

The Crest

*Current Issues in
Coastal Ocean and
Estuarine Science*

Construction Begins on New Buildings

General contractor W.M. Jordan and Company has begun construction on VIMS' Gloucester Point campus for two new buildings—Andrews Hall and the Seawater Research Laboratory.

Funding for the buildings comes from a higher education bond passed by Virginia voters in 2002.

Andrews Hall, named after Cynthia and the late Senator Hunter B. Andrews, is a 4-story research facility similar to Chesapeake Bay Hall. The 71,000-square-foot building will feature 39 laboratories, 25 faculty offices, and space for nearly 100 students, technicians, and visiting scientists.

The four-story structure will also include an electronics shop, distance-learning classroom, conference rooms, and the Aquaculture Genetics and Breeding Technology Center. It will consolidate programs from Biological, Physical, and Fisheries sciences by replacing three outdated laboratory build-

ings and numerous converted single-family dwellings.

The Seawater Research Laboratory (SRL) will provide approximately 46,000 square feet of open, multi-purpose space for setting up flow-through tanks for culturing fish, shellfish, and sea turtles. The plumbing system will provide 900 gallons per minute of seawater to support state-mandated research on finfish and shellfish. A high bay with a retractable garage door and ceiling-mounted crane will permit handling of large oceanographic instruments.

The SRL will also include a disease-challenge facility and a Level 2 Biological Safety Laboratory that will allow VIMS scientists to study moderately dangerous pathogens, such as the mycobacteriosis afflicting Chesapeake Bay striped bass. There will also be a Level 3 Biological Safety Laboratory for

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Steel framing for VIMS' new Seawater Laboratory is now in place.

Warner Proposes \$2.9 M for VIMS to Monitor Bay Restoration Effort

Outgoing Virginia Gov. Mark Warner's proposed budget for the 2006-2008 biennium includes \$2.9 million for VIMS to monitor the Commonwealth's progress in meeting the 2010 Environmental Protection Agency deadline for the clean up of the Chesapeake Bay and its tributaries.

The former Governor's proposed budget is now being debated in the General Assembly. The amended budget will be sent to newly-elected Governor Tim Kaine for his review and signature after the legislature adjourns in mid-March.

VIMS Dean and Director John Wells says "We are very pleased to be part of the commitment of public funds that will be directed towards clean-up efforts in Chesapeake Bay. As the Commonwealth's scientific advisor on natural-resource issues, VIMS has a sig-

nificant role to play in gauging the success of the expenditure of public funds for Bay clean-up."

The VIMS funding was part of a proposed budget that includes \$242.5 million for drinking-water programs—the largest single investment in state history. William and Mary President Gene R. Nichol applauded the governor's budget proposal as well as the bipartisan support in the Bay recovery effort. The VIMS funding would be used primarily for monitoring water quality using state-of-the-art sensors and models.

"This is a tremendous commitment toward moving forward the Commonwealth's obligation to cleaning up the Chesapeake Bay," Nichol said. "We are delighted that VIMS will play a significant role in this recovery effort."

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Workers prepare the footers to be poured for Andrews Hall.

VIMS Collaborates to Restore Lynnhaven

In 1607, England's Jamestown settlers made their first landing in Virginia near the mouth of a pristine Chesapeake tributary today known as the Lynnhaven River.

Now, 400 years on, VIMS scientists have joined a multi-institution effort to begin restoring the river's health, just in time for the quadricentennial of the colonists' landfall.

Modelers and ecologists at VIMS are partnering in the Lynnhaven restoration project with the U.S Army Corps of Engineers and the Virginia Beach City Government. VIMS oyster experts are working with NOAA, the Virginia Marine Resources Commission, the

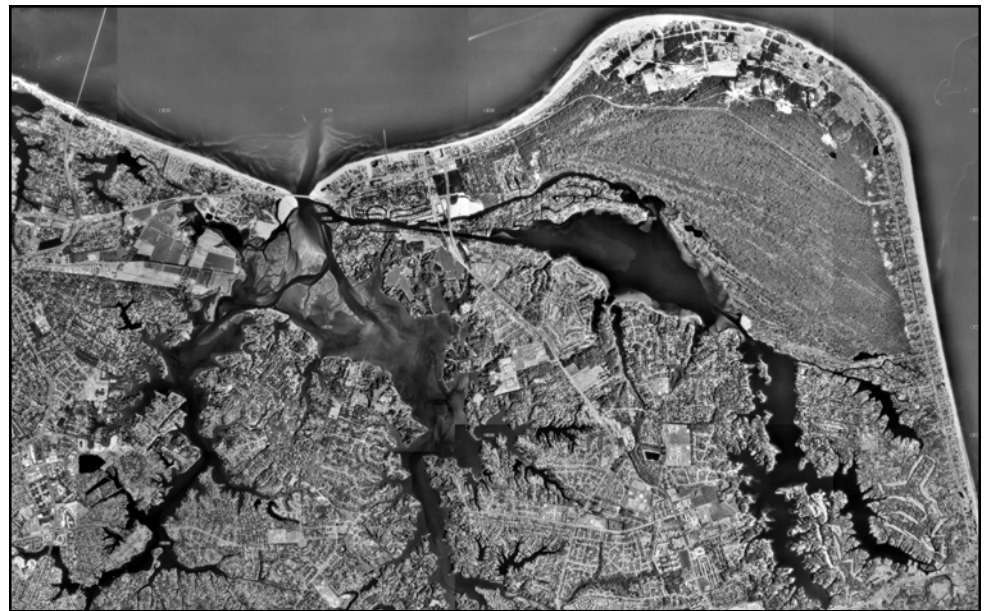
Chesapeake Bay Foundation, and the citizens group *Lynnhaven 2007*.

The Lynnhaven, whose watershed covers one-fourth the area of Virginia Beach, provides vital services to the City and its 400,000 residents—including boating, fishing, crabbing, and ecotourism. However, the river has become increasingly stressed as its watershed has urbanized.

As project lead, the Army Corps is collaborating with its state and federal partners to lessen these environmental stresses through a 5-year, \$3 million coordinated effort to identify and implement the most effective strategies for improving water quality, restoring oysters and bay grasses, and managing siltation.

VIMS' role in the restoration effort is multifaceted. A key component is a 3-year, \$600,000 grant from the Corps to researchers Harry Wang, Jian Shen, Mac Sisson, Albert Kuo, and Yuepeng Li. Their task is to refine the Institute's existing state-of-the-art computer model so that it can accurately simulate water flow and quality within the Lynnhaven's shallow waters. The Corps will use the model to identify the areas of the river where restoration efforts are most likely to succeed.

A unique aspect of the modeling project is a suite of related field studies (see sidebar on page 8) designed to identify and measure the biological and



The Lynnhaven River's three branches (Eastern, Western, and Broad Bay/Linkhorn Bay) cover about 65 square miles in the urbanized northern half of Virginia Beach, the commonwealth's largest city.

chemical processes that affect water quality in the river. Data from these studies will be used to both initiate and test the computer model.

Other VIMS teams, led by Drs. Stan Allen, Rom Lipcius, Mark Luckenbach, and Roger Mann, are working to restore the river's oyster populations. Funding for these efforts comes largely from NOAA.

Modeling

Other than a few boating channels,

most of the Lynnhaven River is only a meter or two deep. The river's shallowness, plus a convoluted shoreline that snakes more than 150 miles, makes modeling its circulation and water quality a real challenge.

VIMS' state-of-the-art "UnTRIM" model takes full advantage of modern computing power to simulate conditions within shallow, complex estuaries like the Lynnhaven. It does so by using a mesh of grid cells that are small enough to

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New Construction

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working with aquatic pathogens that pose a more serious risk to human health. A toxics laboratory will permit analysis of the health impacts of waterborne pollutants. Benthic ecology and coral reef labs, a radiation room, and an entrance suite with offices and an exhibit /conference space complete the facility.

VIMS Facilities Manager Wendell Goodwin says that construction on the two buildings is progressing according to schedule.

"The underground utilities have all been installed for Andrews Hall, allowing construction to begin," says Goodwin. "Excavation for the first floor is now complete, and work on the wall footings has started. Underground utilities within the building pad can then be scheduled for installation. Once the first floor walls are completed, construction of the upper floors can go forward."

"For the seawater lab, most of the piping and electrical conduit has been installed, and pouring of the trench walls is in progress. The galvanized steel fram-

ing is in place, roof installation will commence in the next week or so, and then the first floor slab can be poured and construction of the walls and infrastructure will commence."

The project is scheduled for completion in March of 2007.

Virginia Secretary of Natural Resources W. Tayloe Murphy Jr., Cynthia Andrews, and W&M President Gene Nichol break ground for VIMS' new marine research complex during a September 30th ceremony in Gloucester Point. Numerous other dignitaries joined in the ceremony. When completed, the complex will feature a 46,000

square-foot seawater laboratory and the 71,000 square-foot Andrews Hall, named in honor of Cynthia Andrews and her late husband Hunter B. Andrews, a long-time Virginia senator and VIMS supporter.



A Tale of Two Breakwaters

Editor's note: This pair of articles highlights two parts of VIMS' multi-faceted role in helping to guide shoreline management in Chesapeake Bay.

Shoreline Program Aids Yorktown Revitalization

It might be the last thing on their minds as they relax on the beach, shop in nearby stores, or enjoy an evening concert, but visitors to Yorktown's new Riverwalk Landing are direct beneficiaries of a long-term collaboration between York County officials and scientists at VIMS.

The collaboration, which began with the construction of a small breakwater in 1985, has helped the historic riverfront community stem shoreline erosion, weather Hurricane Isabel and several powerful nor'easters, and maintain a popular swimming beach.

VIMS' lead in the project is Scott Hardaway, head of the Shoreline Studies Program at the Institute and a recent electee to the National Research Council's *Study Committee on Mitigating Shore Erosion Along Sheltered Coasts*.

Hardaway says that VIMS' primary role in the revitalization project has been to provide technical advice concerning the size, shape, and placement of the 12 breakwaters that now line the York River waterfront.

Two floating breakwaters, which serve as piers for commercial and recreational vessels, were designed by the Williamsburg office of civil engineering firm VHB Inc. VHB prepared the final design and plans for all phases of the Yorktown project.

The Yorktown work is part of VIMS' larger Chesapeake Bay Breakwater Database Project, a partnership with the U.S. Army Corps of Engineers to develop guidelines and track breakwater performance at 40 sites around the Bay.

Breakwaters are elongate structures, typically of stone, that are emplaced just seaward of the shoreline to be protected. They work by damping, bending, and otherwise disrupting waves before they reach land.

To ensure that a breakwater system will perform most effectively, Hardaway's group uses a combination of field measurements, mathematical equations, and computer models to identify the particular conditions under which the system will operate. They characterize the prevailing wind and wave direction, predicted wave heights and

water levels for 50- or 100-year storms, the seafloor bathymetry, and the shoreline profile.

They then use this information to specify the many interacting factors that govern a breakwater's shape and placement (see figure). "While we try to consider all of these factors, they rarely carry equal weight," notes Hardaway. "In fact,

satisfying all objectives for any given project is unlikely, as some may be mutually exclusive."

