Why Does Brown Tide Thrive in Local Waters?

"The questions we're asking today are very different from the ones we were asking 15 years ago. We've come a long way."

—Dr. Gregory Boyer, SUNY College of Environmental Science and Forestry

And so began the NYSG-sponsored **Brown Tide Research Initiative public symposium** held at Southampton College of Long Island University where investigators described what is currently known about brown tide. "Solving the brown tide mystery and finding ways to manage the bloom and its impacts are crucial to Suffolk County's environment, economy, and quality of life," said Suffolk County Executive **Robert J. Gaffney** in a statement prior to the event. "I commend NOAA, New York Sea Grant, and the Brown Tide Research Initiative consortium for their commitments to brown tide research."

During the symposium, BTRI and other regional brown tide researchers explained how findings are building a more complex picture of brown tide. Combinations of factors may stimulate growth or, conversely, cause the demise of the microscopic alga responsible for brown tide blooms, *Aureococcus anophagefferens.*

Photo by Barbara Branca

Several of the many brown tide scientists who presented this spring are, from left to right, Christopher Gobler, Ed Thier, Robert Nuzzi, Charles O'Kelly, Darcy Lonsdale and Todd M. Kana.

Christopher Gobler, Assistant Professor of Marine Science at Southampton College, outlined several hypotheses his field research addresses. "My studies deal with a new approach that simultaneously evaluates the role of processes that can enhance brown tide growth rates, such as the use of nutrients, and those that remove brown tide cells, such as microzooplankton grazing," said Gobler. "My results have characterized an ecological niche in which high levels of organic nutrients and low microzooplankton grazing on brown tide contribute to the flourishing of blooms in the bay."

BTRI researcher **Todd Kana**, from the University of Maryland's Horn Point Environmental Laboratories, added, "Brown tide is suspected of being stimulated by nutrients released from the sediments. And, in the shallow bays of Long Island, there is the potential for bottom-dwelling organisms and microorganisms to affect the availability of nutrients to the phytoplankton."

Additional hypotheses as to why *Aureococcus* thrives or dies include growth stimulation by iron, which, although it appears not to be vital to bloom initiation, may be important in bloom maintenance. Also, research has shown that physical characteristics – such as decreased rainfall prior to a bloom, reduced bay flushing or higher salinity – are not solely the causes for such bloom formations as the 1985 event in Narragansett Bay.

Significant advances have resulted from the work of several investigators funded by Suffolk County Department of Health Services (SCDHS). **Julie La Roche**, working at Kiel University in Germany, successfully established bacteria-free, or axenic, cultures of *Aureococcus anophagefferens*. Collaborating with **Robert Andersen** of Bigelow Laboratory of Ocean Science, the axenic *Aureococcus* cultures have been deposited at the Provasoli-Guillard National Center for Culture of Marine Phytoplankton and are available for use by other investigators. Said NYSG's BTRI outreach specialist **Patrick Dooley**, "The establishment of these cultures is an important step in understanding the complexities of brown tide because researchers will now be better equipped to conduct the most informative of experiments, particularly those relative to *Aureococcus*' nutritional and growth requirements."

Photo by Susan Hamill

Sea Grant scholar Dianne Greenfield shows seawater containing brown tide taken from Sayville in the Great South Bay in the summer of 2000.

Other results from the BTRI network of investigators include the availability of 17 *Aureococcus* strains for experimental study, the establishment of laboratory growth conditions, and the detection of no genetic differences among *Aureococcus* strains on the population level.

Research investigating different aspects of brown tide has been ongoing since the algae's first appearance in 1985 in New York and other nearby waters. Since then, *Aureococcus* has been identified from Portsmouth, New Hampshire to Virginia, including Maryland's Chesapeake Bay. Brown tide is not just a northeastern United States phenomenon as an "in press" scientific report (for which SCDHS's **Robert Nuzzi** is a contributing author) documents the presence of *Aureococcus* in Saldanha Bay, South Africa.

Episodic blooms have been detrimental to the Peconic Estuary bay scallop industry, with potential impacts to eelgrass beds. Added Boyer, "Although brown tides do not appear to pose a health threat to humans, its presence may have negative impacts on recreational fishing, boating and swimming."

And why are there still so many questions, concerns and hypotheses since the 1985 brown tide bloom in Long Island? One of the main reasons is, as Kana explained at the symposium, "Brown tide is very intermittent, which can make it difficult to study." Research has answered many of the early questions, but also revealed that the problem was more complex than expected.

Studies by brown tide researcher **Darcy Lonsdale**, from Stony Brook University's Marine Sciences Research Center, have found the presence of hard clams in mesocosm studies – those using 300-gallon plastic tanks to simulate conditions of shallow bays – could prevent the growth of brown tide due to their feeding activities.

Representatives from **Michael Sieracki**'s group at Maine's Bigelow Laboratory for Ocean Studies presented several "take-home points" at the symposium, including the opening of a niche for small algae in the spring that can be filled by brown tide and the fact that organic nutrients may favor brown tide. This, in addition to discovering the existence of a mutual relationship between brown tide and a marine bacterium, may assist in the persistence of *Aureococcus*.

Partnerships remain a key factor in efforts to better understanding why *Aureococcus* thrives in local waters. "We are optimistic that, through working together, we will find the causes of the bloom's onset, persistence, and cessation. This will allow us to develop ways to manage the bloom and its effects," said Gaffney. At the close of the symposium, NYSG Assistant Director **Cornelia Schlenk** emphasized the importance of providing opportunities for researchers to discuss their findings and develop synergistic collaborations. "Maintaining an outreach component to keep managers and all interested parties informed about the ongoing research is also critical, especially as brown tide is a factor in the Comprehensive Management Plans of both the South Shore Estuary Reserve and the Peconic Estuary Program."

Photo by Barbara Branca

Dr. Gregory Boyer (left) discussing brown tide with NYSG's Patrick Dooley who coordinated the symposium.

Brown Tide Back Story

A variety of sponsors provided funding for brown tide studies in the early nineties, including New York Sea Grant, Suffolk County, the New York State Department of Environmental Conservation, Stony Brook University's Marine Sciences Research Center, the Environmental Protection Agency, Peconic Estuary Program, Brookhaven National Laboratory, and Southampton College. In 1995, a brown tide summit was convened to assess the state of knowledge and formulate research recommendations. Then in 1996 the BTRI program was launched in 1996 by the National Oceanic and Atmospheric Administration's (NOAA) Coastal Ocean Program, BTRI is now a 6-year, $3 million NYSG-managed program. It brings together numerous investigators, organizations and institutions to coordinate research and outreach efforts aimed at determining the physical, chemical and biological factors that cause, sustain and lead to the demise of *Aureococcus* blooms.

Sidebar and article by Paul C. Focazio

<www.seagrant.sunysb.edu/BTRI/btri.htm>