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

Volume 5, No. 2
Summer 2003
www.vims.edu

The Crest

Current Issues in Coastal Ocean and Estuarine Science

TBT or not TBT: Collaborators Search for a Solution to Pollution

By Dave Malmquist

Just how little is one part per trillion? "That's a single drop in 1 million 55-gallon drums," says VIMS researcher Dr. Mike Unger.

That might not seem like much, but for a substance like tributyl tin, or TBT, a concentration of 1 part per trillion (ppt) can significantly affect the health of marine organisms.

Unger is collaborating with Dr. Gary Schafran of Old Dominion University to help lessen TBT's environmental impacts by developing a mobile treatment plant to keep the compound from entering seawater.

TBT is used in boat paint to prevent fouling by marine organisms. It enters seawater through leaching and when a ship's hull is washed or its old paint removed. The compound remains toxic to marine organisms even at extremely low concentrations.

"Most environmental contaminants are toxic at parts per million, sometimes parts per billion," says Unger. "What's dramatic about TBT is that we see fairly significant environmental effects at concentrations as low as 1-10 parts per trillion."

The TBT treatment plant resides on a barge that can be moved between dry docks as needed.

Exposure to TBT at these concentrations has been linked to molting problems in copepods and to imposex in marine snails, a condition in which females develop male sex organs. At higher concentrations, say 100 ppt, experiments show that exposure to TBT will kill half a group of exposed organisms within a few days. Affected species include oysters, clams, and mussels.

Concern over these environmental effects has driven regulation of TBT worldwide. Virginia has enacted some of the world's most stringent TBT legislation. In 1987, the Commonwealth set a TBT water quality standard of 1 ppt, and, based on research showing

Continued on page 6

Switch to Circle Hooks Would Benefit White Marlin

On-going studies by VIMS researchers suggest that a minor change in hook type could significantly improve the survival rate of white marlin released by recreational anglers.

Voluntary catch and release efforts by U.S. recreational anglers are one small part of an international effort to help conserve white marlin stocks. Scientists consider white marlin the most depleted billfish species in the Atlantic, with a population at less than 10% of its original level. Most white marlin mortality occurs as incidental catch on longline gear set for tuna and swordfish.

The VIMS studies, conducted by Dr. John Graves and his graduate student Andrij Horodysky, found that white marlin caught on traditional straight-shank "J" hooks were far less likely to survive a catch-and-release episode than those caught on circle hooks (see sidebar on page 2).

"There's a greater incidence of deep-hooking and tissue trauma associated with "J" hooks," say Graves. "Fish caught on circle hooks are more likely to be hooked in the jaw and less likely to incur serious injury."

Continued on page 2

Virginia Institute of Marine Science
School of Marine Science
College of William and Mary
P.O. Box 1346
Gloucester Point, Virginia 23062

ADDRESS SERVICE REQUESTED

Non Profit Organization
U.S. Postage Paid
Glou. Point, VA 23062
Permit Number 6

The Crest

Vol. 5 No. 2 Summer 2003

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

Sea Grant Virginia *Waterfront News*
Vol. 10, No. 2

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.

If you are receiving multiple copies of the *Crest,* or would like to change your address, please call (804) 684-7805 or visit www.vims.edu/newsmedia/crest.html.

Roberts Receives International Award

Dr. Mory Roberts, VIMS emeritus professor, has received the Robert Brink Award for his distinguished service, outstanding leadership, and contribution to standards development in the environmental sciences.

The award was bestowed by ASTM International, one of the world's oldest and largest voluntary standards development organizations.

ASTM standards are used by individuals, companies, and agencies around the world. A familiar example is the ASTM standard for bicycle helmets and other protective headgear. In the area of environmental standards, developers of commercial real estate can satisfy requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (aka "Superfund") using ASTM standards for environmental site assessments.


Dr. Mory Roberts

Roberts joined ASTM International in 1985, and is also a member of the Society of Environmental Toxicology and Chemistry. Throughout his career, mostly spent as a marine science faculty member at William and Mary and VIMS, Roberts focused on aquatic toxicology, sediment toxicology, and the culture of selected marine invertebrates. He published more than 80 papers in the field. A cum laude graduate of Kenyon College with a B.A. in biology, Roberts received his M.A. and Ph.D. in marine biology from the College of William and Mary.

Roberts was selected for the honor by ASTM Committee E47 on Biological Effects and Environmental Fate, which was established in recognition of Dr. Robert Brink, an E47 founding member and leader in methods development. Committee E47 is one of 130 ASTM technical standards-writing committees.

Roberts currently resides with his wife Beverly in Gloucester Point, Virginia.

Circle Hooks
continued from page 1

The researchers studied the post-release survival of white marlin by tethering a new kind of electronic tag near the dorsal fin of 24 captured fish just before their return to the water. Tagging sites included the Dominican Republic, the mid-Atlantic bight, Mexico**,** and Venezuela.

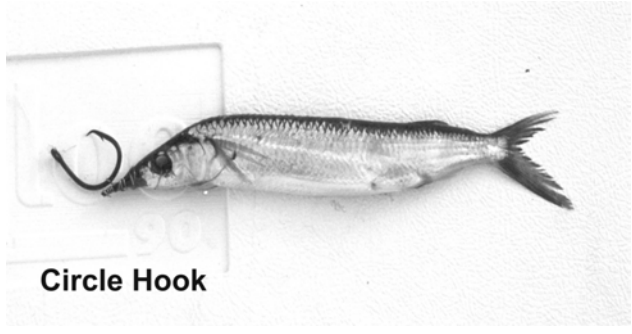
Circle hooks have been around for centuries, but with the increasing popularity of catch-and-release fishing, they are receiving renewed attention. Compared to traditional "J" hooks, circle hooks are more likely to hook in a fish's jaw (rather than deeper in the throat or gut), and thus increase the odds of post-release survival.

The team uses tags that they program to release from the fish after a certain time. For these studies, they set a release time of 5 or 10 days. Earlier studies indicated that billfish mortalities typically occur within 24 to 48 hours of release, and they wanted to be sure to account for any deaths resulting from the catch-and-release that might take place.

Once a tag breaks free from its tether at the specified time, it floats to the surface and transmits its recorded data via a satellite link to Graves and his team for analysis.

The returned data suggest that a switch to circle hooks in the recreational fishery could dramatically increase post-release survival, says Graves. To date, they show that five of fifteen fish released from "J" hooks died, whereas none of the nine fish caught on circle hooks died following release. More work is planned for this summer.

For more information on the use and benefits of circle hooks visit the Atlantic States Marine Fisheries Commission website at www.asmfc.org



When a fish swallows a baited circle hook and moves away, the movement pulls the hook from the throat. Because the hook tip points back at the hook shaft, it is less likely to puncture internal organs, decreasing the chance of gut hooking. As the hook shaft begins to exit the mouth, its shape causes it to rotate toward the corner of the mouth, embedding the barb in the corner of the jaw—adapted from ASMFC *Fisheries Focus*.

Tags Throw Light on White Marlin Diving Behavior

Graves' team has also been using the new tags to better understand the diving behavior of white marlin.Unlike earlier tags, which averaged the time a fish spent within certain depth ranges, the new tags can record and store individual light, temperature, and depth readings every few minutes.

"Data from these tags allow us to reconstruct the diving behavior of each fish in detail," says Graves. Whereas data from earlier tags suggested that white marlin spend most of their time near the surface, the new tags reveal that the fish also make frequent, 20-40 minute dives to 200 ft, and sometimes dive as deep as 600 ft.

These dive patterns suggest to Graves that they are associated with feeding. The extended periods at the surface may help the fish warm their core temperature after forays into deeper, cooler waters.

"If white marlin are diving into cooler waters to feed, it may account for the surprisingly high catch rates of a supposed surface feeder on deep-set pelagic longlines," says Graves.

The new data will help scientists adjust historical white marlin catch rates for changes through time in the depth of longline gear deployments. During the last 30 years, commercial longliners have shifted from surface to deep-set longlines as their target species changed from yellowfin to bigeye tuna. However, the expected decrease in bycatch of the surface-swimming white marlin did not follow. This may reflect the incursion of longline gear into white marlin feeding depths.

"By putting their baits deeper for bigeye tuna," adds Graves, "the longliners may also be putting them right in the white marlin dining room."

Do Tags Put a Drag on Marine Organisms?

A new generation of small electronic tags has opened exciting research opportunities for marine scientists, allowing them to track fish and other organisms across the open ocean, into the deep sea, and during long migrations.