The magnitude of the sand supply is another important design factor. Historically, Yorktown Beach was fed by erosion of sandy banks nearby. However, the beach began to narrow as the natu-

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In its first year of operation, the \$10 million Riverwalk Landing drew more than 65,000 visitors to special events in Yorktown and countless more on an everyday basis. The development pumped millions of dollars into the local economy.

Maa Works with Local Business to Test Breakwater

VIMS researcher Dr. Jerome Maa has been funded by a local company to test the efficiency of floating breakwaters in protecting marinas and other coastal structures from wave action.

The company, Coastal Design and Construction, Inc. (CDCI) of Gloucester County, recently awarded Maa a 4-month contract to study the efficiency of a floating breakwater they've emplaced outside the Hyatt Hotel's River Marsh Marina. The marina abuts the Choptank River near Cambridge, Maryland.

Test results will help the company provide its customers with more realistic estimates of breakwater performance—and help explain a discrepancy between observations of breakwater performance in the laboratory and the real world.

"The marina had asked for a floating breakwater that could reduce wave height by 75%," says Maa. "Lab studies done by a Spanish institute several years ago showed that a floating breakwater would be unable to meet this requirement, but CDCI's experience with real world breakwaters suggests otherwise."

To help the company test breakwater performance in the field, Maa will deploy three separate wave gauges in the vicinity of the Hyatt Hotel's River Marsh Marina—one outside the structure and two in the protected waters within. The gauges, built by VIMS instrument maker Wayne Reisner, employ a bottom-mounted sensor that records the rise and fall of water pressure as wave crests and troughs pass above. In addition to measuring wave height, the external sensor employs a trio of pressure gauges that

together provide data on wave direction.

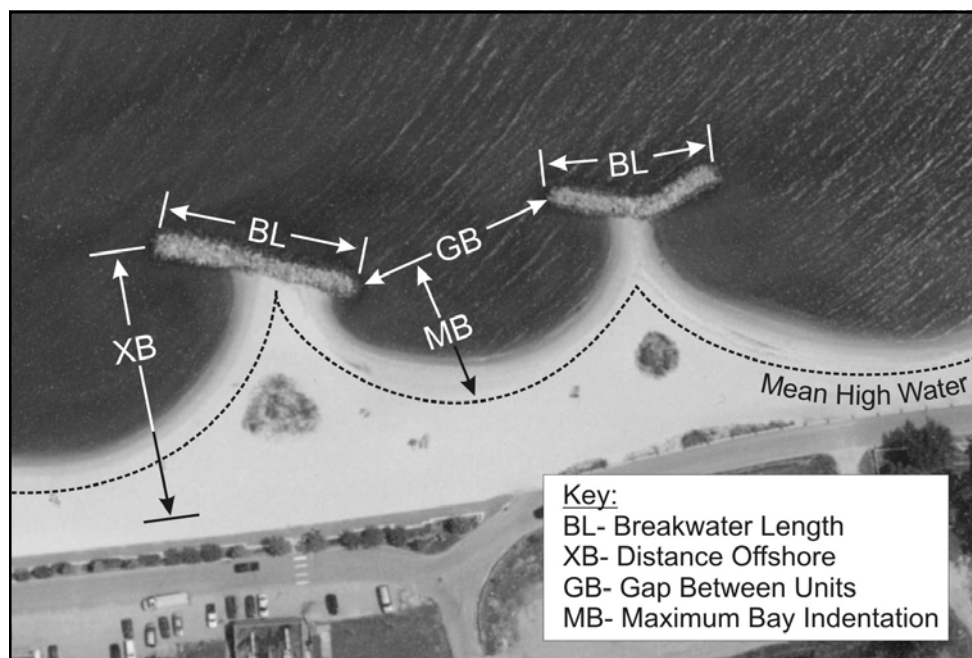
Maa, along with team members Bob Gammisch and Ho Kyung Ha, will travel to the site once a month between December and March to download the wave data for analysis. The four-month study was scheduled for winter in order to sample the larger waves that typically roil Chesapeake Bay and its tributaries during that time.

Maa suspects that his study will confirm that the Choptank breakwater meets the performance requirements requested by the marina. Concerns about breakwater performance, he thinks, are likely a result of the methods used in the original laboratory tests of breakwater efficiency.

"The original experiments with the floating breakwater didn't distinguish between wave diffraction and transmission," explains Maa. "They thus probably underestimated the effectiveness of the device." Results of Maa's study will be provided in a report to CDCI this spring, just after the wintertime experiment ends.

Floating breakwaters are a relatively recent innovation in wave-management technology. Because they float on the surface, they are more environmentally friendly, and typically cheaper, than more traditional designs that require the costly and oftentimes destructive emplacement of stonework on the seafloor.

Floating breakwaters function best in protected coastal areas where wave heights are generally low and the distance between wave crests is short. Shorelines exposed to massive, long-period swells still require the use of solid breakwaters that sit on the seafloor.



Many interacting features govern the shape and placement of elements in a breakwater system. These include orientation, length, and height of individual breakwaters; the gap between adjacent breakwaters; the distance between a breakwater and the shore; the width and elevation of the beach; and the system's possible effects on other shorelines up- and downriver.

Seagrass Die-back Troubles Researchers

Dr. Robert Orth and other seagrass researchers at VIMS observed a troubling die-back in lower Chesapeake Bay's dominant seagrass species during the past summer. The die-back also concerns VIMS blue-crab researcher Dr. Rom Lipcius, as seagrass beds are the primary nursery habitat for juvenile crabs.

Eelgrass (*Zostera marina*) in Chesapeake Bay typically loses some of its leaves during July and August each year as water temperatures approach their seasonal peak. The detached leaves form large floating wracks often encountered by beachgoers. This summer, however, leaf-loss in most eelgrass plants in the lower Bay was almost complete.

"Many areas that had robust eelgrass this past spring, including areas where we've had successful transplants, are now completely defoliated," writes Orth in his program's seagrass blog.

All that remains in most local eelgrass beds is the mat of root-like rhizomes that anchor the plants to the seafloor.

A few areas, notably at the mouth of Mobjack Bay (near New Point Lighthouse) and in VIMS' eelgrass restoration sites along the seaside Eastern Shore, retain some live eelgrass leaves. But plant density at these locations is far less than Orth and colleagues have observed during the autumn of previous years.

Orth and his colleague Dr. Ken Moore think that the die-back is probably the result of unusually warm water, combined with low winds and lower light levels. August in Virginia was the 8th-warmest in 111 years of record. Previous research by Moore suggests that these conditions are a recipe for eelgrass demise.

"[This] might explain why we observed plants only along the seashore and in more open areas of the Bay," notes Orth. Conditions in these areas are likely to be windier and cooler than in the Bay's more sheltered tributaries and coves.

Eelgrass in lower Chesapeake Bay is at the southern edge of its thermal range, making it susceptible to water temperatures even slightly higher than normal. Bay grasses in general are also suffering from increased turbidity, which blocks the sunlight they need in order to thrive. Turbidity in the Bay is on the rise due to sediment runoff from farmland and storm sewers, and nutrient-fueled blooms of algae.

"The die-back is likely a result of long-term increases in Chesapeake Bay turbidity and nutrient stresses combined with unusually high temperature condi-

tions in 2005," says Moore. "The light requirements of eelgrass increase exponentially with temperature."

Orth and colleagues are now monitoring the eelgrass beds to test if they are rebounding from the die-back. Eelgrasses usually begin to send out new leaves from their rhizomes with the advent of cooler water temperatures in late November or December.

"Some of the rhizomes may still be alive," says Orth, "so we may see some re-growth." The full extent of recovery, however, may not be fully determined until next spring.

There is also hope that the eelgrass could come back through the germination of seeds. "We had a successful flowering season in 2005 well before the die-back," says Orth, "so we have seeds in the sediment." Eelgrass seeds typically germinate in November and December.

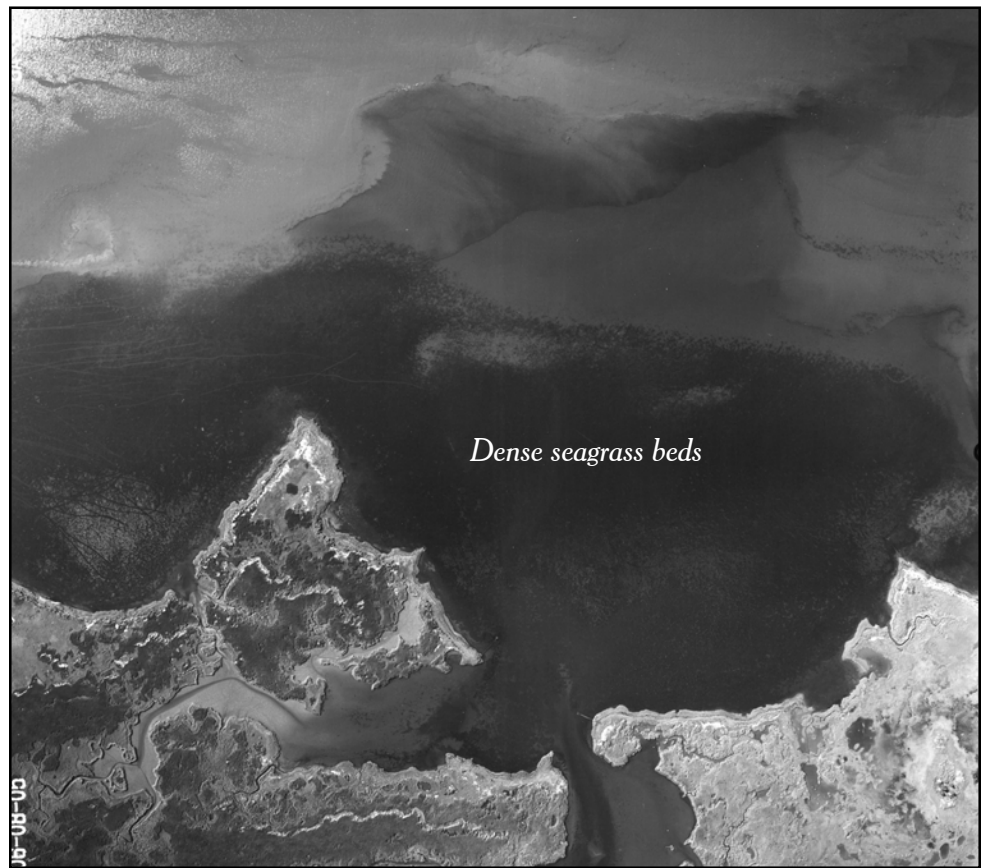
A late November survey of eelgrass beds in the lower Bay showed some new growth from what appeared to be dead rhizomes, as well as some new seedlings. However, shoot densities were only 1 to 18 shoots per square meter, 2-3 orders of magnitude less than what is noted in an average fall. Many plots had no shoots at all.

Moore contends that this summer's unusual die-back may be a sign of things to come. "Given the long-term potential for continuing high summertime temperatures as a result of global warming, the impacts of light reduction through algal blooms and excessive suspended sediments will likely continue," he says. "The eelgrass population can survive here only if spring and summertime light conditions improve through reductions in turbidity."

The continued success of eelgrass beds is crucial to the recovery of the blue crab *Callinectes sapidus*, whose spawning stock is at an all time low in the Bay. The population of female blue crabs in the Chesapeake has declined more than 80% during the last 10 years.

