



# COASTAL OCEAN INSTITUTE



FALL 2009 REPORT

Woods Hole Oceanographic Institution



## Message from the COI Director



Tom Kleindinst, WHOI

Recently back from a research cruise off the coast of California, I found that R/V *Atlantis* and DSV *Alvin* can be as useful for coastal research as for the open ocean studies they often

perform. Our work—studying methane, a powerful greenhouse gas seeping out from the ocean floor—depended on these powerful research assets.

I have finished my first year as COI director. It has been exciting and challenging to oversee this important Institute within WHOI, while also interacting with students, scientists, policymakers, and media. One highlight of the year was that I was asked to advise the President's Council for Environmental Quality in Washington, DC on biofuel spills in the coastal ocean—a problem COI researchers may address in coming years.

COI makes an important contribution to WHOI by providing support to students, postdocs, and scientists. In this report, former COI postdoctoral fellows (now WHOI assistant scientists) Anthony Kirincich and Rubao Ji

discuss how a COI postdoc provided essential stepping-stones for their careers. The Institution relies heavily on the postdoc pool for recruiting scientific staff, and providing COI fellowships is paramount for continued excellence in coastal research.

COI support also provides seed funds for our scientists to gain federal and state support. Please read in this issue how Al Plueddemann and his colleagues leveraged two COI grants into substantial federally-funded programs.

One of my goals as COI director was to increase the Institute's communication and outreach output. A great success is our recently launched Web site on tsunamis, spearheaded by Dr. Jian Lin and Web Communications Manager Danielle Fino—an impressive display of graphics and scientific content. I hope it will catalyze development of other Web sites addressing coastal topics, such as sea level rise and hurricanes.

Again, I thank you for your continued support to the COI. Please feel free to call or email me anytime. If you are planning to visit the Institution, let me know. I would enjoy meeting with you.

—Chris Reddy

## A Coastal Ecosystem Research Initiative (CERI)

The Coastal Ecosystem Research Initiative (CERI), funded by the WHOI Coastal Ocean Institute (COI), focuses on the northwest Atlantic continental shelf, from Nova Scotia to Cape Hatteras. This ecosystem is influenced by relatively cold, fresh water from the north, complicated by interacting phenomena such as ocean fronts, rotating currents (eddies), and meanders of the Gulf Stream. This variability makes predicting future changes in our “backyard” coastal ecosystem extremely challenging.

### The Goals and Objectives

CERI sought to improve our ability to measure, monitor, and analyze ocean processes that shape this ecosystem. Our objectives were:

- To bring scientists together around an interdisciplinary concept,

- To develop a conceptual framework to guide observing and modeling efforts,
- To promote a coordinated plan to use existing and new financial and technological resources for studying this ecosystem,
- To position WHOI scientists to compete for external funding opportunities related to the CERI theme.

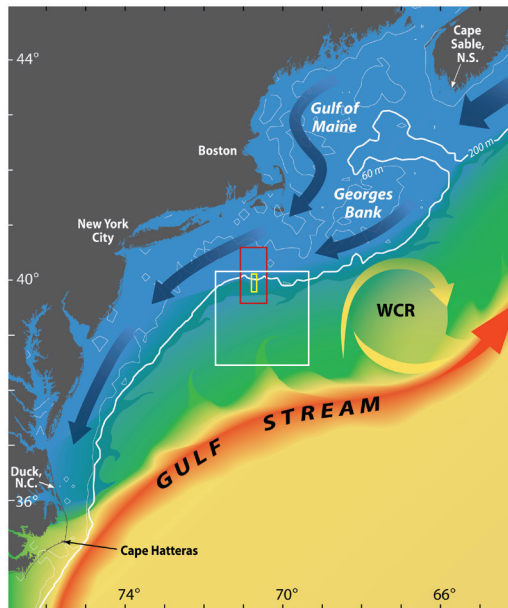
### CERI Accomplishments

We presented the concept to all WHOI departments, plus the NOAA Northeast Fisheries Science Center (NEFSC), solicited their input, and created a document defining CERI research and the strategy for proceeding. We created a map of existing assets for regional observing (e.g. ocean buoys) that researchers are using for proposals and presentations.



