William & Mary VIMS
Virginia Institute of Marine Science
School of Marine Science

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The Crest

Current Issues in Coastal Ocean and Estuarine Science

New Research Aquarium System

How do scientists study the behavior of marine organisms that live inside sponges or test new hypotheses on metabolism? For Drs. Emmett Duffy and Mark Patterson, Dept. of Biological Sciences, an aquarium is a very good place to start. In collaboration with VIMS Adjunct Professor, Dr. Walter Adey of the Smithsonian Institution, Duffy and Patterson have established a 210-gallon, coral-reef research microcosm system. Adey is the world's leading authority on the design and science of controlled marine microcosms. The technology and principles he pioneered are now applied in a wide variety of scientific and commercial enterprises including the 500,000 gallon Great Barrier Reef Aquarium in Townsville, Australia. The reef system at VIMS will be used for research in several areas related to physiology, ecology and behavior of coral reef organisms.

Duffy's plans for the system focus on understanding the ecology and behavior of the curious sponge-dwelling shrimp, which he discovered several years ago. The shrimp, *Synalpheus regalis*, live in social colonies unique among marine animals but strikingly similar to those of social insects such as ants and honeybees (see Duffy, J.E. 1996. *Nature* 381:512-514). Because of their small size and retiring habits, these shrimp cannot be observed under natural conditions in the field. The reef aquarium offers a unique opportunity for extended long-term observation and experimentation under conditions approximating those found in the organism's natural habitat. The researchers will attempt to use medical ultrasound techniques to image the shrimp as they go about their hidden lives inside the sponges.

Patterson's research will use the microcosm to investigate how water motion affects the metabolism (photosynthesis, respiration, and calcification) of corals and their allies. In 1992, Patterson published a paper in *Science* (vol. 255: 1421-1423) that proposed a theory for how the geometric shape of aquatic organisms like corals, sponges, sea anemones, and algae should affect their metabolism. Organism shape affects the pattern of water motion, which in turn affects the thickness of a region of reduced flow found near every surface in nature, called the boundary layer. Thinner boundary layers result in higher metabolic rates for these simple creatures, because dissolved substances like carbon dioxide, oxygen, and other nutrients dissolved in seawater do not need to "fight" their way in (or out) of the organism by molecular diffusion over a long distance. Patterson coined the phrase "flow-modulated metabolism" to describe how the speed of the water, interacting with the shape of the organism, can directly regulate these basic life processes. While the theory has been supported by studies in a

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Dr. Mark Patterson prepares to conduct studies in the new coral reef microcosm system at VIMS.

Finfish Aquaculture at VIMS

This summer VIMS and Virginia Sea Grant will begin to work on culturing and raising several species of marine fishes in their new aquaculture facility on the Gloucester Point campus.

The Marine Advisory Program at VIMS has been raising flounder and cobia for two years, and this year plans to initiate a spawning program that includes black sea bass and tautog, as well as cobia.

"The long term goal of the spawning program is to reach a point where the culture facility is completely self-sufficient, and no longer dependant on wild fish for spawning stock," says Mike Oesterling, Commercial Fisheries Specialist with the Marine Advisory Program at VIMS, "Right now we are raising tautog larvae that were spawned this spring, and we have just added 40-50 black sea bass for brood stock. We hope to add fifteen cobia to the three we already have."

The newly constructed greenhouse is a 2,000 square foot structure with five large fiberglass tanks that look like giant hot tubs. The building temperature is regulated with a completely mechanized evaporative cooling system that serves as air conditioning without the use of a condenser or freon. Its simple design is dependant on only enough electricity to run a water pump, and a few large fans that are dispersed throughout the greenhouse.

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Virginia Creates State Research Reserve System

During this year's General Assembly session, House Bill -2401 was passed and signed into law by Governor Gilmore. Submitted by chief patron Delegate Harvey Morgan with co-patrons, Delegates Bob Bloxom, Marvin Cox, Jo Ann Davis and Tayloe Murphy, the law established a Virginia Estuarine and Coastal Research Reserve System. The law was passed "for the purpose of establishing a system of protected sites representative of the Commonwealth's estuarine and coastal lands in which research and long-term monitoring will be conducted in support of the Commonwealth's coastal resource management efforts."

The law requires the Virginia Institute of Marine Science (VIMS) to establish and administer the System and to coordinate this system, to the extent feasible, with the National Estuarine Research Reserve System. The companion state system can be more closely tailored to Virginia's research needs.

This new law, which went into effect on July 1, 1999, allows VIMS to accept gifts of land or easements; to enter into agreements with federal, state or local agencies; or to enter into agreements with private property owners to include appropriate areas within the system. The new system can include sites anywhere within the region defined as Tidewater Virginia, which includes all coastal counties and cities up to the fall line (Richmond, Fredricksburg, and Arlington)

The law also calls for research and long-term monitoring in support of the Commonwealth's coastal resource management efforts and requires VIMS to consult and seek the advice of those agencies responsible for administering the Virginia Coastal Program. It also calls for the dedication of system sites into the Commonwealth's natural areas preserve system.

Sites currently being considered are Oak Island in the Guinea Marshes, Fishbone Island in Chesapeake Bay north of Tangier, and a wetland in the Pagan River. These areas were previously donated to VIMS for research.

As the Virginia Estuarine and Coastal Research Reserve takes shape, research and monitoring activities at the new sites should begin to allow the Commonwealth's coastal scientists and managers to track long-term resource and habitat responses to watershed activities throughout Virginia's estuarine and coastal areas.

