NC STATE UNIVERSITY

Discovering Coastal Solutions

# cmastcommunicator

**APRIL • 2011**

### Science Café
Monday, May 9, 2011 • 6-8 pm
McCurdy's Restaurant
Atlantic Beach
***Antarctic Whale Research***
Dr. Ari Friedlaender
Nicholas School of the Environment, Duke University Marine Laboratory

### CMAST Seminars
Friday, April 8, 2011 • 11 am
CMAST Room 205
***Design and assessment of marine reserves: theory and practice***
Dr. Will White, UNC Wilmington

### CMAST Summer Fellows
Applications are being accepted for the summer program. p.10

### Skeleton Crew Fundraiser
Bottlenose Dolphin Skeleton Rearticulation Project. p.10

# CMAST Commemorates Ten-Year Mark

Over 100 people filled the lobby of the CMAST building in Morehead City on Friday, October 15, 2010 to celebrate a decade of successes for the NC State University facility. The evening included a reception, facility tours, displays of current research and a speaking program featuring NC State Chancellor Randy Woodson among other guests.

Dr. David Eggleston, CMAST Director, began the program with a brief history of the center. "CMAST is a great example of how people can come together with a common vision, and apply their creativity and energy to make something of significance happen," Eggleston said. "Our goals for this anniversary reception are to look back and recognize the institutions and individuals that turned CMAST from a vision to a reality, take stock of our accomplishments over the past ten years, and set a course for the future," he added.

The original partners and planners of the center were recognized including NC State University, Carteret Community College, Carteret County Cooperative Extension, North Carolina Sea Grant, General Assembly of North Carolina, UNC–CH Institute of Marine Sciences, Duke University Marine Laboratory, Town of Morehead City, Carteret County Board of Commissioners, Carteret County Economic Development Council, and NC Division of Marine Fisheries. A plaque acknowledging these institutions was presented for permanent display at CMAST.

Eggleston spoke about CMASTs accomplishments over the past ten years, particularly research, extension, and partnerships. "In the past decade we have trained over 50 graduate students, taught 539 undergraduates in 2009, primarily via distance education, and have one of the top aquatic veterinary medicine residency programs in the nation," he said.

"Hundreds of community college students utilize this facility every week, and monthly activities engage a large and growing number of K-12 students and teachers. Economic impacts include providing clinical support for the NC Aquarium System, generating technology that creates new businesses, establishing a marine aquaculture research center, branding and marketing programs for local seafood and produce, and conducting research that directly benefits management plans for fisheries, marine habitats, and seafood safety," Eggleston stated. "We will continue to build on what works, create a CMAST

*continued on page 2*

## From the Director

Having a great idea or vision is only a small part of the process—creative people who come together and turn vision into reality is how things often get accomplished, and can be one of the most rewarding experiences of one's career. In the late 1990s, community leaders from Carteret County teamed with faculty and administrators from NC State University and, with the help of local elected officials, turned CMAST from a vision into a reality in 2000. In this issue of the CMAST Communicator, we feature our recent ten-year anniversary celebration of CMAST and present a "Top Ten Over Ten" list of accomplishments and successes that have made CMAST the respected marine science facility that it is today. We also look at the future of CMAST and plans for the next decade – discovering solutions for the ever increasing, complex environmental and economic issues involving coastal ecosystems and communities.

While we look back over the past decade, we also look back at the past year, detailing the varied research conducted by CMAST faculty and graduate students. Oysters were high on the list of research topics at CMAST - from studies on the effects from the recent Gulf of Mexico oil spill and dispersants used in the clean up, to underwater sounds affecting the settlement of oyster larvae in Pamlico Sound, to the ecological role of recently established stone crabs on oyster reefs. Additionally, tag-recapture studies of finfish such as spot and seatrout are providing key data for fishery management plans in NC.

Read also about an example of one of our training partnerships with the NOAA Beaufort laboratory in which Rance Hardison, oceanographer at NOAA and Biology Ph.D. student at NC State, is investigating the toxicity of red tides on mammals and fish. Lastly, we feature research being conducted by our CMAST Visiting Scholar, Dr. Becky Bartel, who is using CMAST facilities to further her work on butterfly migration and links to infectious disease dynamics.

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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**PHOTO CREDITS AND CAPTIONS: p.1:** *top,* CMAST Building, photo by Brandon Puckett; *bottom:* NCSU Chancellor Randy Woodson speaks at anniversary reception, photo by Carol Davis; **p.2:** Anniversary reception audience, photo by Carol Davis; **p.3:** *left:* Blue crab, photo by Kelly O'Neal, *right*, CMAST students filtering samples; **p.4:** Fish illustrations (bluefish, spotted seatrout, spot), Dwayne Raver; *bottom,* Passive samplers and oysters being exposed to tar balls collected from the Gulf area, photo by Kelly O'Neal; **5:** *left,* Greg Bolton with yellowfin tuna, photo by Tyler Averett; *center,* Oyster larvae; *right,* Oyster Reef; **p.6:** Fish illustration (sheepshead), Dwayne Raver; Stone crab; *center,* Oyster shell shows damage from boring sponges; *top right,* Oysters attached to limestone rip rap; *bottom right,* Loggerhead sea turtle receives treatment for injuries; *inset,* Sea nettles, photo by Erin Baxter; **p.7:** *top left,* Greg Bolton speaks to Marine Science Academy students, photo by Jill Miller; *center,* Young sea turtle rehabilitated after oil spill; *bottom left*, Dr. Craig Harms speaks to Marine Science Academy students at dolphin necropsy, photo by Jill Miller; *bottom center,* Chefs prepare seafood at 'Cooking with the Chefs' tent at NC Seafood Festival, photo by NC Seafood Festival; *right,* Paul Rudershausen and Merrill Fox examine fish stomach contents at Big Rock Tournament; **p.8:** *left,* Monarch butterflies*; right,* Dr. Rebecca Bartel searches for migrating monarchs at CMAST, photos by Jaap De Roode; **p.9:** *top,* Teachers from COSEE brainstorm a group project; *middle*: Teachers use a microscope to identify plankton, photos by Jill Miller; *bottom,* Students calculate fish and crab densities; **p.10:** Humpback whale stranded in Core Sound, photo by Vicky Thayer.

