



Brandon Puckett

**SUMMER • 2012**

**Science Café**

Monday, Sept. 10 • 6-8 pm  
 McCurdy's Restaurant  
 Atlantic Beach

Speaker: TBA

**CMAST Seminar**

Friday, Sept. 21 • 12 noon  
 CMAST Bldg. Room 205

Dr. Astrid Schnetzler, NC State, Department of Marine, Earth and Atmospheric Sciences  
 "An Urban Harbor in Distress: A Tale of Algal Blooms and Fish Kills."

**Wind Power at CMAST**

Innovative alternative energy projects for CMAST. p.8

**Skeleton Rearticulation**

Bottlenose Dolphin Skeleton Rearticulation Project. p.12

**Sustainable Fisheries License Plate**

Support CMAST Sustainable Fisheries Research. p.12

**CMAST: *Being in the right place all the time***

In the ecological sciences, it is well known that as the diversity of plant and animal communities increases, so does their productivity and resilience to disturbances. The same can be said for the diversity of the marine science and education community in North Carolina, of which CMAST (The Center for Marine Sciences and Technology) is a vital part. CMAST serves as an interdisciplinary communications and research portal between NC State University and related programs in the marine sciences in North Carolina. CMAST researchers, educators and extension specialists work both individually and in cooperation to advance marine science in powerful and creative ways.

As the diversity of the marine science and education community increases, so does overall productivity in the form of funding, and the resilience of those funding streams during periods of disturbance, such as the recent economic recession. For example, as state funding that many programs in the marine sci-



Dave Eggleston

ence community rely on were either reduced or cut in the recent economic downturn, teams of inter-disciplinary researchers were often able to maintain their research programs via highly competitive sources of federal funding. Similarly, as the competition for federal funding increases nationally, it is critical that we maintain a strong and diverse research community that can compete for federal funding.

The diversity of marine science programs in NC mirrors the growing diversity and complexity of issues facing the coastal zone in NC and globally.

Some of the most pressing scientific issues of today lie at the intersection of the biological, physical, chemical, social and economic sciences. Enhanced inter-disciplinary research collaborations, such as those facilitated by CMAST's presence at the coast, foster the type of synergies in research, teaching, mentoring, and outreach that will make NC State a destination for the best and brightest.

A collaborative system of research was built into

*continued on page 2*



## From the Director

Anchored by North Carolina's three Research I Universities (NC State, Duke and UNC Chapel Hill), the Research Triangle, has produced basic and applied research and an educated workforce that has fueled tremendous economic growth in North Carolina and beyond. A "Research Triangle at the Coast" is a great way to think about the research and education infrastructure and resulting synergies that emerge from the central NC coast with marine laboratories from NC State, Duke and UNC Chapel Hill anchoring a vibrant marine science and education community in Carteret County. When combined with complementary programs at ECU, Carteret Community College, the Coastal Studies Institute in northeastern NC and UNC Wilmington in southeastern NC, the marine science and education enterprise in NC is well positioned to address increasingly complex challenges facing coastal ecosystems, and to secure funding at the most competitive levels.

So, what makes CMAST unique within the NC marine science community? First, consistent with NC State's mission, is the emphasis on both basic and applied research, with extension of results to health and well-being, energy and environment, and safety and security. Second, CMAST has the only Aquatic Animal Veterinary Program and Seafood Technology Program in North Carolina, and hosts the Marine Mammal Standing Network for the central NC coast in collaboration with the NC Division of Marine Fisheries. Third, CMAST has a molecular and environmental biology program that provides expertise and capabilities that bridge expertise on Raleigh's main campus with related expertise in NC. Lastly, CMAST has unique expertise in fisheries with strong ties to related expertise on Raleigh's main campus, as well as partnerships with fisheries experts at the NOAA/National Marine Fisheries Service in Beaufort, NC and the NC Division of Marine Fisheries in Morehead City, NC.

In this issue of the CMAST Communicator, we highlight the benefits of a diverse marine science community through examples of basic and applied research. Examples range from training the next generation of veterinarians and fisheries scientists, to seafood technology and food safety, habitat restoration supporting private industry, to a collaborative study of feral pigs in eastern NC to help maintain the health of livestock operations. We also report on the CMAST facility: a rural broadband initiative that has realized significant costs savings for CMAST's internet access; funding from NSF to build a facility to house one of the only large-bore, marine magnetic imaging systems in the world; two projects on testing the feasibility of small-scale wind and solar power on the coast; and much needed water-proofing repairs.

I invite you to visit our web site, our facility located on Bogue Sound in Morehead City, or contact any of our faculty, staff or students with any questions.

With best wishes, Dave Eggleston

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**Front page photos:** Top: Control room of ROV "Jason" aboard the R/V Atlantis off Barbados. Displays show deep-sea hydrocarbon seep habitats, deep-sea crabs, and the cruise-track of the ROV. Bottom: Moonrise over salt marsh habitat within the Rachel Carson Estuarine Research Reserve, Beaufort, NC

*Right Place continued from p. 1*

CMAST from its very inception to its opening in 2000. Three NC State Colleges with various departments and programs are represented, where cross-college cooperation occurs daily. The proximity alone of the CMAST facility, in the "coastal research triangle" of marine science facilities in Carteret County, encourages multi-institutional and cross-disciplinary research. CMAST, UNC-Chapel Hill Institute of Marine Sciences, Duke University Marine Lab, and the NOAA Beaufort Laboratory are located within five miles of each other. Other nearby agencies and facilities such as the NC Division of Marine Fisheries in Morehead City, the NC Aquarium at Pine Knoll Shores and the NC Maritime Museum in Beaufort provide additional opportunities for collaborative work.

In this issue of the Communicator, we focus on opportunities that present themselves through NCSU's presence at the coast - it's not just being in the right place at the right time, it being in the right place all the time.



## Fisheries and Wildlife Department of Biology

**Dr. Jeffrey A. Buckel**  
Professor

Over the past ten years, Dr. Jeff Buckel has developed a strong applied research program at CMAST. This work directly addresses assessment and management of local and regional fisheries. "Having our program based at CMAST

has made it possible to create and participate in a network of fisheries researchers within North Carolina university and government programs. This facilitates sharing information, resources and field research that strengthens the science underpinning sustainable fisheries management policies for NC, as well as nationally and internationally," Buckel said.

One outcome of this network has been the establishment of the Marine Fisheries Management Fellowship. Originally a collaborative idea of former NC Division of Marine Fisheries (NC DMF) Director Pres Pate and former NC Sea Grant Director Ron Hodson who asked Buckel to assist in its implementation, this fellowship provides frontline fisheries management experience for the fellow and, in turn, the fellow brings state-of-the-art expertise to the agency. NC DMF, NC Sea Grant, and NC State sponsor this one-year fellowship intended for a fisheries graduate or recent post-graduate student. Buckel has been the coordinator and mentor for the program since 2002.

