WILLIAM & MARY VIMS
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

The Crest

Current Issues in Coastal Ocean and Estuarine Science

Volume 2, No. 1
Winter/Spring 2000
www.vims.edu

VIMS Director Invited to Speak in China

VIMS Dean and Director, Dr. Don Wright, was recently an invited keynote speaker and session chair at an international conference hosted by the East China Normal University (ECNU) in Shanghai. The conference focused on estuarine and coastal ocean processes. Dr. Wright's keynote address synthesized the results of his work on the transport of sediment from the mouths of rivers to the continental shelf including research from China's Gulf of Bohai at the mouth of the Yellow River, the Northern California shelf off the mouth of the Eel River, the Louisiana shelf off the mouth of the Mississippi River and the Mid-Atlantic Bight off Duck, NC. While in China, Wright also visited the mouth of the Yangzi (formerly Yangtze) estuary where 50 kilometer long jetties are under construction, the Yangzi gorges and the Three Gorges hydroelectric dam which is under construction. "This is the largest and most ambitious such project ever undertaken in the world," Wright explains. "When Stage 1 is completed in 2004, the water level behind the dam will be raised by 135 meters (just over 400 feet) and one million people will be displaced to new housing at higher elevations. By 2009, the water level will reach 175 meters (525 feet)."

The jetties will double the depth of the harbor and maintain the deep channels to accommodate larger ships in the port of Shanghai. Modifications caused by the channel deepening and the dam will decrease sediment supply and fresh water inputs to the coast resulting in land loss. This is already happening at the mouth of the Yellow Sea.

Wright and scientists from ECNU began making plans for collaborative research to monitor currents and sediment fluxes in the coastal waters off the mouth of the Yangzi River relative to construction of the Three Gorges hydroelectric dam. "Obviously, the combined effects of the dam and river-mouth jetties and deepening will change the coastal environment." Wright is hopeful the research will begin a couple of years before the dam is complete. VIMS has had a memorandum of agreement with ECNU since 1996. This provides an avenue for faculty and student exchange in addition to joint research. Currently there are six Chinese students studying at VIMS. "This is a very important collaboration from which we all benefit." Wright says, "The seas surrounding China are shallow, marginal seas that include the Bohai, Yellow Sea, East China Sea and South China Sea. This is one of the world's most extensive and important coastal oceans. The processes there have far reaching significance for the health of the global ocean and for the health of the global economy. That is why we should care. Furthermore, the processes that we hope to study there will provide generic insights into universal processes of coastal sediment transport that operate elsewhere including the Chesapeake Bay."

Entrance to Three Gorges hydroelectric dam project.

See related article on page 11.

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The Crest

Vol. 2 No. 1 Winter/Spring 2000

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Vol. 7, No. 1

This work is the result of research supported in part by NOAA Office of Sea Grant, U.S. Depart- ment of Commerce, under grant No. NA56RG-0141 to the Virginia Graduate Marine Science Consortium and the Virginia Sea Grant College Program.

Chesapeake Bay National Estuarine Research Reserve in Virginia
a fair Bay Winter/Spring 2000
Vol. 10, No. 1

Finfish Aquaculture Updates

By John Olney, Jr.

Since the completed construction of the Finfish Greenhouse last summer, Jeff Tellock and Mike Oesterling have been able to concentrate on other matters at the Virginia Institute of Marine Science, namely, growing and raising fish. The greenhouse, which took most of the spring and summer of 1999 to complete, is now fully functional, and Oesterling and Tellock have taken full advantage of the new facilities, engaging in four major aquaculture projects in the fall.

The first study that was necessary to begin the aquaculture process was a verification study of the hatching and rearing facilities. This was important to show that the capabilities of the system were sufficient, and make sure future projects could be possible. This study was completed in September by culturing and raising speckled trout (*Cynoscion nebulosus*) from eggs. These eggs were sent from the University of Miami and placed in the closed system to test their rate of survival.

"Speckled trout were used in the study because of their ease of accessibility and their high rate of cannibalism in the juvenile stages," says Oesterling. "Basically, the idea was that if we could raise speckled trout in these tanks, then there is a good chance that black sea bass (*Centropristis striata*) could also be raised effectively."

This summer, around fifty mature sea bass were captured on an offshore wreck site east of Virginia Beach, and placed into holding tanks at the greenhouse. They have been held successfully for over five months in one of the larger tanks, and the broodstock is now being consolidated into the recirculating systems to condition the fish for spawning in the spring of this year. The fry will then be raised in the system that was used for rearing the speckled trout. The expected grow-out time for the sea bass is in the neighborhood of 15-18 months, putting the raised fish in the 1 to 1 1/2 pound range.

More good news on the finfish aquaculture front is that the National Sea Grant Program has granted the program $70,000 to spawn wild caught cobia (*Rachycentron canadum*) in the spring and summer of 2000. Twenty to thirty fish ranging from 15 to 35 pounds are the goal, and they will be collected from local haul seine and pound net fisherman during the spring cobia run in the Chesapeake Bay (usually beginning in late May or early June). These fish will then be transported by boat to quarantine tanks where the fish will be held and observed for disease or parasite problems before they are placed within the closed recirculating system.

Mike Oesterling and Jeff Tellock inspect filtration system in finfish aquaculture facility.

The next step will be conditioning the mature fishes for spawning. The fish will be induced to spawn through a series of natural and artificial stimulus, and the eggs will be taken out and placed in smaller tanks for hatching. The grow-out time for cobia should be around 16 months.

Sea Grant Virginia

Photo: Mike Oesterling

Graduate student Patrick Kilduff measures a black sea bass to document growth within a recirculating water system.

Former VIMS Director Dr. John L. "Laurie" McHugh Dies

The third full time director of VIMS, Dr. John "Laurie" McHugh died in August 1999. Dr. McHugh, a native of Canada, served as director from 1951 – 1959. Under his direction, the Institute built its first research vessel the "Pathfinder" which was specifically designed for research in the Chesapeake Bay and on the continental shelf. Both Maury Hall, the first permanent building on the Gloucester Point campus, and Brooke Hall were constructed while he was director. The monthly trawl survey to monitor commercially and recreationally important fishes in the Chesapeake Bay, was initiated under McHugh and continues today. The McHugh family has established a memorial fund at VIMS, for more information, please contact the Office of Development at (804) 684-7099.

Riparian Buffer Demonstration Sites

By Dr. William G. Reay

Nonpoint source contaminant loadings to the Chesapeake Bay and its tidal tributaries are significant and contribute to the degradation of water quality. Riparian areas are lands adjacent to streams, rivers, and in many cases serve as a transition between aquatic and upland environments. Riparian vegetative buffers are an important resource that protect and remediate surface and groundwater quality, furnish erosion control, provide critical habitat for both plants and animals, and potential economic return. Based on these qualities, riparian buffers provide a useful management option to meet Chesapeake Bay restoration goals. The goal, Bay-wide, is to increase riparian buffers and restore riparian forests on 2,010 miles of stream and shoreline in the watershed by 2010, Virginia's commitment is to restore 610 miles of riparian forest buffers in the same time frame. With support from Virginia's Department of Environmental Quality's Coastal Resources Management Program, Dr. William Reay, Research Coordinator for the Chesapeake Bay National Estuarine Research Reserve (CBNERRVA), has established a number of sites within Virginia's coastal zone to demonstrate the benefits of riparian buffers and provide examples of buffer design, establishment, and management to meet a variety of planting objectives.

