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welcome to profiles

Over a half century ago, the College of William and Mary embarked on an effort to merge research, education and public service related to the natural resources of the Chesapeake Bay. This effort grew out of the vision and foresight of Dr. Donald W. Davis, who, in the mid-1920's, envisioned establishing at William and Mary a program directed at using the resources of higher education to advance knowledge of our natural environment, educate future scientists, and translate gained knowledge into usable information for the stewards and users of our natural resources. In 1940, Dr. Davis's dream was realized with the establishment of the Virginia Fisheries Laboratory, later to become the Virginia Institute of Marine Science and School of Marine Science (VIMS/SMS), on the York River estuary at Gloucester Point, Virginia.

Since then, the Institute’s interests have broadened to include all aspects of coastal and estuarine science as well as management and policy. Today, VIMS is a nationally and internationally recognized center for coastal and estuarine research and education. Over the past ten years alone, the School of Marine Science has graduated more than 200 students with Master of Arts and Doctor of Philosophy degrees who work as faculty members in universities and colleges, as natural resources managers at all levels of government, and as environmental professionals in business.

A recently completed year-long review of the institution’s mission and activities reaffirmed its three-part mission of research, education and advisory services in support of the Commonwealth of Virginia’s interest in marine natural resources conservation and utilization. The active and continuing advisory role that VIMS/SMS plays in the management of the natural resources of the Commonwealth and the nation is a primary example of the service that the university community can provide to society as it faces the challenges of conserving and responsibly using the natural resources of this planet.

It is with great pride in the accomplishments of the men and women of VIMS/SMS that I help inaugurate a new publication to share information about the people, programs and activities taking place at Gloucester Point and at the Eastern Shore Laboratory in Wachapreague, Virginia. Profiles looks inside VIMS/SMS to give you a greater understanding of the lessons learned through the ongoing research effort that builds on over a half century of fundamental and applied studies. Although we have learned much about the natural forces and processes in coastal ecosystems, nature reveals its secrets slowly and we have much more to learn as our society endeavors to preserve the bounty and beauty of the Chesapeake Bay for ourselves and our posterity.

Timothy J. Sullivan
President
The College of William and Mary
Piecing Together The Pollution Puzzle

Marine ecologist Linda Schaffner finds a fascinating and active world in the mud and muck that most people avoid. Schaffner and colleagues are working to help untangle the intricate relationships that affect the health and productivity of coastal ecosystems. "Today, we face a pressing need for greater knowledge of pollution fate and effects. Our work is a major joint venture among VIMS scientists with expertise in a broad range of disciplines including estuarine ecology, geological oceanography, and environmental chemistry," says Schaffner.

Dr. Linda Schaffner

Graduate students Michelle Thompson and Al Curry use a box core to collect samples of the lower Chesapeake Bay's benthic community.
Once pollutants enter the bay, various environmental factors such as currents, waves, water temperature and salinity help determine their movement and ultimate fate. "The VIMS approach is based on two premises. First, interactions between physical, chemical and biological factors affect where and how long pollutants remain active in bay waters. Second, a key element in this complex picture is the diverse community of animals and other organisms that live on or in the benthic boundary layer—the interface between the water and the upper levels of sediments," Schaffner explains.

Nearly 90% of the macroscopic (visible to the eye) animals that inhabit the benthic boundary layer in the lower Chesapeake fall into three groups: worms, mollusks such as oysters and clams, and crustaceans such as shrimplike amphipods. Many smaller organisms, known as microbes, can only be seen with a microscope. All of these organisms consume food particles that may be contaminated with pollutants.

Depending on how an animal processes a pollutant, it may accumulate in the animal's tissue and become more toxic. When the animal is eaten, the pollutant is transferred to an organism that is higher in the food chain. Pollutants also become attached to sediment particles. In places without an active community of
Benthic organisms such as small clams, crustaceans and worms are abundant in the Chesapeake Bay. Through their feeding and burrowing activities, these bottom-dwelling organisms have major impacts on the transport, cycling and burial of pollutants that reach the bottom of the bay.

1. Interactions between biological and physical processes in the water column are important in determining pollutant fate.

