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The Crest

Current Issues in Coastal Ocean and Estuarine Science

Bond Issue for Higher Education Will Support Research Complex at VIMS

On November 5, 2002, Virginians will have an opportunity to make a decision that will impact the valuable marine resources of the Commonwealth for years to come. Included in the bond for higher education is $24 million for a new Marine Research Complex at VIMS. This facility would greatly enhance VIMS' ability to pursue its state-mandated mission of research, education, and advisory services to the Commonwealth. During this time of unprecedented pressures on coastal environments, that mission has never been more important.

Currently 65-70% of VIMS scientists carry out their research in buildings that are severely inadequateto support the sophisticated equipmentand technology required today. The new four-story laboratory will house research programs that are now scattered throughout campus in outdated 30-year old laboratory space and converted 70-year old singlefamily dwellings.

The complex includes a 70,600 sq. ft. research building and a 43,000 sq. ft. seawater laboratory, both of which will facilitate efforts in numerous research areas of economic and ecologic benefit to the Commonwealth:

Submerged Aquatic Vegetation (SAV): The annual monitoring of SAV provides a key indicator Bay health. The VIMS mapping program is the only one of its kind in the world.

Evolutionary Ecology: A diverse range of research relating to the population responses of marine and estuarine organisms to environmental change.

Benthic Studies: Work in this area includes mapping the benthic (bottom-dwelling) resources of the Bay such as crabs and clams, delineating benthic food webs that support estuarine commercial fisheries, and resolving how natural and human induced disturbances affect coastal ecosystems.

3-D Hydrodynamic Modeling: Modeling provides a powerful tool for investigating issues such as pollutant and sediment transport, hydrodynamic response to port expansion, and water quality.

Shoreline Studies: This program provides information necessary for the development of shoreline management plans for localities, military bases, national parks, and private communities through analyses of shoreline processes and wave activity.

Architectural rendering of the Marine Research Complex as seen from Greate Road.

Molluscan and Crustacean Ecology: These studies focus on the economically important blue crab, and the non-native Rapa Whelk, which threatens oyster, clam, and mussel populations.

Continued on page 2

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Chesapeake Bay National Estuarine Research Reserve in Virginia

a fair Bay Spring
Vol. 12, No. 3

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A Sea Change at VIMS

By Don Wright

Over the past few years, VIMS has advanced in many exciting ways: we have recruited a dozen outstanding new faculty members; research productivity reached an all time high last year; we now have state-of-the-art video conferencing facilities; the bond bill that will be voted on in the referendum this November includes almost $25 million for a new marine research complex; and we now have a VIMS Foundation. Other highlights have been reported in this and other recent issues of *The Crest*. Simultaneous with the successes summarized above, the downturn in state revenue has presented us with some of the most serious budgetary challenges in recent memory. On September 20, VIMS, like other state agencies and state-supported units of higher education in Virginia, submitted plans for severe budget reductions. But excellence continues to prevail and many new challenges and opportunities are on the horizon. We now seek new ways to preserve our excellence and pursue the opportunities. We must leverage new federal dollars, attract economic development and partner with industry to provide seed money for new research, and look to other non-traditional sources of funding.

To make possible the essential sea change, we now need uncommon help from a nationally prominent scientific leader who can bring new vision, increased name recognition, high-level federal connections, and bold and inspired guidance to VIMS. In May of this year, I asked Provost Cell to initiate a national search for such an individual to succeed me as Dean and Director. I will continue in my current role until that search is completed and my successor assumes office, at which time I will return to my former life as a scientist and educator on the VIMS faculty. The search for the new Dean and Director is being led by Steve Kuehl and is now well underway. I have very much enjoyed my tenure as Dean and Director, but the time has come for an orderly "changing of the guard." Under new leadership, VIMS will set new standards of scientific excellence and I plan to remain a part of that exciting process as one member of a great community of scientists.

Bond Issue for Higher Education continued from page 1

Toxicology: Important work on the effects of pollutants on populations, and the mechanisms of infection and host/parasite interactions of commercially, recreationally, and ecologically important Chesapeake Bay species will also be housed in the complex.

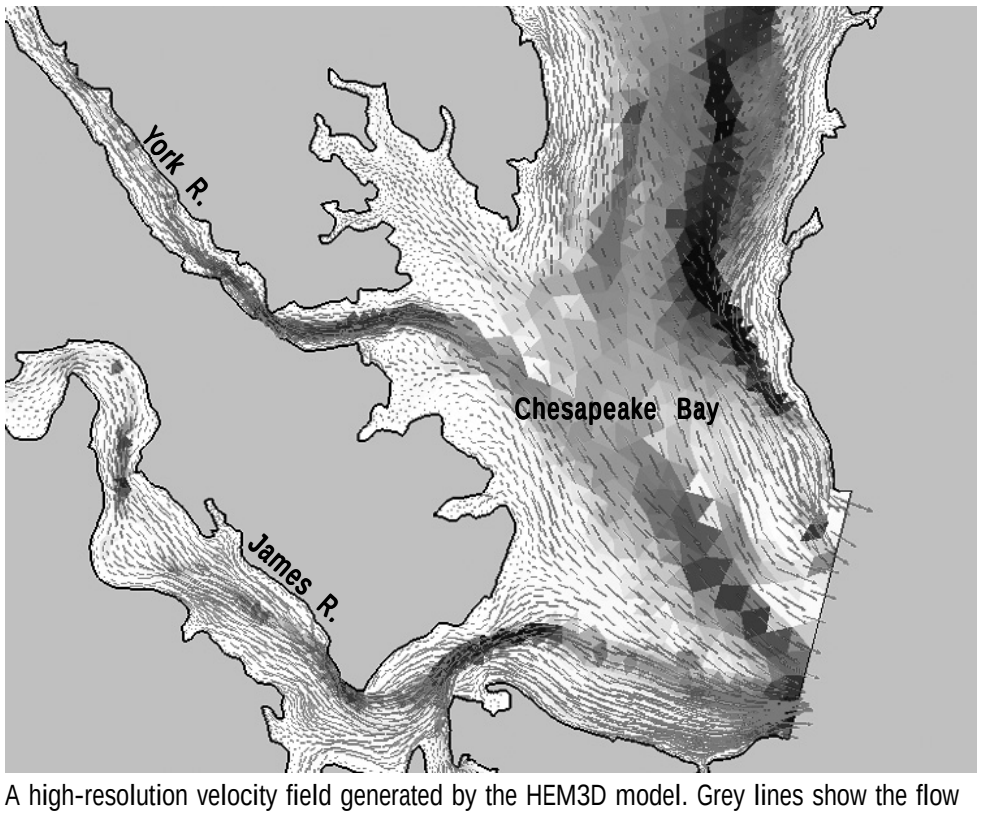
The seawater research laboratory will provide facilities for important work on finfish and shellfish aquaculture and restoration, development of disease diagnostics and vaccines, harmful algal blooms including *Pfiesteria,* and contaminant impacts on living resources.

