NC STATE UNIVERSITY

CMAST COMMUNICATOR

THE CENTER FOR MARINE SCIENCES AND TECHNOLOGY

discovering coastal solutions

VOLUME 2 NUMBER 1 FALL 2008

Chemicals in the Marine Environment

Spotlight on research conducted by Dr. Patricia McClellan-Green of the NCSU Department of Environmental and Molecular Toxicology

Oysters await testing in toxicology lab.

The oyster - to some it's a primitive bivalve, a simple mollusk, a filter feeder that can clean estuarine waters, or even slimy seafood near the end of a food chain. But for many, oysters are a gastronomic delight, and still others, an economic livelihood. But to Dr. Patricia McClellan-Green, expert in environmental toxicology at CMAST, you could say the world is her oyster - at least during her latest research.

Oysters hold vital information to understanding chemical effects on the marine environment. McClellan-Green's research using oysters primarily focuses on the study of natural and man-made compounds in the marine environment and their effects on the metabolic activities of marine organisms - or rather the chemical reactions within the organism that allow it to grow and reproduce. Her passion in research is determining how such mechanisms work within an organism and what outside forces may affect that process. This is a far cry from her early research in graduate school with mammalian and human systems. She turned the tide, so to speak, after moving to the coastal area 20 years ago and began focusing on scales and shells rather than fur and skin with her toxicological research on a variety of marine life - mud snails, shrimp and fish to name a few.

Oyster bed

Some specific examples of Dr. McClellan-Green's recent research includes examining the effects of pesticides, anti-fouling agents (used on marine crafts), and PAHs (polycyclic aromatic hydrocarbons), a petroleum by-product, on oyster growth and reproduction in the waters surrounding Beaufort, NC. Oysters are a great study organism as they filter large amounts of water and are stationary - essentially

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CURRENT EVENTS

CMAST SEMINAR SERIES • ROOM 205

Friday, September 19 • 11:00 am
Scott Baker
NC Sea Grant Fisheries Extension Specialist
"What Does Sea Grant Do? Fisheries Extension in Southeastern NC"

Friday, October 3 • 11:00 am
Dr. Jeffrey Macdonald
Codirector NCSU/UNC/NOAA MRI Facility
"Magnetic Resonance Imaging (MRI) in Marine Sciences"

Friday, November 7 • 11:00 am
Dr. Thomas Lankford
University of North Carolina Wilmington
"Effects of Beach Nourishment on Fish Nursery Function of Ocean Surf Zone Habitats in Southeastern North Carolina"

Friday, November 14 • 11:00 am
Dr. Ami Wilbur
University of North Carolina Wilmington
"Genetic Considerations in Shellfish Restoration"

November 21 • 11:00 am
Dr. David DeMaster
North Carolina State University
"Examining feeding strategies in Antarctic deposit feeders to understand carbon cycling at the sea floor and high latitude responses to climate change."

CMAST DISTANCE/ONLINE CLASSES

TOX 201* • Distance Education
Poisons, People and the Environment, Dr. Patricia McClellan Green
Introduction to the fascinating world of chemical poisons including their many and varied effects on people as well as the environment. Learn how and why poisons have played an important role in history, how to critically evaluate the chemical risk information reported in the media, and the underlying principles of "the basic science of poisons."

FS 354* • Online Course
Food Sanitation, Dr. David Green
This online, self-directed course provides an introduction to hygienic practices, requirements for sanitation programs and modern sanitation practices in food processing facilities.

NCSU Departmental Credit Course. Visit www.ncsu.edu for enrollment information.

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From the Director

There's no doubt chemicals are necessary for today's world. Without them many of mankind's advancements wouldn't be possible - pharmaceuticals for health and beauty, pesticides for disease control, insecticides for greater food supplies - and the list goes on. However, with the use of chemicals come serious considerations about their effect on the environment - humans, animals and plants alike.

In this issue of *CMAST Communicator* we focus on the NCSU Department of Environmental and Molecular Toxicology's work in Marine Toxicology - in particular the work of CMASTs Dr. Patricia McClellan-Green on the biochemical and health effects of exposure to man-made compounds and contaminants on oysters in the marine environment.