2. Digging activities, like those of crabs, cause mud and associated pollutants to be resuspended into the water column enabling the pollutant to be carried back and forth within the estuary with every tidal cycle. As a result, some pollutants can remain in an estuary for a considerable time.

3. In an estuary such as the Chesapeake Bay, benthic organisms are major components of the diets of fish, such as spot and croaker, and the blue crab. After a small worm or clam has ingested a pollutant, the compound can accumulate into body tissue or be metabolized. Some compounds transformed by metabolism are stored within the organism and may actually become more dangerous than the original form of the pollutant.

4. Pollutants reaching the bottom are quickly ingested by resident organisms. There is evidence that the natural activities of benthic organisms lead to large amounts of the pollutant becoming concentrated in their burrows within a few days.

benthic (bottom dwelling) organisms, contaminants that filter through the water column often become buried in sediments. However, in areas where benthic animals are plentiful, the situation is much different. There, the animals burrow into and through the top sediment layers. This activity, called *bioturbation*, moves and mixes mud and may allow once-buried toxics to re-enter the water and ultimately end up in the tissues of larger animals like fish.

"Continued interdisciplinary study will help us to understand the links between benthic communities, chemical processes and physical forces that together shape the transport and fate of pollutants in the bay," says Schaffner.
Who's in the Marsh?

I adapted existing equipment so I didn't always have to ask three or four friends for help with my field work," laughs graduate student, Giancarlo Cicchetti. "In the marsh, conventional fish-sampling equipment, like a trawl or seine, doesn't work because of the marsh grasses." To collect samples, a metal ring is dropped from the front of a boat and everything in the ring is trapped there with minimal disturbance to marsh plants. For his research, Cicchetti devised a hinged screen that drops into the ring and rotates 360 degrees, raking all the creatures into a stationary mesh bag.

At selected sites in a polyhaline (higher salinity) marsh in the Goodwin Islands, Cicchetti is looking at the contributions of a tidal salt marsh to marine ecosystems in adjacent deeper waters. "It is important for us to know not only what species are at the site, but also how many of each species. I am looking at rates of reproduction and growth over a period of time." Tidal salt marshes teem with plant life, insects and worms, and provide food and protection to juvenile fish, small fish and small blue crabs. Cicchetti's research focuses on the fish that swim into the marsh on high tide, feed, and then return to deeper waters on ebb tide. "The invertebrate biomass in the marsh ultimately becomes part of the food web in deeper waters," says Cicchetti. "By sampling over an entire year at four specified sites: the marsh interior, the edge, the outer fringe (where marsh grass meets water) and in non-vegetated deeper waters adjacent to the marsh, I can also examine the ways in which different species use different areas of the marsh," explains Cicchetti.

Cicchetti rigged his "clearing device" using a stepladder.

Giancarlo was the first recipient of the William J. Hargis, Jr. Fellowship Award and used the stipend to develop this unique sampling system.
The Smith-Maclntyre grab is used to sample contaminated sediment. Sediments absorb many pollutants from the water, resulting in increased exposure of bottom-dwelling organisms to contaminants. Over time, sediments may release these contaminants back into the water.

In the mid-1970’s when the James River was contaminated by the insecticide Kepone, VIMS scientists initiated a crash research program on contamination. Since that time, VIMS researchers have taken a leading role in efforts to identify compounds that are potentially harmful to living organisms. Dr. Rob Hale and Dr. Mike Unger are currently involved in implementing,
refining and developing extremely sensitive methods of chemical analysis for detecting potentially harmful organic chemicals in the marine environment.

One method used by Hale and Unger is toxics fingerprinting, which Hale describes as an early warning system. "The environmental damage inflicted by Kepone might have been contained had we had access to more powerful methods for detecting contaminants," Hale points out. Fingerprinting is extremely valuable because it enables researchers to detect targeted compounds (those on existing lists of regulatory concern) and also reveal and track previously untargeted compounds that may be important at specific sites. "In addition, with the fingerprint, we can track compounds for which specific identification can not be made at this time," he explains.