Past fellows have addressed timely questions for management of NC marine and estuarine fishes including: movements and mortality rates for striped mullet; recruitment time series for white perch and yellow perch; and selectivity and mortality rates on red drum. Much of this research has fed directly into fisheries management. For example, tagging data collected by Marine Fisheries Fellows at CMAST filled key information gaps in the 2007 NC DMF Assessment of the red drum population. Current Marine Fisheries Fellow, Jody Callihan, in his first year's work on tagging data, is developing a GIS



**Dr. Jeff Buckel shows a curious visitor the teeth on a black-tipped shark at the North Carolina Seafood Festival. CMAST participates each year by setting up a display on native North Carolina fish species.**



*Fisheries graduate students Jim Morley, center and Tim Ellis, right, examine the contents of a seine net pulled through the sanctuary area in Bogue Sound behind the CMAST building.*

map template that could be used to visualize tag return locations from striped bass tagged throughout North Carolina's coastal waters.

Additionally, doctoral student Samantha Binion is conducting a study on food habits of fish. She is working on a study with the NC DMF through their Coastal Recreational Fishing License grant program utilizing data collected on fish age, growth and reproduction sampling. The goal of this study is to establish a food habits program using fish already collected from other sampling programs. Food habits data will allow for the development of multispecies fisheries models of Pamlico Sound and its tributaries, and the incorporation of mortality when estimating natural mortality in stock assessment models.

Buckel also added, "Being located at the coast makes the likelihood of successful field sampling much higher. The ability to cancel a field trip (e.g., because of bad weather) one day and easily move it to the next day or following week has greatly enhanced my research program. If I were located on main campus, that sampling trip may have been canceled resulting in missing data for that time period. Related to this is the ease of sampling 12 months out of the year. Much earlier research in our coastal areas was restricted to summer months. For example, earlier work on dolphin fish age and growth was based on samples from summer months only. Our recent research sampled dolphin fish twelve months out of the year over a two year period. This year-round sampling resulted in novel findings about the reproductive biology and recruitment timing of this important species."



**Clinical Sciences  
College of Veterinary  
Medicine**

**Dr. Craig Harms  
Associate Professor of Aquatic  
Wildlife and Zoologic Medicine**

"When I first started at CMAST, shortly before opening in 2000, as I met researchers and administrators at the area marine institutions, one of the most common questions I heard was, "what is a veterinarian going to do at a marine lab?" said Dr. Craig Harms, Associate Professor at CMAST. "Once people realized what vet-

erinary services and techniques can provide to enhance animal-related research, and there are veterinarians interested in those creatures, the projects flowed. Harms noted, "We've collaborated with just about every marine institution in the area on everything from marine invertebrates to fish to sea turtles to sea birds to marine mammals." Those institutions include the NC Aquariums at Pine Knoll Shores, Roanoke Island, and Fort Fisher; NOAA/NMFS and NOS Beaufort Laboratory; Duke University Marine Laboratory; UNC Chapel Hill Institute of Marine Sciences; Karen Beasley Sea Turtle Rescue and Rehabilitation Center; NC Wildlife Resources Commission; NC Division of Marine Fisheries; NC Maritime Museum; UNC Wilmington; Carteret Community College; and of course, the colleges of NC State based at CMAST.

Problem solving is paramount to the work conducted by the Aquatic Animal Program. For example, they recently solved how to anesthetize sea turtles and diamondback terrapins – while underwater – to help sensory biologists measure turtles' hearing capacity and determine any effects they experience from human-made underwater noise. The faculty provided educational opportunities to middle school, high school, college, professional, graduate, and post-doctoral students that cannot be replicated.

An example of why there is no substitute for being located at CMAST came this past July, when Harms hosted 4th-place winning high school students from the National Ocean Science Bowl. Halfway through an exercise in

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*Dr. Craig Harms demonstrates necropsy techniques on a stranded bottlenose dolphin specimen to students of the College of Veterinary Medicine Marine Mammal Medicine course. CVM students visit the CMAST facility for a two-week field course in the summer.*



*A loggerhead sea turtle under examination.*

*Right Place continued from p. 3*

protected species forensics - conducting a necropsy on a previously deceased, frozen-thawed loggerhead sea turtle - there was a call about a live marine mammal in trouble in the surf across the bridge in Emerald Isle. After concluding the sea turtle necropsy, Harms' team responded to the marine mammal stranding, students in tow. It turned out to be a dwarf sperm whale, *Kogia sima*, which was near death and required euthanasia. The high school students had the exceptional privilege of witnessing not only a remarkably unusual off-shore, deep diving marine mammal rarely seen by people, but the crowd of people who gathered out of curiosity and compassion, and the gut-wrenching decisions that factor into ending a distressed animal's suffering. Harms said, "You can't schedule the stranding of a dwarf sperm whale. You have to be here."

Veterinary Medicine faculty and staff located at CMAST are called on to provide veterinary assistance and expertise in many areas such as surgery techniques to implant transmitters in many different fish species for research studies, or providing support in times of crisis, as in the recent oil spill or cold stuns affecting countless numbers of marine life.

A longtime inter-institutional arrangement has been in place with the NC Aquariums. Harms, veterinary residents and staff provide medical care and treatment for the captive marine animals at all three aquarium locations. Part of this collaboration allows training opportunities for resident veterinarians at the aquarium. Similarly, Harms and staff also provide medical care for patients at the Karen Beasley Sea Turtle Rescue and Rehabilitation Center in Topsail Beach, where veterinary students and residents can gain first-hand experience in aquatic animal medicine.

Additionally, association with the Central North Carolina Marine Mammal Strand-

ing Program, whose coordinator is located at CMAST, has been both essential and reciprocal. In instances of a mammal stranding, CVM doctors and staff provide emergency treatment or euthanasia if warranted, but in return have an opportunity to perform necropsies to gather important data on a variety of cases, which can provide resources for other veterinarians and researchers. For example, Dr. Harms was called on to assist with the stranding of a large right whale at Cape Lookout, which brought together a consortium of stranding response partners including the U.S. Coast Guard, the Virginia Aquarium and Marine Science Center, UNC Wilmington, Duke University Marine Lab, NC Maritime Museum, Woods Hole Oceanographic Institution, and the New England Aquarium. With NC State CVM providing coordination, all institutions took part in the case workup and eventual findings.