CBNERRVA relies on volunteers to assist with water quality monitoring. Volunteer groups will be used at the new Virginia system sites also.

VIMS To Administer Student Scholarship for The Garden Club of America

The Garden Club of America (GCA) recently selected VIMS to administer a new student scholarship in Coastal Wetlands Studies. The GCA created the annual scholarship award to encourage sound scientific knowledge of coastal wetlands. Students are required to submit wetlands research proposals to be considered for the $5,000.00 annual scholarship. Their work may be conducted at any leading educational institution within the U.S. that specializes in Wetlands studies. "This represents a significant commitment from the Garden Club of America and an excellent opportunity for students interested in wetlands science," said Dr. Carl Hershner, Head of the Center for Coastal Resources Management at VIMS. The first award will be presented in the spring of 2000.

Finfish Aquaculture at VIMS continued from page 1

A 7,500 gallon tank will hold the broodstock cobia, while a 5,800 gallon tank has been built to hold the black sea bass brood stock. After the fish have been conditioned for breeding, they will be placed in the smaller 1,200 gallon tanks where they will be induced to spawn. Eventually, these 1,200 gallon tanks will hold the juveniles throughout the entire grow-out phase.

"It hasn't been documented, but I expect the grow-out time for the black sea bass to be somewhere in the neighborhood of 15-18 months," says Oesterling, "and these fish are going to be in the 1 to 1½ pound range. We are hoping that the aquacultured sea bass will be well suited for the Asian live fish market, as well as domestic specialty markets."

Tanks in the new finfish aquaculture facility.

Oesterling went on to explain that the live fish market is important to the future of the mariculture industry (especially finfish) because the cost of holding and feeding these fish for over a year can be expensive, and a new aquaculture business will only be profitable if the sea bass receives the highest market price possible. Hopefully, by January 2001, we will see if these fish are ready to make the trip to the market.

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Chesapeake Bay National Estuarine Research Reserve in Virginia

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Pollution-Laden Sediments In Constant Flux

James Schultz

Sometimes it's better to let sleeping sediments lie. At least, that may be the case in the heavily trafficked Elizabeth River. The Elizabeth, site of continuous maritime activity for the last 300 years, has been especially vulnerable to accidental release of fossil fuels and petroleum byproducts, including the wood preservative creosote.

Scientists had once hoped that the flow of toxins and heavy metals into the river would be interred within bottom-hugging silts and muds. According to ongoing VIMS research, however, contaminants are regularly stirred up in well traveled channels. Pollutants are thus able to infiltrate the water column and affect marine and plant life. Humans are also at risk if they consume tainted organisms.

Sediment sampling for contaminant transport on the Elizabeth River.

"One of the main things we've discovered is that in channel areas the sediment continues to be well mixed," says Dr. Rebecca Dickhut, VIMS Associate Professor of Marine Science in the Dept. of Physical Sciences. "That's not surprising because of all the large transport activity and dredging. It's a very busy harbor."

"It would be nice if the sediments laid down neatly and cleanly. The problem is that estuaries are very dynamic. Because both the sediments and the contaminants are forced into the water column by ship traffic and biological activity, animal and plant exposure to sediments is long and continuous."

Dickhut is one of a team of VIMS scientists investigating the ways contaminant-containing sediments move within the Elizabeth River system. The project is part of the Chesapeake Bay Environmental Effects Studies Toxic Research Program funded by the National Oceanic and Atmospheric Administration (NOAA).

Within the river are hot spots, regions where pollutants are concentrated. Of particular concern is the extent and accumulation of polycyclic aromatic hydrocarbons, or PAHs. Thought to be highly carcinogenic, PAHs result from the incomplete combustion of fossil fuels and are also a component of coal and petroleum products.

Dickhut and her colleagues have recently focused on an area known as Skuffletown Creek, an offshoot of the Southern Branch of the Elizabeth River. The U.S. Army Corps of Engineers intends to environmentally restore, or bioremediate, this area. Project scientists have conducted 24-hour baseline sampling over tidal cycles and at different times of year to chart current speeds and sediment movement into the water column.

"The idea is to try to determine what processes move these contaminant particles around in the estuaries," Dickhut explains. "A lot of the contaminants are particle-reactive—they attach themselves to sediments. If the Corps dredges out Skuffletown, they're naturally concerned that the creek will just fill in again with contaminated sediments from the main river."

A VIMS team is conducting a similar investigation on the York River. Supported by the Office of Naval Research, the York River study began in January 1999 and is slated to run for three years. Through this work, Dickhut and her team hope to gain a more precise understanding of contaminant transport and sediment mixing in the upper three feet of sediment.

Complete results from both studies will be made available once a detailed chemical analysis of all collected data is conducted. In the case of the Elizabeth River project, initial findings should be announced by mid-2000. You may find more information on this work on the VIMS web site at: **www.vims.edu/physical/ongoing projects/Elizabeth River**

Reserve Educator Leads US-China Environmental Education Workshop

Chesapeake Bay National Estuarine Research Reserve (CBNERRVA) education coordinator, Dr. David Niebuhr recently returned from a trip to Hainan, China where he helped to lead an environmental education training workshop. The purpose of the workshop was to provide training for Chinese coastal and estuarine resource managers in integrated coastal management, specifically planning for public education, outreach and ecotourism. The workshop was part of continuing efforts to strengthen working relationships among US and Chinese marine reserve managers, especially among the three "partner reserves" established under the US-China Science and Technology Agreement. CBNERR is a partner with the Tianjin Paleocoastal and Estuarine Wetland Reserve in Tianjin, China.

