

Winter 2002

The Crest, Winter 2003

Virginia Institute of Marine Science

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The

Crest

Current Issues in Coastal Ocean and Estuarine Science

VIMS Research Helps Protect Navy Ships from Mines

VIMS scientist Dr. Carl Friedrichs is working with an international group of collaborators on a multi-year program to improve the state of the art in mine-burial prediction. The program is funded by the U.S. Office of Naval Research (ONR).

The technology of naval mines has far surpassed the floating powder kegs depicted in old war movies. Many of today's mines lie in wait on the seafloor, then detonate when they sense acoustic or electromagnetic signals emitted by vessels passing far above.

The task of Friedrichs and other investigators in the Mine-Burial Prediction (MBP) program is to develop a computer model that can better predict the likelihood that a seafloor mine will be buried by sediments, and the rate and extent of burial. Mines that are more than 80% buried are difficult for mine hunters to detect.

"The Navy needs accurate models for mine burial to help plan and carry out military operations in coastal waters," says Friedrichs. "We're

working to provide the Navy with a prototype model for forecasting mine burial in strategic areas." Friedrichs, along with Ph.D. candidate Art Trembanis and Dr. Patricia Wiberg of the University of Virginia, just gave an update on that work at the 3rd Annual ONR Mine Burial Prediction Workshop in St. Petersburg, Florida.

Mine-burial models must be able to predict the behavior of mines in a variety of different environments. To do so, they must incorporate dynamic interactions among waves, currents, tides, gravity, and sediments, as well as the size, shape, and mass of the mine itself.



Researchers use inert instrumented mines to study mine burial.

Photo courtesy M. Richardson, Naval Research Laboratory.

Moore Goes with Flow to Monitor Water Quality and Seagrasses

A team of VIMS scientists led by Dr. Ken Moore is using new high-tech sensors to track Virginia's commitment to the water-quality standards of "Chesapeake 2000." This plan is the Chesapeake Bay Program's most recent blueprint for Bay restoration and protection, with standards designed to give Bay organisms the clear, clean water they need to thrive.

Moore's interest in water quality relates directly to his long-term interest in restoring the Bay's submerged aquatic vegetation, or SAV. These underwater grasses once covered about 600,000 acres of Bay floor, providing key habitat for numerous species of fish, invertebrates, and waterfowl. But by 1978, only 41,000 acres remained. The decline, which has been documented by VIMS researchers using historical aerial photographs, is largely due to shading of the grasses by increased levels of sediment, nutrients, and algae in the water.

"Suspended sediment and algal cells are of particular concern," says

Moore. "They block light in the shallows and can severely hinder both natural recovery and efforts to trans-

Continued on page 2

The University of Hawaii's Dr. Roy Wilkens notes that mine-burial models must also be able to forecast on many different time-scales. "Questions raised by the Fleet might range from the probability of objects burying along a particular coast during a particular season, to what might happen to objects deployed along a known beach

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Chesapeake Bay
National Estuarine
Research Reserve
in Virginia

a fair Bay Spring
Vol. 13, No. 1

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Yes Vote on Bond Referendum Good News for VIMS

Virginians voted yes on November 5th 2002 to the bond referendum for higher education, which included \$24 million for a new Marine Research Complex at VIMS. This new research space will change the face of VIMS, providing laboratories for programs critical to the future of Virginia's coastal resources. Laboratories for seagrass restoration and research, hydrodynamic modeling, evolutionary ecology, benthic studies, shoreline studies, molluscan and crustacean

ecology, and toxicology will be moving from outdated 30-70 year old buildings to the new 70,600 sq. ft. research building or a 43,000 sq. ft. seawater laboratory.



An architectural rendering of VIMS' planned marine research building.

Moore Goes with Flow *continued from page 1*

plant SAV to formerly vegetated areas."

Restoration of the Bay's submerged aquatic vegetation is a primary goal of *Chesapeake 2000*. The plan calls for a three-step approach. The first is to restore underwater grasses to 114,000 Bay acres, the area they occupied in the early 1970s. SAV coverage will then be expanded into all areas that historical aerial photographs show once had SAV. The final step is to vegetate potential habitats to a depth of one, then two meters.

Moore's Dataflow sensor is helping to identify areas in the James and York rivers where the water is consistently clear enough to support SAV growth at the depths defined in the *Chesapeake 2000* plan. This task is difficult if not impossible using present monitoring sites and methods.

"Although water quality is monitored at fixed stations in mid-channel

areas of the James," says Moore, "we don't have a good understanding of conditions in the shallower areas where seagrasses grow, or how water-quality conditions vary with space and time."

The Dataflow system allows Moore's team to monitor large expanses of deep and shallow water relatively quickly, allowing them to better understand how water quality varies from place to place, top to bottom, and month to month.

Dataflow is a compact, self-contained system that is deployed during monthly cruises from a small boat operating at speeds up to 25 knots. It collects surface water through a pipe on the bottom of the vessel, pumps it through an array of water-quality sensors, then discharges the water overboard. The sensors record dissolved oxygen, salinity, temperature, turbidity, and chlorophyll—all parameters that relate to water clarity, algal abundance, and seagrass health.

VIMS' dataflow system was fabricated in-house by technicians Todd Nelson and Wayne Reisner.



Britt Anderson and Ken Moore take the DATAFLOW system for a spin on the James River.

Dataflow collects one sample every 2-4 seconds, which at an average speed of 25 knots provides a data point every 40-60 yards. It sends these data to a laptop computer, along with information on location and depth provided by an integrated GPS sounder. VIMS researchers Britt Anderson, David Wilcox, and Betty

Neikirk synthesize these data to produce detailed digital maps that show how water-quality varies across a study site. Bay managers use these maps to evaluate efforts to reduce pollution in Virginia's coastal waters, and to assess whether existing seagrass beds or designated restoration areas actually experience the conditions needed for seagrass survival.

To date, Moore's team has used Dataflow to produce surface maps of water quality in the tidal portions of the York and James Rivers. Funding for the York River work came from the Virginia Department of Environmental Quality. EPA funded the James River work.

The Acrobat, a torpedo-like vehicle that is towed behind a larger boat, is another newly developed instrument platform. It provides a means to sample water-quality in deeper portions of the Bay. Still in its testing phase, Acrobat can be programmed to sample along an undulating course between the surface and deeper waters, thus providing a three-dimensional view of water quality.

Moore and the other collaborators on this project, including Drs. Iris Anderson, Larry Haas, and Howard Kator, are particularly excited about Acrobat's ability to measure levels of dissolved oxygen in real time. "Deeper regions of the Bay often lack the levels of dissolved oxygen needed to support life," says Moore. "Acrobat will allow us to map these zones and to understand how they expand and contract in relation to temperature, salinity, and depth."

Dataflow data is available online through the Chesapeake Bay Program Office at www.chesapeakebay.net/data/index.htm

Orth Illuminates Role of Seed Predators in Seagrass Beds

Anyone who has watched a squirrel bury or eat an acorn appreciates that animals help determine the abundance and distribution of plants on land. Recent work by VIMS researcher Dr. Robert Orth suggests that animals may be doing the same thing to help shape plant communities underwater.

Orth, a Professor of Marine Science in VIMS Department of Biological Sciences, is studying how seagrasses are affected by the marine creatures that might eat their seeds. The work is part of his larger effort to restore eelgrass to Chesapeake Bay by sowing seeds rather than planting young shoots, which is the typical practice. Eelgrass is the most common underwater grass in Chesapeake Bay, but it no longer grows in many areas that once supported lush beds. To help restore Bay grasses, Orth and his staff collect and broadcast millions of eelgrass seeds each year, with support from the Virginia Saltwater Recreational Fishing License Fund.

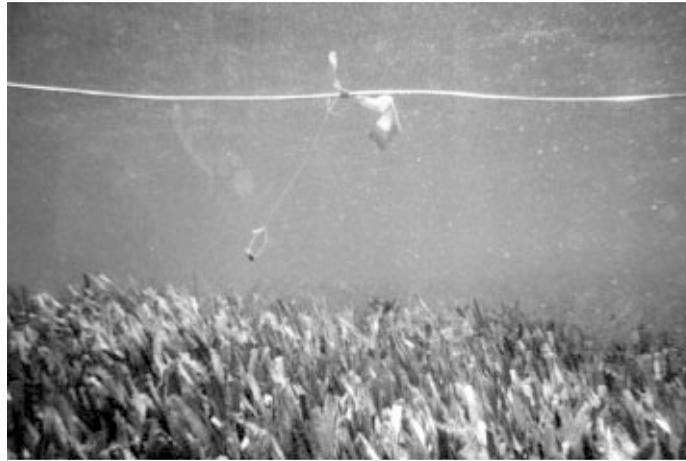
One intriguing question in Orth's research is how seed predators might be affecting seagrasses. To help address this question, Orth traveled half way around the world to Australia.

