



UNIVERSITY OF DELAWARE SEA GRANT REPORTER

INSIDE:
Sea Grant UD marine scientists tackle coastal issues.
ON BACK: Learn about our outreach programs, publications, and Web sites. Enter the drawing for our Great Coastal Gift Package!

Volume 22, No. 1 — 2003 Annual Report

The Ocean Touches Your Life Every Day

M eet the Barczaks from Newark, Delaware. Like most beachgoers, they arrive at the Delaware shore with plenty of gear in tow — from boogie boards to fishing rods — ready for a day of sun, fun, and relaxation.

The Barczaks are among more than 5 million people who visit the Delaware seashore each year, drawn like a magnet to the 24-mile stretch of coastline bordering the Atlantic Ocean.

Yet when their day at the beach is over, the Barczaks' connection to the ocean will not end. And neither will yours.

Whether you live in Delaware or thousands of miles from shore, the ocean touches your life every day. As you'll see highlighted here, the ocean turns up in a lot of places, from the toothpaste you brush your teeth with, to the clothes on your back.

For coastal states like Delaware, this ocean connection is even more inextricable. Nearly all of Delaware resides in the coastal plain, and our heritage and economy have long been linked to the sea through ports and shipping, fishing, tourism, and other industries, and much-treasured leisure-time activities.

Yet increasing human pressures are impacting marine resources in Delaware and around the globe, resulting in polluted waters, declining fisheries, lost wetlands, and other problems.

Through marine research and public education, the University of Delaware Sea Grant College Program is working to address a number of coastal challenges on behalf of Delawareans like the Barczaks and the ocean we all depend on.

As you read this report, we hope you will be reminded of the critical importance of Delaware's marine resources and the role you play in their future.

A face cream manufactured by a major cosmetics line contains *pseudopterosin*, an anti-inflammatory compound extracted from the Caribbean sea whip, a kind of soft coral.

While her new teeth will come in soon, a product made from the skeletons of hard marine corals — *hydroxyapatite* — is remarkably similar to human bone and is being used in dental and medical implants. It can shore up areas of bone loss around the root of a tooth or fill in voids in fractured arms and legs.

New drugs from the sea are destined to appear in her lifetime. A synthetic hormone copied from salmon already is helping to prevent osteoporosis in women who cannot take estrogen. Clinical trials of other marine drugs show promise in treating chronic pain, cancer, arthritis, and AIDS.

The ocean captivates us in literature and the arts. Dozens of books, films, paintings, and musical compositions have been inspired by the sea — from *Moby Dick* to "Surfin' USA."

The ocean contains a bounty of minerals, ranging from gold in seawater to petroleum in the seafloor. SPI Pharma in Lewes is the world's largest manufacturer of antacid agents. The company extracts magnesium from Delaware Bay seawater for use in antacids such as Maalox.

Many of the foods you eat contain marine compounds. Carrageenan, derived from the sugars in red algae, makes peanut butter more spreadable. It enhances the texture of ice cream, pudding, and chocolate milk. It also improves the consistency and flow of toothpaste and other products.

The top species of fish caught by Delaware's recreational anglers last year were black sea bass, tautog, Atlantic croaker, summer flounder, bluefish, and weakfish. The top commercial finfish catch was weakfish. The blue crab was the state's most valuable commercial fishery at over \$5 million.

Beach sand is mined in some areas of the world for elements like titanium — the strong, light metal used to make space capsules, golf clubs, and other products.

A lot of our fuel, food, and clothing travels to us by ship. Wilmington is the top port in North America for imports of bananas, fresh fruit, and juice concentrate.





Dr. Carolyn Thoroughgood

Sea Grant

Research, Education, and Public Service — that's what the University of Delaware Sea Grant College Program is all

about. Our goal is to promote the wise use, conservation, and management of coastal resources by conducting high-quality research, educating the next generation of environmental leaders, and serving the public with trustworthy information.

