

COASTAL RESEARCH

A newsletter from the Coastal Ocean Institute



A message from the DIRECTOR AND CHAIR

This issue of the COI Newsletter highlights two awards for excellence—one given out by the Institute, and one given to one of our investigators. The first is the Bostwick H. Ketchum Award, a highly prestigious award recognizing a scientist who demonstrates an innovative approach to coastal research, leadership in the scientific community, and who provides a link between coastal research and societal issues. This award was presented to University of Delaware coastal oceanographer Richard Garvine in a very moving ceremony. The second award is the Rosenstiel Award, given to a scientist who, in the past decade, has made significant and growing impacts in their field. This award was given to Dennis McGillicuddy of the WHOI Applied Ocean Physics and Engineering Department. Dennis works on a variety of problems in the coastal ocean, and applies his skills to the open ocean as well. We are

Excellence in science needs to be recognized and acknowledged

indeed proud of these two colleagues and want to make sure that all of you have an opportunity to learn of their accomplishments.

Other stories in this issue describe new funding awards, our newest COI Research Fellow, and a general interest story about the difficulties associated with making red tide forecasts. We hope you enjoy this update of recent activities in coastal ocean science.



Don Anderson
Director, COI



Bill Kealy
Chair,
COI Committee

Investigators SPOTLIGHT

Dennis McGillicuddy Receives 27th Annual Rosenstiel Award

The University of Miami's Rosenstiel School of Marine and Atmospheric Science has selected Dennis J. McGillicuddy, Jr., Ph.D., as recipient of the 2008 Rosenstiel Award.

McGillicuddy, a senior scientist in the Department of Applied Ocean Physics and Engineering at the Woods Hole Oceanographic Institution (WHOI), is a pioneer in the study of physical-biological interactions in the ocean. His multidisciplinary studies of plankton and ocean currents are helping to decipher what controls the productivity of marine ecosystems and how this affects the global carbon cycle.

The Rosenstiel Award is designed to honor scientists who, in the past decade, have made significant and growing impacts in their field. It's an award targeted for researchers who, in their early to mid-career stages, are already making outstanding scientific contributions.

McGillicuddy has broken new ground by bridging the gap between several physical and biological oceanographic disciplines, revolutionizing progressive marine ecosystem modeling and observations.

He has developed physical-biological models for studying the population dynamics of copepods (tiny free-swimming crustaceans) on Georges Bank, as well as harmful algal blooms

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in the Gulf of Maine. Some of these models have assimilated physical and biological data, an important step in providing forecasts of harmful algal blooms (popularly known as “red tides”).

“Understanding how marine systems function requires an integrated strategy that includes theory, observation, and modeling,” said McGillicuddy. “By weaving these three approaches together, we can build comprehensive simulations that explicitly resolve the coupled physical-biological-chemical processes. This integration of observations and models not only provides a useful methodology for oceanic process studies, but also



Dennis McGillicuddy

maximizes the utility of observations and aids in their interpretation.”

McGillicuddy’s research uses field data, satellite remote sensing and numerical models. Projects range from mesoscale ocean dynamics to coastal ocean prediction, bio-optics, marine biogeochemistry, marine ecology, and fisheries oceanography. He also

has a distinguished publication record, with more than 52 refereed journal publications to his credit.

As a member of the steering committees for GLOBEC (Global Ocean Ecosystem Dynamics) and GEOHAB (Global Ecology and Oceanography of Harmful Algal Blooms), he par-

ticipates actively in the oversight of national and international programs pursuing interdisciplinary research.

Raised in west Florida, McGillicuddy earned all of his degrees at Harvard University: a bachelor’s in engineering science in 1987, a master’s in applied physics in 1989, and a doctorate in earth and planetary sciences in 1993.

The Rosenstiel Award, created through an endowment from the Rosenstiel Foundation, recognizes outstanding scientists for their contributions to marine science. It is awarded annually to one individual on a rotating basis for achievements in six broad disciplinary areas: marine geology and geophysics; meteorology and physical oceanography; marine and atmospheric chemistry; marine biology and fisheries; applied marine physics; and marine affairs. ■

COI FUNDING ANNOUNCEMENTS

Annual Call for Proposals

COI received 12 proposals requesting nearly \$900K in response to our annual call for research proposals, April 2008. We were able to fund 6 for a total of \$400,000, representing a funding success rate of about 44%—significantly better than the current federal funding success rate.

