

Reports

Fall 2001

The Crest, Fall 2001

Virginia Institute of Marine Science

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The Crest

Current Issues in Coastal Ocean and Estuarine Science

VIMS Named World Reference Laboratory for Shellfish Diseases

The Virginia Institute of Marine Science has been designated as the only world-wide reference laboratory for two groups of pathogens (*Perkinsus* and *Haplosporidium*) that cause disease in shellfish all over the world. Dr. Eugene M. Bureson, VIMS Director of Research and Advisory Service, was named the Reference Expert. The designation was announced

by the Office International des Epizooties (OIE), a Paris-based international advisory organization on infectious animal diseases. OIE is the official arbiter of the World Trade Organization for issues involving living animal products, including wild or aquacultured marine animals.

Species of *Perkinsus* and *Haplosporidium* are responsible for

the oyster diseases Dermo and MSX that continue to cause tremendous mortality in oysters in Chesapeake Bay. Species of *Haplosporidium* cause diseases in native and cultured abalone in Australia and New Zealand, while species of *Perkinsus* cause diseases in oysters and clams in Japan, Korea, France and Spain and in cockles in New Zealand. While these diseases have no effect on humans, they can decimate shellfish populations



Shellfish disease staff, left to right, Lisa Calvo Ragone, Nancy Stokes, Rita Crockett, Dr. Gene Bureson, and Dr. Kimberly Reece.

VIMS Scientists Receive 2001 Best Paper Award

VIMS scientists Dr. Eugene Bureson and Nancy Stokes and Dr. Carolyn Friedman, California Fish and Game, received the 2001 Best Paper Award from the American Fisheries Society. The Society has a tradition of publishing important research on aquatic-resource issues. The Best Paper Award recognizes the high quality of literature among aquatic professionals. The paper, "Increased Virulence in an Introduced Pathogen: *Haplosporidium nelsoni* (MSX) in the Eastern Oyster *Crassostrea virginica*" was featured in the March issue of the *Journal of Aquatic Animal Health*. The article detailed their work on the oyster pathogen responsible for the disease MSX that is prevalent in Chesapeake Bay oysters. The team developed DNA diagnostic tools that proved the parasite found in the Pacific oyster is the same parasite that has caused extensive and continuing mortality of Eastern oysters. The parasite does not cause significant mortality in Pacific oysters. Their work documented that the parasite was introduced to the Eastern oyster during importation of the Pacific oyster to the

East Coast in the 1950s. The parasite first appeared in the Chesapeake Bay in 1959. The work underscores the potential dangers of improperly introducing exotic marine organisms for aquaculture or resource restoration.

and cause economic havoc in both fisheries and aquaculture industries.

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This work is the result of research supported in part by NOAA Office of Sea Grant, U.S. Department 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 Spring
Vol. 11, No. 2

Domestic Interest Grows in Cobia Culture

By Mike Oesterling

After one full year of growth, the first U.S.-spawned-and-raised cobia (*Rachycentron canadum*) weighed more than 8 pounds. This tremendous growth rate has piqued domestic interest in its commercial culture.

Numerous questions need to be answered before investors might be willing to commit to cobia aquaculture. Besides the obvious ones about production technology, an important consideration is just how the cultured product will compare to wild-harvested cobia in the marketplace. To begin answering this question, graduate student Patrick Kilduff conducted two evaluation tests using VIMS-cultured cobia and wild-harvested Chesapeake Bay cobia. The first, a triangle test, had taste-testers attempt to identify the odd sample out of three pieces of prepared cobia. Not designed to identify preference, the test identified whether a noticeable taste difference existed. Approximately two-thirds of the panelists could identify the "different" sample.

The second test conducted by Kilduff was a head-to-head preference test where panelists were asked to choose the piece of cobia they liked best. Each panelist was given two pieces of prepared cobia — one cultured and one wild. They were then asked to indicate which one they preferred, respond to other product questions, and provide comments. The panelists split almost equally in their choices, indicating little difference in the two products and a readily marketable cultured product.

The success of the cobia project served as a catalyst to bring together other scientists interested in cobia culture and resulted in a collaborative, 2-year research effort funded by the



VIMS faculty, staff, and students participated in the cobia taste testing.

federal government. Scientists and private entrepreneurs from Texas, Mississippi, South Carolina, and Massachusetts have now teamed up with VIMS scientists to develop the basic information necessary to fast-track commercial cobia culture.

(NOTE: This article appears in the Fall 2001 Marine Resource Bulletin under the title: Cultured Cobia Satisfies Tastebuds.)



VIMS Foundation Established

The VIMS Foundation, a separate 501(c) 3 organization established in September, has received initial gifts of \$530,000 from numerous donors. The Foundation has also received pledges for an additional \$800,000 to be paid over the next three years. VIMS is planning an endowment campaign to raise \$10 million by 2007 to support faculty, students and scientific equipment and technology.

The Foundation's mission is to solicit private gifts and property for VIMS and administer and manage these funds to support VIMS mission of research, education and advisory service. "The VIMS Foundation has a unique opportunity to help VIMS achieve its goals —buying new research equipment, supporting outstanding students and faculty —this support ensures that VIMS will remain com-

petitive and able to produce cutting edge research," said Dean and Director L. Donelson Wright.

The Foundation Board members include: A. Marshall Acuff, Jr., Thomas Blackburn, Arthur H. Bryant II, Clifford A. Cutchins III, E. Morgan Massey and Guilford Ware. "We are confident that establishing the Foundation will increase support for VIMS important work," said Foundation President E. Morgan Massey.

VIMS Named World Reference
Laboratory
continued from page 1

OIE recruited VIMS for reference laboratory status based on the Institute's long history of research on *Perkinsus* and *Haplosporidium* and because of current research and international collaboration on diagnosis of diseases caused by these organisms. The shellfish pathology and histology skills of Bureson, Ms. Lisa Ragone Calvo and Ms. Rita Crockett are widely recognized. Molecular diagnostic (DNA) tools for identifying these disease agents developed at VIMS by

Bureson, Dr. Kimberly Reece, and Ms. Nancy Stokes are being used worldwide.

"This is a real honor, in recognition of the significant breakthroughs we have made at VIMS in the diagnosis of these shellfish pathogens that occur worldwide," Bureson said. "It will also mean some additional work, but we have a great team in shellfish pathology and we are glad to be of service to the international community."

Reference laboratories serve as an advisory resource for the OIE and as an identification resource for researchers around the world. The labs are also obligated to develop and standardize diagnostic protocols for relevant

disease agents and to provide a diagnostic service for researchers around the world. OIE has been responsible for promoting and coordinating research into the surveillance and control of animal diseases throughout the world since 1924.

Serious diseases that should be contained from accidental geographic spread are designated "notifiable" by OIE. This designation can restrict the export of animal products from a country that has the disease. *Perkinsus* and *Haplosporidium* are found worldwide and cause notifiable diseases. "We are already receiving requests and samples from around the world," Bureson said.

VIMS Environmental Scientists Spearheading New Research in USA

In a recent issue of *Nature* Dr. Rob Hale, Mark La Guardia, and other colleagues at the Virginia Institute of Marine Science reported on their recent work investigating BDEs (brominated diphenyl ethers), a class of environmentally persistent organic pollutants. BDEs are used in producing flame-retardant material. Currently, North America accounts for 98% of the world's demand for BDEs. BDEs are structurally related to PCBs and PBBs, which are no longer used in the U.S. Hale's group has detected BDEs in fish, sediments, and sewage sludges. They also detected these pollutants in high concentrations in "biosolids," sewage sludges used in agriculture, landscaping, and land reclamation. This finding is particularly noteworthy as millions of tons of sludge are

recycled in this manner each year and thus the practice may reintroduce BDEs to the environment. The lower brominated BDEs bioaccumulate in wildlife and have begun to be detected in humans. Limited toxicity studies have been conducted to date, mostly in Europe. Results suggest a possible interaction with the endocrine system.

While BDEs have been a concern in Europe for several years and will be banned there in 2003, research in the U.S. is just beginning. According to Hale, "Europeans have been particularly concerned over increasing concentrations of BDEs in human breast milk. We know about some of the effects of PCBs and PBBs. Since these compounds are related, we feel more information on their sources, effects, and fate are needed. In

addition, further attention to possible organic contaminants present in land-applied 'biosolids' is merited."

A paper documenting high concentrations of nonylphenols and related detergent-breakdown products in these same sludges, authored by La Guardia, Hale and coworkers, has also recently been accepted in *Environmental Science and Technology*. These findings further indicate the need to fully examine the chemical constituents of sludge and possible repercussions of their land application. The papers have been provided to the National Academy of Sciences review panel evaluating the current risk assessment underlying the regulations developed by the U.S. EPA pertaining to biosolids safety.



Dr. Rob Hale collecting biosolid samples from wastewater treatment plant.

VIMS Capital Campaign for Kauffman Aquaculture Center Meets Its Goal

In April, VIMS launched a capital campaign to match a \$600,000 gift from Mr. and Mrs. Jack Kauffman to construct the Kauffman Aquaculture Center on the Topping Campus.

By September, the Institute had met its challenge. The facility will be the first building on the Topping Campus. "The level of support we have received reflects the importance of this kind of research to the Chesapeake Bay," said Jim Rogers, Chairman of the Campaign. "This is an excellent example of the kind of public/private partnership that can truly make a difference." Gifts include leadership commitments from the Elis Olsson Memorial Foundation, Smurfit-Stone Container Corporation, Tim Blackwood, Weston Conley, and Dominion

Virginia Power. Twenty-seven individuals, corporations, and foundations contributed to the campaign.

With these facilities at the Kauffman Aquaculture Center, VIMS will be uniquely positioned to lead the nation in the field of marine shellfish aquaculture. Techniques developed at the Center will have a wide array of applications worldwide in shellfish and finfish aquaculture. "The Kauffman's support provides an outstanding opportunity to advance research that has enormous ecological and economic importance not only in the Chesapeake Bay but also for shellfish worldwide," said Dr. Eugene Burreson, Director of Research and Advisory Service at VIMS.



Rendering of the proposed Kauffman Aquaculture Center in Middlesex County.

Dr. William Reay Named New Manager of the Chesapeake Bay National Research Reserve

VIMS recently announced the appointment of Dr. William G. Reay, Research Assistant Professor, as Manager of the Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA). CBNERRVA is one of the 25 National Estuarine Research Reserves established through state-federal partnerships under the Coastal Zone Management Act.

A 1989 graduate of VIMS/SMS, Dr. Reay was awarded his Ph.D. in 1992 from the Virginia Polytechnic Institute and State University where he worked as a Research Scientist in the Department of Civil Engineering before joining the Institute in 1997 as a Research Coordinator with

CBNERRVA. He has also served as the Assistant Manager of CBNERRVA and was appointed as Acting Manager July 1, 2001 when Dr. Maurice Lynch

retired from the position. Dr. Reay will oversee a coordinated research, monitoring, stewardship, outreach education and advisory program focused on, but not limited to, the estuarine habitats managed by CBNERRVA. In addition, he will coordinate the activities of the CBNERRVA with the Virginia Estuarine and Coastal Research Reserve System, a state

designated system of estuarine and coastal protected areas. He is a member of the Department of Coastal and Ocean Policy.



Dr. William Reay

Fourth Annual VIMS Auction

Plans are underway for the VIMS Auction to be held on April 20, 2002. Auction Chair Carrie Garland said the event would benefit the VIMS Library again this year.

Volunteers, VIMS faculty, staff, and students, and area merchants have worked together to make the VIMS auction a huge success in the past. "This is always such a fun, well-received event - I hope everyone will mark their calendars," said Garland.