The new tags can gather and archive information about an animal's location and behavior for months at a time, then automatically release from the fish and transmit the stored data via satellites to scientists on land. The technology provides access to animals that have proven difficult to follow for long periods with traditional tracking techniques.

Data from these "pop-up satellite archival tags" (or PSATs) are giving scientists important insights into the behavior of a wide variety of fishes, including tuna and marlin (see article on front page). These insights help regulatory agencies better manage commercial and recreational fisheries.

Ocean researchers are applying electronic tags to more and smaller fish to help gather the data needed to effectively manage commercial and recreational stocks. VIMS scientists are now studying whether drag from tethered tags might affect fish enough to alter the very behavior the tag is meant to record.

However, increasing use of PSAT technology has some scientists concerned. "We've generally assumed that these tags are so small and streamlined that they don't impose a major drag on large marine organisms," says VIMS researcher Dr. John Graves. "But current research is expanding their use to much smaller species and individuals. Drag from these tags may pose a significant energetic cost for smaller organisms."

For example, the International Commission for the Conservation of Atlantic Tunas recently mandated the release of all live blue and white marlin by international fleets (U.S. longliners have been prohibited from keeping any marlin since 1988). The measure also limited U.S. recreational landings of both marlin species to 250 total fish per year.

Although Graves and Kerstetter have shown post-release survival for blue marlin, which often weigh in at 300 pounds or more, adult white marlin are typically much smaller at only 30-70 pounds.

The white marlin mandates, together with a growing conservation ethic among recreational anglers (who now release more than 95% of the billfish they catch), have raised the question of how many of these smaller fish survive a catch-and-release episode—a question best answered through the use of PSATs.

Graduate students David Kerstetter (L) and Andrij Horodysky prepare the VIMS flume for their tag-drag study.

To measure the additional energy a fish needs to drag a tethered tag through the water, Graves' graduate students David Kerstetter and Andrij Horodysky have begun a series of experiments in VIMS' flume facility. They are investigating seven different tag types, both commercial and homemade.

The flume, which is 80 feet long and holds 6,000 gallons of water, can generate a current of up to 1.2 knots. (Blue marlin, one of the largest and most migratory of pelagic fishes, typically swim at about this speed.) To measure drag, the pair gradually accelerate the flume current while recording the force a submerged tag exerts on a vertical suspension rod. The rod, fabricated onsite by VIMS technician Wayne Reiser, has two cutouts that lie at right angles to each other. Each is fitted with two tiny strain gauges. The electrical resistance of the two gauges changes as the rod and gauges bend, and the resulting change in electric current tells Kerstetter and Horodysky how much force the tag exerts. One set of gauges measure drag, the force that opposes the tag's velocity; the other measures lift.

Kerstetter and Horodysky also videotape the tags so that they can carefully observe and document whether the tags move through the water smoothly or instead swing up and down or from side to side. Such movements may increase the possibility of tags working themselves out of the fish's musculature, resulting in premature tag releases and losses of data.

The duo use the measured drag value and the known speeds at which a particular fish typically swims to calculate the energy the organism needs to expend to pull the attached tag through the water. They then compare this value with the known metabolic rates of other fish species.

So far, says Kerstetter, "our results suggest that the tags don't constitute an excessive energetic cost to the host animals." However, he cautions that researchers should carefully consider the possible effects of these tags on the animals' behavior.

"As tags become smaller and more powerful, the range of species that can adequately carry this technology will only expand," says Kerstetter. "When matched to the appropriate scientific question, these tags remain an invaluable tool for better understanding habitat preferences and movements for marine animals."

VIMS Graduate Dr. Beth Hinchey Awarded Thatcher Prize

Dr. Elizabeth K. Hinchey, a recent graduate of the School of Marine Science, has been awarded The Thatcher Prize for Excellence in Graduate and Professional Study by the College of William and Mary.

Hinchey accepted the award during the College's commencement ceremony, sharing the stage with former British Prime Minister Margaret Thatcher, for whom the award is named.

The College awards the Prize each year to recognize an outstanding graduate student from the schools of Arts and Sciences, Education, Marine Science, Business Administration, or Law. This marks the second time in the four-year history of the prize that the award has gone to a student from VIMS.

Hinchey earned her PhD under advisor Dr. Linda Schaffner by studying how physical disturbances such as tides, waves, and currents affect the invertebrate communities that live within muddy sediments of Chesapeake Bay and other estuaries. These communities are important because they help support marine food webs and serve as sensitive indicators of estuarine health.

Stephen Salpukas

William & Mary President Timothy Sullivan awards the Thatcher Prize to Dr. Elizabeth Hinchey during commencement ceremonies at the college.

"Beth distinguished herself both as a scientific scholar and a model campus citizen," says Schaffner. "It was an enormous pleasure to serve as her academic advisor."

While at VIMS Hinchey showed an avid interest in science education. "She gave generously of her time to participate in public outreach events ranging from Elder Hostel to Career Days at local elementary schools," says Schaffner. Hinchey even took time from her research to publish a paper for biology teachers on an inexpensive way to build a "critter collector" for gathering marine organisms for classroom or laboratory study.

Hinchey is currently employed at the US EPA Atlantic Ecology Division in Narragansett, Rhode Island. She earned her Masters degree from VIMS in 1996, and a Bachelor of Science degree in Biology from Notre Dame in 1993. Previous recognition includes the Craig L. Smith Memorial Educational Scholarship from VIMS in 1999, the International Women's Fishing Association Scholarship (1997-1999), an Honorable Mention in VIMS' Best Student Paper Award (2001), and Best Student Poster awards at the Atlantic Estuarine Research Society meetings in Beaufort, NC (1998), and Hampton, Virginia (1996). Hinchey also received the Dean's Prize for the Advancement of Women in Marine Science in 2002.

Video Technology Links VIMS to the World

Teaching to an empty classroom might be considered an instructor's nightmare, but for Dr. Mike Newman and other users of VIMS' new video conferencing system, it's the fulfillment of a long-standing dream.

Newman, a Professor in Environmental and Aquatic Animal Health, used the system last fall to teach his Quantitative Ecotoxicology course to students at the Eastern Shore Lab in Wachapreague.

While Newman stood before an empty classroom at VIMS, a digital video camera transmitted his image via a high-speed Internet connection to a classroom on the Eastern Shore. There, students saw his image inset upon an underlying picture of selected course materials—at times a PowerPoint® slide, at times a computer-generated visualization, statistical software program, or interactive computer model.

Gretchen Arnold, a senior marine scientist at the Eastern Shore Lab, participated in Newman's course along with other ESL staffers. "The cost and time involved in traveling to Gloucester Point usually kept us from taking advantage of academic opportunities at VIMS," says Arnold. "So we were really psyched when we had the chance to take Mike's course through the new distance-learning technology. It was a great course and we're excited about taking others in the future."

"I was surprised at how human you can make it," says Newman. The system is capable of instantaneous two-way communications, so that instructor and students can interact in real-time, posing and answering questions, highlighting screen elements with the computer mouse, and collaboratively running software programs. The voice-activated video camera can even swivel to follow a pacing professor or reveal a shy student.

The system became operational in summer 2002, after three years of collaborative planning and implementation by VIMS' Information Technology and Networking Services (ITNS), Department of Facilities Management, and Graduate Dean's Office.

ITNS analyst Kevin Kiley configured the system to record the lectures, which were then posted to the VIMS' web site so that students could review them at any time. Newman and Kiley also created a web "backbone" for the course by posting lecture notes, web links, and related databases on the VIMS' web site.

"This technology lets us reach out and communicate with colleagues around the world," says Kiley. "That's a real advantage in a field as unique and far flung as marine science."

Newman was the first VIMS faculty to use the system for a comprehensive distance-learning course, but based on the popularity of the course among his students, he won't be the last. In fact, given the variety of uses to which the new technology has already been put (see sidebar), future uses seem almost endless.

"This technology can benefit all facets of the VIMS community," says Dean and Director Don Wright. "It gives VIMS students easier access to classes at the main campus, the Eastern Shore lab, and institutions such as ODU and Virginia Tech, and vice versa; allows outside scientists to attend a class or a conference when their physical presence isn't possible; facilitates interaction with K-12 science teachers and state agencies such as VMRC; and helps VIMS scientists collaborate and exchange data with research colleagues."

Funding for the video-conferencing system was recommended by the Governor and funded by the General Assembly in 1998. The system includes a number of fixed and portable video conferencing units. Purchase and installation of these units proceeded in tandem with a larger project to upgrade VIMS' telecommunications infrastructure so that it could provide the bandwidth needed for transmitting video over the Internet.