Blue crabs depend on eelgrass beds for protection during their vulnerable juvenile stage. Lipcius is concerned that loss or thinning of eelgrass beds will force young crabs into neighboring sand flats, where they are more susceptible to predation by striped bass, drum, spot, sea trout, croaker, and larger blue crabs.

Lipcius and colleagues are in the midst of a series of experiments designed to test whether the release of hatchery-raised blue crabs into seagrass beds and sheltered coves can help enhance the wild population.



Dense seagrass beds



Bare, unvegetated sand

This pair of before (June, top) and after (December, bottom) aerial photos from the bayside eastern shore of Maryland clearly shows the seagrass die-back observed by VIMS researchers throughout the lower Bay during the summer of 2005.

Orth last observed an eelgrass die-off of this magnitude in 1975. Eelgrass did rebound the following spring, but the extent of the rebound is unknown as the event predates VIMS' annual survey of Chesapeake Bay seagrasses. The survey, which began in 1978, is based on analysis of more than 2,000 black-and-white aerial photographs taken each year between May and October.

The poor health of eelgrass beds in the lower Bay contrasts with the unparalleled recovery of other seagrass species in the upper Bay, particularly near the Susquehanna Flats. Data from VIMS' bay-grass monitoring program show that underwater grass acreage in upper Chesapeake Bay doubled between 2003 and 2004.

VIMS Premieres New Ocean Observatories Course

A new course in VIMS' School of Marine Science gave fall-semester students an exceptional opportunity to learn about ocean observing systems, the latest tool in the world of marine research.

The course, *Ocean Observing Systems: Technology and Applications*, is one of only a handful of such courses currently being offered in the U.S. It was developed and taught by VIMS Associate Professor Dr. Mark Patterson, a leading expert in the design and use of autonomous underwater vehicles, or AUVs.

Implementation of a nationwide ocean-observing network was one of the twelve critical actions recommended by the President's Commission on Ocean Policy in their 2004 report. Integrated ocean observatories will provide services at sea similar to those now provided by the global network of weather sensors, helping society to better deal with episodic events such as tsunamis and hurricanes, and to better understand and predict the ocean's long-term impacts on climate, shipping, and fisheries production.

The goal of the course, says Patterson, is "to prepare students for their likely role in future research by making them expert in ocean observing system technology and applications."

The seven students who enrolled in the fall's inaugural course offering got the chance to explore the nuts and bolts

of ocean observatories, including hardware components, sensors and navigation techniques for mobile platforms, integration of observatory data with computer models, and data management. They also examined the important policy issues and societal expectations for these systems.

The course included hands-on experience with the AUV *Fetch*, a 6-foot robot sub that Patterson helped develop through his technology spin-off company Sias Patterson LLC. Vehicles like *Fetch* are finding increasing use in applications as diverse as fisheries management, homeland security, and assessment of harmful algal blooms. Sias Patterson LLC provided *Fetch* at no cost through a cooperative arrangement with the College of William and Mary.

Students also gained hands-on experience by working with VIMS' York River data buoy and other fixed sensor platforms, as well as the data available on-line via other ocean observatories around the world. These include the Chesapeake Bay Observing System (CBOS), SEA-COOS along the Southeast Atlantic coast, TABS in the Gulf of Mexico, CalCOFI on the West Coast, NEPTUNE Canada, and the European Seafloor Observatory Network (ESONET). The research community's ultimate goal is to create a Global Ocean Observing System, or GOOS.



From L: Graduate students Lorraine Brasseur, Justin Vandever, Rob Condon, and Jarrell Smith pose with Professor Mark Patterson and classmate Taiping Wong before launching *Fetch* from the Yorktown waterfront. Classmates J. Paul Reinheimer and Pat Dickhudt were aboard the chase boat.

Dean of Graduate Studies Iris Anderson praises the course, noting that "it provides our students with an exciting opportunity to keep on the cutting edge of marine research."

Funds for course development came from VIMS, with additional contribu-

tions from members of the VIMS/Ocean Industry Partnership Group.

For more information on ocean observatories, visit the VIMS Ocean Observing System at www.vims.edu/realtime/.



Graduate student Jarrell Smith launches *Fetch* into the chilly waters of the York River.



Members of the Virginia Marine Resources Commission visited VIMS on October 28 to learn more about the services and products that the Institute provides. Here, Jim Gartland (forefront) of VIMS' Chesapeake Bay Multispecies Modeling and Assessment program shows Commission members how fish ear bones can be used like tree rings to determine a fish's age. From L to R: Commission Associate Members J. Carter Fox, F. Wayne McLeskey, and Russell Garrison; Mrs. Eleanor Garrison; Fisheries Division Chief Jack Travelstead; Commissioner William A. Pruitt (face obscured), Law Enforcement Chief and Deputy Commissioner Steve Bowman, and Gartland.

VIMS Sees the Light

On December 2nd of last year, Information Technology and Networking Services Assistant Director Gary Anderson ran a length of fiber optic cable into the Customer Service Center at VIMS, thus completing a multi-year project to replace the campus' original copper network cabling.

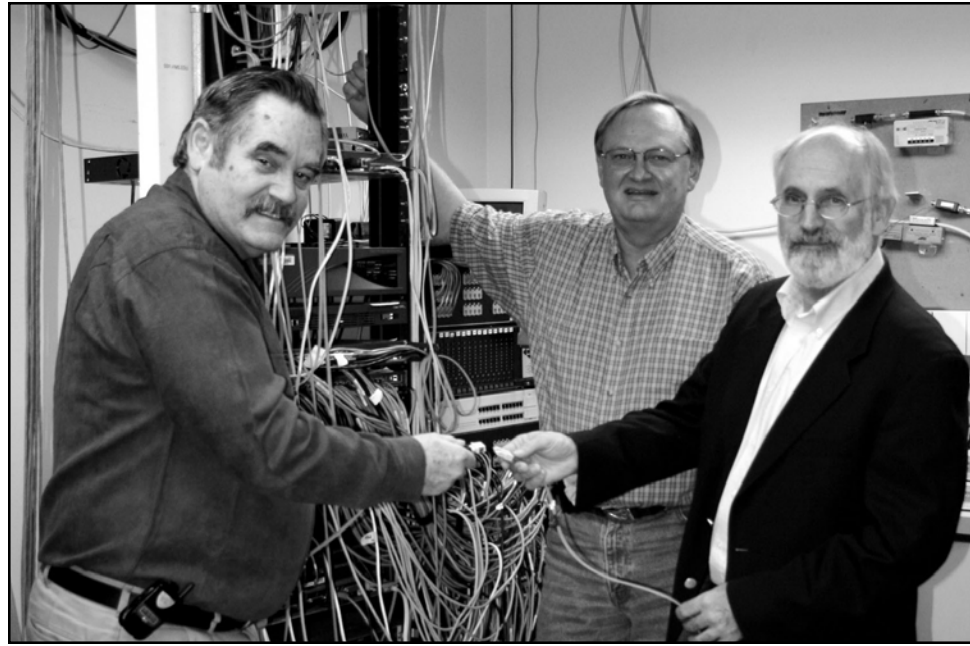
The new fiber-optic cabling makes possible high-bandwidth connections among all VIMS buildings, labs, offices, and classrooms. VIMS' Internet bandwidth is now 700 times larger than it was in 1997.

However, the biggest immediate benefit of the new network is that fiber optic cable does not conduct electricity. Lightning will thus no longer damage the VIMS data network and connected equipment and computers via their network connection.

"In addition to providing higher connection speeds, the network will be much more reliable and be much easier

for the ITNS staff to maintain," says ITNS Director Newt Munson.

The new fiber-optic network will allow VIMS to implement new technolo-



VIMS Information Technology and Networking Services Director Newt Munson (L) and Asst. Director Gary Anderson (C) join Dean and Director John Wells (R) in ceremoniously connecting the final link in VIMS' new fiber optic network.

gies, such as VoIP, or Voice over Internet Protocol, which brings the power of the web to telephone systems. The additional bandwidth will also facilitate more widespread use of video conferencing and collaboration technology.

The next step in VIMS' ongoing efforts to increase Internet access is pursuit of a high-speed connection to William and Mary, which will increase external connection speed by a factor of 20.

"This will provide access to the National LambdaRail network, which will better serve the VIMS community, especially our research faculty and students," says Munson.

VIMS Dean and Director John Wells adds that "VIMS now sees the 'light at the end of the fiber,' which is the foundation for the future information technology that we need to remain a world-class research, education, and advisory service organization."

Breakwaters continued from page 3

ral sediment supply was depleted by "hardening" of the shoreline upstream due to emplacement of riprap and bulkheads.



An aerial view of the Yorktown waterfront shows the breakwaters that protect the new Riverwalk development.

"By the 1970s and 80s, the Yorktown beach was easily overwashed during storms, and continued to erode," says Hardaway.

VIMS scientists entered the picture in 1985 after a particularly damaging nor'easter, when they were asked to become technical advisors to York County's Public Beach board. Hardaway and colleagues have partnered with the County ever since, helping to design and monitor all four phases of Yorktown's current system, which now features 12 separate breakwaters that range from 80-150 feet long.

VIMS has also advised on nourishing and stabilizing the Yorktown beach. A common misconception, explains Hardaway, is that breakwaters trap sand to form the adjacent beaches. Instead, he says, the beaches are created by sand brought in from upland sources. In Yorktown, some of the beach sands were obtained during dredging for Coleman Bridge widening in 1996.

Once created, the beaches are stabilized by planting cord grasses in the

sandy ridge, or tombolo, that connects the breakwater to the shore.

Breakwater systems at Yorktown and elsewhere around the Bay weathered a severe test when Hurricane Isabel blew ashore in 2003. At Yorktown, Isabel produced a 7-foot storm tide topped by 6-foot waves. During the height of the storm, waves of 4 feet or higher were breaking across Yorktown's breakwater system and into the adjacent walkway, road, and buildings.

Although Yorktown's waterfront suffered considerable damage from Isabel, Hardaway notes that the breakwaters did provide an important service, by preventing even worse damage.

"The breakwater system significantly reduced wave action, which likely ensured the structural integrity of the buildings on Water Street," says Hardaway. "The system experienced sand losses and local scour but maintained its overall integrity and performed above expectations. It was designed for a 50-year event and sustained what many consider a 100-year event in this part of the Bay."

Hardaway notes that trade-offs between protection and cost are an integral part of any breakwater design. "The Yorktown breakwater system minimized Isabel's damage, hastened post-storm recovery, and provides the benefits of beach and dune habitat. Higher breakwaters and more sand would give more protection, but at what cost?"

Local officials will continue to grapple with that question during the

coming years, as many hurricane experts predict that the current period of enhanced hurricane activity in the Atlantic will continue for a decade or more.

In addition to breakwaters, the Shoreline Studies group at VIMS can choose from several other alternatives when advising localities on shoreline protection.

Bulkheads are vertical wooden structures parallel to shore that reflect the energy of breaking waves. They commonly promote scour on the seaward side.

Revetments are inclined piles of stone riprap that protect the base of eroding banks. The slope of a revetment minimizes wave reflection and seaward scour.

Groins are built perpendicular to the shore to trap sand for beaches. In areas with insufficient sand supply, they can starve existing beaches "down-drift."