The decision to hold a Marine Reserve Management Workshop grew out of the first meeting the Integrated Coastal Management (ICM) Panel, held in Beijing in September 1998. The ICM Panel includes six-member teams from the US and China, consisting of coastal and marine management experts from both the national and provincial (state) levels. A training program for selected Chinese coastal specialists and marine protected area managers in the principles of integrated coastal management was identified as a high priority for the ICM Panel. Subsequent discussions further identified ecotourism and education as concepts of particular interest to the Chinese side of the panel.

Dr. Niebuhr was selected to lead the education portion of this project by the National Ocean Service (NOS) of the National Oceanic and Atmospheric Administration (NOAA).

The workshop was held in Hainan Province which includes Hainan Island (China's second largest island) and the South China Sea islands. The marine waters of the province stretch about 1,800 km north and south and over 900 km east and west. Hainan is being developed as a tropical beach resort and tourism area, and is locally nicknamed "Hawaii of the East." Marine resource management officials are concerned about protecting the healthy coral reef resources while increasing the economic prospects for the area.

The ICM agreement encourages our two countries to share, teach and learn strategies for effective coastal management, through workshops, exchanges and joint projects. Dr. Zhang Jinguo, senior engineer, Tianjin Oceanic Administration, which is responsible for the Tianjin Paleocoastal and Estuarine Wetland Reserve, spent the month of June at VIMS with the staff of CBNERRVA.

Craig Smith Scholarship Endowment

The Craig L. Smith Memorial Educational Scholarship Endowment which was formally established in March 1999 has reached $11,800.00 toward a goal of $25,000. The scholarship will be awarded to provide assistance for an academically distinguished graduate student with demonstrated financial need. For more information, contact the Office of Development at (804) 684-7099.

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limited number of invertebrate species, and algae, Patterson will conduct more extensive experiments using plants and animals maintained in the microcosm. Patterson also plans to collaborate with a French scientist, Dr. Eric Basillais, a biological engineer who has extended Patterson's theory by incorporating the theory of fractal geometry to an analysis of the flow-modulated metabolism.

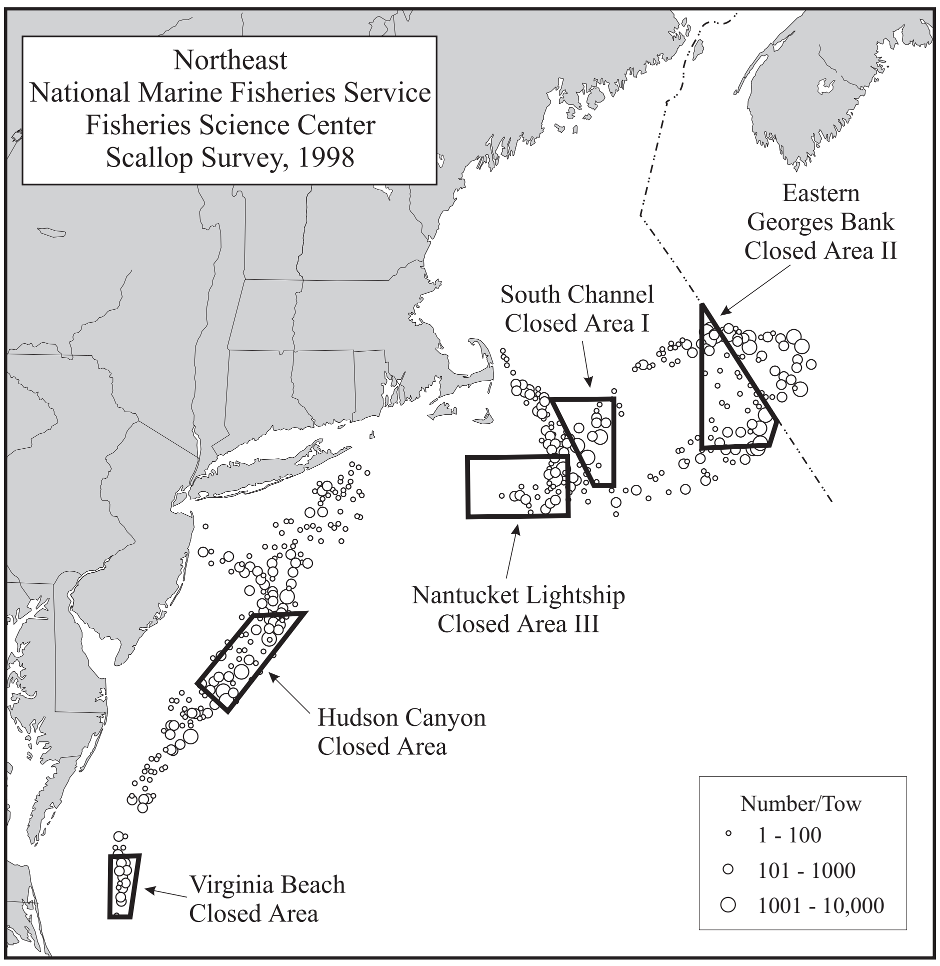
Ph.D. students Tripp Macdonald and Ruben Rios are also involved in the project, which will contribute to their dissertation research.

Survey of Mid-Atlantic Sea Scallop Closed Areas Set for Summer 1999

David Rudders

In 1998, the New England Fishery Management Council approved the closure of two areas off the mid-Atlantic coast to the harvest of sea scallops. The two areas totaling roughly 1,900 square miles are located (1) south of Hudson Canyon off the New Jersey/Delaware coast, and (2) off of Virginia Beach, VA. These areas were selected due to the high concentration of juvenile scallops observed by the annual sea scallop survey conducted by the National Marine Fisheries Service (NMFS).