*Anniversary continued from p.1*

Visiting Scholars Program, expand and diversify educational opportunities, better integrate NC State University Engineering programs, and expand our biotechnology capabilities."

A reception, facility tours, displays of current research and a speaking program rounded out the celebration. Guest speakers included Dr. Dan Solomon, Dean, NCSU College of Physical and Mathematical Sciences; Dr. Johnny Wynne, Dean, NCSU College of Agriculture and Life Sciences; Dr. Kerry Youngblood, President, Carteret Community College; NC Senator Jean Preston; and Dr. Randy Woodson, Chancellor, NC State University. Chancellor Woodson remarked, "Solutions can be found at the marine science level. I am committed to continuing our presence in this part of North Carolina." CMAST was also recognized that night with a proclamation from the Morehead City Council, presented by Mayor Jerry Jones.

### Partnerships Are Key

CMAST is an excellent example of successful, cost-effective and productive partnerships. The physical CMAST building, facilities, internet-technology, and housekeeping/maintenance are shared between NCSU, Carteret Community College, NC Sea Grant, and NC Cooperative Extension, and there is also shared space with the NOAA/Beaufort Laboratory. CMAST provides office and laboratory space to faculty, students and staff from three NCSU colleges and six departments. CMAST became a founding member of the Marine Science and Education Partnership (MSEP), which provides a vehicle for effective communication, strategic planning and efficient implementation of programs for business development, research, education and outreach among various marine science and education programs in Carteret County and the UNC-system. Additionally, partnerships with industry, federal and state agencies (e.g. NOAA and NC Division of Marine Fisheries) support student training and research at CMAST.

### The Top Ten Over Ten

Our ten-year anniversary provided an opportunity to look back on accomplishments and to formulate future goals as well. Below, a "Top Ten" list of achievements over the past ten years reveals the successes and support of two underlying missions: (1) Provide Educational Opportunities and be a Focal Point for Citizen Contact; and (2) Discover Coastal Solutions.

### Provide Educational Opportunities and be a Focal Point for Citizen Contact

#### NC State University

1. Graduate Training: 53 graduate students and Vet Med residents met graduation requirements in 10 years; built one of the top aquatic vet medicine programs in country.
2. Undergraduate Students: Increased number of students served via Field Courses based at CMAST and through distance learning, from 43 in 2006 to over 539 in 2009.
3. Education: Supported K-12 and teacher training.
4. Industry Training: Over 1,000 NC seafood industry personnel trained in FDA seafood safety.
5. Citizen Contact: Assisted commercial and recreational fishermen seeking advice on proposed fisheries management; helped entrepreneurs seeking to apply university knowledge and technology; popular and consistent source of information for general public.

#### Carteret Community College

6. One of the best community colleges in NC - hundreds of students passed through CMAST each week for classes; CMAST

provided hands-on experiences in marine sciences for CCC students.

### NC Sea Grant

7. Provided education and extension programs to hundreds of people each year, as well as research funding to academia and fishermen.

### NC Cooperative Extension

8. Volunteers donated time in excess of $250K per year in support of the Master Gardeners program, senior health and insurance information, and 4H, among others.
9. Increased initiation of breastfeeding from 30 to 80% in Carteret County.
10. Established wellness program for county employees; assisted hundreds of senior citizens each year with Medicare questions and issues.

## Discovering Coastal Solutions

### From an economic perspective…

1. Aquatic Vet Med program provided clinical support for the entire NC Aquarium System, one of the leading economic drivers of tourism in NC, while building a strong international reputation.
2. Seafood Technology lab partnered with industry to increase profitability of small bay scallops, by combining with natural protein which formed larger, and more lucrative, scallops marketed as "scallop medallions."
3. Marine Ecology Program partnered with University of Maryland to culture blue crabs in hatchery, and with funding from NC Sea Grant, pioneered raising blue crabs in freshwater to help rebuild a dwindling blue crab industry and help diversify family farm incomes.
4. NC Sea Grant developed seafood branding and marketing campaign "Carteret Catch" as a means to promote locally-caught seafood and help sustain local seafood industries.
5. Marine Aquaculture Research Center established in Carteret County on privately donated land, with assistance from the College of Agriculture and Life Sciences Foundation, and engineered environmentally sustainable, closed system aquaculture technology.
6. Carteret Community College's Aquaculture Technology Program extended aquaculture knowledge and technology to hundreds of students, many of who have created businesses and contributing to local economy.