### The Fingerprinting Process

Samples such as sediments or tissues from aquatic organisms are collected from a contaminated site. First, the pollutants are extracted from the sample. Next, interfering compounds, such as natural fats, are removed. Pollutants in the purified extracts are individually identified using a combination of analytical tools. High resolution gas chromatography is used to separate the hundreds of individual compounds still present in each extract. Mass spectrometry is then utilized to provide a fingerprint for each compound as it emerges from the chromatograph, by fragmenting it in a reproducible manner (Fig. A). The pattern of these fragments or masses may then be compared to reference spectra for known compounds. If no references are available, the masses may be interpreted to provide compound fingerprints.

Separation of PCTs (B) and PCBs (C), on a gas chromatograph. These were originally manufactured, sold and used as formulations called Aroclors. Each consists of a mixture of many closely related components. Generic structures illustrating their similarities are given. The time it takes for each compound, to peak, or exit the machine is one clue to its identity.
Finding the Unexpected

One example of the utility of the VIMS toxics fingerprinting approach came with Dr. Rob Hale's discovery of high concentrations of polychlorinated terphenyls (PCTs) in sediments and oysters in Tabbs Creek, a Chesapeake Bay tributary. PCTs are closely related to the toxic and potentially cancer-causing polychlorinated biphenyls (PCBs). Although no longer manufactured, PCBs and PCTs are persistent in the environment where they may accumulate to high concentrations in organisms and sediments.

Using the "fingerprinting" method, Hale and colleagues identified a mixture of PCTs hitherto unreported in the Americas. The close similarity of PCTs to PCBs raised serious questions about the toxicological significance of the PCT contamination. Subsequent studies, using specifically developed methods, showed that PCTs had accumulated in high concentrations in a variety of organisms, including fish, crabs, oysters and marsh grasses. Further work proved that PCTs cause effects similar to those caused by PCBs on critical enzyme systems of exposed aquatic organisms. Field studies have identified several sources of the contamination, and cleanup efforts have been initiated by federal and state agencies. VIMS scientists are currently investigating the potential for destruction and bioremediation of PCTs using microorganisms.

Fingerprinting is a major advance over earlier techniques, which only reported the presence of a limited number of known substances, selected in advance.
Tributyltin (TBT) is a powerful marine antifoulant painted on the hulls of vessels to prevent the attachment and growth of barnacles, tubeworms and other nuisance animals. Evidence that TBT causes harm to nontarget organisms, particularly shellfish, raised concerns about the potential effects of widespread TBT use on recreational, commercial and naval vessels. “Because of the extreme toxicity of TBT, standard analytical techniques were not adequate to quantify the low concentrations that were causing adverse effects in aquatic organisms,” explains Dr. Mike Unger, an environmental chemist in the Department of Environmental Sciences. “For most of the pollutants we have studied, toxicity to marine organisms occurs at parts per million or parts per billion levels. TBT presented a new challenge, as concentrations several orders of magnitude lower were suspected of causing adverse effects.” To evaluate the effects of TBT, Unger and co-workers developed a sensitive and highly specific technique that enables them to detect levels of TBT as low as one part per trillion.

VIMS scientists continue to monitor Chesapeake Bay for TBT to assess the effectiveness of legislation that restricted its use on smaller vessels. The continued use of TBT paints on ships over 25 meters in length still raises the concern for elevated concentrations of this contaminant in areas of high ship traffic. Additional research is examining the combined effects of TBT and other stresses such as disease and low oxygen on the health of oysters.
Why a Coastal Inventory?

By 2010, three quarters of the nation’s population will live within 50 miles of a coastline.

In Virginia, the trend toward coastal development is well-established. Managing and maintaining the Commonwealth’s unique coastal environment requires highly precise and reliable scientific data. In 1989, the Virginia General Assembly authorized VIMS to establish a Comprehensive Coastal Inventory (CCI) Program through its Center for Coastal Management and Policy. Today, Program Manager Marcia Berman administers a dynamic and growing CCI program.

CCI focuses primarily on environmentally sensitive shoreline regions, where management strategies must balance the pressures for coastal development with the need to preserve and protect the coast as a resource. “Our main objective is to create, develop, update and maintain a natural resource inventory of the Virginia tidal shoreline and its tributaries,” explains Berman.