Sills are elongate, wedge-shaped piles of rock built near-shore to help establish a marsh fringe or "living shoreline."

During the last few decades, there has been a move from traditional "hardened" structures like bulkheads and revetments toward breakwaters and sills, as shoreline managers promote the benefits of a living shoreline.

VIMS Student Marches with the Penguins

The documentary *March of the Penguins* helped millions of people around the world better understand the many dangers faced by Emperor penguins during their annual migration to Antarctic nesting grounds.

VIMS graduate student Heidi Geisz is studying a more insidious penguin danger—the long-term build-up in their tissues of persistent organic pollutants released by human activities thousands of miles away.

Her research is part of a larger study headed by faculty co-advisors Hugh Ducklow and Rebecca Dickhut (see *The CREST*, Spring 2001). Ducklow heads the Long-term Ecological Research site at Palmer Station, one of three U.S. research stations in Antarctica.

Persistent organic pollutants, or POPs, are chemicals found in insecticides, pesticides, industrial wastes, and flame-retardants. As their name implies, these chemicals resist breakdown, and thus persist in the environment, where they tend to accumulate in the fatty tissues of organisms high up the food chain. Many, including now-banned chemicals like DDT and PCBs, are highly toxic.

POPs accumulate in the Antarctic and Arctic via repeated cycles of evaporation and condensation as they move poleward through the atmosphere from the tropical and temperate zones where most are released.

Ducklow, Dickhut, and graduate student Amy Chiuchiolo began studying Antarctic POPs in 2001. Their initial focus was to investigate the

mechanisms by which POPs enter the base of the Antarctic food web. Their studies showed clear evidence that POPs were moving from snow and sea ice into ice algae and krill.

That work naturally led to Geisz's current research—exploring how POPs move up the food web into penguins and other Antarctic seabirds.

Geisz is studying POPs in Adélie penguins, south polar skuas, and southern giant petrels. Adélies, a smaller cousin of the Emperor, feed on krill and fish; skuas and petrels add the eggs and chicks of other seabirds to their diet. All three species thus risk biomagnification—the process by which contaminants become increasingly concentrated as the food pyramid narrows from the large number of primary producers at its base to the few predators at its peak.

Evidence from the other pole shows a clear link between elevated POP levels and declining health in arctic birds—POPs can cause cancer and are known to disrupt the endocrine system.

Although seabirds in Antarctica have been examined for POPs since DDT was discovered there in the mid-1960s, Geisz's study is one of the first to track POP levels in Adélie penguins. That's because these birds are highly protected and sampling for POPs typically requires invasive procedures to obtain tissue samples. Geisz avoids this concern by dissecting carcasses of Adélies that have already died from natural causes.

Even though the use of DDT is now banned in the U.S., production of other

POPs, including the flame-retardant chemical BDE, has increased significantly during the last 20 years. Geisz will be on the lookout for this chemical (which Chiuchiolo found in her studies of plankton and krill), as well as a DDT derivative known as DDE. She will add her DDE data to a record that started when DDT was first discovered in Antarctic penguins in 1966.

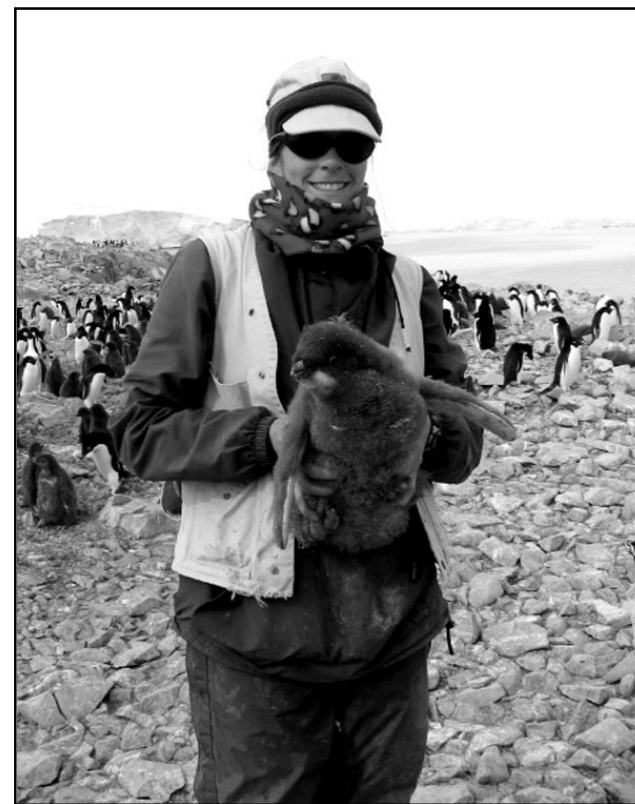
To date, POP levels measured in Antarctic wildlife are not readily or obviously harmful, says Geisz. She cautions, however, that they are approaching and in some cases comparable to levels in the Arctic. "That makes new investigations really important," says Geisz.

Geisz began collecting samples for her current study during seasonal trips to Palmer Station in 2002, 2003, and 2004, when she worked with Dr. Bill Fraser, who heads the seabird component of the Palmer Long-Term Ecological Research (LTER) site. The Palmer LTER is one of 26 sites that make up the National Science Foundation's global LTER network, a system designed to investigate ecological processes over many years and across entire ecosystems.

It was at Palmer that Ducklow and Dickhut persuaded Geisz to enroll at VIMS. She began her studies in the School of Marine Science in fall 2004 and was awarded an EPA STAR fellowship for her research. Geisz is now collecting additional Adélie carcasses halfway across the Antarctic continent, working in her spare moments during a 2-month stint with VIMS researchers Walker Smith and Kam Tang, who are conducting a separate study at the U.S. research station in McMurdo.

Returning to McMurdo is a homecoming for Geisz, who began her Antarctic career there on the grounds crew. "I worked one summer at McMurdo shoveling snow for 3 bucks an hour and loving every minute of exposure to Antarctic science," she says.

When Geisz returns to VIMS in February, she will continue analyzing POP levels, both within the McMurdo birds and in those she collected earlier at Palmer.



VIMS graduate student Heidi Geisz holds an Adélie penguin chick.

Geisz's ultimate goal is to use satellite tagging and diet-sampling techniques that have long been part of the Palmer seabird study to explore how the POP levels she measures relate to the feeding habits of her three seabird species—all within the context of the Palmer Station's overall LTER program and the earlier contaminant studies by her VIMS colleagues.

On-going work by the seabird group at Palmer reveals that Adélies, south polar skuas, and giant petrels have different feeding habits. The skuas and petrels migrate equatorward during the austral winter (June-Sep) and return to feed along the ice edge in the austral summer (Dec-Mar). In contrast, Adélie penguins remain in Antarctica throughout the year, feeding close to breeding colonies in the summer and following the ice edge in the winter. That's a trait that Adélies share with their larger cousins the Emperors—they are the only two penguin species that never leave Antarctic waters.

Speaking of Emperors, did Geisz like the depiction of these birds in *March of the Penguins*? "I did," says Geisz. "Although there was a lot of anthropomorphic interpretation of the penguins' actions—words like 'love' and 'bereft'—I thought the natural history was right on. What a great example of highly adapted animals needing a specific niche to maintain a stable population."

Schooner Virginia Prints

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Lynnhaven
continued from page 1

capture the intricacies of the river's circulation, and by incorporating the bottom processes that dominate water quality in shallow systems.

High-resolution computer models that simulate both circulation patterns and water quality are relatively new, as they require both high-speed computers and sufficient field data.

Sisson, who works as Project Manager for Lynnhaven model development under the guidance of modeling-group leaders Wang and Shen, notes "We use an integrated modeling approach that combines field measurements with high-resolution interactions between hydrodynamic, water-quality, sediment, and watershed models. Because shallow-water systems are inherently more difficult to model, we measure sediment nutrient fluxes and sediment re-suspension rates seasonally in each branch rather than just calibrating for these. High-resolution water-column measurements also play a key role in model calibration."

This integration and resolution comes at a price. "Even with today's high-speed microprocessors, a year-long simulation of circulation patterns and

water quality in the Lynnhaven still takes six days of computer time," says Sisson.

Dr. Mark Brush, another VIMS modeler involved in the project, notes that most of the models used for management were developed for Chesapeake Bay and other large estuaries. "Now there's a real need to take these models into the shallows, into the small systems that we actually manage at the local level. Harry's group has been able to adapt their model for that use."

"The beauty of the model," adds Sisson, "is that the Corps and City can turn around and use it as a management tool. They can run scenarios where they cut nutrient loading in an area by 50%, and see what that will do to water quality throughout the river. That's the great thing about modeling, you can handle the what-if questions."

Process Studies

For the Lynnhaven project, Brush has set aside his modeling hat to focus on field studies of the ecological processes that affect water quality, including fluxes of oxygen and nutrients between the water and sediments. He and other VIMS researchers have also employed a battery of sensors designed to measure salinity, temperature, dissolved oxygen, chlorophyll, turbidity, and other variables.



VIMS Laboratory Instrument Maker Wayne Reisner (L) and Lab specialist Tim Gass (R) attach a current-meter to a Lynnhaven channel marker.

Other VIMS researchers are measuring physical variables such as tidal level, current direction, and the re-suspension of bottom sediments.

All these variables are being incorporated into the UnTRIM model to provide an unusually comprehensive data set for both initializing the model and testing its performance.

The new sensor network is far more comprehensive in space and time than previous sampling efforts in the Lynnhaven. The sensors, which are deployed on navigational markers and from moving vessels, measure water-quality variables at intervals from a few seconds to 30 minutes. One sensor measures conditions on the bottom. Samples were previously taken twice monthly, and only near the surface.

"There's a critical need when you build a model to have the data to validate it and show that it's working right," says Brush. "The Lynnhaven project is a great example of how you should do these things. It's been done smartly because we have all these pieces feeding data into the model."

Field data are particularly important in a shallow-water system like the Lynnhaven, where bottom processes exert much greater influence. "Relative to a deep system you have a more complex bottom that's more important in terms of friction, drag, and channelization," says Brush. "The hydrodynamics are much more complicated, there are many more driving processes."

Bottom-dwelling organisms also play an exaggerated role in shallow water. "These are systems where light

reaches the bottom," says Brush, "so you have benthic microalgae, macroalgae, and seagrass, plus epiphytes on the seagrass. You have a diversity of primary producers. Clam and oyster filtration is also critical. You just don't know how much impact some of these critters have on water-column dynamics until you take measurements."

Oysters

The Lynnhaven was a well-known oyster ground until disease, declines in water quality, and frequent shellfish closures shut down the fishery in the early 1970s. Project partners seek to revive the river's oyster stocks through a combination of reef construction and planting of disease-resistant native oysters. *Lynnhaven 2007*, whose Executive Director is VIMS alumna Laurie Sorabella, aims to restore edible oysters to the river by that year through reductions in bacteria levels.

Dr. Roger Mann, VIMS' Director of Research and Advisory Service, says the project benefits significantly from lessons learned during earlier oyster restoration efforts elsewhere in Chesapeake Bay. "We've learned that oyster restoration works best when it's done in conjunction with efforts to improve water quality to the levels that oysters need to thrive, and at a scale sufficiently large to overcome natural variations in oyster spawning stocks."