### From the perspective of basic and applied research...

7. Research conducted in support of and direct involvement in establishing Fishery Management Plans for many of NCs most important commercial species.
8. Participated in some of the largest ecological restoration projects in the US: wetlands in N. River Farms; oysters in Pamlico Sound; and shorelines that can migrate with sea level rise, including the waterfront at the CMAST facility.
9. Marine Mammal Stranding Program responded to marine mammals found along shorelines, monitored stranding and mortality rates, collected and disseminated tissue samples and conducted investigations on causes of death.
10. Helped with national disasters, such as the BP Horizon Oil Spill, where members of CMASTs Vet Med Program along with colleagues from the NCSU CVM main campus provided support for oiled birds and sea turtles, and gained valuable knowledge such as the opportunity to perform blood transfusions from healthy to injured turtles as a means of rehabilitation.

The success and accomplishment list is long and continues to grow, but would not be possible without these partnerships and collaborations that exist at CMAST.

## What's on the horizon for the center for the next decade?

The coming decade should prove to be an exciting time for CMAST. As environmental issues and economic opportunities in the coastal zone become more complex, CMAST will be utilized as a vehicle by NC State University to address these issues and opportunities.

### Build on what works.

Build on the partnerships and programs that have been successful so far by supporting core strengths. Keep focused on those collaborations that have served so well during the first 10 years.

### Expand and diversify educational opportunities.

Support an informed citizenry as coastal issues become more complex. Add a Marine Science Educator based at CMAST to help support K-12 education, teacher training, and semester-at-the-coast programs for undergraduates.

### Enhance the experience for and the success of NCSU Undergraduates.

Use CMAST as a tool to provide a high impact educational experience via a CMAST Semester-at-the-Coast Program and Living/Learning Environment in Coastal Sustainability.

### Integrate NCSU Engineering.

Increase the use of CMAST as an educational tool by building "green" housing for visiting faculty, staff and students, which would also serve as an example of sustainable living utilizing NCSU Engineering department strengths in:

- Sea level rise and hurricanes
- Buffers and shoreline stabilization
- Ecological restoration
- Stormwater technologies/LID
- Alternative energy

### Enhanced applications for marine biotechnology.

Complete a Magnetic Resonance Imaging system that allows for more in-depth study of marine life by scientists. Participate in the development of a Center of Innovation in Marine Biotechnology supported by the NC Biotechnology Center.

### Deep-sea exploration.

Take part in research programs that will enhance understanding of the ocean floor such as:

- Cooperative Institute in Ocean Exploration and Research
- National Science Foundation-funded study on Deep Sea Hydrocarbon Seep Communities

Additional objectives will be added to this list in the years to come as natural resource issues of the planet ebb and flow, as complex problems of the natural world need solutions, and discoveries continue to shape the future. There's much to look forward to in the next ten years and beyond as the CMAST partners and collaborators continue to Discover Coastal Solutions.

# Research 2010: Out and About

*CMAST is home to NCSU professors and students working on a variety of projects involving marine science and other disciplines. Research ebbs and flows and continues year-round, in all types of climate and weather conditions. Take a look back at just a sampling of work over the past year.*

## College of Agriculture and Life Sciences

### Marine and Estuarine Fisheries Ecology, Department of Biology

*Dr. Jeff Buckel, Associate Professor*

The Marine and Estuarine Fisheries Ecology group took part not only in research but in fisheries management activities as well. **Dr. Jeff Buckel** attended the South Atlantic Fisheries Management Council Science and Statistical Committee's August 2010 meeting to set Allowable Biological Catch levels; served on the NC Marine Fisheries Commission Striped Bass Advisory committee advising on the Fishery Management Plan for the Roanoke River/Albemarle Sound striped bass stock; and worked with the NC Marine Fisheries Commission's Strategic Habitat area advisory committee charged with identification of strategic habitat areas in the Pamlico Sound region.

In addition, Buckel participated in writing the article "Contemporary issues and emerging concepts of predator-prey interactions in marine ecosystems," the outcome of an international workshop held at Oregon State University. Theoretical and empirical ecologists along with fisheries biologists were brought together to discuss current issues and emerging concepts of predator-prey interactions in marine ecosystems.

Understanding natural and fishing sources of morality is critical to estimating the health of fisheries populations. **Jim Morley** conducted a series of experimental predation trials with bluefish at the CMAST wet lab to support his research "The influence of temperature and prey size on predator-prey interactions using bluefish and bay anchovy." Specimens were netted during the summer from nearby sounds. Trials were conducted using either a large or small size class of bay anchovy prey, at different temperatures, and were video taped using synchronized camcorders, one positioned above the tank and the other in the front of the tank. Using grids and two camera angles, Morley was able to determine the position of predators and prey in three dimensions during feeding trials. This unique method allowed him to measure many aspects of predator-prey encounters, including attack speed of bluefish and the reaction distance of anchovy and any temperature or prey size effects.

**Tim Ellis** continued intensive computer work, analyzing fall, winter and spring tagging and telemetry data collected from tagged spotted seatrout in the New River and Cape Fear River. Ellis' research is aimed at gaining a better understanding of the movement and mortality of spotted seatrout in NC. His goals are to obtain regional estimates of fishing mortality, determine the significance of overwinter natural mortality, and identify stock boundaries for the species.

**Sarah Friedl,** who recently defended her thesis in Zoology, focused her work on mortality rates of juvenile spot. Sonic telemetry was used to locate these fish in two North Carolina creeks in the coastal area. Seventy-five juvenile (age one) fish were tagged and tracked for two field seasons. Her final fieldwork was conducted between March and August 2010, tagging the fish before they migrated to the ocean as adults after two years inland. The scope of her project was to determine how are spot were utilizing nursery areas and observing the mortality rates, the results of which may have implications on stock assessment and management of the species.