Included will be a Biological Safety Laboratory used for studies to determine the health risks of various pathogens to fish, shellfish, and humans within the Chesapeake Bay region. A toxics challenge lab will permit analysis of health impacts of pollutants on species found in the Bay and surrounding watershed.

For more than 60 years VIMS has been a leader in efforts to understand complex, dynamic coastal and estuarine environments. The faculty includes the finest marine scientists in the nation. The graduate education program is unsurpassed and attracts the brightest students from leading colleges and universities all over the world. The Institute remains committed to excellence and to the search for solutions that will ensure sustainable marine resources for future Virginians. The entire VIMS community urges you to vote and to support the bond issue for higher education.

VIMS Acquires New Code for Model

VIMS has been one of the leading institutions committed to the development of numerical models for estuarine and coastal sciences. Private funds enable the Institute to acquire an UnTRIM code for expanding the capability of the second-generation HEM3D (Hydrodynamic Eutrophication Model, Three Dimension) model. The model represents the best technical tool to address issues by providing "what-if" scenarios in an efficient, comprehensive and cost-effective manner. The UnTRIM code also is better able to deal with intertidal environments such as Virginia's tidal marshes. Dr. Harry Wang, Dept. of Physical Sciences, explains, "The beauty of the second-generation HEM3D model is that chemists and biologists can write their own subroutines and run scenarios. This flexibility makes the model very useful for VIMS." Utilizing the new model, researchers have already generated approximately $400,000 in new work over the next three years.



A high-resolution velocity field generated by the HEM3D model. Grey lines show the flow of currents. The shaded areas represent the topography of the Bay.

VIMS Researchers Win 5-year, $1.7 Million NSF Award

By Dave Malmquist

A multi-institution team headed by VIMS researchers has received a 5-year, $1.7 million grant from the National Science Foundation to study the role that plankton play in the consumption and production of dissolved organic matter in the ocean.

The DOMINO project (for **D**issolved **O**rganic **M**atter **In** the **O**cean) is led by VIMS scientists Drs. Deborah Bronk, Walker Smith, and Deborah Steinberg. Dissolved organic matter, or DOM for short, refers to the vast pool of biologically produced carbon, nitrogen, and phosphorus compounds dissolved in seawater.

Grant recipients Drs. Walker Smith, Deborah Bronk, and Deborah Steinberg.

Researchers have long known that plankton are the major consumers and producers of DOM in the sea. What's unique about the DOMINO study, says Bronk, is that it represents "the first time that anyone has studied the three major modes of DOM production—direct leakage from phytoplankton cells, zooplankton grazing of plankton cells, and viral infection and rupturing of plankton cells— at the same time." Simultaneous study of the three processes will allow the researchers to quantify the relative role that each plays in DOM cycling.

Another novel aspect of the study is its use of an analytic technique developed by Bronk for isolating organic nitrogen dissolved in seawater. Because phytoplankton are mostly made of carbon, isolating nitrogen and other less-abundant bodily constituents had previously proven difficult.

A better understanding of dissolved organic nitrogen compounds is vitally important, especially in heavily developed estuaries like Chesapeake Bay. In the Bay, excess inputs of nitrogen from fertilizers and car exhaust can nurture algal blooms so dense they cloud the water, shading ecologically important Bay grasses. When the algae die, their decomposition can deplete oxygen supplies.

The DOMINO team will investigate the three DOM production processes using both laboratory experiments and research cruises to Chesapeake Bay. Bronk notes that the Chesapeake provides an ideal system for examining the processes that control DOM release in marine environments. "Much of the original work on the cycling of dissolved organic nitrogen took place in Chesapeake Bay, and there have been a number of classic studies concerning the release of dissolved organic carbon there as well," says Bronk. "The Bay

Continued on page 7

From Crew to Congress

By Susan Polk

What if fisheries managers had experience as marine scientists and as commercial fishermen? What if the scientists advising policy makers were also crewmembers on commercial longliners? Perhaps the person to ask is VIMS Ph.D. student David Kerstetter. He would know. During the last three years, he's worked as a crewmember on longliners in the U.S. and abroad in order to collect data.

Dave Kerstetter (center) prepares to tag a white marlin.