Only native vegetation has been utilized at the sites. Native plant species have evolved over long periods of time to local climate, soils, and biotic interactions with other native organisms. Therefore, in contrast to many exotic species, once native plants are established they are generally very hardy and require minimal or no supplemental watering, fertilizers, or pesticides. This can lead to significant savings in both time and money for property owners.

One demonstration site, developed by Reay, is located in Richmond County at the U.S. Fish and Wildlife's Tayloe Wildlife Sanctuary. Here a riparian vegetative buffer was established to reduce groundwater and runoff nutrient loadings from an agricultural field to an adjacent first-order stream and provide for enhanced wildlife habitat.

Groundwater samples at the site showed elevated levels of nitrate (levels were greater than 25 mg/L as N-the US EPA drinking water standard is 10 mg/L as N). Water quality benefits derived from the buffer included a reduction of channelized flow caused by storm events; sequestering of nutrients in the soil and plant biomass; and reduction of nitrogen levels by enhancing denitrification through additional carbon inputs. *Denitrification* is the microbial process that transforms nitrate, a mobile and biologically available form of nitrogen, into relatively unreactive dinitrogen gas which comprises 78% of our atmosphere. Research has shown that forest systems can typically retain 80-90 percent of the incoming nitrogen and that denitrification can be responsible for a majority of the nitrogen removal. The demonstration riparian vegetative buffer integrated two planting zones, mixed hardwoods and native warm season grasses, to create a buffer that offers effective short and long-term (>10 years) benefits while utilizing a minimum of land area along 3,170-feet of stream bank.

The native warm season grasses, provided an effective buffer within the initial year and will be gradually displaced due to shading from the trees as they grow. Reay has worked with the Virginia Department of Game and Inland Fisheries to promote the use of native warm season grasses.

Photo: Dr. William G. Reay

Mixed hardwood and summer grass buffer at USF&WS Tayloe Wildlife Sanctuary site.

Erosional processes can occur in both instream and adjacent upland regions. A second demonstration project located at the Zoar State Forest exhibited severe instream erosion along 100-feet of shoreline that traditionally served as a popular area for fishing and launching canoes. Erosion control for this demonstration site included utilization of native material revetment for shoreline protection, shoreline revegetation for long-term stability, and construction of a low-impact canoe launch. Tree revetments typically consisting of recently harvested evergreen trees, are suitable where eroded bank heights are generally less than 10-feet in height. In addition to providing cover protection to the streambank, tree revetments reduce water flow enabling more suspended sediments to settle out of the water. This sediment deposition can result in formation of a new, more stable bank. At this site, a low impact timber canoe launch, built by Virginia's Department of Forestry, further reduced erosion impacts due to public access.

Prime habitat for wildlife, which can vary with season and target species, includes a combination of diverse food sources, shelter from the elements and potential predators, a source of water and in some cases a travel corridor to connect nearby habitats. The primary objective the U.S. Fish and Wildlife Service's Eastern Shore Wildlife Refuge demonstration planting, located in Northampton County, was to provide habitat enhancement for a wide variety of birds, specifically for neotropical and temperate migratory songbirds birds. Conservation strategies suggest that no single habitat is optimal for neotropical migrant species, and therefore a mosaic of native habitats is recommended. This planting resulted in two 10-acre forested-shrub regions and a 44.0-acre warm season grass meadow. Woody plants were selected to provide a source of food and shelter during periods of peak migration. In addition to year-round shelter benefits, the native warm season grass meadow supplies significant food resources in the form of resident insects and seed. Reay, in collaboration with the Department of Defense, created a riparian buffer in Yorktown designed to enhance gamebird (turkey and quail) habitat. Prime habitat for wild turkey, which can vary seasonally, includes a combination of forest types and ages, mixed with openings, which provide diverse food sources, brood rearing habitat, edges for nesting, room for courtship, and roosting trees. The planting design included pine and hardwood components, shoreline and meadow border shrubs, and two interior native warm season grass meadows for a total planting area of 2.4 acres and incorporated 1,300-feet of shoreline. Plants used for food sources were selected to provide both softmast (examples: wild cherry, blueberry, viburnum, dogwood, and blackberry

Photo: Dr. William G. Reay

Planting site at USF&WS Eastern Shore Wildlife Refuge.

Continued on page 5

Bay-Sustaining Life Bustling On The Bottom

By James Schultz

Featureless save for a series of longitudinal striations gently veering off diagonally, the seabed in the photo held by Dr. Linda Schaffner appears wholly lifeless. No shellfish or finfish are visible and no greenery is present. "Other than the striations —foot-wide furrows set down by ceaseless tidal cycles— the muddy world at the bottom of the water seems as barren as the moon," explains Schaffner

But that's a misguided assumption. Schaffner, an Associate Professor in the Department of Biological Sciences, points out that life is indeed present—if hidden. Unvegetated muddy sediments account for 95 percent of the bottom habitat of the Chesapeake Bay; more than 50 percent of the Bay's harvestable resources depend upon and are partially or entirely linked to bottom-dwelling animals, or *benthos*. For most of their lives, such species as blue crab, spot and croaker feed on benthic organisms. Without the benthos, a linchpin in the complex Chesapeake Bay ecology, the Bay's rich marine bounty would diminish or disappear outright.

"Out of sight, out of mind," Schaffner says. "But much of the Bay's productivity comes from its unvegetated bottoms. This is a habitat that is, critical to the lives of marine animals that human beings harvest. "

Schaffner, Institute colleagues and students are currently participating in two major initiatives that focus on benthic processes and the communities of organisms that populate the bay bottom. One project, funded by the Environmental Protection Agency, aims to assess the health of benthic communities across a wide geographic area, from the Hudson River Valley in New York State, to the Delaware and Chesapeake bays, and south through coastal estuaries in North Carolina. Sampling has already taken place and data are now being analyzed for a comprehensive report that is scheduled for release in the first half of 2000. Earlier investigations leading to this present study showed that widespread environmental problems, including eutrophication, oxygen depletion and pollution, significantly affect the health of benthic communities along the eastern seaboard of the United States.

Another investigation, underwritten by the National Oceanic and Atmospheric Administration, begins in January and is slated to run for five years. Its focus will be an evaluation of the ecological risks to living resources of the Chesapeake Bay ecosystem posed by the presence and concentrations of contaminants, such as metals and pesticides, within sediments. A multidisciplinary team of investigators from Virginia and Maryland will identify sublethal effects of contaminants on individual organisms and then link these effects to processes such as growth and reproduction.