Fishery managers and scientists are currently concerned with the small size at which sea scallops are being harvested. The closure of the mid-Atlantic areas addresses this issue by protecting smaller scallops from harvest until they grow to a larger size. By delaying the capture of scallops in the closed areas, gains in both yield and reproductive potential can be realized.



The detection of large numbers of juvenile scallops can provide the basis for an area closure, yet long-term continued monitoring of the resource is necessary in order to make correct decisions regarding the timing of re-opening. Periodic surveys to assess the status of the resource within the closed areas provides information regarding stock biomass and allows managers to establish catch limits once the areas are slated to re-open.

In the spirit of the experimental fishery that took place on Georges Bank during the summer of 1998, the mid-Atlantic survey will again feature a cooperative effort between the sea scallop industry, academia, and the federal government. The survey is being led by VIMS Professor Dr. William DuPaul in close conjunction with the NMFS Northeast Fisheries Science Center in Woods Hole, MA.

The major goal of the project is to conduct a systematic survey of the sea scallop resource in the closed areas using two commercial sea scallop dredge vessels. The survey will consist of the sampling of roughly 400 pre-determined stations with unmodified commercial sea scallop dredges to quantify scallop distribution and size composition. The bycatch of finfish and non-target invertebrate species will also be quantified. Comparisons of performances between the commercial scallop dredge relative to the NMFS survey dredge will be made. The NMFS survey vessel, R/V *Albatross*, will conduct its annual survey consisting of stations within the closed areas in the same time frame as the commercial survey so a comparison can be made. Additional experiments attempting to determine dredge efficiency will also be conducted. Understanding dredge efficiency is vital in order to correctly estimate scallop biomass in the closed area. In addition, the environmental impacts of scallop dredges also will be examined.

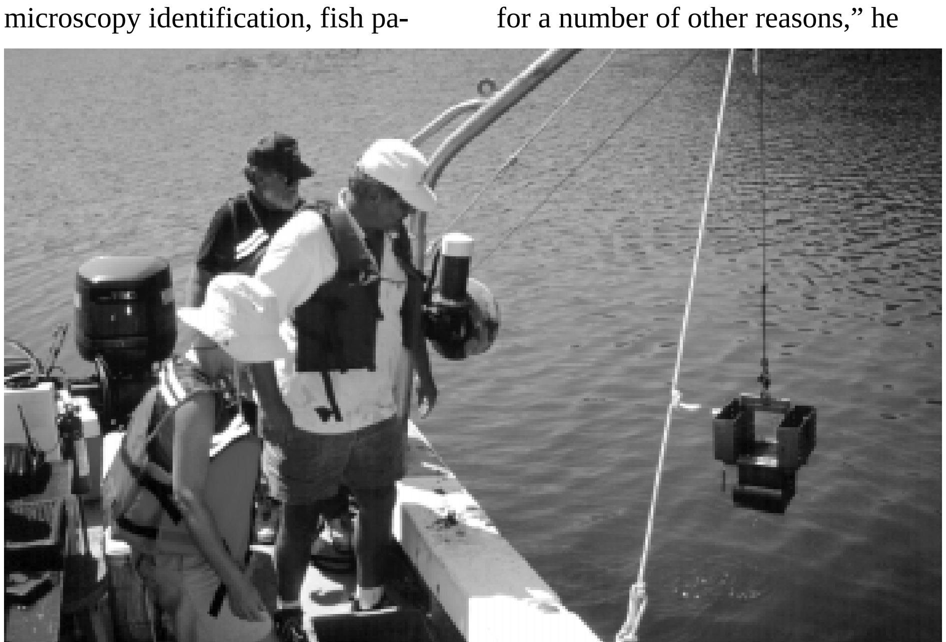
The summer of 1999 has the potential to be an eventful one in the evolving management of the Atlantic sea scallop. Scallop managers are currently exploring measures to utilize rotational closures as a management strategy of the future. This strategy has the potential to increase the size of scallops landed, and to broaden the age distribution of the sea scallop population. The success of the mid-Atlantic survey is significant in that it could provide information in support of a rotational area management strategy. The continuation of resource surveys involving industry, academia, and the federal government can only help to strengthen the cooperative spirit that is necessary to tackle complex fishery problems.

Pfiesteria Update

Since 1997, when fish kills in three Maryland rivers were linked to *Pfiesteria piscicida,* VIMS scientists have devoted a great deal of effort to learning more about the microorganism. With support from both state and federal sources, VIMS has focused multidisciplinary programs on all aspects of *Pfiesteria.* In addition to the long-term finfish monitoring program, ongoing work includes the development of molecular diagnostics, *Pfiesteria* Like Organisms (PLO's) culture, scanning electron microscopy identification, fish pathology and lab challenge studies. Researchers are also involved in an ecological study in the Great Wicomico River to understand the relationship between PLO's, fish lesions and environmental parameters.

Dr. Wolfgang Vogelbein, head of the VIMS Aquatic Animal Disease Diagnostic Lab, has extensively examined scores of fish with lesions during 1997 and 1998. "Most people associate fish lesions or sores with *Pfiesteria*, but lesions can be present for a number of other reasons," he says. Vogelbein's current research demonstrates that a pathogenic and highly invasive fungus called *Aphanomyces* is consistently found in the lesions and is considered to be the causative agent. "If *Pfiesteria* is playing a role, it's playing a very early role. It may be an initial event, a sub-lethal exposure that provides a port of entry for the fungus." Vogelbein feels it is difficult to pinpoint the source of infection, fungal or not, simply by finding diseased fish in a given river or cove. By the time lesions are noted, they are one or two weeks old; adequate time for the fish to have swum dozens if not hundreds of miles.