Kerstetter is studying the interaction of billfish with longline gear to determine modifications that could reduce the numbers of by-catch from tuna and swordfish fisheries. He gathers information in part by attaching pop-up satellite tags to marlin hooked on commercial longlines. (For more about satellite tagging, see the Winter 2000 issue of *The Crest* at: www.vims.edu/newsmedia/crestarchives.html)

"The experiences I've had working on fishing boats in places ranging from Brazil to Georges Bank have given me a real understanding of fishermen and fisheries abroad," says Kerstetter, whose main interest is in marine fisheries policy. He believes the polarity at meetings of commercial fisheries and fisheries managers wouldn't exist if more managers had the opportunities he has had with his research at VIMS. "When you're covered in squid slime and swordfish blood, you're one of the crew," he adds with a smile. "That gains trust."

This unique arrangement began by accident, or perhaps serendipitously, in the summer of 2000. Arrangements had been made for Kerstetter to tag blue marlin in Bermuda on board a commercial longliner. When a crewmember didn't show up, he convinced the captain that he could act as a member of the crew. And so it began. He now arranges in advance to go as crew. Kerstetter sees this win-win situation continue to provide research opportunities onboard commercial vessels.

Kerstetter's masters' research at VIMS, on the post-release survival rates of blue marlin caught by commercial longline gear, also provided important policy-making results. This study, which showed a high survival rate for those fish, was instrumental in the decision by the International Commission for the Conservation of Atlantic Tuna (ICCAT) nations to require the release of live billfish. He commented, "It was great to see the work I was involved with at VIMS provide answers to international concerns."

Dr. John Graves, fisheries geneticist and Chair of VIMS Department of Fisheries Sciences, is Kerstetter's faculty advisor. Through this mentorship, Graves has helped Kerstetter create opportunities that aren't possible in most graduate programs. VIMS' state mandated role of advisory services provides a platform for involving students in fisheries management with the guidance of a professor. Graves explains, "Integrating marine science and policy is unique to VIMS and reinforces our mission of research, education, and advisory services."

Graves also chairs the U.S. ICCAT Advisory Committee and recently served on the Status Review Team appointed by the National Marine Fisheries Service (NMFS) to evaluate the risk of extinction of white marlin. As Graves' student, Kerstetter has been able to attend the annual ICCAT meetings for the last three years in a support role to the U.S. ICCAT Advisory Committee.

Says Graves, "Our students have the unique distinction of gaining experience in fisheries management issues while obtaining an education at one of the best marine science schools in the world. This is why VIMS students are so highly sought by NMFS and other government agencies." Dr. Nancy Thompson, Director of the Miami Laboratory of the Southeast Fisheries Science Center, NMFS, commented, "We work closely with faculty and students at VIMS and expect our collaborations to increase over time as VIMS is showing clear vision anticipating the need for resource mangers, policy makers, and scientists to ensure sustainable management of living marine resources."

Drought: What's Going on Underwater

Drought brings different images to different people. Day after day of clear skies with no rain, water restrictions in cities, no car washing, stunted crops, and increases in forest fires out west are today's images. Some remember the famous "Dust Bowl" images from the 1930s. The tidewater region has been in a summer drought for the last three years, and in some areas it rivals the 1930s. Occasional rains of normal magnitude lull some into believing the drought is over. But, where there is a water deficit, *normal* only maintains existing conditions— they don't get worse, but they don't improve either.

The long-term lack of rain, not just in the Tidewater area, but in the mountains as well, profoundly impacts Chesapeake Bay marine life. In many cases, the full effects will not be evident for several years. Rain feeds freshwater into the Bay and helps to maintain the environment in which marine plants and animals live and thrive. During periods of drought, less freshwater comes into the Bay allowing saltwater to move up from the Bay mouth into areas that are commonly less salty. For example, at the mouth of the Bay salinity is 30 parts per thousand (ppt), and is usually 20 ppt at the VIMS pier near the mouth of the York River. Further up the river at West Point, 10 ppt is usual, and at the head of the Bay the water is basically fresh. Changes in the salinity affect various species in many ways:

Submerged Aquatic Vegetation (SAV)

The reduction in rain causes a reduction in river discharge. Reduced river discharge means less sediment and fewer nutrients are carried down by the rivers, resulting in better sunlight penetration in the Bay and also higher salinities. This improves the potential for growth of SAV species in the lower Bay that prefer salty environments. However, for those freshwater species that are intolerant of salt, the salt intrusion in the upper Bay has resulted in the decline of SAV.

Oysters

Summer spatfall counts from the oyster-monitoring program have yielded counts that are higher (14-30 spat per shell) than normal Bay-wide (e.g. 1999, 5-8 spat per shell). However, the pathogens that cause oyster diseases thrive in higher salinity conditions. While the 2002 oyster disease survey has yet to begin, preliminary observations suggest that MSX has moved farther up-river, and that Dermo, which moved up-river last year, has remained up-river. During the drought summers in 1981 and 1986 these diseases moved up into Maryland waters where they had not previously been recorded.

Blue Crabs

During drought years, when salinities are higher than normal in the middle and upper portions of the Bay, blue crabs are affected in two primary ways. First, adult females with egg masses are observed much farther up the Bay than usual—sometimes as far north as the Bay Bridge near Annapolis. Whether the progeny of these females survive is unknown, but unlikely. Second, recruitment of young juveniles may be higher during drought years because the reduced freshwater flow out of the bay allows larvae and post larvae to remain closer to the Bay mouth, allowing the post larvae to reinvade the Bay in greater abundance, which may produce a larger year class.

Sport fishermen in the Chowan River report catching flounder in their favorite freshwater bass holes and also report having to navigate around crab pot buoys. VIMS juvenile finfish survey personnel have reported seeing crab pot floats up to Hopewell on the James and up to the Walkerton Bridge on the Mattaponi River.

Finfish, like these striped bass, are vulnerable in Chesapeake Bay during periods of drought.