Student Research Awards

This program for joint program graduate students working in coastal ocean science has been highly successful. Student research awards provide modest funding for thesis research expenses such as field work, equipment, and supplies that are not covered by advising scientists’ research support. In 2008, we were able to provide

\$20,000 to five of our Joint Program students in four departments.

New COI Research Fellow Karen Casciotti

Associate Scientist
Marine Chemistry and
Geochemistry Department

Karen’s research interests focus on marine nitrogen cycling, and often involves field work in globally important but remote locations that are difficult to access on a regular basis. As a COI Fellow, Karen plans to expand her research to study the production of the greenhouse gas nitrous oxide (N_2O) in coastal waters of Cape Cod, MA. Despite the potential importance



Karen Casciotti

of coastal waters to increasing global N_2O emissions, the flux of N_2O from these regions is poorly understood. In addition to developing a program to study production and emissions of N_2O at the Martha’s Vineyard Coastal Observatory (MVCO), Karen hopes to work together with local researchers who study the delivery of nitrogen from land to the coastal ocean to better understand the

connections between anthropogenic nitrogen loading and greenhouse gas production in our coastal oceans. She will also conduct public outreach and education on the impacts of nitrogen loading in our local waters.

Red tide Forecasting

THE RISKS AND THE REWARDS

Coastal scientists often strive to develop conceptual and numerical models of the systems they study in order to forecast future events. Program managers in Washington frequently urge the scientists they fund to demonstrate the practicality of their research in this way. One area where this goal is evident is with red tides. In the Gulf of Maine region, considerable research has been conducted on the toxic dinoflagellate *Alexandrium fundyense*, the species responsible for making shellfish dangerously poisonous. Our research has led to a fundamental understanding of *Alexandrium* blooms and to the formulation of a numerical model of bloom dynamics for the region. The model is initiated from a map of *Alexandrium* cyst abundance. Cysts are dormant, resting cells that fall to bottom sediments during blooms, providing the inoculum for future outbreaks, just like seeds in higher plants.

Model simulations have demonstrated a strong correlation between cyst abundance in the western Maine coastal region and the magnitude of subsequent *Alexandrium* blooms. As a result, extensive cyst mapping surveys have been conducted to document interannual variability. Our latest map in 2007 recorded the highest

Alexandrium cyst abundance since 1997—more than 30% higher than in 2004, immediately prior to the massive 2005 *Alexandrium* red tide that closed shellfish beds from eastern Maine to Martha's Vineyard, and caused millions of dollars of damage.

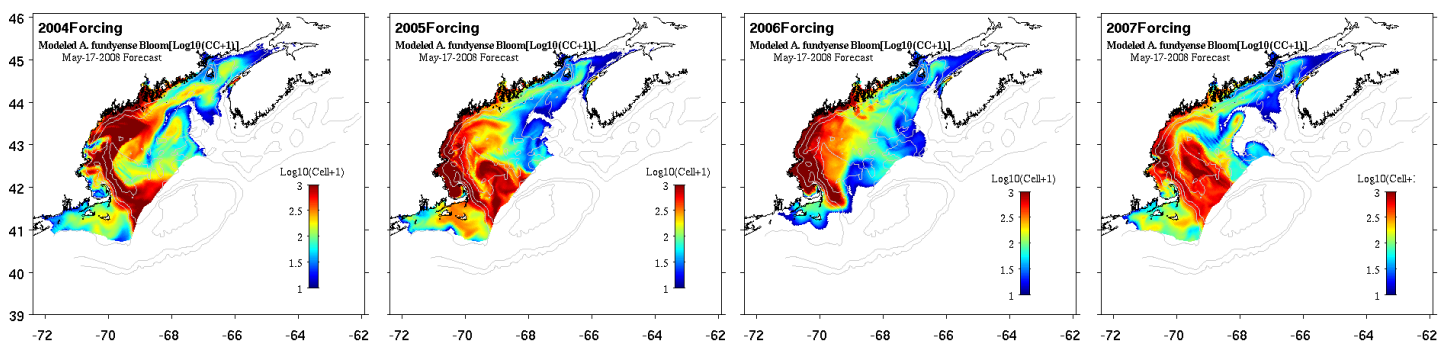
We then faced a dilemma. Our experience and the high cyst abundance suggest that 2008 could be a major bloom year, and we therefore should issue a forecast. Like many scientists, however, we are reluctant to make forecasts based on hypotheses that are not fully tested. Proving a hypothesis to be false is part of the scientific method, and is an entirely acceptable outcome in a research setting. Making an incorrect public prediction is not as acceptable, since it can be interpreted by other scientists as “show boating” and by the public as evidence of poor or premature science.

