. Task Group on Harmful Algae researchers are leading the way in advancing the science behind this important environmental issue.

Extension Specialists Hold HAB Workshop

This summer S.C. Sea Grant Extension Program specialists Cal Sawyer and Jack Whetstone organized a Harmful Algal Bloom Workshop at NOAA’s Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) in Charleston, S.C. Members of the S.C. Task Group on Harmful Algae presented their work on HABs in South Carolina.

The workshop was an outreach component of a grant from NOAA National Ocean Service for the Harmful Algal Bloom Initiative for South Carolina. Intended as an in-service training session for Clemson Extension agents, the workshop drew over 50 participants, including representatives from NOAA, S.C. Department of Health and Environmental Control, S.C. Department of Natural Resources, University of South Carolina, U.S. Geological Survey, city of Myrtle Beach, city of Charleston, city of Isle of Palms, Town of Hilton Head, and Kiawah Island Community Association.

The agenda included the following presentations:

- Overview of the S.C. Task Group on Harmful Algae—Rick DeVoe, S.C. Sea Grant Consortium
- Introduction to HABs in South Carolina—Alan Lewitus, University of South Carolina Belle Baruch Institute and S.C. Department of Natural Resources
- Ecological Monitoring Activities—Robert Van Dolah, S.C. Department of Natural Resources Marine Resources Division
- Volunteer Monitoring Activities—Steve Morton, NOAA/CCEHBR

- Research Overview and Assessment Efforts—Geoff Scott, NOAA/CCEHBR and Alan Lewitus, USC, SCDNR
- HABs and Human Health—Robert Ball, S.C. Department of Health and Environmental Control
- Mitigation and Best Management Practices to Improve Water Quality—Cal Sawyer and Jack Whetstone, S.C. Sea Grant Extension Program

After the workshop, attendees took a field trip to Kiawah Island with Norm Shea, Kiawah Island Community Association (KICA) lakes director. Since monitoring began on Kiawah, the golf course ponds have been algal bloom “hot spots” during the summer months. Participants on the field trip observed Susan Wilde with SCDNR and USC take water samples of a blue-green algae, and measure pH and salinity. Before Mr. Shea was hired, all the ponds were on a preventive schedule and sprayed with pesticides every month, costing upwards of \$100,000 per year. Now KICA is taking an ecologically based approach to control the algal blooms, including working with HAB scientists to monitor the ponds and enlisting the help of the U.S. Fish and Wildlife Service to stock oysters and install native *Spartina* grass.

As a result of the workshop, environmental horticulturalist Gary Forrester of Clemson Extension in Horry County is now working with the S.C. Phytoplankton Monitoring Network (SCPMN), directed by Steve Morton at NOAA/CCEHBR. Mr. Forrester has recruited master gardeners to sample two locations once-a-week in Murrell’s Inlet and Pawley’s Island, and hopes to work with the SCPMN to expand the monitoring network to schools in Horry and Georgetown counties.

Information and Resources

Web sites

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>

National Office for Marine Biotoxins and Harmful Algal Blooms at Woods Hole Oceanographic Institution: <http://www.whoi.edu/redtide>

Bigelow Laboratory for Ocean Sciences, Toxic and Harmful Algal Blooms: <http://www.bigelow.org/hab>

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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