Mann notes that the Lynnhaven was chosen for oyster restoration because it has supported natural oyster populations in recent years and had a history of regular spat settlement and significant private oyster production before the oyster disease MSX became established in the 1960s.

Collection of information on current populations requires a variety of techniques. Mark Luckenbach and P.G. Ross have been using video and GPS to prepare high-definition maps of shoreline types, while Rom Lipcius, Russ Burke, and Justine Woodward have been sampling rip-rap and other shorefront structures to quantify oyster populations. Lipcius will use output from the UnTRIM model to estimate how far and fast oyster larvae are likely to be carried before they settle to the bottom.

These approaches will combine with others to estimate the current population size as a baseline prior to intensive restoration efforts that involve both habitat rebuilding (the Army Corps constructed three-dimensional reefs in the waterway in 1997, 2001, 2002, and 2003, and is considering more) and selected addition of brood stock.

Faculty and students from all departments at VIMS are involved in efforts to restore the Lynnhaven River

Modeling and Process Studies

- ◆ Harry Wang, Jian Shen, Mac Sisson, Albert Kuo, and Yuepeng Li: Integrated modeling
- ◆ Carl Friedrichs, Grace Cartwright, Larry Sanford* and Steve Suttles*: Sediment re-suspension studies
- ◆ Bob Gammisch, Wayne Reisner, and Tim Gass: Measurements of tides, currents, salinity, and temperature
- ◆ Carl Hershner and Howard Kator: Fecal coliform bacteria in runoff
- ◆ Ken Moore and Britt Anderson: Mapping water quality with *Dataflow*
- ◆ Mark Brush, Iris Anderson, and Hunter Walker: Sediment fluxes and water quality

Oyster Restoration Studies

- ◆ Stan Allen and Lionel Dégremont: Disease tolerance of native oysters
- ◆ Jens Carlsson: Oyster genetics
- ◆ Rom Lipcius, Sebastian Schreiber, David Schulte, and Russ Burke: Population dynamics of historical and extant oyster reefs
- ◆ Rom Lipcius, Mark Luckenbach, Russ Burke, and P.G. Ross: Oyster survival on alternative reefs
- ◆ Rom Lipcius, Justine Woodward, and Russ Burke: Oyster survival on rip-rap reefs
- ◆ Mark Luckenbach and P.G. Ross: Oyster settlement patterns

Other Restoration Studies

- ◆ Mark Brush and Lance Gardner: Sea grasses and water quality
- ◆ Rochelle Seitz and Amanda Lawless: Benthic community structure and shoreline development

* University of Maryland, Horn Point Laboratory

News Briefs

For more details on these news briefs, visit the VIMS "Top Stories" web page at www.vims.edu/topstories

Grad Appointed Assoc Editor

VIMS graduate student Todd Gedamke has been appointed Associate Editor of the *North American Journal of Fisheries Management*. Faculty advisor John Hoenig notes that Gedamke is the first VIMS student to be appointed to such a position. The journal is published by the American Fisheries Society, the world's oldest and largest professional fisheries body.

NPR Airs VIMS Pair

National Public Radio's *All Things Considered* featured separate interviews with two VIMS researchers in recent months. VIMS shark expert Dr. Jack Musick appeared in October, providing context for scientist Ramon Bonfil's discovery that a great white shark had swum from South Africa to Australia and back, covering 12,400 miles in less than 9 months. Musick suggested that the female shark might have been looking for a mate. Bonfil's finding supports efforts to protect shark stocks on a global basis. Listen on-line at www.npr.org/templates/story/story.php?storyId=4948212

VIMS fish-health expert Dr. Wolfgang Vogelbein was interviewed for a January segment that explored possible causes for the large number of sick and

dying fish in East Coast estuaries. Vogelbein discussed mycobacteriosis, a chronic wasting disease affecting striped bass in Chesapeake Bay, suggesting that lack of oxygen in the Bay's deeper waters during summer may be contributing to the prevalence of the disease. His hypothesis is that these deep-water "dead zones" force stripers into shallower, warmer waters that stress the fish and compromise their immune systems. Listen on-line at www.npr.org/templates/story/story.php?storyId=5162318

Diaz Receives Grant to Study O₂ and Fish

The National Oceanic and Atmospheric Administration (NOAA) has awarded VIMS researcher Dr. Bob Diaz \$43,000 to study the impact of low oxygen levels on the quality of fish habitat in coastal bays. The award is the first installment of a three-year, \$135,000 grant. Low-oxygen waters, also known as "hypoxic" or "Dead" zones, are of growing concern in coastal areas and estuaries around the globe.

VIMS Spans the Globe

VIMS likely set a record for the geographic dispersal of its employees when ITNS Director Newt Munson was invited to travel to Barrow, Alaska (latitude 71°N) in January to provide advice on computer networking and videoconferencing to members of the Barrow

Arctic Science Consortium. While Munson was in Barrow, Dr. Walker Smith was near the other pole aboard the RV *Nathaniel B. Palmer* in Antarctica's Ross Sea at 78° S. The distance between the two VIMS employees was 10,430 miles, nearly half the Earth's polar circumference.

Wright Co-authors Academy Review of LA Plan

VIMS Chancellor Professor Dr. Don Wright has co-authored a new National Academy of Sciences report that recommends several significant changes to the federal and state plan for restoring Louisiana's receding coastal wetlands. The fragility and importance of Louisiana's coastal ecosystem was made apparent when hurricanes Katrina and Rita slammed ashore earlier this year.

Alumna Wins SETAC Award

VIMS alumna Serena Ciparis (MS 2003) won the global award for best student paper in *Environmental Toxicology & Chemistry* for her study of the interaction between marine worms and flame-retardant chemicals in the environment. Ciparis' faculty advisor at VIMS, Dr. Rob Hale, notes "it's particularly noteworthy that Serena received the award for her Master's research, as the competition was also open to doctoral students and graduates." The award was

presented at the opening ceremony of the Society of Environmental Toxicology and Chemistry Meeting in Baltimore in November.

Healthy Bay for Healthy Kids

Fifteen 1st and 2nd graders from local schools got a chance to combine science and cooking during the Healthy Bay for Healthy Kids event at VIMS on October 4th. The students joined Chef John Maxwell and VIMS scientist Dr. Kirk Havens to make a healthy and delicious Chesapeake Bay seafood dish while learning about the natural resources needed to sustain marine populations. The event was part of Virginia's Seafood Month. View the streaming video at www.vims.edu/events/videos/HealthyBayKids.mov

Grant Promises New Dimension for Oxygen Studies

A team of VIMS researchers that includes Drs. Larry Haas, Iris Anderson, and Howard Kator has received a \$200,000 technology-development grant to enhance the capabilities of *Acrobat*, a towed instrument platform used to map oxygen-poor waters in Chesapeake Bay. The new grant will allow them to test and refine the software needed to add a third dimension to their studies. 3-D maps are crucial for accurately calculating the volume of dissolved oxygen in Bay waters.



Members of the Board of Visitors of the College of William and Mary visited VIMS in November for a retreat and tour of VIMS facilities. Here, Board member John Gerdelman (with glove) feeds cobia in the VIMS finfish hatchery as other group members look on. From L: Rector of the College Susan Magill, Gerdelman, commercial fisheries specialist Mike Oesterling (VIMS Sea Grant program), and Board members Barbara Ukrop, Sarah Gore, and Suzann Matthews.



Members of the Senate of Virginia's Finance Committee toured VIMS in September to learn more about the Institute's facilities, products, and services. Here (from L to R), VIMS Dean and Director John Wells, VIMS Director of Research and Advisory Service Roger Mann, and Senate Finance Committee Chairman John H. Chichester discuss the capabilities and uses of a towed oceanographic instrument called Acrobat.

American Fisheries Society Recognizes Hoffman

Editor's Note: VIMS graduate student Joel Hoffman was awarded second place in the Student Writing Contest during the American Fisheries Society's 135th annual meeting in September. The award recognizes students who do an excellent job communicating the value of fisheries research to the general public. Hoffman's piece, which is scheduled to appear in the March issue of the AFS journal Fisheries, is reprinted below courtesy of AFS. Founded in 1870, AFS is the world's oldest and largest professional society representing fisheries scientists.

Do American shad grow on trees? Linking forests with the life history of a marine fish

It's not yet sunrise. I hold tight to the side of a small, wooden skiff as it bounces across the rough chop of the James River. Icy water splashes my face, turns my lips salty, and runs down the inside of my oilskins. At the helm, commercial fisherman and marina operator Marc Brown keeps the outboard engine at full throttle. His business opens early and he wants to get back before dawn. Years ago, Marc, and generations of his family before him, fished to sell American shad. Now Marc fishes to monitor a closed fishery.

On this March morning, we are heading to a staked gill net to count American shad returning to spawn in the James River. Like oysters and At-

lantic sturgeon, the American shad is emblematic of the wealth of aquatic resources that greeted early colonists arriving in Chesapeake Bay. Today, their stocks are a shadow of their former size. Despite the fishing moratorium, increased access to blocked spawning habitat and stock-enhancement with hatchery-reared fish, recovery in the James, York and Rappahannock rivers has been slow.

American shad are anadromous—they spend their first year of life in coastal rivers and their adult life in the ocean. In the spring, adults return to spawn in the river in which they were born. This complicated life history means it is hard to gauge where conservation measures will matter most—should we focus on conserving spawning and nursery habitat, or should we cut back fishing on adults? Fishery scientists know that habitat conservation must be part of a recovery plan, however we lack basic data on how American shad use river habitat. My research aims to address this problem.

It's not easy to find scientific techniques that can identify connections between fish and their habitat. For the past two decades, scientists have been developing the use of biomarkers: chemical signatures picked up by fish from their environment. A useful biomarker is the stable isotope of carbon, carbon-13. Carbon-13 is quite rare in nature. Different types of plants, such as trees, marsh plants and algae, have slightly different

amounts of carbon-13 in them. Consequently, we can use the carbon-13 signature to determine where plant material came from.

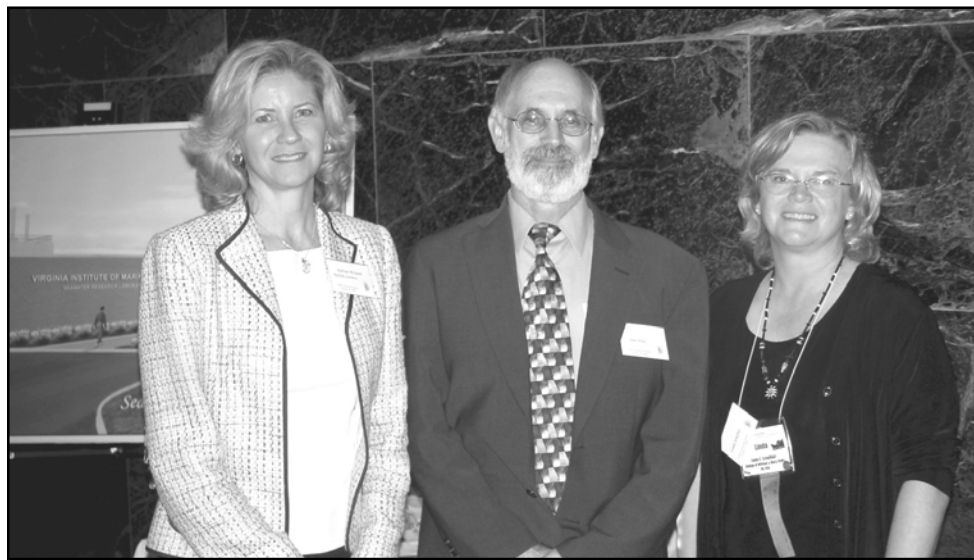
Why is carbon-13 useful? A complex mix of plant material forms the base of river food webs. When microscopic crustaceans (called zooplankton) and aquatic insects eat this material, they incorporate the signature into their tissue. When American shad eat zooplankton and aquatic insects, they incorporate the same signature into their tissue. By measuring the carbon-13 in American shad, I can identify whether their diet was based on plants from the forest or the river.