**Seafood Laboratory  
Food, Bioprocessing and  
Nutrition Sciences**

**Dr. David Green, Professor and  
Department Extension Leader**

For more than 40 years, the Seafood Laboratory has worked with North Carolina's seafood industry to ensure a nutritious, safe and abundant supply of seafood products. Dr. Frank Thomas, a food scientist and the first seafood extension specialist at NC State in Raleigh, established the Seafood Lab in the late 1960s. Thomas saw the need to be positioned at the coast, to work alongside industry members - fishermen and processors - to provide them with the latest research on contemporary processing tech-

niques and educating them on keeping seafood safe for consumption.

Now under the direction of Dr. David Green, the Seafood Laboratory has established a national reputation for the training of industry and regulatory personnel to provide for a safe food supply. Green said, "Without being physically located at the coast, those early connections and the trust that was built with the industry by Dr. Thomas, the program would not have been able to succeed for the past four decades. By being uniquely positioned at CMAST, it allows us to help solve coastal issues and create partnerships with other institutions, government agencies, industries and citizens in eastern North Carolina."



*Dr. David Green, right, advising a fresh seafood retailer.*



*Students learn regulatory requirements at a Basic Seafood HACCP Workshop, a training and certification course offered by the Seafood Laboratory.*



**In Thailand, Dr. Michael Stoskopf teaches NCSU veterinary students and Thai veterinarians health management of sea turtles, using a double stethoscope that allows students to hear with the teacher when auscultating.**

For example, Seafood Laboratory personnel have participated in cross-disciplinary and inter-institutional teams since the mid-1990s in curriculum development and delivery of seafood safety education and training programs. It was, and continues to be, crucial to provide training programs locally to reach more industry members who require training on new federal and state regulations regarding seafood handling and processing.

The Seafood Lab first offered Basic Seafood Hazard Analysis and Critical Control Point (HACCP) training to regulatory and industry personnel in 1997 on implementation of federal regulations “Procedures for the Safe and Sanitary Processing and Importing of Fish and Fishery Products.” These rules are based on preventative controls to ensure a safe food supply. The training and certification courses are offered on a national level and courses are delivered in North Carolina with instructors from the U.S. FDA, NC Department of Agriculture and Consumer Services and NC Shellfish Sanitation. This cooperative approach in education and training provides a more meaningful learning experience for participants as they interact with public health officials from multiple agencies.

More recently in 2011, the Seafood Laboratory and the Department of Food, Bioprocessing and Nutrition Sciences was awarded a U.S. FDA cooperative grant for curriculum development and delivery of acidified food products (salsas, sauces, pickles) education and training programs. The aim of this collaboration of representatives from NC State, University Wisconsin Madison,

NC Department of Agriculture and Consumer Services, USDA Agricultural Research Service and AFDO is to establish NC State University as a National FDA Center of Excellence in Food Safety Training and Certification.

Research-based knowledge is important if North Carolina’s seafood industry is to remain competitive in the marketplace. The Seafood Laboratory is providing inter-disciplinary and inter-institutional technical services and support for a number of new and exciting research projects. For example, the first sturgeon farm was established in 2005 near Lenoir, NC with help from Dr. Tom Losordo, Department of Biological and Agricultural Engineering, and Dr. Jeff Hinshaw, Department of Biology. A second production facility was established this year in Marshallberg, NC. The Seafood Laboratory provided the necessary HACCP training to personnel and technical services and support to establish a commercial processing operation for caviar and smoked sturgeon meat, which is steadily becoming a lucrative market.



**Clinical Sciences  
College of Veterinary  
Medicine**

**Dr. Michael Stoskopf, Professor of  
Wildlife and Aquatic Medicine**

When it comes to studying physiological impacts of environmental factors on marine organisms, one particularly important issue is the availability of specimens. Another is being able to maintain sophisticated instruments in a con-

trolled environment to optimize their functional life spans. “In the development of the world’s first large-bore magnetic resonance imaging and spectroscopy facility (to be located at the CMAST facility in 2013), CMAST, its location and basic infrastructure have been key to our ability to attract external funding,” says Dr. Michael Stoskopf. “The NC Biotechnology Center funding which initiated our efforts in this arena certainly was influenced by the fact that CMAST provides a secure, well-supported base of operations, where sophisticated technology can be applied to a wide range of marine and coastal issues,” Stoskopf said.

Being at the coast and on the shore of the sound, with relatively easy access to a wide variety of species near and offshore is an obvious advantage. Equally important, the diverse intellectual resources of the CMAST faculty makes it possible to fully exploit new technologies, collaborating with them to look at important questions ranging from seafood safety to marine conservation health. Stoskopf continued, “This breadth of application certainly makes investing in CMAST more attractive to agencies funding shared-use instrumentation.”



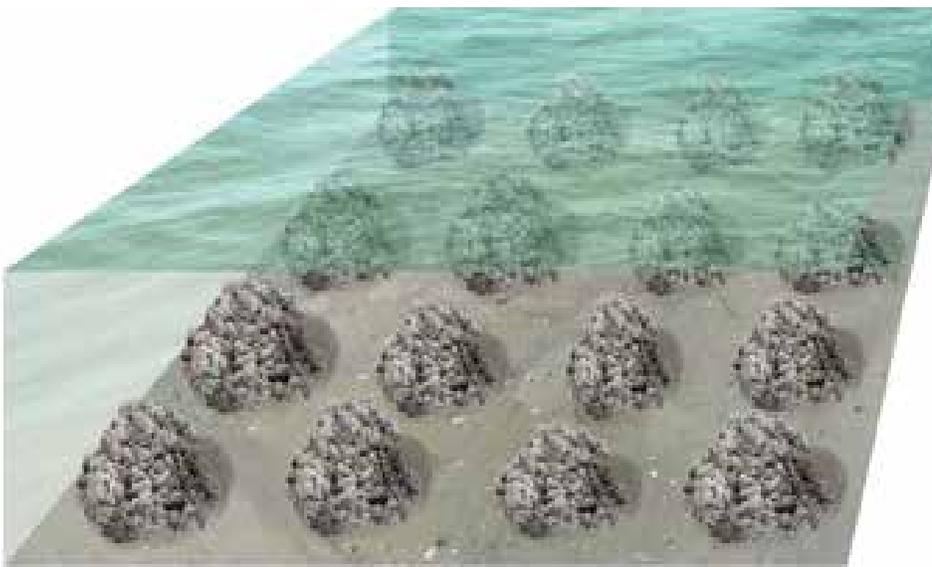
**Marine Ecology and  
Conservation  
Marine, Earth and  
Atmospheric Sciences**

**Dr. David Eggleston  
Professor and CMAST Director**

CMAST gives faculty, staff and students an opportunity to be “at the right place all the time,” says Dr. David Eggleston, Professor of Marine Science in the Department of Marine, Earth and Atmospheric Sciences, and CMAST Director. Eggleston leads the Marine Ecology and Conservation Program at CMAST. Since becoming CMAST Director in 2006, Eggleston has found that being a part of the marine science and education enterprise in Carteret County has greatly facilitated his research funding. He credits his success with the ease with which one can share research needs, ideas, methods and results with colleagues from multiple disciplines and institutions at the coast. Eggleston points to three examples of funding that started with conversations in Carteret County.

