NC STATE UNIVERSITY

CMAST COMMUNICATOR

THE CENTER FOR MARINE SCIENCES AND TECHNOLOGY

Discovering Coastal Solutions

VOLUME 2 NUMBER 3 FALL 2009

CMAST Graduate Students Help Drive Coastal Discoveries

A key mission at CMAST is "discovering coastal solutions." One way this mission is realized is by serving as a tool for resident and visiting faculty and students. With multiple laboratories available, marine vessels at hand, close proximity to estuarine and ocean waters, and collaborations with area marine science institutions, CMAST is a valuable key to students seeking higher degrees.

And students there are – over 60 graduate students have graced CMAST's halls since opening in 2000. With all these students comes a multitude of topics for research – from blue crab tracking in the sounds to bluefish mortality in the ocean and everything in between. Some come as undergrads and advance to doctoral studies. Some come only in the summer, some come only in the winter, while others still have a place here year-round to carry out their work. Aside from how much time is spent at the CMAST facility, all find it an invaluable resource to their research.

Read on to learn what the current CMAST graduate researchers are doing to help "*Discover Coastal Solutions*."

Photo courtesy fishermanspost.com

Tim Ellis, Doctoral Student, College of Agriculture and Life Sciences, Fisheries and Wildlife Science

After receiving his B.S. in Biology from UNC-Chapel Hill in 2002, **Tim Ellis** arrived at CMAST in the summer of 2004, to begin work on a Masters Degree under Dr. John Miller, Biology Professor at NCSU. Before coming to CMAST, he worked for other marine science institutions in Morehead City as a fisheries observer and a research technician. It was during the two years working on his masters that Tim decided to further his graduate studies, having been influenced by the interactions with other students and researchers at CMAST. In his five years at CMAST, Tim completed a M.S. degree in Zoology, a NC Marine Fisheries Fellowship and started doctoral research in the Fisheries and Wildlife Sciences program with graduate advisors Dr. Jeff Buckel and Dr. Joe Hightower of the Biology department.

Ellis' Research – Spotted seatrout movement and mortality

North Carolina anglers consistently target spotted seatrout (*Cynoscion nebulosus*) more than any other species, making it the most important sportfish in North Carolina. The NC Division of Marine Fisheries (NCDMF) is currently reviewing an assessment of spotted seatrout as part of the state's first Fishery Management Plan (FMP) for the species, due for completion in late 2010. Tim's research is aimed at better understand-

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CURRENT EVENTS

CMAST SEMINARS • ROOM 205 • 11:00 AM

September 25
Dr. David McConnell
NC State University
"The mid-career makeover kit: less talk, and more action in the science classroom"

October 16
Dr. Joel Fodrie
UNC Chapel Hill Institute of Marine Sciences

"Are there "big ones" left in the Gulf of Mexico: evidence from fishery dependent catch data and inter-generational perceptions among fishers"

October 23
Dr. Michael Burchell
Assistant Professor, NCSU, Department of Biological and Agricultural Engineering,
Specialty: Wetland Restoration

"North River Farms Wetland Restoration- Can it help future restoration design and implementation?"

Note: An afternoon tour of Open Grounds Farm is available to those interested. Contact David Eggleston (eggleston@ncsu.edu) for info.

November 13
Dr. Steve Ross
Associate Professor, UNC-Wilmington, Marine Science
Specialty: Ecology of deep-water corals and pelagic systems on the US Continental Shelf.

"Deep-Sea Coral Ecosystems off the Southeastern US"

November 20
Dr. Roldan Munoz
National Marine Fisheries Service, NOAA Beaufort
Topic -TBD

December 4
Paul Rudershausen
NCSU Center for Marine Sciences and Technology

"Cross-continent by bicycle."

Science Café Comes to Carteret County

November 9, 2009

Guest Speaker
Dr. Pete Peterson, UNC IMS
"Capture the Wind"
Wind Power Generation Along Our Coast

Please contact Jill Miller of CMAST at 252.222.6334 or email jill_miller@ncsu.edu for location and registration information.

From the Director

Welcome to the CMAST Communicator

Most university faculty would likely agree that graduate students are the engines that drive successful university research programs. Graduate students add their own creativity and ideas to the scientific method, and generally become such strong experts in a given research area that they eventually "teach the teacher." Graduate education is essential for maintaining a vibrant economy and healthy communities, especially in the face of increasing global competition and complex environmental challenges such as global climate change. Graduate education teaches students how to think critically, thereby preparing them to deal with and find solutions to future problems that we cannot even conceive of today.

In this issue, we highlight the breadth of graduate research at CMAST, and describe how CMAST serves as an effective tool for graduate training, while simultaneously benefiting from students whose research and educational outreach help CMAST to "discover coastal solutions." CMAST-based support for graduate students ranges from providing laboratories with specialized equipment, to a staging area for field operations, to veterinary professional training.

Lastly, we update you on many of the diverse research and community activities by CMAST faculty, students and staff, including an update on research on invasive lionfish, a large-scale oyster restoration program funded by the American Reinvestment and Recovery Act, spreading the word on NC's delicious seafood, and highlighting CMAST teaching and outreach activities. We are especially proud of the cross-country bike-ride fundraiser conducted by CMAST's Paul Ruderhausen, which is also highlighted in this issue. I invite you to visit our web-site, our beautiful facility located on Bogue Sound in Morehead City, or contact any of our faculty, staff or students with questions.