We're part of a national network of Sea Grant colleges based along the entire U.S. coastline. Our funding comes from the federal government through the National Oceanic and Atmospheric Administration (NOAA), the State of Delaware, and the University of Delaware.

Currently, Delaware Sea Grant is conducting 19 research projects in five priority areas: coastal ocean studies, coastal engineering, environmental technology, marine biotechnology, and fisheries. These projects range from determining the conditions that trigger blooms of *Chattonella*, a species of harmful algae recently discovered in Delaware's Inland Bays, to developing new satellite technologies for monitoring the health of our waterways.

This report highlights only a small portion of our research and outreach program. To learn more, visit us at www.ocean.udel.edu. To share your coastal concerns, please fill out the brief survey on back or write to us at MarineCom@udel.edu. Your input is important to us!

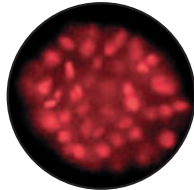
Carolyn A. Thoroughgood

Dr. Carolyn A. Thoroughgood
Director, UD Sea Grant College Program
Dean, UD Graduate College of Marine Studies

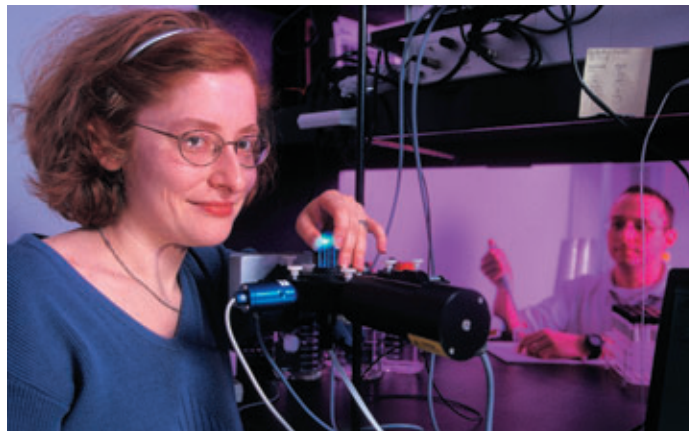
Chattonella: Investigating a New Bay Threat

In the past decade, an unwelcome cast of characters has appeared in Delaware's Inland Bays. First it was *Pfiesteria*, then red tide, then brown tide. Then in 2000, *Chattonella* came on the scene, implicated as "a contributing factor" in a massive fish kill in Bald Eagle Creek.

Chattonella and its companions are Harmful Algal Bloom (HAB) species — microscopic plants that can multiply rapidly, or "bloom," with often-devastating results for marine life. Some HAB species, like *Chattonella*, release toxins dangerous to fish and humans.



Above: The red dots in these *Chattonella* represent chloroplasts, the organs that enable the algae to convert sunlight into food. **Below:** Graduate student Mattie Madden uses a chlorophyll fluorometer to measure the health of a *Chattonella* culture as marine scientist Mark Warner looks on.

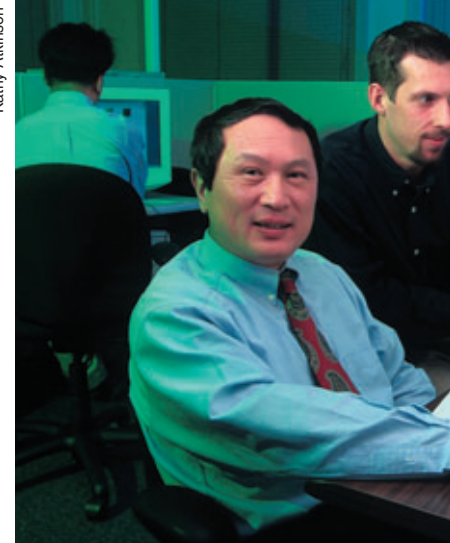


During the next two years, UD marine scientists Mark Warner and David Hutchins will be working to find out what conditions trigger *Chattonella* blooms and exploring methods to control future outbreaks.