The first example started with a simple question, “Can we help?” posed by Eggleston to Craig Hardy, Chief of the Resource Enhancement Section of the NC Division of Marine Fisheries (NC DMF), located five blocks from the CMAST building. Eggleston was referring

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**Schematic of oyster reefs constructed in Pamlico Sound by deploying mounds of ~ 150 tons of limestone boulders per mound. (image from NC DMF)**

*Right Place continued from p. 5*

to helping Hardy and NC DMF determine if a network of oyster broodstock reserves in Pamlico Sound were growing or not in areas closed to oyster harvest, and where in Pamlico Sound future oyster reefs should be built. This conversation and resulting collaborations over the next five years with the NC DMF, NC Coastal Federation (located twelve miles from CMAST), and NC Sea Grant (staff located at CMAST), led to funding from NC Sea Grant Fisheries Resource Grant Program, NC Coastal Recreational Fishing License Program, and a \$5 million grant from NOAA's Habitat Restoration Program funded via the American Recovery and Reinvestment Act.

The second example grew from the first. In this case, Eggleston sought the expertise of Drs. Rick Luettich and Joel Fodrie from UNC Chapel Hill Institute for Marine Sciences, located six blocks from CMAST. One of the key questions remaining from the collaboration with NC DMF described in the first example was, "Are fished oyster reefs producing larvae that are settling and fueling growth of oyster reefs that are protected from harvest?" Eggleston says that research on the value of marine protected areas that are closed to harvest has typically focused on the 'spill-over of larvae' from protected areas to fished areas. He said, "But no one was looking at the role that fished areas played in supporting populations in protected areas."

Luettich, whom Eggleston has collaborated with since 1999, had expertise in modeling the currents in Pamlico Sound that were important inputs to a computer model that Eggleston's

group used to predict where in Pamlico Sound oyster larvae dispersed in the water column, and Fodrie had expertise analyzing the chemical signatures on the shells of bivalves to determine their natal origin, which was key to validating the predictions from the computer model of larval dispersal. This collaboration, which also included Dr. Elizabeth North of the University of Maryland, another expert in the modeling of larval dispersal, resulted in a grant of over \$1 million from the National Science Foundation. "This project will produce new tools, as well as test and refine others for studying larval connectivity in marine systems," Eggleston said. "It also will provide decision-support tools for

improving the efficacy of marine reserves for management and restoration of marine species and ecosystems." He noted that the grant would also help train future generations of marine scientists.

The third example that also grew from the first, illustrates the importance of conferences. Every fall, the Duke University/UNC Oceanographic Consortium, which administers the research vessel Cape Hatteras, hosts a meeting for NC marine scientists to share their research at Duke University Marine Laboratory, located five miles from CMAST. Dr. Cindy Van Dover, Director of the Duke Marine Lab and a world renowned deep-sea biologist, saw Eggleston's research presentation on oyster larval connectivity and marine reserves in Pamlico Sound and asked the question, "Can we apply those same tools to deep-sea communities?" In this case, the deep sea communities were "cold seeps," in which hydrocarbon fluids or gas beneath the seafloor "seeps out," providing the basis of the food web for a unique, yet relatively unknown community of deep-sea organisms somewhat similar to those found at hydrothermal vent communities. This led to a collaborative project involving additional researchers from NC State, Duke University and the University of Oregon, which received NSF funding worth approximately \$2 million, with nearly \$2 million in ship- and submersible-time. This team is currently integrating studies of oceanographic circulation, larval dispersal, invertebrate life histories, population genetics, and phylo-geography to advance our understanding of population connectivity in the deep-sea.



**Retrieving the remotely operated vehicle (ROV) "Jason" from a survey of deep-sea hydrocarbon seep communities off Barbados.**

## UNC System President Visits CMAST



University of North Carolina System President Tom Ross and North Carolina State University Chancellor Randy Woodson visited the Center for Marine Sciences and Technology in Morehead City last December on a fact-finding mission about university marine science research and facilities in Carteret County and Eastern North Carolina. President Ross, completing his first year at the helm of the university system, traveled with Chancellor Woodson for the day visiting several NC State facilities and programs in eastern NC. Their two-hour stop at CMAST included a working lunch in which Dr. David Eggleston, CMAST Director, provided an overview of the CMAST partnerships, as well as the research, teaching and extension activities that make CMAST a unique facility and program, followed by a presentation of the future vision for CMAST, a round-table discussion with faculty, and laboratory demonstrations.

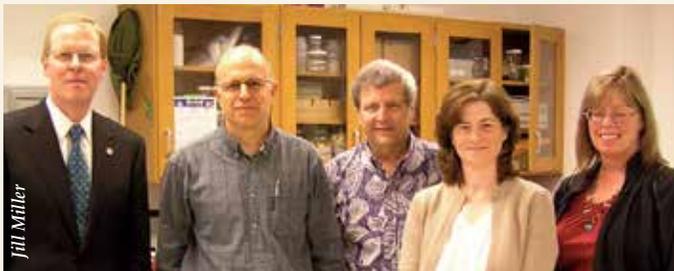
Chancellor Woodson brought President Ross to the CMAST facility to show first hand the diverse partnerships and activities being conducted, as well as have the opportunity to develop an appreciation of the synergistic research collaborations between NC State/CMAST, UNC-CH/IMS and Duke University Marine Laboratory, and their ability to successfully compete with top marine science programs in the U.S. for federal funding. Dr. David Eggleston stated, "I was excited to have the opportunity to discuss our programs as a CMAST faculty with President Ross." President Ross and Chancellor Woodson were very interested in what work is being conducted, the numerous and



UNC President Tom Ross (center) and Chancellor Randy Woodson (left) speak with David Eggleston, CMAST Director, as they tour the CMAST facility.

diverse marine science and education partners in the county, and the future vision for CMAST." Eggleston continued, "The collaborations between marine science institutions in Carteret County continues to grow and strengthen, helping to maintain our scientific leadership nationally and internationally."