Finfish

Finfish recruitment and distribution patterns are affected by drought. Changes in recruitment, the successful spawning and survival of juvenile fishes, can be biologically dramatic, but not noticed for years. The presence or absence of fingerling (1-2") striped bass for example goes unnoticed until four to six years later when the fish reach maturity, enter the fishery and begin to spawn. Successful striped bass recruitment occurs during cool damp springs. The summer of 2002 was one of the warmest and driest on record, and striped bass recruitment was one of the three lowest in the 15 years since the striped bass stock began to recover. Preliminary estimates are that shad and river herring recruitment are also down. Shad, river herring, and striped bass are all anadromous spawners. They live in the Bay and ocean and migrate into the rivers each spring to spawn before returning to the ocean.

Anecdotal reports include spadefish and puppy drum (juvenile red drum or channel bass), both common at the mouth of the York River, being taken as far up river as West Point. Anglers at a freshwater bass tournament held on the Mattaponi River reported that they only caught croaker!

VIMS Research Sheds New Light on Barndoor Skate

By Dave Malmquist

Field research by VIMS scientists on Georges Bank is providing the first direct biological data on the age and growth of the barndoor skate *Dipturus laevis.* The data are needed to accurately assess and effectively manage north Atlantic populations of the species, which is currently listed as a "species of concern" under the Endangered Species Act.

Careful study of more than 2,500 barndoor skates by VIMS Ph.D. student Todd Gedamke and VIMS researchers Drs. Bill DuPaul and John Musick suggests that the species may reach sexual maturity much earlier than previously believed. "Concern over the extinction of this species may thus be premature," says Gedamke, "but more direct information is necessary to accurately assess the threat." Species that reach sexual maturity late in life are less prolific than species that mature earlier, and thus more susceptible to fishing pressure.

A 1998 *Science* article generated concern when it used long-term research surveys to contend that barndoor skate populations had declined throughout the species' range. However, no direct biological information was available and the researchers were forced to estimate age at maturity at 11 years based solely on analogy with the common skate *Dipturus batis.* The study warned that fishing pressure on a species exhibiting such late maturation put them in imminent danger of extinction.

In response to this study, environmental groups in 1999 petitioned the National Marine Fisheries Service to list the barndoor and other similar-looking skate species as endangered and to immediately designate Georges Bank as critical habitat. Because barndoor skates are a by-catch in the commercial finfish and scallop fisheries on Georges Bank, an endangered listing would effectively shut down those operations within U.S. portions of that fishing ground. Such an action would significantly harm Virginia's sea scallop industry, the Commonwealth's most valuable seafood sector (see story on page 7).

The VIMS data show that a relatively large population of these animals exists in the area studied and suggest that the skates reach sexual maturity at about 6 years, which would significantly reduce their overall sensitivity to fishing pressure.

Todd Gedamke holds a barndoor skate.

DuPaul and Gedamke collectively spent nearly 100 days at sea measuring skates captured as by-catch during commercial scallop fishing operations in Georges Bank Closed Area II (closed to use of mobile fishing gear in 1994, this area was opened to limited commercial scallop fishing in 1999). The pair's sampling of vertebrae, stomach contents, and reproductive tracts from nearly 600 skates give the first direct biological evidence of the species' age, growth, feeding habits, and fecundity.

Sea Grant Virginia

VIMS Researchers Complete Three-Year Study on Hard Clam Disease

During the past few decades hard clam aquaculture has emerged as one of Virginia's most important crops. Recent estimates indicate that nearly 600 million cultured clams are being grown in Virginia waters— a $35 million industry to the Commonwealth. Unlike the oyster industry, the hard clam industry has flourished in the absence of any disease threat. However, scientists and aquaculturists have become increasingly concerned about QPX (Quahag Parasite Unknown), a parasite that has caused significant disease problems in hard clams in New Jersey, Massachusetts, and Canada. QPX was first detected in Virginia in 1996 and has been found in cultured hard clams at 10 coastal bay sites on Virginia's Eastern Shore. Localized outbreaks of the disease in 2001 and 2002 caused extensive clam mortalities at two of the ten Eastern Shore grow-out sites. VIMS scientists Lisa Ragone Calvo and Eugene Burreson, in collaboration with researchers from Rutgers University and Woods Hole Oceanographic Institute, recently completed a three-year study to gain a better understanding of the disease. A report issued in August 2002 outlines their work and findings.

The focus of the study was to determine the effect of genetic origin of clams and geographic location of grow-out on QPX disease susceptibility. The scientists obtained brood stock of five commercially important clam strains from hatcheries in Massachusetts, New Jersey, South Carolina, and Virginia. Seed clams were produced from each of the stocks at VIMS in the spring of 1999. In the fall of 1999, the seed produced from these five brood stocks was planted at grow-out sites in Massachusetts, New Jersey, and Virginia.

VIMS scientists plant clams during field study.

The stocks were monitored for growth, condition, QPX disease, and survival as they grew to market size during the following 30 months. At the termination of the study, in the spring of 2002, all live and dead clams remaining in the experimental plots were collected and quantified to determine final cumulative mortality. All strains performed well in terms of growth and condition. However, the clams originating from South Carolina and Florida brood stocks had significantly higher prevalence of QPX and higher mortality than clams originating from Virginia, New Jersey, and Massachusetts brood stocks. "This work shows that geographic origin of clam seed is an important factor in QPX disease susceptibility. We don't really understand the reasons for this yet, but we are beginning new studies that we hope will address some of these questions," said Calvo, a VIMS shellfish pathologist. "This work suggests that there is a genetic basis for QPX disease susceptibility. This is important as clam culturists may be able to avoid the disease by using seed produced from stocks that are more resistant to QPX disease," added Calvo. "We are fortunate to have an excellent team of molecular biologists and geneticists at VIMS that are already working to develop QPX-resistant clam strains."