Using an electronic Geographic Information System (GIS), the CCI
staff develops layers of information. Each layer represents a unique set of data relating to a particular characteristic of a defined stretch of shoreline. Layers are created from measurements, on-site surveys, aerial photographs, color infra-red images, topographic maps and historical charts. Once a data set for a given shoreline is complete, the GIS generates maps of the area that reflect the various layers of information and projects the data at any scale. CCI targets features like the location and configuration of tidal wetlands, river and stream watersheds, shoreline changes due to erosion or accretion, land use and development patterns. “The biggest challenge in developing and maintaining a resource inventory is producing an extremely accurate map,” says Berman. CCI relies on the use of advanced surveying technology known as a Global Positioning System (GPS), which computes the positions of geographical features by triangulating with orbiting satellites. On the ground, the GPS system receives satellite signals every three-tenths of a second and is able to determine an object’s position within two centimeters—less than an inch—anywhere on Earth.

**Tidal Marsh Inventories**

Tidal marshes are vital elements in coastal ecosystems, serving as wildlife habitat and as purifiers that help ensure water quality. VIMS began developing inventories of Virginia’s tidal marshes in the 1970s.

Human activity and natural events have wrought many changes in Virginia’s tidal marshes. To meet management needs for the most accurate, timely information, CCI staff use high-resolution digital image processing to update and refine the existing inventories. As each new inventory is completed, resource managers gain a comprehensive portrait of the mapped area and a clear view of changes that may have occurred there over time.
Habitat Restoration

The York River watershed is one of many Virginia waterways facing conflicting pressures from population growth and economic development on the one hand, and the need to restore the quality of waterways and associated ecosystems on the other. In many localities within the watershed, resource managers face a daunting task as they try to assess future development needs balanced against responsibilities to preserve and restore habitat.

CCI personnel maintain large databases of all localities in the watershed, which extends from York and Gloucester counties at the river’s mouth to Orange and Louisa counties at its headwaters. For each study area, the system integrates a massive amount of data—including inventories of physical, chemical, geological, and biological parameters. Researchers and managers use GIS to search a target landscape or nearshore area, and identify areas that are good candidates for habitat restoration.

Use Conflict Studies

Increasingly, resource managers in coastal localities must deal with conflicting use proposals for submerged land areas. In this arena also, CCI’s GIS database makes a vital contribution. For example, demand is steadily increasing for sites for shellfish aquaculture in the lower Chesapeake Bay. At the same time, in many lower Bay regions there is a recognized need to preserve or restore submerged aquatic vegetation (SAV), a key component of the blue crab habitat. CCI personnel and graduate students have used GIS to perform a large-scale spatial analysis that helps delineate sites suitable for shellfish aquaculture.

“Over the past five years,” Berman says, “CCI staff has accurately mapped and catalogued key areas of the 5000+ miles of tidal shoreline in Virginia and we can regularly update this information. As a result, policymakers and regulators have ready access to essential data on the current status of environmentally sensitive coastal areas.”
Graduate student Dan Redgate gathers data from a 70-foot tower in the sky to study the water budget in a forested wetland. "While everyone is familiar with tidal marsh wetlands, most people don't think of these non-tidal forested areas as wetlands," says Redgate. "In fact, the largest percentage of wetlands in the coastal plain are non-tidal forested wetlands." Prior to this work, the hydrologic function of this type of wetland had not been documented. Redgate's 15-acre research site includes the instrumentation tower and a grid of groundwater wells.

"To understand the water budget in an area, we must first understand the total input (precipitation, surface inflow from streams, and ground water supply) and total output, which includes surface outflow, ground outflow, and evapo-transpiration," Redgate explains. Instruments on the tower measure net radiation (the amount of sunlight reaching the site), air temperature, relative humidity, wind speed and direction. "This is important because in a forested wetland evapotranspiration is the most significant avenue for water outflow." The tower enables Redgate to gather essential data without altering the natural processes occurring in the area. Depending on the hydrology, wetlands may function to improve surface or subsurface water quality. "This kind of information helps us to understand how forested wetlands fit into the larger picture. Where does the water come from? Where does it go? Until we understand this more fully, we can't answer basic questions such as: Why are these wetlands important? What role do they play in erosion prevention, flood control, and water quality?"
Survival is a chancy affair
for a sea scallop. Like oysters and
many other aquatic animals, spawning female
sea scallops produce millions of eggs, but only some of
the eggs are fertilized by the males' free-swimming sperm.
Of those that become fertilized, many fall prey to a gauntlet
of hungry predators and other rigors. The survivors develop into
swimming larvae, which are also potential food for a range
of aquatic animals. Only a tiny fraction of
larvae—perhaps several in 100,000—are destined
to survive the four or more years
required for a scallop
to reach harvestable size.
Dr. DuPaul's gear-selectivity evaluations are carried out aboard a commercial fishing vessel.