Summer Course Connects Scientists with Science Teachers

By Vicki Clark

For six days and five nights this summer, the dormitory at the VIMS Eastern Shore Laboratory in Wachapreague served as headquarters for 15 science educators as well as VIMS faculty and staff from the Gloucester Point campus. The teachers came from middle schools and high schools across Virginia to participate in a special course, "Environmental Issues in Marine Science: Case Studies from Virginia's Eastern Shore." The two-credit graduate course was designed to increase the teachers' marine science knowledge, introduce them to VIMS research activities, and provide insight into some of the environmental issues facing Virginia's coast.

The course emphasized concepts in physical and chemical oceanography as well as marine ecology and biology. Topics ran the gamut from tides to barrier-island habitats to biodiversity. Lectures and lab tours provided overviews of ongoing research in shellfish aquaculture, non-indigenous species, toxicology, and fisheries

management, and supported select Virginia Standards of Learning. Participants each developed two teaching activities appropriate for their students back home.

Daily schedules included field investigations on a variety of Eastern Shore habitats, such as intertidal mudflats, barrier-island beaches, and tidal creeks. The class spent one evening in the well-equipped computer lab at the Eastern Shore Community College in Melfa, exploring ways to use the internet and other computer technologies to teach selected marine science topics. On July 4, the class explored Onancock, Assateague Island, and Chincoteague, and celebrated in town with a festive crowd enjoying the holiday fireworks.

Course funding was provided by the Chesapeake Bay Restoration Fund, Virginia Recreational Fishing Development Fund, Virginia Sea Grant, and VIMS. A handful of scientists and staff—led by Dr. John Graves of the VIMS Fisheries Department and by Susan Haynes and Vicki Clark from the Virginia Sea Grant Marine Advi-



VIMS physical oceanographer, Dr. John Brubaker (center), demonstrates earth/moon interactions in creating high tides toward and away from the moon.

sory Program—provided program instruction and coordination. Lectures, field investigations, and laboratory activities were also provided by VIMS School of Marine Science faculty Mark Luckenbach, Peter Van Veld, Michael Unger, Elizabeth Canuel, and John Brubaker. Graduate student Janet

Nestlerode and educator Lisa Lawrence provided instruction and logistical support.

For more information on upcoming professional development programs for teachers, contact the Marine Advisory Program office at VIMS at 804-684-7170.



Beset Near 68°S, 69°W...

A recent Antarctic research cruise turned into an experience of a lifetime for a team of VIMS students and faculty. The cruise left Chile on September 6 and arrived in Antarctica just a few hours before the attacks on the World Trade Center and Pentagon. Rumors of the events began filtering to them within a few minutes, however, it was evening before they really knew what had happened because they received email only twice a day. On Sept. 14, they began work on the sea ice. The schedule called for each research group to have extended and repeated opportunities to sample at locations along a north-south transect of several hundred kilometers. The carefully constructed plan, however, never came to fruition. The *R/V Nathaniel B. Palmer* was beset (stuck) in the ice pack from September 24 until October 20!

Dr. Hugh Ducklow, Department of Biological Sciences, via email:

"Today we had a dramatic demonstration of ice dynamics. We were moored in an ice floe with the gangplank down and several groups of people out on the ice, 25 - 100 meters out from the vessel. Suddenly cracks began to form, and one floe quickly



Stuck in the ice aboard the *R/V Nathaniel B. Palmer*.

began to raft up over another. The bridge radioed to get everyone off the ice, fast! People even dropped gear to run aboard. While a couple of people were actually on the gangplank, an ice floe began to lift it up off the ice! Gigantic ice ridges were heaving up and coming in over the rails, onto the main deck, 15 feet above the water line. The entire vessel shook and shuddered as the ice buckled against the side. Everyone was back safe on board in less than 2 minutes, but in that

time the entire landscape changed. What had been a nice flat plain of ice and snow was now a jumbled, ridged, cracked terrain. Amazing event, right before our eyes. It all took about

10 minutes. Kind of like being in an earthquake. Fortunately the divers were not in the water."

Dr. Rebecca Dickhut, Chair, Department of Physical Sciences, first Antarctic cruise:

"Early in the cruise as many as 25 scientists were on the ice at one time. One ice station rapidly collapsed and we nearly lost some costly equipment. After that, four scientists at a time were lowered, in a basket, over the bow of the vessel onto a floe. This was

necessary so that if the ice floe started to crack, the scientists could jump onto the basket and be lifted by a crane back aboard. Our group was lucky enough to acquire a sufficient number of ice samples for analysis. We also managed to acquire several water and air samples while we were stuck. However, the ship's exhaust contaminated the snow around us making it impossible to collect snow samples. I was never worried about the situation, we had an experienced captain and crew. Later, the ice pilot said he thought we would not break free until December, I'm glad that didn't happen."

Ph.D. student **Shelby Walker**, first Antarctic cruise:

"Early in the cruise we watched *South*, a documentary incorporating footage shot during Ernest Shackleton's catastrophic Antarctic cruise early in the 20th century. When I realized we were stuck in Marguerite Bay, one of my first thoughts was 'at least our ship isn't wooden.' It's one thing to be told you're stuck in the ice, it's another to see exactly what you're up against. Pressure ridges on the ice surface look like piles of snow; however, underwa-

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New VIMS Researcher Studies Tiny Organisms that Play a Big Role

By David Malmquist

For new faculty member Dr. Deborah Steinberg, taking a position at VIMS was a homecoming of sorts.

"I first became interested in oceanography during family clamming and crabbing trips to the Eastern Shore," says Steinberg, who grew up in Maryland. That interest started a career in marine science that has taken her from California to Antarctica, Bermuda, and most recently, back to Chesapeake Bay.

Steinberg, a biological oceanographer, began at VIMS in January 2001 as a new member of the Biological Sciences Department. Her research interests focus on how zooplankton community structure affects the flux of organic material and the cycling of nutrients in the sea.

"Our lab is involved in a number of projects with this theme," says Steinberg.

Steinberg came to VIMS from the Bermuda Biological Station for Research, where she had spent the previous six years as a Research Scientist and coordinator of the Ber-

muda Atlantic Time-series Study, or BATS. BATS is part of a large interdisciplinary and international program whose purpose is to understand the role of the oceans in large-scale processes of global change.

Prior to Bermuda, Steinberg was a post-doctoral researcher at the University of California, Santa Cruz, where



Dr. Deborah Steinberg

she also earned her Ph.D. in Biology. She has a B.A. in Aquatic Sciences from the University of California, Santa Barbara.

Much of Steinberg's previous research has focused on zooplankton in the deep waters of the open ocean. "One of the reasons I came to VIMS," says Steinberg, "was because I was interested in expanding my horizons to study zooplankton in shallow coastal ecosystems as well." She completed her first research cruise on the Bay in late September aboard the *R/V Ferrel*. The goal of the cruise was to examine how current patterns in the lower Bay affect the distribution of plankton.

In Bermuda, Steinberg focused on the vertical migration of zooplankton in the Sargasso Sea. Many zooplankton and fish that live in deep waters of the ocean during the day migrate up to the food-rich surface waters at night to feed under the cloak of darkness, which helps conceal them from visual



Copepod- The most abundant type of zooplankton in the world's oceans.

predators. After feeding, they return to the deeper, dark waters. These migrating zooplankton play an important role in transporting organic matter and nutrients to the deep sea.

Another research interest is the role that "marine snow" plays as a habitat and food source for plankton. Marine snow is organic detritus that is visible to the naked eye. Because it is heavy enough to sink, marine snow serves to transport organic material from surface waters to the hungry organisms of the deep sea. Marine snow also serves as a "community center" where a diverse suite of organisms, from tiny bacteria to copepods ("insect-like" plankton the size of a rice grain), live and feed.

Steinberg ties her plankton research into carbon and nutrient cycles in the ocean. In the last decade one of the main concerns of environmental scientists has been to understand carbon cycles in the ocean and atmosphere, due to increasing levels of atmospheric carbon dioxide and concern over global warming. Vertical transport processes like zooplankton migration and sinking of marine snow are an important part of the carbon cycle.

Steinberg enjoys going to sea, and has participated on oceanographic cruises to the Antarctic Peninsula, Monterey Bay, the subtropical Pacific, the Sargasso Sea, and Chesapeake Bay. The research programs on these cruises varied widely, including studies of Antarctic krill, marine snow, and blooms of gelatinous zooplankton. She also has experience using submersibles and blue-water (open ocean) SCUBA diving in her research.

Steinberg is also actively involved in educational programs at VIMS, as an instructor for Plankton Ecology courses, graduate student advisor, and as a mentor for high school students attending the Governor's School.

VIMS Welcomes New Students

Twenty-one new graduate students arrived at VIMS in August. The class includes members from across the United States, China, and India. Nine of the incoming class are Masters students and 12 are seeking Ph.D. degrees. Dean of Graduate Studies, Dr. Mike Newman, notes that the

average GRE and GRA scores for the class are the highest of any entering class in the history of the School of Marine Science. "This is an outstanding group of students that brings diverse interests and backgrounds to VIMS," said Newman.

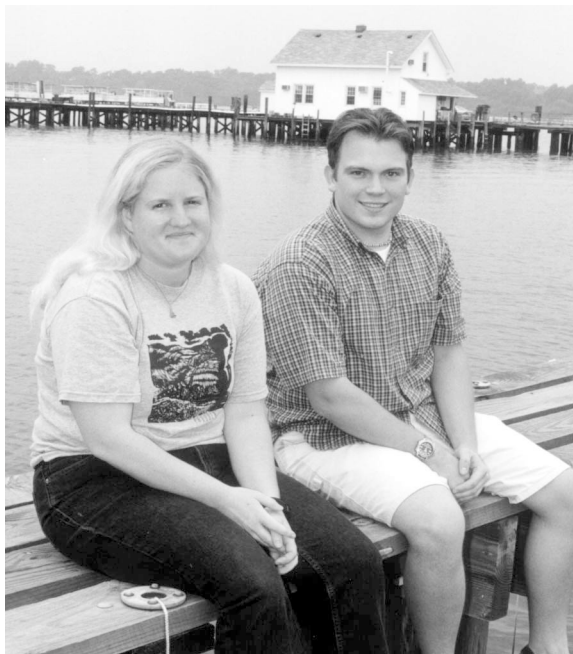
Among the entering students, Andrew Walker, from Boston University, learned about the SMS program while doing a semester at Woods Hole. "As I began looking at graduate schools, I quickly decided that VIMS offered the program that most interested me. I was also impressed by the close faculty-student interaction at VIMS. I'm really looking forward to my time here," he said.

From land-locked Kansas, Masters student Amy Shields has traveled extensively as an assistant scientist on the *SSV Westward* owned by the Woods Hole SEA Program. Faculty expertise was important to Shields as she began looking for a graduate program.

Her advisor Dr. Walker Smith says, "When I met Amy, I was very impressed by her enthusiasm and felt she would fit in great with my group. She is willing to do what is necessary to get the job done."

Prospective students are responsible for contacting faculty advisors at VIMS to match their own research interests with faculty expertise and research. "In a graduate research program, not only are students competing for slots for admission, but also for specific faculty mentors," explains Newman. VIMS accepted only 16% of applicants for fall admission.

First year students are required to take and pass five core classes. Core courses are designed to provide a broad base of knowledge as an underpinning for interdisciplinary research. The Core courses are *Fundamentals of Marine Science, Coastal and Estuarine Processes, Issues and Investigations, Fundamentals of Statistical Methods and Data Analysis, and Fundamentals of Experimental Design and Sampling.*



First year VIMS students Amy Shields and Andrew Walker.