We held a WHOI workshop to identify funding and program opportunities for WHOI researchers and co-organized an Ecosystem Initiative Scoping workshop, sponsored by NOAA's Cooperative Institute for Climate and Ocean Research (CICOR), to discuss the scale of work.

We developed a concept of "Science Supporting an Ecosystem Approach to Management," presented it to the WHOI directorate, and promoted it as part of an overall WHOI strategic plan for ecosystem research. We worked with COI; CICOR; the Center for Oceans, Seafloor, and Marine Observing Systems (COSMOS); the WHOI Development Office; and individual scientists to determine WHOI's role in northwest Atlantic ecosystem research and coastal observing.



*The focus area of the CERI was the Atlantic continental shelf from Nova Scotia to Cape Hatteras.*

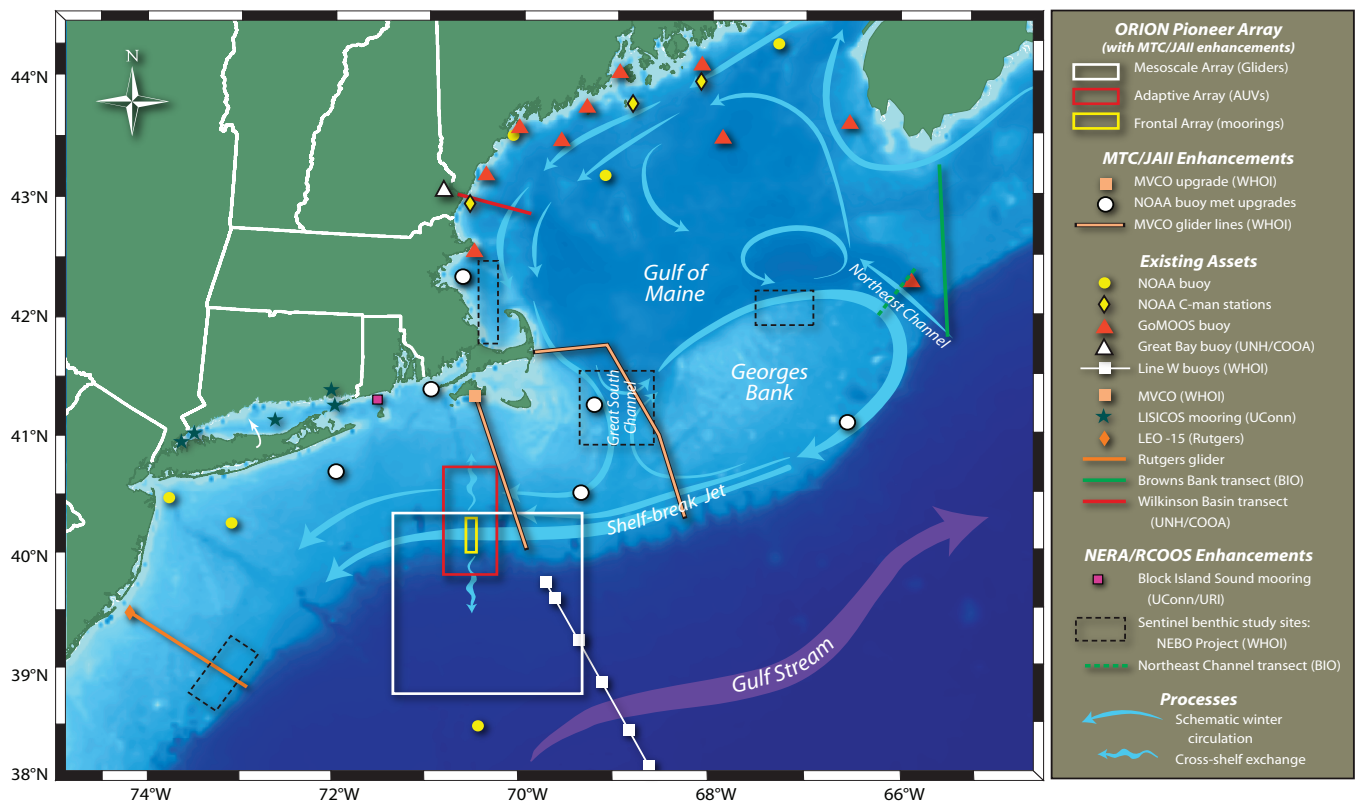