As state coordinator for the Sea Grant Marine Advisory Program, Dr. William DuPaul of VIMS works closely with Virginia's commercial fishing industry. "Today, seafood harvesters, processors, and retailers operate in a challenging business climate. The industry consists mainly of small firms that must compete in global markets. Consumers expect safe, wholesome seafood products at a reasonable price. The rising demand for seafood has placed unsustainable pressure on many fisheries," DuPaul characterizes the current environment. To remain economically viable in the face of these often-conflicting forces, Virginia's seafood industry relies on research and advisory services from Virginia's university system.

For several years, DuPaul and his associates have played a vital role in developing strategies for conserving the natural sea scallop fishery resource along the Atlantic coast. Currently the sea scallop (Placopecten magellanicus) accounts for annual landings worth more than $30 million, or 50% of the total value of the wild seafood harvested by Virginia's commercial fishing.

Scallopers fish by dredging. The dredge consists of a set of steel rings. The inside diameter of the rings determines the diameter of scallop shells that will be retained by the dredge. Gear-selectivity research looks for ways to minimize the unintentional harvest of undersized sea scallops—those with a shell diameter of roughly 3 inches. Usually, sea scallops don't reach this minimum size until they are 3-4 years old. Harvesting smaller animals rapidly depletes the pool of reproductively mature sea scallops. In response to declines in the sea scallop harvest in some areas, 1994 Federal regulations increased the minimum size for dredge rings to 3.25" rings from 1994-1995 and 3.50" after 1995.
industry. "In conjunction with industry, the New England Fishery Management Council, and the National Marine Fisheries Service, our work is focused on sound management practices for this resource," says DuPaul. "Most recently we have been conducting gear selectivity studies to examine the design of scalloping gear. We are looking for methods that will optimize the efficiency of the harvest while maintaining the fishery stock at a sustainable level over the long term."

Since 1993, DuPaul and his colleagues have undertaken a series of research cruises on vessels fishing the waters from Virginia to Georges Bank to assess the selectivity of different sizes of scallop dredge rings. On the cruises, fishing practices are strictly at the discretion of the captain. "This gives us first-hand, realistic exposure to actual conditions under which the fishery operates. Our research shows that, as expected, larger ring dredges significantly reduce the number of juvenile sea scallops caught," DuPaul says. The larger rings also reduce the overall number of scallops taken, so more mature animals, which produce more offspring than younger animals, remain in the fishery. In addition, because larger sea scallop meats bring a higher price than do smaller ones, vessels harvesting fewer but larger scallops can still net their owners, skippers, and crews an acceptable profit. Equally important, this assures that a thriving base of smaller animals will remain to produce the food resource of the future.

In much scientific research, several years may elapse between the time experiments are planned, funded and carried out, and the time results are available to users outside the scientific community. By contrast, cooperative programs such as the Marine Advisory Program gear-selectivity studies provide research findings to both industry and government policymakers almost immediately.

Graduate student Jeffrey Brust working with a crew to build an experimental scallop dredge. Brust’s thesis work is on gear-selectivity.
Behind The Scenes . . .

Vessels Center

(L to R) Charles Machen, Captain of the R/V Langley, George Pongonis, Supervisor Vessels Center and Durand Ward, Captain of the R/V Bay Eagle.

With people working in waters from the continental slope through the Chesapeake Bay, in estuaries, rivers, streams and marshes, the VIMS Vessels Center is a hub of activity. "Our fleet as well as our whole method of operating has evolved to support the kinds of field work conducted by our scientists," says George Pongonis, Marine Superintendent of the Vessels Center. "If you look at the geography of the Bay and river systems in which we operate, it is pretty apparent that maneuverability and accessibility are primary considerations for our vessels."