With recent funding from the USDA and Virginia Sea Grant, Mark Camara and Kimberly Reece of VIMS will begin work that focuses on the genetic aspects of domesticating and improving clam stocks for traits such as QPX resistance and enhanced performance. Hatchery operators have been domesticating clams for many years; however, due to the very large numbers of eggs produced by female clams and the high variance in male mating success in typical spawns, hatchery reared stocks can become highly inbred. Inbred lines may have reduced fitness and are less likely to survive new disease and environmental stresses. The VIMS team will develop molecular (DNA) tools to determine the levels of relatedness among individuals and apply these tools to selective breeding of class stocks for QPX resistance and for improved performance. In addition, molecular markers will enable the researchers to genetically type (or fingerprint) parents before crossing brood clams, allowing them to design breeding strategies that will reduce inbreeding.

"These technologies will enable us to make rapid progress in clam stock development. Ultimately we hope to provide aquaculturists genetic services that will enable them to develop selected stocks that are tailored to the particular conditions unique to their hatchery systems and grow out sites," said Camara.

— *QPX Facts* —

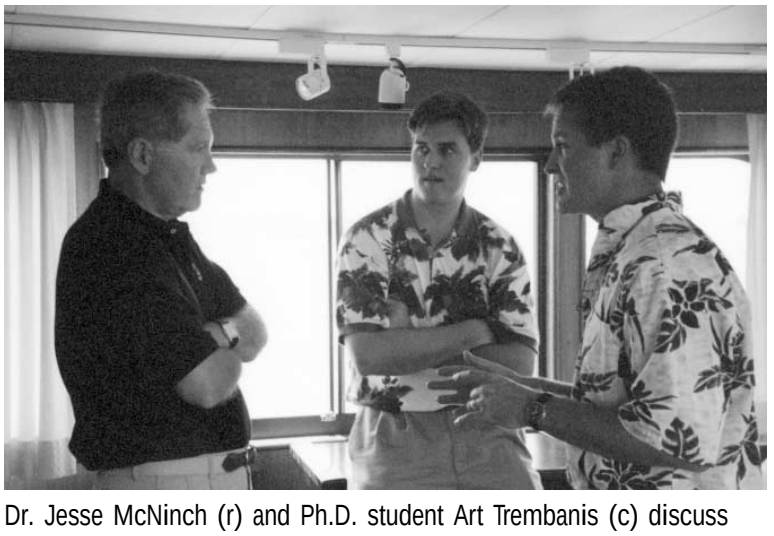
QPX (Quahog Parasite Unknown) is a protozoan parasite of the hard clam *Mercenaria mercenaria*. QPX is:

- Tentatively placed in the Phylum Labyrinthulomycota, whose members are ubiquitous in marine and estuarine habitats and include several disease agents
- Associated with sediments, benthic algae, and marine plants
- Generally saprophytic (obtains its food from dissolved organic matter)
- Found in coastal waters from Canada to Virginia
- An opportunistic parasite (it does not absolutely depend on a parasitic way of life, but easily adapts to it)
- Limited to high salinity (>25-27 ppt) environments
- Most prevalent in cultured clams
- Found in market or near-market size clams
- Acquired in field during first or second year after planting (it does not originate in hatcheries)

McNinch Receives Young Investigator Award from Army Research Office

Dr. Jesse McNinch, Dept. of Physical Sciences, recently received a Young Investigator Award from the Army Research Office to continue his work on erosional hotspots. These highly competitive awards are bestowed upon outstanding young researchers during the first five years of their career. McNinch's work has received a great deal of attention in recent months from federal and state agencies.

Research conducted by McNinch at the US Army Corps of Engineers' Field Research Facility in Duck, North Carolina suggests that hotspots are caused by a complex chain reaction that begins when large storm waves expose muddy patches beneath the sandy surf zone. Exposure of these muddy patches causes changes in bottom currents that alter the configuration of offshore sandbars. This summer, McNinch and others began a similar study at Sandbridge in Virginia Beach.



Dr. Jesse McNinch (r) and Ph.D. student Art Trembanis (c) discuss "hotspot" research with William and Mary Rector Donald Patten (l).

Erosional hotspots are short stretches of sandy beach that suffer severe erosion during storms. Shortly after a storm passes, hotspots refill with sand, leaving little or no evidence of their previous existence, making it difficult to study the phenomena. Traditional measures of beach erosion, including pre- and post-storm surveys, can completely miss a hotspot's presence. Hotspots have the potential to damage seawalls, hinder beach replenishment efforts, and disrupt military maneuvers.

New Shark Research Consortium – VIMS One of Four Sites Chosen Nationally

Smooth dogfish pup *(Mustelis canis)* born in live well on VIMS R/V *Bay Eagle*.

A new national effort to advance field and laboratory studies of elasmobranchs was launched July 1, 2002 with the implementation of the National Shark Research Consortium (NSRC), a coalition of four major shark research organizations working in cooperation with the National Marine Fisheries Service (NMFS). The NSRC includes VIMS' Shark Research Program, Mote Marine Laboratory's Center for Shark Research, Moss Landing Marine Laboratories' Pacific Shark Research Center, and the Florida Program for Shark Research at the Florida Museum of Natural History, University of Florida. The impetus for the formation of the NRSC arose from the need for coordinated studies of shark life history, population dynamics, and other aspects of shark biology essential for fisheries management. VIMS will receive $330,000 for the first year of the program.

Exciting new research is planned, including sophisticated age and growth studies, satellite tracking of shark movements, and ecosystem modeling. Research projects will be based in the U.S. Atlantic, Gulf of Mexico, and Pacific. The U.S. Congress provided funding of $1.4 million for the first year of activities to the NSRC through the NMFS Highly Migratory Shark Fisheries Research Program. Lead researchers are Jack Musick (VIMS), Bob Hueter (Mote Marine Laboratory), Greg Cailliet (Moss Landing), and George Burgess (University of Florida). All of the researchers have served as President of the American Elasmobranch Society and together bring nearly 150 years of shark research to this effort. Along with the scientists, at least twelve doctoral-level scientists, many biologists, and graduate and undergraduate students will be involved in the research.