**Jen Weaver**, Marine Fisheries Fellow, has been working closely with the NC Division of Marine Fisheries (DMF) to identify and designate Strategic Habitat Areas (SHAs) in Pamlico Sound. As part of this work, she has used DMFs trawl survey data to analyze patterns in fish abundance in Pamlico Sound and incorporate the results into several conservation planning scenarios generated using MARXAN computer software. In addition, she generated maps and other output to present scenario results alongside additional sources of data to members of the SHA advisory committee.

**Paul Rudershausen**, Research Technician, continued his investigations into comparing the effectiveness of circle vs. J hooks in the offshore troll fishery for dolphinfish, wahoo, and yellowfin tuna. He also spent the summer finishing analysis of black sea bass mark-recapture data to estimate discard mortality rates of not only this species but other reef species in waters off NC. Paul also began a study using PIT tags to estimate natural mortality rates of estuarine-dependent fish species, using tidal creeks in Carteret County as study sites for this multi-year project. He conducts the bulk of his research during the summer months as winter temperatures and weather patterns make time in the field limited. Additionally, summer is the height of the season for black sea bass harvesting, which allowed him to tag a larger number of fish.

### Department of Environmental and Molecular Toxicology

*Dr. Damian Shea, Professor and Department Head*

Scientists continued to study the effects of the massive oil spill in the Gulf of Mexico last year, the largest offshore oil spill in US history. One of the many ecological and human health issues associated with the spill is the potential for exposure to and accumulation of polycyclic aromatic hydrocarbons (PAH) and other oil components in the food chain and how the use of dispersants may have influenced the bioavailability of PAHs.

Bioavailability is a measure of how much of the total PAH in the water is actually available to be taken up by biological organisms. PAH in fresh crude oil is much higher than in heavily weathered oil, but accurate risk assessments require a quantitative understanding of this change.

**Dr. Damian Shea**, research technician **Pete Lazaro**, and graduate student **Kelly O'Neal** used CMASTs seawater laboratory to investigate the bioavailability of PAH in fresh and weathered crude oil to zooplankton, bivalves, crustaceans, and fish. They also tested the ability of passive sampling devices (PSDs) and standard water sampling to predict PAH bioavailability. PSDs, made from absorbent polymers, can accumulate PAHs and other chemicals in a manner similar to aquatic organisms and are just one of the monitoring techniques used in the research work on the oil spill. Results are anticipated to provide a basis for determining the bioavailability of PAH as a function of weathering and the appropriateness and potential pitfalls of various sampling technologies used to estimate PAH exposure and bioavailability following the oil spill.


## Seafood Laboratory, Department of Food, Bioprocessing and Nutrition Sciences

*Dr. David Green, Professor and Director*

Two projects came to a close in 2010 at the Seafood Laboratory: improving the quality and traceability of farm-raised hybrid striped bass; and reducing risks associated with chilling large blue fin tuna.

Several refereed and non-refereed articles were published based on the graduate work of Dr. Kristin Bjornsdottir-Butler which was completed in 2009. Her work focused on the development of molecular techniques to identify spoilage bacteria responsible for histamine formation in scombroid fish.

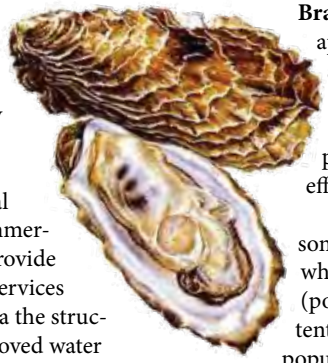
New projects were also started: the validation of the heat-shock method as used by NC oyster processors as a post-harvest treatment method for Gulf oysters; and a validation study of consumer instructions on microwave cook-in-place packaging of fresh and frozen seafood.

# College of Physical and Mathematical Sciences

## Marine Ecology and Conservation, Dept. of Marine Earth and Atmospheric Sciences

*Dr. David Eggleston, Professor*

Much of the focus of **Dr. David Eggleston's** research programs were on assessing the success of a large-scale oyster restoration effort in Pamlico Sound, conducted by NC Division of Marine Fisheries and NC Coastal Federation, and the role that oyster reefs play in the ecology of Pamlico Sound.

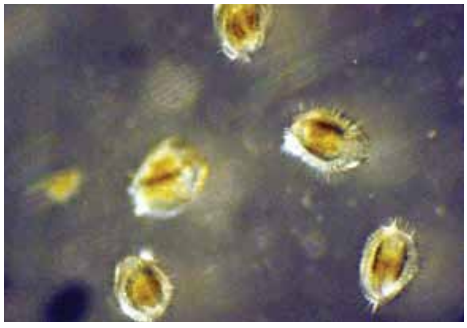


Oyster reefs are currently at less than 10% of their historical abundance. In addition to commercial importance, oyster reefs provide key ecosystem functions and services such as essential fish habitat via the structural complexity of reefs; improved water quality via their filtration capabilities; and, important nutrient cycling that helps reduce the deleterious effects of over-fertilization of coastal waters. The loss of oysters combined with these key ecosystem functions and services has fueled efforts worldwide to restore oyster reefs.

Related oyster research was conducted by graduate students in the Eggleston lab.

**Ashlee Lillis,** Ph.D. student, worked on a project dubbed "Sounds of the Sound." Snapping shrimp, fish grunting, whales singing, ship engines churning, and waves crashing all contribute to a diverse underwater soundscape. Studying a marine soundscape has potential to provide valuable sensory information on dispersing larvae, since acoustic signals are transmitted relatively large distances and reflect physical and biological characteristics of the environment. Conversely, other stimuli (e.g. light, chemicals) are rapidly attenuated from the source.