The VIMS vessels operation is centralized, with permanent, full-time administration, shore support and underway support for maximum responsiveness and equipment utilization. "Our support crews know the vessels inside out from the engines to the wiring," says Durand Ward, Captain of the R/V Bay Eagle. "Often scientists have only a small window of time in which to conduct studies: a species is most likely to spawn in a certain location under specific conditions, a tidal phenomenon occurs only three or four times a year, or water sampling studies must be completed within a 72 hour period. Our vessels must be dependable."

The trailerable fleet is especially valuable for the coastal and estuarine research at VIMS. For research sites 40-60 miles up river, it may be more efficient both in time and dollars to trailer a boat to the site than to take a vessel the same distance by water. Many of the trailerable vessels have been adapted to accommodate scientific and electronic equipment that can be transferred easily from vessel to vessel. Small vessels are currently utilized better than 100%—often the same boat will be used by two different researchers on the same day.

"There are occasions when we give the Vessels Center basically zero-lead time. Without their support as well as their knowledge of the vessels, the waters in which we work and the nature of our research, we would not be able to accomplish our goals," says Dr. John Boon, Chairman of the Department of Physical Sciences. "They work with us as a team. I depend on them to bring our equipment on board safely in pitching seas and to advise me on the best way to approach a problem in the water. With our research, trial and error can be very expensive both in time and money; their contribution is invaluable."

Shirley Crossley schedules more than 1,000 deployments per year.
For speckled trout and blue crabs, eel grass beds provide excellent nursery habitats. Using whole plants and seeds, faculty, staff and students from the Department of Biological Sciences are working on methods to restore these valuable beds at sites on the Rappahannock River. Similar restoration projects have been successful in some sites on the York River since 1984. During the heat of summer, increased turbidity in the water decreases the amount of sunlight reaching the grass beds. Without adequate sunlight, the plants are unable to thrive. Grass beds like these are primary indicators of water quality.

As part of the Artificial Seagrass Pilot Project, senior scientist Bob Gammish outfits the 26' Osprey with a digital fathometer and side-scan sonar to monitor the area around one of the pilings on the Chesapeake Bay Bridge Tunnel where artificial seagrass has been used for the first time. "The fathometer gives us a slice or plane view of the area directly under the boat. With the side-scan sonar we can see a 100 meter swath of the bottom. The side-scan provides an image similar to an aerial photograph, but the image comes from reflected sound instead of light," says Gammish. Using this information he can create a bathymetric map of the area to monitor the amount of erosion or accretion that is occurring. This information helps Gammish to evaluate the effectiveness of the artificial seagrass mat for trapping sediment.
Dr. Elizabeth Canuel, Assistant Professor in the Department of Physical Sciences, recently received a five year grant from the National Science Foundation’s Faculty Early Career Development Program. These highly competitive grants are awarded to junior faculty who plan to pursue full, balanced academic careers that include both quality research and education. The grant will enable her to continue to develop graduate level courses, mentor graduate and undergraduate students, and establish a summer program to initiate high school girls to scientific research in labs where they can work closely with female mentors. Canuel, who joined the VIMS/SMS faculty in 1994, currently teaches Principles of Chemical Oceanography and Marine Organic Geochemistry in the School of Marine Science. Her primary research interest is in understanding the processes that control organic carbon cycling in the marine environment. With the NSF grant she will implement an integrated research program using techniques that allow her to determine the sources of organic matter in the Chesapeake Bay. The work will focus on the processes likely to be most important namely freshwater inflow, phytoplankton blooms, and microbial transformation through metabolic processes.

Dr. John Graves, Associate Professor Department of Fisheries Science, received the 1994 Thomas Jefferson Teaching Award at the William & Mary Charter Day celebration in February, 1995. His research program is directed toward the use of molecular techniques to understand the population structure of marine organisms. Graves and his students analyze the DNA of various species in the Chesapeake Bay and in open oceans. His research has demonstrated distinct genetic populations in several fishes previously assumed to be homogenous.