## External Efforts

Meeting with potential collaborators outside WHOI, such as the NEFSC and the office of the Consulate General of Canada, we advocated for a regional approach and plan for ecosystem research. We served as WHOI representatives to the Regional Association for Research in the Gulf of Maine.

We participated in two international workshops in St. John's, Newfoundland, and in workshops and meetings of the fisheries and ocean technology industries. Finally, we helped prepare four successful proposals that won funding from NOAA, the National Science Foundation, and the

Commonwealth of Massachusetts. COI grants helped bring the vision of interdisciplinary regional research to reality and put us on the path to understanding our coastal ecosystem.

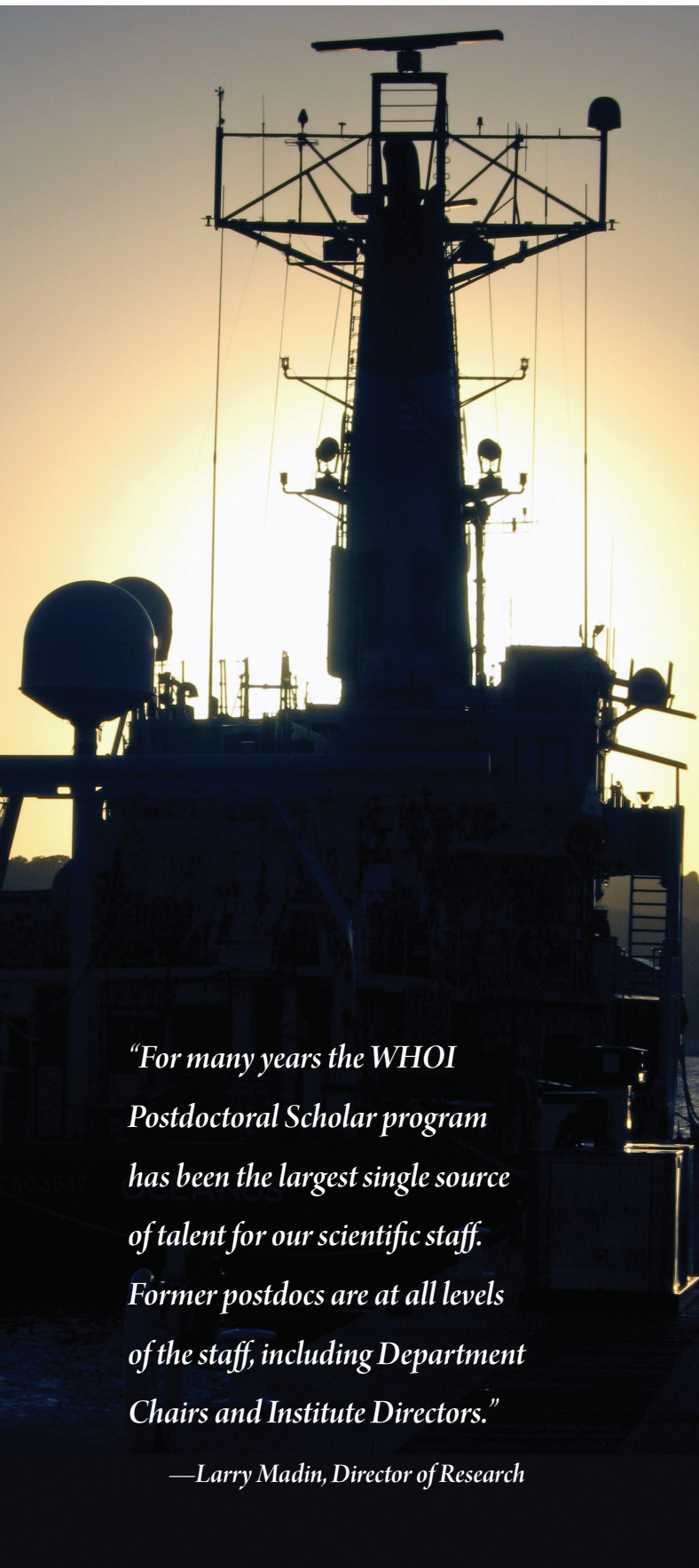
—Al Plueddemann, Heidi Sosik, & John Trowbridge