"Our telecommunications network is key to our strategic growth," says Director of Planning and Budget Carolyn Cook. "By enhancing our network infrastructure and adding video conferencing, we've begun to take the steps we need to move into the 21st century as a world-class marine science institution."

VIMS' new videoconferencing system allows members of the VIMS community to interact with colleagues around the world with much less difficulty and expense than previously possible. During the past year VIMS staff have used the system to facilitate communication in education, research, and administration with colleagues from the Eastern Shore to New Zealand.

Distance Learning Courses

Quantitative Ecotoxicology—Three VIMS staff members at the Eastern Shore Laboratory in Wachapreague took this course during the Fall 2002 semester (see article).

Principles of Chemical Oceanography and *Sediment Biogeochemistry*—John Pohlman, a Ph.D. student in VIMS' Physical Sciences Department, is attending these courses from the Naval Research Lab in Washington, D.C.

Environmental Statistics—John Walter, a Ph.D. student in VIMS' Fisheries Science Department, is taking this University of Maryland course at VIMS.

Recorded Lectures

Instructors for *Fundamentals of Marine Science, Quantitative Ecotoxicology,* and *Coastal and Estuarine Processes and Issues* have recorded their lectures for later playback by students who may have missed a class or need a review.

Seminar Series

Faculty and students from the University of Virginia and Christopher Newport University "attended" several lectures during the VIMS Fall and Spring Seminar Series.

Student Committee Meetings

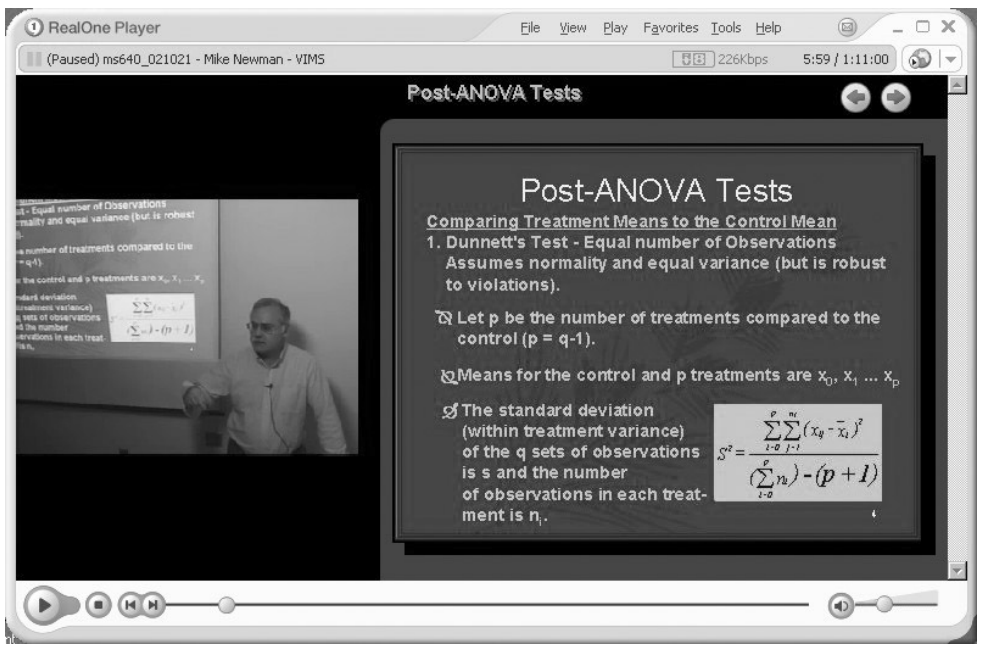
PhD student Art Trembanis' qualifying exam was streamed live to outside committee member Dr. Mal Green in New Zealand. Wes Dowd's Ph.D. qualifying exam was videoconferenced to outside committee member Dr. Peter Bushnell at Indiana University.

Research

Drs. Iris Anderson and Linda Schaffner conducted a proposal "pre-briefing" with the Department of Defense via videoconference from VIMS. Mark Patterson conducted a meeting via videoconference with fellow researchers in Florida.

Administration

Kevin Kiley and ITNS Director Newt Munson participated in Ohio State University's *MegaConference IV*, an interactive videoconference with more than 100 participants from all over the world.



VIMS' video-conferencing system allows faculty, staff, and students to interact with colleagues around the world. Top: The video display seen by students at the Eastern Shore Lab during Dr. Mike Newman's distance-learning course last fall. Left: Dr. Newman's view of two of his Eastern Shore Lab students in their Wachapreague classroom.

For-hire Fishing Captains Drawn to Regional Workshops

By Sally Mills

Fishing "for hire" with a group of paying customers has become big business in Virginia, as it has along the entire eastern seaboard. A recent educational workshop series hosted by the Mid-Atlantic Sea Grant programs is helping charter and guide boat operators better manage the changing climate of this fast-growing industry.

Today's captains operate charter boats or slightly larger head (or party) boats built to accommodate a range of angler preferences for recreational fishing. Bob Zales, who operates a charter fleet in Florida and currently serves as president of the National Association of Charterboat Operators, estimates that these boats carry at least 13 million passengers a year off U.S. shores to fish, and generate $23 billion in revenue to the national economy. Much of that money gets fed directly to coastal towns providing tourism-related services.

This slice of overall fishing activity, however, often falls between the cracks of traditional commercial and recreational fishing sectors. As more scrutiny is paid to tracking fish stocks – and fishing effort – and sharing that information across state and regional boundaries, resource managers have begun to pay greater attention to this missing link.

The Mid-Atlantic Sea Grant program's workshop series was designed to help charter and guide boat operators keep pace with pending management changes regarding such things as licensing, customer safety, fish handling, and effort and catch reporting.

The idea behind the workshops was simple. "We wanted to invite charter boat operators to come together and share their perspectives with those who are making decisions about their future," noted Dr. William DuPaul, who directs the Marine Advisory Program of Virginia Sea Grant. "Sea Grant often plays such a role among groups – getting information directly to the stakeholders affected."

Workshop participants had the chance to speak directly with NOAA fisheries managers and members of the U.S. Coast Guard about issues impacting their business operations.

Workshops were held throughout the spring from New York to North Carolina, drawing about 40-50 boat captains to each session. The content of each workshop was tailored to information requested by the participants, who replied to an industry-wide survey conducted by Tom Murray, a marine business specialist with Virginia Sea Grant. This ensured consistency among workshops while also customizing each to local industry issues as Murray helped coordinate the series.

In addition to licensing and safety requirements, topics included marketing for the World Wide Web, ideas for extending the business season, advice about business insurance, and the hard truths about admiralty law. Murray was pleased with the interest shown throughout the region, and found that the majority of participants appreciated the opportunity to learn and share this information with their peers. Plans for future workshops are under discussion.

Sea Grant Virginia

Local CBF Chapter Establishes VIMS Library Special Collection

The York Chapter of the Chesapeake Bay Foundation recently presented a $1,000 check to the VIMS Library to establish a special collection of books in memory of Hayden Ross-Clunis Jr., a founding member of the Chapter who died in January 2003.

The Hayden Ross-Clunis Jr. Collection will focus on citizen involvement in environmental management and policy making, an activity that was a major part of Ross-Clunis's life for more than 30 years.

Hayden Ross-Clunis Jr. was a founding member of a citizen's group formed in the early 1970s to prevent development of the Goodwin Islands. This group later became the first local chapter of the Chesapeake Bay Foundation. The York Chapter successfully preserved the Goodwin Islands for more than 20 years. The Islands were eventually donated to the College of William & Mary for VIMS to use as a research site and were designated as a VIMS-managed Chesapeake Bay National Estuarine Research Reserve in 1990.

Ross-Clunis was an active member of the York Chapter CBF. He served continuously on the Board of Directors since its inception, and served on numerous occasions as President, Treasurer, or Secretary.

Maurice Lynch, President, York Chapter, Chesapeake Bay Foundation, presents a $1,000 check to VIMS Librarian Charles McFadden to establish a collection of books in memory of Hayden Ross-Clunis Jr., a long time VIMS Board member and Past-president of the Chapter who died in January 2003.

The map in the background is an original 1853 sailing chart of the North Atlantic produced by Matthew Fontaine Maury, Hydrographer of the Navy. The VIMS library purchased the chart with funds donated by the York Chapter in memory of Paul Baker, another long time Board member and Past-president of the York Chapter who died in April 2001.