Other NC State visitors touring the facility included Dr. Raymond Fornes, Professor Emeritus from the College of Physical and Mathematical Sciences, who was instrumental in the planning and development of the CMAST facility in the late 1990s and, Dr. Walt Robinson, Head of the Department of Marine, Earth and Atmospheric Sciences.



## CVM Deans Tour CMAST

Newly appointed College of Veterinary Medicine Dean Paul Lunn (left) and Associate Dean for Research and Graduate Programs Kathryn M. Meurs (second from right) visited CMAST for the first time in April. After meeting with CMAST Director Dave Eggleston, Drs. Michael Stoskopf (center), Suzanne Kennedy-Stoskopf (far right) and Craig Harms (second from left) provided a tour of the laboratories and facilities in the building.

## CMAST Hosts SEERS Meeting

CMAST hosted a reception and poster session for the Spring 2012 meeting of the Southeastern Estuarine Research Society (SEERS). Over 60 people were in attendance. Ashlee Lillis, CMAST graduate student and society member, was given a presentation award for best graduate poster.

## Sea Grant Hosts Summit Meeting

North Carolina Sea Grant and Saltwater Connections, a regional economic development initiative funded by the NC Rural Center, hosted a meeting on communication strategies for community-based, local-seafood educational organizations or catch groups on February 22. The summit was designed to help

the catch groups (Carteret Catch, Brunswick Catch, Ocracoke Fresh, and Outer Banks Catch) communicate the value of local seafood to consumers, the lifestyle of fishermen and the challenges commercial seafood producers face to satisfy the increasing demand for North Carolina seafood. Forty-four individuals attended the one-day workshop.

## Students Visit CMAST

CMAST faculty, staff and students hosted numerous educational outreach activities, ranging from the Brad Sneedon Marine Science Academy for 8th graders in Carteret County, to high school students with the Virginia Living Museum's summer field program, to a Marine Mammal course for students at Duke University.

# CMAST and Coastal Wind Power Projects



Wind and solar power system at MARC facility (left). Vertical axis wind turbine erected at CMAST (right).

## Innovative wind turbine installed at CMAST

A new design in wind-generated power turbines was recently installed at CMAST. The demonstration and educational project is a partnership with NC State/CMAST, Green Sky Wind Systems, the innovator of the vertical axis wind turbine, as well as Carteret Community College and the NC Solar Center. The ZEPHYRE 1.2 kW system was unveiled at a launch ceremony and reception at CMAST in July 2012.

“We are extremely fortunate and proud to be partnering with NC State’s CMAST and with Carteret Community College for this inaugural installation,” said GreenSky Founder and President, Quenten Ankri. “We have invested considerable time into R&D and perfecting our technology. The location, expertise and feedback provided by these two institutions will further validate our technological advances and enable us to take further steps to efficiently harness this untapped, abundant and clean natural resource.”

“We are excited to partner with GreenSky Wind Systems, Carteret Community College, and the NC Solar Center to provide a demonstration project of small-scale wind energy in the coastal zone, and to quantify the amount of electricity generated so that consumers can make informed decisions when considering the purchase of a small-scale wind turbine,” said Dave Eggleston, CMAST Director. “The wind turbine and its scenic location overlooking Bogue Sound should provide an attractive venue for people wanting to learn more about wind energy. It supports a growing set of examples of coastal sustainability on the CMAST campus when added to the very successful shoreline restoration project on the sound-side of the CMAST building, and our system for capturing stormwater from parking lots to preserve nearby water quality.”

The 8x7 foot ZEPHYRE airfoil turbine is mounted on a 30-foot tower located adjacent to CMAST on the Carteret Community College waterfront campus overlooking Bogue Sound. The turbine runs silently (a maximum of 26db) without vibration in five mph winds, and is engineered to survive wind speeds up to 135 mph. The ZEPHYRE turbine can also be mounted on rooftops. It produces electricity at very low rpms

## Alternative energy system provides power at MARC

The “green” light was given to power up in April when a newly constructed, alternative energy system passed its final electrical inspection at NC State University’s Marine Aquaculture Research Center (MARC) in Smyrna, NC. The demonstration hybrid photovoltaic (solar)-wind system powers pumps, and heats and cools water for application to the state’s growing aquaculture industry.

In 2011, NC State University’s Center for Marine Sciences and Technology (CMASST) was awarded \$253,501 in funding for the project, part of a \$4.6 million Green Business Fund Award granted through the NC Department of Commerce, as well as an additional \$37,000 from private donors.

The hybrid system consists of a 10 kW Wind Turbine that stands about 90 feet tall and a 10 kW Solar Array, using 40 separate solar panels each generating approximately 240 watts. Computerized data logging systems record the amount of electricity generated from wind versus solar. Projected energy generation is 21,500 kWh of the 100,000 kWh annual demand, which

will be used to offset nearly \$2,300 per year in electricity costs at the Carteret County facility.

The NC State University MARC facility was constructed in 2010 to study saltwater aquaculture, which currently lags behind freshwater aquaculture in terms of research and technology transfer. One technology project being tested at MARC is a unique flowing seawater system, which takes in water from a nearby creek, cleans it for laboratory use and treats it again before being returned to the creek without causing any adverse impact on the environment. The additional alternative energy technology geared for such facilities adds an extra opportunity for aquaculture farm success.

Construction of the 90-foot turbine tower required a variance from the Carteret County Board of Commissioners, as the structure is taller than the 75-foot maximum allowed for wind turbines in the county. Now functioning, the turbine at full speed produces very little sound and disruption to the area. CMAST, in collaboration with the NC Solar Center, contracted Hart Power Solutions from Kill Devil Hills, NC to construct the system, which was completed within two weeks and used materials and equipment made in the U.S.

with maximum efficiency utilizing a unique array of vertical j-shaped foils and a direct drive generator. A patented magnet and coil arrangement controls speed and virtually eliminates friction in the unit reducing wear and tear and maintenance.

As a key component of this educational/private sector partnership, the NC State Solar Center will be monitoring the turbine's output and generating independent proficiency data.

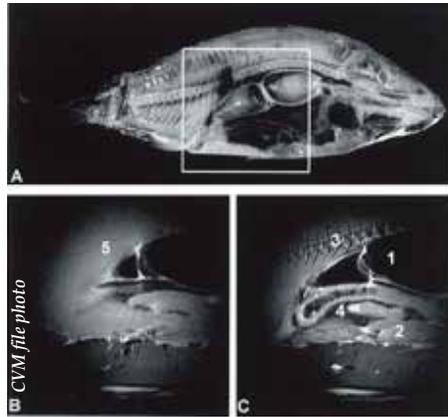
## Sea Grant and ECU receive funding for study

North Carolina Sea Grant and the College of Business at East Carolina University were awarded a \$75,000 grant in May 2012 from the North Carolina Rural Center to conduct a supply-chain analysis of the North Carolina commercial fishing industry. Research findings and recommendations will focus on three benchmark species that comprise the state's most profitable fisheries: shrimp, flounder and Atlantic blue crab. This research will emphasize where and how improvements to the seafood supply chain can result in increased revenue for commercial-fishing participants.

