

The Use of Volunteers to Monitor Harmful Phytoplankton

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Abstract

The South Carolina Phytoplankton Monitoring Network comprises over 35 groups monitoring for potential harmful algal species. Volunteer groups are composed of both high school classes and environmental citizen groups. This NOAA-sponsored community program increases awareness of harmful algae to constituent groups and directly involves volunteers in coastal stewardship. Observation and identification of phytoplankton along the South Carolina coast will be used to develop a species list. In the program's first year, volunteers observed several algae taxa not previously known to exist in South Carolina, including *Pseudo-nitzschia*, *Dinophysis*, and *Prorocentrum lima*.

Introduction

Phytoplankton monitoring networks exist in nine coastal USA states. These networks are based on volunteer collection and identification of phytoplankton in water samples. One example of a successful program is the Maine Phytoplankton Monitoring Network, which began in 1996. Volunteers were able to identify *Alexandrium* and a number of blooms of *Dinophysis* in Maine waters before potential human health complications arose (Morton *et al.*, 1999).

The South Carolina Phytoplankton Monitoring Network (SCPMN) began in January 2001 as a result of a recommendation by the National Oceanic and Atmospheric Administration (NOAA) Marine Biotoxins Program to the South Carolina Task Group on Harmful Algae. One step in the assessment of harmful algal blooms in South Carolina was to begin a statewide surveillance of South Carolina's marine waters. The goals of SCPMN include promoting education on harmful algae to the general public, monitoring of coastal waters in South Carolina where potentially harmful algae may exist, and the development of a general species list for the state of South Carolina.

Volunteers are currently sampling in six of the eight coastal counties in South Carolina. These counties include

Beaufort, Berkeley, Charleston, Colleton, Georgetown, and Horry (Fig. 1). Volunteer groups maintain between one and four sampling sites depending on group size and time availability. Volunteer groups consist of middle and high school biology and marine biology classes or extracurricular organizations, environmental citizen organizations, and state parks.

Materials and Methods

SCPMN volunteers attend a training session before becoming involved with the program. Background information on SCPMN, volunteer responsibilities, phytoplankton identification, and harmful algal blooms (HABs) are presented in the training session. HABs are defined as "accumulations of microscopic species of algae that cause injury or death to other organisms in the water." Volunteers are trained on sampling techniques and identification methodologies by watching a training identification video, performing a plankton tow, and performing light microscope.

Volunteers are supplied with a 20- μ m student plankton net (Sea-Gear Corporation) and a refractometer (VWR Scientific). Plankton tows are performed mainly from floating docks by pulling the net horizontally through the water for three minutes. Samples can be identified on the same day

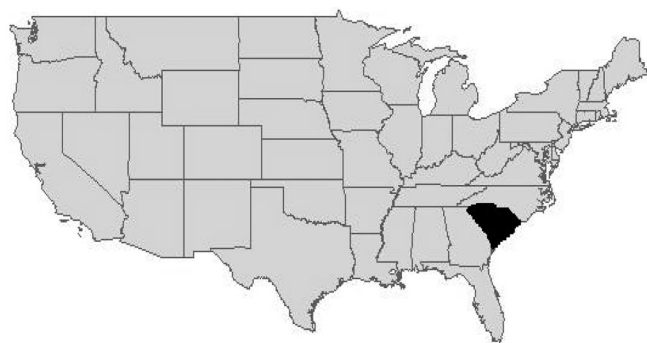
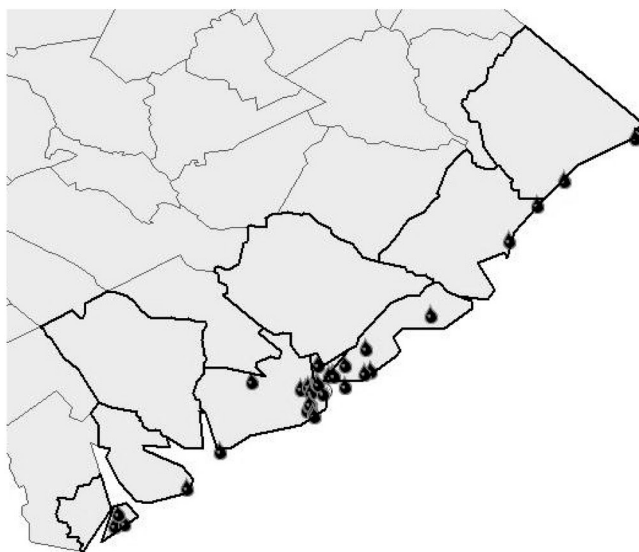