Teachers Gain Hands-On Research Experience

For the fourth year in a row, educators and scientists at VIMS have combined expertise to teach a course that helps high school teachers integrate quality marine science into their classrooms.

The two-credit graduate course, *Marine Science Fisheries and Management*, was again held at VIMS' Eastern Shore Laboratory in Wachapreague. It was coordinated by Susan Haynes and Vicki Clark, Marine Education Specialists in the Sea Grant Marine Advisory Services Program, and Dr. John Graves, Fisheries Science Chair. Several VIMS scientists provided instruction throughout the week.

"The caliber of work completed by this year's teachers was excellent and, from their comments, they clearly gained a great deal," says Haynes.

The 14 participating teachers, from Virginia and beyond, gained hands-on experience in internal and external fish anatomy, methods for fish tagging, quantitative fisheries stock assessment, and modeling. They were required to take the information presented and develop a lesson plan to take back to their classroom.

The course, which is funded by the National Marine Fisheries Service, included lectures as well as laboratory, field, and computer activities. It provided teaching-assistant experience for two VIMS graduate students.

Jim Gartland (I) and students dissect a croaker.

"I valued most the interaction with the researchers!" noted one teacher.

Another wrote that "the course was a well-balanced survey with exceptional instruction. And it's fun! I'll use a great majority of course material in an extended unit on Fisheries Science in a high school marine and environmental science course."

"We plan to offer similar courses for secondary science teachers on an annual basis," says Haynes, "and look forward to the continuing participation by VIMS scientists."

For up-to-date information on courses and workshops visit www.vims.edu/adv/ed

Sea Grant Virginia

TBT or not TBT
continued from page 1

the highest TBT levels in recreational boating areas, banned its use on vessels shorter than 25 meters. The Virginia ban mirrored similar regulations passed earlier in France, the U.K. and by the U.S. federal government.

But TBT use continues on larger vessels, and for good reason. Application of TBT helps save fuel by reducing the drag generated when organisms like barnacles, mussels, and algae attach to a ship's hull. "The cost savings are phenomenal," says Unger. "Fouling organisms on a hull translates to fuel and pollution. That's why commercial ships, cruise ships, love it. They want their ships to be as fast as possible. Everybody does."

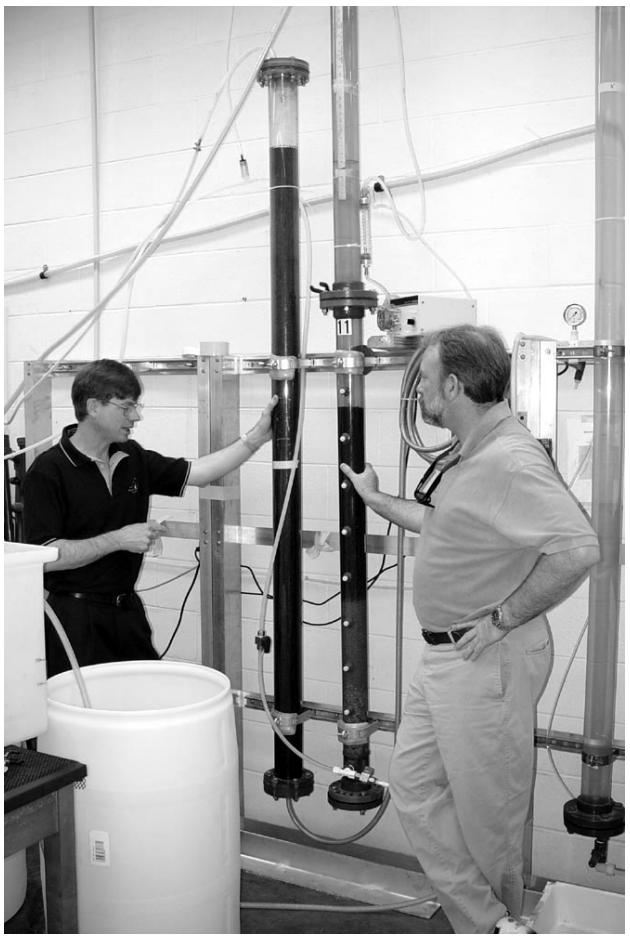
The advantages of TBT help explain why 70% of ocean-going vessels still use TBT paints. But continued widespread use of TBT, coupled with increasingly strict regulations (including a proposal by the U.N.'s International Maritime Organization to ban the release of TBT from any size vessel by 2008), has put local shipyards between a rock and a hard place.

"Therein lies the problem," says Unger. "You've got a water quality standard of 1 ppt, you've got shipyards that are in the business of servicing vessels, and you've got 70% of the merchant marine painted with TBT paint. Even if you're not going to paint with TBT again, you still have to get the old paint off."

Repainting a 900-foot long ship can produce up to 400,000 gallons of wastewater, with TBT concentrations a million times higher than the 1-ppt water quality standard allowed in Virginia.

Schafran began searching for a solution to the wastewater dilemma in 1998, when approached by representatives from the Center for Advanced Ship Repair and Maintenance, a Hampton Roads non-profit set up to encourage collaboration between Virginia's shipyards and universities.

The Center had begun with a literature search to see what had previously been done with TBT. "There were hundreds of papers on TBT's biological effects," Schafran says, "but only a handful dealt with treatment issues, and really none of them were relevant to shipyards, their wash waters, and their situations. There wasn't a single paper that addressed getting TBT out of waters where it was at a million ppt."



Drs. Gary Schafran (L) and Mike Unger inspect columns of activated carbon like those used to remove TBT from shipyard wastewaters.

To do that, Schafran spent the next few years developing a system of mechanical and chemical filters in collaboration with local shipyards. A key part of the system is a series of long tubes filled with activated carbon, the same material used to filter drinking water and home aquariums. Mounted on a barge, the mobile treatment plant can be towed to an active dry dock, where it helps removes TBT from wastewaters before they are released to the environment.

Early trials showed that the treatment plant could remove 99.8% of TBT from shipyard wastewaters. "From an engineering standpoint, that's phenomenal," says Unger. "But when you're starting with a part per million and you've got to get down to a few parts per trillion, you're not even close. That kind of puts the magnitude of the problem in perspective."

Treatment success was also inconsistent and difficult to predict. It depended not only on the initial concentration of TBT in the wastewater, but on the water's salinity, pH, and the presence of dissolved organic carbon. Effluent from the treatment plant might contain 20 ppt of TBT for half an hour, then suddenly spike up to 200 ppt. It achieved the 50 ppt level necessary for permits only 25% of the time.

To consistently achieve the additional removal needed to meet water quality standards, Schafran realized he had to better understand the intricacies of the treatment process. "Our focus was on the engineered system," he says. "We pretty regularly got 99.8% removal, but that's not good enough. So we wanted to know, 'Why isn't it good enough? Why does it sometimes work and sometimes not?' We needed a mechanistic understanding of what was going on."

That's when Schafran approached Unger. Unger studies the behavior of TBT in the environment, and thus has the expertise, methods, and instruments needed to identify and track TBT and related compounds at exceedingly low concentrations.

Schafran suspected that TBT-laden particles of activated carbon might occasionally break free to produce the TBT spikes he saw. Unger is testing this idea by using X-rays to analyze wastewater samples under a scanning electron microscope. Early results suggest that the water does indeed contain carbon particles, but that the tin is not associated with the particles. Instead, it appears to be dissolved in the wastewater itself.

Related experiments suggest that increasing the acidity of the wastewater increases the carbon's removal efficiency. They also show that dissolved organic carbon, which forms in wastewater when fouling organisms are washed or scraped off a ship's hull, may compete with the activated carbon to absorb TBT, thus decreasing its effectiveness.

Determining the chemical form of the dissolved tin is another crucial step in the analysis. "There's an orders of magnitude difference in toxicity between TBT and its breakdown products," says Unger. Thus the treatment process could reduce the environmental impacts of TBT even if it did not completely remove all the tin-bearing compounds. Degrading the original TBT to a less toxic form would also have value.

Unger uses a device called a gas chromatograph to determine the composition of the dissolved tin compounds in wastewater. This allows him to test the effectiveness of various methods for degrading TBT.

To date, two methods appear particularly promising. One is to expose wastewater to ultraviolet light after adding hydrogen peroxide. UV treatment has the added benefit of destroying many other organic contaminants that occur in the wastewater. Schafran plans to add a full-scale UV device to the end of the existing treatment plant at shipyards this July.