## Three awards received from National Science Foundation

Two CMAST programs are the recipient of three awards from the National Science Foundation (NSF) which will benefit both the CMAST facility and an ongoing research program.

A \$340,000 grant was awarded from the NSF Improvements to Field Stations and Marine Laboratories Program to support a CMAST project entitled "Development of in-vivo marine magnetic spectral imaging capabilities." Drs. David Eggleston, Marine Earth and Atmospheric Sciences and Michael Stoskopf, Clinical Sciences, CVM, teamed on the proposal, which includes \$173,000 in cost-sharing from NC State's Office of Research Innovation and Economic Development, with some previous funding support from the NC Biotechnology Center. This award adds improvements to the CMAST facility with the construction of an addition to the first floor of the main building, providing dedicated space for an existing horizontal bore, high field magnetic resonance imaging and spectroscopy (MRI/S) magnet devoted to the in-vivo study of marine and aquatic biota. The magnet's capabilities will



**Magnetic resonance imaging allowed the measurement of dynamic changes in the water content of cells in a fish when exposed to osmotic challenges.**

be unique, moving the U.S. to the forefront in the study of aquatic and marine adaptations to environmental changes.

The location of the instrument at CMAST will enable broad cross-disciplinary work which ensures contributions to meaningful partnerships between academia and the private sector in areas ranging from bio-prospecting to seafood processing. The building addition was designed by Burnete Architecture of Morehead City, NC and construction will be overseen by NCSU Construction and Design Services. The scientific research program will be led by Dr. Stoskopf.

The two additional NSF awards support "Sounds of the Sound," a research project on underwater sound. Ambient underwater sound is emerging as an important orientation and settlement cue for marine fish and invertebrate larvae. Yet, sound patterns and larval responses remain largely unknown, particularly in estuarine environments.

NC State's Department of Marine, Earth and Atmospheric Sciences was recently awarded two grants for the study of underwater noise and its effects on the behavior and settlement of larval bivalves. The first award of \$15,000 was made

from NSF's Doctoral Dissertation Improvement Grant Program for the project "Underwater soundscapes and their potential role in the settlement of estuarine benthic invertebrates."

The second award was made from NSF's Biological Oceanography Program for \$456,000 for a project entitled "Can you hear me now? Estuarine soundscapes and their role in larval settlement." Drs. David Eggleston and Del Bohnenstiehl, both of Marine Earth and Atmospheric Sciences, as well as doctoral student Ashlee Lillis teamed on the proposal. Eggleston stated that "This multi-disciplinary project will advance our general understanding of the role of underwater sound in biological oceanography using larval bivalves and subtidal oyster reefs in Pamlico Sound, North Carolina as a study system." He also stated that these types of interdisciplinary research projects, such as in this study between a marine ecologist (Eggleston) and geophysicist (Bohnenstiehl), will help train the next generation of highly inter-disciplinary Ph.D. students such as Lillis.

## Collaborative study on feral pigs in coastal NC

Interdisciplinary work of CMAST faculty and researchers can extend outside the marine science field. Case in point is the recent work on feral pigs by Dr. Suzanne Kennedy-Stoskopf, Research Professor of wildlife infectious diseases with the College of Veterinary Medicine (CVM) and a member of the CMAST faculty.

A recent report from the USDA indicated that feral pigs (wild hogs) are not native to NC, but have been introduced and are increasing rapidly, especially in coastal NC, and along the Neuse River flood plain. "Feral pigs can negatively impact coastal agriculture through destruction of crops, livestock operations through disease

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**Biological sources of noise underwater include reproductive behavior of fish that beat their swim-bladders while spawning, social communication and echolocation by fish and whales, snapping shrimp that "snap-crackle-pop," spiny lobsters that make rasping noise to communicate ready to mate or anti-predatory alarms.**

# cmastpeople

**Dr. Jeff Buckel**, Biology Department at CMAST, was presented the Excellence in Fisheries Education Award by the Tidewater Chapter of the American Fisheries Society at the March 2012 meeting.

**Dr. David Eggleston** participated in an invited working group on Marine Fisheries Habitats during June for the International Council for the Exploration of the Seas, Copenhagen, Denmark.

**Dr. David Green** was a presenter at the national Seafood HACCP Alliance (SHA) Supervisory Trainers' Workshop held in Hawaii this August. Green serves on the SHA Steering Committee as coordinator for the supervisory trainers' course. This workshop was the last of four workshops conducted across the country with colleagues from several universities, industry associations and Federal and State public health authorities.

**Dr. Craig Harms** presented three papers at the annual meeting of the International Association of Aquatic Animal Medicine in Atlanta in May 2012. The topics were: "Low residue euthanasia of stranded mysticetes," "Tissue enzyme activity in black sea bass (*Centropristis striata*) captured off North Carolina," and "What a difference de-capitalization makes: computed tomography (CT) imaging of a True's beaked whale (*Mesoplodon mirus*) head."

**Tim Ellis**, doctoral student, received the 2012 Walter B. Jones Memorial Award for Coastal and Ocean Resource Management for Excellence in Coastal and Marine Graduate Study. This award recognizes graduate students whose academic study promises to contribute materially to the development of new or improved approaches to coastal or ocean management. Ellis' work is focused primarily on the movement and mortality rates of spotted seatrout.

**Greg Bolton**, Research Specialist with the NC State Seafood Laboratory at CMAST, was certified as a Basic Seafood HACCP Instructor after attending a train-the-trainer workshop in Baltimore, MD, in May 2012. The Association of Food and Drug Officials (AFDO) and the national Seafood HACCP Alliance sponsored the training. This certification allows Bolton to teach Basic Seafood HACCP (Hazard Analysis and Critical Control Point), which is based on the U.S. FDA Fish and Fishery Products Hazards and Controls Guidance.

**Dr. Vicky Thayer**, Marine Mammal Stranding Coordinator and Research Assistant Jill Sullivan presented a poster at the Southeast Marine Mammal Stranding meeting, in Charleston, SC in February 2012. The poster, entitled

"Neonate bottlenose dolphin strandings in North Carolina, 1992-2010," was co-authored with many of the North Carolina Stranding Partners.