Dr. Jack Musick, VIMS Acuff Professor of Marine Science, has conducted research on sharks, rays, skates, and sea turtles for more than 40 years. In addition, he is currently co-chair of the Shark Specialty group for the International Union for the Conservation of Nature. In 2000, the American Fisheries Society (AFS) recognized Musick for his outstanding contributions in the area of aquatic resource conservation. In 2002 he received the AFS Excellence in Fisheries Education Award. Musick is the author of several books including the recently published *Shark Chronicles,* co-authored with his wife Beverly McMillan, and Life in the *Slow Land – Ecology and Conservation of Long-lived Marine Animals*. He has also authored four AFS policy statements on long-lived marine fish resources.

The work to come from the consortium is aimed at providing NMFS the information it needs to keep shark populations healthy and stable through sound management plans. Researchers hope the studies will help the United States to take a leading role in the conservation of shark populations worldwide. Congressman Sam Farr (D) California, among others was instrumental in securing funding for this initiative.

Musick and McMillan will be at the Virginia Marine Science Museum on Saturday, November 16 for a presentation and book signing.

Monitoring Marsh One Year After Spray Dredging

Virginia's Pamunkey and Mattaponi rivers are home to some of the largest pristine tidal freshwater marshes in the nation. The largest of these wetlands are found in the bends of the two rivers just upstream of West Point. The marshes are highly valued as habitat for waterfowl, fish, and an amazing diversity of plants. The tidal freshwater plant community is among the most productive natural communities known, with plant biomass production equivalent to the most intensive agricultural efforts.

Several years ago, some of the owners of the marshes in the Pamunkey and Mattaponi systems noticed a growing change in the character of the vegetation. Where large stands of giant cordgrass *(Spartina cynosuroides)* used to dominate, arrow arum *(Peltandra virginica)* was now the most common plant. The change was particularly noticeable in the fall when migrating waterfowl moved through the marshes. Where the marsh surface had once been screened by the dead standing stems of giant cordgrass, the marsh now looked like a giant mud flat.

Drs. Kirk Havens (l) and Carl Hershner (r) examine plant communities in the marsh.

Puzzled about the causes and consequences of this change, the marsh owners, under the leadership of Mr. Sture Olsson, funded a research initiative to be conducted by the VIMS Wetlands Program.

The scientists hypothesized that rising sea level, potentially combined with local subsidence, was making it impossible for the marshes to accumulate surface material fast enough to maintain their position in the intertidal zone. This would explain the change from a plant community dominated by giant cordgrass to one dominated by arrow arum.

The project has been underway for almost two years. Spray dredging was conducted during 2001 to test if it might help counteract the effects of sea-level rise. Follow-up studies and the basic ecological investigations have been underway since that time. Although results are preliminary at this time, several observations can be drawn. First, spray dredging appears to be a potentially useful method of dredged-material disposal. The initial findings on the three tests plots suggest the marsh vegetation was able to withstand the slurry application and grow through the accumulated material. An important caveat to this observation is that the material used in the Pamunkey marsh study was very fine silt and mud. Heavier material such as sand or dense clay may have more significant impacts. Second, spray dredging using fine silt and mud from marsh creeks is not a particularly effective method of increasing marsh surface elevation. Third, there are some apparent differences among the marsh communities being intensively studied. Although data are still being collected and analyzed, initial findings suggest that bird and insect communities do vary in arrow arum, giant cordgrass, and Phragmites plant communities. If continuing work confirms this initial observation, the slow transition from one type of vegetative community to another may indeed portend shifts in the ecological services provided by these systems.

VIMS researchers are currently undertaking a number of new studies, as well as continuing the basic ecological monitoring. This summer another effort will be made to increase elevations on the marsh surface in a number of very small test plots. Methods will include: containment of dredged material in biodegradable containment bags; creation of stilling ponds on the marsh surface using bio-logs (coconut fiber landscaping logs); and addition of wood chip layers to the marsh surface.

None of the methods of increasing marsh elevations is seen as a panacea for the problem of disappearing tidal wetlands. There are simply not enough materials or funding to address the entire problem. The current project is moving us closer to understanding the consequences of the ongoing change. It is also arming VIMS scientists with the information necessary to provide sound advice on potential future management options.