Figure 1 A map of the United States of America highlighting the state of South Carolina. The South Carolina map, right, is enlarged to represent the coastal counties where volunteer groups are currently sampling.



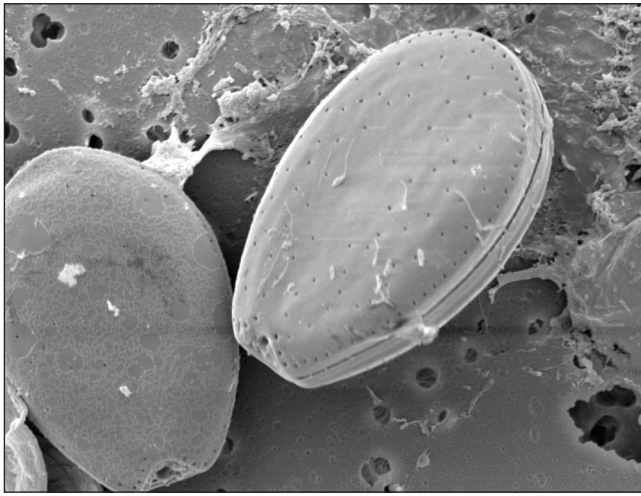


Figure 2 Scanning electron micrograph of *Prorocentrum lima*.

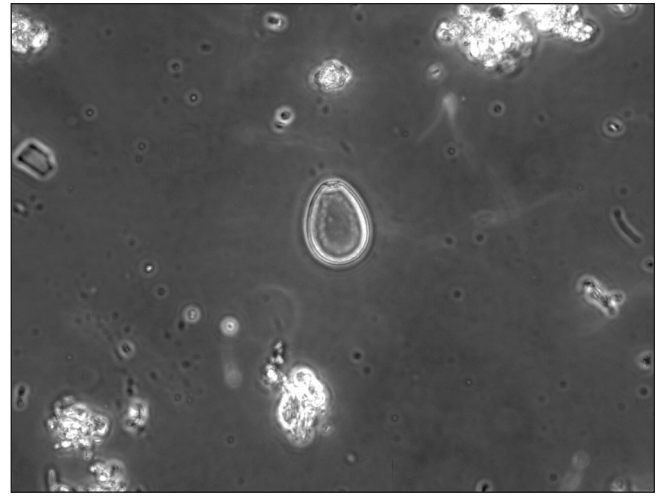


Figure 3 Light micrograph of *P. lima* theca.

or up to three days after the tow was performed, although older samples can have lysed, dead phytoplankton. Data sheets are completed at the time of identification and submitted via electronic mail or facsimile.

Volunteers record sample results on the SCPMN data sheet. The species on the SCPMN data sheet include six dinoflagellate taxa (*Akashiwo sanguinea*, *Ceratium* spp., *Dinophysis* spp., *Karenia brevis*, *Prorocentrum micans*, and *Protoperidinium* spp.) and six diatom taxa (*Chaetoceros* spp., *Coscinodiscus* spp., *Ditylum* spp., *Odontella* spp., *Pseudo-nitzschia* spp., and *Rhizosolenia* spp.). Volunteers record qualitative rather than quantitative abundance ratios (Table 1) for these species and submit weekly or biweekly data sheets.

In addition to phytoplankton abundance, volunteers record other ancillary data that include water temperature, salinity, date and time of the plankton tow, and the location of the sampling site.