This issue also highlights the critical role of philanthropy in helping to inspire and energize our efforts in providing coastal solutions. A variety of exciting opportunities for you to combine your passion with ours for making the world a better place may be found on our web site www.cmast.ncsu.edu.

Lastly, we update you on many of the diverse research, education and community activities by CMAST faculty, students and staff, including hosting our US Congressional Delegation for hands-on activities in the marine sciences, our CMAST Summer Fellows and Intern Programs, a visit to the area by NCSU Basketball Coach Sidney Lowe and the Wolfpack Caravan, new art on the walls of CMAST, as well as an impressive range of meetings and workshops hosted ranging from an international fisheries technology conference to a local Kayak anglers workshop. 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

SPOTLIGHT ON CMAST FACULTY AND NCSU DEPARTMENTS (con't.)

serving as local water quality sentinels. One study determined there was a marked, negative impact on the growth and reproduction of oysters in some areas due to contamination from toxic substances in the water, even though levels of the chemicals found in the water were within allowable limits set by the Environmental Protection Agency (EPA).

Another study, funded by the NC Sea Grant Program and in collaboration with Dr. Amy Ringwood of UNC Charlotte, examined the effects of low dissolved oxygen, often called hypoxia, on enzyme functions of oysters.

Generated by excess nutrient inputs, hypoxia has a chronic impact on shallow waters that is increasing worldwide. Phenoloxidase is an enzyme that is in an oyster's immune system. Drs. McClellan-Green and Ringwood found that when exposed to hypoxia and contaminants, the metabolic system of the oysters was stressed, causing a lowered immune response. When oysters have a lowered immune system it makes them susceptible to diseases and infection. When oysters aren't healthy, they can't reproduce effectively and the population dwindles. With smaller populations of oysters, estuarine waters suffer because of the loss of the tremendous filtering capabilities of oysters.

In a parallel project, Dr. McClellan-Green is studying the effects of pharmaceuticals, personal care products, and anti-

Samples being taken from oyster.

fouling agents on oysters. The chemicals being studied are Triclosan and Tropolone (antibacterial agents), SDS (found in shampoos), and Triton X-100 (a surfactant). The work is conducted on a cellular level using hemocytes extracted from the oysters. Experiments using minuscule amounts (millimolar concentrations) of three of the four chemicals produced a depression in the immune response of oysters. Triton X-100 is the exception that is showing an increase in the immune response of oysters by activating a pro-enzyme. Additional work in this area will continue, increasing the exposure times, working with the entire organism and looking at the impacts of other common personal care products on oyster metabolism.

Dr. McClellan-Green is also known for her work on the effects of Aqueous Fullerenes (aqua-nC60) on different life stages of fish. Fullerenes are nanoscale particles of carbon whose structure closely resembles that of a soccer ball. McClellan-Green and Ph.D. student Michelle Blickley found that aqua-nC60 stimulates the oxidative stress response in fish and that increased antioxidant defenses can provide some physiological resistance to the effects from exposure to low concentrations of these materials. She is waiting to find out what happens with higher concentrations.

By examining the molecular and biochemical pathways involved in endocrine production, metabolism and development, Dr. McClellan-Green hopes to discover why what is considered safe, or non-lethal, amounts of contaminants still pose risks to humans and the marine environment.

For more information on the work of Dr. McClellan-Green contact her at 252.222.6367 or pdmcclel@ncsu.edu

Dr. McClellan-Green (r) speaks to congressional staffers about oyster research.

CMAST and the Philanthropic Spirit

What's your passion? Are you an avid fisherman and want to help conserve fisheries and their habitats? Did you have a great teacher that inspired you to help educate our youth? Are you excited about the many solutions for addressing sustainable drinking water, food and energy? These and many related passions inspire and motivate faculty, staff and students at NC State University's Center for Marine Sciences and Technology to help make the world a better place, and we invite you to join us!