Drs. David Tunbridge of Western Australia's Murdoch University and Ken Heck Jr. of Alabama's Dauphin Island Sea Lab collaborated in the study.

Results from the Australian study, recently published in *Marine Ecology Progress Series*, shed light on seagrass restoration in Chesapeake Bay. They suggest that restoration of eelgrass with seeds may be more successful in unvegetated sand, where the survival rate of seeds is higher, than in areas near eelgrass beds.

"Our results came just at the right time," says Orth, "as we are expanding our restoration efforts using seeds."

Ironically, one of Orth's reasons for working down under was to escape the turbid waters that threaten the Chesapeake's seagrasses. The Western Australian sites provide the clear water that seagrasses need to thrive, and that Orth needs for his experi-



VIMS researcher Robert Orth tethers seagrass seeds to study their animal predators.

ments, in which SCUBA divers visually monitor the fate of individual seagrass seeds tethered to a monofilament line. This tethering technique had previously been used only in animal studies.

Studies of animals in seagrass beds show that prey items—small fish and invertebrates—are more likely to be eaten if they wander from the cover of a seagrass bed into a nearby sand patch, where there are fewer places to hide.

But when it comes to seeds, the situation is reversed—Orth's experiments show that seeds within a seagrass bed are more likely to be

chewed or swallowed than those in bare sand. The reason? Orth thinks the pattern may reflect the type of animals—small crabs—that likely feed on seeds. Small crabs generally hide within the cover of seagrass blades to avoid predation in open areas of bare sand. Though crabs may have more difficulty finding seeds within a seagrass bed, those seeds are safer for the crabs to eat because the crabs don't have to worry about being eaten themselves.

In addition to aiding seagrass restoration efforts, Orth's finding may help explain the dynamics of seagrass meadows, at least those dominated by the species studied. Because seeds dispersed into an existing patch are more likely to be eaten, it appears seed dispersal plays a relatively minor role in a bed's on-going development. Instead, seeds may be more important in helping a patch colonize sandy areas and expand. Given the prevalence of storms and strong currents along the western Australia coast, relatively higher survival in sand may be needed for patches to re-establish themselves in denuded areas following large-scale disturbances.

VIMS Researchers See the Bay in a Grain of Sand

Like canaries in a coal mine, the creatures that dwell in and along the floor of Chesapeake Bay can provide scientists with a good sense of environmental stress.

Using a test known as the Benthic Index of Biotic Integrity, or B-IBI, scientists compare a bottom-dwelling community at a site disturbed by human activities to the type of community expected at a pristine site. Undisturbed sites tend to be highly productive, with high biodiversity and lots of food for predators, such as birds, crabs, and fish. A site dominated by pollution-tolerant species or containing few organisms at all is taken as a sign of human disturbance.

A recent grant from the Department of Defense will allow VIMS scientists Drs. Linda Schaffner and Iris Anderson to couple the B-IBI test with a more detailed look at the types of organisms that make up a benthic community, and how those organisms function together in an integrated ecosystem. Whereas the traditional B-IBI test focuses on relatively large and conspicuous creatures like clams,

snails, and worms, Schaffner and Anderson will extend the test to include animals so tiny they inhabit the spaces between sand grains. This community of Lilliputian creatures is a key component of estuarine food webs, especially

for juvenile fish such as spot and croaker.

The 3-year, \$666,000 grant will allow Schaffner and Anderson, along with a team of graduate students, summer interns, and technicians, to

conduct B-IBI studies at six military bases along the Chesapeake Bay shoreline. These include Langley Air Force Base, NASA's Langley Research Center, and Fort Eustis.

One aim of the team's study is to use the B-IBI approach to investigate how pollution from military installations may be impacting Bay health. Several military bases in Virginia and Maryland have been placed on the National Priorities List of most hazardous sites because of non-point source pollution of adjacent aquatic ecosystems.

A more general goal is to better understand what the B-IBI approach truly says about estuarine ecosystems. "The Chesapeake Bay Program has long used the B-IBI as an index of estuarine health," says Anderson. The approach works because benthic organisms tend to be couch potatoes. Many derive sustenance by consuming the sediments and associated detritus in which they live, ingesting any contaminants that may have settled there. And unlike fish or plankton, most bottom-dwellers are literal stick-in-the-muds



Communities of microscopic organisms like this nematode support the marine food web and may shed light on Bay health.

Photo courtesy of M. Hooge, Univ. of Maine

Virginia Seafood Council Proposal to Continue Non-native Oyster Tests Gets a Facelift, with Help from VIMS

Editor's Note— The Virginia Seafood Council (VSC) recently submitted a proposal to deploy 1 million sterile non-native oysters into Chesapeake Bay as a large-scale test of the economics of oyster aquaculture. The following article by Dr. Stan Allen provides background on how VIMS is fulfilling its research and advisory role in relation to non-native oysters and VSC requests. Dr. Allen is Director of VIMS' Aquaculture Genetics and Breeding Technology Center (ABC).

In 1995, VIMS began testing non-native oysters in Chesapeake Bay as one way to help revitalize the Bay's oyster population. These tests, requested by the Virginia General Assembly through House Resolution 450, have all used sterile oysters produced by newly developed technology.

VIMS' initial field tests focused on the Pacific oyster, *C. gigas*, the most popular oyster species in the world. But Pacific oysters are seldom reared in estuaries like the Chesapeake and their disappointing performance here emphasized why—they do not thrive in warm, low salinity, turbid waters. In 1997, trials began with another non-native oyster, the Suminoe or Asian oyster *C. ariakensis*, which excelled. Its growth and survival was outstanding and it even passed muster with local oyster connoisseurs.

By 2000, the success of the VIMS tests had piqued industry interest, and the Virginia Seafood Council (VSC) proposed a small trial of about 6,000 sterile oysters distributed among 6 growers. Results were so encouraging that VSC proposed another trial the following year with 60,000 oysters and 13 growers. In 2002, VSC proposed the largest test yet, with one million oysters to be distributed among as many as 39 growers.

All the VSC proposals were submitted to the Virginia Marine Resources Commission (VMRC), the agency with sole authority for the release of non-native species in Virginian waters. VMRC and other regulatory agencies will make any future decisions regarding the use of non-native oysters in light of a National



The Suminoe oyster *Crassostrea ariakensis* is a market favorite in southeastern China.

Academy of Sciences report that is due in June 2003 (see article on facing page).

The 2002 VSC proposal differed from previous efforts in several significant ways. First, the sterile oysters VSC proposed to use would have been produced by technology inferior to that available today. The new technology, which now resides at VIMS, was not available when VSC penned their proposal. Second, the participant list was three times larger than the 2001 trials and included aquaculture novices as well as seasoned veterans. There were other less significant issues, but the main criticisms of the 2002 proposal concerned "biosecurity."

In the context of non-native oyster trials, biosecurity refers to measures taken to prevent the inadvertent introduction of a species, its pathogens, or associated pests. VIMS has taken great care in its trials to exercise biosecurity (see the Spring 2002 issue of the *Crest*). Biosecurity measures in the VSC proposal were less stringent, and realizing this, they withdrew their proposal from consideration. Following the withdrawal, VIMS discussed their concerns with VSC and offered guidance on improving the proposal. A revised proposal was written for 2003 and will be before VMRC in a public hearing on February 25th.

In addition to articulating biosecurity guidelines, VIMS contributed in other significant ways to the revised proposal. VIMS' most substantive contribution—and the one most important to biosecurity of the project—is making available its cutting-edge technology for producing sterile oysters. VIMS' Aquaculture Genetics and Breeding Technology Center (ABC) brought this technology on-line during summer 2002.

The technology involves a unique method to breed oysters with many more chromosomes than normal. The effect this has on the oyster varies with the number of chromosomes. For example, a normal oyster (called a diploid) has 20 chromosomes comprising 2 "sets" of 10. It obtained the two sets from its parents—one from mom, one from dad. Oysters containing 3 sets of chromosomes (triploid) are sterile because of their inability to produce normal eggs and sperm. However, endowing an oyster with 4 sets (tetraploid) re-establishes fertility. The cutting-edge technology is that process that creates tetraploid oysters, which are then mated with diploids to make sterile triploids.

Mating tetraploid and diploid to make sterile oysters is the key to large-scale trials of non-native oysters, in this case *C. ariakensis*, and of any future proposals to begin commercial aquaculture. ABC's accomplishment last

summer was creation of significant numbers of the heretofore elusive tetraploids to enable the production of sterile triploids. This method of making triploids is superior to any other because a mating between tetraploid and diploid produces young oysters that are all—each and every one—sterile.