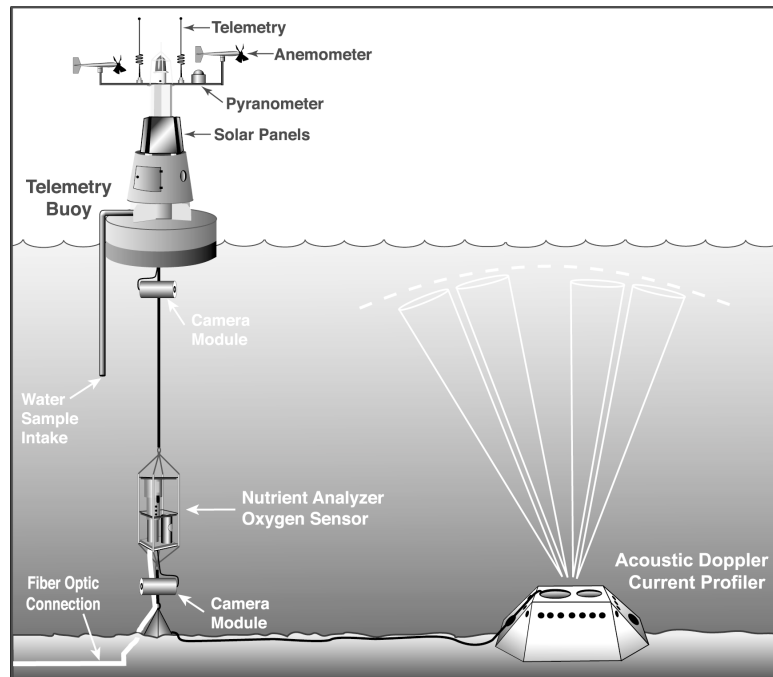
VIMS to Deploy First Buoy to Initiate Coastal Observing Program

By David Malmquist

Imagine life with no weather stations—no thermometers, barometers, wind gauges, or rain gauges. Farmers, flight controllers, commuters, tourists, event organizers, all who depend on weather data and forecasts would be left to guess at nature's whims.

An analogous situation now faces maritime interests in Hampton Roads—an almost complete lack of instruments to provide the sustained real-time data needed for characterizing or predicting the condition and behavior of coastal waters.

VIMS scientists plan to help remedy this shortfall by implementing a system of instrumented buoys in the lower Chesapeake Bay that can measure winds, waves, currents, salinity, nutrients, water density, water quality, and fish stocks. These buoys will be connected to the Internet via telemetry and eventually by submerged fiber optic cable. This will allow high-speed transmission of real-time data to any and all who need them, including researchers, military and shipping concerns, watermen, sailors, surfers, and beach-goers. The first mooring is



expected to be deployed in the lower York River in early January 2002.

The planned system is termed CBOS-II, for Chesapeake Bay Observing System-Phase II. It will be part of a larger regional Southeastern Coastal Ocean Observing Program (SCOOP). Both systems support the international call for an integrated and sustained Global Ocean Observing System (GOOS).

The data provided by the CBOS buoys will also be fused with computer models to help predict the future state of Bay waters. This will allow modelers to more readily test the models and improve the accuracy of their predictions. Bay models can be used to predict

the likely path of an oil spill, coastal erosion hazards, the location of a menhaden school, or even the chances for encountering jellyfish at a local beach.

CBOS-II will also provide an enhanced ability to forecast the likely paths of toxic substances or dangerous objects. This is particularly important given current concerns regarding homeland security.

The CBOS-II project promises significant economic benefits for Tidewater Virginia. A 1999 Congressional report suggests that the ports of Hampton Roads and Baltimore, now behind only New York and Los Angeles in tonnage, will see doubled trade over the next 20 years. CBOS will provide for better planning of future port development, and also allow for better tracking of any environmental effects.

According to VIMS Director Don Wright, "CBOS-II, like the more expansive SCOOP, will provide a multi-functional infrastructure in support of the scientific community, the general public, and students at all levels. Key features of CBOS-II are that access to the data will be open to everyone in real-time and the observations will be sustained for decades."

CBOS will also provide a testing ground for development of new marine observing technologies and is likely to attract new electronics and instrumentation industries to Hampton Roads. Given the proposed scope of the Global Ocean Observing System, the market for this type of environmental-monitoring equipment is likely to be large.

VIMS Student One of Five Nationally to Receive Dr. Nancy Foster Scholarship Award

The U.S. National Oceanic & Atmospheric Administration (NOAA) recently awarded the newly established Dr. Nancy Foster Scholarship to five outstanding graduate-level researchers in the fields of oceanography, marine biology, and maritime archaeology.

VIMS student Laurie Ann Sorabella was one of the five recipients nationally. Sorabella is currently pursuing a Master's degree in marine biology at VIMS. Her research centers on estuarine and coastal



Laurie Ann Sorabella

most desirable oyster strain for use as broodstock in oyster reef restoration, and second, to characterize water quality changes associated with a restored oyster reef and the potential for reefs to create a more habitable environment for seagrasses.

NOAA received more than 500 applications for the five awards. The award carries a stipend of \$16,800 per year and up to \$12,000 annually for tuition. "We received a large number of applications from a

pool of extremely well-qualified students. It is great to see such interest in the first year of the program," said NOAA acting administrator, Scott Gudes.

CHEF'S Symposium

The Chefs' Seafood Symposium, an education program for professional chefs certified by the American Culinary Federation, was held at VIMS on October 15. Over 100 Virginia chefs, culinary students, educators and representatives from seafood businesses attended the event.

Guest presenters included Bob Fisher, VIMS seafood specialist;

Michael Jahnke, of the Virginia Agricultural Seafood Research Center in Hampton, Shirley Estes, Executive Director of the Va. Marine Products Board; Chef Joaquim Buchner, CEC, CMC, from Chevy Chase Club, Chevy Chase Maryland, and Chef Harry Brockwell, CEC, from Oceanside Caterers, Westlake Village, California.



Chef Harry Brockwell offers tips for cooking seafood to participants in the annual Chef's Seafood Symposium.

Virginia Fisheries Trends

By Tom Murray

Understandably, recent attention on the traditional commercial fishing industry in Virginia has focused on the status of the oyster and blue crab fisheries. Both are subject to extensive evaluation and management efforts to rebuild and stabilize stocks. Those concerned with the well-being of Virginia's seafood and fishing industry often wonder if there is any "good news."

There are, indeed, positive indicators of the status of commercial fisheries in Virginia, important to the Commonwealth and nation, that perhaps somewhat mitigate the prevailing view of continued declining wild fisheries and a receding fishing industry.

First, how does Virginia compare these days with other states in commercial fisheries?

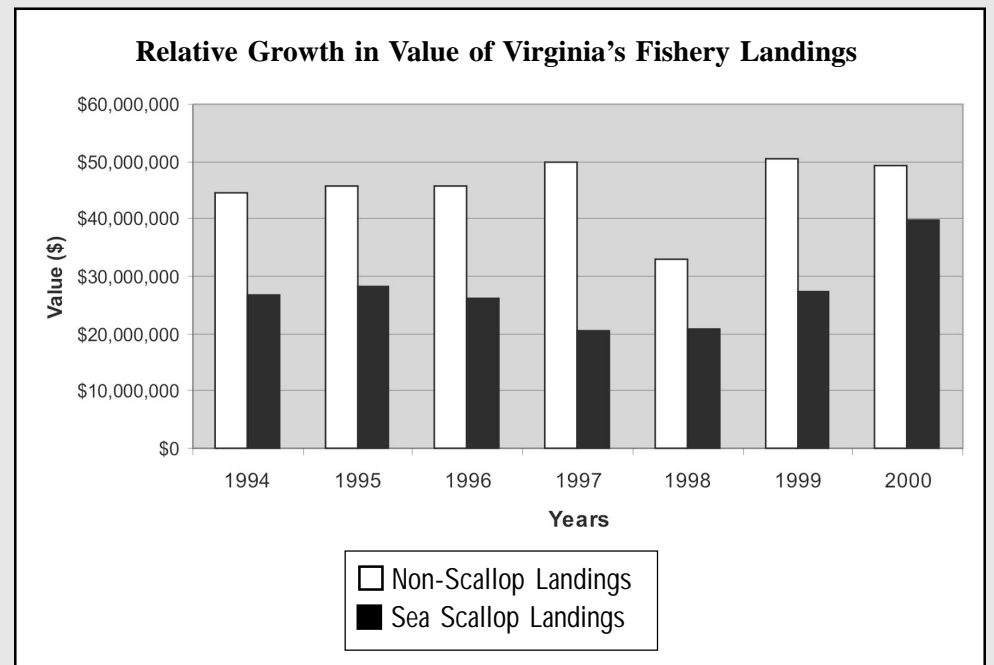
As a measure of fishing activity and ranking of major commercial fishing ports, the Hampton Roads, Virginia Area ranked 7th in the value of the catch landed among all U.S. ports, according to recently summarized data from NOAA Fisheries.¹ Interestingly, last year New Bedford, Massachusetts landed the highest value of fishery products among all U.S. ports. Bolstering the commercial fishery values both here and in Massachusetts were sea scallops – one of the "bright spots" in an otherwise troubled commercial fishing industry.

The growing success of the scallop fishery is good news to Virginia's industry and economy. It is significant that the fishery has recently prospered, in part, by virtue of a harvest management regime jointly fostered by Virginia's scallop industry and government, led by scientists at VIMS. The use of special-area management zones to optimize fishing grounds, along with improvements in harvest-gear efficiency, have combined to create this success story.

This stands in stark contrast to the recent past. When Virginia first entered the offshore sea scallop fishery in a significant manner two decades ago, the prospect for failure was quite clear. Based on overcapitalization—which stemmed from over-harvesting during the 1970s—a once viable fishery was thought by many at the time to be "about over."

Recent trends in the harvest of sea scallops suggest a different prospect for the future and an increasing importance of this sector to the state.

Preliminary data provided by the Virginia Marine Resources Commission indicate that last year Virginia landed 81.8 million lbs. of fish and shellfish valued at \$89.1 million. Those totals included 9.4 million pounds of sea scallop meats valued at \$39.8 million, for an average dockside price of \$4.23 at the boat level. In total, about 40% of the entire value of Virginia's wild-harvested seafood landings came from scallops.²



What the harvesting and unloading of this volume of seafood products means to Virginia (besides the obvious financial contribution of the catch to harvesters) is a welcome boost in economic activity for at least a part of the state's traditional seafood infrastructure. Viewing the growth in scallop-related business since 1994 provides a convenient timeline with which to update some earlier economic impact estimates.