"While there are still many unanswered questions, scientists are much better prepared to deal with the issue than they were in 1997," says Dr. Gene Burreson, Director of Research and Advisory Service. Today, VIMS has a facility for culturing toxic organisms, the ability to identify the PLO's and perform necessary toxicity testing. "With this capability the state does not have to rely on outside laboratories for work as it did in 1997."



VIMS scientists taking samples to culture PLO's from surface sediments in the Great Wicomico River.

Pathfinders Course

In June, twenty-six teachers and preservice science education students from the mid-Atlantic region took part in an oceanography course at VIMS and Kitty Hawk, NC. The "Operation Pathfinder" program, one of six offered nationwide, was supported by the National Ocean Partnership Program and Sea Grant. The course was designed to help teachers incorporate marine science concepts and local coastal issues into their classroom programs. Activities at VIMS included field, lab and classroom work conducted by VIMS scientists and marine educators. Topics included shoreline processes, tides, oyster reef ecology, underwater research, salt marshes, and blue crab biology.

The final week took place in Kitty Hawk where the group studied beach erosion and had a first-hand look at the relocation of the Cape Hatteras lighthouse. In addition, they investigated inlets and sounds from small aircraft and kayaks, and participated in a two-day computer technology workshop.

New Computer Program Helps Planners Balance Growth, Protection

James Schultz

Population density is on the rise within the Chesapeake Bay watershed. With development comes pollution, runoff, deforestation and habitat reduction that can seriously impact coastal ecosystems. There is now help for local decision-makers who must weigh difficult trade-offs between human habitation and environmental protection.

VIMS Professor of Marine Science, Dept. of Biological Sciences, Dr. Richard Wetzel and colleague Dr. Ting Dai have developed a computer program that can simulate and predict the effects of population growth, pollution and nutrient discharge into the Bay's rivers and streams. Their creation, **BasinSim 1.0**, is a user-friendly Windows interface that links with sophisticated databases containing updated information on climate, land use, regional population, soil type, water volume and quality, and non-point-source discharges.

Co-designer Wetzel says that the software is a new kind of computer tool that will enable managers to devise methods of reducing high levels of sediment, nitrogen and phosphorus that flow into waterways. Lower amounts of those substances should boost Bay health by increasing dissolved oxygen, promoting plant growth and fostering healthy marine life.

Dr. Richard Wetzel will conduct courses for research managers to incorporate the modelling.

"The beauty of this model is that it uses real data," Wetzel points out. "Land-use managers can play 'what-if' scenarios. You can look at the effects of increased population growth or changes in land use on the estuary. You can predict the effects of runoff and what happens when sediments or nutrients end up in the water. It's a fairly sophisticated numerical model."

Developed over three years, **BasinSim** will work on any Windows-based desktop computer. Before running a given simulation, the program automatically checks and incorporates three primary user-defined input files — including such factors as sediment amounts, erosion rates, nutrient levels and current weather — plus seven optional, advanced-features files. Once the simulation concludes, the user can save the results for later analysis. In its present form, BasinSim has some connectivity to the Internet, but relies mostly on archived information supplied by such federal and local agencies as the U.S. Geological Service, the Environmental Protection Agency, local Soil Conservation Districts and gauge stations on area rivers and streams.

Current plans call for **BasinSim** to be introduced to local and regional planners in mid-summer through hands-on seminars at VIMS' Gloucester Point campus. User suggestions for improvements to this "beta" model will be subsequently adopted and a modified final version produced no later than this coming December 1999. **BasinSim** will then be distributed free of charge to environmental managers.

Planners throughout Virginia will eventually be able to use **BasinSim** to model tributaries and small coastal basins in all parts of the state. Future versions should be available for downloading directly over the Internet, at a website which will be hosted by the Chesapeake Bay Local Assistance Department (CBLAD). "We are excited about this project since it helps CBLAD provide state-of-the-art technical assistance to Tidewater local governments who implement the Chesapeake Bay Preservation Act through land use planning that protects water quality," said Michael Clower, director of CBLAD.

"Knowledge is power. What can come out of models like this is the ability to minimize the impact on living resources like animals, plants, finfish and shellfish," Wetzel asserts. "What's exciting to me about this project is that it's something that will have a widespread, common use. We think it will be greatly beneficial."

CBNERRVA Research Fellows Chosen For the 1999 Year

Each year the Office of Coastal Resource Management of NOAA selects two fellows to conduct research at each of the National Estuarine Research Reserves in the United States. This year's fellows at Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) are Ph.D. students Janet Nestlerode and Scott Neubauer from the Dept. of Biological Sciences.

Neubauer, a second year CBNERRVA fellow, is focusing on tidal freshwater marsh carbon cycling at Sweet Hall Marsh, one of the CBNERRVA sites. Carbon is one of the nutrients that is necessary for life and is essential in the photosynthesis/respiration cycle of plants. Scott and fellow researchers are examining two questions: What are the sources of carbon to this tidal freshwater marsh? What ultimately happens to this carbon?

Scott Neubauer at research site in Sweet Hall Marsh.

Neubauer and his team created a process-based carbon mass balance model to determine plant material exported from the marsh to adjacent tidal waters. This model compares plant photosynthesis, respiration, and the rates of sedimentation within the marsh and marsh burial by incoming sediments.