VIMS also contributed to the 2003 VSC proposal by offering to provide a comprehensive analysis of the economics of sterile *C. ariakensis* aquaculture. One of the principal reasons to expand trials with non-natives from 60,000 to a million is to study the cash flow and economic feasibility of oyster aquaculture, and the marketability of non-native oysters. To date, the vast bulk of oysters processed for sale in Virginia have been from natural harvests, not controlled aquaculture. The Marine Advisory Service at VIMS, through economist Tom Murray, has designed a quantitative assessment of *C. ariakensis* aquaculture, to the extent that the VSC proposal is now titled "Economic analysis of triploid *C. ariakensis* aquaculture."

The continued examination of *C. ariakensis* aquaculture is consistent with VIMS' official position statement on non-native oysters, which counsels a careful, systematic approach. Specifically, VIMS recommends that "scale-up to commercial production needs to be accompanied by implementation of and improvements in biosecurity."

The seafood industry is understandably eager to make an investment in the promise shown by *C. ariakensis* by expanding research trials to the development phase. Progressively larger industry trials are keeping stakeholders on their toes regarding the eventual use of non-natives. With the worst oyster catch on record this year in Maryland, the Bay community at large will be carefully watching the results of the VSC project, if approved. VIMS will be there to support the science of revitalizing the oyster industry and the goal of environmental stewardship.

For more information on VIMS' research and advisory role concerning non-native oysters, visit the Aquaculture Genetics and Breeding Technology Center web site at www.vims.edu/abc/

National Academy of Sciences Conducts Study of *C. ariakensis*

Recent large-scale efforts by the Virginia Seafood Council to assess the potential of the non-native oyster *Crassostrea ariakensis* for use in commercial aquaculture (see article on facing page) have led a variety of organizations, including the US Environmental Protection Agency, National Oceanic and Atmospheric Administration, US Fish and Wildlife Service,

Maryland Department of Natural Resources, Virginia Sea Grant, Maryland Sea Grant, and Connecticut Sea Grant to contribute the \$350,000 needed for a National Academy study on the issue.

The National Academy of Sciences (NAS) is a private, non-profit society of distinguished scholars charged by Congress to provide independent and objective evaluations concerning issues of national importance. NAS considers the potential introduction of *C. ariakensis* into Chesapeake Bay a nationally important issue because it touches on several other nationwide concerns, including invasive species in ballast water, biodiversity, and ecosystem restoration.

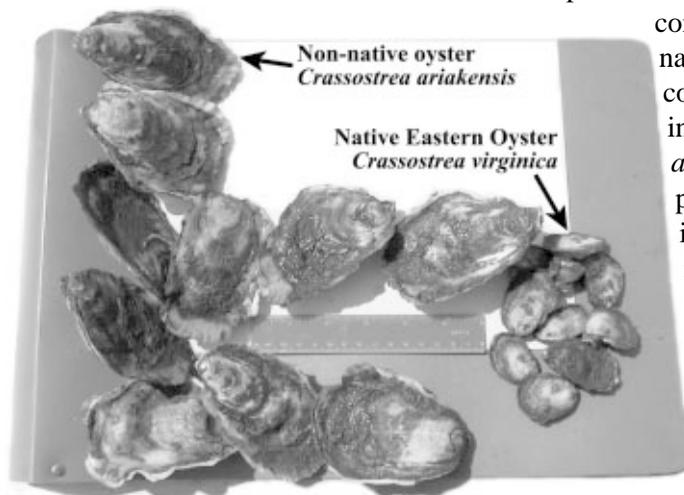
The potential use of *C. ariakensis* of course also raises a

number of critical issues for the Chesapeake Bay itself, such as the effects of re-establishing oysters as a keystone species, providing an alternative resource to reduce pressure on the blue crab fishery, and helping to save the oyster fishery, which is all but over using native species. Furthermore, the use of sterile non-natives in aquaculture provides an intriguing alternative to direct release of a new oyster. At the very least, triploid aquaculture provides an interim solution during which time researchers at VIMS and other institutions can further investigate the biology and ecology of *C. ariakensis*.

Begun in summer 2002, the NAS study "will examine the ecological and socio-economic risks and benefits of open water aquaculture or direct introduction of the non-native oyster, *C. ariakensis*, in the Chesapeake Bay." A committee of oyster experts will address how *C. ariakensis* might affect Bay ecology, including effects on native species, water quality, habitat, and the spread of human and oyster

diseases. It will also consider possible effects on recovery of the native oyster, *C. virginica*. The study will explore the potential range and effects of the introduced oyster both within the Bay and in neighboring coastal areas, and investigate the adequacy of existing regulatory and institutional frameworks to monitor and oversee use of non-natives. The committee will also "assess whether existing research on oysters and other introduced species is sufficient to support risk assessments of three management options: 1) no use of non-native oysters, 2) open-water aquaculture of triploid oysters, and 3) introduction of reproductive diploid oysters. Where current knowledge is inadequate, the committee will recommend additional research priorities."

NAS will issue a preliminary report to sponsoring organizations in late June 2003, with a full, published version scheduled for September 2003. For more information on the NAS review visit www.nas.edu/ and search for the keyword "oyster."



C. ariakensis typically grows faster than the native oyster *C. virginica*.

Early VIMS Work on Hard Clams Pays Off

By Thomas J. Murray

"Hard Clam Culture Method

Developed at VIMS." So declared the headline in a 1970 news release from Gloucester Point, Virginia.¹ The story made a little "splash" at the time, but since then its significance has become much clearer. The aquaculture methods developed by VIMS under the leadership of Mike Castagna in the late 1960s have provided the technology necessary for an aquaculture industry that has evolved into a multi-million-dollar economic engine on Virginia's Eastern Shore. The hard clam (*Mercenaria mercenaria*) is currently considered the most valuable commodity among the Eastern Shore's diverse agricultural portfolio—worth over \$20 million at the "farm gate" last year.

Early VIMS experiments with spreading shell, gravel, or other materials on submerged bottom led to the first successful technology for protecting hard clam seed from natural enemies. Predators (primarily blue crabs, but also cownose rays and others) destroy nearly all unprotected clams smaller than one inch, the most common market size for hard clams. Spreading aggregates over sand or mud bottom before planting seed gave the clams added protection, which

made large-scale planting economically feasible.

In addition to enhancing production from commercial clam beds, associated techniques developed by VIMS during the late 1960s provided the methods that emerging clam hatcheries needed to produce a virtually limitless supply of seeds from selected, fast-growing parent stock. Further milestones in applied research by VIMS faculty also provided the means to hold millions of young clams in trays to avoid predation before setting them out on newly developed aggregates.

The growth of the aquaculture clam industry in Virginia has added immense value to the state's seafood marketplace. Today, watermen continue to harvest hard clams from the state's public resources, while watermen-farmers provide vast quantities of additional quality seafood to consumers.

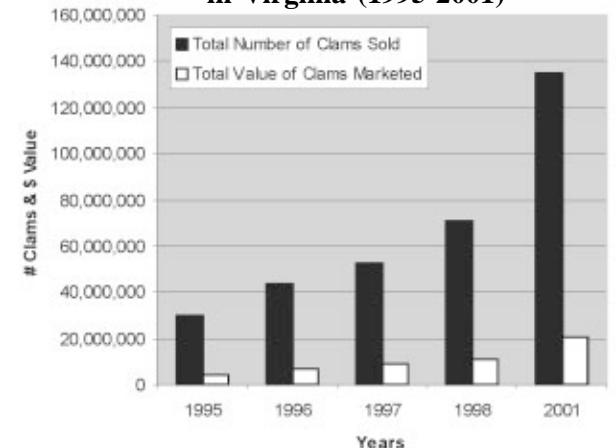
Looking back to the seafood supply situation at the time of VIMS' groundbreaking developments, Virginia's wild hard clam harvests fluctuated annually between an estimated 1 million and 3 million clams. In 2001, the most recent year for which VMRC has reported on wild clam harvests, watermen harvested fewer than 5 million clams

(457,524 lbs.) from the traditional (wild) public fishery.

Contrast the wild harvest with the continued expansion of the clam-farm sector shown to the right. Currently, Virginia producers estimate that 565 million hard clams are covered by the experimental crop insurance program on the Eastern Shore of Virginia, compared to 415.4 million in 2001². For the current (2002) crop year, Virginia clam farmers have purchased 74 policies on 191 leases with a total insurance liability of \$29.5 million, compared to 55 policies on 54 leases with a total liability of \$13.9 million for the 2000 crop year.³ Knowledgeable sources estimate that, with a 60% overall survival rate representing 2.5 year classes, more than 135 million clams are now produced annually by the Eastern Shore of Virginia industry for a national seafood marketplace.

Industry representatives and scientists further estimate that in order to continue crop planting at the current level, 350 million seed clams will be needed annually by Virginia clam

Growth in Hard Clam Aquaculture in Virginia (1995-2001)



farms. Thanks to hatchery and grow-out techniques first developed by VIMS in the late 1960s, the Virginia aquaculture industry clearly has such a capacity. The prospect for this commodity maintaining its pre-eminent position among agricultural crops in Tidewater Virginia is quite good.