Best wishes,
Dave Eggleston

GRADUATE RESEARCHERS AT CMAST

ing the movement and mortality of spotted seatrout in North Carolina. Using a combination of conventional tagging and telemetry tagging, his goals are to obtain regional estimates of fishing mortality, determine the significance of overwinter natural mortality, and identify stock boundaries for the species.

The tagging component of the study will occur over four years and involves releasing spotted seatrout across coastal NC with visible streamer tags, and then relying on commercial and recreational fishermen to recapture the fish and return valuable information such as the date and location of where they caught the fish, in exchange for a reward.

The telemetry component of the study will take place during the winter months over the next three years in low salinity creeks. It involves surgically implanting fish with transmitters and tracking their subsequent movement and survival, particularly during winter freeze events.

Funding for his research is through a Fishery Resource Grant (FRG) administered by NC Sea Grant, and through the NC Marine Resources Fund, which is composed of proceeds from the sale of the Coastal Recreational Fishing License, administered by the NC Marine Fisheries Commission and the NC Wildlife Resources Commission.

Sarah Friedl, Masters Student, College of Agriculture and Life Sciences, Biology

Sarah Friedl is a graduate of Eastern Michigan University with a B.S. in Biology and Conservation Resource Management. After graduation she worked as a research technician at the USGS Great Lakes Science Center in Ann Arbor, MI, gaining direct experience in the field of fisheries management. She knew about CMAST and the work of Dr. Jeff Buckel, so Sarah chose to pursue her Masters research at North Carolina State University to further her education and experience in fisheries management. CMASTs location at the coast was a major factor in her decision to come to NCSU.

Friedl's Research - Sarah is a Master's student working with Drs. Jeff Buckel and Joe Hightower in the Biology Department. Her research includes using sonic telemetry to determine if density-dependent mortality occurs in age-1 Spot (*Leiostomus xanthurus)* in Neuse River estuarine creeks, as well as to estimate natural mortality rates during this important life stage. The purpose of this research is to compile much needed data on juvenile estuarine fish. Spot was chosen because of its importance commercially, recreationally and economically to Eastern North Carolina. Sarah hopes that the results will be influential and applicable to spot fishery managers as well as others who are interested in studying the population dynamics of other juvenile estuarine fish.

Lindsay Glass, Doctoral Student, College of Agriculture and Life Sciences, Fisheries & Wildlife Science

Lindsay Glass arrived at CMAST in May of 2006 after graduating from Texas A&M with a Master's degree in Wildlife and Fisheries. CMAST allows her to have a base of operations during her summer field season and makes it possible to conduct research in NC's estuaries, whereas most of her labmates are based out of Raleigh and work on fresh water species. Lindsay says, "A good majority of people at CMAST make me feel welcome even though I am not a 'local.'"

Glass' Research - Under the direction of Dr. Jim Rice and funded by NC Sea Grant, Lindsay's Ph.D. work focuses on the direct and indirect effects of hypoxia on growth of juvenile fish (specifically spot) in the Neuse River Estuary. This past summer she extended her research sites to include tidal creeks in Bogue Sound and further south in the Wilmington area. In addition, she conducts laboratory tank trials with spot to try to define the relationship between growth and three bioindicators of fish health (hepatosomatic index, RNA-DNA ratios, and insulin-like growth factor-I).

GRADUATE RESEARCHERS AT CMAST

Erika Millstein, Masters Student, College of Physical and Mathematical Sciences; Marine, Earth and Atmospheric Sciences; Marine Science

Erika Millstein arrived at CMAST as a second year Master's student in the Marine, Earth and Atmospheric Sciences Department. She completed undergraduate work with a B.S. in Biology at Bates College, in Lewiston, Maine with a final semester at the Duke Marine Lab in Beaufort. It was then she met Dave Eggleston, and was very interested in his research, especially his dedication to science outreach.

Millstein's Research - Habitat restoration as a fisheries management tool

Erika is studying how marine fisheries species use and interact with their habitat. During her studies on campus at NCSU, she completed two research projects focusing on those topics. For her thesis research, she built a mathematical model to evaluate the biological and economic effectiveness of oyster reef restoration as a black sea bass management tool in the southeast United States. She assessed the final black sea bass population size and net economic benefit yielded when black sea bass is managed via oyster reef restoration, compared to when black sea bass in managed via reducing catch by fishermen versus management inaction over a 30-year model period. Her advisor on the project was Dave Eggleston, and her committee members were Laura Taylor, Joseph Hightower, and Jing Lin, and ecological modelers including Jeffery Wielgus and Tilo Ziehn. With their help Erika says, "I learned a tremendous amount about fisheries, ecosystem modeling and environmental economics."

In addition to the modeling project, she completed a pilot study to assess the timing and route of migration of mature female blue crabs in the White Oak River. Using acoustic radio transmitters, VR2W receivers and hydrophones, ovigerous blue crabs were tracked from their mating locations, down river toward Bogue Inlet, where they spawned their eggs. This project will eventually help blue crab managers evaluate the effectiveness of managing female migration corridors to protect the blue crab spawning stock. Erika's work was supported by a grant from the NC Blue Crab Research Program, administered by NC Sea Grant. She also collaborated with White Oak River commercial crabber Russell Howell, who provided advice and information on the project.