The spirit of collaboration and giving feeds the soul by expressing our concern for and our willingness to do something practical on behalf of our fellow citizens and the world. The philanthropic spirit helps to further inspire and energize solutions to problems by combining creative ideas with the resources to realize them. A very simple example at CMAST is the education of youth. Our faculty and staff provide hands-on educational opportunities for undergraduate and graduate students primarily through state- and grant-supported funding. As state support declines in the face of a retracting economy, programs such as this are eliminated. This past summer many of our faculty pooled resources to provide a variety of hands-on experiences for a rising high school junior, Ms. Mari Hawkins (*see related article on page 4*). This educational "experiment" with Mari was a big success, and we hope that through your philanthropic spirit we will be able to provide this hands-on research opportunity at CMAST to more high school students in the future.

When you make a gift to CMAST at NC State University, you are supporting a dynamic organization committed to the highest-quality research, teaching and public service. Our faculty and students are engaged in exciting research that runs the gamut from curiosity-driven "pure science" to applied research that addresses some of society's greatest challenges. At the same time, we continue to explore new teaching methods and technologies. While we receive a portion of our revenue from tuition and government funding, we rely on the support of individual and institutional partners to achieve our goal of producing the next generation of science leaders for North Carolina, the nation and the world. We invite you to combine your passion with ours for ***discovering coastal solutions***.

CMAST VISITORS

Congressional Staff Visits CMAST

Staff members of North Carolina's Congressional Delegates toured the CMAST facility last summer as part of a two-day engagement and inquiry session. They wanted to learn firsthand about the collaborative research underway among NCSU, UNCCH and UNCW related to climate change, ocean observing, ecological restoration, applied fisheries, seafood technology, and marine animal health care.

Staff for Senators Dole and Burr, as well as Congresswoman Fox, and Congressmen Coble, Hayes, Jones, McIntyre, Price and Miller participated in a variety of hands-on activities which included: Applied Fisheries Research with **Dr. Jeff Buckel**; Sustainable Shorelines with **Meg Rawls**, Biology Instructor Carteret Community College; Seafood Technology, Sustainability and Human Health with **Dr. David**

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Congressional staff visit the Seafood Laboratory Pilot Plant to hear about traceability and sample a smoked trout aquaculture product from NC..

Sea Grant's Brian Efland (r) and Bob Hines (far left) demonstrate and discuss the use of circle hooks versus j-hooks in fishing.

Staffers view loggerhead turtle up close.

Green; Sea Turtle and Marine Mammal Health with **Dr. Craig Harms;** and Environmental Toxicology and Health with **Dr. Patricia McClellan-Green**. Staffers observed Dr. Harms perform a "check-up" on a live sea turtle recovering from pneumonia, brought from nearby NC Aquarium at Pine Knoll Shores.

This visit by NC's delegation was coordinated by the federal relations liaisons for the UNC-system, as well as NCSU and UNC-CH and gave our marine scientists the opportunity to show the exciting work being conducted on coastal solutions, with discussion on ways in which the NC delegation can help support marine programs.

Sidney Lowe Visits with Wolfpack Caravan

Wolfpack Alumni came out in force when Head Basketball Coach Sidney Lowe

came to Carteret County last summer. The "Wolfpack Caravan," a Wolfpack Club-sponsored tour that included Lee Fowler, NCSU Athletic Director, and Wolfpack Club Executive Director Bobby Purcell, tours the state each year to generate excitement for Wolfpack Athletics and provide an opportunity for questions and answers with NC State coaches. The Caravan was co-sponsored by the Carteret County NCSU Alumni Association and included a social, dinner and fund raiser at the Dunes Club in Atlantic Beach.

Dr. David Eggleston, CMAST Director, addressed the group, introducing them to the work at CMAST and fund raising efforts underway. Eggleston also held a raffle from CMAST with the prize being a day-long, Gulf-Stream trip fishing alongside CMAST scientists evaluating circle-hook versus j-hook rigging in recreational fishing of offshore sportfish (See *CMAST Communicator* Vol. 1 No. 4 for complete article on circle hook research.)