¹Marine Resources Advisory Series. No. 4, 1970. Michael A. Castagna, Scientist-In-Charge, VIMS Eastern Shore Laboratory. Virginia Institute of Marine Science, Gloucester Point Virginia

²Virginia Shellfish Growers Association Newsletter. February 2002. Not all growers are insured but it is felt that the great majority of planters are covered at some level by the pilot crop insurance program.

³Federal Crop Insurance Corporation Report. 3/4/02

VIMS Leads Long-Term Ecological Research Program in Antarctica

Scientists define an ecosystem as a collection of species—animals, plants, and microbes—that have adapted over millions of years to function together. What happens when these finely balanced systems face natural or human-induced change? How does migration of new species in and out of the system affect the food web? Do some species die out as others replace them?

These are the kinds of questions biological oceanographer Dr. Hugh Ducklow and others are asking as they continue their ecosystem studies in Antarctica. Ducklow, Glucksman Professor in VIMS' Department of Biological Sciences, will for the next six years be lead investigator for the Long-Term Ecological Research (LTER) site at Palmer Station, one of three permanent U.S. research outposts in Antarctica. The Palmer LTER site is one of 24 sites funded for long-term studies through the National Science Foundation (NSF). Ducklow will coordinate research with scientists from the Scripps Institute of Oceanography, U.C. Santa Barbara, Columbia University, and the Montana-based Polar Oceans Research Group.

"This is an outstanding opportunity for our students to work with scientists and students from leading marine research centers all over the country," says Ducklow. The collaborating scientists will share the six-year grant totaling \$4.2 million.

NSF established the LTER program in 1980, as a unique program for studying the fundamental nature of ecosystems and their response to disturbances. "This is a very innovative approach to research," says Ducklow. "Most grants provide funding for two to three years, then you start over with another proposal. By having support and sites available for long-term study, scientists can better explore the interaction between humans and ecosystems." LTER sites also provide an accumulation of data and knowledge to help build new research and to support infrastructure. Only 24 institutes in the U.S. host LTER programs, at sites that include desert, forest, coastal, grassland, prairie, everglade, and both Arctic and Antarctic ecosystems.

Dr. Polly Penhale, with NSF's Office of Polar Programs, notes that "the polar regions play a critical role in

global processes on Earth. In order to understand global and regional changes in the biosphere, it is critical to collect long-term data that can be used to gain an understanding at both temporal and spatial scales."

Comparative studies with other LTER sites in the U.S. will lead to a greater understanding of the structure and function of ecosystems. "The Antarctic ecosystem is simpler than the Chesapeake Bay system," Ducklow explains. "In an area of lower temperatures there are fewer species and it is possible for us to observe changes earlier." Global warming is occurring more rapidly in the Antarctic than anywhere else on the planet. Winter temperatures have warmed by 5 degrees C in the past 50 years. In this environment, scientists have an opportunity to see changes occurring. "By studying this system, we not only gain a better understanding of changes in the Antarctic ecosystem, but also knowledge that will help to anticipate changes that may take many decades to centuries to occur in a system like Chesapeake Bay."

Scientists don't know how changing ecosystems will work. A new



Dr. Hugh Ducklow leads a program that studies how Antarctic ecosystems are responding to global change.

collection of species in a system may not be as well adapted to living together and the system may be in transition for many years. For instance, the Adelie penguin is at the top of the food web in Antarctica. During the past 25 years their populations have decreased by 50-75%. Ducklow and colleagues are examining the abundance of phytoplankton and krill to determine if inadequate nutrition is contributing to the penguins' population decline. The scientists also note that other species of penguins are moving in and adapting to the warmer climate fairly well. Says Penhale, "Whether

these changes signal global change with implications for the Earth as a whole or simply indicate a regional cycle in temperature is unclear. Long-term data collection and analysis is the key to answering such questions."

LTER places a high priority on education at all levels, notes Ducklow. "With this new award we'll be able to train a new generation of graduate students, extend to undergraduates at William & Mary and elsewhere a unique opportunity to visit Antarctica, and bring the polar ecosystem into Virginia classrooms from kindergarten up."

Data and Models Help State Manage Shellfish-growing Waters

By Carl Hershner

Closure of shellfish-growing waters because of elevated bacterial levels is a common, long-standing problem in Virginia. The Commonwealth is now engaged in efforts to improve these conditions by reducing controllable sources of bacteria entering tidal waters. This activity is part of the water-quality management program operated by Virginia's Department of Environmental Quality (DEQ).

Remediation of contaminated water involves development of total maximum daily load models, or TMDLs. These models do just what the name implies—calculate the total maximum daily load of bacteria that can be allowed to enter a water body without violating water-quality standards. Once regulators know these limits, they must figure out where excessive bacterial loads originate.

VIMS currently plays an important role in DEQ's effort to develop TMDLs for condemned shellfish-

growing waters. Scientists in the Center for Coastal Resources Management (CCRM) and the Physical Sciences Department are working on projects to create databases and models that will facilitate Virginia's efforts to develop shellfish TMDLs. CCRM scientists have created an extensive database of near-shore shellfish waters using geographic information systems (GIS). The database contains digital maps of the small coastal watersheds that feed each of the 276 condemned shellfish areas in Virginia. The CCRM staff has also converted shoreline surveys into a computer-based system that allows regulators quick access to much of the information necessary to develop a TMDL. These surveys are conducted by the Department of Health's Division of Shellfish Sanitation.

Scientists in VIMS' Physical Sciences department have developed models that link watershed, hydrody-

namic, and water-quality parameters to generate TMDLs. These models take information in the computer database and quickly calculate both the required limits on bacterial loads and various ways to achieve those limits. The output is a number of management options that can be considered by DEQ and local residents in efforts to "clean up" affected areas.

Both of these projects are nearing completion. VIMS scientists are now working with DEQ staff to plan for the actual development of TMDLs for all the condemned shellfish-growing waters in the Commonwealth. The Institute will assist DEQ by using its expertise to develop and analyze models for each of the affected shellfish-growing areas. The effort, which will require several years to complete, is an outstanding example of the Institute using its expertise to solve very practical problems for the Commonwealth.

Chesapeake Bay National Estuarine Research Reserve Announces Educational Programs for Summer 2003

High School Student Multi-day Programs

June 16 – 20: Aquatic Habitat Restoration: Submerged Aquatic Vegetation, Salt Marsh, and Oyster Reefs. This 5-day program is sponsored and run in cooperation with the Gloucester Courthouse Rotary Club. Students are housed in dormitories at Christ Church Academy on the banks of the Rappahannock River and will spend five days investigating aquatic SAV, salt marsh, and oyster reef habitats by boat, canoe, and wading. Students will also learn about the latest restoration techniques used to increase the amount of these important estuarine habitats. The program, including all meals, transportation and housing, is free to qualified students.

July 19-25 and August 9-15: Blue Crabs and the Blue Crab Fishery in Virginia. The first 5 days of these 7-day programs will be based at VIMS' Gloucester Point campus, with students meeting from 9-5pm. The last 2 nights will be residential with students living in the dormitory at the VIMS Eastern Shore lab in Wachapreague, Virginia. Students will gain first-hand understanding of blue crab biology and the complexities and far-reaching social and ecological impacts of blue crab management in

Virginia through field studies and interactions with VIMS scientists and graduate students, Virginia Marine Resources Commission (VMRC) managers, crab-house owners, and local watermen. Canoes, small boats, and intertidal wading will be used for field studies and field exploration. Students must be able to get to and from the VIMS Gloucester Point campus during the first five days of the program. These programs, including all meals, transportation, and dormitory fees while at the Wachapreague lab are free to participants thanks to a grant from the National Oceanic and Atmospheric Administration.

All high school students are encouraged to apply for these programs.

Teacher Training Programs

June 24 – 27 and July 8-10: Restoration on the York River: Oysters, Riparian Buffers, and Submerged Aquatic Vegetation. VIMS' restoration scientists will use field studies and classroom presentations to impart timely information about the biology, ecology, current status, and restoration of oyster, riparian buffers, and submerged aquatic vegetation habitat in the York River and the Chesapeake Bay. The course will run

from 8-4 each day, allowing local teachers to go home during evenings. Accommodations at the VIMS campus may be available for teachers that live prohibitively far away. The courses are free to participants thanks to a grant from the Chesapeake Bay Restoration Fund (Chesapeake Bay license plates). Graduate credit through the College of William and Mary School of Education may be available, although details are not yet final.