Jim Morley, Doctoral Student, College of Agriculture and Life Sciences, Biology

Jim Morley received a B.S. in Biology from SUNY Cortland, NY and a M.S. in Fisheries and Wildlife Sciences from NCSU. His Masters work was under the direction of Dr. Jeff Buckel of CMAST. As a member of Buckel's group, he was in Raleigh for the first year, to take classes for two semesters before moving to Morehead City. Jim says, "I'm very grateful to be working here as it makes doing field work much easier. My field sampling sites are all in this area (one literally behind the CMAST building), which makes my work much more efficient. Also, with a wet lab just a quarter mile away I'm able to conduct experiments nearby."

Morley's Research - Overwinter ecology of juvenile bluefish off North Carolina: foraging, energy storage, growth, and survival

Fisheries biologists are interested in the overwintering period of bluefish (*Pomatomus saltatrix*) as mortality may be high during this time, which can lead to a bottleneck in recruitment. Juvenile fish are forced to rely on stored lipid reserves to sustain them during winter. Experimental work suggests that the ability to feed during the winter can greatly increase survival, especially with smaller individuals, because of their lower energy stores. The first part of Jim's research examines the foraging ecology and energy storage dynamics of juvenile bluefish during their first winter. He coordinated a monthly trawl survey off North Carolina to address the temporal changes in bluefish feeding activity and how temperature, prey availability, and energy storage influences feeding during the winter. Jim is also conducting two experiments to aid in interpreting field data - the first examines how low temperature affects feeding and growth of bluefish, and the second is testing how temperature affects a predator's ability to capture and ingest prey.

The second aspect of his research concerns the survival of juvenile bluefish cohorts, spawned at different times of the year, and their relative importance to the population. Bluefish spawn throughout the year, resulting in multiple cohorts of juveniles of different sizes at the onset of winter. It is unclear if only one of these cohorts contributes the majority fish to the adult stock, or if multiple cohorts contribute. To address this question, Jim is using scales obtained from adult bluefish, which can be used to age fish similar to reading the rings on a tree, to back-calculate the size of each fish when the first annual ring was formed. Information on size-at-age will reveal the size of each fish at the onset of its first winter, which can be used to approximate what time of year the fish was originally spawned.

This research will help managers understand how the overwintering period can affect the survival of juvenile marine fishes. More specifically, Jim's work will determine how stressful winter is for juvenile bluefish, and help determine which spawning seasons produce the majority of bluefish recruits, thereby aiding fishery managers in choosing an appropriate juvenile abundance index to track the status of the population.

Ray Mroch, College of Physical and Mathematical Sciences; Marine, Earth and Atmospheric Sciences; Marine Science; 2008 NC Marine Fisheries Fellowship

Ray Mroch received his Bachelor's degree from the University of South Carolina. He was accepted to NCSU in Dr. David Eggleston's laboratory working toward his Masters degree in Marine Science. While there he was involved in a project that

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allowed him to travel frequently from Raleigh to CMAST to conduct fieldwork. He had such a positive impression of CMAST and Morehead City, he moved there in August of 2008.

Mroch's Research – Spatiotemporal Variation in Broodstock Reserve Fecundity

One of the most effective management strategies for conserving fisheries and marine biodiversity in the worlds oceans is the establishment and enforcement of networks of no-take marine reserves. Ray's research involved quantifying oyster fecundity (egg production) in a number of oyster reserves throughout Pamlico Sound as a key step towards addressing the questions of how big should a given reserve be, and where should it be located to be most effective in conserving oysters? Ray identified when oysters spawn in Pamlico Sound, and which reserves tend to produce the most eggs on a per unit area basis (eggs/m2), or based on the size of the broodstock reserve. This information is currently being used to help guide a large-scale oyster restoration effort in Pamlico Sound funded by the American Reinvestment and Recovery Act.

Close to the time when Ray was finishing his Masters degree, he was chosen as the NC Marine Fisheries Fellow at CMAST allowing him to stay in Morehead City for another year. His work on the fellowship, supervised by Dr. Jeff Buckel, involved determining the best aging structure for use in aging summer flounder (*Paralichthys dentatus*), a topic with implications on how the fishery is managed. The fellowship has come to a close and Ray has accepted a position working for CMASTs Dr. Craig Harms, College of Veterinary Medicine.

Brandon Puckett, Doctoral student, College of Physical and Mathematical Sciences; Marine, Earth, and Atmospheric Sciences

Brandon Puckett (B.S. '02) graduated with honors from NC State, after which he enrolled as a M.S. student at the University of Maryland's Chesapeake Biological Laboratory where he conducted research on the charismatic - if not just plain savory - Chesapeake Bay blue crab. (He defends, "My athletic allegiance is still with the 'Pack.") Brandon's transition from M.S. to Ph.D. programs was rapid; two days after his M.S. thesis defense in Maryland, he started coursework at NC State, for the second time. Upon completing the required coursework on main campus in June 2007, Mr. Puckett jumped at the opportunity to relocate to what Brandon refers to as NC State's best-kept secret, the Center for Marine Sciences and Technology (CMAST).