*Diagram of the Northeastern Regional Coastal Ocean Observing system, taken from a WHOI-led IOOS proposal to NOAA*



## Fellowship Allowed Scientific Freedom and Flexibility



*"For many years the WHOI Postdoctoral Scholar program has been the largest single source of talent for our scientific staff. Former postdocs are at all levels of the staff, including Department Chairs and Institute Directors."*

—Larry Madin, Director of Research

The best thing about my time spent as a Coastal Ocean Institute Postdoctoral Fellow at WHOI was the freedom to choose the problems I worked on and the people I worked with. As a physical oceanographer, I am working to better understand how the circulation of the coastal ocean controls how nutrients, pollutants, plants and animals move between the surfzone and the larger coastal ocean offshore.

While postdocs at other institutions are tied to a specific principal investigator and a specific topic, fellows at WHOI are able to choose their initial mentor as well as where they spend their research time. This may seem small, but it was huge for me.

While I started out working on a particular question my mentor and I were both interested in, an off-handed conversation between us one day started a completely different line of research, working with a completely different data set. Because I wasn't tied to any one project, I was able to spend the time pursuing this additional research along with my original project. At the end of my fellowship, I was able to merge these two different lines of research together into a much greater result, and make a broader contribution to science.

This freedom also allowed me to explore the science taking place here at WHOI. I was able to go on cruises unrelated to my initial research topic and develop new collaborations with other researchers. Through these multiple lines of research, I developed a feel for the range of research conducted here, and began to understand where I might fit as a scientist here myself. While I am still collaborating intensely with my original mentor, these activities have opened the door for much of the new research I will likely do in the next year as an assistant scientist.

—Anthony Kirincich

*"The COI and its postdoctoral program are one of WHOI's strengths, providing a comfortable, bright, enthusiastic environment for scientists generally, and directions for the future."*

—James Yoda  
Academy

Anthony Kirincich, WHOI

At left, the R/V Oceanus taken at dusk on cruise 449.



## Plankton in a changing climate



zooplankton that consume them, and further up the food chain to higher levels (such as fish).

**M**icroscopic floating plants (phytoplankton) and animals (zooplankton) in the ocean play a critical role in marine ecosystems. The energy obtained by phytoplankton through photosynthesis can be transferred to

Plankton can also serve as “beacons” of climate change because they are sensitive to temperature changes, have a short life span (typically less than a year) and respond quickly to temperature change, and because they passively drift following ocean currents and water mixing, we can predict their movements.

However, understanding the impact of climate change on varying plankton populations remains a very challenging problem. This is largely due to the complex interactions between plankton and environmental factors, and our limited ability to advance our understanding by making observations alone. I believe biological-physical coupled computer modeling is one key way forward, and I have

been working on developing and applying this kind of model while I was a COI Postdoctoral Scholar at WHOI.

The COI Postdoctoral Scholarship support was critical in my career development. It allowed me to continue studies that I started during my Ph.D. work, related to an existing research program, the U.S. GLOBEC Georges Bank Program. I have benefited greatly from the broad base of knowledge of the WHOI scientists who have extensive experience studying the Georges Bank ecosystem, including Cabell Davis, Peter Wiebe, and Carin Ashjian from the Biology Department, Robert Beardsley from the Physical Oceanography Department, and many others. The scholarship support provided me flexibility to focus on my research interests while receiving guidance and mentoring from leading scientists, allowing me to stay abreast of the most recent findings and identify the critical challenges that lie ahead. Most importantly, the COI scholarship opened a door for me to continue my research as an assistant scientist here at WHOI.