August 21: Estuarine Aquarium Keeping. This one-day program at VIMS' Gloucester Point campus will introduce teachers to keeping Chesapeake Bay fish and crabs in the classroom. Instructors will cover the basics of bay water aquarium-keeping including planning and purchasing, aquarium set-up, operation, feeding,

and maintenance. Participants will capture fish, crabs, and shrimp from the York River to set up a demonstration tank. Please note that this class is not intended to cover keeping tropical fish or corals. We will instead cover how to maintain hardy Chesapeake Bay organisms using simple aquarium filters and air stones.

All teachers are encouraged to apply for the professional development courses. All courses are free although participants will have to pay for the graduate credits if they choose to take the courses for credit.

Students and teachers should contact Bob Carroll at the Chesapeake Bay National Estuarine Research Reserve at bcarroll@vims.edu or 804-684-7526 for more information or application materials.



Ducklow Elected AAAS Fellow

Dr. Hugh Ducklow, Glucksman Professor of Marine Science in VIMS' Department of Biological Sciences, was recently elected a Fellow in the American Association for the Advancement of Science (AAAS). This award of distinction is bestowed to scientists for their efforts toward advancing science or fostering applications that are deemed scientifically or socially distinguished. Ducklow was recognized for his fundamental studies of ocean bacteria and for dedicated

leadership of major oceanographic programs.

In addition to his research, Ducklow has served as Chair of the Steering Committee of the U.S. Joint Global Ocean Flux Study and is currently Chairman of the International Steering Committee for the Joint Global Ocean Flux Studies program.

Founded in 1848, AAAS has more than 134,000 members from 130 countries. The tradition of AAAS Fellows began in 1874.

Workshop Series Targets Charter Boat Operators

VIMS' Marine Advisory program is working with other mid-Atlantic Sea Grant programs to host a series of workshops for the charter boat industry, aimed at helping operators succeed in a changing business environment. The workshops will be held from the Virginia-North Carolina border to Long Island, New York during February and March when operators are most available to participate.

Panel discussions will focus on four theme areas that are important to charter boat captains, as gleaned from an industry-wide market survey. A fisheries management panel will discuss stock assessments and management plans as they relate to federal and state regulations and permits. The U.S. Coast Guard and representatives of the insurance and legal fields will cover business considerations related

to safety, personal and business insurance, and admiralty law. Another panel will discuss marketing strategies to help small business operators expand their customer base. The workshops will end with a "roundtable" of industry representatives.

Local workshops are scheduled as follows:

- February 11-12: Chesapeake, Virginia / Contact Dianne Roberts, 804-684-7173
- March 11: Solomons, Maryland / Contact Dianne Roberts, 804-684-7173
- March 13: Ocean City, Maryland / Contact John Ewart, 302-645-4060

A \$25 registration fee covers lunch, 2 breaks, and educational materials. Pre-registration is strongly encouraged; walk-ins will be taken at \$35 as space allows.



VIMS Takes to the Air(port)

A new display in the main lobby of the Newport News/Williamsburg International Airport educates airport visitors about VIMS' mission of research, education, and advisory service. Built with private funds, the kiosk was designed by Public Relations Coordinator Susan Polk and Graphic

Design Supervisor Susan Stein. It includes numerous artifacts of public interest, including shark jaws, the shell of a juvenile loggerhead turtle and a blue crab, sediment cores, a zooplankton sample, and a super-sized DNA model that was assembled (down to the last CH₃ (methyl) group of thymine) by VIMS' own Ryan Carnegie, Lidia Sandoval, Mark Camara, and Drew Luellen on a volunteer basis. The display will run through the coming year. Almost 1 million visitors pass through the airport each year.



A wave motif adorns the new VIMS airport display.

Scientists Conduct Census of Marine Life

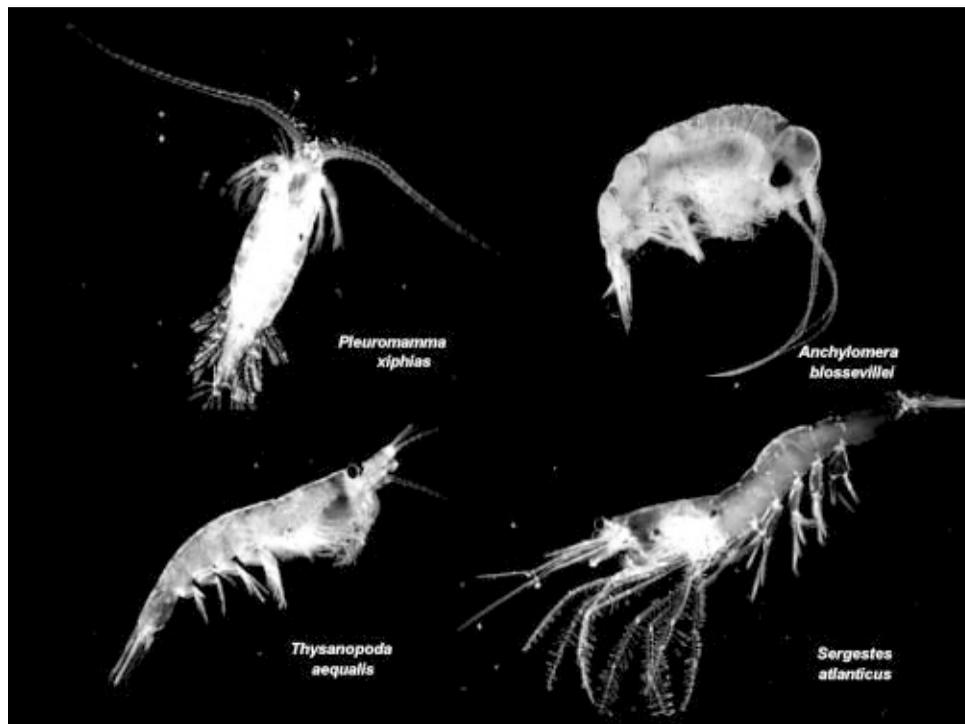
The Census of Marine Life is a 10-year international research program to assess and explain the diversity, distribution, and abundance of the world's marine organisms. The information and technologies developed through the Census will be made publicly available to strengthen management of marine ecosystems and improve public understanding of the ocean environment. The following article is the first in a two-part series designed to highlight the work of VIMS researchers involved in Census of Marine Life projects. The next issue will describe Dr. Mike Vecchione's work with deep-sea squid on the Bear Seamount.

The researchers in Dr. Deborah Steinberg's lab can empathize with the challenges faced by census takers. But rather than unfriendly dogs or unwilling citizens, their trials involve the task of collecting, identifying, and cataloging the myriad species of zooplankton in the mid-Atlantic's Sargasso Sea.

Steinberg, along with VIMS technicians Joe Cope and Stephanie Wilson, is working with collaborators at Woods Hole, the Russian Academy of Sciences, and the Smithsonian on a 2-year, \$380,000 grant to provide the first-ever complete census of plankton diversity in the western North Atlantic. Their efforts are part of a U.S. initiative to create an on-line database of marine animal and plant distributions called the Ocean Biogeographic Information System. OBIS is in turn part of the larger international Census of Marine Life program.

The need for a census of marine life is clear. Steinberg notes that oceans cover 70% of Earth's surface, provide 90% of its living space, and harbor a diversity of life that may rival that of rain forests. "But because the world's oceans are so vast and inaccessible, our description of marine biodiversity is far more limited than our description of terrestrial diversity," says Steinberg. "As the health of the world's oceans decline and species are lost, people are becoming increasingly aware of how important it is to study and maintain biodiversity."

A census of zooplankton diversity and abundance is particularly important, says Steinberg. She notes that "a zooplankton census will ultimately help us better understand the role that plankton play in biogeochemical cycling and the marine food web. Zooplankton provide a direct link between primary producers and higher trophic levels such as fish, seabirds, and marine mammals."



These photos illustrate the diversity of zooplankton near Bermuda. Clockwise from upper left are a copepod, amphipod, shrimp, and krill.

To reveal trends, a census needs to continue through time. "By describing and understanding how patterns of zooplankton distribution and abundance change from day-to-day, season-to-season, or year-to-year," says Steinberg, "we can dissect the difference between natural variability and real 'change' in plankton diversity, and better understand and model the effects of long-term climate change on ecosystems."

But conducting a long-term zooplankton census is easier said than done. The fragility of these creatures makes them difficult to collect, while their small size hinders identification. The researchers must also work around storms, ship time, and funding.

The plankton samples were collected during monthly cruises to the Bermuda Atlantic Time-series Study (BATS) site between 1994-2001. BATS is a 15-year, on-going series of monthly oceanographic measurements collected by scientists associated with the Bermuda Biological Station for Research. It builds on the 49-year-long "Hydrostation S" program to provide one of the most intensively studied patches of ocean in the world.

Sampling in the surface waters of the Sargasso Sea requires use of a large, 3-foot-diameter plankton net to gather the relatively low numbers of plankton these nutrient-poor waters support. Once netted, the plankton are funneled into clear plastic bottles and then split into samples small enough for counting. A peek in Steinberg's lab

reveals the fruits of this labor—more than 1,000 small jars filled with a thin plankton soup.