How did we proceed? In this instance, we followed the approach of hurricane forecasters who project the uncertainty in landfall of a storm using multiple model formulations and assumptions. We ran our numerical model using four different scenarios (2004 – 2007) spanning weather and ocean conditions that gave rise to very small *Alexandrium* blooms (i.e., 2004) or to the massive 2005 outbreak. For

all cases, the 2007 cyst map initiated the model. The figure shows the range of cell abundance and distributions predicted by these scenarios. **In all cases, the model simulations project higher *Alexandrium* cell abundance relative to past years—including 2005.** The differences between scenarios are in the extent to which these cells reach the shoreline, where near-shore shellfish toxicity is of concern.

Using this approach, we issued a forecast, emphasizing the importance of wind patterns that can keep the toxic cells offshore or transport them onshore, with dramatic differences in shellfish toxicity and impacts. As this newsletter goes to press, it is too soon to say whether this type of seasonal prediction is appropriate and useful. There is, however, clear value in shorter-term forecasts similar to those for the weather. In this respect, we look forward to the day when we deploy instruments that robotically sample the water, count *Alexandrium* cells, and relay data to shore for assimilation into our models, allowing accurate real-time predictions. Such capabilities are not far off, and will hopefully be provided through growing investments in ocean observatory programs. ■

—Don Anderson & Dennis McGillicuddy





Kevin Quinlan, University of Delaware

teaching at the University of Connecticut, Garvine joined the faculty of the University of Delaware in 1977.

Rich Garvine is known throughout the oceanography community for his humility and for his ability to deflect praise no matter how much he deserves it. So as he stood in front of his many colleagues and friends assembled to see him accept the Bostwick H. Ketchum Award, his words came as no surprise.

“I am pleased to accept this award on behalf of the College of Marine and Earth Studies and for my graduate students, because they represent my legacy to the future,” said the Maxwell P. and Mildred H. Harrington Professor of Marine Studies.

Glen Gawarkiewicz, a WHOI scientist and one of Garvine’s former students, touched on his mentor’s research contributions, saying, “It is a hallmark of Rich’s work to do both absolutely state-of-the-art observations and then follow it up with groundbreaking theory work.”

Two speakers, WHOI Senior Scientist Ken Brink and graduate student Ana Rice, announced that Garvine had more accolades coming his way. Brink said that the *Journal of Marine Research* will complete a special issue in Garvine’s honor, and on behalf of CMES, Rice presented him with a book filled with kind words from colleagues, friends and family. Sadly, Rich Garvine passed away shortly after the Ketchum award ceremony, following a long illness. ■

Physical Oceanographer Receives 2007 KETCHUM AWARD

Dr. Richard Garvine received the 2007 Bostwick H. Ketchum Award at a ceremony in his honor held at the University of Delaware in November 2007.

Garvine, an internationally known pioneer and expert on coastal oceanography, received the award for demonstrating an innovative approach to coastal research, for his leadership in the scientific community, and for providing a link between coastal research and societal issues.

Together with his graduate students, Garvine discovered and named the Delaware Coastal Current. With his studies off Delaware and the Connecticut River, he pioneered the study of buoyant coastal plumes—lenses of lighter, fresher water that lay on top of denser, saltier ocean waters. Coastal plumes often support high levels of

biological productivity and sometimes harmful algal blooms (also known as “red tides”). These freshwater plumes can also carry oil and pollutant spills long distances.

Garvine has investigated the physics of ocean currents and their relation to forcing by winds, tides, and runoff along the coast. He helped build models of how water masses and heat, salt, buoyancy, and crab and fish larvae are exchanged between estuaries, the continental shelf, and deep water at the shelf-break.

Garvine earned his bachelor’s degree in aerospace engineering from the Massachusetts Institute of Technology, and a doctorate in mechanical and aerospace engineering from Princeton University. After a short stint at General Electric and eight years

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