From the data collected, Neubauer calculated that plant respiration exceeded plant photosynthesis at Sweet Hall Marsh. When a plant photosynthesizes, it fixes carbon dioxide from the air into glucose. Then during respiration it uses the glucose to produce energy. If this carbon is used in respiration and not replaced, a plant could stop its production of energy and eventually die. If the entire marsh was doing this, it would suggest that the marsh is shrinking. However, he found in the sedimentation data that the amount of carbon entering the marsh in imported sediment was offsetting the respiration deficit. Data suggest tidal marshes could be less important sources of organic matter than was once thought. The research will continue through this summer.

Janet Nestlerode on-site at man-made oyster reef.

Nestlerode began her research in July. She will focus on characterizing and quantifying the benthic (bottom surface-dwelling) community at a man-made oyster reef off the Goodwin Islands. In the spring of 1995, the Virginia Marine Resources Commission (VMRC) and Amoco Oil Refinery installed an oyster reef. Due to a shortage of oyster shells, 30,000 bushels of shucked clam shell were used to construct the reef. The collected data will be used to determine secondary production of the benthic macrofauna (animals large enough to be seen with the naked eye) associated with the constructed reef and to begin charting the movement of energy of the reef in relation to adjacent habitats.

Oyster Reef Tank

Dr. William J. Hargis, Jr., former Dean and Director of VIMS, has provided support to develop a living oyster reef tank in the VIMS' aquarium. The support was given in memory of Dr. Donald Pritchard and Dr. Eugene Cronin. In the late 1960s, their increased awareness of problems within the Chesapeake Bay led Cronin, Pritchard, and Hargis to establish the Chesapeake Bay Council.

The purpose of this council was to initiate collaborative research efforts among Maryland and Virginia scientists. As a result of their work, the Council was asked by the National Science Foundation to "examine the research needs of the Bay." Their report led to the creation of the Chesapeake Research Consortium, which is still active today.

Virginia Sea Grant to Administer Commercial Fishery Resource Program

There is good news for commercial fishermen in Virginia. This year, the General Assembly has approved the allocation of $300,000 in grant money to establish the Commercial Fishery Resource Grant Program (CFRGP) in Virginia. Already well received in North Carolina and funded at a level exceeding $900,000, the CFRGP finances research proposals submitted by commercial fishermen to "protect and enhance the state's coastal fishery resources."

What this means for Virginia is that fishermen with innovative ideas for improving fishing gear, eliminating bycatch, developing new markets, or improving Virginia's seafood industry, can receive financial support from the General Assembly for their ideas. A similar project has done extremely well in North Carolina and has funded projects such as *Pound Net Bycatch Reduction through Escape Panels*; *Gear Development for the Live Flounder Market*; *TED Development for Small Trawls*; and *HACCP Program Assistance for Small Seafood Processors and Dealers*, among others. The basic principle of the program is that people in the industry often have excellent ideas for enhancing and protecting fisheries, but they lack the financial resources to experiment with innovations.

The grant money will be available on a competitive basis to all persons actively involved in a fishing industry. Individuals not directly involved with a fishing industry may be eligible if their projects have written endorsements from organizations representing fishing industries.

All proposals will be reviewed by a panel of seven members. Five members shall be appointed from nominations made by various watermen's associations in Virginia, one member will be appointed by the Commissioner of the Marine Resources Commission, and one member shall be appointed by the Director of the Virginia Institute of Marine Science. Based on panel reviews and Advisory Board input, proposals will be recommended to the Virginia Graduate Marine Science Consortium. The Consortium will make all final decisions on grants, including the level of funding for each project.

A list of potential research areas has been developed and approved by the CFRGP Advisory Board. Though this is not intended to be an all inclusive list, it is provided to give suggestions about the types of programs that could be appropriate for proposals to the CFRGP. There are certainly many more research areas that could qualify as appropriate. Approved research areas include: 1) new fisheries equipment or gear, 2) environmental pilot studies, including water quality and fisheries habitat, 3) aquaculture or mariculture of marine-dependant species, and 4) seafood technology.

Though the dates have yet to be announced, several grant writing workshops are going to be made available to the public to better explain the grant program, the eligibility and funding priorities, how to complete the application form, and where to go for more help in developing the grant package. Dates and registration information will be announced in the near future.

If you would like more information, please contact Bill Rickards, Director, VGMSC, at (804)924-5965, or Bill DuPaul, Sea Grant Marine Advisory Program, VIMS, at (804)684-7163.

As of now, the application shall include but not be limited to the following:

1. Name and address of the primary applicant;
2. List of the licenses issued to the applicant by the state of Virginia;
3. A description of the project;
4. A detailed statement of the projected costs of the project including the cost to plan and design the project;
5. An explanation of how the project will enhance the fishery resource;
6. List of names and addresses of any other persons who will participate in the project; and
7. Any other information necessary to make a recommendation on the application.

VIMS Stranded Sea Turtle Program Underway

The season for sea turtles in the Chesapeake Bay and its tributaries is here again and VIMS scientists urge anyone who finds a stranded sea turtle to call (804) 684-7313. "We need your help," says Soraya Moein-Bartol of VIMS, "we can't continue collecting this valuable data without help from our local residents, visitors and fishermen. All information is important to us and helps us learn more about these marine animals." VIMS scientists have been collecting data on sea turtles in Virginia waters for 19 years and respond to any stranded sea turtle (alive or dead) found north of the James River.