"Lots of different algae live in our coastal waters," Warner says. "The algae that bloom are often superior competitors for available light and nutrients."

In addition to examining how *Chattonella* responds to various light and nutrient levels, the scientists want to identify the bacteria and viruses that attack *Chattonella* in its natural environment.

"Such native biological controls may lead to practical ways of containing *Chattonella* blooms in the future," Hutchins notes.



Monitoring the Delaware Bay Health from Space

Miles above us, satellites orbit the Earth what they see. Using these images, UD oceanographer Xiao-Hai Yan has pioneered techniques for monitoring ocean phenomena on global to local scales.

Yan made international headlines recently when he discovered that El Niño, the infamous weather phenomenon that causes an imbalance in the Earth's rotation, can be up making our day a few fractions of a second.

Currently, in Sea Grant research, he and his research team are working out the complex mathematics behind new satellite image-processing techniques that will help scientists and resource managers more easily monitor the health of Delaware Bay. Examining high-resolution images of the bay taken by satellites and radar, he and his team are steadily sorting out the spectral signatures of water-quality indicators, such as chlorophyll. This reveals the presence of algae in the bay.

Going with the Flow in Little Assawoman Bay

Aboard the 26-foot research vessel *Captain Thomas White*, UD marine scientist Kuo-Chuin Wong prepares to release a current meter into Little Assawoman Bay. The black sphere, about a foot in diameter, will record the speed and direction of the water flow at this location over the next 75 days.

It's a task that will be repeated several times in the next year. Wong also will be monitoring water temperature, salinity, and sea-level rise at several locations and sorting out the effects of tides, wind, and river discharge on water flow. The goal of his research is to provide scientists, resource managers, and local citizens with a clearer understanding of this shallow bay's circulation.

Little Assawoman Bay is connected to Indian River Bay on the north by the Assawoman Canal, and to the Assawoman Bay on the south via a narrow channel. No one knows how much water is exchanged among these systems. The answer could help shed light on a number of issues facing Little Assawoman Bay, from the increased incidence of

harmful algae to a recent call for dredging the Little Assawoman Canal.

The study is funded by Sea Grant in partnership with the Delaware Department of Natural Resources and Environmental Control.



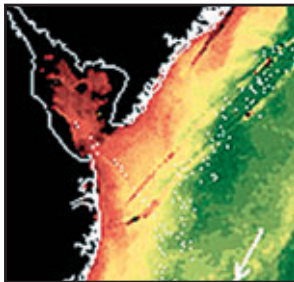
Far Left: UD scientist Kuo-Chuin Wong (left) and Art Sundberg, assistant director of marine operations, prepare to deploy an S-4 current meter in Little Assawoman Bay. **Left:** The current meter can record the speed and direction of the current, as well as water temperature and salinity.

More than 5 million people live in the Delaware River and Bay's watershed — a land area covering 13,539 square miles in four states. Over 60,000 people live in the 300-square-mile watershed that drains into Delaware's Inland Bays (Rehoboth, Indian River, Little Assawoman bays).