Ecological acoustics and soundscape orientation is a promising new field in need of exploratory studies to characterize ambient sound patterns at spatial scales relevant to larval settlers and to investigate larval responses to sound. Using oyster sanctuaries in Pamlico Sound, Lillis characterized the estuarine acoustic environment encountered by dispersing larvae, and examined the effects of underwater sound on larval behavior and settlement. An improved understanding of the relationship between the underwater sound field and subsequent larval settlement has important implications for bio-physical studies of larval connectivity and recruitment in marine systems, the potential adverse effects of noise pollution in the ocean, and the role of acoustics in the establishment of marine reserves.



**Brandon Puckett,** Ph.D. student, applied a combination of field measurements and computer models to help guide oyster restoration efforts in NC and, in doing so, provided a template for restoration efforts worldwide.

Animal and plant populations are sometimes able to persist in habitats where they suffer high mortality (population "sinks") due to consistent replenishment from "source" populations. When faced with the need to prioritize areas for conservation or restoration, identification of source habitats is crucial to success. Marine reserves that are closed to fishing are a powerful management tool for protecting or re-building populations, especially if they are established as a network connected by larval dispersal and in "source" habitats.

Puckett's research over the past year identified oyster population "sources" and "sinks;" determined whether the current network of reserves in Pamlico Sound are sufficient in number, size, and spatial configuration to ensure that they will persist in time; and, designed the optimal combination of number, size, and location of additional oyster reserves, thereby guiding allocation of funding and resources for oyster restoration in NC.

**Katie Pierson,** M.S. student, quantified the abundance and diversity of estuarine fish inhabiting oyster reefs and nearby estuarine bottoms without reefs. She examined the stomach contents of fish, such as sheepshead, to better identify the food web connection between

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oyster reefs and unstructured estuarine bottom, thereby contributing to the knowledge of the ecosystem functions and services that oyster reefs provide for fish. Oyster reefs provide plenty of niches not only for invertebrates such as crabs and other bivalves like mussels, but for fish as well.

**Ryan Rindone**, M.S. student, was studying the increase in stone crab populations in North Carolina. Stone crabs are known for their delicious claws, and are commonly fished in tropical and subtropical areas such as Florida. During scuba dives to assess oyster reefs in Pamlico Sound, CMAST divers started to notice more and more stone crabs inhabiting what was considered the sole domain of blue and mud crabs. Rindone found that previously non-indigenous stone crabs were reproducing and well-established in Pamlico Sound at densities that rivaled those found in Florida.

Moreover, stone crabs are voracious predators on oysters compared to the blue and mud crabs, and are also capable of snapping an adult blue crab in half with their powerful claws. It was questioned, would this increase in stone crabs be a significant threat to the oyster and blue crab population in North Carolina? Rindone determined in laboratory experiments that due to their relatively high densities on oyster reefs, small endemic mud crabs, not the stone crab, were an oyster's biggest enemy.

Many oyster restoration programs use limestone "rip-rap" piled on the bottom of a sound to create oyster reefs and serves as a settlement substrate for oyster larvae and other members of the "fouling community." Preliminary data from Eggleston's oyster research program in Pamlico Sound suggests that in the highest salinity areas, relatively small boring sponges, which settle and grow on oyster shells and rip-rap, may be compromising the strength of the "armor" that oyster shells provide against crab predators, as well as the structural integrity of the rip-rap itself.

M.S. student **Robert Dunn** tested the feasibility of using other substrates for oyster restoration, such as concrete and granite, on oyster settlement, growth and survival along a salinity gradient in the Newport and North Rivers, NC. The information from this study will increase knowledge of how the oyster fouling community influences the formation and persistence of oyster reefs through time, as well as oyster settlement, growth and survival.

## College of Veterinary Medicine

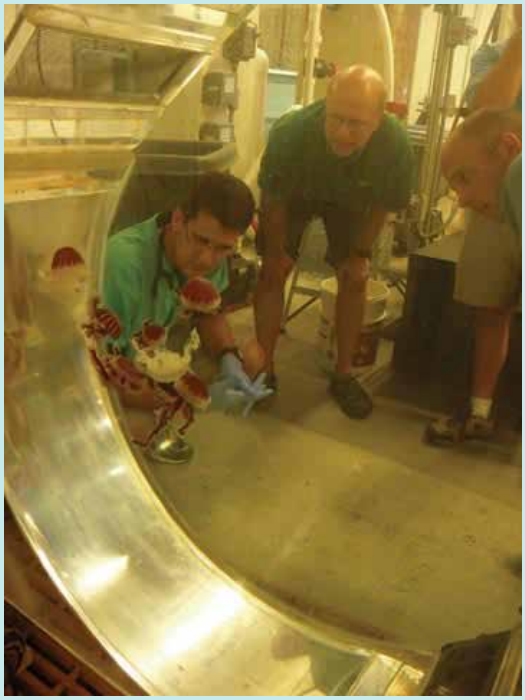
### Department of Clinical Sciences

*Dr. Craig Harms, Associate Professor*

At the end of summer 2010, an annual two-week sea turtle rotation for veterinary students, directed by Dr. Harms, was held at the Karen Beasley Sea Turtle Rescue and Rehabilitation Center in Topsail Beach. In this setting, future veterinarians received hands-on experience working with marine animals. The group assisted with the release of five rehabilitated Kemp's Ridley turtles, the most endangered turtle species in the world, making a unique experience for the students.