Puckett's Research – Oyster metapopulation dynamics and restoration

Brandon's dissertation research involves monitoring a suite of oyster reserves, or areas protected from harvest, and optimizing future reserve designs, using Pamlico Sound in eastern North Carolina as the model system. With oyster harvests at historic lows along the southeastern Atlantic coast, Puckett's work addresses several applied questions such as: Are existing oyster reserves functioning as an interconnected network that is self-sustaining and capable of persisting through time? If so, which of these reserves contribute most to network persistence (i.e. which reserve provides the most "bang for the restoration buck")? And if not, how does increasing the size and/or number of reserves improve network persistence?

His research, which partners academic scientists with state (NC Division of Marine Fisheries) and federal agencies (National Marine Fisheries Service), commercial fisherman, and high school students, will ultimately assist in the management of oyster reserves and future regulations. In addition, this work will increase the current knowledge and expertise on spatial management practices and in particular, marine reserve network design. In 2008, Brandon was awarded the prestigious National Marine Fisheries Service (NMFS)Sea Grant Population Dynamics Graduate Fellowship which funds his research for three years.

Ryan Rindone, Masters Student, College of Physical and Mathematical Sciences; Marine, Earth, and Atmospheric Sciences

In 2007, Ryan Rindone graduated with a B.S. in Natural Resources, Marine and Coastal Concentration and a minor in Biological Sciences from NCSU and soon after accepted a position with the Division of Marine Fisheries Management in Florida. Graduate school was in his thoughts as he had been communicating with Dr. David Eggleston about the potential of attending NCSU for graduate studies. Ryan's interests were in both black sea bass and stone crabs. Ryan is in his second year of Masters studies with his time divided between Raleigh and Morehead City, completing required coursework at the Raleigh campus and during the summer at CMAST to do laboratory work.

Rindone's Research - Potential predatory impact of non-indigenous stone crabs on oysters

Increasing trends in global sea surface temperatures have led to both range expansion and shrinkage of certain species, as well as species' extinctions. The non-indigenous, Florida stone crab (*Menippe mercenaria*) appears to be extending its range north from Florida and the Caribbean into North Carolina. Although anecdotal information suggests that stone crabs are well established in NC, there is no quantitative data on their distribution and abundance, nor potential predatory impact on ecologically and economically important oyster populations.

As a result of the limited data on the stone crab invasion in to North Carolina waters, Ryan is conducting diver and trap surveys in Pamlico Sound to establish a quantitative base line of their distribution and abundance. He is also conducting laboratory predation trials to determine feeding rates by stone crabs on varying sizes of oysters and how these rates vary with the density of oysters. To estimate the potential predatory impact of stone crabs on oyster populations within North Carolina's broodstock oyster reserves, Ryan will integrate both his field surveys of stone crab density and distribution patterns, and his laboratory feeding rates, into a mathematical computer simulation model that will aid fishery resource managers to better predict the impact of this non-indigenous predator as it presumably increases in abundance in NC's more saline estuarine waters.

Veterinary Medicine Professional Training Offered at CMAST

Along with graduate research at CMAST, a Zoological Medicine Residency Program is available through NCSUs College of Veterinary Medicine (CVM). This three year, post-graduate program trains veterinarians pursuing board certification in zoological medicine and was the first in the country to have an aquatic animal focus even before CMAST opened.

Dr. Craig Harms was the first zoological medicine resident with an aquatic medicine emphasis in 1992 and is currently a permanent faculty member at CMAST, which opened in 2000. Working in collaboration, Dr. Harms along with Drs. Michael Stoskopf, Greg Lewbart, and Suzanne Kennedy-Stoskopf have built what is recognized as one of the strongest programs in aquatic animal medicine in the country. Partnerships with the Topsail Island Sea Turtle Hospital, the three NC Aquariums, and the Marine Mammal Stranding Network provide opportunities not only for the zoological medicine residents but for students currently studying at NCSU to become veterinarians and for residents pursuing training in other veterinary medicine specialties at CVM.

A limiting factor for greater resident and student involvement is due mostly to a lack of available housing in the area. Plans are on the table for a CMAST guesthouse for such residents as well as visiting faculty. Dr. Suzanne Kennedy-Stoskopf, Research Professor, Department of Clinical Sciences at CVM says “This aquatic medicine program could be strengthened even more with available housing for our residents and veterinary students.”

For further information about the residency program contact Dr. Craig Harms at craig_harms@ncsu.edu.

Internship and Graduate Programs Affiliated with CMAST

North Carolina Sea Grant Fellowship in Marine Fisheries Management
http://www.ncseagrant.org/home/research/fellowships

CVM Zoological Medicine Residency
http://www.cvm.ncsu.edu/ed/res_zoo.html

CMAST Summer Fellows Program (awaiting funding) http://www.cmast.ncsu.edu/education/2007_fellows.php

Fisheries and Wildlife Internship
http://www.cnr.ncsu.edu/fer/fishwild/fwschol.html

Hutton Junior Fisheries Biology Program, American FIsheries Society (high school level) http://www.fisheries.org/afs/hutton.html