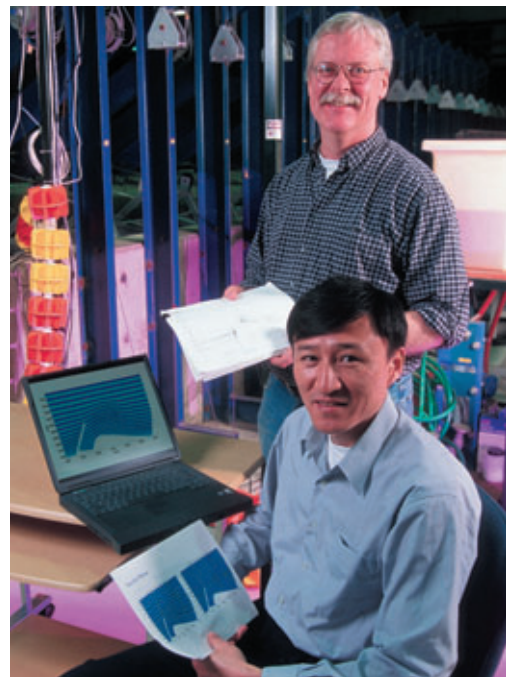


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Top: Graduate student Brian Dzwonkowski and UD scientist Xiao-Hai Yan view recent El Niño research. **Above:** This satellite image of Delaware Bay, taken on April 11, 2002, shows high chlorophyll concentrations — an indicator that there are lots of algae in the water. The highest levels (red areas) appear in the upper bay and along the coast. This may be due to high concentrations of the nutrients nitrogen and phosphorus, which are typically associated with land runoff.

Kathy Atkinson



Happy as a Clam? — High-Tech Tool May Tell ▶

Whether steamed and served with butter or swimming in chowder, the hard clam (*Mercenaria mercenaria*) has lots of fans among seafood lovers. In Delaware, the hard clam supports both commercial and recreational fisheries in the Inland Bays. Region-wide, the commercial shellfishery is valued at over \$65 million and is expected to grow.

UD marine biologist Adam Marsh is leading a Sea Grant research project to develop a new technique for monitoring hard clam health. He and marine biologist Kevin Fielman and Marine Advisory Service specialist John Ewart will be examining hard clams at the DNA level to identify “biomarkers” — key stress-response proteins that can be used as a rapid test for QPX disease or other environmental stressors.

QPX is a parasite that can cause high mortalities in hard clam populations. Aggressive monitoring programs for the clam parasite have been established in a number of states; however, none currently exists in Delaware.

“With oyster populations decimated along the Atlantic seaboard and continuing declines in blue crab landings, hard clams rapidly are becoming a more important fishery resource in the Mid-Atlantic states,” Marsh says. “An advanced monitoring program in Delaware’s Inland Bays could help aid future management of this public resource.”



Above: The hard clam (*Mercenaria mercenaria*) is a “filter feeder,” meaning that it filters its food — tiny algae — out of the water. **Right:** UD marine scientist Adam Marsh prepares a culture for an upcoming lab experiment.



Kathy Atkinson

Bob Bowden



◀ Finding Fresh Water in the Sea

Ancient Greek and Egyptian sailors knew of freshwater seeps along the coast where drinking water could be collected during long ocean voyages. Scientists now believe these groundwater discharge zones may be responsible for up to 10% of the total freshwater input to the ocean.

However, these seeps release more than just fresh water to the sea. They also transport nutrients and other contaminants from the land.

During the past few years, UD oceanographers Bill Ullman and Doug Miller have identified seeps along the Delaware coast and have analyzed in detail the hydrology, chemistry, and biology of a seep along the Delaware Bay at Cape Henlopen and several others in Indian River Bay.

During the next two years, the scientists will be working to set up a permanent observatory for the study of groundwater discharge at one of the sites.

“We know that seep water has high concentrations of nutrients, but we don’t know the quantities of nutrients that these seeps are contributing to coastal waters, particularly in enclosed systems like the Inland Bays,” Miller explains. “A permanent observatory will help us define that unknown.”

The scientists also want to learn more about the organisms that inhabit these freshwater oases in the sea.

“Seeps are fascinating zones that support unique communities of organisms — mostly marine worms called polychaetes,” Miller says. “These worms turn over the entire seafloor as they feed on microbes in the mud. Their dense burrows and pellets often can reveal a seep’s location along the coast.”



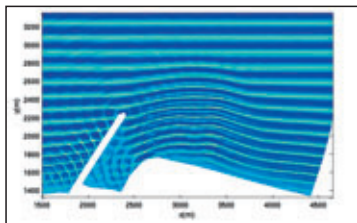
Upper Left: At low tide, UD oceanographer Doug Miller and graduate student Jill Brown survey a seep along Indian River Bay. **Above:** This sediment core exposes the red-gilled mud worm (*Marenzelleria viridis*) and its tell-tale burrows. This worm inhabits a freshwater seep in the Delaware Bay near Cape Henlopen. The worm would not otherwise survive in the salty bay.