Cooperative, Savvy Management Key to Scallop Fishery's Success

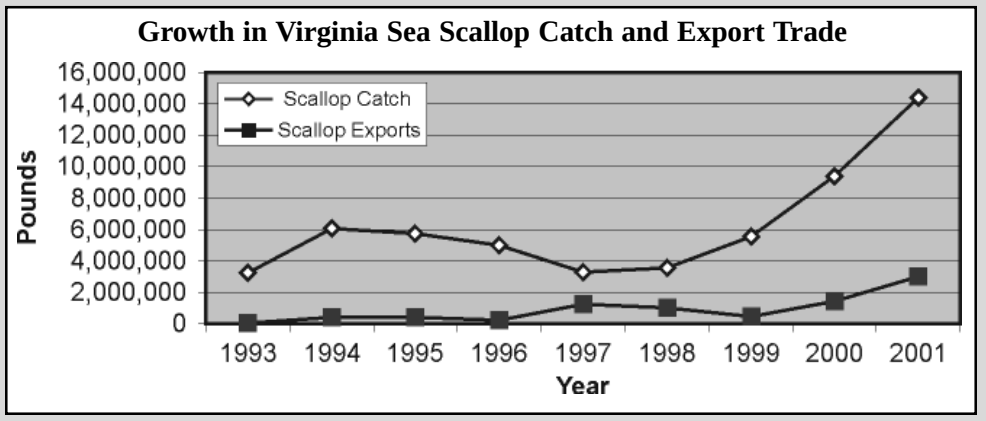
By Tom Murray

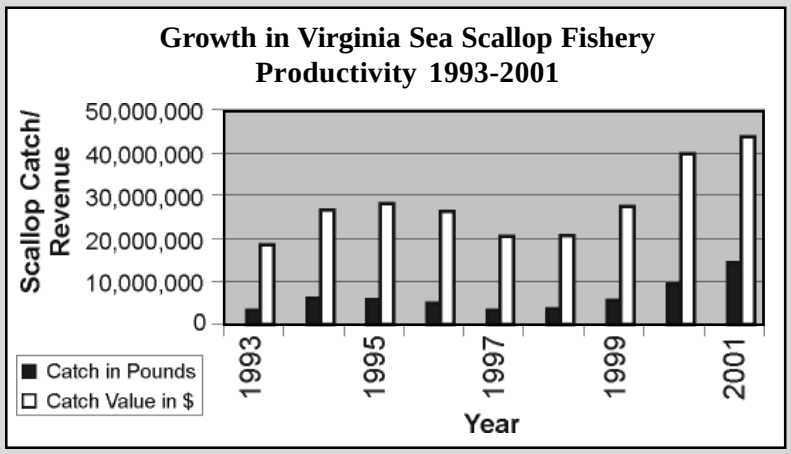
The growing success of the sea scallop fishery is good news to Virginia's seafood industry and economy. It is not often that fishery management receives credit for increasing industry profitability and fostering growth. But it's important to note that the fishery has recently prospered, in part, by virtue of a calculated harvest management plan jointly fostered by the East Coast scallop industry, governing authorities, and scientists at VIMS. In fact, Dr. William DuPaul of VIMS is a member of the New England Fishery Management Council's *Sea Scallop Plan Development Team* and has conducted numerous research projects on scallop gear selectivity, by-catch reduction, and optimizing yield from special management areas in both the mid-Atlantic and Georges Bank.

The overall stability in the sea scallop fishery and attendant, increased share of landings coming into Virginia have resulted in an economic boost to the Commonwealth, whose seafood industry is capitalizing on a growing share of the world's scallop market.

The recent economic growth summarized below would not be possible without strong recruitment (courtesy of Mother Nature) and a healthy resource. Signs of recent sustainability suggest that the prospects are good for a renewable sea scallop resource that will benefit Virginia's commercial fishing industry in the near future.

A look at trend data over a nine-year period underscores the point. In a 1994 study, VIMS economists used primary economic surveys and input-output modeling to ascertain the business activity associated with sea scallop harvesting, processing, marketing, and distribution.[1] During that season, Virginia's scallop fleet landed 6.1 million pounds of sea scallops in the state with an ex-vessel value of $26.6 million. In contrast, during 2001 Virginia's sea scallop fleet returned to Tidewater ports with over twice the poundage, valued at 60% more than the 1994 harvest.





Based on economic impact assessments developed in the 1994 study, it is estimated that the direct economic impacts of the fishery in 2001 were $72 million in economic output to the state. The figure includes $47 million of income generated. By estimating the associated secondary economic impacts to firms that sell supplies and other items to seafood businesses, and third-round impacts from households that re-spend the income earned on other goods in Virginia, the total economic output arising from Virginia's scallop industry currently exceeds $150 million annually – including $94 million in income. In terms of ex-vessel value, scallops are now the most important commercial fishery in Virginia.

The Virginia scallop industry has grown its business by simultaneously increasing its share of an expanding catch while also increasing its share of the world scallop market. According to information from the U.S. Department of Commerce, Norfolk now leads all U.S. Custom Districts in the export of sea scallops to foreign nations.[2] In 2001, Norfolk handled 32% of all scallops exported by the U.S., shipping more than three times the amount shipped by its nearest competitive foreign trade center in Boston, Massachusetts. Of Virginia's growing scallop harvest, an increasing percentage – currently 21% – is destined for export. By harvesting the offshore resource and returning it to Virginia ports for domestic and international marketing, the Virginia scallop industry remains a significant contributor to base economic growth in the state. While Virginia's scallop catch has grown by 65% since 1991, the amount of harvest exported has risen over 8 times, or 800%.

Smart, aggressive domestic and foreign trade coupled with sound management has positioned Virginia as one of the most important scallop markets in the world and certainly bodes well for the future of its seafood industry.

Sea Grant Virginia

[1] Virginia's Commercial Fishing Industry: "Its Economic Performance and Contributions", James Kirkley VIMS. SRAMSOE No. 337

[2] National Marine Fisheries Service. "NMFS Trade Query – Comparison by Product for All Customs Districts." 10/1/02

VIMS Researchers Win 5-year, $1.7 Million NSF Award
continued from page 3

also typically has a well-defined spring algal bloom, so it's an excellent place to study the fate of phytoplankton biomass once it forms."

The fate of phytoplankton biomass is particularly important in the Bay because Bay managers currently only look at nitrogen concentrations and uptake rates. "Knowing that phytoplankton biomass forms is only part of the story. What happens to that biomass is equally important," says Bronk. "For example, if most of the biomass is released in a dissolved form, it's not going to sink to the bottom and contribute to low oxygen levels. Instead, it may be carried out of the Bay into the coastal ocean."