Dr. Linda Schaffner.

Schaffner's past research has shown that benthic communities often control the cycling of nutrients within Bay waters, filtering or entombing them within sediments. This activity helps to determine the fate of toxins and other contaminants that threaten Bay health. Through a process known as bioturbation, benthic animals mix sediment as they burrow and feed. While this can delay the burial of pollutants by 100 or more years, it also can lead to enhanced degradation rates for many compounds.

In particular, Schaffner points to the parchment worm, a specialized, sophisticated organism that lives in the upper several inches of the muddy bottoms of lower Chesapeake Bay. Despite its anonymity and relative fragility — removed from its home and protective tube, it will quickly perish — each worm manages to filter as much Bay water as an oyster. Research by Michelle Thompson and Alessandra Sagasti, graduate students working with Schaffner, has been important for understanding the ecological role of a variety of poorly known benthic filter-feeders of the Chesapeake Bay system.

The extent to which increased sediment deposition is altering the ecology of the bay ecosystem is a major new area of research in Schaffner's lab. Recent investigations with her colleagues in the Department of Physical Sciences suggest that within the past century, some bottom areas of the Bay's tributaries have seen accumulations of as much as 20 to 30 feet of mud. These accumulations represent erosion of sediment from the surrounding watershed which is then trapped in tributaries, such as the York and Patuxent Rivers, by natural circulation processes. Elizabeth Hinchey, a graduate student working with Schaffner, is investigating how tidal reworking of these unstable sediments leads directly to diminished productivity and health of benthic living resources that support harvestable commercial species such as spot, croaker and blue crabs. Schaffner and her colleagues believe that increased sedimentation and turbidity will continue to be major problems that directly threaten current and future attempts to mitigate ecological damage and restore the Bay to some semblance of its pre-industrial health.

On October 10, 1999 more than 100 people joined VIMS and the Chesapeake Bay Foundation to honor Delegate Tayloe Murphy and Senator Joseph Gartlan for their long service in the Virginia General Assembly and their unwavering commitment to the Chesapeake Bay. Both Delegate Murphy and Senator Gartlan retired from the General Assembly after years of distinguished service. (Left to right: Senator Joseph Gartlan, VIMS Director Don Wright, Delegate Tayloe Murphy, and Chesapeake Bay Foundation President, Will Baker.

Support VIMS

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New Technology Boosts Billfish Survivability Research

By James Schultz

Prized and protected, Atlantic Ocean billfish— including blue and white marlin and sailfish— are nevertheless under population stress. Although limits on commercial billfish harvest are in place and recreational fishermen release an estimated 90 percent of their catch, numbers of sailfish and marlin stand at roughly 25 percent of what scientists consider long-term sustainable levels.

A key question that remains unanswered is the effectiveness of post-catch release. Do animals wounded or exhausted by an extended struggle with line and hook survive long enough to reproduce? Is release an effective strategy in species conservation, or is it ineffective in limiting physical damage and death?

Recently VIMS researcher, Dr. John Graves, Chair, Department of Fisheries Science, sought partial answers with a study that evaluated a new marine science tool, a microprocessor-based tracking device known as a pop-up satellite tag. The tag regularly records sea water temperature and transmits it to ground stations via orbiting satellites. Nine blue marlin caught on recreational gear off the southwest coast of Bermuda were tagged for the testing. The device, attached to the marlins' musculature, is housed low-drag, lightweight composite materials and towed by the fish. The study group traveled up to 150 miles from the original point of capture. After a preprogrammed five-day period, a mechanism on the nose of the housing activated, releasing the tag, which then traveled to the surface and transmitted its data to an Aros satellite system.

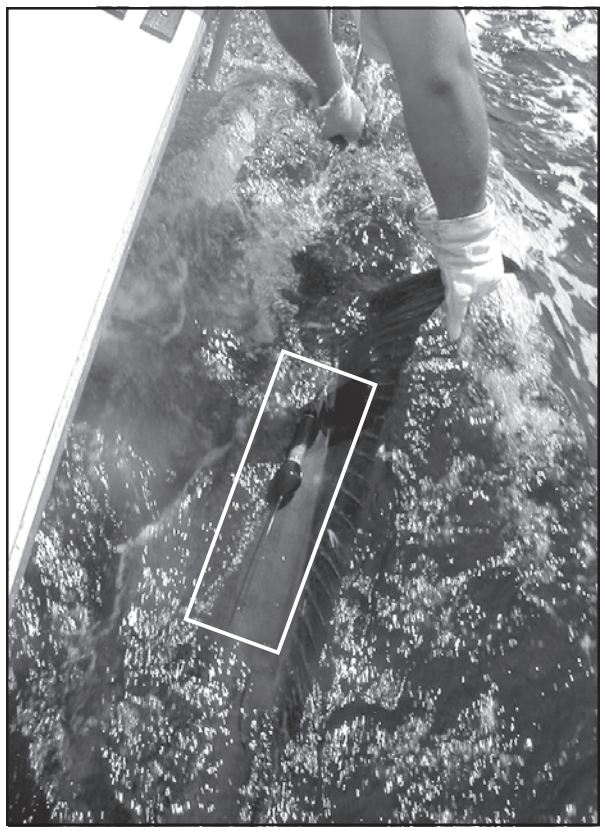

Photo: Dr. John Graves

Pop-up satellite tag on a blue marlin.

Eight of the nine tags broadcast information at the end of the five days. Temperature records indicated that each fish moved freely from surface waters to depths up to 40 meters (131 feet) and back again. Readings were consistent with active, vigorous movement seen in healthy billfish. In short: the animals appeared healthy.

"If the fish is alive, it will move up and down in the water column. All of our data suggest the animals were alive and swimming. Here, obviously, we can say they survived recreational capture." says Graves.

Graves is also Chair of the U.S. Advisory Committee for the International Commission on the Conservation of Atlantic Tuna. "One of the biggest causes of billfish mortality is entanglement in commercial long line fishing gear, designed to catch other species such as tuna and swordfish," Graves explains. Modification of these lines, or changes in hook design and bait type could substantially affect billfish mortality. Currently VIMS researchers are also studying "J" and circle hooks and their impact on survivability.

"We've demonstrated that this is a great technology to track post-release survival," Graves says. "The next step is to put these [tags] on fish released by the commercial fishery. If we can show that a large fraction of those survive, we may be able to persuade other countries to make changes in their fishing practices which would benefit the billfish."

Outlook on Ocean Science Program Reaches Out Locally

By Susan Haynes

In an effort to respond in a unified manner to the many requests from teacher and student audiences for outreach programs and special event speakers, the Sea Grant Marine Advisory Services Department developed a new program called *Outlook on Ocean Science*. This program is designed to help educators provide students with current and accurate information about the nature and scope of the work of marine scientists (emphasizing VIMS research) and related academic and career planning.