## All Creatures Great and Small…

CMASTs Veterinary Medicine Resident Eric Anderson, left, Dr. Craig Harms, Resident Faculty, center, and first year Veterinary Medicine Resident J.B. Minter, right, evaluate the health of Atlantic sea nettles (jellyfish) kept at the NC Aquarium at Fort Fisher. The Aquatic Animal Vet Med program provides care for animals at all three NC aquariums.



## CMAST Veterinarian Aids Turtles in Oil Spill

In May 2010, Dr. Craig Harms, CMAST resident faculty and Associate Professor, College of Veterinary Medicine, responded to an emergency request from the National Oceanic and Atmospheric Administration to work with the Audubon Nature Institute and Gulf World Aquarium to assist in managing turtle rescue efforts following the BP oil spill. Harms and colleagues Dr. Greg Lewbart and veterinary technician Shane Christian, spent a total of three weeks in Louisiana and Florida working with green, loggerhead, hawksbill, and the endangered Kemp's ridley sea turtles.

Harms estimated the team helped rehabilitate over 100 animals during the stay. He commented, "Although unfortunate, this incident afforded an opportunity to learn and has provided us with valuable experience should an oil spill ever affect the NC coast."

## Sea Grant Recognized for Outreach Programs

North Carolina Sea Grant's combined Local Catch efforts were recognized by the Sea Grant Association in October 2010 to represent the South Atlantic region for 'superior outreach programming.' The projects included research and varied outreach, including working with local seafood branding groups such as Carteret Catch, Brunswick Catch, Outer Banks Catch and Ocracoke Fresh.

Other outreach activities focusing on food quality and freshness include tools to support community-supported fisheries (CSF) and local entrepreneurs; consumer education posters, cards and Coastwatch stories; marketing workshops; and the Cooking with the Chefs program at the annual NC Seafood Festival. CMASTs Barry Nash and Brian Efland were part of the four NC Sea Grant team members that were honored.

## Tournament Provides Data for Research

Each year in the early part of June, Morehead City hosts the popular Big Rock Blue Marlin Tournament. Events such as this can greatly boost the local economy. But another benefit reaches beyond the businesses in town - to marine fisheries science and research.

In an agreement with tournament planners, researchers from the Marine and Estuarine Fisheries Program at CMAST establish a research station each year at the docks on the Morehead City waterfront, waiting for boats to arrive with catches of marlin, wahoo, yellowfin tuna or dolphin (mahi). Dolphin is the most common fish utilized by the researchers who analyze stomach contents for a current research study. Paul Rudershausen of Dr. Jeff Buckel's laboratory heads the research.

## Marine Mammal Strandings Report

Dr. Vicky Thayer, Marine Mammal Stranding Coordinator responded to 12 marine mammal stranding incidents during the summer. The count includes one sperm whale, eight bottlenose dolphins, and three dwarf sperm whales. The three dwarf sperm whales washed in dead at Buxton, NC and was considered a mass stranding, which is defined as a simultaneous stranding of two or more cetaceans of the same species, other than a female and her calf.

Responding to strandings requires a multi-institutional response: Assistance was contributed by NCSU CMASTs Dr. Craig Harms, Dr. Eric Anderson, Dr. Tres Smith, and Dail Bridges; NC Maritime Museum's Keith Rittmaster; UNCWs Bill McLellan and Steve Thornton, and volunteer Joshua Summers.

## Carteret County Marine Science Academy

For the second year in a row, students from the 2010 Brad Sneeden Marine Science Academy took part in activities at CMAST last June. Over 50 middle school students participated in the week-long camp sponsored by Carteret County Public Schools.

In the Seafood Laboratory Pilot Plant, students learned about seafood quality and safety. Greg Bolton of the lab showed different types of fish as well as prepared cooked samples of mahi to taste. Concurrently, Dr. David Green presented a lesson on sensory science – what it is, how and why it's used to assist not only food companies in product development, but also scientists researching how the human senses work and respond to stimuli.

Dr. Craig Harms of the College of Veterinary Medicine performed a necropsy on a bottlenose dolphin while the academy students observed. Dr. Eric Anderson, Dr. Vicky Thayer, and former Research Assistant Ray Mroch assisted with the procedure. The team quizzed students on their knowledge of anatomy, explained much about a dolphin's life and fielded a multitude of questions from the enthusiastic students and teachers alike.

In addition to the scheduled presentations, students were surprised with a viewing of the head and tail of a record-breaking blue marlin (863 lbs.) brought to CMAST that week during the Big Rock Blue Marlin Tournament held in Morehead City. CMAST had possession of the marlin for use in research projects.

## Grad Students Assist at Blue Heron Bowl

On February 26, 2011 six NCSU graduate students participated in the Blue Heron Bowl, a competition for high school students held at East Carolina University, part of the National Ocean Sciences Bowl. Katie Pierson of CMAST (M.S. at MEAS) was among the group.

Half of the volunteers had participated in past events and looked forward to another spirited competition, as they were familiar with the level of marine science knowledge that these high school students possess. The grad students were assigned to judging teams for Round Robin competitions.

# Butterfly Migration Provides Clues to Infectious Disease Dynamics

Every year the mass migration of monarch butterflies is a common occurrence in the US as they find their way to Mexico to breed. Dr. Rebecca Bartel, CMAST Visiting Scholar and NCSU Alumni, couldn't wait for their "fly-by" along the North Carolina coast, as this annual parade of flying insects provides her with more research data. Bartel has been following monarch butterflies around the world to find out if there is a link between infectious disease dynamics and animal migration.