◀ Engineering a New Nearshore Wave Model

The complex interplay of waves and currents in harbors like Indian River Inlet often can result in treacherous boating conditions. Predicting the sea’s actions in nearshore regions is the goal of a new wave model that Delaware coastal engineers are developing in collaboration with scientists from across the United States.

UD coastal engineer Jim Kirby is leading the project, which is funded by the National Oceanographic Partnership Program and involves physical oceanographers from nine states. When completed, the new model will be able to accurately predict waves, currents, sediment transport, and changes in bathymetry between the shoreline to a depth of about 10 meters (33 feet) and along a distance up to 5 kilometers (3 miles).

Kirby’s Sea Grant research is critical to the model’s real-world application. During the next two years, he and colleague Fengyan Shi will be developing computer programs to access the data their small-scale model needs from larger-scale models that can predict tides and waves along shorelines as long as half the East Coast and as far offshore as the Gulf Stream.



Left: In UD’s Ocean Engineering Lab, coastal engineers Jim Kirby and Fengyan Shi (seated) work on a computer model that can predict waves, currents, sediment transport, and bathymetric change near shore. **Above:** This graphic generated by their model shows the wave field approaching Ponce de Leon Inlet in Florida. Land areas are in white.

The Delaware State Seal contains two major symbols of the state’s maritime heritage: the ship represents New Castle County’s shipbuilding industry and Delaware’s extensive commerce. The water stands for the Delaware River — “the mainstay of the state’s commerce and transportation.”



Delaware has a state fish (weakfish) and a state marine animal (horseshoe crab). The state fossil — *belemnite* — also lived in the sea. It was a squid-like carnivore with tentacles for catching prey. The most common fossilized part, the cigar-shaped internal shell called the rostrum (shown here), often can be found along the Chesapeake and Delaware Canal.



Fossil courtesy of Delaware Geological Survey

OUTREACH

Sea Grant has an ocean of information to share with you! Our outreach team — the Marine Advisory Service (MAS) and the Marine Public Education Office — work together to relay research-based information on a variety of topics.

From UD's Lewes campus, the MAS travels the state to assist Delawareans with issues in aquaculture, fisheries, coastal processes and hazards, marine education, marine transportation, tourism, seafood technology, and water quality.

The Marine Public Education Office, based at UD's Newark campus, translates complex scientific information and presents it in award-winning publications, "SeaTalk" radio announcements, on-line expeditions, and Web sites.

This page highlights just a few of our outreach activities. For more information, visit Sea Grant on the Web at www.ocean.udel.edu or contact the MAS at (302) 645-4346 or the Marine Public Education Office at (302) 831-8083.



Watch Out for Rip Currents

Rip currents cause over 100 drownings along the U.S. coast each year. MAS specialist Wendy Carey is working with the National Weather Service, DNREC, and local beach patrols to establish a rip current warning system for Delaware. Educational signs about rip current safety and other topics also have been installed at Rehoboth Beach, Dewey Beach, and Bethany Beach through a community partnership program.



Delaware's Clean Marinas

Delaware Sea Grant, DNREC, and the Center for the Inland Bays have launched a statewide Clean Marina Program. Besides an extensive guidebook for marinas, MAS specialist David Chapman has developed a handy boater tip card for the boating public. For a free copy, call (302) 645-4346.

Students Discover Deep Sea

Last fall, 42,000 middle- and high-school students from across the United States joined "Extreme 2002," a virtual field trip to hydrothermal vents in the Pacific Ocean. The innovative program, led by UD scientist Craig Cary and the Marine Public Education Office, was supported by the National Science Foundation, WHY-TV, and the MBNA Foundation. Among its honors, the expedition Web site — www.ocean.udel.edu/extreme2002 — has earned the National Science Teachers Association's mark of excellence. Dive in today!