To date 62 graduate students have studied and worked at CMAST since 2000

Kyle Adamski, M.S. ’07-‘09
Robert Aguilar, M.S. ’01-‘03
Grey Allen, M.S. ’03-‘04
Eric Anderson, D.V.M. ’08-present
Nate Bacheler*, Ph.D. ’02-‘08
Erica Balmer-Hanchey, M.S. ‘01
Anna Barrios, M.S. ’02-‘04
Becky Bartel, Ph.D. ’07-‘09
Geoff Bell, Ph.D. ’04-‘08
Dana Bethea, M.S. ’02-‘03
Michelle Blickley, Ph.D. ’05-present
Summer Burdick*, M.S. ’05-‘06
Chris Butler, M.S., ’05-‘07
Juan Chaves, M.S. ’02-‘03
Satya Chinnadurai, D.V.M. ’07-‘08
Beth Chittick Nolan D.V.M. ‘01
Tres Clarke, D.V.M. ’08-present
Meaghan Darcy, M.S. ‘02
Felix Del Toro Silva, Ph.D. ’04-’08
Stephanie Drake, M.S. ‘04
Tim Ellis*, Ph.D. ’04-present
Lisa Etherington, Ph.D. ‘01
Sarah Friedl, M.S. ’08-present
Lindsay Glass, Ph.D. ’06-present
Lia Goeller, M.S. ‘00
Pamela Govett, D.V.M. ‘04
Erica Hanchey, M.S. ‘01
Heather Henson-Ramsey, Ph.D. ’04-‘07
Wynne Hopkins, M.S. ’01-‘02
Eric Johnson, Ph.D. ’01-’04
Jennifer Keller, Ph.D. ‘03
Terra Kelly, D.V.M. ‘05
Todd Kellison, Ph.D. ‘00
Allison Leidner, Ph.D. ’06-‘08
Stacy Luthy*, Post-doc ’04-‘05
Robert Maclean, D.V.M. ‘04
Regan McNatt, M.S. ‘02
David Medici, M.S. ‘04
Erika Millstein, M.S. ’08-present
Warren Mitchell*, M.S. ’06-’08
Jim Morley, Ph.D. ‘02-present
Ray Mroch*, M.S. ’08-‘09
Corey Oakley*, M.S. ‘03
Brandon Puckett, Ph.D. ’07-present
Mary Radlinski, M.S. ‘07
Nathalie Reyns, Ph.D. ’01-‘05
Ryan Rindone, M.S. ’08-present
Jocelyn Romano, Ph.D. ‘04
Kara Schwenke, M.S. ’02-‘04
Steve Searcy, Ph.D. ’01-‘05
Elizabeth Shimps, M.S. ‘04
Betsy Stringer, D.V.M., ’08-‘09
Chris Taylor, Ph.D. ’01-‘07
Jack Tuomikoski, M.S. ’03-‘04
Allison Tuttle, D.V.M. ’04-‘07
Jennifer Weaver*, M.S. ’09-‘10
Jennifer Webber, M.S. ’04-‘05
Karen Wolf, D.V.M. ’06-‘08
Trevor Yip-Hoi, Ph.D. ‘03

International students

Kristin Bjornsdottir, Ph.D. ’05-’09 Iceland
Arni Petersen, M.S. ’03-’06 Faroe Islands
Andrey Tikunov, Ph.D. ’08-’09 Russia

*NC Marine Fisheries Fellow

CMAST RESEARCH

Lionfish Research Takes a New Turn

As reported in the Spring 2009 issue of *CMAST Communicator*, lionfish are on the move in the southeast Atlantic Ocean and are beginning to have an adverse effect on native fish populations by reducing the food resources for juvenile stages of important reef fish. Studies are being done collaboratively with NCSUs College of Veterinary Medicine and NOAA on monitoring lionfish movement, density, distribution, life history, temperature tolerance and more.

But just maybe these invaders can be put to good use - as food. In addition to the scientific research being conducted, the NCSU Seafood Laboratory staff, located at CMAST, has been testing recipes utilizing these intruder fish. With assistance from NOAA and a local diving business in Beaufort, NC, lionfish were caught, poisonous spines clipped, scaled, filleted and prepared in five recipes at the Lab. The results have been delicious.

Joyce Taylor (left), head of the Seafood Lab Kitchen, is filmed and interviewed by Discovery Channel Canada producer Agatha Rachpaul.

News of this invasion and subsequent kitchen research has traveled fast. In addition to local and state publicity, Discovery Channel of Canada got wind of the research and recipe testing and visited CMAST in July to film and interview the folks involved. The segment is to be aired sometime in the fall on Daily Planet, a science news program. There will be a web site link made available so Americans will be able to watch. Be sure to "stay tuned" for more info.

Oyster Reef Stimulus Project Begins

Over the past 100 years, oyster populations along the East coast have declined to historic lows due to overfishing, reduced water quality and disease. Now, NC State, CMAST researchers and partners are poised to aid in a recovery project aimed at revitalizing oyster beds along the Pamlico Sound as well as an industry that has been suffering during the recent economic downturn.

The National Oceanic and Atmospheric Association (NOAA) has given the NC Coastal Federation a $5 million stimulus grant toward building two large oyster sanctuaries along the Pamlico Sound. Reefs will be created with 54,000 tons of stone and will cover over 46 acres. As designated sanctuaries, the reefs will not be available for harvest, but they will have benefits to both commercial and recreational fishermen as nurseries for oysters and valuable species of fish. Studies have shown that oyster reefs produce larvae that travel to other parts of Pamlico Sound where they will mature and can eventually be harvested.