I studied American shad in the Mattaponi River, a large tributary of the York River that supports the most American shad of all Virginia's rivers. From May to July 2003, the signatures in the zooplankton, aquatic insects and American shad all resembled forest and marsh plants. I obtained similar results in early May of 2004, but by June the signatures in the zooplankton and American shad mostly resembled the algae in the river. What happened? The spring and summer of 2003 were very wet. The combination of high river flow and turbid water prevented algae from growing. Consequently, the zooplankton and aquatic insects consumed the material washed into the river from the adjacent forests and marshes. In 2004, river flow was lower, the water was less turbid and the algae bloomed, providing food for zooplankton. As a result, the fish's diet was based on material from the forest and marshes before the bloom and algae after the bloom.



VIMS graduate student Joel Hoffman searches a push net for young American shad.

These findings are important because they link the forests and marshes to the river food webs upon which American shad depend. In a sense, American shad are growing on trees! Changes to the land surrounding the river—from removing streamside trees to urbanization—probably have a significant, though indirect, impact on American shad habitat. If we are to bring back American shad and restore the fishery that is so important to Marc Brown and other watermen like him, we may need to conserve the ties between the land, the river and this marine fish.



Norfolk Southern Corporation hosted an alumni reception for VIMS in conjunction with the Estuarine Research Federation's 18th biennial conference in Norfolk in October. Norfolk Southern has a 20-year history of support for VIMS' programs, including a major contribution to Andrews Hall, VIMS' new research building named in honor of Cynthia and the late Senator Hunter B. Andrews. Here, Ms. Kathryn McQuade of Norfolk Southern (L) joins VIMS Dean and Director John Wells (C) and VIMS researcher and out-going ERF President Dr. Linda Schaffner (R) during the reception.



Dr. Steve Kaattari (facing camera) discusses his work on oil-spill tracking with participants in VIMS' Associates Day celebration. VIMS holds the event each year to honor and recognize supporters and volunteers from the local community. Drs. Howard Kator and Mike Unger also hosted laboratory tours during the event.

Fabrizio Team Wins NOAA Bronze Medal Award

Dr. Mary Fabrizio, newly appointed Associate Professor in VIMS Fisheries Science Department, has won a Bronze Medal Award from the National Oceanic Atmospheric Administration (NOAA) for ultrasonic tagging work conducted at the National Marine Fisheries Service prior to her arrival at VIMS in October 2005.

Fabrizio will be recognized as a recipient of the award in a formal ceremony in Washington D.C. in March. The Bronze Medal is the highest honor award that can be granted by NOAA's

chief administrator Conrad C. Lautenbacher.

NOAA Bronze medals are awarded to individuals, teams, and organizations. Fabrizio's medal is part of a team award to fellow recipients Jeff Pessutti, John Manderson, and Beth Phelan. The other team members are at the Northeast Fisheries Science Center (NEFSC) in Sandy Hook, New Jersey, where Fabrizio was formerly Chief of the Behavioral Ecology Branch.

Fabrizio's team was recognized for their pioneering work in using ultrasonic

tags to study habitat use and dispersal by marine fishes off New Jersey. The team used the tags and a network of moored receivers to closely track large numbers of individual black sea bass and summer flounder. This helped them clarify the factors affecting the fishes' dispersal from a habitat that had been disturbed by the placement of dredge spoils.

Fabrizio plans to implement similar tagging studies in Chesapeake Bay and Virginia's coastal waters.

Habitat issues have become important in fisheries management and are formally recognized in the essential fish habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act, the nation's primary federal law governing fisheries management issues.

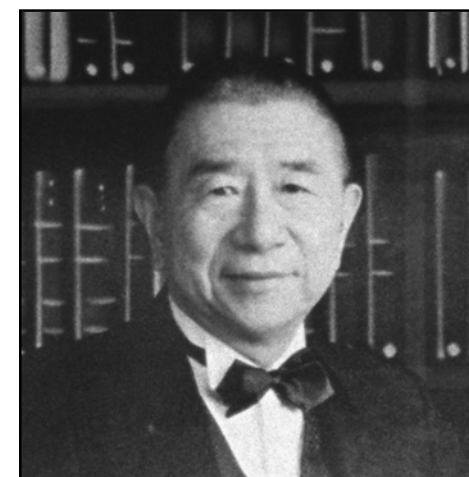
Dr. Tom Noji, Chief of the Ecosystems Processes Division at NEFSC and Fabrizio's former supervisor, says "Mary led her team to the successful completion of a landmark project for the Center. Their investigation is inspiring not only because of its careful preparation and implementation, but also because it spearheads regional fisheries research into a new and technologically sophisticated era."



Dr. Mary Fabrizio (L) surgically implants a miniature radio transmitter into a summer flounder during her tagging study off the New Jersey coast.

Former Professor Frank Fang Dies

Former VIMS faculty Dr. Ching Seng (Frank) Fang died unexpectedly on November 5, 2005. During his tenure at VIMS from 1970 to 1985, Fang led the thrust to develop numerical hydrologic and water-quality models for Virginia's estuaries. He was head of the Physical Oceanography department for many years. Following his time at VIMS Frank and his wife Carol established a successful import business. Donations to Dr. Fang's Memorial Scholarship Fund can be sent to C&F Enterprises, Inc., c/o Frank Fang Memorial Scholarship Fund, 819 Blue Crab Road, Newport News, VA 23606.



Dr. Ching Seng (Frank) Fang

VIMS Contributes to Science-Education Tradition

VIMS faculty, graduate students, and staff are helping spark the next generation of aspiring marine scientists through their participation in the Blue Crab Bowl, a high school academic competition focused on the ocean sciences.

This year's Blue Crab Bowl will take place at Old Dominion University on Saturday, February 11.

VIMS collaborates with ODU each winter to co-host the event, one of 25 regional contests held around the nation as part of the National Ocean Sciences Bowl. The NOSB® is coordinated by the Consortium for Oceanographic Research and Education (CORE) in Washington, D.C.

Sixteen teams from across the state will participate in the 9th annual event. The winning team will advance to the national competition, held in Monterey, California in May. The NOSB® program seeks to generate student interest and excitement about science and the oceans, and give young people a chance

to examine marine science as a field of study and possible career path.

VIMS will contribute about half of the 60 or more volunteers needed to run the event. Staff from the Virginia Sea Grant Marine Advisory Program coordinate VIMS' participation in the program. Funding for the Blue Crab Bowl comes from CORE, ODU, and VA Sea Grant; local businesses and organizations provide additional support.



Students address a "team challenge question" during the 2005 Blue Crab Bowl.

WILLIAM & MARY VIRGINIA INSTITUTE of MARINE SCIENCE

Web Update

Welcome Research Education Advisory Services Administration Resources News & Media

Breakwater Database
This site highlights the work of VIMS' shoreline studies group in documenting breakwater-system performance around Chesapeake Bay. Visit www2.vims.edu/breakwater

Chesapeake Bay Dunes
This site describes the extent and changing nature of dune systems around the Bay. Visit www.vims.edu/physical/research/shoreline/cbdunes

IVARS
This site provides information on the Dr. Walker Smith's IVARS project. IVARS (for Interannual Variability in the Ross Sea) is a 5-year project to learn more about year-to-year changes in the biology, physics, and chemistry of Antarctica's Ross Sea. The site includes periodic updates on IVARS expeditions to Antarctica. Visit www.vims.edu/bio/ivars

KAC
Learn about VIMS' new Kauffman Aquaculture Center (KAC) by visiting www.vims.edu/kac. The Kauffman Center significantly expands the scope of aquaculture research at VIMS by providing a facility that was specifically designed to hold both native and non-native species in quarantine.

Volunteer Page
Visit www.vims.edu/welcome/vol_opport to learn about opportunities in the VIMS Volunteer program. Volunteer positions are regularly available in the Library, Visitor's Center, Gift Shop, in laboratories, and in the field. There are also opportunities to lead group tours and assist with public outreach events.

Lambert Chosen as Knauss Fellow

VIMS graduate student Debra Lambert has been awarded a prestigious John A. Knauss Marine Policy Fellowship through the National Sea Grant Federal Fellows Program.

This one-year fellowship matches outstanding graduate students from around the nation with hosts in legisla-



Knauss Fellow Debra Lambert

tive or executive offices in Washington, DC. The program provides a unique educational experience for students who have an interest in national policy decisions affecting ocean, coastal, and Great Lakes resources.

Lambert, who earned her master's degree in December, will begin her fellowship on February 1st at NOAA's National Marine Fisheries Service, in the Office of Sustainable Fisheries, Domestic Fisheries Division.

Lambert applied for the fellowship because she wanted "to learn more about marine policy at the federal level, especially the interface between science and policy."

For her master's thesis, Lambert worked with faculty advisor Dr. Rom Lipcius to investigate the effectiveness of the spawning sanctuary for mature female blue crabs in the Virginia waters of Chesapeake Bay. She found that the sanctuary provides an effective means for

Bay Restoration continued from page 1

According to the Governor's proposal, \$200 million in funding is designated for the Virginia Water Quality Improvement Fund, which will accelerate improvements to 92 wastewater treatment plants in the Chesapeake Bay watershed. The funding will also help the state meet new water regulations for all five tributaries in the watershed, which were adopted last month after a two-year regulatory process. The work will enable the Commonwealth to reduce nitrogen loads by about 2.6 million pounds per year—which is about two-thirds of the

state's 2010 Chesapeake Bay Agreement requirement.

"We have paired the strictest water quality regulations in the nation with the single largest investment by any state for Bay cleanup, all with a 2010 deadline looming," Warner said. "I applaud members of the General Assembly who have advocated progress on the Bay, and have and will act responsibly to provide for it. The Chesapeake Bay is a national treasure and we will continue to work closely with Congress and our other Bay state partners to make its restoration a reality."

-by Brian Whitson

VIMS BY THE NUMBERS

- ◆ 3 Advisory programs in VIMS' Center for Coastal Resources Management (CCRM): Tidal Wetlands, Non-tidal Wetlands, Shoreline Inventory

Tidal Wetlands Program:

- ◆ 7 Current full-time employees (FTEs)
- ◆ 3.5 FTEs funded by state funds
- ◆ 3.5 FTEs funded via external grants
- ◆ 1,027 Permits reviewed in 2005 by the Wetlands Program
- ◆ 10.5 State-funded FTEs in 1985
- ◆ 629 Permits reviewed in 1985 by the Wetlands Program
- ◆ 34 Years of reviewing tidal wetland permit applications (since the 1972 Tidal Wetlands Act)
- ◆ 36 Number of wetlands boards in Virginia
- ◆ 853 Advisory reports posted to the web in 2005
- ◆ 2001 Year Wetlands Program began posting reports to the web

protecting females migrating to or residing in the spawning grounds.