Schafran and Unger discovered the second option, treatment with bacteria, through a mixture of hard work and serendipity. One thing Schafran needed to know when designing his original treatment plant was how long the activated carbon would absorb TBT before it became saturated. Based on previous work, he thought it would take a few weeks. Instead, like the Energizer bunny the carbon just kept working. "We kept running it and running it and getting 99^{+}% removal continually, for 9 months," says Schafran.

Puzzled, Schafran invited Unger to his lab. During the visit, the pair noticed a pink coating inside the tube leading from the carbon filter. "I think you have bacteria growing in there," said Unger. "It was like, wow!" says Schafran. "I guess the TBT isn't too harmful for this bacteria! Somebody's eating it." An ODU biologist later confirmed that two species of bacteria were living in the tube.

Unger is now analyzing the bacteria to confirm that they are indeed accumulating or absorbing tin. "This is pretty wild stuff," says Unger. "Although we don't think it's a viable technique to treat the water, it may have other applications in terms of treatments of solids. What are you going to do with TBT-contaminated dredge spoils, things like that? We're hoping that it may be another avenue for research."

"To me, the really zippy part of the project is to use things that we've learned about here at VIMS to try answer an applied engineering question," he says. "I think the public perception is often that scientists are good at finding problems, but not so good at finding solutions. I think we have a responsibility to apply the techniques we use to answer basic science questions to help solve problems. Here's a case where we've been successful at that."

Funding for the pair's collaborative research comes from NOAA's Sea Grant program. To read an enhanced version of this article, visit www.vims.edu/newsmedia/topstories

2003 Governor's School

Five high school students are hard at work at VIMS this July as participants in the 2003 Summer Governor's School, a 5-week residential program provided in cooperation with Christopher Newport University. For 14 years, this program has been providing high-achieving Virginia high school students with authentic experiences in marine research. For more information visit www.vims.edu/adv/ed/gs

Pictured are (clockwise from top L): Cassie Stoddard, Jessica Lee, and Alicia Beets, Jamie King, and Yassi Pourkazemi. The students are working with Drs. Rom Lipcius, Rochelle Seitz, Kam Tang, and with Jacques van Montfrans and Daniel Ha.

VIMS Scientists Chair International Science Conference

Drs. Hugh Ducklow and Deborah Steinberg, Dept. of Biological Sciences, joined Dr. Mark Abbott of Oregon State University to chair the recent JGOFS Open Science Conference at the National Academy of Sciences in Washington, D.C.

The conference, "A Sea of Change: JGOFS Accomplishments and the Future of Ocean Biogeochemistry" celebrated the successful completion of the Joint Global Ocean Flux Study, a 15-year international effort to better understand the ocean carbon cycle and climate change. The meeting was attended by 332 scientists and students from 32 countries around the world, including VIMS graduate students Matt Church, Rob Condon, Bob Daniels, Jacques Oliver, Jill Peloquin, Amy Shields, Sasha Tozzi, and Stephanie Wilson.

"The conference focused on JGOFS' exceptional legacy while also looking ahead to the crucial questions that future programs should address," says Steinberg.

"JGOFS has been wider, deeper, and richer than most of us ever imagined," says Ducklow. "It mapped the ocean carbon cycle with unprecedented precision and amassed more than a decade's worth of high-quality observations of climate change and ecosystem transformation. As we studied ocean biogeochemistry, we learned that our simple views of carbon uptake and transport were severely limited, and a new 'wave' of ocean science was born."

Dr. Deborah Steinberg (R) introduced keynote speaker Carol Browner, head of the EPA in the Clinton Administration, during the recent JGOFS Open Science Conference. Browner discussed global climate policy in a lecture at the Smithsonian's National Museum of Natural History.

Knowledge gained from JGOFS' field and laboratory studies is now being used to support the Synthesis and Modeling Project, or SMP. The current and final phase of the JGOFS program, SMP aims to develop computer models that can accurately simulate the ocean carbon cycle and its associated uncertainties.

The U.S. component of JGOFS was supported primarily by the National Science Foundation in collaboration with NOAA, NASA, DOE, and the Office of Naval Research.

Pair Use Neural Network to Predict Hurricane Waves

Hurricane waves pose a significant threat to recreational, commercial, and military vessels, and can inflict massive damage to beaches and beach-front property.

VIMS researchers Dr. Jerome Maa and graduate student Jun-Young Kim are now testing whether a new type of computer model can improve wave forecasts and thus help mariners better withstand a windstorm's fury. As a lieutenant commander in the South Korean Navy, Kim takes both an academic and professional interest in his work.

The new model, called an artificial neural network or ANN, is designed like the human brain to learn from its experiences and to recognize patterns. "ANN models are simpler and require much less computing time than traditional numerical models," says Kim. Their ability to quickly forecast a wave field makes them particularly promising for vessels at sea.

The National Hurricane Center and other U.S. forecasting agencies currently predict waves using a state-of-the-art numerical model known as WAVEWATCH III. But "even these third-generation wave models aren't perfect," says Kim.

Most importantly, traditional numerical models require prohibitive computing time and power. This drawback is particularly vexing for naval vessels, which would prefer wave forecasts on a real-time basis.

Kim estimates that a 2,000-times increase in computational power would be required to meet the forecasting needs of the navy; an increase that is unlikely to occur any time soon.

Current numerical models also suffer from the scientific community's imperfect knowledge of the complex processes involved in wave formation, a deficiency well appreciated by anyone who has looked out at the wind-driven cauldron of spray and white caps generated by a hurricane or nor'easter.

"Wind-wave generation is a complicated non-linear process that we don't yet fully understand," says Kim. Maa notes that interactions among waves, transfer of momentum from wind to waves, and dissipation of energy from white capping and bottom friction are the processes that are understood least.

Attempts to improve traditional numerical models by incorporating additional equations, for instance to account for wave-to-wave interactions, further increases computing time.

Maa and Kim are trying to sidestep these problems by using an ANN model instead.

Unlike current numerical models that use physically based equations to calculate wave height, frequency, and direction, ANNs "simply find the difference in patterns between observed inputs and outputs," says Kim.

Maa uses an automotive analogy to describe the difference between the two model types. "If you want to predict how fast a car can go, you can stand on the street and watch the cars go by. With practice, just by looking at a car's shape you can recognize what kind it is. If it's a BMW 850, you know it can go really fast. That's ANN modeling, which is based on pattern recognition. With a numerical model, you'd have to know the processes by which the car works: how its internal

Continued on page 8

Graduate student Jun-Young Kim and Dr. Jerome Maa (seated) are testing whether an artificial neural network can accurately forecast ocean waves.

VIMS Honors Van Engel with Inaugural Lifetime Achievement Award

Editor's note: The following citation was read by Dean and Director Don Wright during VIMS' annual award ceremony on May 16th.

"Today I have the rare honor to introduce Dr. Willard A. Van Engel, one of the true pioneers in the field of marine science and someone who has been an integral part of the VIMS community for the past half century. In fact, he is one of the individuals responsible for the very creation of VIMS itself.

"William W. Warner, author of *Beautiful Swimmers*, called Van 'the complete estuaries biologist, as much at home in theoretical discussions with his scientist colleagues as he is in meeting with watermen throughout the Bay.'

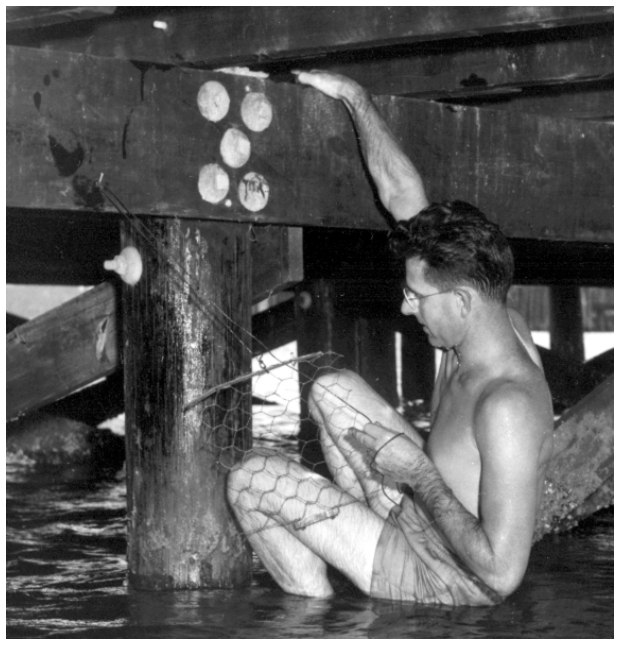
"At a time when research was done with slide rules and adding machines, Van and his colleagues were on the cutting edge of research in the Chesapeake Bay. Vans' early papers on the blue crab fishery formed the nucleus of work in the field. Van also foresaw the need for a fisheries survey for the blue crab, which has become the longest on-going data set for the blue crab, or any other any Portunid crab worldwide. Van was a pioneer in many research areas that we now take for granted, such as the relationship between recruitment dynamics and environmental parameters.