Approximately $300,000 of the funds have been directed to NC State, NC Sea Grant and the University of North Carolina at Wilmington to monitor the project's success. "We will be assessing the ecological performance of this very large-scale oyster restoration effort by focusing on four groups of response variables," says Dr. David Eggleston, director of NC State's Center for Marine Sciences and Technology (CMAST), professor and lead investigator on the project.

The four variables include density, size and frequency of oysters in existing and newly created oyster habitat; the settlement of oyster larvae on oyster shells over time to

Tugboat displays "Coastal Restoration at Work" banner, for a project funded by a NOAA economic stimulus grant.

Barge with heavy machinery begins work on oyster-habitat restoration project in Pamlico Sound.

indicate whether or not this restoration effort is increasing the number of oysters; the abundance, size and diversity of other species that use oyster reefs as habitat, such as fish and crabs; and any positive changes to recreational fishing opportunities and catch-per-unit effort in broodstock reserves and adjacent areas.

Using a variety of gear and personnel, from professional scuba divers to high school volunteers, Eggleston and his team will measure the response variables. Divers will retrieve clumps of oysters from the seafloor for counting and measuring, and then replace the clumps. Students from the Pamlico Sound region will retrieve "shell-strings" hanging off docks, and take water quality measurements. The shell-strings will be replaced weekly with a fresh set, and will be examined in a laboratory at NC State to identify and count newly settled oysters. "This gives us a relative measure of oyster settlement in space and time, and we can examine annual settlement as a function of the amount of oyster reef restoration to see if there is a relationship," says Eggleston.

Gill nets, fish-, minnow- and crab-traps will be used to assess other species that may inhabit the reefs. Changes in recreational fishing opportunities will be assessed using a combination of creel-surveys of fishermen at boat ramps, aerial surveys of the number of boats and anglers at oyster restoration sites, and follow-up phone interviews with recreational fishermen.

In addition to an eight-member science team, approximately 140 jobs will be created for over an 18-month period. Many of the positions will be available in industries hard-hit by the economic downturn. Commercial fishermen, quarry workers, tug boat and barge operators and fisheries technicians are among those who will receive the benefits of this project.

CMAST OUTREACH

Discovery Place in Charlotte "Discovers" NC seafood

Chef Tom Condron (l) and Chef Mark Hibbs (r) prepare seafood dishes at Discovery Place.

More and more consumers want to know, "Where is it from?" when purchasing fresh seafood. Science Café – *Carolina Catch of the Day* was held at Discovery Place of Charlotte on June 9 to educate the public about ocean health, the seasonality of coastal seafood commodities and the state and federal regulations that protect the consistency of commercial fisheries. NC Sea Grant organized the event in partnership with Discovery Place and the Charlotte Area Science Network.

Charlotte chefs Tom Condron of Harper's Restaurant Group and Mark Hibbs of Ratcliffe on the Green prepared samples of shrimp and Atlantic blue crab dishes. The seafood was provided by Pamlico Packing of Grantsboro and smoked trout appetizers were provided by Sunburst Trout Company of Waynesville.

"The desire for wholesomeness and concerns over the 'carbon footprint' of imported products are driving the demand for local seafood," says Barry Nash, Sea Grant technology and marketing specialist at CMAST. Nash says people also are eating more seafood because of its health attributes.

NC Sea Grant has developed a number of education products to help consumers learn the availability of their favorite seafood and how to assess seafood quality. It has also assisted three communities launch local seafood promotional campaigns, including the successful Carteret Catch.

Coastal Ecology and Management Class

Over 30 students participated in the second year offering of Coastal Ecology and Management Week, part of the six-week Fisheries and Wildlife Program Summer Camp. Taught by Drs. John Miller and Jeff Buckel, the first week of the course was held at CMAST where students received hands-on experience learning about the coastal environment.

In addition, Sea Turtle Biologist Matthew Godfrey, from the Wildlife Resources Commission, spent a day with the class and lectured on sea turtles and what work is being done through the Wildlife Service for protection of their nests.

Ecology students standing next to a marked turtle nest. They had the opportunity to release an endangered Kemps Ridley turtle that had been rehabilitated after being caught on hook and line.

Students aboard the RV Susan Hudson learn about fisheries habitat relationships by catching and studying juvenile fish from the ocean up in to the Neuse River.

DIRECTOR'S OUTREACH

CMAST Director David Eggleston (red shorts), CMAST's Craig Harms (green hat), and College of Vet. Med's Lizette Hardie, Dept. Head of Clinical Science (pink t-shirt) assist with the release of a rehabilitated sea turtle from the Sea Turtle Hospital on Topsail Island, June 3, 2009. Right: Jean Beasley, Hospital Director, (on left) stands watch as Eggleston and others wrestle "February" to the water.

Seafood Blog Features Fresh Seafood Ideas

Mariner's Menu, the new blog based on Joyce Taylor's popular book of the same name, offers consumers a new way to get seafood recipes, learn about local fisheries and traditions, and stay up to date on safety, handling and preparation tips. The project is in response to the increase of consumers

eating healthier and including more seafood in their diets. Taylor is a NC Sea Grant seafood specialist and leads the Nutrition Leaders' group in the Seafood Lab Kitchen at CMAST.