Since I became an assistant scientist, I have expanded my research scope from the Georges Bank system to the Gulf of Maine, and further to the entire Northwest Atlantic and Arctic Oceans, focusing on the impact of climate change on plankton in coastal and shelf ecosystems.

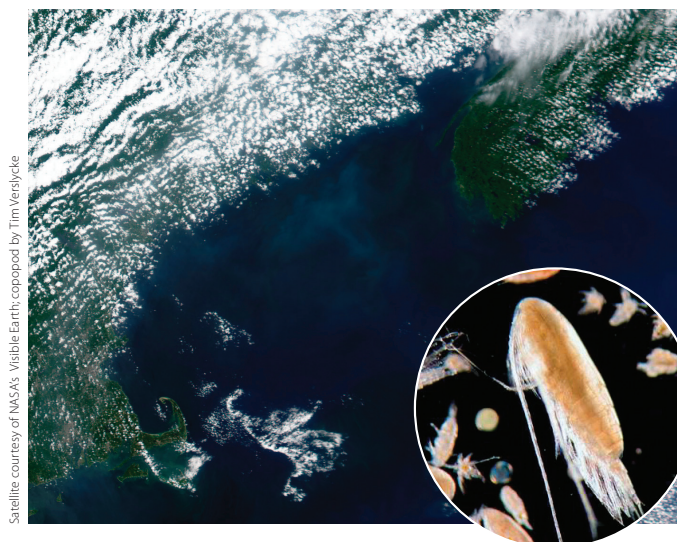
As a key step toward understanding this impact, I am leading an effort to examine the year-to-year variability of coastal phytoplankton blooms in the Gulf of Maine, and how this variability relates to local and remote ocean conditions.

I have been working with my collaborators on developing computer models that take into account plankton’s life histories, coupled with a second model that takes into account amounts of the nutrient, nitrogen, and dead material (detritus) in the water. This coupled model we have developed will allow quantitative evaluation of hypotheses about how biological and physical mechanisms lead to differences in zooplankton species distributions in both North Atlantic and Arctic Oceans—which may eventually allow us to predict how climate change will affect coastal ocean food webs.

—Rubao Ji

*A satellite image shows phytoplankton bloom in the Gulf of Maine. Inset, a dominant North Atlantic copepod zooplankton species (Calanus finmarchicus).*

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Satellite courtesy of NASA's Visible Earth; coposed by Tim Verolycke



# COI Funds Interactive Tsunami Web site

## Problem/Opportunity

Despite the tremendous loss of life that tsunamis have caused, there is no user-friendly and interactive tsunami

Web site that can quickly attract the attention of the public and educate individuals about what tsunamis are, the warning signs of an approaching tsunami, and what to do if they see a warning sign. Immediately after the 2004 Indian Ocean tsunami, WHOI received a tremendous number of inquiries from the media and public about tsunamis and WHOI's role in

addressing this important issue. The lack of a designated WHOI tsunami Web site made it very difficult for our scientists to convey WHOI's messages clearly.

## Approach

To address this outstanding problem, we have created an interactive Web site that conveys simple messages via a wide range of attractive Internet-based tools. Our targeted audience are all inhabitants of, and visitors to, coastal zones of the U.S. and the world. It is also an educational tool for students from the middle-school level and up. The content includes animations and interactive illustrations explaining tsunamis and their warning signs, video and audio interviews with tsunami survivors, and an interactive tour of a tsunami warning center. In addition, the Web site highlights projects and instruments—including those of WHOI—that could contribute to tsunami forecasting. We plan to provide key information in multiple languages. The Web site is relatively maintenance-free. However, if a major event occurs, such as the recent September 2009 Samoa Tsunami, we can quickly update the site with the appropriate scientific content and insight.