But the hardest part is yet to come—trying to identify the huge diversity of plankton these samples contain. "In the nutrient-rich waters of Chesapeake Bay, plankton are abundant but the diversity is low," says Steinberg. "It's the opposite in the Sargasso, where plankton are less abundant but much more diverse."

Joe Cope, a research technician in Steinberg's lab, is responsible for identifying the ostracods, clam-like crustaceans about the size of a sand grain. He compares this work to sorting a shuffled deck of microscopic cards into suits, with the suits defined by the ostracods' shape, size, and the number of bristles on their limbs. "The microscope work can be tedious and frustrating," he admits, "but we've

identified at least 30 species, one that's new to the Sargasso." Technician Stephanie Wilson works with krill, an important food source for whales, and has so far identified 25 species of these shrimp-like creatures.

The copepods, flea-like crustaceans the size of a rice grain, are even more diverse. Dr. Elena Markhaseva, a copepod expert from the Russian Academy of Sciences' Zoological Institute in St. Petersburg (see article on facing page), has identified more than 100 different species of calanoid copepods, including seven that are new to the Sargasso Sea and three never-before recorded from the Atlantic.

Dr. Frank Ferrari, of the Smithsonian's National Museum of Natural History, another partner in this project, will add any rare, previously undescribed, or missing species to the Smithsonian's collections.

To Steinberg and her team, the great diversity of these samples is not surprising. "What is surprising," says Steinberg, "is how different species occur at different times of the year." Thus one species of copepod might appear only in summer samples, while a closely related species, which might differ only in the number of bristles on its legs, occurs in winter.

Steinberg thinks that these seasonal swings might be an example of "niche partitioning," wherein organisms evolve different life-style strategies to avoid competing for food or other resources.

Funding for OBIS is provided through the U.S. National Oceanographic Partnership Program (NOPP) by the Alfred P. Sloan Foundation and the National Science Foundation (NSF). For further information on the VIMS plankton census, visit www.vims.edu/bio/zooplankton/BATS/

VIMS By the Numbers.....

- **128,000** Specimens in VIMS' Ichthyological Collection, one of the largest and most diverse collections of marine and estuarine fishes from Nova Scotia to North Carolina. See www.vims.edu/ich_coll.html
- **4,775** Maps and charts available in the VIMS library.
- **2,269,689** Hits on the VIMS web site during October 2002, the busiest month of that year. Hits represent the total number of requests made to a web server.
- **47** Percentage of the \$1.5 million in private contributions received by VIMS in 2002 that came from individual donors. Of the remaining contributions, 40% came from private foundations and 13% from corporations.
- **45,174** Number of active grid cells in the VIMS HEM-3D computer model, which is used to perform high-resolution simulations of tidal flow in the Elizabeth River.
- **15** Women in the School of Marine Science 2002 graduating class, 52% of the students who earned Masters and Ph.D. degrees in that year.

What's In a Name?

Visiting Russian Scientist Devotes Career to Copepod Taxonomy

Russian scientist Dr. Elena Markasheva lived and worked at VIMS last fall as part of Dr. Deborah Steinberg's Census of Marine Life Project (see article on facing page). The following profile describes the path that led to her esoteric career as a copepod taxonomist.

Dr. Elena Markasheva knows the importance of a name.

As a world expert in the taxonomy of copepods, Markasheva has devoted her entire career to identifying and naming these tiny marine creatures. As a Russian who in 1991 saw her native Leningrad renamed St. Petersburg, she knows that the act of naming can signify a fundamental shift in reality or its perception.

Taxonomy—the science of describing, naming, and classifying Earth's myriad organisms—is a dying art. Few young scientists enter a field whose detractors liken to bean counting or stamp collecting. Why spend innumerable painstaking hours counting copepod spines when you could be swimming with dolphins? Why struggle through the convoluted bifurcations of a taxonomic key when your real interest is an organism's role in an ecosystem?

Why indeed. "Taxonomy," argues Markasheva "is the very foundation of biology." If species are actors on the world's stage, taxonomy provides a playbill to identify them, describe their roles, and tell when they enter and exit a scene. Biology without taxonomy is like Shakespeare without Cliff's Notes.

Markasheva notes that taxonomy is particularly relevant in today's climate of biological crisis. Earth currently faces a mass extinction event like that which finished off the dinosaurs. As habitat loss, pollution, and human exploitation push more and more species toward extinction, humanity risks losing a resource that provides both tangible benefits like food and medicine, and intangible values of beauty, joy, awe, and diversity.

In fact, some now define taxonomy as the science of documenting biodiversity. Like curators rushing priceless artifacts from a burning museum, taxonomists are scouring the globe to collect, describe, and name as yet uncatalogued species before they go extinct or their natural distribution is disrupted. Markasheva hopes that the growing recognition of taxonomy's

central role in biodiversity will help fuel a resurgence in her field.

Markasheva first became interested in marine biology as a young girl after seeing a TV show featuring Jacques Costeau. "I knew then that I wanted to be included in some kind of marine research," she says. A mentor advised her to become a biologist if she really wanted to be connected to the sea. "At that time in Russia to be a woman oceanographer was not so easy. Going on a research cruise was considered masculine work."

At age 14, Markasheva enrolled in a marine science course at her high school. Summertime trips with her teacher to a research station on the White Sea confirmed her career choice. "When I graduated from this school I was absolutely sure that I would study marine invertebrates," she says.

Upon graduation, Markasheva began working at the Russian Academy of Sciences' Zoological Institute, while simultaneously taking evening classes to earn a Master's degree from Leningrad (now St. Petersburg State) University.

She ascribes her interest in copepod taxonomy to chance. "I was working in the Institute when a position opened with a very well known researcher." This was Dr. Konstantin Brodsky, a "copepodologist" so well regarded by his colleagues that several have paid him the ultimate taxonomic compliment—five copepod species now bear his name. Dr. Brodsky died in 1991. "I was his last student and we had a very good connection," says Markasheva. "I decided if I am working in this department and have such a good professor, I will continue with copepods." She earned her Ph.D. degree from the Institute in 1991.

Markasheva now says that her "whole life is devoted" to copepods. To date, she has named 15 new copepod species, and re-named numerous others. Her esoteric expertise brings her offers to travel to laboratories around the world, helping researchers identify the copepods in their samples. "Since the Iron Curtain fell, I am traveling nearly every year," says Markasheva. "I have been in Norway, Amsterdam, U.S., and many other places."

Her role in the Census of Marine Life project is to identify a single group of copepods called calanoids. "There

are many other kinds of copepods in the samples," she says, "but I've concentrated on the calanoids because it was too much for me to look at all the groups." Copepods, the most abundant multi-cellular animals on Earth, are extremely diverse, with about 11,000 different species.

Identifying a copepod is no easy task. "You can compare a copepod to a grain of rice with a small tail" says Markasheva. "To identify these animals to species level it is necessary to dissect and look at them under the microscope, because distinguishing characters may be number of spines or spinoliths, spines on spines. They are

different shape, different length, and all this plays a role in taxonomy."

"It's not like to catch a lobster and say 'Oh, that's a lobster.' You need to work a little bit more. It is very, very laborious work."

During her two visits to VIMS, in the fall of 2001 and 2002, Markasheva identified more than 100 copepod species. She transfers her list of species to VIMS technician Joe Cope, who enters them into a computer database. "Then it is possible to take a really interesting look at what is going on," she says. "After this it is possible to look at their abundance and diversity and how it might change with time."



Researchers active in the Census of Marine Life program include (L to R) Joe Cope, Dr. Deborah Steinberg, Stephanie Wilson, and Dr. Elena Markasheva.

VIMS Researchers See the Bay in a Grain of Sand *continued from page 3*

who could not move from an unhealthy neighborhood even if they wanted to.

The B-IBI has proven highly effective for detecting changes in the biodiversity and abundance of benthic communities, but the relation of B-IBI to other potential measures of ecosystem health remains unknown. "The question," says Anderson, "is what B-IBI really means. One way to judge its meaning is to compare it with other measures of ecosystem function such as nutrient cycling, algal blooms, and the rate of microbial processes."

"Management of the Bay's ecosystem will be easier if we are able to show that the B-IBI predicts changes in ecosystem function as well as the health of benthic communities, which are important living resources" say Schaffner.

The pair hopes that extending the B-IBI to include investigations of smaller organisms and measures of physical and biogeochemical processes will help provide a yardstick for measuring more subtle changes in ecosystem health and function.

The B-IBI test has been the backbone of the Chesapeake Bay Benthic Monitoring Program since 1994. The program was set up to help scientists and managers track and meet the Chesapeake Bay Program Benthic Community Restoration Goals. These are part of the larger Chesapeake 2000 Agreement, which calls for reducing nutrient and sediment pollution enough by 2010 to remove the Bay and its tidal rivers from the EPA's list of "impaired" waters.