Partners on the project include North Carolina Sea Grant, North Carolina State University Seafood Laboratory, Core Sound Waterfowl Museum, and North Carolina Division of Marine Fisheries. Follow Mariner's Menu online at **www.marinersmenu.org.**

Marine Science Academy Students Visit CMAST

Over 55 students and teachers visited CMAST in June 2009 as part of the annual Marine Science Academy, a weeklong camp offered by Carteret County Schools. Campers were divided into two groups with one group visiting the NCSU Seafood Laboratory Pilot Plant, and the other group moving outside to pull seine nets in Bogue Sound.

In the Pilot Plant, David Green and Greg Bolton of the Seafood Laboratory spoke about seafood safety and gave information on how to determine if a fish is fresh. They were shown samples of fresh flounder and mahi-mahi and then treated to a snack of fried mahi and Smoked Rainbow Trout jerky from the North Carolina Mountains.

David Green speaks to students about seafood safety in the Seafood Lab Pilot Plant.

Warren Mitchell (l) and Jeff Buckel (r) show students what marine life can be found in Bogue Sound behind the CMAST building.

The outside group pulled two seine nets under the instruction of Jeff Buckel and Warren Mitchell of NCSUs Biology Department at CMAST. Large numbers of shrimp, along with pinfish, cornet fish and others were collected. The group also had the opportunity to test water salinity, dissolved oxygen and temperature that they would compare with results obtained from a trip to Cape Lookout.

Cape Hatteras Students Win Prize

Above students Evan Haas, Ashley Hodges, and Kailee Pieno, along with their teacher, Tracy Shisler, of Cape Hatteras Secondary School of Coastal Studies in Buxton won third prize in the Siemens "We Can Change the World Challenge." The national competition encourages school students across the US to team up and "go green" by creating and implementing environmental change in their communities. The winning project focused on creating an artificial reef to help restore the oyster population in Pamlico Sound. ***Note:* Ashley Hodges** *is one of 12 high school students measuring oyster settlement throughout Pamlico Sound as part of the large oyster restoration projected CMAST is involved with, reported on page 6.*

CMAST STAFF NOTES

Award winner moves to next level

NCSU Award for Excellence winner, Ernie Yeager, will continue as a nominee in the State Employees' Awards for Excellence Program. This is the highest honor that a state employee can receive in North Carolina. Ernie is the Facilities Coordinator for CMAST. Winners are determined in October.

It's a Mission Accomplished for Wildlife

"A journey of 1,000 miles begins with the first step" so goes the ancient proverb. But what if it's journey of 3,000 miles and begins with two wheels? That's what one CMAST researcher decided to find out.

On September 6, Paul Rudershausen, biologist and Research Assistant in the Zoology lab at CMAST, rolled in to Pine Knoll Shores, NC after completing a 36-day, 3,525-mile bicycle trek across the United States from the Oregon coast to the North Carolina coast, all to support a local animal rehabilitation group. The ride was to raise funds for the Outer Banks Wildlife Shelter and Education Center (OWLS), a non-profit wildlife hospital located in Newport, NC, where injured, sick, and orphaned native North Carolina wildlife are cared for until strong enough to be released back into the wild.

Paul was a day rider, runner, and hiker for many years, working up to his first solo ride in summer 2008, when he traversed 5,000 miles across Canada. It was on that ride a fund raising idea was born. Many people asked what cause he was representing – to which there was no benefactor from that trip - except for Paul himself attaining his personal best. This put an idea in his head for the next year. As an OWLS volunteer, it was a natural pairing for him to ride and raise money for the center. This exceptionally caring and compassionate man, proposed the idea to the OWLS staff who started to make plans for the fund raising adventure – planning the route, getting sponsors to support

the project, creating a web site for Paul to blog his journey daily, and garnering publicity from area media. A goal of $10,000 was set for the "Pedal 4 Wildlife" charity ride.

It started with a flight to Newport, Oregon. Paul pedaled for 32 of the 36 days on the road. He took four days off intermittently to rest and rejuvenate before tackling the road again. Mostly camping along the way, Paul did stay in the occasional motel. "Sometimes it was only an extra $20 for a motel room compared to a campground, it was a no-brainer at times to choose the motel," Paul says. All his gear had to be packed on his bike – camping gear, lights, locks, sports drinks and more added about 45 lbs. to his ride – a significant amount when hauling it up mountains and hills. He endured heat, headwinds, hills, mountains, tractor-trailers, rain and more on the journey and remarkably had no accidents or even close calls. And most challenging perhaps was the psychological endurance he maintained to get up every day and continue the ride. At times he doubted himself, but never let that rule his emotions. He needed to complete this journey not only for the center but also for himself.

What follows is an excerpt of his final entry on the blog. "Over the past two years I have biked across the two greatest countries in the history of Earth. I was at the whim of strangers on countless occasions – when getting passed by tens of thousands of cars, when getting directions, when getting a friendly wave or served a hot meal. Time and time again Americans and Canadians showed me a wonderful side of the human spirit that seemingly never gets reported to us by media outlets. Moving slowly across our vast and stunningly diverse continent allowed me to absorb ever fiber and grit of these two countries; in them, the essential goodness of people is on display everywhere."