"In addition to forging key relationships with the Virginia Marine Resources Commission, industry, and watermen, Van and his colleagues at the Virginia Fisheries Laboratory had the great foresight in the late 1940s to create what has grown to be the diverse academic community now known as VIMS. When Van retired in 1985 at the age of 70 he was the longest-serving employee at almost 39 years.

"In 1947, Van accurately predicted the need for keeping duplicates and reprints of scientific papers and reports in a centralized location that eventually grew to be the VIMS library.

"At the American Association for the Advancement of Science meeting in 1948 Van and others, who at the time called themselves the 'Brackish Boys,' created what later became known as the Atlantic Estuarine Research Society.

"In addition to his service as educator and researcher, Van has also made a generous donation to William & Mary that has allowed for the Van Engel Graduate Fellowship and Library Endowment to continue in perpetuity.



Dr. Willard van Engel, or Van, examines a trap beneath the VIMS Ferry Pier.

"Thank you very much, Van, for all you have done over the years. We are delighted to present you with VIMS' inaugural Lifetime Achievement Award for your outstanding contributions to the Commonwealth and the College of William and Mary."

Hurricane Waves continued from page 5

combustion engine operates, the rate at which it burns gas, the thermodynamic transfer of energy from gas to wheels."

In recognizing patterns, ANNs resemble the human brain. "An ANN is designed to imitate the brain to learn from past experiences," says Kim, "much like a child learns to recognize dogs from examples of dogs." After these early learning processes, a child can generalize beyond the family pet by recognizing other dogs, even an unfamiliar breed.

In order to teach an ANN to predict wave height and frequency, Kim first trains it by entering wind-speed data for specific storms, like 1999's Hurricane Floyd, and corresponding wave data as measured by a set of five NOAA buoys along the U.S. East Coast. Once the ANN has "learned" the height and frequency of waves generated by Floyd's unique wind field, Kim repeats this "training" process with similar data sets from other Atlantic hurricanes or winter storms.

As the training continues, the ANN's circuits begin to recognize the characteristic wave pattern that results from a particular wind field. Once the ANN "recognizes" this pattern, it can begin to predict the wave field that is likely to result from an ongoing or future storm.

To date, Kim's ANN model has shown mixed success. "So far, we are lucky with winter storms, we can get a correlation of 80-85% between predicted and observed waves," says Maa. For hurricanes we are not that lucky yet." He estimates the correlation between predicted and observed hurricane waves at about 70%.

The disparity in forecast accuracy is partly due to differences between the storms. Whereas winter storms tend to be large and slow moving, with evenly distributed winds, "A hurricane's wind speed and direction change drastically with time and distance to the eye," says Kim. "That's why hurricane prediction is much more difficult than storm-wave prediction."

The main problem, though, is a lack of data. "The performance of an ANN model depends on how good your data are," says Maa. "We are very lucky in this country because we don't have too many hurricanes, but because of that we also don't have enough data to fully observe the pattern."

Whereas the northwest Pacific experiences an average of 16 typhoons a year, the Atlantic basin averages only 5 hurricanes annually. "In Taiwan, where I come from, we have 1 or 2 typhoons each year," says Maa. "If you had a good wave-monitoring program there for 20-30 years, you'd get enough data."

In the meantime, Kim is examining ways to interpolate between the 10 existing points for which wind data are available in the western Atlantic. "There should be a way to use some type of interpolation to find the waves at other places," says Maa. "But what kind of interpolation we don't know yet."

Despite the drawbacks of ANN modeling, Maa still thinks Kim's approach provides significant value. "This is one of the first studies using an ANN model to predict wave height using the correct wind input," he says. "ANN is a technique that can be applied in many, many areas. We have the tool now, and a good example to show how we can use it. Now we would like to see other people build on this study."

VIMS By the Numbers.....

- **64.6** Water temperature off VIMS' Ferry Pier on June 1. Normal water temperature for June 1 is 72.7° F.
- **$37,810,402** Monetary value of VIMS research grants active during the 2002 fiscal year (416 multi-year awards).
- **$5,000** Biennial budget of the Virginia Fisheries Laboratory (VIMS' predecessor) for 1939-1940.
- **150** Commercial watermen who collaborate in VIMS' bounty program for the invasive marine snail *Rapana venosa*. The program, which started with 35 watermen in 1998, pays $5 for a live Rapa whelk and $2 for a dead one. To date, bounty hunters have turned in more than 5,000 specimens, and more whelks are collected each year.
- **36** Number of research vessels in the VIMS fleet.
- **7,400,000** Number of bibliographic records available for query by users of VIMS' new on-line library database.
- **12** Percentage of VIMS graduate students who hail from outside the U.S.
- **40** Number of VIMS faculty and students certified for scientific diving.
- **300** Approximate number of sea turtles that strand within Virginia's waters each year, mostly juvenile loggerheads and Kemp's ridleys.

Seamount Census Reveals New and Poorly Known Marine Life

Editor's Note: The following article is the second in a two-part series designed to highlight the work of VIMS researchers involved in Census of Marine Life projects. The Census of Marine Life is a 10-year international research program to assess and explain the diversity, distribution, and abundance of the world's marine organisms. The information and technologies developed through the Census will be made publicly available to strengthen management of marine ecosystems and improve public understanding of the ocean environment.

Like anglers everywhere, Dr. Mike Vecchione knows what it feels like to snag a lure and break a line—but on a much grander scale. On a research cruise last year he lost a 60-foot bottom trawl on a seafloor snag a mile down, after only three casts.

Vecchione, a NOAA Fisheries employee, adjunct faculty at VIMS, and world expert in deep-sea squid, describes the loss with surprising equanimity. "One of the risks of deep-sea exploration is losing gear," says Vecchione. "You just have to be willing to face that hazard."

Vecchione lost the trawl while studying bottom-dwelling organisms on Bear Seamount, a dormant undersea volcano near Georges Bank. The seamount begins 9,000 ft beneath the waves and rises more than 6,000 ft to its flat top, which still lies more than 3,000 ft below the sea surface. It's at the inshore end of a seamount chain that runs southeast toward Bermuda, and is distinct in that it rises out of the continental slope.

"Seamounts hold great promise for undiscovered biodiversity," says Vecchione. "The fauna of such steep, deep bottoms is practically unknown." One reason is the difficulty of deep-water trawling across a rough volcanic seafloor.

Even more poorly known is the ocean's mid-water fauna, the community of fishes, squid, and other organisms that hover in the water column midway between surface and seafloor.

"Bottom life is generally better known than the stuff up in the water, because it's easier to study an interface and things tend to concentrate there. We've only studied a tiny percentage of the bottom, but it's still taught us a lot more than what we know about what's in this huge volume of water below 1,000 m. That realm makes up more than 90% of the biosphere, but it's the part of the Earth that we know the least about."

Vecchione's deep- and mid-water investigations are part of MAR-ECO, a Census of Marine Life (CoML) project to explore the poorly known ecosystems of the northern Mid-Atlantic Ridge (MAR). The seamount cruises, which also contribute to another CoML project aimed at the Gulf of Maine, are funded by NOAA's Ocean Exploration Program.

"MAR-ECO wants to compare deep-water communities on the Mid-Atlantic Ridge with similar communities elsewhere," says Vecchione.

Dr. Mike Vecchione and other members of the *Delaware II* crew bring in a deep-sea trawl catch.

William and Mary graduate students Kathleen Krick, Taylor Heyl, and Jennifer Dreyer hold a chimera fish caught in a mid-water trawl above the Bear Seamount.

"Bear Seamount is associated with the continental slope, but it's depth and steepness resemble that of a ridge environment."

Vecchione notes that the Census of Marine Life and MAR-ECO were designed to gain a basic understanding of life in the sea. "But there are applied implications to the work as well," he adds.

"Fishing has been moving progressively into deeper water and fishing on seamounts has become a hot topic. Deep-sea fishery resources are being exploited in such areas elsewhere in the world. It thus makes sense to explore and study deepwater habitats and the distribution and biology of such animals before large-scale exploitation begins in the western North Atlantic."

A May 2003 cruise was Vecchione's third and most recent trip to Bear Seamount. Previous trips include a 2-week summer cruise in 2002 (when he lost his bottom trawl) and a winter voyage in 2000. The recent spring cruise allowed the expedition's team to further explore how biodiversity on the seamount might change with the seasons.