Keeping Seafood Safe

Do you know how to properly store, handle, and prepare seafood once you've purchased or caught it? MAS specialist Doris Hicks delivers safe seafood handling programs to industry and the public. To learn more, visit her pages on the Sea Grant Web site at www.ocean.udel.edu.



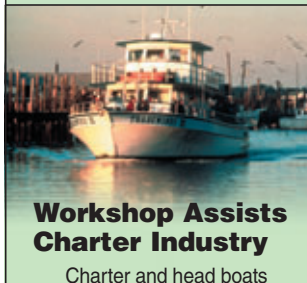
Sussex Residents Define "Quality of Life"

Clean environment, good economy, presence of open space, and good transportation system — these are all major factors that add up to Sussex Countians' quality of life, according to recent surveys conducted by MAS specialist Joe Farrell and MAS director Jim Falk through Sea Grant's Coastal Communities initiative. The final reports, available in the near future, will aid local planning efforts. For more information, please contact the Sea Grant Marine Advisory Service at (302) 645-4346.



Workshop Assists Charter Industry

Charter and head boats have formed the backbone of the Mid-Atlantic sportfishing industry for over a century. Delaware Sea Grant recently helped host a regional workshop on business and legal issues affecting offshore chartering and regional sportfisheries. The successful program attracted charter operators from five states. For more information, contact MAS specialist John Ewart at (302) 645-4060.



Explore a Marine Science Career!

There's a whole ocean out there, waiting to be explored! If you're interested in marine science, contact the Marine Public Education Office at (302) 831-8083 and request a free copy of "Marine Science Careers." Written by MAS specialist Bill Hall, the full-color, four-page publication highlights careers in marine biology to ocean engineering, the education you'll need, and job outlook.



Bob Bowden

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COMING EVENTS

Ocean Currents Lecture Series —

Free lectures by UD marine scientists are presented once a month, April through September, at 7 p.m., UD Hugh R. Sharp Campus, 700 Pilottown Road, Lewes. Reservations are required. Contact: (302) 645-4279.

Marine Science Tours —

Free tours of the UD College of Marine Studies in Lewes are offered every Friday at 10:30 a.m., June through August. Ages 12 and up. Reservations are required. Contact: (302) 645-4346.

Coast Day —

Sunday, October 5, Lewes Campus. 11 a.m. to 5 p.m. Free admission; \$2 parking. This award-winning festival features research lectures, exhibits, ship tours, children's activities, a crab cake cook-off, and more! Contact: (302) 831-8083. Web: www.ocean.udel.edu/coastday

Extreme 2003 —

Middle- and high-school teachers, sign up now for this innovative educational program, sponsored by the National Science Foundation, that will connect your students with UD marine scientists working live at deep-sea hydrothermal vents this fall. Register on-line at www.ocean.udel.edu/expeditions. Contact: (302) 831-8083.

Wilmington Lunch & Lecture Series —

Held periodically from November through April, this popular lecture series highlights the latest UD marine research over a delectable lunch at the four-star Hotel du Pont. Cost: \$15 per person. Reservations are required. Contact: (302) 831-8083. E-mail: MarineCom@udel.edu



SEA GRANT COLLEGE PROGRAM
University of Delaware
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Take This Survey and You Could Win a Prize!

Delaware Sea Grant wants to hear from you! Fill out and mail us this brief survey, and you will be entered into a drawing for our **Great Coastal Gift Package**, to be awarded **July 31, 2003**. Mail your completed survey to *University of Delaware, Marine Public Education Office, Newark, DE 19716-3530*.

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1. What marine issues most concern you?

2. How would you rate this report? (check one)
 Excellent Very Good Good Poor

Comments: _____

3. Would you like to sign up for our free, e-mail news service? If so, please fill in your e-mail address.

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