With the assistance of several graduate students, the program was piloted in the fall of 1998 and implemented last January. The success of the program is largely a result of the expertise and enthusiasm of over 30 VIMS graduate student instructors. With funding from DuPont, *Outlook on Ocean Science* has traveled to 49 classrooms and 3 career fairs to date, reaching over 3000 students from Richmond to Virginia Beach. This includes many local programs—3 at Gloucester High, 12 at Mathews High, and 2 at Grafton High.

Photo: Krisa Arzayus

Ph.D. student Rebecca Arenson with students in the summer program at the C. Waldo Scott Center for Hope in Newport News.

Here's what teachers have had to say:

"[The instructors had] excellent interaction with high school students. Outlook on Ocean Science with its hands-on activities is an "awesome" program. Please continue!!"

—Mathews High School

"The presenter's understanding of the topic was excellent. My students thoroughly enjoyed the presentation."

—Norview High School

"Excellent program! Well organized and well executed!"

—Grafton High School

For more information, contact Susan Haynes in the Marine Advisory Services Department. (804) 684-7735, email: shaynes@vims.edu

Sea Grant Virginia

Riparian Buffer Demonstration Sites continued from page 3

species) and hardmast (examples: oaks, hickory).

To promote the conservation and utilization of native plant species in landscaping, a native plant arboretum for the Coastal Plain region of Virginia was established at York River State Park in James City County. This demonstration planting included over 70 varieties of herbaceous and woody plant species planted along a 670-foot handicap public access walkway. The planting design incorporated plant communities to reflect a variety of landscaping and educational themes; these included songbird and butterfly habitats, herbaceous flowering landscapes, a transition region from meadow to forest, upland erosion control, and edible and commercially important native plants.

A Profile of the Aquaculture Molecular Genetics Laboratory:
Probing the DNA of the Oyster and its Parasite *Perkinsus marinus* (Dermo)

Dr. Kimberly S. Reece

Dermo, the disease caused by the pathogen *Perkinsus marinus*, has seriously compromised native oyster populations in Chesapeake Bay. The Aquaculture Molecular Genetics Laboratory of Aquaculture Genetics and Breeding Technology Center (ABC) at VIMS is examining the genetic material (DNA) of both this pathogen and its host, the oyster. Research on the parasite involves analyzing the DNA of *P. marinus* cells from infected oysters collected along the Atlantic and Gulf coasts of the US from Massachusetts to Texas. ABC scientist, Dr. Kimberly Reece, in collaboration with Dr. David Bushek of the University of South Carolina, has found that genetically distinct strains of *P. marinus* can be found in different geographic locations, with some areas, such as the southern Chesapeake Bay and the southeastern US coast, harboring several strains of the pathogen. "If the pathogen differs genetically, it is possible that it will also differ in its ability to infect and destroy its host (its virulence)," Reece explains. Clearly it would be advantageous to prevent the movement of strains among regions. "We are examining the virulence of these different strains of *P. marinus*. In preliminary studies, some differences in virulence among *P. marinus* cells from different geographic locations was observed." In addition to the practical recommendation to limit the movement of oysters from one region to another, this information can be used to start looking for the genes that contribute to this variation in virulence. Correlating virulence and genetic differences among strains is a first step in identifying genes that contribute to the virulence of the parasite. By understanding the nature of the pathogen's genes (that is, the nature of the infective proteins coded for by the DNA) it may be possible to understand how the host defends against the pathogen. Knowledge of genetic variation, virulence and resistance of both the parasite and its host are important for developing effective breeding and disease management strategies, and ultimately will accelerate efforts to produce robust breeding stocks that are resistant to even the most virulent strains of *P. marinus*.

Current research on the host includes DNA studies of the native eastern oyster, *Crassostrea virginica*, as well as several non-native species. For example in one study, scientists in Reece's lab are examining genetic differences among native and non-native species. Non-native species from the Pacific such as *Crassostrea ariakensis* and *Crassostrea gigas* are less susceptible to Dermo and MSX (another very serious disease of the eastern oyster) than our native oyster *C. virginica*. "These 'population genetic' studies serve two important functions. First, in our continuing investigation of potential candidate non-native oysters for breeding, our genetic 'fingerprinting' allows us to unambiguously assign an oyster to its proper species, or species group. When oysters are collected in the wild (especially in exotic locales like Southeast Asia), its species status is not always clear from its appearance. Second, studies of population genetics allow us to determine if there are genetically distinct subgroups of a species that might differ in important characters like tolerance to salinity or temperature variations," Reece explains.


Dr. Kimberly Reece leads oyster genomics project for ABC at VIMS.

Another aspect of the ABC research is to identify specific DNA sequences that can be used as genetic markers or tags. ABC is taking a lead role on these "genomic" studies for our native *C. virginica*. Concurrently, other researchers around the world are identifying DNA markers for other oyster species, in particular *C. gigas*. The DNA markers will be used to develop a genetic map to locate genes that help oysters resist disease and genes that are involved in determining growth rate and tolerance to various environmental conditions. These DNA markers and the information gained from the genetic map will ultimately be very useful in developing brood stock.

Origin of MSX in Eastern Oyster Documented by VIMS Scientists

The March issue of the Journal of Aquatic Health will feature an article on work done by Dr. Gene Burreson's lab on an oyster pathogen *Haplosporidium nelsoni* which is responsible for the disease known as MSX. Burreson and staff developed DNA diagnostic tools used to show that the parasite found in the Pacific oyster, *Crassostrea gigas*, is also *Haplosporidium nelsoni*. It has been speculated that the parasite occasionally found in *C. gigas* was *H. nelsoni*, but there was no way to prove it until the development of DNA diagnostic tools specific for *H. nelsoni*.

VIMS researchers tested infected Pacific oysters from Korea, Japan, and California with the DNA tools, and all were positive for the parasite. These tests proved conclusively that the parasite in *C. gigas* is *H. nelsoni*. These results also provided strong evidence that *H. nelsoni* was introduced to the eastern oyster, *C. virginica*. It is also likely that the introduction of the parasite involved its host, *C. gigas*. There were many documented importations of *C. gigas* from Louisiana to Maine beginning in the 1930s.

MSX is found in only about 1% of the Pacific oyster populations, however, in Chesapeake Bay eastern oysters, it is commonly found in 30-60% of the oysters sampled in the summer. While the parasite does not cause significant mortality in Pacific oysters, it has caused extensive, continuing mortality of eastern oysters since its first appearance in Chesapeake Bay in 1959.


Dr. Gene Burreson and Nancy Stokes developed DNA diagnostic tools.

It is presumed that the Pacific oyster is the natural host for *H. nelsoni*, where it is relatively benign. When it was introduced to the eastern oyster, a new "naive" host, the parasite's virulence was greatly increased. None of the importations of *C. gigas* to the Atlantic coast resulted in successful establishment of the Pacific oyster, but they did result in the establishment of one of its parasites, *H. nelsoni*, in the native oyster, *C. virginica*, with catastrophic consequences. This work also underscores the potential dangers of improperly introducing exotic marine organisms for aquaculture or resource restoration.