"Our overall objective is to document the biodiversity of this seamount and how it might differ from the continental slope and from other seamounts," says Vecchione. "We're also trying to look at seasonal changes in diversity, particularly among pelagic animals." He plans a fall research cruise within the next few years.

The May cruise gave students in Vecchione's Deep Sea Biology course at VIMS a unique opportunity to take part in oceanographic research. Student crew members were Joel Hoffman, a Ph.D. student at VIMS, and five masters students from Dr. Cindy van Dover's laboratory at William & Mary.

The group sailed from the National Marine Fisheries Service lab at Woods Hole, MA, on May 12th aboard the 155-foot, 600-ton NOAA ship *Delaware II* for a 19-hour transit to the seamount. They spent the next 10 days working around the seamount before returning to Woods Hole on May 23rd.

"It was pretty rough the first two days," says William & Mary student Taylor Heyl, "but after that it wasn't too bad. The weather didn't cut into our sampling at all. And the food was excellent. That kept morale up."

While onboard, the scientists kept busy during their 12-hour watches by sorting the trawl catches, recording log entries, and processing salinity, temperature, and depth data from a trawl-mounted CTD.

Heyl notes that the mid-water trawls generally went off without a hitch, but that the bottom trawling was "a little more precarious," due to occasional snags on seamount crags. "The snags would actually pull the boat backward," she says. To escape, the ship would have to stop, reverse course for a few hundred meters, then resume its forward motion. Fortunately, this time around the maneuver prevented the loss of any trawl gear.

Continued on next page

Seamount
continued from previous page

"Our main goal was to explore the seamount's biodiversity by collecting fishes and cephalopods in bottom and mid-water trawls," says Vecchione. The researchers identified, counted, and measured the netted organisms, and sampled tissues for later DNA analysis. They also prepared voucher specimens for museum collections at the Smithsonian, Harvard, and Yale. Their deepest trawl ran to more than 6,000 feet.

In keeping with the Census of Marine Life's goal to develop and implement new marine-science technologies, the group tested a new computer-based measuring system during the cruise. The system, which uses a magnetized ruler and a digital weight table to automatically record an organism's length and weight, "worked extremely well," says Heyl.

Preliminary identifications indicate that the group collected about 200 species of fishes, more than 40 species of cephalopods, and many other invertebrate species from on or over Bear Seamount during the cruise. A more precise list will be produced once taxonomic experts complete their studies of the animals captured and compare their findings with results from previous cruises. Many of the species are extremely rare in previous collections and some specimens are the largest ever captured for their species. A newly discovered species of mid-water fish is being described from the 2002 cruise.

Both Vecchione and Heyl consider their most exciting find a cephalopod species called the ram's horn squid. "This is a very unusual kind of deep-sea cephalopod with an internal coiled shell," says Vecchione. Just a few inches long, these creatures float and sink through the water column by varying the amount of gas within their shell. Detailed photo-documentation of the live animal and tissue collected for DNA analysis will be useful for figuring out the relationships of this strange little squid.

This ram's horn squid was one of the unusual deep-sea organisms collected in mid-water trawls above the Bear Seamount. Its internal coiled shell is partly visible to the right.

Vecchione's team is also intrigued by an unusual biogeographic pattern that has begun to emerge after analysis of taxonomic and range data from the three cruises. "One interesting result from these studies is that a small percentage of the fauna is represented by 'natural invader' species," he says. "Most of these species are more typically found in the eastern Atlantic, and are either rare or previously unknown from the western Atlantic. Their occurrence appears to represent a natural process. We don't yet know for certain how they arrived at Bear Seamount, but it's possible that the seamount chain is acting as a series of 'stepping stones' across the deep seafloor."

"Some people seem to think that a taxonomic study like the Census of Marine Life is a cut-and-dried exercise, just arranging organisms in little cubbyholes," says Vecchione. "But it's not. It's the process of understanding relationships. And its really important for us to know the relationships among different groups of organisms so that we can understand things like how evolution occurs and how different organisms come to be where they are."

For more information on MAR-ECO and the Bear Seamount cruises visit www.mar-eco.no

VIMS Helps Local Students Aid Oyster Restoration Effort

Students from local schools are helping to restore Chesapeake Bay's beleaguered oyster population through a hands-on collaboration with two Gloucester Point agencies.

Researchers with VIMS' Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) and the Oyster Reef Keepers of Virginia (ORKV) helped the students transplant 104,000 one-year-old oysters onto the Felgates Creek Oyster Reef this past spring and summer. Felgates Creek empties into the York River between Yorktown and Williamsburg.

The students, from York, Gloucester, Hampton, Williamsburg, and Newport News, grew and monitored the oysters during the 2002-2003 school year through an ORKV oyster-restoration education program. CBNERRVA ran oyster-transplant field trips that allowed the students to access the Felgates Creek oyster reef with canoes launched from the Yorktown Naval Weapons Station, by wading to the reef from National Park Service property on the Colonial Parkway, or by boating to the reef from VIMS.

"We had great student interest and involvement during the oyster transplant field trips this past spring and summer," says CBNERRVA Education Director Bob Carroll, "and we'll continue the program in 2004."

ORKV Director Laurie Sorabella says it was "a great partnership" and notes that ORKV is looking for 10 new teachers to participate in the program this coming year. Sorabella is a recent VIMS graduate who started the ORKV program after she completed her master's thesis under Drs. Mark Luckenbach and Ken Moore.

Early monitoring suggests that the transplanted oysters are surviving and will hopefully increase oyster reproduction on the Felgates Creek reef and surrounding areas.

For more information about how school groups can start growing oysters in this restoration program, contact Laurie Sorabella at 804-721-8806 or email oysterreefkeeper@yahoo.com

Students from Gloucester Montessori school help restore oysters to Felgates Creek.

Members of the organizing committee for the 2003 Crustacean Society Annual Meeting gather at VIMS on June 5th. Committee members are (L to R) Dr. Rochelle Seitz, Dr. Jeff Shields, Dr. Martha Nizinski (formerly at VIMS), Senior Research Scientist Karen Hudson, and Dr. Emmett Duffy. The conference, which was held in Williamsburg, attracted 150 scientists from 11 countries and featured symposia on the biology and ecology of the blue crab, exploited shrimp, deep-sea crustaceans and the behavioral ecology of crustaceans. Meeting participants also celebrated the scientific career of Dr. Willard van Engel, VIMS faculty emeritus, who recently received VIMS' inaugural Lifetime Achievement Award (see story on page 8).

From Counting Fish to Implementing Energy Policy

Editor's Note: Occasionally the Crest will highlight the accomplishments of a VIMS alumnus to give our readers a sense of the many different career paths taken by graduates of the School of Marine Science.

By Dr. Maurice Lynch

Dr. Robert Middleton *(Ph.D. '89)* was recently named Director of the White House Task Force on Energy Project Streamlining, a group established by Executive Order in May 2001 in response to recommendations in the National Energy Policy.

The task force was formed to coordinate regional energy policy, reaching out to states, local communities, tribes, businesses, and non-governmental organizations, particularly in geographic areas where increased energy development activity is expected. The task force's mandate is to help assure that natural gas, oil, coal, wind, electrical, and other forms of energy are available to American citizens in an environmentally sound and safe manner.

Middleton received his MA at VIMS in 1979 with a thesis on the abundance, distribution, and bionomics of a group of deep-sea fishes called grenadiers or rat-tails. He went on to earn a Ph.D. at VIMS in 1989, with a dissertation on finfish use of an intertidal York River creek.

"VIMS gave me an excellent education," says Middleton. "The best part was the cross-fertilization between grad students and professors. They made you get out there and do things to make things happen. It wasn't just book learning."

Middleton's Ph.D. advisor Dr. Richard Wetzel notes that Bob was "always challenging the status quo, looking for new solutions to existing environmental issues and testing current thinking through questioning and observation. Our relationship quickly evolved from mentor-student to colleague and friend."

Middleton began his federal career in 1983 with the Marine Fisheries Statistics Group of the National Marine Fisheries Service on an Interagency Personnel Assignment from VIMS. Later that year he began a long tenure with the Department of Interior's Mineral Management Service (MMS) working on environmental assessments of offshore oil and gas development in the North Atlantic.

"Working on these contracts was a great opportunity to learn the federal decision-making process from the ground up," says Middleton.