Her work has drawn international attention. Two prestigious scientific journals, *Science* and *Ecology*, have published her research reports: *Animal Migration and Infectious Disease Risk, and Monarch Butterfly Migration,* and *Parasite Transmission in Eastern North America,* respectively, in the January and February 2011 editions.

Monarchs often travel along coastlines and peninsulas as part of their long-distance journey. Bartel chose the well-situated CMAST, along the shoreline of Bogue Sound in coastal NC, as a home for her research. This particular geographic area is located along a known migration route used by monarchs flying south towards overwintering grounds in central Mexico.

Collaborating with researchers at the University of Georgia, University of Minnesota, and Emory University, Bartel examines the effects of long-distance migration on host-parasite dynamics, using the host-pathogen system of monarch butterflies *(Danaus plexippus)* infected by a single-celled parasite, *Ophryocystis elektroscirrha.* "The monarch butterfly was chosen for this study because they display a variety of migratory behaviors - ranging from the long-distance migration they are known for in eastern North America (up to 5000 km round-trip) to the non-migratory populations in Hawai'i and the Caribbean Islands. This variety combined with their widespread distribution and abundance makes them ideal for studying the dynamics of migration and infectious disease," says Bartel.

Funded by a three-year postdoctoral fellowship from the National Institutes of Health, Bartel, advisor Sonia Altizer of UGA and others analyze parasite infections in monarchs on a continent-wide scale. Results from her work revealed within-season changes in prevalence, with similar patterns repeated over four years of field monitoring. She found that across the eastern North American breeding range, parasite prevalence was lowest at the start of the breeding season and peaked in late summer/early fall, just prior to the fall migration. This pattern

is consistent with the idea of migratory escape, suggesting the strategy of migrating to Mexico each year could result in butterflies leaving behind contaminated habitats and lowering overall infection levels.

Understanding the mechanisms by which migration can affect animals and their parasites is essential to predicting future threats of infectious diseases to wildlife health. In monarchs, threats to the population include deforestation of overwintering grounds, loss of critical habitat across the breeding range, and climate change. Collectively, these have caused the monarchs' annual migration to be considered a "threatened phenomenon." At the same time, local pockets of winter-breeding monarchs have appeared sporadically along the Gulf coast and the southern Atlantic coast in recent years. If the large eastern migratory population declines and year-round breeding monarchs expand, Bartel surmised, this could lead to greater disease prevalence and reductions in overall population health.

Her study is part of larger research efforts recently published in Science studying animal migrations that provide scientists data to better predict future threats of infectious diseases to humans and wildlife.

# Oceanographer Utilizes CMAST Facility to Study Red Tides

Rance Hardison, NOAA Oceanographer and NCSU Biology doctoral student, utilized CMAST facilities for researching his dissertation topic "The Environmental Factors that Influence Brevetoxin Concentrations in *Karenia brevis* Blooms." *Karenia brevis* is a dinoflagellate that blooms and forms red tides from the Gulf of Texas to the west coast of Florida continuing to the east coast of Florida all the way to North Carolina. These blooms produce a neurological toxin called brevetoxin that negatively affects the nervous system of all mammals and is responsible for fish kills, manatee deaths, respiratory distress of beach-goers as well as neurological shellfish poisoning (NSP). Currently many coastal management decisions are based on cell counts and not toxin concentrations.

The research is showing that toxin concentrations can vary as much as three-fold, proving that bloom conditions and toxin concentrations are far more important than the actual cell numbers. These results can better support decisions made on beach closures, swimming advisories, or shellfish closures.

Hardison is examining various environmental factors on blooms under laboratory conditions at CMAST to determine their role in regulating brevetoxin concentrations of *Karenia brevis*. Hardison remarked "CMAST plays a very important role in this research by providing the necessary facilities for state-of-the-art analysis instruments such as the LC/MS (liquid chromatography/mass spectrometry), which require a stable environment consisting of constant temperature, humidity, and electrical power. This instrument is one of only a few east of Raleigh, and the only one in the Beaufort-Morehead City area. We thank CMAST for their joint cooperation with NOAA in providing cutting edge marine research and hope this relationship continues to grow."

# cmastpublished

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# cmasteducation

## CMAST Hosts COSEE Leadership Institute

Over 25 educators from North Carolina, South Carolina and Georgia were hosted by CMAST last June, part of the 2010 Ocean Sciences Education Leadership Institute. The institute, titled "Seas of Change: Exploring Southeastern Climate Change," was a professional development event planned by the Center for Ocean Sciences Education Excellence/South East (COSEE SE), part of a national network (COSEE.net) of 12 regional and thematic centers devoted to excellence in marine education.

Participants, fifth to twelfth grade educators, took part in marine science activities in the field and the classroom. Warren Mitchell, former research fellow at CMAST, instructed the group on bridge-net sampling near Pivers Island. The group used the samples in a classroom activity led by Dr. David Eggleston, using microscopes to identify a variety of species of zooplankton. The educators finished the CMAST class with group projects designed to provide a better understanding of the effects climate change has on marine life.

Behind the CMAST facility educators toured the estuarine shoreline restoration project with Meg Rawls, Carteret Community College Biology instructor and project coordinator Additionally CMASTs Tim Ellis and Jen Weaver pulled a seine net through a lagoon area to show COSEE members the variety of sea life in the Bogue Sound area.

## Coastal Ecology and Management Course

Thirty-five Fisheries and Wildlife undergraduate majors attended an intensive week-long field course in Summer 2010 entitled "Coastal Ecology and Management" at CMAST. Students were given hands-on opportunities to study fishery and wildlife resources along the North Carolina coast.