**Why WHOI?** WHOI is a leader in oceanographic research, engineering and education, and has a demonstrated ability and commitment to communicate



## Introduction

The 2004 Indian Ocean tsunami, in which 240,000 lives were lost, reminded us how devastating these events can be. Giant undersea earthquakes or landslides can trigger tsunamis, which generate sudden motion of ocean water that results in a series of large waves. Traveling as fast in the open ocean as a jet plane, they slow and grow in height as they near the coast, and can extensively flood populated coastal areas resulting in loss of life and property. While tsunamis are not particularly rare—25 noticeable ones have occurred in the last century in the Pacific Ocean, Indian Ocean, Caribbean, and Mediterranean—they are rare enough to escape the collective consciousness, so that people do not recognize them or know what to do when they occur. Tsunamis can neither be prevented nor precisely predicted, but people educated about identifiable warning signs can save their own lives and the lives of others.



effectively to the public via its Communications and Graphics Departments. It is also important that this Web site be located in an academic environment, independent of the control or restrictions of government agencies. The scientific leader of this project, Dr. Jian Lin (senior scientist in the Department of Geology and Geophysics) is actively involved in tsunami research and a member of a U.S. national committee on tsunami warning and preparedness. His research colleagues have reviewed the Web site for accuracy, as have members of the WHOI Trustees. The other project leader is Ms. Danielle Fino, manager of the WHOI Communications Web Group, who has a decade of experience in creating and managing Web sites with earth science content. She recently led a major effort developing an interactive Web site on the DSV *Alvin*. Along with Dr. Lin and Ms. Fino, WHOI has a diverse group of professionals in graphics, Web development, public relations, and scientific writing. This team has created an effective WHOI Web site that will educate readers about tsunamis, and that we hope will save lives, as well as clearly convey the important role of ocean sciences and WHOI in addressing this important topic.



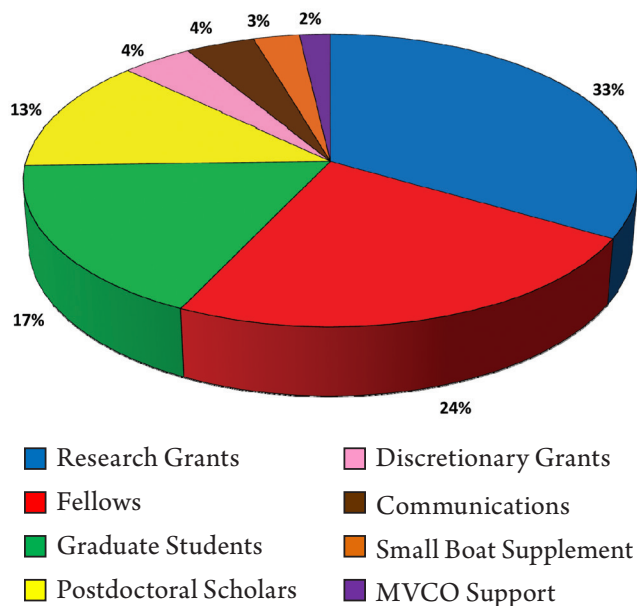
Photo courtesy of the United States military