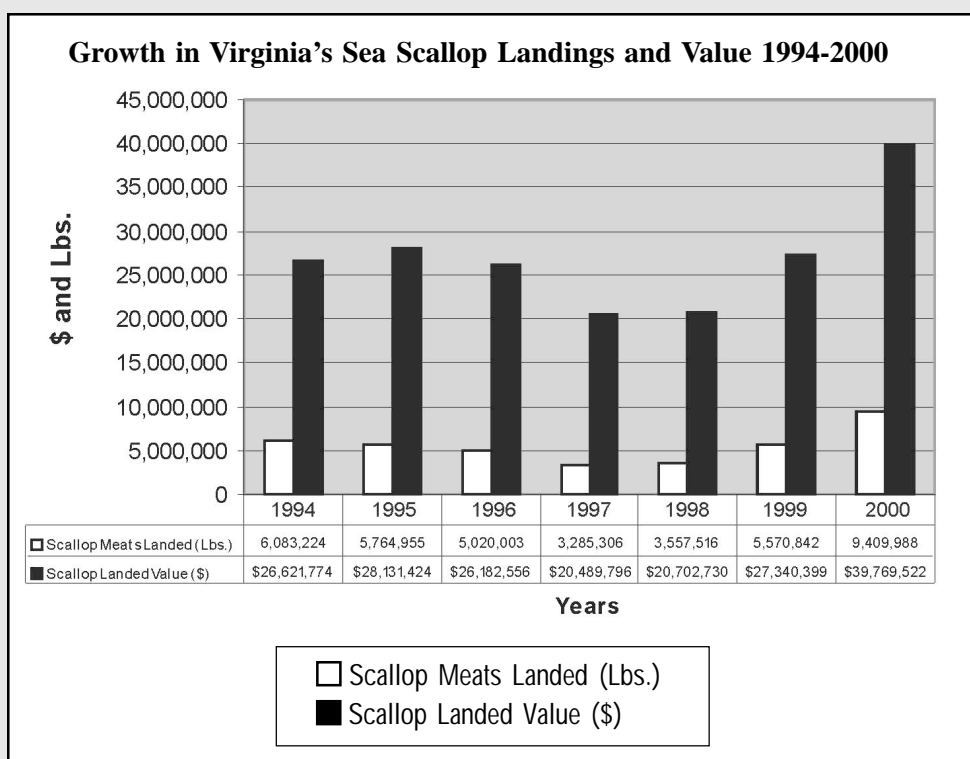
Virginia's Commercial Fishing Industry: "Its Economic Performance and Contributions," a 1994 study completed by VIMS economist James Kirkley, used primary economic surveys and input/output modeling to ascertain the business activity associated with sea scallop harvesting, processing, marketing, and distribution. In fact, all of the state's commercial fisheries were evaluated in that study, and it still offers considerable truth about the current state of Virginia's wild fisheries.

In the year studied (1994), industry unloaded 6.1 million pounds of sea scallops in Virginia with an ex-vessel value of \$26.6 million. As indicated above, at the end of 2000, Virginia's

fleet had unloaded nearly half again as many sea scallops in terms of value; almost \$40 million of scallop meats, primarily in the Hampton Roads area.

During 1994, the economic contributions of the scallop fishery ranked third among all species landed in Virginia (behind blue crabs and menhaden). Given the significant increase in poundage and continued strong scallop prices, it is likely that sea scallops are currently the most important fishery in Virginia, in terms of certain economic impact measures such as income.³

Simply expanding the impact figures from the 1994 study, it is estimated that the direct economic impacts of the fishery in 2000 were \$66 million in economic output and \$43 million in income generated. Estimating the associated secondary ("indirect") economic impacts to firms selling supplies and other inputs to the seafood businesses, and third-round ("induced") impacts from households re-spending the income earned in the direct and indirect sectors on other goods in Virginia, the total economic output arising from Virginia's scallop industry today exceeds \$125 million. Finally, the expanded value and impact suggest that the earlier estimate of 1,900 employment equivalents stemming from the scallop industry is still a reasonable estimate. In view of this, efforts to maximize the value of the offshore fishery for the benefit of Virginia are to be considered *good news*.



¹ Fisheries of the U.S. 2000. U.S. Department of Commerce, NOAA, NMFS

² When including industrial fishery (menhaden) landings at Reedville, Virginia, the total harvest for 2000 was 448.6 million pounds worth \$118.6 million ex vessel. NMFS.

³ During 1994, blue crabs and industrial finfish (menhaden) were estimated to be the largest in terms of total economic output to the State.

Can Spray Dredging Help Save Local Marshes?

Scientists at VIMS are investigating the potential of spray dredging to provide new solutions to environmental management problems. Spray dredging is a technique for disposing of materials dredged from channel bottoms by spraying a thin layer of material over adjacent areas. The method was developed for use in the Louisiana coastal wetlands. Removing material dredged from the canals to remote disposal sites was always a problem until someone thought of mixing the material with a stream of water and spraying it in a thin layer over wide areas next to the dredging project.

The spray method of dredged material disposal has always been prohibited in Virginia, where vegetated wetlands are protected under the state's tidal wetlands law. VIMS scientists have been cautious about the potential impacts on existing wetlands, but recently they have been motivated to examine the technique more closely for two reasons. First, there is always a need to find economical and environmentally acceptable methods of

disposing uncontaminated dredged material. Second, some of the Commonwealth's tidal wetland resources are showing signs of stress due to rising sea levels.

Marshes must accrete or accumulate material on their surface at a rate equal to the rise in sea level in order to sustain themselves. If material accumulates too slowly, marshes are inundated by tides at increasing frequency, until finally the vegetation can no longer survive. VIMS scientists reasoned that applying thin layers of dredged material might aid marshes in keeping pace with sea-level rise, if it could be done in a manner that did not destroy existing vegetation.

The Pamunkey River, just above West Point in the York River system, has some of the nation's largest pristine tidal freshwater and low salinity wetlands. These marshes are among those in the mid-Atlantic showing the greatest potential impact from rising sea level. Private owners of these wetlands, led by Mr. Sture Olsson, have provided funding to enable VIMS

scientists to study the changes and to investigate potential management methods designed to preserve existing plant communities. Spray dredging is one of the leading methods under investigation.

The experiments are led by Dr. Carl Hershner, Director of the Center for Coastal Resources Management at VIMS, and Mr. Troy Deal, president of Aztec Development Company of Orlando, Florida. Aztec has refined the techniques necessary to produce a thin, even layer of material over a broad band next to the dredge site.

Under the direction of VIMS scientists, the dredge operators removed sediments from the bottom of the Pamunkey River and a small channel in one of the marshes just upstream of West Point. The material was sprayed onto test plots, which have been studied by researchers for the past year. The experiment will allow VIMS scientists to document the

same time without requiring the replanting of those that haven't reached market size. Commercial growers see greater returns when they can save the effort of replanting slow-growing clams.

The clams will also be monitored for resistance to the recently discovered clam disease QPX. QPX was first observed in New Brunswick, Canada in the 1950s and has recently been detected farther south. The parasite is common in parts of Massachusetts, where some productive clam growing areas had to be abandoned. It was first detected in Virginia waters in 1996 by VIMS researchers. Last summer the disease caused sufficient mortality to have an economic impact on Virginia clam growers for the first time. One Eastern Shore grower lost an entire crop to the disease. Finding clam strains resistant to QPX can help avoid such losses in the future.



Spray dredging is a version of hydraulic dredging. Underwater sediments are cut loose by a rotating head on the dredge. The sediment is mixed with surrounding water and sucked into the dredge by a powerful pump. The slurry is then forced, under great pressure, through a hose and nozzle, which can spray the mix up to 100 feet over adjacent areas.

impacts of the disposal method on the vegetation and fauna of the marshes.

Scientists hope to determine whether the spray-dredging technique can be used in Virginia as an environmentally acceptable method of dredged-material disposal. They also hope to discover if the technique has promise as a beneficial use of dredged material to help marshes sustain themselves in the face of rising sea level.

Scientists expect to see the first evidence of effects next spring when the marsh vegetation begins to regrow. The experiments on the Pamunkey marshes will extend over four years.

VIMS Researchers Are Domesticating the Wild Clam

Researchers at VIMS just began a new experiment that may change the future of clam farming in Virginia. Dr. Mark Camara, Breeding Research Manager for the VIMS Aquaculture Genetics and Breeding Technology Center at VIMS, led a team that planted hundreds of thousands of clams for monitoring from Mobjack Bay to the Eastern Shore in cooperation with commercial clam growers who are providing growing space and logistical support. Camara explained that the purpose is to determine through genetic

experimentation which clams thrive best in various environments and to begin selective breeding to improve them.

Dr. Camara began this experiment at the center's clam hatchery at the Eastern Shore Laboratory in Wachapreague with five of the most common clam stocks purchased by Virginia growers and mated these five strains in all possible pair combinations, resulting in 15 distinct genetic lines. The 15 lines of clams are being planted in areas of different salinity and will be

monitored for about two years to see which clams perform best in each environment.

Camara will be looking for clams with high survival and fast, uniform growth. The time spent harvesting clams is greatly reduced when all the clams in a planted bed grow at a uniform rate, allowing all clams to be harvested at the



VIMS team planting clams at one of several research sites.

“Clam farming is very new compared to land-based agriculture,” Camara commented, “and the clams being farmed have only been in the hatchery for a few generations. This can add difficulties in farming because they really aren't yet adapted for domestication.”

Camara says to get stocks that perform well in different areas, “You need to do more than just breed big clams with big clams. There's no such thing as a ‘super clam’ strain that will survive and grow under any conditions,” he says “You've got to tailor the animals' genetics to environmental conditions, and that is a big part of our mission at the center. Right now, most clam aquaculture takes place on the Eastern Shore. We're planning to develop a number of strains that thrive in other areas and make aquaculture profitable in a wider range of environments.”

Dean/Director Made Honorary Fellow at University of Wales Bangor

VIMS Dean and Director L. Donelson Wright was made an Honorary Fellow of the University of Wales Bangor. During the presentation, Professor John Simpson, of the University of Wales, chronicled Wright's career contributions to understanding sediment-transport processes first in the Mississippi delta and later on the Australian coast. Wright has also worked extensively throughout the Mid-Atlantic Bight and Chesapeake Bay as well as on the California coast and in the Yellow River delta in China. Simpson said Wright's work "produced an enduring account of how sediment transport processes operate, an account which is nowadays widely quoted in oceanographic and geologic textbooks. Above all though, he is an outstanding scientist of international repute who is rather unusual in having successfully combined the traditional approaches of geology and physics in studying the workings and effects of sediment transport. In these endeavors, he has produced an impressive list of



Professor John Simpson and Dr. L. Donelson Wright.

scientific publications which have strongly influenced the science agenda in his field."

Wright was instrumental in establishing a collaborative relationship between the University of Wales, Bangor and the College of William and Mary. Supported by the Drapers Company of London, there has been an active exchange of faculty and students between the two institutes for the past several years.

Marine Trades Expo & Conference Coming Up

By Tom Murray

Recreational marine businesses are facing an increasing number of hurdles in their efforts to succeed. Trials and tribulations range from expanding laws and regulations, to taxation, finding skilled workers, and waterfront development pushing out traditional maritime businesses. The marine trades associations of both North and South Carolina have been trying to help their members deal with these issues through an annual meeting.

This year, big changes are in store for what would have been the third annual SC/NC Marine Trades Expo. To begin with, the Expo concept has been expanded to include marine businesses in Virginia and Georgia as well as North and South Carolina. Reflecting broader regional focus, the name is now the Southeastern Marine Trades Expo and Conference, and the event will draw industry and government participants from all four states to Charleston, SC, December 11-13.

Sea Grant programs from all four states are participating this year. Created in 1966 as a partnership of university, government, and industry leaders to focus on marine research and advisory services, the Sea Grant program is uniquely qualified to help conference organizers bring such leaders to the meeting.

This year's seminar series will focus on issues of importance to the development of the recreational marine industry – including topics that link marine businesses with the broader issues of coastal community development and public access. The Coastal Community & Waterfront Redevelopment session, besides including a panel discussion, will feature a tour of Charleston's municipal waterfront developments and its Maritime Center. A reception that evening will be held at the South Carolina Aquarium.