Fieldwork included visiting a variety of coastal habitats (estuarine, ocean, pocosin, etc.) on foot or by boat, utilizing gill nets, bottom trawls, beach seines and the like.

# cmastpeople

CMAST faculty members **Dr. Craig Harms,** Associate Professor, and **Dr. Suzanne Kennedy-Stoskopf,** Research Professor, both of the NCSU College of Veterinary Medicine, Department of Clinical Sciences, have been selected to receive 2010 Outstanding Extension Service Awards (OESA). They were also chosen by their peers, from the group of 17 award winners, to be inducted into the Academy of Outstanding Faculty Engaged in Extension (AOFEE). The AOFEE is the professional equivalent of NCSUs Outstanding Teaching Award and Outstanding Research Award.

Both will be recognized for their outstanding contributions in service to constituencies outside of NC State University at the Ninth Annual Extension, Engagement, and Economic Development "Celebrating the Engaged University" Awards Ceremony to be held on April 18, 2011. Induction into the Academy of Outstanding Faculty Engaged in Extension is the highest recognition that NC State University can bestow on its faculty for their work in university outreach.

**Tim Ellis**, doctoral student at CMAST, received NC Wildlife Federation and NC Coastal Conservation Association academic scholarships in 2010.

CMAST Director **Dr. David Eggleston** spoke at a symposium on Search and Discoveries: Revolution of Science through Scuba sponsored by the Smithsonian Institution, the National Science Foundation and the Ocean Studies Board of the National Research Council in May 2010. Eggleston presented a talk on "Grouper, Lobster and Sneaky Divers: Using Scuba to Inform Conservation and Education." Visit www.si.edu/sds/agenda.htm to view his webcast.

**Dr. David Green**, Director of the NCSU Seafood Laboratory at CMAST, was elected to the Executive Council of the Academy of Outstanding Faculty Engaged in Extension (AOFEE) serving a three-year term, which began in fall 2010. The AOFEE promotes and recognizes excellence in extension and outreach at NC State and elsewhere and also encourages faculty and staff to address critical social problems and/or opportunities that require creative, interdisciplinary solutions or collaborations.

**Brandon Puckett,** doctoral student at CMAST, and visiting Brazilian scholar **Marcos Alaniz** attended the 13th International Conference on Shellfish Restoration held in Charleston, SC on November 17-20, 2010. Puckett delivered a paper presentation entitled: "Several large or several (more) small: designing marine reserve networks for oyster restoration."

Ph.D. student, **Ashlee Lillis** (MEAS/CMAST), recently won the M. Carriker Student Research Award from the National Shellfisheries Association, and won a Best Student Presentation Award at the Marine Benthic Ecology Meeting held in Mobile, Alabama.

## 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. Our goal is to raise $10,000 needed to put the pieces together.


You can help by joining our "Skeleton Crew" and sponsor a bone! There are over 275 opportunities to choose from with prices ranging from $12 for phalanges to $750 for the cranium. Visit www.skeleton-crew.org for information.

## CMAST Undergraduate Summer Fellows Program Accepting Applications

CMAST is accepting applications for the Summer Fellows Program that provides support for two or three summer undergraduate students in a ten-week program. In consultation with a faculty advisor who matches their interests, each student will: 1) identify an independent study project addressing a current issue affecting coastal ecosystems and communities; 2) participate in research design, implementation, and effective presentation of research results; and 3) gain an understanding for the ethical issues surrounding environmental research.

Located at the CMAST facility in Morehead City, the program will start May 28 and run through August 3. At the end of the ten weeks, students are expected to submit a written summary of their research, as well as give a 15-minute oral presentation before their faculty mentors and invited guests during their last week at CMAST.

The program is open to all students statewide at the university, college or community college level, but preference is given to science majors from Carteret County. To apply, students must complete an application form (available online), provide a copy of courses taken, and include the names and addresses of two references (one from their home institution). The student is also encouraged to submit a short essay (one page) on why a summer research experience is important.

Visit the CMAST web site for an application, and for applicant requirements www.cmast.ncsu.edu or, contact Dr. Patricia McClellan-Green at pdmcclel@ncsu.edu for more information.

## Humpback Whale in Core Sound

On March 7, 2011, a call came in concerning a humpback whale spotted in the shallows of Core Sound. Dr. Vicky Thayer, Marine Mammal Stranding Coordinator working at CMAST, and others associated with the Stranding Network, took to the air to locate the 30 ft. animal and later by boat to assess its health. A whale that size is a rare visitor to North Carolina's inland waters. It was anticipated there may be something wrong to lead it off course. The suspicion was right, as the team of experts observed the whale was suffering with massive wounds from a ship's propeller, as well as other net entanglement wounds. The whale had maneuvered into shallower water, eventually becoming stranded on a shoal at low tide. The team waited for a day as a storm system passed the area, hoping that a rise in water level might allow the whale to free itself. However, the next assessment revealed additional wounds were appearing inflicted from sharks and birds as the whale lay helpless and unable to move to deeper water. The team decided to humanely euthanize the animal to relieve it from any further suffering.

Multiple agencies and people came to the aid of this animal, providing invaluable assistance to the Stranding Network team. Contributors to this effort were from: UNC Wilmington; NC State University Veterinary School; NC Maritime Museum; Duke University Marine Lab; National Marine Fisheries Service Regional Stranding Coordinator; NC Division of Marine Fisheries; and Tow Boat US. Flights were provided by: NC Marine Patrol; and USMAS Cherry Point. Boat transportation was provided by: local fishermen, US Coast Guard; and Cape Lookout National Seashore personnel.