CMAST RESEARCH

CMAST Summer Fellows and Intern Programs

Four college undergraduates were chosen to participate in the 2008 CMAST Summer Fellows Program: **Kirk Smith**, NCSU Junior studying Microbiology in the Food, Bioprocessing and Nutrition Sciences Department; **Joshua Wiggs**, NCSU Junior, studying Marine Science and Zoology in CALS and PAMS Colleges; **David Bennett**, UNCCH Sophomore, studying Journalism; and **Morrell Fox**, 2008 West Carteret High School graduate and Freshman at UNCW studying Biology. Fellows program coordinator Dr. Patricia McClellan-Green said of this year's students, "They all did an exceptional job and worked very hard. I'm proud of all of them."

CMAST Summer Fellows. Standing l to r: Kirk Smith and Morrell Fox. Seated l to r: David Bennett and Joshua Wiggs.

Fellows are assigned to various labs within CMAST and work on projects for a ten-week period each summer. Smith was assigned to the Seafood Laboratory and worked with doctoral student Kristin Bjornsdottir on a comparison of histamine detection kits. He commented that he learned more about how actual research works and made many contacts with the university as well as industry. Wiggs participated in a project on the settlement of Eastern oysters in Pamilco Sound with Dr. David Eggleston. Wiggs remarked that research is not easy, but it was fun. He was unsure before about his choice of major, but that this experience helped to validate his reasons for what he hopes to accomplish in the future.

Bennett worked with Dr. McClellan-Green for a second summer on toxicology research. His project was titled "Measuring Fullerenes in Environmental Matrices." He enjoyed learning to use laboratory equipment and perform higher level experiments. He hopes to put this experience to use toward his goal of becoming a writer for science journals and magazines. Fox was also in his second year at CMAST, his first year was as the AFS Hutton Fellow as a high school student. He worked with Dr. Jeff Buckel and doctoral student Kyle Adamski on Gag Grouper Research. His experiences included learning how to extract odiliths, studying sea grasses and how to pilot a boat.

In addition, **Mari Hawkins**, a junior at West Carteret High School, served as a sort of educational "experiment," in which she worked for two weeks in each of four research programs at CMAST. This was a tremendous opportunity for a rising junior when most students Mari's age are searching for their first job. Her internship was considered experimental in that it was unclear how a two-week rotation among research programs would work.

Hawkin's work encompassed a variety of projects including: dissecting marlin, tuna, wahoo, and dolphin stomachs in the Zoology lab; extracting hemocytes from oysters in the Toxicology Lab; studying aquaculture production and learning lab techniques in the Seafood Laboratory; and tagging blue crabs, using a hydrophone to track crabs and boat piloting with the MEAS Marine Ecology Program. Hawkins said that this internship was a "fantastic opportunity" to get hands-on field and lab experience in marine science, but would want more time in each program.

Summer intern Mari Hawkins with Dr. Eggleston..

CMAST hopes to expand this program next summer to provide opportunities to more rising high school juniors with this experience.

For more information on applying for a fellowship, visit the CMAST web site at www.cmast.ncsu.edu.

CMAST OUTREACH

CMAST Adopts Local Artists

Member artists of the Arts Council of Carteret County (ACCC) are displaying their work in the halls of CMAST though a program called Adopt-an-Artist. CMAST joined the program in late summer 2008 in an effort to not only brighten the lobby and public areas of the CMAST building, but to take part in a community effort to promote local artists.

Several area artists have hung work at CMAST including Sally Anger, Pat Warnke, Peter Roulan, Meg Forward and Linda Anderson. Sally Lumpkin, ACCC Treasurer and program coordinator said, “We are very pleased that CMAST is taking part in this program. With their participation we now have over 30 venues in the area showcasing local artists’ work.”

CMAST chooses the work they wish to display when available. Artists visit and hang their work for a two-month period and then rotate to other locations in the county. Visit the ACCC web site http://accc.wordpress.com/ for more information.

CMAST Director David Eggleston assists Sally Anger in hanging two large paintings in the building lobby. Ernie Yeager assists.

Sea Grant Kayak Anglers Workshop

North Carolina Sea Grant sponsored the “Coastal Kayak Angling Workshop” on Saturday, September 27, 2008 at the CMAST building. Over 30 participants learned about the latest tackle, techniques and safety requirements for kayak angling from professional fishing guides.

Top: Participants view the latest in kayak angling equipment. Bottom: Demonstration of fishing from a kayak behind the CMAST building.