The Virginia Sea Grant Seafood Education Program was honored by the Virginia Chefs Association with the presentation of an award from the American Culinary Federation. The Chefs Association received the award on the basis of the Chefs Seafood Symposium, an annual educational conference cosponsored by the Virginia Sea Grant and VIMS. On behalf of Virginia Sea Grant and VIMS, Vicki Clark, Education Specialist, accepted the award presented by Hans Schadler, Executive Chef at the Williamsburg Inn.
Aboard the R/V Cape Hatteras

First year graduate students in MS 503 Field and Lab Techniques were aboard the R/V Cape Hatteras for 24-hour sampling cruises in the Gulf Stream. The Cape Hatteras is a fully equipped deep-water research vessel outfitted by the National Science Foundation and operated by Duke University and the University of North Carolina. SMS students conducted sampling studies at four stations. In addition to conductivity (salinity), temperature and depth probes, the students conducted fluorescence studies to measure the amount of phytoplankton and towed bongo nets to collect zooplankton.

Dr. Herb Austin, course coordinator, said, "This experience provides our students with a balanced perspective of blue water and estuarine research."

(Above) Sean Cregan, Fisheries Science, conducting water sampling tests.
(Right) Instructor Betty Berry and crew member (l) demonstrate equipment for measuring light attenuation in the water column to Kimani Kimbrough, Physical Sciences and John Davis, Environmental Sciences.

Carrie O'Farrell, Department of Fisheries Science, and Aswani Volety, Department of Environmental Sciences, received awards at the 1995 Annual Meeting of the National Shellfisheries Association in San Diego. O'Farrell received the Best Student Paper award, and Volety was recognized as presenting Best Student Poster. Rochelle Seitz, Department of Fisheries Science, and Anamarija Frankic, Department of Resource Management and Policy, have been awarded American Association of University Women fellowships for doctoral work. Seitz was selected as one of 64 American Fellows from a pool of 1,119 applicants. Frankic received one of 42 International Fellowships from 977 applicants. Sid Mitra, Department of Physical Sciences, was awarded a Hudson River Foundation Fellowship for doctoral research. Lance Garrison, Department of Fisheries Science, received the Willard A. Van Engle Fellowship for crustacean studies. Chris Pearle, Department of Resource Management and Policy, recently spent a semester as an Assistant Scientist on a Sea Education Association research cruise. SEA sponsors three-month long courses designed primarily for undergraduate students and science teachers. Mike Chassey, Department of Physical Sciences, received a Graduate Student Fellowship from the U.S. Environmental Protection Agency. Craig Tobias, Betty Berry and Randy Cutter, Graduate students in the Department of Biological Sciences, received awards at the 1995 Annual Atlantic Estuarine Research Society Meeting at Ocean City, MD. Tobias received the Best Ph.D. Student Paper award, Berry received the Best M.S. Student Paper award, and Cutter received the award for Best Student Poster Presentation.
VIMS/SMS 1994 Annual Awards

Dr. Linda Schaffner, Associate Professor, Department of Biological Sciences was the recipient of the Outstanding Teacher Award for 1994.

Adele Pile, Department of Biological Sciences, received both the Dean’s Prize for the Advancement of Women and the John M. and Marilyn Zeigler Student Achievement Award.

Dean Grubbs and Sarah Gaichas, Department of Fisheries Science, students were awarded the William J. Hargis, Jr. Fellowship Award.

Sarah Rennie, Department of Physical Sciences, received the Matthew Fontaine Maury Award for achievements in studies of Physical Oceanography.

Durand Ward of Vessel Operations, the Scientific/Research Award.

Mozelle Brandford, Facilities Management, Outstanding Facilities and Trade Award.

Marilyn Hudgins, Accounting, Outstanding Administrative/Clerical Award.

from the bay

Northern Puffer - *Sphoeroides maculatus*

Although commonly found in the Chesapeake Bay, the Northern Puffer ranges from Newfoundland to northeast Florida. An opportunistic feeder with powerful jaws, the puffer primarily preys on invertebrates. Puffers inflate their bodies as a defense mechanism to appear larger and more formidable to potential predators. Deep emerald-green eyes are also characteristic of the species. Recreational fishermen often catch puffers on hook and line.