Up to 10,000 loggerhead sea turtles are in the Bay during the summer. Turtles start to arrive in the Bay when the water temperature approaches 66° F, and migrate out of the Bay to wintering grounds off the Florida coast when temperatures drop to around 60 degrees F. Chesapeake Bay provides summer feeding grounds for both adult and juvenile loggerheads. Kemp's ridleys are the second most abundant sea turtle in the Bay. Kemp's are the most endangered of all sea turtles. They usually become stranded during their migration into and out of the Bay. Ridleys forage in the shallow waters around the margins of the Bay while loggerheads most often utilize deeper water near channels. Green and leatherback turtles have on occasion been found in Bay waters.

If you see a stranded sea turtle anywhere north of the James River, please contact: VIMS at (804) 684-7313. This number is checked frequently during the day and after hours.

Loggerheads are the most abundant sea turtle in the Chesapeake Bay.

Second Master Oyster Gardeners Course

Oyster gardening has become a major hobby all over the Chesapeake Bay with more than 1,000 now participating. In response to this overwhelming interest, the second class of Master Oyster Gardeners completed their course at VIMS in early July. Developed in collaboration with the Tidewater Oyster Gardening Association (TOGA) and the Sea Grant Marine Advisory Program, the course focused on the oyster's life cycle, disease and predator control, water quality issues, grow-out techniques and permitting requirements. Scientists from VIMS and various state agencies taught the four day course. In addition to classroom activities, participants spent a full day working in the VIMS hatchery, visited the Piankatank River oyster reefs and the Middle Peninsula Aquaculture Hatchery. To be eligible to become a Master Oyster Gardener, participants must have been gardening for at least a year and agree to serve as a resource for other gardeners in their area. The Master Gardening course was developed to educate a network of gardeners to complement ongoing efforts to conserve the native Chesapeake Bay oyster stock.

Dr. Stan Allen with master oyster gardeners in the Gloucester Point Hatchery.

Coastal Sediments Offer Clues to Climate Change, Pollution

James Schultz

Pouring from mountainous uplands into rivers and bays is a voluminous collection of eroded soil and rock, cataloged in non-erasable layers of silts, muds and liquified soils. For Dr. Steven Kuehl, VIMS Professor of Geological Oceanography and Chair of the Dept. of Physical Sciences, such coastal sediments tell a complex tale of human use, natural development and climate change.

In research extending over two decades, Kuehl has made a continents-spanning career studying where these sediments accumulate and how they affect near-coast and deeper-ocean transport of pollutants and toxic materials. With accelerating concerns about human influence on global climate and possible, long-term rise in planetary temperature, coastal-sediments research has acquired singular relevance. Because coastal sediments set down an unblinking record of the history of land and water, they reveal past events in vivid geochemical detail.

"Clues about past environments are locked up in ancient rocks," Kuehl explains. "Understand what physical, chemical and biological processes form the rocks, and what happens to them once they turn to soil or silt and you have an idea of the past. Using the past as analogue, you can begin to understand the present."

Dr. Steve Kuehl and MS student David Heroy sampling for cesium and lead 210 on the Ganges-Brahmaputra flood plane in Bangladesh.

Working in the Chesapeake Bay, Kuehl and his students have discovered that contaminant laden sediments have long residual times in the environment because of frequent bottom resuspension.

"The hope was that contaminants would eventually bury themselves in the sediments at a level where they're not taken up," Kuehl says. "Unfortunately, from the studies we've done, those substances are continually recycled up into the water column and affect plant and animal life. We've calculated that this stuff could hang around for centuries before it's removed from the water."

Kuehl is currently working on a two-year project to understand the past and present of the Ganges-Brahmaputra river system in India and Bangledesh, in particular the architecture of its underwater delta. As suspended sediments settle out just beyond the mouths of large rivers, they assume a unique shape known as a clinoform. More precise understanding of the geometry and transport of river sediments should aid in efforts to improve water quality in one of the most flood-prone areas in the world.

A better understanding of the structure and dynamics of coastal sediments may, in the long run, also provide more accurate prediction of climate change. Although many believe that human-generated, greenhouse-gas emissions are driving a planetary warmup, it may be that such gases have delayed an expected and overdue planetary glaciation. Nevertheless, a major unanswered question concerns the ultimate fate of carbon, one of the biggest contributors to global warming.

It is here, Kuehl points out, that there is plenty of opportunity for further study. Researchers are only beginning to understand the complex processes that drive the accumulation and cycling of carbon in coastal environments.

"There's a lot of dissolved carbon in the oceans — about 60 times more than we have in the atmosphere," he explains. "We're trying to understand the role of carbon dioxide in climate change. In order to do that, we have to understand how carbon separates into its various components. The whole picture is pretty complicated and we frankly don't understand it completely."

Seemingly Barren Habitat Proves Vital for Economically Important Virginia Fish

April Bahen

While Giancarlo Cicchetti, a recent CBNERRVA fellow, was completing dissertation work in the nearshore habitats of the Goodwin Islands, he noticed that quite a number of juvenile summer flounder were frequenting his research areas. Summer flounder is an economically important fish in Virginia and in the Bay. Cicchetti, with CBNERRVA Research Coordinator Dr. William Reay, designed a quantitative survey of juvenile summer flounder use in unvegetated nearshore sandy-bottom and mud habitats around Goodwin Islands. There is not a large volume of literature available on these habitats and the nekton they support. The study included examining when flounder were using the areas, how many of them were present during the recruitment period, and what food source was attracting them to the habitats.

Summer flounder begin their life in a planktonic stage. When they metamorphose into their more familiar form, they move to the bottom and many look to these shallow areas for protection and food. Once they leave the shallow waters, they swim out to deeper water, many times at the edge of deeper channels.