Guess What Really Takes A Blue Crab's Breath Away?

By April Bahen

Sandra Rene' Hypes, a graduate student at Virginia Commonwealth University (VCU) in the Center for Environmental Studies, found that hypoxia work on blue crabs had been completed in large rivers and bays but few studies had addressed low oxygen/high carbon dioxide (hypoxia/hypercapnia) as multiple stress factors in small estuarine creeks. In 1998, Hypes contacted Dr. William Reay of the Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) about conducting blue crab research at Taskinas Creek, a CBNERRVA's site located within York River State Park.

To determine how blue crabs reacted to hypoxic/hypercapnic events in small estuarine environments, Hypes looked at a number of factors including dissolved oxygen (D.O.), pH (as an indirect measure of CO_2), temperature and salinity. Measurements were taken in Taskinas Creek (both upstream and near the mouth of the creek) and at a shallow beach area on the York River, also close to the mouth of Taskinas Creek. In addition to the aquatic measurements, Hypes also determined blue crab abundance in the areas and described blue crab physiological responses in the field and in the laboratory to hypoxia and hypercapnia.

As work progressed Hypes noted that the decrease in oxygen occurred concurrently with a decrease in pH. Therefore, she felt blue crabs were exposed to multiple stressors (D.O. and pH) rather than a single stressor, the decrease in oxygen.

In laboratory experiments, extreme pH levels affected blue crab oxygen uptake. The lowering of pH in the external environment, is hypothesized to create an acidosis within the crab as well. This internal acidosis may cause the hemocyanin in the blood to become less efficient at uptaking oxygen at the gills of the blue crab. Therefore, when there is a high ratio of CO_2 to O_2 in the water, the pH will be lowered and the blue crab oxygen uptake efficiency reduced. Another interesting observation made by in Hypes was that when the pH was high, blue crabs also had trouble uptaking oxygen. Again hemocyanin's ability to release oxygen at the tissues may be affected by a pH increase within the blue crab. Hypes would like to expand her work to look more closely at the relationship between the blue crab's internal pH with the pH of its surroundings.

The correlation between low D.O., increased carbon dioxide (hypercapnia) and low pH has significant implications for coastal managers. This study shows that a pH range of 7.0-7.2 was optimal for blue crabs in terms of respiratory functions.

Within the restoration goals for Living Resources Habitats, there is no mention of simultaneously addressing more than one stressor such as pH in addition to hypoxia. However, the factors causing hypoxia also appear to be accompanied by hypercapnia and low pH, which in turn lead to adverse effects in blue crabs. For more information on this study, please email: cbnerr@vims.edu or call (804) 684-7135.

Blue crabs, like most other animals, have to breathe oxygen to survive and need a specific level of oxygen to perform optimally. They do not breathe oxygen as humans do, but take dissolved oxygen (D.O.) molecules from the water over their gills. The oxygen is delivered to the blood by a protein called **hemocyanin**. There are times, especially in the summer, when the levels of dissolved oxygen in the water can become quite low due to warm temperatures, elevated nutrient inputs, and stratification (freshwater floating over top of denser saltwater). Scientists refer to a period of drastically decreased D.O. as a hypoxic event. In some areas, including the Gulf of Mexico, blue crabs actually come out of the water and onto shore to escape these low oxygen conditions. This is known as a "crab jubilee." In addition to **hypoxia,** high levels of carbon dioxide or **hypercapnia** can also accompany low oxygen. These conditions are found in shallow estuarine waters at night to due to decreased photosynthesis and increased carbon dioxide (CO_2) production. When aquatic animals respire they release CO_2. The CO_2 reacts with the water (H_2O) and as this process continues, hydrogen ions are released which lowers the pH of the water. This phenomena is reversed during the daylight hours, when photosynthesis is the dominant process in the estuary, producing high D.O. levels and low CO_2.

Catch and Release Symposium Tackles Tough Salt Water Fishing Issues

By Jon Lucy

Over 130 experienced fishery researchers, managers, and outdoor media leaders met in December to hear new study results and debate the complexities of catch and release fishing issues in coastal waters. Organized by the Sea Grant Marine Advisory Program, the National Symposium on Catch and Release in Marine Recreational Fisheries attracted participants from nearly every U.S. coastal state as well as Canada, Norway, Bermuda, and Australia.

The meeting was organized to bring together those most experienced with catch and release research and fishery issues, providing a forum in which they could closely examine and critique catch and release research, management issues, and marine angler education-outreach efforts. Out of this process came a consensus whereby the most critical issues and concerns were defined and ranked, along with what actions would provide solutions, better information and data, or new strategies for the future. The most important concept agreed upon was, "Catch and release fishing, especially in salt water, is not a single issue, but a highly varied mixture of often complex issues."

Many factors affect what "catch and release fishing" actually means to individuals and groups of anglers. For example: What specific fishery are you referring to? What fishing situation and regulations apply? What shape is the given fish stock in; i.e., if in good shape, interest and motivation for catch and release may not be at all as great as if the fish stock were in "trouble?" Who typically catches most of the fish in question; i.e., commercial or recreational fishers? Who is doing the fishing; e.g., native Americans or other ethnic groups (individuals of African American, Hispanic, South-

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Photo: Jon Lucy

Networked computers enabled participants at symposium to interact more efficiently.

1999 Chef's Symposium Another Smashing Success

By Sally Mills

Once a year, the auditorium in Watermen's Hall becomes a sea of towering white hats, and the air fills with the delightful aromas of such designer dishes as "Seared Scallops in Sweet Dumpling Squash" and "Candy Striped Oyster Ravioli with Crabmeat and Tomato-Basil Broth." It's the annual Chef's Seafood Symposium, co-sponsored by the Virginia Chefs Association and the Sea Grant Marine Advisory Program at VIMS. It is attended by members of the seafood industry, restauranteurs, executive and student chefs, and wanna-be chefs lingering in the lobby. This year, the event was held on October 11th and the audience included a new row of faces: 43 students from Chef Mark Kimmel's class at the Chesterfield County Technical Center. The students came to observe professionals in their field of study and, in exchange, prepared a delicious lunch for attendees, featuring clam chowder and seafood gumbo.

Chef Rennie Parziale demonstrates cooking techniques for a new scallop product.

According to symposium organizer, Vicki Clark, "The chef's symposium is a unique event that brings together fisheries scientists, professional chefs, culinary students, and people in the seafood business to share current information that relates to seafood issues. Seafood supply, quality, and safety are among the issues discussed, and seafood preparation is the focal point for participating chefs."