Other planned sessions include presentations from already successful industry-training programs and legal

Environmental Education for Special People

By April Bahen

On a sizzling July day, 31 students— 19 hearing impaired, 7 visually impaired, and 5 without disabilities— from the summer camp at the Virginia School for the Deaf, Blind, and Multidisciplined in Hampton (VSDBMH) came to York River State Park (YRSP) for a totally new experience. Students, teachers, group leaders, and American Sign Language interpreters were embarking on the first environmental education program designed specifically for visually and hearing-impaired students.

The program was developed by Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) Assistant Education Coordinator April Bahen and Manager Dr. William Reay, and funded by the American Honda Foundation. The program was two-pronged, consisting of an in-class and field-based portion. The first order of business was to find teachers with whom CBNERRVA could consult on the development of the program. Two teachers from VSDBMH, Linda Ross, a teacher of the visually impaired, and Rhea Dunlop, a teacher of the hearing impaired, were contracted to help create a large

portion of the in-class component. In February, two teacher workshops were held to introduce the project. Each teacher received a *Tidewater Virginia Natural Resource Box*. The box was created to be used in the classroom prior to and after visiting the field site at York River State Park. It included four sets of natural manipulatives, a video produced at YRSP on basic environmental information and concepts in the Tidewater Virginia area, and a resource guide with printed environmental information, raised line drawings for the visually impaired, and activities and themed questions to focus the students' learning on basic environmental facts and concepts.

After discussions, VSDBMH decided their summer camp participants would attend the field excursion in July. All students seemed to enjoy the program, and the educators who were surveyed at the end of the day said the program was worthwhile, safe, and the staff had wonderful attitudes towards the students. Lead teacher Rhea Dunlop even wrote to VIMS after the program that students were bragging to their parents about what they had seen and done.

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Educator April Bahen with students and sign language interpreter.

discussions covering marina and boatyard liability issues. There also will be a session on current boating access, with emphasis on new programs to educate the boating public, as well as dredging issues in marinas and navigable waterways.

"We will be discussing innovative new programs for the recreational marine industry," explained South Carolina Marine Association (SCMA) director Jamie O'Brien. "The sessions will benefit all in the industry and, ultimately, the boating public." O'Brien and Nancy Schilling, past president of SCMA, are very proud of the program they have put together with the assis-

tance of Tom Murray, Marine Business Specialist at the College of William & Mary. They expect the splendor of Charleston during the Christmas season will provide an additional attraction for attendees in what they hope will prove to be an unparalleled event for the boating industry.

The Westin Francis Marion Hotel, next to the Lightsey Conference Center, is the host hotel. For further information for exhibitors and participants, contact Jamie O'Brien, SCMA, P.O. Box 12187, Charleston, SC 29422; call 843-795-7857; or e-mail jamie@scmarine.org.

It's a *Breve* New World for Nitrogen Research at VIMS

By David Malmquist

In recent years, blooms of harmful algae have killed thousands of fish and raised public concern about the increasing number of such episodes along coastlines worldwide.

VIMS scientist Dr. Debbie Bronk and colleagues are now working to better understand harmful algal blooms by focusing on one of their key ingredients—the dissolved nitrogen that algae require for rampant growth.

Algal blooms are formed by aggregations of tiny marine plants that require nitrogen and other nutrients. Many scientists attribute the recent escalation in harmful algal blooms at least in part to nutrient enrichment of coastal waters due to human activities such as the application of nitrogen fertilizers to fields and lawns. Rivers and the wind can transport nitrogen from these sources into shallow waters offshore.

But such thinking fails to fully explain the algal blooms that typically occur during fall in the eastern Gulf of Mexico. The waters there are nitrogen-poor, yet they frequently nurture vast blooms of the toxic algae *Gymnodinium breve*, or *G. breve* as researchers call it.

These “red tides” threaten fishing and tourism along Florida’s west coast. The algae release a neurotoxin that can kill fish, which then often float ashore and foul nearby beaches. Build-up of the toxin in shellfish such as oysters precludes their consumption by humans. There is also anecdotal evidence that the toxin can affect humans directly. Swimmers exposed to the toxin have complained of itchy eyes and scratchy throats, as have boaters, who could be exposed to the toxin if it enters the air when waves break.

The luxuriant growth of nitrogen-loving algae in nitrogen-poor waters poses a fundamental question. Asks Bronk, “What’s fueling these guys?” The situation also provides a natural laboratory for studying the role that nitrogen plays in marine food webs elsewhere, including Chesapeake Bay.

Along with colleagues from the University of South Florida and Old Dominion University, Bronk is testing the idea that the nitrogen required to fuel *G. breve* in the Gulf of Mexico is supplied naturally by a colonial, nitrogen-fixing marine bacterium called *Trichodesmium*.

On land, bacteria within root nodules on plants like peas and beans

help the plants extract or “fix” nitrogen directly from the atmosphere. These plants play a key role in terrestrial ecosystems by allowing vegetative growth in areas with nitrogen-poor soils. Farmers take advantage of this ability when they alternate plantings of corn, a heavy nitrogen feeder, with soybeans, a nitrogen-fixer that returns nitrogen to the soil.

it occurs in a dissolved organic form, within compounds such as urea and amino acids. To date, researchers have mostly looked for forms of dissolved inorganic nitrogen, such as ammonia and nitrate, when trying to balance nitrogen budgets in the ocean.

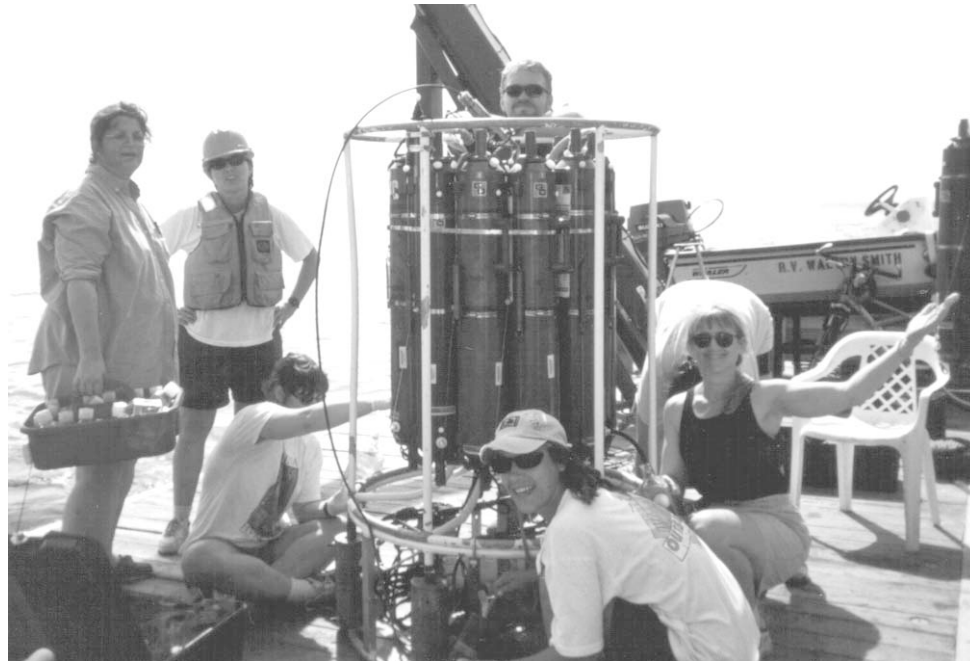
To test their hypothesis, Bronk and her colleagues have received a grant from the National Science Foundation

thinking. They did so by adding a dose of heavy nitrogen isotopes to a sample of nitrogen gas, and then adding this “labeled” nitrogen gas to seawater containing colonies of *Trichodesmium*. If specialized *Trichodesmium* cells do indeed fix nitrogen and share it with other cells, labeled nitrogen should appear throughout the colony.

After sampling an unusually rich bloom of *G. breve* during their September cruise, Bronk and Sanderson began investigating the relationship between *G. breve* and *Trichodesmium*. They added labeled nitrogen to a vial of seawater containing a population of *Trichodesmium* separated from a surrounding population of *G. breve* by a semi-permeable membrane. The openings in this membrane are large enough to allow passage of dissolved organic nitrogen, but too small for either organism. Thus any labeled nitrogen they detect in the tissues of *G. breve* will provide evidence that this organism does indeed take up organic nitrogen released by *Trichodesmium*. Early results from these tests confirm their hypothesis.

Bronk is also working with Craig Tobias, a current post-doctoral student at the Woods Hole Oceanographic Institution and VIMS graduate. Their goal is to further test the idea that dissolved organic nitrogen produced by the summertime *Trichodesmium* bloom persists and is used by *G. breve* in the fall.

The laboratory technique they use to test this link was developed by Bronk. Applying this technique to measure the natural abundance of organic nitrogen dissolved in seawater has never been done before. It relies on measuring the tell-tale ratio between two naturally occurring nitrogen isotopes that results when *Trichodesmium* fixes nitrogen. Detecting nitrogen compounds within *G. breve* containing a similar ratio would provide strong evidence of a link between the two organisms.



Dr. Deborah Bronk (far right) collecting water samples aboard the *R/V Walton Smith* during a research cruise studying the fate of recently fixed nitrogen by *Trichodesmium* in the eastern Gulf of Mexico.

Trichodesmium is thought to play a similar role in nitrogen-poor tropical seas. Scientists suspect that specialized cells within a *Trichodesmium* colony extract atmospheric nitrogen dissolved in seawater for their own growth and development. Then, scientists think, these cells release nitrogen-bearing compounds such as amino acids into the surrounding water, to nurture other cells in the colony. It is this dissolved organic nitrogen, Bronk and her colleagues believe, that leaks into the surrounding water and later stimulates the growth of *G. breve*.

The team’s hypothesis is based partly on the process of elimination, as measurements show that inputs of nitrogen from rivers and the air into local waters fail to supply the quantities needed to support blooms of the extent observed. The team also points to the timing of *G. breve* blooms along the west Florida coast. These occur in early fall, shortly after *Trichodesmium* undergoes its own annual summertime bloom.

Bronk suggests that previous research has overlooked the nitrogen derived from *Trichodesmium* because

to conduct a pair of research cruises off Tampa Bay, Florida during each of the next three years. The project is part of the national ECOHAB (Ecology and Oceanography of Harmful Algal Blooms) program, which was established by NSF and NOAA in response to the upward trend in harmful algal blooms along America’s coasts. A July cruise is timed to collect samples of *Trichodesmium* during its summer bloom. A September cruise is designed to sample *G. breve*.

This year the team took their first pair of cruises. During the July cruise, Bronk and her laboratory manager Marta Sanderson began experiments to test whether *Trichodesmium* colonies fix nitrogen according to accepted

Environmental Education for Special People
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The project has been an overall success. CBNERRVA plans to continue the field trips to YRSP this fall and throughout the next year. For those who are visually impaired, an information audio tape of the trail immediately

surrounding the YRSP Visitor’s Center is being produced and will be released in September. An introductory guide to developing environmental education programs for the visually and hearing impaired is being completed to be distributed to the other National Estuarine Research Reserves (NERRS) around the country.



“One Fish, Two Fish, Red Fish, Blue Fish”

This famous line from Dr. Seuss is about to take on a whole new meaning for a team of VIMS scientists and their colleagues who are combining high-resolution side-scan sonar, sophisticated image analysis, and robotics to identify and count fish.

New technology, which is being developed and tested by Dr. Mark Patterson, Dept. of Biological Sciences, Dr. Roger Mann, Dept. of Fisheries Science along with Dr. Zia-ur Rahman, Dept. Computer Science, William and Mary and VIMS graduate student Daniel Doolittle promises to provide a more comprehensive and accurate view of

fish population dynamics. The research, which utilizes recent advances in sonar, underwater vehicles, and computer software, is being developed and tested by Drs. Patterson and Mann and other scientists at VIMS, along with colleagues at the College of William and Mary and partners in the marine technology industry.