Recruitment of juvenile flounder into the unvegetated shallow water habitats begins in March. The young fish utilize these habitats through June with very few remaining in the areas by July. Flounder are a rapidly growing fish. Therefore, by the time they leave the shallow water and swim out to deeper areas, they are typically about 6.0 cms in length.

At this point, there does not seem to be a large difference in the number of flounder using the sand vs. mud bottom environments. The fish were found to be feeding primarily on a plentiful benthic worm, Spionids, in these nearshore habitats. When the quantification of benthic infauna is completed, a profile can be completed on summer flounder use of nearshore sand and mud habitats during the juvenile phase of their existence.

Field work on the juvenile flounder research project.

Fisheries Science Students Receive Awards

Two students in the Dept. of Fisheries Science recently received awards at national conferences. **Brett Falterman** received the Manuel Caboz Award for the best student abstract submitted prior to the conference. The award provided full expenses to the 50th Annual Tuna Conference in California where Falterman presented his paper entitled "Population Structure of the Black Marlin, *Makaira nigricans,* Inferred from Analysis of Nuclear and Mitochondrial Molecular Markers." Falterman is the third VIMS student to receive this award in the past ten years.

Meredith Bostrom was winner of the Storer Poster award at the annual meeting of the American Society of Ichthyologists and Herpetologist. Bostrom's poster entitled "An Investigation of Possible Hybridization between the Coney, *Cephalopholis fulva*, and the Creole, *Paranthias furcifer*" is based on her dissertation research. The meeting which was attended by approximately 1,000 members was held at the University of Pennsylvania in June, 1999.

Calendar of Events

—August—

14 "Shark and Man: Roll Reversal - The Plight of an Ancient Beast in a Modern World" presented by Dr. Jack Musick. 2pm, Nauticus
23-24 Orientation for New Students School of Marine Science

—September—

13 Seafood Seminar: VIMS
15-17 Wetlands Education Workshop: VIMS
15 Mini-School of Marine Science: Mariners' Museum
16 VIMS Council Meeting
21 Seafood Seminar: VIMS
22 Mini-School of Marine Science: Mariners' Museum
27 Seafood Seminar: VIMS
29 Mini-School of Marine Science: Mariners' Museum

—October—

6 Mini-School of Marine Science: Mariners' Museum
10 Garden Club's Program, 2 pm, VIMS auditorium
13 Mini-School of Marine Science: Mariners' Museum
23 Teacher Workshop
23 Homecoming : Tours BayScapes Coastal Habitat and Teaching marsh
27 Seafood Seminar: VIMS
27 York River Watershed Conference
28-31 William and Mary Homecoming

Blue Crab Bowl Winners

The winning team from the Blue Crab Bowl, regional competition for the National Ocean Sciences Bowl, came back to VIMS in June for a research cruise aboard the R/V *Bay Eagle*. The three students and two coaches from Lord Botetourt High School in western Virginia were accompanied by a secondary school supervisor from Botetourt County. The team participated in a shark research cruise to capture, measure, tag and release sandbar sharks. During the cruise, VIMS scientists were testing the use of side-scan sonar to determine if small sharks produce distinct, recognizable sonar signals. With this information, scientists could gain a better understanding of whether concentrations of juvenile sandbar sharks are random aggregations or organized schools and estimate how many of the juveniles frequent an area.

The Lord Botetourt students assisted in preparing and recovering the long-lines and logging data.

BCB team member assists Ph.D. student Dean Grubbs with shark survey.

Virginia's Oyster Reef Teaching Experience

In July, Virginia middle and high school teachers had the opportunity to participate in hands-on workshops describing oyster reefs and their ecological role in the Bay. The two field and laboratory workshops were sponsored by VIMS, Virginia Sea Grant, Virginia's Environmental Endowment and the Chesapeake Bay Restoration Fund Advisory Committee. Teachers from Hampton Roads, Virginia Beach, Yorktown, New Kent, Charlottesville, and northern Virginia attended one or both of the one-day workshops that provided teaching resources and scientific content to support teaching Virginia Standards of Learning (SOL's) in life science, biology, ecology, marine science and earth science. VIMS fisheries scientists and marine educators presented both workshops. Classroom and laboratory instruction provided an overview of the history of the Bay's oyster reefs, oyster biology and water quality relationships. Field activities in the Piankatank River demonstrated reef physical habitat structure, reef community trophic relationships, and connections with local water quality. Participants working in research teams collected and analyzed data and applied the information to make oyster reef restoration site selection recommendations. For more on this program visit the web site at: www.vims.edu/fish/oyreef/vortex/html

Oyster Float Construction Workshop

On September 11th, an oyster float construction workshop will be held at the VIMS oyster hatchery at Gloucester Point. This hands-on course will be conducted by TOGA and will give the participants instruction on how to begin their own oyster garden. Each participant will have the opportunity to build their own Taylor float for off- bottom culture. Oyster seed will be provided so that participants can begin their own growing operation. All of the construction materials necessary to build the float will be provided. There is no registration fee for the event, but the participant will be responsible for paying for the materials that are used in their float construction.

For more information on this event or on becoming a Tidewater Oyster Gardening member, please contact TOGA president Jackie Partin at (804) 694-4407.

Support VIMS

Support research and education with a gift to VIMS. All gifts help generate new knowledge in coastal marine science. In addition to outright gifts, other types of charitable donations help VIMS and may have tax benefits for the donor. Please contact the Director of Development at (804) 684-7099 for more information.