**Dr. Tres Clarke** completed his three-year residency in Aquatic Zoological Medicine at CMAST and has accepted a position as the Head Veterinarian at the Audubon Aquarium, part of the Audubon Nature Institute and Research Facility in New Orleans, LA. Additionally, the CVM Department of Clinical Sciences awarded House Officer of the Month to Clarke for May 2012.

**Dr. Greg Lewbart** received the William Medway Award for Excellence in Teaching at the 43rd Annual Meeting of the International Association for Aquatic Animal Medicine (IAAAM), held in Atlanta, Georgia, May 2012. This award is presented to an individual who has made a significant impact on teaching aquatic sciences within the past ten years.

Congratulations to **Heather Broadhurst**, and husband Steve, as they welcomed baby Hannah Mae on April 6. Hannah was 8 lbs and 3.5 oz and 21 inches long. Heather is a Research Technician with the Department of Clinical Sciences, College of Veterinary Medicine at CMAST.

**Samantha Binion** joined Dr. Buckel's lab in Ph.D. studies on diets of multiple types of predator fish and working on creating a food web model. She also received 3rd Place in the Best Poster Award at the Tidewater Chapter of the American Fisheries Society Meeting in March 2012. Her poster title was "Development of models to predict estuarine fish counts in Pamlico Sound, North Carolina."

**Robert Dunn**, masters student in Dr. Eggleston's lab, received Honorable Mention in Best AFS Student Oral Presentation at the recent Restoration 2012: Beyond Borders Conference in Victoria, BC. His talk was titled "Impacts of reef substrate material on Eastern oyster demographic rates and Cliona boring sponge growth across a salinity gradient." Dunn also has received a graduate fellowship from the National Science Foundation, as well as a scholarship award from the Coastal Conservation Association North Carolina (CCA). He will be presenting information on his thesis research at an upcoming CCA meeting.

**Ashlee Lillis**, doctoral student in Dr. Eggleston's lab, received several awards recently: Best Graduate Student Poster Award at the Tidewater Chapter of the American Fisheries Society Meeting, March 2012; Best Graduate Student Poster Award from the Southeastern Estuarine Research Society, April 2012; and, the Doctoral Dissertation Improvement Award from National Science Founda-

tion for a project entitled "Underwater soundscapes and their potential role in the larval settlement of estuarine benthic invertebrates."

**Jim Morley**, doctoral student in Dr. Buckel's lab, received 3rd Place Oral Paper Award at the American Fisheries Society Tidewater Chapter Annual Meeting in March 2012, titled "The relative contribution of spring- and summer-spawned bluefish to the adult population and the influence of size-selective winter mortality."

**Paul Rudershausen**, research assistant in Dr. Buckel's lab, has completed a multi-year project on the effects of circle hooks and j-hooks on mahi-mahi, yellowfin tuna and wahoo. The project was done in collaboration with NC State Department of Biology, NOAA and NC Division of Marine Fisheries. An interview and study results were publicized online at [www.sciencedaily.com](http://www.sciencedaily.com) in March 2012 and mentioned in *Sport Fishing* magazine in June 2012.

## Where are they now?

### Previous CVM Residents:

**Beth Chittick Nolan**, 2004, is Veterinarian at Disney's Animal Kingdom and Living Seas, Orlando, FL. She was the first zoological medicine resident at CMAST.

**Robert MacLean**, 2006, is now Senior Veterinarian at the Audubon Zoo, part of the Audubon Nature Institute in New Orleans, LA. He was instrumental in Audubon's sea turtle rehabilitation efforts following the Deepwater Horizon oil spill.

**Betsy Stringer**, the most recent veterinary medicine resident to complete the program, has accepted a position as a veterinarian at the Denver Zoo in Colorado.

**Allison Tuttle**, 2007, is Head Veterinarian at the Mystic Aquarium in Connecticut.

**Kelly Britt**, a former summer scholar at CMAST during her DVM studies, has taken a position as an associate veterinarian at Eastern Shore Animal Hospital in Grandy, NC.

### Previous Graduate Students:

**Eric Johnson** (PhD '04, MEAS) is an Associate Professor at University of North Florida, Jacksonville, FL.

**Ryan Rindone** (MS '10, MEAS) is a Coordinator/Fishery Biologist for the Gulf of Mexico Fishery Management Council's SEDAR (SouthEast Data, Assessment, and Review) Program, based in Tampa, FL.

## CMAST Research continued from page 9

transmission from feral pigs to domestic pigs, and possible disease transmission to humans," stated Kennedy-Stoskopf. According to the USDA, feral pigs are known to carry or transmit over 30 diseases and parasites that can be transmitted to livestock, people, pets, and wildlife.

Dr. Kennedy-Stoskopf recently collaborated on a study that found feral pigs in NC have tested positive for *Brucella suis*, a harmful bacteria that can be transmitted to humans. She stated that "testing positive for antibodies to *B. suis* means the feral pigs have been exposed to and

mounted an immune response against the bacteria. Antibodies do not eliminate *B. suis* from pigs, so the animals are considered infected and capable of transmitting the bacteria to other pigs and people." She added that control and eradication programs introduced in the late 1990s eliminated swine brucellosis from all commercial pig populations in the United States and that *B. suis* can be transmitted among pig populations when they ingest infected tissue or fluids. Direct contact with infected pigs or ingestion of contaminated food and water could cause currently uninfected pig populations to become infected.

"Spillover from infected feral pigs to commercial pigs is an economic and a public-health concern," Dr. Kennedy-Stoskopf says. "The biggest public-health risk is to pork processors and hunters who field dress feral pigs. Although cases of brucellosis are rare in the United States, people need to understand the clinical signs – such as intermittent fevers and persistent headaches – and go to the doctor for diagnosis and treatment if they have these flu-like symptoms. As clinical signs are so non-specific, it is important to tell your physician if you have had any exposure to feral swine carcasses and meat."



## Building repairs from Hurricane Irene complete

Repairs at CMAST, needed as a result of Hurricane Irene in August 2011, were completed during Spring '12. Crews worked on the building from February to May and completed interior painting, exterior window sealants, windowsill replacements, and spray waterproofing of the entire brick exterior to make the building ready before the upcoming hurricane season.