This year's program included discussions by VIMS scientists about ongoing research, including a presentation about restructured scallops given by Bob Fisher, and an overview of the Rapana whelk investigation given by Roger Mann. After each technical session, participants were treated to cooking demonstrations featuring the seafood highlighted by renowned chefs from the region: Pastry Chef Annie Hubbard from Hondo's Restaurant, Executive Sous Chef Stephen Perkins from The Founders Inn, Chef-Owner C. Meredith Nicolls, Jr. of the Café Rosso, and Certified Master Chef Rudy Speckamp of Rudy's 2900 in Finksburg, Maryland.

Mike Hutt from the Virginia Marine Products Board gave a brief overview of that organization's mission and emphasized that the Virginia seafood industry maintains extremely high standards of quality control.

A presentation by consultant Arthur Shavit was made possible by another partner in this event, the Wine Marketing Office of the Virginia Department of Agriculture and Consumer Services. Mr. Shavit explained how Virginia wines can be used to bring out complementary or contrasting flavors in seafood entrees.

The annual chef's symposium typifies what Virginia Sea Grant does so well: bring together different players within an industry niche for cross-fertilization of ideas and information exchange. The day was capped off with a reception and vendor's exhibit in which participants could conduct their own taste-testing experiments and speak to seafood representatives on a one-to-one basis.

Sea Grant Virginia

Oyster Reef Habitat Restoration Book now Available

Oyster Reef Habitat Restoration:
A Synopsis and Synthesis of Approaches
Editors: Mark W. Luckenbach, Roger Mann and James A. Wesson

This recently published volume brings together contributions from fisheries managers and research scientists in an attempt to develop a common information base and a convergence of objectives and approaches towards oyster fisheries enhancement and reef habitat restoration. A growing body of evidence indicates that oysters and the habitats that they generate provide important ecosystem services and that the decline in oyster stocks have had significant ecological consequences beyond the loss of the oyster fishery. From their role in affecting water column dynamics to their support of biodiversity as ecosystem engineers, oysters appear to qualify as keystone species in many estuarine environments. The 24 chapters in the book review the historical distribution and morphology of unexploited oyster reefs, current fisheries enhancement efforts, some of the ecological benefits as well as ideas for new approaches towards restoring reefs and sustaining their associated fisheries. The book can be purchased through the VIMS Publications Center (804) 684-7011. Softbound and hardbound editions are available.

Teaching Marsh Update

With support from the Garden Club of Gloucester and private donors, construction on the VIMS teaching marsh has been completed. "The marsh has been constructed to provide both freshwater habitat and a tidal saltwater environment," explains Dr. Carl Hershner, Director, Center for Coastal Resources Management at VIMS. Examples of all the plants identified in the "Virginia Tidal Wetlands Act" have been planted in the two areas. This area will become an integral part of the Wetlands Education program to teach Wetlands Board members, agency personnel and the public about various plants. A variety of trees, shrubs and flowering plants will be labeled and used as a botanical reference site. "Our objective," says Hershner, "is to obtain and plant as many native species as possible to facilitate plant identification courses."

Approximately one-half acre of old landfill was excavated and vegetated with over 10,000 individual grasses and shrubs. "The long range plan is to develop additional teaching and demonstration opportunities that are found in and around the working research center. Our goal is to have an outstanding, comprehensive example of an intensive, environmentally sensitive riparian area," says Hershner.

More than 50 people attended a lecture by noted author Angela Ovary and a tour of the teaching marsh sponsored by the Garden Club of Gloucester.

Lifelong Learning: CBNERRVA Finishes 5th Year of Elderhostel

By Dr. David Niebuhr

Providing opportunities for retired adults to learn about unique and interesting topics, Elderhostel serves thousands of eager learners each year. CBNERRVA education coordinator, David Niebuhr, is finishing his 5th year as an Elderhostel instructor, specializing in teaching participants about the Chesapeake Bay estuary. CBNERRVA has provided over 35 classes for Elderhostel programs from William and Mary, Virginia Commonwealth University and Virginia Tech where more than 300 senior citizens have learned about the dynamics, fisheries and environmental issues affecting the Bay and its tributaries.

"Older learners are no different than the younger ones . . . most of them think marine science is all about dolphins and sea turtles. When I begin with discussions on estuarine circulation– it opens new doors for most of them," quips Niebuhr, with a grin. Yet, there are some differences between folks from previous generations and younger folks when it comes to "environmental issues."

Beach seining during Elderhostel program.

Many participants start the class prepared to "disagree" about environmental issues, taking a defensive stance against anything that limits property or corporate rights. "I make it clear to them that I'm a scientist," he adds. "I give them the facts and it's their job to make informed decisions about environmental trade-offs in the American lifestyle. This strategy helps some folks listen to the issues with an open mind, and most participants, even the anti-environmentalist are discussing the pros and cons of various environmental and fisheries protection measures by the end of class," Niebuhr explains.

There's one other difference in teaching Elderhostel classes over those of traditional students – these participants are paying to learn *and* to have fun. CBNERRVA classes are designed to emphasize the interesting facts while including the other information that completes the "story" of the Chesapeake Bay ecosystem and teaches participants information to help them make informed environmental decisions. This balance of education and entertainment helps to keep the non-scientist participants involved from the beginning of the course straight through to the final bell making CBNERRVA classes successful and sought-after. Assistant education coordinator, April Bahen, receives "high marks" on participant evaluations for her use of real oyster floats and crab pots in her lecture and for her energy and enthusiasm (these are important elements of successful Elderhostel programs) and David Niebuhr has even been known to sing a song or two to involve students in the presentation. In fact, during Hurricane Floyd, when the hotel flooded and the electricity went out during Niebuhr's lecture, he kept the folks in class and gave an impromptu lecture on the maritime history and songs of the lower Chesapeake Bay region.

Catch and Release Symposium Tackles Tough Salt Water Fishing Issues

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east Asian, East Asian, Mid-East backgrounds, etc.)?

The highest ranking issues or concerns were determined during the final days of the symposium using a team-facilitated approach aided by participants interacting anonymously and efficiently through a 50 laptop computer network. Results were outlined in a Research-Fisheries Management Action Agenda and an Education-Outreach Action Agenda.

Of the top 16 ranked Research-Management priorities, the first three were: (1) More hook-release research needs doing (especially using new telemetry tagging techniques, given that mortalities are being documented to be strongly species and fishing-water conditions specific); (2) Increased attention by fishery scientists, managers, writers, and educators to better convey factual information, i.e., "the truth" about catch and release mortality to the public and anglers (e.g., pros and cons of catch-release fishing in specific fisheries and under variable fishing conditions, etc.); and (3) Need for more research on long term effects of catch-release fishing on marine fish species and their populations.

Similarly, 21 top ranked needs were agreed upon under the Education-Outreach Action Agenda, indicating the difficulty and complexity of marine fisheries catch-release concerns. The top three issues were: (1) Develop an overall media/communication strategy for better addressing catch and release fishing "information and education" needs; (2) Form angler/industry/government agencies outreach-education partnerships (to reduce redundancy and improve the accuracy and effectiveness of educational and outreach programming, ways of packaging and getting the best, most practical information into the hands of anglers); and (3) Better define the varied elements, concerns, and problems associated with the complex issues comprising marine anglers actual practice and acceptance of an effective catch and release fishing ethic which will positively impact salt water recreational fisheries.