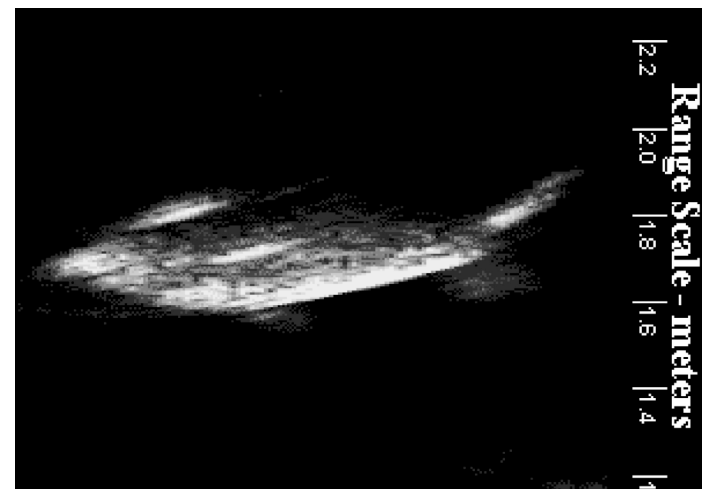
The team has mounted a sonar device on a miniature submarine called an AUV (Autonomous Underwater Vehicle). The sonar unit, which was developed by a team led by Marty Wilcox of Marine Sonic Technology Ltd. in Gloucester, resembles the “fish finders” used by anglers, but provides images of such high resolution that the

shapes of individual fish can be clearly discerned. The unit produces images by emitting sound waves and recording the echoes produced when the waves reflect off underwater objects. The remotely controlled AUV, developed by

Sias Patterson, Inc., can dive to depths of 1,000 ft and stay submerged up to 4 hours.

With the support and cooperation of the Virginia Marine Science Museum in Virginia Beach, the team is beginning their work in the Norfolk Canyon and Chesapeake Bay aquariums located at the museum by gathering images of selected fish species. Next, they will “train” a computer so that it can, when fed a digital sonar image, quickly count and measure individual fish of selected species based on their shape. To ease the computer’s task, the team plans to enhance the sonar images prior to analysis with a state-of-the-art image-processing system developed by Dr. Rahman. This includes adjusting the image so that the shape analysis is not confounded by the orientation of the fish relative to the sonar unit.

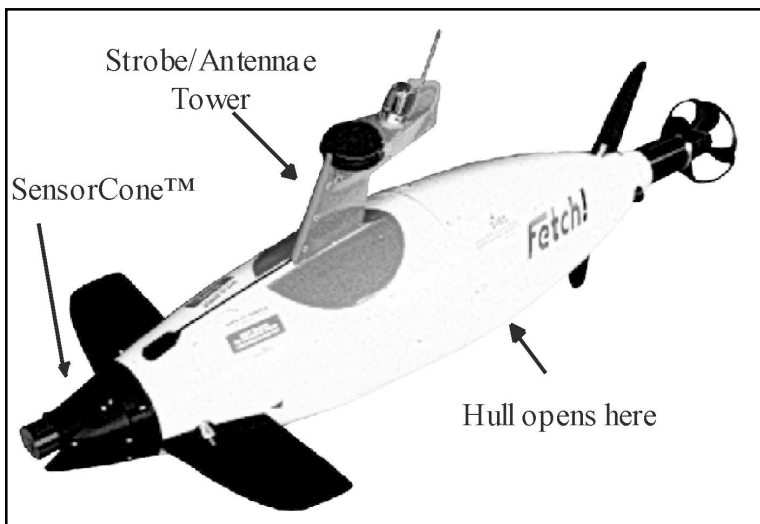
Marty Wilcox of Marine Sonic Technology, Ltd, said, “We have observed single fish and schools of fish while developing and using our high-resolution sonar, but this is taking the technology in a whole new direction. We are very excited to be a part of this very innovative and ultimately very beneficial application of our technology.”



Tarpon (*Megalops atlantica*) at close range on 600 kHz side scan.

To effectively manage commercial and recreational fisheries, regulatory agencies need to know the populations of different fish species and how they vary through time. But accurately counting fish isn’t easy. Traditional methods, in which scientists count fish caught in a net or on a line, only provide a “snapshot” of a population at a specific time and place. Such data are less than ideal, particularly in estuaries like the Chesapeake Bay, where fish populations vary tremendously from day to day, year to year, and place to place.

If the team is successful, assessment of fish stocks in the Chesapeake Bay and other estuaries will never be the same, as a fleet of instrumented AUVs augment the use of trawl nets and long lines, and help to meet the growing need for improved fisheries data.



Autonomous Underwater Vehicle built by Sias-Patterson, Inc.

Kelley Watson Fellowship

The first Kelley Watson Fellowship was awarded to Wes Dowd, M.S. student, Dept. of Fisheries Science.

The fellowship, which provides tuition and a stipend, is awarded on the basis of outstanding academic merit in the first year core courses. The fellowship was established in the spring of 2001 in memory of Masters student Kelley Watson. Fellow students and faculty recognized in Kelley an unusual degree of enthusiasm and commitment to marine science. “It is a great

honor to have received a fellowship bearing Kelley’s name, yet simultaneously I am saddened to know that Kelley likely would have earned the

fellowship because she exhibited all the attributes I aspire to in my scientific career,” says Dowd. Dowd is currently



Wes Dowd on longline cruise.

developing plans to conduct the bulk of his thesis research during the summer and fall of 2002. He will be addressing the role of the seasonal summer population of juvenile sandbar sharks in the Chesapeake Bay ecosystem from a bioenergetic modeling approach. His thesis will focus on assessing the metabolic requirements (via oxygen consumption measurements) and daily ration necessary to support observed growth rates and activity of this predator in the Bay region.

VIMS Annual Fund Board Hosts Donor Day

Donor Day at the Virginia Institute of Marine Science was a day of celebration and recognition. On Saturday, September 22, VIMS Associates gathered in McHugh Auditorium. Dean and Director L. Donelson Wright welcomed the group and thanked them for their “continuing support and involvement.” He announced receipt of approximately \$1.2 million in gifts from corporations, foundations, and individuals in FY 2001. “These gifts are critical to our mission to support research, education, and advisory services in marine science,” Wright said.

Annual Fund Board President John Dayton awarded the first VIMS Associates Scholarship to Lawrence Carpenter, a Ph.D. student. Carpenter spent 20 years as a professional fire fighter in London, before retiring after an injury. After a year of intensive college science courses, he began his study of Marine Biology at the University of Newcastle upon Tyne. In September of 1999, he came to VIMS as a Ph.D. student. Carpenter is especially interested in the study of deep-sea equipment. In February, he will be in the Antarctic working with underwater high-tech video production and he hopes to investigate internal waves in the Gulf of Maine in 2002.

VIMS Launches New Web Site

The VIMS web site has quickly become the primary portal between VIMS and the outside world, with about 80,000 visits in an average month. Visitors include prospective graduate students, VIMS scientists checking e-mail from the field, citizens and students searching for information about marine science, and journalists seeking expert commentary on a breaking news story.

To better meet the diverse needs of this rapidly growing audience, VIMS has developed and launched a new web site: www.vims.edu. The site is designed to provide quick and easy access to the wealth of on-line information and resources VIMS has to offer. The team was led by VIMS web editor David Malmquist and web master Nancy Wilson, along with the research and marketing firm DIA Inc., and graphic artist Phillip Billups.

A primary goal of VIMS' new web site is to provide a "virtual media center" that helps journalists keep abreast of VIMS research and events. This project was funded through private contributions.

DIA staff began the process by interviewing each VIMS faculty member. These in-depth interviews helped to clarify the current relationship between VIMS scientists and the media, and to identify ways in which this relationship could be expanded and strengthened.

The new VIMS media center (www.vims.edu/newsmedia/) provides several features designed to help publicize VIMS' expertise for science writers and journalists. These include an on-line library of video clips and still images that can be downloaded for use in newspapers, magazines, TV, or the Internet. The News & Media pages also feature a constantly updated events calendar, an interactive list of content-area experts that helps journalists quickly identify the right person to contact for an interview on a particular topic, and downloadable versions of recent and archived press releases, newsletters, and program brochures.

The broader goals of the web design process were to make the new VIMS web site faster to download, easier to navigate, and more consistent from page to page. "User feedback shows that our goals have been met," says web editor Malmquist. "The new VIMS home page downloads about three times faster than the old home page, navigation is much cleaner, and all the pages now share a similar 'look and feel'."

Because the VIMS web site increasingly serves as the primary information gateway for each of the Institutes' departments and programs, the creation of the new site required a collaborative effort that incorporated input from faculty, staff, students, and



administrators. Particularly important to the project's success were the volunteer efforts of the "websters" who create and maintain web pages for specific administrative units. The VIMS websters are Chris Bonzek (Fisheries Science), Greg Mears (Environmental Sciences), Jesi Morgan (Biological Sciences), Katherine Small-Davis (Sponsored Programs), Dave Weiss (Center for Coastal Resources Management), and Dave Wilcox. Advisory Services staff members Lee Larkin, Lisa Lawrence, and Susan Haynes were also instrumental in the effort. Kevin Kiley, of Information and Technology Services, helped transfer

the site to a new server that will increase the site's reliability, ease maintenance, and allow for broadcast-quality streaming video.

Staff at DIA are helping to publicize the new web site through an outreach program that includes mailings of VIMS promotional materials to science and policy journalists around the U.S. These mailings are intended to help journalists better appreciate VIMS as a source for exciting research stories and content expertise, and to help distinguish VIMS from other local institutions with similar acronyms or names, such as VMRC, VMI, and the Virginia Marine Science Museum.

Two Boats Added To Fleet

Two especially useful vessels have been added to the VIMS fleet recently, thanks to the generosity of several very thoughtful donors. One boat is a sturdy 36-foot cabin cruiser named *Eagle's Nest*. The donors, Kay and Jerry Ainsworth of Williamsburg previously operated the *Eagle's Nest* as a passenger carrying vessel on the James River. They currently operate narrated, historical cruises as well as lunch and dinner cruises aboard the 65-foot *Yorktown Lady* from the Waterman's Museum pier on the York River. The *Eagle's Nest* maintains a certificate of inspection from the U. S. Coast Guard for passenger carrying operations. VIMS scientists such as Dr. Carl Hershner plan to use the *Eagle's Nest* for intensive marsh studies and shoreline inventory work. They will monitor the movement of fish, sediment and nutrients through



Marcia Berman, Harry Berquist, and Dr. Carl Hershner aboard the *Eagle's Nest*.

marshes along the Potomac, James, Rappahannock and Eastern Shore

tributaries. This vessel can accommodate a team of five researchers for up to 5 days. This independence from shore will allow them to continue their work on site, significantly decreasing travel time and expenses.

The second vessel donation is from the LaCour family of Charlottesville. This gift honors the memory of V. Alfred "Jack" Etheridge and Bennett Joseph "BJ" LaCour, the deceased fathers respectively of Denise and W. Gregory LaCour. This vessel is a 21-foot, fiberglass hulled

center console, equipped with 150 horsepower outboard motor and dual axle trailer. Named *Frigate Bird* due to the bright red color of its hull, this vessel is fully equipped with an array of state of the art electronics including GPS navigation and the latest depth and fish finding instruments. *Frigate Bird* has an aluminum control tower which affords the operator a vantage point which puts eye level about 12 feet above the water. This enables control of the boat by a researcher while looking down at fish swimming near by. This boat also contains an aerated live well, which will be beneficial for collecting and keeping species alive during research.