For further information about the Chesapeake Bay Benthic Monitoring Program, visit www.baybenthos.org or www.versar.com

VIMS Scientists to Host International Conferences

Several VIMS scientists will be busy in the coming months planning and hosting professional conferences in their field of expertise. These conferences provide an invaluable venue for scientists from around the world to discuss research results and plan future research directions.

Dr. Jim Kirkley, Department of Coastal & Ocean Policy, and Tom Murray, Marine Business Specialist, will co-chair the **2nd North American Fisheries Economics Forum**. The purpose of the meeting is to strengthen communication among industry, government, and academic fisheries economists. Themes for the meeting include Fisheries Economics and Management, Aquaculture, Domestic and International Trade, Programs and Strategies for Capacity Reduction, Economic Valuation and Fisheries Management, Consumer Demand Analysis in Fisheries, and Computer-Based Economic Models.

The conference will be held from May 4-7, 2003 at the Williamsburg Hospitality House Hotel and Conference Center in Williamsburg. For more information, see the conference web site at <http://oregonstate.edu/Dept/IIFET/NAAFEforum.html>

Dr. Deborah Steinberg, Dept. of Biological Sciences, is chairing the Scientific Program Committee for the **Third International Joint Global Ocean Flux Study (JGOFS) Open Science Conference**. Dr. Hugh Ducklow, chair of the International JGOFS Scientific Steering Program, will also participate. The conference focuses on the legacy of JGOFS, a 15-year international program in which hundreds of scientists from around the world collaborated to increase understanding of the ocean carbon cycle and climate change. Carol Browner, head of the EPA in the Clinton Administration, will present a keynote lecture on global climate policy.

The conference will be held at the National Academy of Sciences in Washington, D.C., from 5-8 May 2003. For more information, see the conference web site at <http://usjgofs.whoiedu/osc2003.html>

Dr. Jeffrey Shields, along with VIMS researchers Paul Gerdes, Karen Hudson, Ruben Rios, Jacques van Montfrans, Emmett Duffy, Martha Nizinski, and Rochelle Seitz, will host the **2003 Annual Meeting of The Crustacean Society**. The conference will include symposia on the biology and ecology of the blue crab, the biology of exploited shrimp, and the biology of crayfish. The Crustacean Society is an international organization with more than 600 members worldwide.

The conference will be held in Williamsburg from June 1-5, 2003. For more information, see the conference web site at www.vims.edu/tcs/tcs2003.htm

Dr. Jerome Maa of VIMS' Physical Sciences Dept. will host **INTERCOH 2003**, the 7th International Conference on Nearshore and Estuarine Cohesive Sediment Transport Processes. INTERCOH provides a venue where scientists and engineers can meet to develop a better understanding of the transport of fine-grained sediments such as mud and clay. The fate of these sediments is an important environmental issue because electrostatic charges on their surfaces tend to attract and carry contaminants. Participants will focus on field and modeling questions related to transport of cohesive sediments and particle-bound contaminants. Typically, about 100 scientists attend.

The conference will be held at VIMS from October 1-4, 2003. For more information, see the conference web site at www.vims.edu/intercoh/

VIMS Researchers in Educational Videos

VIMS researchers Drs. Liz Canuel, Jim Bauer, Bob Diaz, Rob Latour, and John Hoenig appear in a new trio of educational videos produced by Louisiana Public Broadcasting as part of its Enviro-Tacklebox™ series. Canuel and Bauer are featured in *Carbon: Element of Surprise*, a look at the global carbon cycle, while Diaz appears in *Hypoxia: The O₂ Blues*, which investigates the cause and effects of low-oxygen conditions in estuaries. Latour and Hoenig were interviewed for an upcoming episode on population dynamics.

The Tacklebox series has twice been awarded top national honors for instructional television shows by the National Educational Telecommunications Association. Louisiana Public Broadcasting produces the series in partnership with the Satellite Educational Resources Consortium, with funding from the U.S. Dept. of Education's Star Schools program. The videos are distributed nationally, with an intended audience of middle school environmental science students.

For more information and to see a broadcast schedule, visit www.envirotacklebox.org/

WILLIAM & MARY VIRGINIA INSTITUTE of MARINE SCIENCE

Web Update **VIMS**

Welcome Research Education Advisory Services Administration Resources News & Media

VIMS Web Update
The VIMS web site served 7,820,365 pages in 2002— clear evidence that www.vims.edu is becoming a primary portal to the Institute. This new feature highlights recent additions or upgrades to the VIMS web pages.

The Crest
The Crest is now available on the VIMS web site in digital form. Readers can download any past issue, or choose individual articles from an archive that stretches back to Summer 2000. Visit www.vims.edu/newsmedia/crest.html

Eastern Shore Lab
VIMS' Eastern Shore Laboratory in Wachapreague now has its own web site, which highlights the educational and research opportunities the facility affords. Visit www.vims.edu/esl/

Mycobacteriosis
Recent media reports describing an outbreak of bacterial disease in striped bass from Chesapeake Bay have raised concern about whether the disease organism poses any threat to human health. The VIMS Mycobacteriosis site describe what is currently known about the fish disease and its potential human health impacts, and what remains to be discovered. Visit www.vims.edu/myco/

Sentinel Oyster Project
Oyster gardeners around the Bay can go on-line to enter data concerning the health of their test oysters. They can also enter environmental information such as temperature and salinity to help scientists determine the reasons for the success or failure of particular oyster types. Visit www.vims.edu/abc/green/sop.html

SMS Applications
Recent applicants to the School of Marine Science took advantage of a new opportunity to complete and submit their application materials on-line. Of the 149 applicants for Fall 2003, 87 used the on-line forms.

Sponsored Programs
Principal investigators can now submit their proposals to VIMS' grant's office on-line for more efficient handling and approval.

VIMS Faculty
Web pages for each faculty member at VIMS are currently being updated. Read about their recent accomplishments at www.vims.edu/sms/faculty.html

Hoening Writes “Hot Paper”

A recent paper by Dr. John Hoening of the Fisheries Science Department has been selected by the Institute for Scientific Information® (ISI) as a “hot paper” in the field of mathematics. ISI ranks papers based on the number of times they have been cited in other research articles. ISI consistently tracks ten million articles in more than 8,500 journal titles from around the world. Hoening’s article ranked in the top one tenth of one percent.

The paper, “The abuse of power: The pervasive fallacy of power calculations for data analysis,” appeared in the September 2002 issue of *The American Statistician*. Hoening coauthored the paper with Dr. Dennis Heisey of the University of Wisconsin’s Dept. of Surgery Biostatistics & Medical Information.

The paper showed how “power analysis”—a statistical practice that researchers in applied fields commonly use to analyze their data—was in many

cases being used inappropriately, and pointed to a more appropriate methodology.

Why has the paper been cited so often by other researchers? “It’s unsettling when a seemingly logical, widely touted method is suddenly declared inappropriate,” says Hoening in a commentary prepared for ISI. “Using power analysis to interpret statistical test results was advocated in more than 20 applied science journals and in some statistics texts but we showed this is inappropriate.”

The impetus for the paper came, says Hoening, when several journal editors insisted that he perform inappropriate power analyses in submitted papers. “This was an abuse of power we decided to fight.”

To read a commentary by Hoening on his paper, visit <http://esi-topics.com/nhp/comments/september-02-JohnHoening.html>

Schaffner Wins Statewide Faculty Award

VIMS associate professor Dr. Linda Schaffner has been selected as 1 of 10 recipients of the 2003 Outstanding Faculty Awards, the Commonwealth’s highest honor for faculty at Virginia’s colleges and universities.

“I am pleased to recognize these distinguished faculty members and higher education leaders,” Governor Warner said at a State Capitol ceremony in January. “Their accomplishments in advancing educational excellence contribute greatly to Virginia’s educational, economic, civic, and cultural vitality. Each of this year’s

award recipients brings pride to the profession and honor to the Commonwealth.” Recipients received a \$2,200 award and a commemorative plaque from the State Council of Higher Education for Virginia (SCHEV), which administers the awards program.

Schaffner joined the VIMS faculty in the Department of Biological Sciences in 1988. According to Dean of Graduate Studies Dr. Iris Anderson, Schaffner’s commitment to VIMS’ graduate education program is unmatched. “Dr. Schaffner has exhibited a deep and lasting commitment to the School of Marine Science,” says Anderson. “She has also exhibited an enthusiastic involvement with college undergraduates and others participating in the Summer Intern Program, as well as an unending effort to enhance the participation of under-represented groups in science.” Schaffner has headed the Summer Intern Program at VIMS for the past 14 years.