After volunteer groups perform a plankton tow and submit their data sheet, data is then entered into a Geographic Information Systems (GIS) database to create a spatial interpretation of the collected data. The GIS database will assist scientists in understanding trends of phytoplankton species found by volunteers in South Carolina waters. Maps show species distribution along the

coast and the volunteer sampling locations. Map layouts will be placed on the SCPMN web site at <http://www.chbr.noaa.gov/CoastalResearch/SCPMN/SCPMNmain.htm>. for volunteers and interested visitors to observe.

Results and Discussion

The use of volunteers to monitor phytoplankton has proven to be beneficial to scientists in South Carolina. Results from the first year of monitoring (2001) include the discovery of three potentially toxic algae not previously known to exist in the state. These taxa are *Dinophysis* spp., *Prorocentrum lima* (Schaefer and Morton, this Proceedings), and *Pseudo-nitzschia* spp. *Dinophysis* spp. were first observed by volunteers during the spring of 2001 at the Folly Beach Fishing Pier (32°39'14"N, 79°56'28"W), Charleston, South Carolina by the Academic Magnet School. This species was seen in rare abundance. *Dinophysis* spp. was not observed from the spring of 2001 until September 2002 at four different SCPMN sampling sites. *Prorocentrum lima* (Fig. 2) was first observed at the Fort Johnson Road sampling site (32°45'15"N, 79°54'34"W) in May 2001 in rare abundance (Schaefer and Morton, this Proceedings). *Prorocentrum lima* theca (Fig. 3) were found in rare abundance at three additional sampling locations in central coastal South Carolina: Amoco Creek (32°57'56"N, 79°54'28"W), Flag Creek (32°56'56"N, 79°54'34"W), and Goose Creek (32°58'01"N, 79°56'05"W), South Carolina (Schaefer and Morton, this Proceedings). *Pseudo-nitzschia* spp. were observed the most frequently out of these three species. *Pseudo-nitzschia* spp. ranged from rare to abundant on 185 submitted data sheets covering 33 sampling sites. The period of highest activity was from August to September 2002. All three of these taxa, along with other potentially toxic algae, are continually monitored by SCPMN volunteers.

There are numerous scientific and outreach benefits resulting from volunteers monitoring South Carolina waters. The data collected by volunteers has helped scientists build

Table 1 Abundance ratios represent the percent abundance of each observed species in the sample. Volunteers assign qualitative abundance ratios to species on the SCPMN data sheet.

None	0
Rare	0.1–1%
Present	1.1–10%
Common	10.1–40%
Abundant	40.1–80%
Bloom	80.1–100%

a continuing species list for the state, which was one of the initial program goals. The long term benefits of this monitoring program will hopefully lead scientists to new sampling sites for further study, to identify the time and place of blooms, and to eventually predict blooms. The outreach aspect of the SCPMN has increased community awareness of HABs, resulted in increased public awareness of research conducted by federal and state groups, and enabled improved communication between scientists and volunteers. The long-term outreach benefits of the SCPMN will be a stronger interaction between the scientific community and the general public.

In order to obtain a better spatial resolution of monitoring data along the coast, counties will extend sampling for SCPMN into all eight coastal counties of South Carolina. The extended survey area throughout the year will allow for a more thorough investigation of coastal waters, leading to fulfillment of the long-term scientific benefits listed above.

The discovery of three potentially toxic taxa in South

Carolina (*Dinophysis* spp., *Prorocentrum lima*, and *Pseudo-nitzschia* spp.) has initiated new research projects conducted by NOAA scientists. Scientists are testing oysters for the presence of okadaic acid from the sampling sites where *Prorocentrum lima* was originally discovered in 2001 (Schaefer and Morton, this Proceedings). The efforts of volunteers are crucial for the continued success of SCPMN and to provide preliminary observations to NOAA scientists on the current status of phytoplankton in South Carolina's waters.

Acknowledgements

The authors would like to thank NOAA for funding this program and the South Carolina Task Group on Harmful Algae for their assistance.

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