Lambert's selection as a Knauss fellow continues a long tradition of involvement in the program by VIMS students. Of the 46 students from institutes of higher education in Virginia who have served as Knauss fellows since the program began in 1979, 30 (65%) have hailed from VIMS.

In fact, the current director of the Knauss Fellowship Program is Dr.

Jacques Oliver, a 2005 VIMS graduate and 2004 Knauss alumnus. He considers the Institute's rich tradition of participation in the Knauss fellowship program "a testament to VIMS' well-rounded interdisciplinary programs."

The Knauss program is named in honor of one of Sea Grant's founders, former NOAA Administrator John A. Knauss. More information on the program is available at <http://www.seagrant.noaa.gov/knauss/knauss.html>.



VIMS alumnus Carole Baldwin (C) answers questions about sustainable seafood while Executive Chef Rob Klink of the Oceanaire Seafood Room in Washington, D.C. (R) serves pan-seared bluefish to guests at VIMS seafood-cooking demonstration in October. Baldwin (PhD 92) is co-author of the Smithsonian Press book One Fish, Two Fish, Crawfish, Bluefish. The 330-page volume gives advice on how to promote sustainable fishery practices while fishing, shopping, or eating out.



New VIMS Council Chair Jim Rogers (L) talks with W&M President Gene Nichol (R) during the council's July meeting at VIMS' Eastern Shore Lab in Wachapreague. ESL Director Mark Luckenbach (2nd from R) looks on. Rogers, who holds a master's in nuclear engineering from the University of Virginia, is President of SCI Investors, Inc. and a consulting partner of Colonnade Capital. He replaces Carroll Owens, who had chaired the council since 2002. Other new Council members include Travis Massey (3rd from R) and Dan Bacot.

VIMS' Role in Tidal Wetlands Permitting: A Case Study in Advisory Service

Ann Burruss knew she had a problem. The water in her house from Hurricane Isabel was long gone, but she was still losing her beloved marsh.

Burruss has lived on the northwest branch of the Severn River on Heywoods Creek for 50 years, 20 of those in her current home in Hayes, Virginia. "I've seen a lot of changes over the years. Thirty years ago there were oysters here and now they're long gone," says Burruss.

In 2003, the retired schoolteacher and member of the Gloucester County school board saw the most dramatic change yet, as Isabel took more than 5 inches of sediments from the wetlands around her home.

"Since Isabel, I've watched as the high tide has encroached closer and closer to the house and I knew that something had to be done," explained Burruss. "If the water kept coming up, I wouldn't have any yard left at all." Burruss needed help with erosion control.

In Virginia, since 1972, any work on tidal shoreline or wetlands, no matter how small, requires a permit. "Our goal is no net loss, avoiding any shoreline changes that we can, or at least minimizing the impact," says Pam Mason, Marine Scientist with VIMS' Center for Coastal Resources Management. Her

job is to review the permit applications for Gloucester and Matthews counties. Other VIMS staff review projects in the other tidewater counties.

In July, Burruss submitted a *Joint Permit Application for Activities in Waters and Wetlands of the Commonwealth of Virginia* to the Virginia Marine Resources Commission (VMRC), the state agency charged with overseeing the Commonwealth's Tidal Wetlands Act. The Act was established in 1972 to preserve the state's tidal wetlands.

VMRC in turn forwards the application to the local county Wetlands Board and VIMS for review. VIMS' role in the permit process is strictly advisory, providing technical and scientific advice to help the Wetlands Board make an informed decision about each project.

Burruss' original permit requested permission to construct 150 feet of timber bulkhead and 30 feet of riprap to protect the front of the house and yard from flooding and erosion, a project that would result in the loss of more than

2,400 square feet of wetlands.

After visiting the site, Mason submitted a VIMS report to the Gloucester County Wetlands Board and Burruss. She found that the original proposal was not necessarily the best solution to address Burruss' tidal flooding. Mason concluded that Burruss could protect her upland property and its associated ecological functions while still protecting much of the 2,400 square feet of tidal marsh.

As an alternative, Mason suggested the use of either a revetment or soil berm (levee) placed landward of the wetlands to provide the change in elevation requested. Either option would more closely follow the existing contour to reduce the wetlands loss. The revised project's lighter approach only impacted 730 square feet of wetlands, a third of the original plan.

"I was glad the suggestion was made and we were able to reach a compromise," says Burruss. She revised her project and submitted new drawings that were accepted by the Wetlands Board in August. "I was willing to try a dirt berm with the understanding that if I am still having problems in one year, I could put in a solid timber bulkhead."

Mason was pleased that Burruss and the Wetlands

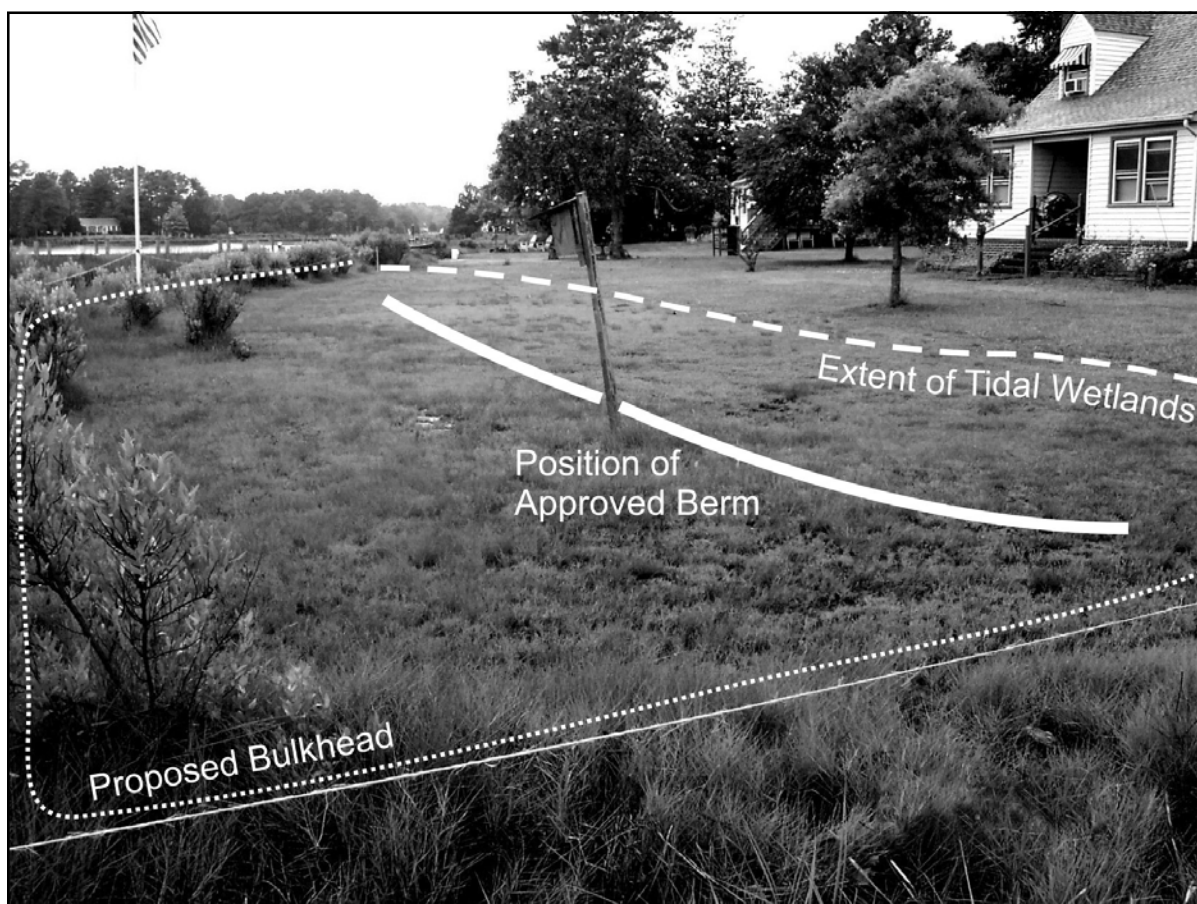
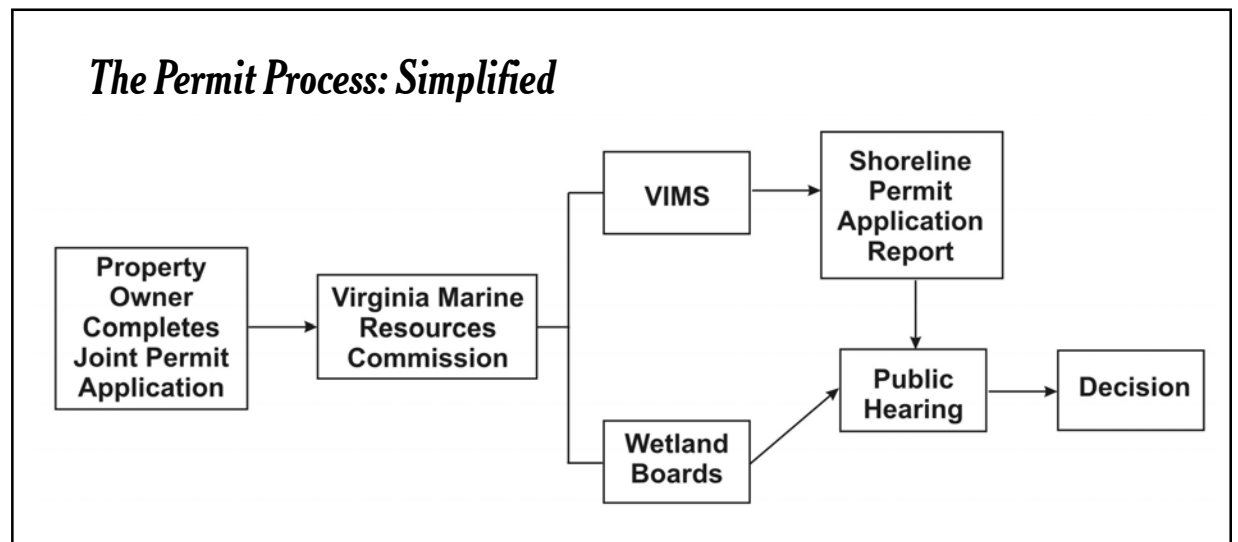
Board decided to take her advice to pursue another option. "One thing to remember is that landscapes and shorelines are in a constant state of change. One trend we have observed in the tidewater area is that the sea level has been rising," explains Mason. "Not all erosion is bad. Marshes need to trap sediment to keep pace with the relative water level. The only way they can do that is through sediment in the water. No sediment in the water, no marsh. So not all shorelines need to be hardened and protected."

"Our approach is: 'less is more.' We try to help homeowners determine and do just what they need to do. Many projects do not need to go property line to property line. From an ecological perspective, we prefer to take a softer approach, allowing as much of the biotic component to remain to continue the ecological function of the marsh."

Burruss' berm was completed in September and she is happy with the results. The entire process from application submission to completed berm took just 4 months and Burruss feels everybody gained.

