CDC Awards Grant for Coastal Estuarine Pond Research

There are several thousand brackish ponds associated with residential housing or recreational areas along the South Carolina coast. These lagoons are marked by close human interaction—fishing, swimming, boating, golfing—and usually receive high levels of nonpoint source pollutants from fertilization and irrigation. Slowly flushed, shallow, and having low dissolved oxygen, the ponds are favorable for the growth of many types of HABs.

Recognizing the need for pond research, the Centers for Disease Control and Prevention (CDC) recently funded a one-year proposal, “Assessing risks of *Pfiesteria* and other toxic algal blooms in South Carolina coastal estuarine ponds.” The project director is Robert Ball, MD, MPH, an epidemiologist with the S.C. Department of Health and Environmental Control (SCDHEC) and S.C. Task Group on Harmful Algae member. Several state agencies and institutions will collaboratively evaluate the impacts of *Pfiesteria piscicida*, *Pfiesteria shumwayae*, *Cryptoperidiniopsis spp.*, and other harmful algal blooms (HABs) on the environment and human health.

The grant will allow task group scientists to:
- determine the association between harmful algal abundance, harmful algal toxicity, and environmental variables in ponds near residential or recreational locations vs. ponds in undeveloped areas;
- establish the relationship between harmful algal abundance, harmful algal toxicity, and ecosystem properties in ponds near residential or recreational locations vs. ponds in undeveloped areas;
- study toxin production and fish pathology; and
- correlate findings with any reported human health effects through an academic-based medical evaluation system.

South Carolina’s estuaries have been shown to harbor species of *Pfiesteria* and other harmful algae. In spring 2001, three ponds located in coastal residential communities and golf courses had fish kills associated

> Are these blooms unique or annually persistent?
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with these HABs. Although estuarine rivers and harbors in South Carolina are unlikely to have *Pfiesteria*-related fish kills or human health events because of high tidal flows, the discovery of HABs in coastal estuarine ponds requires more research and rapid response.

**Ecological studies of ponds**

Are these blooms unique (e.g. the result of the recent 3-year drought) or annually persistent? And to what extent is nutrient loading caused by increased coastal development linked to the problem? Brackish ponds in South Carolina had never been examined for harmful algae.

Blooms of *Pfiesteria* in brackish ponds may be promoted by annually high nutrient loads. Researchers say nutrient buildup in pond sediments could cause more HABs, and large blooms could occur over time. The surveillance program provided for in this grant will not only improve understanding of how coastal development influences HABs in residential ponds, but will assess HAB impacts on environmental conditions, ecosystem structure and function, and fish and human health.

Scientists will focus on “hot spots” using known *Pfiesteria*/HAB, fish kill, and GIS data to determine the best sites for monitoring three coastal regions: Hilton Head Island, Kiawah Island, and the Myrtle Beach area.

In each region, brackish ponds differing in age and influenced by residential housing complexes or recreational areas will be studied. Most ponds contain finfish, and ponds with a history of fish kills will be targeted. In addition, two brackish wetland impoundments from the Sampit River/Winyah Bay area and three residential freshwater ponds (one from each region) will be sampled.

Approximately two dozen ponds will be sampled weekly or bi-weekly during the summer and monthly during the winter.

Researchers will study population growth and control, feeding preferences, and the effects of high nutrient levels for *Pfiesteria piscicida*, *Pfiesteria shumwayae*, and *Cryptoperidiniopsis spp.*

Four theories will be tested:
1) The population growth of harmful algal species is indirectly stimulated by nutrient supply.
2) These species prefer to feed on cryptophytes, a type of phytoplankton associated with fish kills in North Carolina and Maryland.
3) The growth of *Pfiesteria piscicida* and *Cryptoperidiniopsis spp.* can be controlled by microzooplankton grazing.
4) HABs require a high nutrient supply for bloom formation.

**Human health response**

Partner agencies are developing Rapid Comprehensive Response Teams for fish kills, algal blooms, and reports of human health effects. SCDHEC, in collaboration with the Medical University of South Carolina (MUSC), has developed a system of patient referral and evaluation for potential HAB toxin effects. This system will make a DHEC medical epidemiologist more available, provide timely, thorough HAB toxin data to correlate with patient evaluation, and allow medical evaluation by an infectious disease specialist at MUSC for certain cases. The Response Teams will also inform the public about major fish kill events, HABs, and human health effects through media releases, community forums, and informational material.

Findings from the research will be available in a final report scheduled for release in 2002.