And so, it's mission accomplished. Although the monetary mission hasn't been realized as yet (about 10% left to go), a personal mission was achieved by Paul that few of us get the chance to do – to be so extremely driven, dedicated and committed, to literally put body and soul on the line to help give the gift of life for those who have no voice.

Visit Paul's blog at **www.pedal4wildlife.org** for a compelling account of an amazing cross-country journey. And donations are still being accepted.

Bacheler Recognized for Outstanding Dissertation

Recent NCSU graduate Dr. Nate Bacheler has received the 2009 Graduate School Dissertation Award for the College of Agriculture and Life Sciences. This award recognizes "outstanding scholarly research that has a positive impact on both the North Carolina economy and the quality of life for all its citizens." Nate's dissertation, entitled "Factors influencing the abundance and distribution of subadult Red Drum in North Carolina," was completed under the mentorship of Drs. Jeff Buckel and Joe Hightower. Congratulations Nate.

Paul Rudershausen flanked by his friends and supporters the day he arrived in Pine Knoll Shores after a 36-day, 3525-mile fund raising solo bicycle trek across the United States.

Puckett Honored

Brandon Puckett, Doctoral Student at CMAST, was recognized at the University Honors Baccalaureate in May 2009 for the National Marine Fisheries Service/Sea Grant Population Dynamics Graduate Fellowship he received during the 2008-09 academic year. Former NCSU Chancellor James Oblinger and Provost Larry Nielsen presented the recognition award.

WHERE ARE THEY NOW?

Kyle Adamski completed his M.S. in Fisheries and Wildlife Science in May 2009. Kyle has accepted a Research Technician position with USGS Conte Anadromous Fish Research Center in Turner Falls, MA.

Kristin Bjornsdottir Butler received her Ph.D. in Food Science in May 2009. She and newlywed husband **Chris Butler** (formerly with CVM at CMAST) have since relocated to Mobile, AL. Kristin is now Research Scientist with the FDA on Dauphin Island, AL. Chris has accepted a job as Research Technician with the University of Southern Mississippi's Gulf Coast Research Laboratory in Ocean Springs, MS.

The following is a short list of some former CMAST graduate researchers and what they are up to now.

Nate Bacheler, Ph.D., Biology, '08, Assistant Professor, Univ. of Wisconsin, Green Bay, WI

Geoff Bell, Ph.D., MEAS, '08, Instructor and Visiting Asst. Prof. UNC-Chapel Hill

Dana Bethea, M.S. Zoology, '03, Fishery Biologist, Shark Pop NOAA Fisheries Service, FL

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WHERE ARE THEY NOW?

Meaghan Darcy, M.S., MEAS, '03, Ph.D. student, Univ. of British Columbia, Vancouver, BC

Pamela Govett, DVM, ACZM, Zoological Medicine, '04, Assistant Professor, Western Univ. of Health Sciences, College of Veterinary Medicine, CA

Eric Johnson, Ph.D., MEAS '04, Research Scientist, Smithsonian Environmental Research Center, MD

Nathalie Reyns, Ph.D., MEAS '04, Associate Professor, University of San Diego, CA

Steve Searcy, Ph.D., MEAS '05, Assistant Professor, University of San Diego, CA

Chris Taylor, Ph.D., Zoology, '07, Research Scientist, NOAA/Beaufort

Jack Tuomikoski, M.S., Zoology '04, Fisheries Biologist, US Geol. Survey, OR

Allison Tuttle, DVM, ACZM, '07, Staff Veterinarian, Mystic Aquarium, CN

CMAST University Connections

College of Agriculture and Life Sciences
harvest.cals.ncsu.edu/indexmain.cfm

Environmental and Molecular Toxicology
www.tox.ncsu.edu

Food, Bioprocessing and Nutrition Sciences
www.ncsu.edu/foodscience/

Biology
www.cals.ncsu.edu/biology

College of Physical and Mathematical Sciences
www.pams.ncsu.edu

Marine, Earth and Atmospheric Sciences
www.meas.ncsu.edu

College of Veterinary Medicine
www.cvm.ncsu.edu

Clinical Sciences
www.cvm.ncsu.edu/docs

CMAST WORKS THE SEAFOOD FESTIVAL

CMAST provided a display at the NC Seafood Festival held October 2-4 in Morehead City. Spearheaded by graduate student Sarah Friedl, the display was similar to what's found in a fish market - a tank filled with ice which held many species of fish, shellfish and more. However, these fish weren't for sale, they represented the research being done at CMAST. Spot, blue crab, black sea bass, bluefish, oysters, trigger fish, spotted sea trout and more were on display. Signs were put in the tank to describe the research being conducted, where the species is found, its life history, season for fishing or harvesting and stock status. Faculty, students and staff were on hand to talk about the research.

Special thanks to CMASTs Paul Rudershausen, Tyler Averett, Ray Mroch, Tim Ellis, Jim Morley, and also Sharp Kemp, Fisherman Tom Burgess, and Chris Conklin of Blue Ocean Seafood Market for catching, seining, and/or providing the samples used at the event. It wouldn't have been a success without their able assistance and generosity.

Hello - anybody in there?

CMASTs Sarah Friedl talks up fish.

Octopus, not for the faint of heart.

CMASTs Tim Ellis answers questions.

CMASTs Warren Mitchell shows the tentacles.

You shoulda seen the one that got away!

Photos by Sarah Friedl