"I feel very good that I could persevere and do all of this myself. I think the berm is great. I have the same herons, ducks, and marsh grass to enjoy. And now my grandchildren can play in my front yard and not in the mud." "Pam was extremely knowledgeable and really knows her business," adds Burruss. She was also favorably impressed with the Wetlands Board. "They were most helpful and I think they get a bad rap sometimes. The revised berm project cost considerably less than the original bulkhead project. And saving my front yard will also enhance my real estate value."

-by Leslie McCullough



The Burruss property with lines showing the proposed location of the timber bulkhead (dotted), the approved position of the soil berm (solid), and the landward extent of the tidal wetlands (dashed), which were routinely mowed.

VIMS' Ghostbusters Study Effects of Lost Fishing Gear

Crab pots are inevitably lost during storms or when accidentally cut free by boaters. Researchers in VIMS' Center for Coastal Resources Management (CCRM) are now studying to what extent these "ghost pots" continue fishing, and how that might affect the Bay.

The 1-year pilot study, to Dr. Kirk Havens, Dr. Donna Marie Bilkovic, Dave Stanhope, and fellow scientists in CCRM, is funded by the National Oceanic and Atmospheric Administration (NOAA).

"The pilot project will ascertain the best way to locate unmarked pots, what marine species are being fished by these pots, and how long the pots continue to fish," explains Havens. "This will pave the way for future larger scale projects needed to determine the impact of ghost pots."

Project scientists are locating the pots using side-scan sonar. With the crabbing season's end in early December, the team is now documenting the GPS coordi-

nates of unclaimed pots in the lower York River. They will continue their search into February. Their findings will both provide a first estimate of the number of ghost pots in the River, and help determine the usefulness of side-scan sonar for pot identification.



VIMS researcher Kory Angstadt pulls in a ghost pot.

Havens' team examines each recovered pot to determine its catch. The early results are intriguing. So far, ghost-pot fatalities have included flounder, white perch, toad fish, muskrats, and turtles, as well as crabs.

In addition, Bilkovic is reviewing data from the Chesapeake Bay Multi-species Monitoring and Assessment Program (ChesMMAP) to compile the number of ghost pots retrieved during ChesMMAP trawl surveys, and the marine life each held. ChesMMAP began at VIMS in 2002.

"Having past information available is an obvious asset to the program," says Stanhope. "The information on location

and catch throughout the Bay will greatly complement our York River study."

To verify how long ghost pots are capable of fishing, the researchers modified several crab pots by providing the option of closing access to marine animals. With this modification, they can determine, without increased impact, how long a pot remains intact in the water before corrosion provides an escape for would-be catch. To find out if pots that no longer have bait will continue to fish, the access will be opened one week each month.

"Marine scientists in other areas of the country have begun documenting the effects of detached commercial nets and other ghost fishing gear," says Havens. "In Chesapeake Bay and its tributaries, crab pots are the gear to investigate. Based on our early results, this pilot program will provide an excellent model for broader research."

-by Susan Maples

Virginia Clean Marina Program Tops 60 Members

The Virginia Clean Marina Program, a collaborative venture between the Virginia Sea Grant Program at VIMS and the Virginia Coastal Program, certified 8 new marinas during the past year. That makes a total of 29 marinas that are demonstrating their commitment to keeping Virginia waterways clean.

An additional 32 marinas have pledged to join the program. A complete list of Virginia's certified Clean Marinas is posted on the program's web site at www.virginiacleanmarina.com.

According to Pete Hall, Marina Specialist in the Sea Grant Marine Advisory Program at VIMS, "Certification as a Virginia Clean Marina rewards marinas for their efforts to implement best management practices to improve and maintain water quality and living resources."

To become certified, a marina must meet all legal and regulatory standards as well as a percentage of the best management practices as outlined in the Virginia Clean Marina (VCM) Guidebook.

Support for the VCM program is provided by the Virginia Sea Grant Marina Technical Advisory Program. Program personnel conduct annual reviews of the Clean Marinas; hold workshops to provide educational opportunities for marina owners, opera-

tors, and staff; and provide technical assistance as needed. The program advisory board includes industry as well as Virginia's departments of Health, Environmental Quality, and Conservation and Recreation.

"The VCM program has given marina owners and operators the opportunity to avoid more government regulation by voluntarily adopting and implementing best management practices and common-sense approaches," says Hall. "Becoming a certified Virginia Clean Marina is one way for marina operators to let the boating public know that they are committed to improving and maintaining water quality in Chesapeake Bay."

Hall adds that the boating public has become more environmentally conscious and looks to patronize marinas that share their view. "In a way the Clean Marina designation is a form of 'eco-labeling.' Aside from the environmental benefits, the implementation of best management practices leading to VCM certification means increased business and economic growth for marinas."

A recent survey of Virginia's certified Clean Marinas provides insight into how industry views the benefits of becoming a clean marina. The survey shows that 79% of clean marinas feel that VCM status has brought economic benefits to their marina by reducing costs

and increasing revenues. The same percentage also felt that VCM status led to more "goodwill" and significantly improved relationships with regulators. The group also consistently echoed a response that "regulators are more responsive to new ways to accomplish a given end;" and "are more willing to work with us knowing that we are all working toward the same goal."

On the marketing side, VCM marinas cited increased transient traffic, increased fuel sales, and an overall perception by the customer of value added as important measures of economic benefits gained. One marina concluded "Recognition for caring for the environment brings in a higher quality clientele. They tend to take better care of their boats (business for us) and our property."



Salt Ponds Marina in Hampton is one of 29 Virginia marinas that have received the Clean Marina certification.

Student Award Winners



Six VIMS graduate students were recognized for their presentations during the Estuarine Research Federation's Annual Meeting in Norfolk, Virginia in October. Malcolm Scully received third place in the graduate student competition for his talk on turbulent mixing in estuaries. Jessie Campbell won an honorable mention for her talk on the ecological factors affecting sea-grass germination. David Gillett, Grace Henderson, Frank Parker, and Adriana Veloza were recognized as among the top 50 student presenters. Back row from L to R: Parker, Gillett, and Scully. Front row from L to R: Henderson, Veloza, and Campbell.

VIMS graduate students Amanda Spivak (L) and Chris Long (R) have won highly competitive fellowships from the U.S. Environmental Protection Agency to support their studies. Spivak, a Ph.D. candidate advised by Drs. Elizabeth Canuel and Emmett Duffy, won a 3-year STAR fellowship in support of her study of how biodiversity affects carbon cycling in seagrass beds. Long, a Ph.D. candidate advised by Dr. Rochelle Seitz, won a 3-year Greater Research Opportunities fellowship to support his study of how low oxygen levels affect an important Chesapeake Bay clam. The STAR and GRO fellowships support masters and doctoral students in environmentally related fields. The EPA awards approximately 100 fellowships per year, from more than 1,000 applicants around the nation.



Calendar of Events

February 2006

- 10 Spring Seminar Series - "Biological Stoichiometry in Ecology and Evolution," Jim Elser, Arizona State Univ.
- 11 9th Annual Blue Crab Bowl (ODU)
- 15 Application deadline for NSF-REU Summer Intern Program

March 2006

- 3 Spring Seminar Series - "Tropical Marine Biodiversity," Nancy Knowlton, Scripps Institute of Oceanography
- 4-12 Spring Break
- 17 Spring Seminar Series - "Viruses in Marine Ecosystems: Vaccines and Ecology," Jo-Ann Leong, Hawaii Institute of Marine Biology

April 2006

- 14 Video Lecture and Book Signing with Guy Harvey
- 15 VIMS Art Show and Auction "Angling for Art" featuring Guy Harvey
- 21 Spring Seminar Series - "Measuring and Modeling Fine Sediment Erosion," Larry Sanford, Univ. of Maryland

Future Events

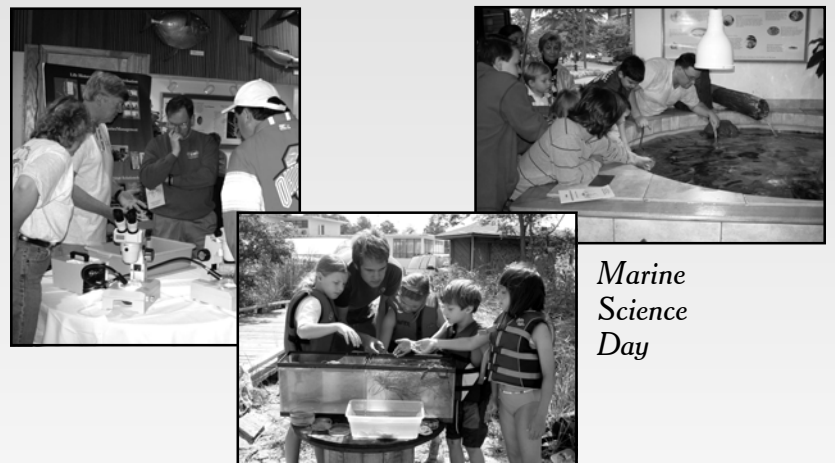
VIMS Marine Science Day - May 20th

Public Tours - every Friday June through August

After Hours Lectures - the last Thursday of the month, June through November

Summer Saturdays - selected Saturdays July - August

VIMS' Raft-Up is scheduled for September 29, 30



Marine Science Day

For an up-to-date listing of public events and seminars at VIMS, visit the on-line calendar system at www.vims.edu/calendars/

For more information call
804/684-7846 or 804/684-7001.

Visit our website at www.vims.edu

CBNERR Dedicates New Catlett-Burruss Laboratory

The Catlett-Burruss Laboratory will support monitoring of water quality in Chesapeake Bay coastal waters, studies of watersheds and shallow-water habitats, and education of students, teachers, and coastal decision-makers.



The Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) dedicated the new Catlett-Burruss Research and Education Laboratory in a September 12th ceremony at VIMS. The new building is named in honor of the Catlett and Burruss families for their generous long-term support of CBNERR and VIMS. From L (top row): Mr. John Gerdelman, William and Mary Board of Visitors; Delegate Harvey Morgan; Ms. Laurie McGilvray, Chief, NOAA Estuarine Reserves Division; Dr. John Wells, VIMS Dean and Director; Dr. William Reay, Director, Chesapeake Bay National Estuarine Research Reserve in VA. Bottom row: Robert Burruss, Alex Burrus, Mary Catlett Burruss, and John Catlett.

CBNERR Director Dr. William Reay addresses the crowd during the Catlett-Burruss dedication. From L: Tim Keeney (NOAA Deputy Asst. Secretary for Oceans and Atmosphere), Laurie McGilvray (Chief, NOAA Estuarine Reserves Division), The Honorable Harvey B. Morgan, John Gerdelman (William and Mary Board of Visitors), VIMS Dean and Director John Wells, and Reay.

Topping the Crest

- Construction Begins on New Buildings Pg. 1
- Governor Proposes \$2.9 M for VIMS Pg. 1
- VIMS Collaborates to Restore Lynnhaven ... Pg. 2
- A Tale of Two Breakwaters Pg. 3
- Seagrass Die-back Troubles Researchers Pg. 4
- VIMS Premieres New Course Pg. 5
- Pengiu Parade Pg. 7
- News Briefs Pg. 9
- A Case Study in Advisory Service Pg. 13
- VIMS Ghostbusters Pg. 14
- Clean Marinas Tops 60 Members Pg. 14

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