*Repairs in progress at CMAST. Left: Workers in cherry pickers caulk and seal all windowsills. Right: Windows were masked on the entire structure before waterproof spraying could begin.*

## CMAST partners on rural broadband initiative

In July 2012, CMAST began serving as a broadband Point-of-Presence (PoP) for a Broadband Technology Opportunities Program (BTOP) led by the Microelectronics Center of North Carolina (MCNC) and North Carolina Research and Education Network (NCREN). The BTOP is part of a federal and state coordinated strategy to improve broadband access for businesses and residents in underserved areas. The MCNC and NCREN partnership currently provides Intranet and Internet access for nearly all of the state's K-12 education institutions. The BTOP includes 480 miles of new fiber-optic cable throughout the western and southeastern parts of North Carolina that will help ensure that K-12 schools, universities, community colleges, university hospitals and other community anchor institutions (libraries, public health) have access to unlimited amounts of bandwidth now and into the future.

By serving as a PoP, CMAST provides "downstream" broadband access to customers in Carteret County such as Carteret Community College, NOAA Beaufort, UNC Chapel Hill Institute of Marine Sciences, and Duke University

Marine Laboratory, among others. A key benefit to CMAST serving as a PoP is that annual broadband fees have dropped to \$0.

## Marine biotechnology center hires first executive

A CEO has been hired for the Marine Biotechnology Center of Innovation (MBCOI). Dr. Deborah Mosca began her new role in March 2012. The purpose of the center is to foster commercial development and jobs based on North Carolina's marine life. The MBCOI was funded by a four-year grant from NCBC in 2011. The NC Biotechnology Center is working with regional economic development groups for North Carolina's Eastern and Southeastern regions as well as representatives from CMAST, UNC Wilmington and MARBIONC, UNC Chapel Hill Institute of Marine Sciences, and Duke Marine Lab on the development of the MBCOI.

## Marine mammal strandings

From January through May of 2012, there were 13 reported strandings along central coastal North Carolina reported by Vicky Thayer,

Marine Mammal Stranding Coordinator.

Three incidents in January included a young minke whale stranded on South Core Banks; two bottlenose dolphins, one in the Pamlico River and the other on North Core Banks. In February, one stranding was reported of a juvenile male bottlenose dolphin on the Neuse River.

March brought three marine mammal strandings plus one humpback whale entanglement. The three strandings included a juvenile harbor porpoise on South Core Banks; a mature female bottlenose dolphin on North Core Banks; and a young female bottlenose dolphin at Fort Macon State Park. The whale was entangled in a net approximately two miles off Cape Hatteras. A NMFS observer was nearby and reported the entanglement. The captain and crew were successful in removing most of the gear and the whale was able to swim away.

In April there were four bottlenose dolphin strandings in total. One of these animals was a fetus, and the other three were newborns.

Three more strandings occurred in May. The first was a female bottlenose dolphin stranded at Ocracoke Island. The second was a live Risso's dolphin stranded at Nags Head. The last animal was a bottlenose dolphin that stranded at South Core Banks.

## CMAST Summer Fellows Program

CMAST enthusiastically supports undergraduate research. The annual CMAST Summer Fellows Program provides students with opportunities to design projects and gain rewarding research experiences. Students are mentored by a faculty advisor who matches their interests. During the ten-week program, coordinated by Dr. Patricia McClellan-Green at CMAST, each student identifies an independent study project addressing a current issue affecting coastal ecosystems and communities; participates in research design, implementation, and effective presentation of research results; and gains an understanding for the logistical challenges, ethical issues, and positive rewards surrounding environmental research.

In 2012, there were three participants in the program. Lydia Neal, a senior at UNC CH, is majoring in Biology with a minor in Marine Science. Her project with Dr. Dave Eggleston, MEAS, was on "Oyster Spat Settlement in Pamlico Sound." Lindsay Barnes is a rising sophomore at NC State studying Chemical Engineering. She worked with Dr. Jeff Buckel, Biology, and doctoral student Paul Ruderhausen on "Comparison of benthic macro in fauna among tidal creeks in Carteret County, NC." Erin McCarthy is a junior at UNC Wilmington and is studying Marine



Top: 2012 CMAST Summer Fellows l to r: Lydia Neal, Lindsay Barnes, Erin McCarthy. Inset: Sasha Doss, REU program.

Biology. Erin worked with Dr. Patricia McClellan-Green, Toxicology, on "Detection of CYP4501A1 in Loggerhead Sea Turtle Hatchlings."

Another student, Sasha Doss was also working in the Toxicology lab. She is a student at Washington and Lee University in Virginia and was taking part in the Research Experiences for Undergraduates (REU) through Duke University.

## 2012 Marine Science Summer Field Course held at CMAST

Fourteen students from the Department of Marine, Earth and Atmospheric Sciences (MEAS) descended on CMAST during May/June 2012 to take part in an annual summer field course (MEA459 "Field Investigations of Coastal Processes") coordinated by Dr. Dave DeMaster, Professor of Marine Science, MEAS. Students spent three weeks immersed in an intensive series of hands-on field experiences, with opportunities for data analyses and interpretation, and group presentations. The annual course emphasized the multi-disciplinary nature of coastal processes, and allowed students to collect data using a variety of approaches in physical, chemical, biological and geological oceanography through the assistance of faculty from MEAS, including Drs. Del Bohnenstiehl, Paul Lui, Chris Osburn and Bill Showers. Study systems included: tidal-freshwater coastal wetlands, estuaries, barrier islands, tidal inlets, continental shelves and shelf-margin habitats. Complementing the time spent in the field, students also utilized the CMAST laboratories to work up scientific data from coastal samples.



Top left: Behind the CMAST facility, Dr. Jeff Buckel describes seining techniques used to understand coastal fisheries ecology. Top right: Aboard R/V/ Humphries, Dr. Chris Osburn and students prepare the ADCP (Acoustic Doppler Current Profiler) for deployment in the Neuse River Estuary. Bottom left: Entire MEA 459 class and Adeline Brym (TA) aboard the R/V Susan B. Hudson just inside Lookout Bight. Bottom right: Graduate Student Robert Dunn describing salt marsh ecology to students. (photos Dave DeMaster)

### Skeleton Crew Fundraiser



Help CMAST's educational outreach mission by reconstructing the skeleton of a Bottlenose Dolphin planned for display in the two-story lobby of the CMAST building. You can help by joining our "Skeleton Crew" and sponsor a bone!

Visit [www.skeleton-crew.org](http://www.skeleton-crew.org) for information.

### Sustainable Fisheries License Plate



Support CMAST student research by purchasing a Sustainable Fisheries License Plate. Your support will allow continued research and conservation of recreational and commercially important fisheries, support undergraduate and graduate student training and provide educational outreach to help keep North Carolina waters full for generations to come. To preorder a specialty plate contact CMAST at 252-222-6302 for an application or visit [www.cmast.ncsu.edu](http://www.cmast.ncsu.edu) for details.