The wide range of interest in catch and release issues is reflected by the various sponsors including: the National Sea Grant Office, National Marine Fisheries Service (NMFS), U. S. Fish and Wildlife Service, Atlantic States Marine Fisheries Commission (ASMFC), Virginia Marine Resources Commission (through Recreational Fishing Development Funds), The Billfish Foundation, American Sportfishing Association, American Fishing Tackle Company (AFTCO), Federation of Fly-Fishers, Eagle Claw Fishing Tackle, TTI True Turn & Daiichi Hooks, Virginia Beach's IGFA Striped Bass World Championship fishing tournament, Chesapeake Bay Foundation, Coastal Conservation Association-Virginia, and others.

More detailed information on the symposium is available on the VIMS Web site: www.vims.edu/adv/catch/release. The site includes abstracts of presentations and posters, the complete listing of Research and Education-Outreach Action Agenda items, and how to participate, via a special Web listserve, in a continuing dialogue on the varied issues debated at the meeting.

A mailing list is also being developed for those individuals interested in being notified of the availability of an angler-oriented symposium "summary publication," to be approximately 10-12 pages in length and available by late spring. Also, persons may be placed on a separate mailing list for announcements concerning ordering the technical Proceedings of the Catch and Release Symposium to be available in the fall.

For additional information, contact: Ms. Barbara Kriete, Sea Grant Publications, VIMS, Gloucester Point, VA 23062, or (804) 684-7170; FAX 804-684-7161; email: bdk@vims.edu.

Sea Grant Virginia

New Faces in Virginia Sea Grant Marine Advisory Services

Sally Mills has joined the Virginia Sea Grant Marine Advisory Program as communicator and public relations coordinator. Sally has a masters degree in professional writing from Towson State University in Maryland and has a long history of working in the areas of natural resource conservation and protection. Most recently, she operated a desktop publishing business and concentrated her efforts on writing and designing publications about environmental topics for state agencies and grassroots organizations. Prior to coming to VIMS, Sally crossed paths with many in this community through her work with the Mattaponi and Pamunkey Rivers Association. Before moving to Virginia in 1990, Sally lived in Baltimore, Maryland, where she worked for the Alliance for the Chesapeake Bay.

Sally Mills

In her new assignment, Sally will produce the quarterly *Virginia Marine Resource Bulletin* and looks forward to working with scientists and educators in the Marine Advisory Program on a variety of outreach projects. You can reach Sally at 804-684-7167, or by e-mail to, mills@vims.edu.

Tom Murray has recently joined Virginia Sea Grant Marine Advisory Services as a marine business specialist. Tom has practiced applied natural resource economic analysis for the past 20 years and has broad experience in economic development, marine industry economics, teaching, and research. His work has spanned financial feasibility analysis and forecasting, to marine industry infrastructure development, to economic impact analysis.

Tom Murray

After conducting economic analysis for the South Carolina Wildlife and Marine Resources Department, Tom was employed as a resource economist at VIMS during 1980-1981 and subsequently served as a Senior Loan Officer and Aquatic Specialist with the Farm Credit System in the Southeast. He has held academic appointments at the University of Florida and, most recently, at the University of South Florida and the Georgia State University School of Business. During the period 1985-1991, he was Executive Director of the Gulf and South Atlantic Fisheries Foundation.

In his new assignment, Tom will focus on the economic analysis of Virginia's marine industries and fisheries as well as the evaluation of coastal development alternatives.

The VIMS Marine Advisory Program would like to announce the addition of a Marina Technical Advisory Specialist to their staff. Mr. Harrison Bresee, a former Florida Sea Grant Marine Extension agent from Miami, Florida has taken the position and will serve as VIMS and Virginia Sea Grant's primary contact for marina operators.

Harrison Bresee

This position was created by Virginia Sea Grant to provide information and technical assistance on management issues, regulatory compliance issues, and economic viability to current and prospective marina operators in the state of Virginia. Mr. Bresee plans to set up a client-based advisory committee with the local marina owners and operators to establish a local communications network with the marina groups.

Mr. Bresee holds a bachelor's degree from the Virginia Military Institute and a master's degree in Zoology from North Carolina State University. While a graduate student in North Carolina, Mr. Bresee worked with the "Rake your Own Clam Farm" in Hatteras, North Carolina and as a post graduate he worked with the North Carolina Fisheries Resource Grant.

VIMS Shellfish Culture Industry Meeting

"Status of Clam Culture in the United States"
Saturday, February 19, 2000
9:30am - 4:00pm
The Trawler Restaurant
Exmore, Virginia

This Meeting is presented in cooperation with the Virginia Shellfish Growers Association and the Virginia Sea Grant Marine Advisory Program.

The meeting will focus on clam culture, nursery and grow-out technology from around the coasts. Representatives from clam producing states will be invited to give presentations on the status of the clam culture industry within their state, including such topics as current levels of production, numbers of producers, most prevalent nursery/grow-out technology and state or regional issues impacting clam culture. Speakers are expected from all east coast states with major hard clam culture industries, as well as a representative from the west coast clam culture industry. To the best extent possible, actual industry members will be giving the presentations.

Here is a great opportunity to hear from industry leaders from around the country and to learn about the clam culture industry first-hand.

Questions? Contact Mike Oesterling at 804-684-7165, or email mike@vims.edu or Francis O'Beirn at 757-787-5873, or email francis@vims.edu.

Sea Grant Virginia

Bridge Web Site Recognized for Excellence

The Bridge, a web-based teacher resource site developed and maintained by VIMS marine educators, recently received the Argus Clearinghouse Digital Librarian's Award. Began two years ago, the Bridge provides a cyber-clearing house of information especially for teachers who are looking for current information on marine science. The site has had about 87,600 visits from teachers worldwide.

Perhaps the most outstanding feature of the site is that it is not static; the Bridge staff continuously update the site to be certain all information and web links are current. The site is supported by the National Oceanographic Partnership Program and co-sponsored by the National Marine Educators Association and Sea Grant. Visit the Bridge at http://www.vims.edu/bridge/.

Sea Grant Virginia

Mini-School Series

VIMS and the Mariners' Museum held the second Mini-School series in the fall of 1999.

The series "Challenges on the Horizon" focused on issues directly related to Virginia's coastal environment. More than 85 participants attended the series that concluded with a tour of laboratories at VIMS. The series will be presented at the VIMS Eastern Shore Laboratory beginning in February. A second session on Environmentally Sensitive Landscaping will be presented at VIMS in April. This course will be a follow-up to the first landscaping series offered in the spring of 1999. For more information, please call (804)684-7011 or (804)684-7101 or email: programs@vims.edu.