These vessel donations are important and valuable to VIMS research; the generosity shown by their donors will long be remembered and appreciated.

Baby Billfish – Figuring Out Who’s Who

An important part of any fishery management plan is the definition of “essential fish habitat.” For many coastal fishes there are specific environments critical for spawning, nurseries, feeding, etc., and these areas need to be protected if the species are to remain at healthy levels. Do open ocean fishes such as tunas and billfish have specific essential habitats?

In the case of billfishes, we don’t know enough about their life histories, facts like where and when they spawn or where their larvae and juveniles live, to define essential habitats. A major impediment to studying the early life histories of billfish is that, although adult and juvenile billfish are very distinctive, it is extremely difficult to identify larvae to the species level (or: it is extremely difficult to tell them apart).

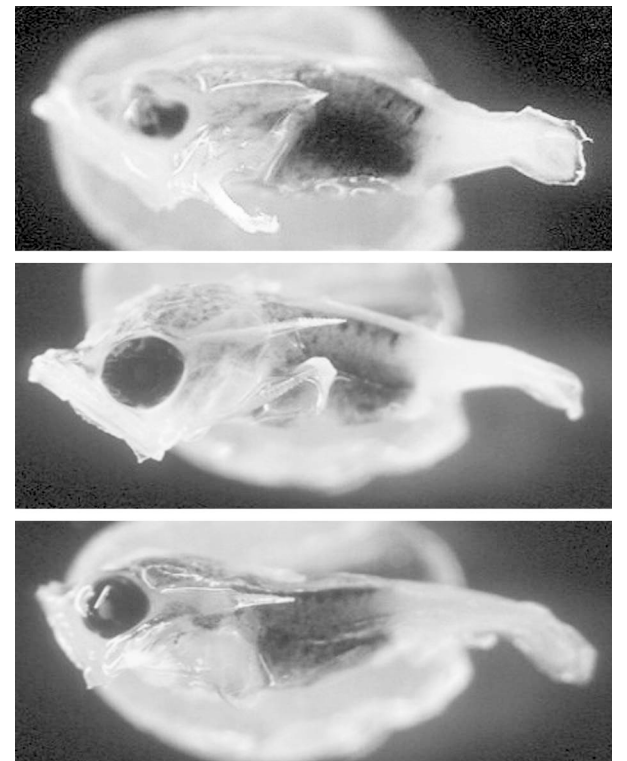
These bizarre forms (see figure) don’t look at all like adults but they look a lot like each other, and most larval fish biologists agree that the physical characters (morphology) currently used to distinguish among the species are suspect.

Fortunately, VIMS fish geneticists have a whole new arsenal of molecular tools to help with identifications. Researchers in the VIMS Fisheries Genetics Laboratory, under the direction of Dr. John Graves, have been developing molecular markers to identify the different billfishes. Ph.D. student, Jan McDowell determined that the molecular techniques for identifying billfishes would most likely work with larval billfish. To pursue this research, McDowell established collaboration with graduate student, Stacy Luthy, at the Rosenstil School of Marine and Atmospheric Sciences (RSMAS) of the University of Miami. Together, they have adapted these molecular markers for the identification of billfish larvae. This definitive identification will give scientists information about when and where the different species of billfish spawn.

Several years ago the VIMS Fisheries Genetics lab received a grant to develop molecular markers to identify the different billfishes. The objective was to find genetic charac-

ters that differed between species, but had little variation within a species. McDowell, took on the project. After considerable work she found two gene regions that when digested with specific restriction enzymes generated different fragment patterns for each species of billfish. The identification process doesn’t take that long. In two to three days McDowell can isolate the DNA, amplify the gene region using the polymerase chain reaction (PCR), digest the gene region with the appropriate enzymes, and separate the resulting fragments on a gel.

McDowell realized that the molecular techniques for identifying billfishes would probably work with larvae, but billfish larvae are few and far between in our waters off Virginia. Fortunately, colleagues at the RSMAS have been ramping up a billfish pro-



Larval billfish. These larvae, all less than 1/2" long, were identified using species-specific molecular markers. Top: Sailfish (*Istiophorus platypterus*) Middle: White Marlin (*Tetrapturus albidus*) Bottom: Blue Marlin (*Makaira nigricans*)

gram within their Center for Sustainable Fisheries, and were collecting

Continued on page 15

Oyster Reefs Restoration: How Should Sanctuary Reefs Look?

In January 1999 a group of academic and government scientists from around the Chesapeake Bay met at VIMS’ Eastern Shore Laboratory to outline a scientifically sound course for restoring oyster populations in the Bay. One of the major components of the restoration plan was the establishment of oyster reef sanctuaries. The plan also identified the need for constructing complex, 3-dimensional reef bases, instead of low-relief shell plantings often used in harvest areas. Since that time Dr. James Wesson, who heads up the Virginia Marine Resources Commission Oyster Repletion Program, has been implementing the plan, completing over 30-reef sanctuary sites to date.

But just how much do we know about how to restore oyster reef habitat? According to Dr. Mark Luckenbach, Director of the VIMS Eastern Shore Laboratory, while there is much that we do know, there is much that we still have to learn. “For instance, we’ve learned over the past few years that certain aspects of the architecture of the reefs, namely vertical relief and interstitial space, are critical to the development of viable oyster populations,” said Luckenbach, “but we know little about how the size



Depositing oyster and clam shells to construct a research reef.

of reefs or their arrangement in the landscape affect their development.”

During the summer of 2000, Luckenbach in collaboration with Wesson, designed and constructed a series of experimental reefs at four sites in the lower Rappahannock River. The sites were chosen because they historically contained oyster reefs.

“We designed the reefs so we could study the role reef architecture and size may play in restoration success,” said Luckenbach. “As we embark on large scale restoration efforts, it is important for us to know what really works. Especially in light of the fact that shell and other substrate

resources are limited, it is important to optimize its use in restoration activities.”

Wesson and his crew used approximately 2000 cubic yards of oyster and clam shell in the construction of a replicated block design that established four reef bases of varying sizes.

Luckenbach and his team, with support from the Virginia Sea Grant Program, are following the development of the community of organisms, including oysters,

on the reefs. The researchers are monitoring water quality, including salinity, temperature and dissolved oxygen and mapping the flow fields at each site. The team used side-scan sonar to develop detailed, 3-dimensional maps of the reef field. “Through the use of the detailed maps and characterization of the flow fields around the reefs, we hope to learn more about how to construct reef bases and understand the factors that affect the development of reef communities,” said Luckenbach. “We are especially interested in the numbers and growth rates of oysters and the abundance of transient finfish and blue

crabs on different size constructed reefs.” The group is also conducting experiments on the reefs using hatchery-produced oysters to test hypotheses about growth and survival in relation to reef size.

Numbers of oysters in the lower Bay are at an all time low and diseases remain widespread. Nevertheless, in most of the lower part of the Bay, oyster populations are slowly, but progressively becoming established on the sanctuary reefs. “Recovery of viable oyster populations is not going to occur in a few years” notes Luckenbach, “it may take several decades of sustained effort to make this work.” The work being done by Luckenbach and others at the Eastern Shore laboratory will provide much needed information for continuing restoration efforts. Of the community of organisms living on a reef sanctuary, Luckenbach says, “if we build it, they will come, but how we build it and manage it may determine if they stay.”

(Dr. Mark Luckenbach, Director Eastern Shore Laboratory, recently testified before the House Subcommittee on Fisheries Conservation, Wildlife and Oceans on the status of oyster restoration efforts in Virginia.)

Many Perspectives, Many Questions on Non-Native Oysters

Scientists, policy makers, industry representatives and watermen from Virginia, Maryland, New Jersey, Delaware and North Carolina gathered in Williamsburg recently to share information and views on the potential use of the non-native oyster *Crassostrea ariakensis* for aquaculture.

In 1996, VIMS was directed by the Virginia General Assembly to investigate the potential for using a foreign oyster both in aquaculture and for the possible introduction of a self-sustaining fishery. Initial work was conducted on *Crassostrea gigas*, an oyster that is used extensively in aquaculture in other parts of the world. However, it did not perform well in Chesapeake Bay. Subsequent work has shown that *C. ariakensis* appears to thrive in the Bay environment. Both species are found throughout Asia.

For the past two years, the Virginia Marine Resources Commission has allowed industry trials of sterile *C. ariakensis* to be conducted in controlled aquaculture projects. VIMS Aquaculture Breeding and Technology Center, directed by Dr. Stan Allen, developed a technique for producing

oysters with three sets of chromosomes, making them effectively unable to reproduce. These oysters, called triploids, were provided to industry to test their performance in aquaculture in Chesapeake Bay. This species was chosen because early field tests had shown that they adapt well to the Bay environment and are resistant to the diseases that have ravaged native populations. In the field, the oysters exhibited rapid growth, reaching market size of 3" in one year to eighteen months. Additional research at VIMS has focused on developing techniques to mass-produce triploid (sterile) oysters that could be safely grown in the wild without threatening restoration efforts of the native *C. virginica* that are underway. "The goal of our research has not been just academic," says Allen, "we have been working to find ways to develop and sustain an oyster aquaculture industry in Virginia."

At the symposium, industry and watermen from both Virginia and Maryland felt that dwindling harvests should be a major consideration in future plans for the use of a nonnative

species. Other attendees expressed opinions that having more filter feeders in the bay could only be good for improving water quality and other environmental conditions. Most scientists agreed that additional information on the biology of the oyster is needed, but especially before considering diploid introductions. Questions were raised about the potential for introducing unknown diseases. By using hatchery-reared oysters, scientists can eliminate the threat of parasites and bacteria, but because of a lack of bivalve mollusk cell lines, viruses are difficult to detect. Over time, a small percentage of the triploid oysters begin to revert to their natural diploid (two sets of chromosomes) state. In time some individuals may become capable of reproducing although, in laboratory tests, this has not been observed. Even in a controlled aquaculture situation, some animals could be scattered during storm events raising the likelihood that in time they

could revert to diploids and begin reproducing. There was general agreement that any introduction – even triploid – carried the potential that a self-sustaining population in the Bay could occur at some time in the future. "A lot of the research questions we need to address now relate to diploids," says VIMS Director of Research, Dr. Eugene M. Burreson. "I think the research focus is going to shift."

"The range of options available is still all over the board, from abandoning the research on a promising new species to its full fledged introduction to the Bay. Triploid aquaculture still represents a moderate practical course," says Allen.



One year old *C. ariakensis* grown in VIMS hatchery.

An Evening For Honors

Approximately 125 guests attended the Annual Maury Dinner on June 8, 2001. Highlights of the evening included acknowledging recent student and faculty awards.

Dr. Jack Musick was named Outstanding Professor of the Year by the State Council of Higher Education and also received an American Fisheries Society Award for his lifetime contributions to fisheries management.

Dr. Linda Schaffner received the Thomas Jefferson Teaching Award from the College of William and Mary and Dr. Elizabeth Canuel received the Alumni Society Outstanding Faculty Award for 2000. During the evening, Capt. Maury Werth presented the Mathew Fontaine Maury Award to Krissa Murray, a Ph.D. student in the Department of Physical Sciences for her outstanding interdisciplinary work.



Guests at the annual Maury Dinner.