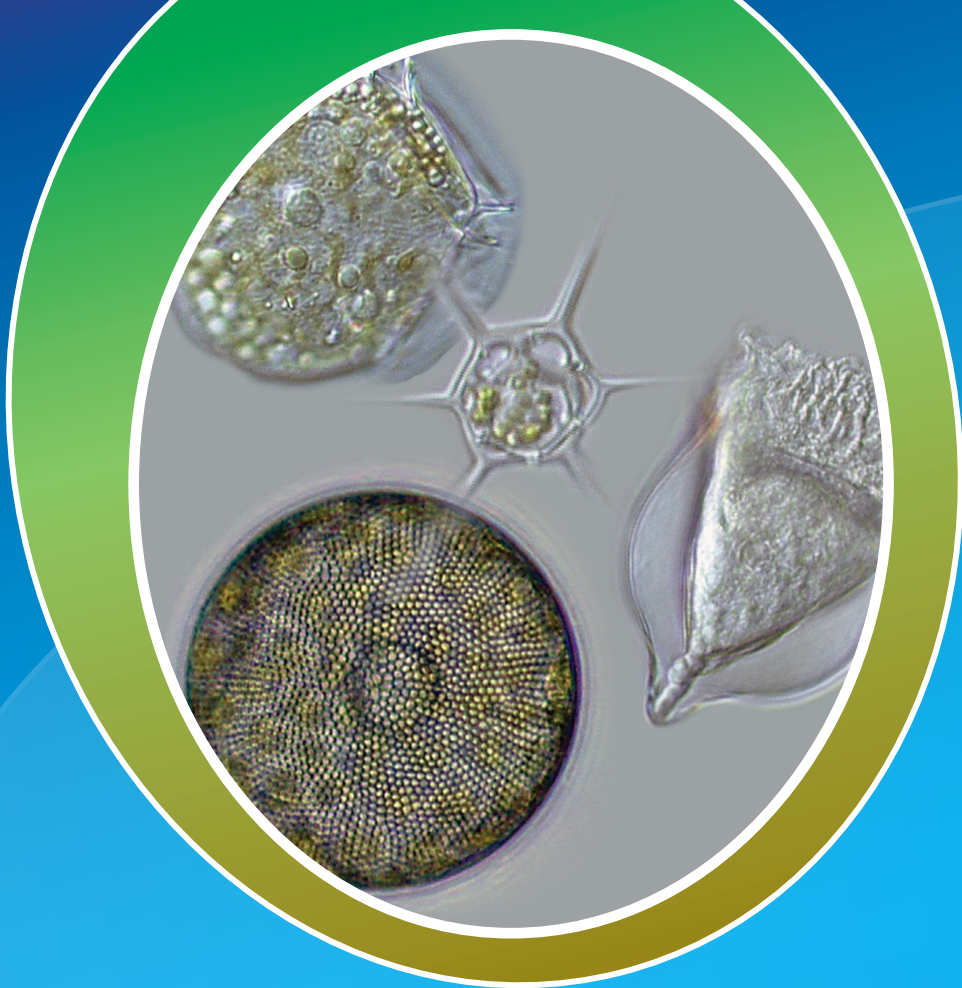
*A town near the coast of Sumatra lies in ruin on January 2, 2005.*

## Financial update

COI distributed \$542,463 in funds for 2009. COI allocated the majority of its funds to research grants (33%) and Fellowships (24%), supporting about 9 WHOI scientists. Funds were provided for WHOI Postdoctoral Scholars (13%) and Joint Program PhD students (17%), fostering development of the next generation of scientists working in the coastal ocean. Discretionary (4%) and Communication funding (4%) was used to support travel, Seminars and Workshops, and outreach activities by several WHOI scientists and staff including the COI Seminar Series and Tsunami Web site. COI also provided support to the Martha's Vineyard Coastal Observatory (2%) and the small boat fleet (3%) for coastal researchers.

**COI Spending Jan. – Sept. 2009: \$542,463**





## About the Coastal Ocean Institute

The Coastal Ocean Institute promotes scientific inquiry into the phenomena that shape our coastal waters and ecosystems. Through grant programs, scientific gatherings, and state-of-the-art facilities, the Institute encourages innovative, interdisciplinary research and high-risk technology development to improve our understanding of the fundamental processes at work in the coastal ocean. COI strives to translate the results of this basic research for citizens and policymakers, while providing a solid information base for better resource management.

### COASTAL OCEAN INSTITUTE

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*Front cover: An aerial photo of Buzzards Bay was used in promotional materials for a COI seminar titled "Efforts to protect and restore Buzzards Bay: Scientific and political challenges for the next decade" given by Joe Costa, Buzzards Bay National Estuary Program, Massachusetts Coastal Zone Management, April 23, 2009. (Photo by Brian Dowley) Back cover: A variety of protists, single-celled organisms, that are critical links in the ocean's food web. (Photos by Dawn Moran, WHOI)*