Future Alterations to the Yangzi Estuary

By Dr. L. Donelson Wright

The Yangzi (formerly Yangtze) River is the largest river in China and the third largest in the world (after Amazon and Ganges-Brahmaputra). Its drainage basin covers 1.8 million square kilometers (1/5 the area of China). The water and sediment discharge of the Yangzi passes through a large funnel shaped estuary and enters the shallow East China Sea (Donghai) a short distance to the east of Shanghai, a city of 13 million people. The nature and fate of the material debouched by the Yangzi affect Asia's coastal ocean in major ways. The sediment itself has provided the material that composes the Yangzi Delta (which supports and surrounds Shanghai). The water provides buoyancy that influences coastal circulation, nutrients that affect biological productivity and pollutants and pathogens that can impact the health of marine organisms. Understanding the processes that control the fluxes and fates of the materials that issue from the Yangzi and mix with coastal waters is essential to the proper management of this vast, highly complex and economically important coastal marine system.

Two huge engineering projects that will greatly impact the regime of the Yangzi Estuary and the East China Sea are now well underway. One of these involves improving maritime shipping access to Shanghai by doubling the depth of the estuarine channels and "training" or stabilizing the main shipping channel by constructing concrete jetties at the river mouth. When completed, the jetties will extend 50 km in the East China Sea, thereby altering coastal circulation. The second project is even more ambitious: the construction of the "Three Gorges Dam" in the middle reaches of the river. When stage 1 of this project is completed in 2004, the water level behind the dam will rise by 135 meters and the downstream flow of water and sediment will be reduced. Together, these two projects have the potential for reducing the supply of land-building sediment, altering the coastal transport regime and allowing the penetration of salt water farther upstream. However, because the numerous interactions are so complex, it is not yet possible to foresee the ultimate outcomes.

Construction on Three Gorges Dam.

VIMS scientists are now involved in a serious dialogue with scientists at East China Normal University and elsewhere in China about a collaborative study of the sediment transport processes that operate in the East China Sea off the mouth of the Yangzi. Among other things, including numerical modeling, this will involve emplacement of sophisticated moored instrument systems that use acoustic techniques to record currents and sediment fluxes at multiple levels within the water columns. VIMS scientists have used such tools extensively in the Chesapeake Bay and in numerous other environments around the world. Because the signal of mud transport in this environment is expected to be very strong, we hope to gain new universal understandings that can be applied to solve some of our own problems back here at home.

This area of the gorge will be flooded up to 300 feet when the project is complete.

This map shows the funnel-shaped Yangzi Estuary and its junction with the shallow coastal ocean of the East China Sea

Calendar of Events

— February 2000 —

2: Mini-School of Marine Science: Eastern Shore
5: Charter Day: College of William and Mary
17, 19: Air and Space Museum, Hampton: VIMS Exhibit
19: Shellfish Culture Meeting: VIMS
26: Blue Crab Bowl: Old Dominion University

— March 2000 —

1: Mini-School of Marine Science: Eastern Shore
3: Mid-Atlantic Marine Educators Association: VIMS
3 National Estuarine Research Reserve Research Coordinators Meeting: VIMS
3,4,5: Bay Days: Science Museum of Virginia, Richmond

— April 2000 —

3: Seafood Seminar: VIMS
5: Mini-School of Marine Science: Eastern Shore
5, 12, 19: Environmentally Sensitive Landscaping Mini-School of Marine Science: VIMS
11: Seafood Seminar: VIMS
15-17: National Ocean Science Bowl: Washington DC
17: Seafood Seminar: VIMS
22: Open House: VIMS Gloucester Point Campus, 11 am – 4 pm
29: Garden Week: Virginia Garden Club: VIMS Teaching Marsh/ BayScapes Tour

Visit our website at: www.vims.edu

Second Annual VIMS Auction

In spite of the cold and threat of snow, more than 150 people turned out for the second annual VIMS Auction on January 22. Auction items which included vacation packages, catered dinners, limited edition prints, and original art were provided by more than 115 local merchants, individuals, as well as VIMS faculty and staff, The event was chaired by Mrs. Carrie Garland with support from the VIMS Docent Guild, and VIMS employees Mrs. Christine Evans, Judy Cahill, Nita Walker and Rita Crockett. Jazz pianist Eric Lyttle provided live entertainment during the silent auction. A silent auction preceded the live auction, which was led by Mr. Coby Owens. The auction raised approximately $15,000.00 that will be used to further develop exhibits and programs for the Visitor Center. Proceeds from the first auction supported the repair of aquarium tanks and exhibit materials including a video kiosk and a computer kiosk for the Visitor Center.

Folk art sculpture, "Devil Fish," was one of the many items at the VIMS auction.

Blue Crab Bowl Only 1 Month Away!

By Sally Mills

Calibrate your stop watches and brush up on your addition! It's time to gear up for the annual Blue Crab Bowl, scheduled for February 26, 2000 at Old Dominion University. This yearly competition will draw 20 teams from high schools throughout Virginia, who spend the day outwitting each other on any number of questions related to marine science. Several area schools are competing this year including teams from Exmore, Virginia Beach, Norfolk, Hampton, Portsmouth, Tappahannock, Yorktown and Isle of Wight.

The competition is held in a round-robin and double-elimination format. Regional winners go on to Washington, D.C., for a national competition in which the ultimate winners receive assorted prizes, including a trip to Monterey Bay, California!

Enthusiastic volunteers have already met with Susan Haynes, Blue Crab Bowl Coordinator at VIMS, to discuss general logistics and ideas for improving the annual event. Volunteers are still needed to keep time, act as a rules judge, and act as a room runner between the competition room and "Crab Pot Central." If you are on staff at VIMS and can donate your time and expertise to this special event, contact Susan at shaynes@vims.edu, or by calling (804) 684-7735.

Shoreline Management In Chesapeake Bay

Publication Date: October 1999

Authors: C. Scott Hardaway, Jr. and Robert J. Byrne

The Chesapeake Bay with its extensive shoreline is a dynamic place, where change is constant but not always consistent. Years can go by with little impact to a shoreline, but a major storm or change in land-use management can suddenly make a huge difference.

The need for sound shoreline management becomes critical when human occupation and investments are threatened. This book addresses shoreline management from a comprehensive standpoint. It was written for property owners, land-use planners, local and state officials, resource managers, watermen, marina owners, and all others who are concerned with and involved in shoreline management along the Chesapeake Bay. It not only takes into account shoreline erosion, but also explains the basic physical parameters behind shoreline change. Most important, the book presents practical solutions to management problems, with an eye toward cost-effectiveness, sound construction, coastal hazards, property loss, habitat preservation, and water quality.

Shoreline Management In Chesapeake Bay is printed in full color and filled with photographs, schematic diagrams, and other useful illustrations that make it extremely user friendly. The 54-page book is available for $10.00; call Barbara Kriete at (804) 684-7170.

Sea Grant Virginia