In 1987 he received his first major promotion within MMS to a position dealing nationally with protected species. He served as MMS liaison with other federal and state agencies on offshore leasing and permitting matters. He also was detailed to work on special projects with increasing responsibility in policy areas that culminated in his promotion to Chief of Staff in 1993.

Career highlights include membership on the Department of Interior team that created the National Biological Services (now the Biological Resources Division of the US Geological Survey); and membership on the National Implementation Team of the Coastal America Program.

Middleton became active on the international scene as the Project Officer of a Department of Interior training and technical assistance program to Hungary, which resulted in the establishment of a new agency to manage that nation's mineral resources.

In 1997 Middleton was awarded the Department of Interior's Meritorious Service Honor Award for career achievements. The award specifically cited his successful management of environmental research studies, participation in the Vice President's National Performance Review of the Department's mission and activities, and continual advancement of new technology to increase the effectiveness and efficiency of departmental programs. In addition, the Secretary highlighted Middleton's work in helping Hungary to facilitate its economic and political transformation to a free-market economy and his organization of a subsequent international conference in Budapest to share this information with the other newly independent states of Poland, Slovenia, Croatia, Khazakstan, Bulgaria, and Romania.

VIMS alumnus Dr. Bob Middleton directs the White House Task Force on Energy Project Streamlining.

Middleton was asked to serve as a member of the Presidential Task Force on Energy Project Streamlining in 2001, and assumed his present position as Director of the Task Force in 2003.

REU Program in Swing at VIMS

Students in the 2003 Summer Intern Program are gaining research experience with VIMS faculty mentors. Their 8-week stay is funded primarily by NSF's Research Experience for Undergraduates program. Top row L to R: Chris Eaton (Williams College), Rachel Fontana (Univ of Miami), Lisa Kurian (Slippery Rock Univ), Jennifer Foley (Marietta College). Middle: Theresa Childress (Hampton Univ), Adolph Flowers (Morehouse College), Lisa Marko (Western Washington Univ), Sara Grill (Eckerd College), Margaret Cerf (Texas A&M). Bottom: Andrea Barber (UNC Wilmington), Alison Smith (UMASS Dartmouth), Cynthia Craig (Morgan St. Univ), Mike D'Amico (Univ. of Hawaii Hilo).

WILLIAM & MARY — VIRGINIA INSTITUTE of MARINE SCIENCE

Web Update

VIMS

Welcome | Research | Education | Advisory Services | Administration | Resources | News & Media

Awards Ceremony

VIMS' Annual Award Ceremony recognizes faculty, staff, students, and volunteers for their outstanding achievements during 2002. Visit www.vims.edu/newsmedia/topstories.html to learn about the winners of this year's Awards, and more.

Charting Our Destiny

VIMS has begun an ambitious but essential campaign to raise $23 million in private funds during the next 5 years. The campaign web site highlights naming opportunities, provides progress reports, and presents stories that illustrate the many ways that private and corporate donors have contributed to VIMS.
Visit www.vims.edu/campaign/

Crest

Interested parties can now subscribe to CREST or change their mailing address using an on-line form. The form also provides an option for joining a "Top Stories" e-mail list to receive periodic updates on important VIMS research and events.
Visit www.vims.edu/newsmedia/crest.html

New Zealand Workshop

This website highlights a recent international workshop in New Zealand that was chaired by VIMS researcher Dr. Steven Kuehl. The NSF-funded workshop educated participants on studies of the New Zealand continental margin and stimulated collaborative relationships between New Zealand and US scientists.
Visit www.vims.edu/margins/workshop.html

Tides and Currents Tutorial

Emeritus Professor Dr. John Boon has developed an interactive tutorial to help upper-level students better understand the cause and behavior of tides and currents.
Visit www.vims.edu/physical/research.html

Weather, Water, and Tides

Boaters and other outdoor enthusiasts will enjoy the real-time data this site affords. Displays show air and water temperature, wind speed and direction, and salinity. Archived data are also available. Visitors can access local tide calendars as well as a table of time and height differences for locations in the Bay.
Visit www.vims.edu/resources/realtime.html

Calendar of Events

—August 2003—

1, 8, 15, 22, 29	VIMS Public Tours
2, 9, 16, 23	Summer Saturdays at VIMS
13	USDA NRCS Cultural Diversity Day
25-26	Orientation for new students
27	Classes begin
28	After Hours Lecture Series: The Shark Chronicles, Dr. Jack Musick

—September 2003—

5	Maury Society Dinner
25	After Hours Lecture Series - TBA
26-27	VIMS Council Meeting
30-Oct 4	INTERCOH 2003 (through Oct 4), (International Conference on Cohesive Sediment Transport)

—October 2003—

1-4	INTERCOH 2003
4	Raft Up (see article below)
13	Chefs Seafood Symposium
16	Associate's Day
17-18	VABE (Virginia Assoc. for Biological Education)
30	After Hours Lecture Series - TBA
Oct 30 - Nov 2	W&M Homecoming
Oct 31	W&M Alum Tour

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

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

Visit our website at www.vims.edu

VIMS After Hours Lecture Series

In April, VIMS kicked off its After Hours Lecture Series, which offers the public an opportunity to hear first-hand from scientific experts about the natural resources of the Chesapeake Bay and its watershed. To date, audience members have learned about sea turtles, blue crabs, and seagrasses.

The series, generally held the last Thursday of each month, has been warmly received and well attended. "It's always pleasant to listen to an enthusiastic, informed person," said one attendee, while others commented on "the speaker's level of expertise" and "ability to share information in an understandable fashion."

Designed for non-scientists, the lectures are presented in a public-friendly manner. Sponsorship from the Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERR-VA) and the Center for Coastal Resources Management (CCRM), both located at VIMS' Gloucester Point campus, allows the lectures to be provided to the public free of charge. Due to limited space, advance reservations are required. Call 804-684-7846 or e-mail programs@vims.edu for information or reservations.

Upcoming After Hours Lectures

July 31st—*Jellyfish in the Chesapeake Bay and Beyond*

Join Dr. Deb Steinberg on Thursday, July 31 at 7 pm to learn how there's much more to jellies than "the sting." During her 45-minute talk, Steinberg will explore the biology, ecology, and behavior of jellyfish and other gelatinous ocean drifters in the Chesapeake Bay and the open sea.

August 28th—*The Shark Chronicles: A Scientist's View of the Consummate Predator*

World-renowned shark expert Dr. Jack Musick will highlight the biology, food habits, and population dynamics of sharks in Virginia's coastal waters. Signed copies of Musick's recent shark book will be for sale.

Stay tuned to www.vims.edu/newsmedia/topstories for upcoming topics.

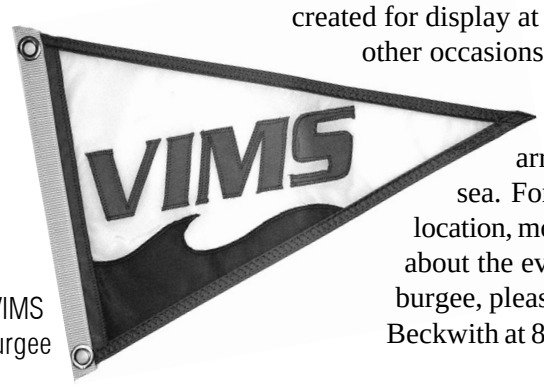
Kauffman Aquaculture Center Nears Completion

Exterior construction of the new Kauffman Aquaculture Center has been completed on schedule and final interior work is on target for the facility's planned October dedication. The Center will provide capabilities to house both native and non-native oyster stocks in isolation and gives access to the low-salinity environment of the Rappahannock River. Establishment of the Center was privately funded through a challenge grant by Boots and Jack Kauffman, which has been matched by many generous individuals, corporations, and foundations.

Masons recently completed brickwork on the Kauffman Aquaculture Center, and roofers are set to finish shingling within the next few weeks.

Raft-up for VIMS

Attention all boaters!! Mark your calendars for the first ever Raft-up for VIMS beginning Friday, October 3rd, 2003. Plans are to raft-up on Friday and Saturday before going ashore by dingy on Saturday for a reception. The reception will include exhibits and hands-on activities to educate the boating community about VIMS' mission of research, education, and advisory service. A brunch will be served to all participants on Sunday morning, October 5th. A donation of $50 per person is encouraged. The exact raft-up location will be announced in the near future.



VIMS burgee

A colorful VIMS burgee has been created for display at this event and on other occasions. VIMS supporters are encouraged to arrive by land or by sea. For the exact location, more information about the event and the burgee, please contact Mimi Beckwith at 804-684-7784.