Award recipients were selected from a list of peer-nominated candidates by a committee consisting of past Outstanding Faculty Awards Recipients, faculty, college administrators, and business and community leaders. There are nearly 10,000 full-time faculty members in Virginia eligible to be nominated.



Dr. Linda Schaffner lectures to a class of VIMS graduate students.

VIMS and Partners Win Grants To Promote Ocean Education

VIMS has been awarded two different federal grants as part of the national Centers for Ocean Science Education Excellence program, or COSEE. The goal of COSEE is to educate a broad spectrum of the U.S. population about ocean science.

COSEE was formed under a five-year, \$5 million grant from the National Science Foundation. NSF awarded its first eight COSEE grants in 2002. These established seven regional COSEE centers, together with a central coordinating office to be run by the Consortium for Oceanographic Research and Education (CORE).

The Virginia Sea Grant Marine Advisory Program at VIMS won a contract from CORE to create and maintain a web site called *COSEWeb* that will begin as a focal point of communication for COSEE and its growing network of partners and later expand to external audiences. The web site will integrate administrative elements, the web-based resources of each center, and the Bridge, an existing on-line resource center for ocean-science teachers that resides at VIMS. *COSEWeb* will support COSEE efforts to reach groups traditionally under-represented in the ocean sciences and ocean-science education.

VIMS Research Helps Protect Navy Ships from Mines
continued from page 1

five days previously,” says Wilkens.

Sandy coastal areas dominated by waves, like many parts of the U.S. East Coast, are an area of particular strategic concern for the Navy. This is an environment that Friedrichs understands well. His research expertise lies in the physics and modeling of sediment erosion, transport, and deposition under exactly these types of highly energetic coastal conditions.

The specific role of Friedrichs’ team in the MBP project is to develop 5-day forecasts of wave-generated bottom currents at MBP field sites off the Florida and Massachusetts coasts. Friedrichs then inputs the wave forecasts into a second model that predicts the rate at which scour processes are likely to mobilize sediments and bury the dummy mines used in their experiments.

Estimates of the probability of mine burial may determine whether a Navy

VIMS will also play a role in the Mid-Atlantic COSEE center, one of the seven regional centers established with NSF funding. Partners in the Mid-Atlantic COSEE include Rutgers University, Stevens Institute of Technology, New York Aquarium, Hampton University, and the University of Maryland. The group won the NSF funding in a year-long competitive process.

The Mid-Atlantic COSEE will develop educational materials, curricula, and programs to promote lifelong learning about the ocean sciences. Like the other centers, it will attempt to reach a broad audience including K-12 teachers, K-16 students, coastal managers, families, and diverse groups that normally receive little exposure to marine science.

“Recent surveys show that many Americans have misleading ideas about the ocean and coasts,” says Dr. Mike Newman, who leads VIMS’ participation in the Mid-Atlantic COSEE. “NSF wants us to promote new ways of thinking and teaching to help everyone understand just how intertwined we truly are with the ocean environment.”



fleet employs mine sweeping or mine hunting in a given area. Sweeping, which often involves use of a towed vehicle, seeks to activate mines across a large area by simulating the disturbances that a ship or other platform would produce if it traversed a route. In mine hunting, a remotely operated vehicle confirms the presence of an individual mine, then physically disarms or destroys it.

“Our field sites provide ideal laboratories for testing forecast models for mine burial by scour,” says Friedrichs. During tests, the researchers deploy dummy mines on the sea floor in 10 to 40 meters of water. These mines have optical sensors that let them “see” whether and how fast they are being buried. At the same time, the scientists search for the mines with sonar. Comparing the optical and sonar results with concurrent model forecasts provides a good test of the model’s predictive abilities.

For more information on the Mine Burial Program, visit www.vims.edu/physical/projects/CHSD/projects/MBP/

Calendar of Events

—February 2003—

- 17 Reedville Mini School of Marine Science
21-22 Blue Crab Bowl

—March 2003—

- 1-9 Spring Break
3 Reedville Mini School of Marine Science

—April 2003—

- 5 GSA Spring Party
21 Reedville Mini School of Marine Science
23 VIMS Council Meeting

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

For more information call 804/684-7101 or 804/684-7846.

Visit our website at www.vims.edu

VIMS Council Elects New Officers and Members

The Council, VIMS' advisory board, is pleased to announce the election of the following officers and new members for FY2003: Carroll W. Owens, Jr., Chairman; James E. Rogers, Vice Chairman; and The Honorable Jack O. Marsh, Jr., Secretary. Carroll Owens lives in Gloucester and Alexandria, Virginia and is Vice President of Davenport and Company of Virginia. A graduate of the College of William and Mary, Carroll has been active with VIMS for many years and has served on the Council since 1996. "The VIMS community is fortunate to benefit from Carroll's leadership during this time of transition and budget cutbacks at VIMS," said Dean and Director L. Donelson Wright.

New Council members include Dr. Elizabeth L. Anderson, President and Chief Executive Officer of Sciences International, Inc. of Alexandria, Virginia; A. Cameron Blandford, retired Vice President of Newport News Shipbuilding from Lancaster County; Robert M. Freeman, retired Chairman and Chief Executive Officer of Signet Banking Corporation from Richmond, Virginia; and Charles J. Natale, Jr., Senior Vice President and Managing Principal of Environmental Science Services, Inc. in Wellesley,



Dean and Director Don Wright, Carrie Owens Garland, Patty Owens, and new VIMS Council Chair Carroll Owens, Jr. during the Campaign launch dinner.

Massachusetts. Members serve a four-year term and work with the Dean and Director, faculty, and staff to advance and promote VIMS.

In addition, two members retired from the Council: Mr. Henry C. Wolf, Executive Vice President of Finance for the Norfolk Southern Corporation; and The Honorable W. Tayloe Murphy, Jr., Secretary of Natural Resources. Appointed in September 2002 to complete their terms were Kathryn McQuade, Senior Vice President of the Norfolk Southern Corporation; and William J. Strickland, managing partner of McGuire Woods in Richmond. The Council and VIMS extend their heartfelt thanks to Hank and Tayloe for their service to the Council and support of the Institute.

\$6,666,618. We apologize for the error and appreciate it being brought to our attention. If you would like to receive a copy of the *Investors Report*, or the 2002 VIMS *Foundation Audit*, please call (804) 684-7099.

Correction

An error appeared in the 2001-2002 *Investors Report* in the VIMS Financial Statement. The WAVE Fellowship value as of June 30, 2002 was \$237,826. This changes VIMS' total endowment market value to

VIMS Launches Campaign

VIMS has launched its first major campaign to raise private funds to support a variety of endowment, capital, and programmatic needs. VIMS' goal of \$23 million, a part of a comprehensive Campaign for William and Mary, will be raised during the next four years. Representing VIMS on the College's National Campaign Committee are A. Marshall Acuff, Jr., William

Hargis, E. Morgan Massey, and Mr. and Mrs. Carroll W. Owens, Jr. Look for an announcement of leadership gifts to VIMS and chart VIMS' progress toward its goal in future issues of the *Crest* and on the VIMS campaign website at www.vims.edu/campaign. For additional information about the campaign or to make a gift please call (804) 684-7099.

Hargis Honored

Former VIMS Director Dr. William Hargis Jr. has been selected as one of Virginia's Outstanding Scientists and Industrialists of 2003. The awards were announced by Governor Mark Warner and Science Museum of Virginia Director Dr. Walter Witschey. Honorees will receive their awards at the Science Museum on April 1.

"These recipients are at the cutting edge of their fields, from cancer cures to the protecting the Chesapeake Bay," says Governor Warner. "Their creativity, contributions, and dedication are aimed at making life—in Virginia and beyond—better for us all."

Hargis served as the Director from

1959 to 1981 and was responsible for transforming the Institute from the Virginia Fisheries Laboratory to the Virginia Institute of Marine Science. He was the first Dean of the School of Marine Science.

"Bill has contributed and continues to contribute significantly to Virginia in the areas of marine science, marine education, and stewardship of natural resources," says VIMS Dean and Director Don Wright. "He has made these contributions as a research scientist, educator, administrator, and national leader. This is an honor not only for Bill but for VIMS and the College of William and Mary."

VIMS Mourns Loss of Community Leader

Clifford Armstrong Cutchins III, died Dec. 24, 2002. A native of Southampton County, Va., he graduated from Virginia Polytechnic Institute and State University. He served as a captain in the U.S. Army during World War II and returned to Franklin, Va., where he began a long and distinguished career in banking. He served as chairman and CEO of Sovran Financial Corporation, now part of Bank of America.

Cliff was a founding member of the VIMS Foundation, an emeritus member of the Council, and a member of the Maury Society. "Cliff was always the first volunteer to step forward and help any way he could. He was a remarkable man and he will be missed by our community," said Dean and Director L. Donelson Wright. Dr. Wright announced that the annual award for volunteer of the year will be named in Cliff's memory.