A key goal of the project's laboratory experiments is to better understand how seawater nitrogen levels affect the amount of DOM released by phytoplankton. Nitrogen is typically a limiting nutrient for phytoplankton growth. By adding more nitrogen to their tanks, Bronk and Smith can simulate the phytoplankton blooms that occur when storms or run-off from fertilized land inject this nutrient into sunlit surface waters. By later adding zooplankton, Steinberg can measure how DOM production rates change as these creatures begin to eat the marine plants.

Taken together, results from the lab and field studies will help quantify how nitrogen-availability and the life-styles and stages of various plankton species affect how much dissolved organic carbon and nitrogen they produce, and what chemical forms these elements take.

Figuring out the sources and chemical forms of dissolved organic carbon compounds is particularly important to the issue of global climate change. Because the ocean's reservoir of dissolved organic carbon is so large, even small changes in its size can significantly affect other components of the global carbon cycle—including the atmospheric pool of the greenhouse gas carbon dioxide.

Results from the DOMINO lab and field studies will help support another goal of the project, which is to create a computer model that can accurately simulate the relative roles of carbon and nitrogen in the marine DOM pool. This modeling component is essential to improving the realism of the large-scale models used to predict global carbon-cycle dynamics and how they might respond to human activities.

The DOMINO project includes a significant educational component as well. The researchers will work with the VIMS public relations staff to develop a marine science mini-school to be offered annually to the general public, and create an interactive computer model of the carbon cycle that can be used by mini-school lecturers and in public displays at a number of venues around the Commonwealth.

The DOMINO project is funded under NSF's Biocomplexity in the Environment program, which supports studies that help clarify how the biological, physical, chemical, and human components of the global ecosystem interact.

Calendar of Events

—October 2002—

7	Reedville Mini-School of Marine Science
12	Musick Book Signing, W&M Bookstore
12-15	Fall Break
13	Power Boaters - VIMS Tour
14	Chef Symposium
19	GSA Fall Party
25	W&M Homecoming - VIMS Tour
26	Donor Day

—November 2002—

4	Reedville Mini-School of Marine Science
11	Seafood Seminar
15	Nat'l Assoc. of Interpreters- VIMS Tour
16	Musick Book Signing, Va. Marine Science Museum
18	Seafood Seminar

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

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Maury Dinner Celebrates Gifts and Achievements

More than 100 people attended the 5th Annual Maury Dinner at VIMS. The event recognizes support from private donors and outstanding faculty and student achievements over the past year. Special guests included RADM Thomas Wilson, Oceanographer of the Navy; The Honorable Tayloe Murphy, Sec. Natural Resources, Commonwealth of Virginia; Governor Linwood Holton; and the Honorable Hunter Andrews and his wife and VIMS Council member, Cynthia. "We are very fortunate and grateful to have such outstanding support. In these times of financial uncertainty, it is encouraging to realize how many people value the work done at VIMS," said Dean and Director L. Donelson Wright.

The evening program included recognition of VIMS faculty members Deborah Bronk, who received an award of $1.7 million from the National Science Foundation for biocomplexity studies in Chesapeake Bay; John Graves, for his advisory and research contributions in recent debates over listing white marlin on the Endangered Species List; Wolfgang Vogelbein, who led a team of VIMS scientists in publishing important new work on *Pfiesteria* in a recent issue of the journal *Nature*; and Jack Musick, whose shark research program was one of four nationwide chosen to become the National Shark Research Consortium (see story on page 6). Graduate students Art Trembanis, Laurie Sorabella, and Kate Mansfield were honored for their achievements and scholarships.

This was VIMS' most successful year to date for private fund raising. VIMS received gifts of $1.47 million, bringing total gifts and commitments during the "silent phase" of VIMS $23 million campaign to $5 million. The VIMS Campaign is part of the Campaign for William and Mary that will officially kick off in early 2003. Several campaign commitments were recognized at the dinner:

The Glasel family committed $750,000 to the VIMS Foundation for endowment. This gift completed the challenge by Morgan Massey and an anonymous donor to bring the VIMS endowment total to $2 million. "Providing an unrestricted endowment for VIMS is an important step toward protecting the future of the Institute and placing it in a better position to respond to emerging issues that affect our marine resources. I am very pleased to have a part in this, " said Foundation President Morgan Massey.

Thanks to many supporters, construction of the Kauffman Aquaculture Center, the nation's first facility dedicated to advancing aquaculture and oyster restoration has begun in Topping. This facility, built entirely by $1.4 million in private funds, will also attract new grants for additional research on complex problems in oyster restoration and aquaculture.

Hunter and Cynthia Andrews created a $100,000 annuity to fund a fellowship in memory of their son Booker. This fellowship will help VIMS to continue to attract the very best students from around the world.

VIMS Alumni Charlie Natale announced a challenge grant of $25,000 to support the Zeigler Student Fellowship in memory of VIMS Dean of Graduate Studies, John Zeigler. Natale will head the campaign to meet the challenge.

Left to right: Marilyn Zeigler, Don Wright, Charlie Natale, and Morgan Massey announce a challenge grant for student support.

Ph.D. student Art Trembanis (l) and Oceanographer of the Navy, RADM Thomas Wilson.

Acoustic Guitar Series Great Success

Since last December six of the world's finest acoustic guitar players have delighted attendees with their performances at VIMS. Dr. Linda Schaffner, Dept. of Biological Sciences, and her husband, guitarist Stephen Bennett, developed the series to support the Hargis Library Endowment. "The fact that the performers are all friends of Linda and Stephen gave the series an up close and personal feeling that is rare," said VIMS Director of Research and Advisory Services Gene Burreson, who attended the series. On behalf of the Library Endowment, the entire VIMS community thanks the performers, Linda Schaffner, and Stephen Bennett for bringing an entire year of outstanding entertainment to VIMS.

The series raised more than $8,000 for the Hargis Library Endowment.

Musician Stephen Bennett, Dr. William Hargis, and Linda Schaffner.