VIMS Environmental Scientists Author New Risk Assessment Book *Coastal and Estuarine Risk Assessment*

Risk assessment is the cornerstone of contemporary environmental protection. Despite recent progress, implementation of the ecological risk assessment paradigm to coastal and estuarine ecosystems still lags behind that for freshwater and terrestrial systems. VIMS faculty have now developed a book to address this imbalance. Written by Dr. Morris Roberts, Chair, Department of Environmental Sciences, Dr. Michael Newman, Dean of Graduate Studies, and Associate Professor Robert Hale, the book discusses the development of fundamental concepts related to chemical risks from the molecular to the landscape level. It also covers early recognition and evaluation of exposure to new-use chemicals before they reach critical levels. "Understanding

and assessing these risks is essential to sound environmental policy and management," says Newman who has authored other books on risk assessment. The team drew examples from their varied career experiences as well as from diverse North American and European ecosystems. This is the first book to apply the NRC risk assessment paradigm to coastal marine environments.

Newman is also the author of the well known and widely acclaimed "Fundamentals of Ecotoxicology," which is considered to be the most comprehensive textbook or working reference in the new science of toxicants in the environment.

Both books are available through Lewis Publishers.

A Variety of Suspension Feeders May Be Assisting Oysters in Filtering Bay Water

A variety of suspension feeders in the Chesapeake Bay and its tributaries may be filling an ecological niche that was once occupied by oysters. A team of scientists at the Virginia Institute of Marine Science is studying this possibility, and their results will increase knowledge of water quality, food webs, habitat diversity, and the fate of some pollutants in the Bay. Dr. Linda Schaffner, Associate Professor, Dept. of Biological Sciences, and her students are examining how the decrease in oysters is affecting the abundance and productivity of other suspension feeders in the Bay. These animals include other bivalves and a diverse assemblage of “fouling” organisms that grow attached to almost any substrate

they can find. These organisms include barnacles, sea anemones, sponges, polychaetes (marine invertebrate worms), and small crustaceans that grow on shells, stones, boat hulls, or pier pilings. They feed on small, suspended particles in the water, including plankton and decay from larger plants and animals. Oysters, which used to be a dominant species in the Chesapeake, are now almost gone due to disease, pollution, and fishing pressure.

Surveys completed by the VIMS team this past summer show that the Bay now supports dense communities of fast growing suspension feeders. “These creatures span a range of salinity similar to oysters and also provide water filtration capacities and

habitat structure,” says Schaffner.

To determine the effectiveness of filtration, Schaffner and her students observed growth and feeding rates of major species, and will use this information to calculate productivity and rates at which the organisms filter water.

The research group has been using Geographic Information Systems (GIS) to produce maps showing the population distribution of suspension-feeder communities, which can be compared to the present and historic oyster distribution patterns. These investiga-



Dr. Linda Schaffner (right) with students collecting suspension-feeding organisms for study.

tions will shed light on the role these species play in the evolving ecosystem. According to Schaffner “We may find that these animals can be used to help us clean up the Bay ecosystem and, ultimately, assist in the restoration of oyster and seagrass habitats.”

Science and Economics?

By Amanda Gammisch

“How would improving the habitat of the Chesapeake Bay benefit society?” That is the question environmental economist Dr. Rob Hicks, Dept. of Coastal and Ocean Policy, is investigating in a new study.

While earlier research has focused on oyster disease and habitat, Hicks wants to expand this focus to help understand the link between an improved aquatic environment due to oyster reef restoration and the people who use or value the Bay. “In theory, improved oyster reefs will enhance the fishing experience, fish habitat, nutrient filtering, and water quality,” says Hicks. “I want to get a clearer understanding of these difficult-to-quantify values.”

Hicks feels that it is much easier to demonstrate the cost of environmental regulations designed to insure the Bay’s health than to calculate the benefits from the Bay’s environmental services. His project is designed to develop a comprehensive inventory of value arising from the Bay’s oyster reefs, making it possible to compare costs and benefits. The research will also help target specific areas where oyster reefs can be placed.

According to Hicks, there are several ways in which people will

benefit from these improvements. The first benefits come from direct use of the reefs (use values) with improved water quality, better sport fishing, improved commercial fishing, increased land values, and more enjoyable boating. Indirect benefits for those who do not directly use the Bay (non-use values) are derived from knowing that oyster reefs exist and provide positive environmental services to the ecosystem (existence values). Finally, knowing that improved environmental conditions will make future use of the Bay more enjoyable (should one choose to use it) offers option values.

The project is estimated to take one year to complete and will cover areas in Virginia and Maryland. Working with Hicks are colleagues Tim Haab from Ohio State University, and Doug Lipton

and Bill Goldsborough from University of Maryland. Hicks explains that “when assessing the merits of environmental programs- particularly oyster restoration- the focus has almost always been on the costs of the programs because these are easy to measure. Hopefully this study will provide information about the benefits from a healthy oyster population in the Bay, allowing society to compare costs to something tangible.”



Dr. Rob Hicks at reef site in York River.

Clean Marina Program Takes Off

By Harrison Bresee

The Virginia Clean Marina Program now has 19 pledging marinas. Five of those marinas have made changes in their operations in order to meet the criteria required to become Virginia Clean Marinas: Hampton Public Piers in Downtown Hampton; Ginney Point Marina in Cobbs Creek; Salt Ponds Marina in Hampton; Severn River Marina in Hayes; and Two Rivers Yacht Club in Williamsburg. Look for the Clean Marina Flag at these outstanding examples of marinas

committed to stewarding Virginia’s waterways.

In recognition of their commitment, a Virginia Clean Marina Designation Ceremony is planned this fall to publicly congratulate these exemplary businesses.

This winter, look for the Virginia Clean Marina display at the Richmond Boat Show from February 14-17, the Capital Boat Show in Chantilly from March 7-10, and the Mid-Atlantic Boat Show in Virginia Beach in early February.



Baby Billfish

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larvae in the Florida Straits. Coincidentally, Luthy, was trying to find morphological characters to identify larval billfish, a tough task if one doesn’t know who’s who at the start. So McDowell and Luthy began their joint work. Luthy came to VIMS to work in the lab with McDowell to identify billfish larvae using VIMS’ molecular markers. Through trial and error, they developed a method that allowed them to positively identify a 1/4-inch larva by using only the tissue from one of the larva’s eyeball—and the eye of a 1/4-inch larva is pretty small! This left the rest of the larva intact for analyses of morphological characters. As with the adult tissue samples, independent genetic markers could be used to verify results. Over a period of

several months the team identified hundreds of larvae. Luthy is now trying to find diagnostic morphological characters (which would be faster and cheaper than the molecular analyses) to identify the larvae, using her molecularly identified “knowns” as reference. She plans to use her identifications to study the seasonal occurrence of billfish larvae in a few areas.

In the long run, this information will allow scientists to find out when and where the different species of billfish spawn – data that will help identify essential fish habitat. That will be one piece of the puzzle, but there is still a lot that is not known about the early life history stages of billfish; for instance, where they live, what they eat and how fast they grow.

Calendar of Events

—November—

- 16 York River Watershed Conference
 16 Seminar Series - Dr. C. Wylie Poag "Meteorite Mayhem in Ole Virginny"
 30 Annual Holiday Sale - VIMS Gift Shop

—December—

- 5-7 Coastal Program Workshop
 8 Holiday Concert - Stephen Bennett

- 11-13 VIMS Sea Grant Co-Sponsoring 2001 Marine Trades Expo and Conference, Charleston S.C.
 13-14 Winter Botany Class
 13-14 Atlantic Intracoastal Waterways: Virginia Sea Grant Regional Economic Workshop Charleston, S.C.

—January 2002—

- 11 Biotechnology Conference
 15 Mini-School of Marine Science, Washington, DC

For more information call 804/684-7101 or 804/684-7011.

Visit our website at: www.vims.edu

Holiday Concert To Benefit Hargis Library Endowment

Guitarist, Stephen Bennett, will kick off a series of concerts to support the Hargis Library Endowment at 8:00pm on Saturday, December 8th, 2001, in the John L. McHugh Auditorium, VIMS.

Bennett is respected both nationally and internationally for his fingerpicking and flatpicking guitar styles and is known as "the quintessential harp guitarist" (*Walnut Valley Occasional*).

Last year his tour schedule included 20 states, France, and Italy. He also appeared recently on Garrison Keillor's "A Prairie Home Companion."



Stephen Bennett

Bennett's recordings include original music along with interpretations of some traditional tunes and other pieces.

When he's not on the road, Bennett is home in Virginia on the Chesapeake Bay where he lives with VIMS' own Linda Schaffner and their son, Will.

Concert Tickets are \$22.00 (VIMS students - \$17.00, Children 12 and under - \$12.00). Dinner Tickets are

\$25.00 per person and limited to the first 100 reservations (dinner tickets separate). For reservations and information, please call Lisa Phipps at (804) 684-7099.

Beset Near 68°S, 69°W....
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ter photos taken by the krill research divers showed the ice was from 30-60 feet thick in places. After seeing the photos, I think everyone realized that we weren't going anywhere for a while. For me, the worst part was telling my parents that we were stuck in the ice at the bottom of the world. There's really not a good way to say that.

Masters student **Amy Chiuchiolo**, first Antarctic cruise:

"I loved it! I was sad to leave when we finally broke free. While we were stuck, we were still taking samples and doing lab work. I loved

being able to go up on the bridge and look at the beautiful scenery and watch wildlife. A seal was born right near the ship and we were able to watch it for five days! I also had a chance to spend time talking to other researchers from all over the country! It was amazing though, when the wind shifted direction and the ice loosened up. A storm moved in and at first the ice ridged up around the back of the ship from all the pressure from the 40+ knot winds. But, by morning cracks had formed and leads had opened, and we were able to cruise out in about a day. Incredible!"

From a commentator at McMurdo Base Antarctica: "Out on the other side of the continent, the *Nathaniel B. Palmer*, U.S. research vessel is stuck

Washington Office for W&M

When the College of William & Mary cut the ribbon and officially opened the doors to its first-ever Washington DC Office, more than 200 alumni, faculty, administrators, students, and dignitaries were on hand. The ribbon cutting was accompanied by remarks from President Timothy J. Sullivan '66 who told the audience, "The Washington Office will enable us to bring the world to William and Mary and William and Mary to the world."

The mission of the Washington Office, as articulated by Director, Susan Wayland '68, is first and foremost to support and enhance the academic opportunities of the students at the university. A strong emphasis is

being placed on connecting students to both national and international policy makers. Additionally, the office will support the academic endeavors of the faculty, support the alumni who live, work, or travel in the Washington area, serve as a platform for increased student recruitment, and as a platform for development initiatives. Wayland, who has worked for the U.S. Environmental Protection Agency for over thirty years and most recently as their Acting Assistant Administrator for the Office of Prevention, Pesticides, and Toxic Substances, has a special interest in projects with an environmental component.

in the pack ice—reminiscent of Shackleton's *Endurance* except the food is better and there are videos to watch. The ship is about 60 miles from the ice edge and wedged between Adelaide and Alexander Islands with rafts of sea ice 65-foot deep around it."

Ph.D. student **Matt Church**, fourth trip to Antarctica:

"Perhaps the real drawback was the concern for safety. We were so isolated that no one (ship or plane) would be able to reach us in less than a month."

In over 10 years, the *R/V NB Palmer* had never been unable to maneuver. The exact reasons are not clear, but seem to have been a combination of unusually thick ice, an



Basket ready to retrieve scientists working on the ice.

unusually heavy snow cover and a sustained period of northerly winds. North winds tend to blow the ice floes in against the Peninsula, gradually packing them tighter and tighter, causing them to raft up over each other. This causes the formation of ice ridges, which can extend up to 30-50 feet below the surface.