Research participants include SCDHEC, SCDNR, USC’s Baruch Institute, NOAA’s National Ocean Service, S.C. Sea Grant Consortium, and MUSC.
Tidal Creek Habitats Monitored

In 1999, the S.C. Department of Natural Resources (SCDNR) and the S.C. Department of Health and Environmental Control (SCDHEC) initiated a major new collaborative coastal monitoring program: the South Carolina Estuarine and Coastal Assessment Program (SCECAP). The objective of the program is to monitor the condition of the state’s estuarine habitats and associated biological resources on an annual basis.

SCECAP—one of the most comprehensive coast-wide monitoring programs in the U.S.—expands ongoing efforts being conducted by each Department by drawing upon the expertise of both in a cooperative effort. The program integrates measures of water and sediment quality with multiple measures of biological condition throughout the state’s coastal zone.

Historically, water quality monitoring has primarily focused on open water habitats, such as bays, sounds, and tidal rivers. SCECAP will contribute significant data needed to assess tidal creeks—important nursery habitats for most of the state’s economically valuable species. Many of these tidal creeks are also the first point of entry for nonpoint source pollution from upland areas, providing an early indication of human stresses on the nature system.

Sampling method

Approximately 60 stations randomly located throughout the state’s coastal zone are selected for sampling each year, with new sites rotated in every year. Half of the sites are located in tidal creek habitats and the other half are located in open water habitats.

The primary sampling period is during the summer (June through August) when water quality can reach critical limits. Summer is also the time when many species are using the estuary as nursery habitat. To investigate seasonal fluctuations, SCDHEC will continue routine, monthly monitoring of water quality indicators at 15 tidal creek and 15 open water sites for one year.

SCECAP part of national effort

The U.S. Environmental Protection Agency (USEPA) initiated “The National Coastal Assessment Program” (formerly the Coastal 2000 Program) as a cooperative effort with most coastal states in the summer of 2000. SCDNR is the lead agency for integrating South Carolina’s research into the national program. The USEPA program provides an opportunity to link state monitoring goals with national monitoring objectives, while allowing an expansion of monitoring activities that would otherwise not be feasible through state funding alone.

Additional research projects have been incorporated into SCECAP, providing more funding and opportunities for collaboration. One example is the Harmful Algal Bloom Initiative, funded by NOAA, which will provide information on the presence of harmful algal species at all sites sampled by SCECAP. Data obtained from the HAB Initiative will include an assessment of phytoplankton composition and a test to evaluate for the presence of Pfiesteria-like organisms.

In the near future, State of the Estuary summaries will be available through printed reports, electronic files, and the Web sites of both agencies. The first two years of sampling have provided useful data on the conditions found in tidal creeks and open water habitats, and the proportion of each habitat throughout the state that meets or exceeds “normal” conditions. The information already gathered indicates that tidal creeks function very differently than larger, open water habitats—and many of the water quality and biological condition measures will need revisions reflecting this difference.

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## Information and Resources

### Web sites

**Harmful Algal Blooms**  
The National Office for Marine Biotoxins and Harmful Algal Blooms at Woods Hole Oceanographic Institution:  
[http://www.redtide.whoi.edu/hab](http://www.redtide.whoi.edu/hab)

NOAA's Marine Biotoxins Program:  
[http://www.chbr.noaa.gov/CoastalResearch/Whols.htm](http://www.chbr.noaa.gov/CoastalResearch/Whols.htm)

10th International Conference on Harmful Algae:  

**Water Quality**  
S.C. Department of Health and Environmental Control:  
[http://www.scdhec.net/water](http://www.scdhec.net/water)

S.C. Department of Natural Resources–Marine Resources Research Institute:  
[http://www.dnr.state.sc.us/marine/mrr/mrr.html](http://www.dnr.state.sc.us/marine/mrr/mrr.html)

Nonpoint Education for Municipal Officials (NEMO):  
[http://www.nemo.uconn.edu](http://www.nemo.uconn.edu)

### 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](http://www.ioc.unesco.org/hab/news.htm)

**Journal of Phycology.** Dr. Patricia Wheeler, Editor:  
[http://www.blackwellscience.com/journals/phycology](http://www.blackwellscience.com/journals/phycology)

**Harmful Algae.** Sandra Shumway and Theodore Smaida, Editors-in-Chief:  
[http://www.elsevier.com/locate/hal](http://www.elsevier.com/locate/hal)  
Scheduled to be published in early 2002.

### Other

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

Algae-L Listserv, Mike Guiry, Moderator:  
[http://www.seaweed.ie](http://www.seaweed.ie)

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