Sea Grant’s **Brian Efland** gave an overview of kayak fishing in North Carolina as well as low impact and ethical angling practices. CMASTs **Tim Ellis**, Fisheries and Wildlife doctoral student, provided information on current research in recreational fisheries, including speckled trout and red drum tagging projects.

Boat and gear demonstrations were provided by Great Outdoor Provision Company, Heritage Kayaks, Hurricane Kayaks and Wilderness Systems.

Future kayaking workshops are being planned for Spring 2009. Contact Brian Efland for information at brian_efland@ncsu.edu or 252-222-6314.

Fisheries Technology Conference Held

North Carolina State University, North Carolina Sea Grant, UNC Wilmington and the North Carolina Biotechology Center hosted the 8th Joint Meeting of the Society of Seafood Technologists (SST) and Atlantic Fisheries Technology (AFT) Conference in conjunction with the First North Carolina Biotechnology Symposium, held October 19-22 in Wrightsville Beach. Maximizing Value from Sustainable Ocean Resources was the theme of the conference. The event was organized by NCSU Seafood Laboratory.

Over 150 people participated in the conference, representing 14 US states as well as Canada, Denmark, England, Iceland, Ireland, Italy, New Zealand, Norway and Sweden. The event opened with a live video address from Italy by Grimur Valdimarsson, Director of the Fish Products and Industry Division of the Food and Agriculture Organization (FAO) of the United Nations.

SST and AFT industry topics were the focus on days one and two, with experts presenting information in five different sessions: International Trade and Sustainable Fisheries; Developments in Aquaculture; New Technologies and Tools for Enhancing Seafood Quality and Safety; Health, Convenience and Processing Technology; and Emerging Regulatory Issues. Over twenty-five presentations were made.

On day three, the topic switched to Marine Biotechnology in North Carolina. Academic, industry and government representatives listened to 18 speakers in four session topics on: Bio-Energy - Fuel

Barry Nash, conference chair, makes opening remarks as the conference gets underway.

Joseph Reardon, (l) Director, Food and Drug Protection Division, NCAG&CS presents luncheon address to SST and AFT. E. Norris Tolson (r) President and CEO of NC Biotechnology Center addresses the Marine Biotechnology Symposium.

sources from the sea; Bio-Processing - Converting seafood discards into value-added products; Bio-Discovery - Natural products with pharmaceutical potential, and Bio-Business - Industrial applications of science.

Conference organizers were **Barry Nash**, Chair, NC Sea Grant at CMAST, Scott Baker, Conference Secretary, NC Sea Grant at UNCW. Marine Biotechnology Symposium cochairs were **David Green**, NCSU Seafood Laboratory and Dan Baden, UNCW Marine Science Center.

Elementary Students Land at CMAST

CMAST hosted White Oak Elementary fifth-graders for a second year as they studied their unit on marine habitats and longitude and latitude. Fifth grade teacher Amy Riley coordinated the program with members of **Dr. Jeff Buckel's** laboratory at CMAST. Nearly 100 students visited over a two-day period to learn about sea life and GPS navigation. The event included a slide presentation on latitude and longitude in the marine environment, geocaching (treasure hunts using handheld GPS units), and beach seining.

Top: Fifth graders wait to observe creatures from the sea. Middle: Students work with hand-held GPS devices to find "treasure" with CMASTs Ray Mroch. Bottom: CMASTs Tyler Averitt (l) and Jim Morley (r) pull a seine net to the shore.

Teachers from White Oak Elementary included Jessica Barth, Dana Edgren, Wendy Johnson, Karen Creech and Wyatt Lee.

Members of the Buckel lab - **Kyle Adamski, Tyler Averitt, Tim Ellis, Jim Morley** and **Ray Mroch** helped present an exciting program for the students.

CMAST EDUCATION

Bluefin Tuna Workshop Held

George Leone (l) and Brian Efland (r) demonstrate proper handling of tuna to optimize value and meet FDA requirements at a recent workshop. Leone is currently working with NC Sea Grant researchers to determine how handling tuna affects internal cooling rates, a project funded through the Sea Grant Fisheries Resource Grant program.

A collaborative workshop on Bluefin Tuna Safety Requirements, Regulations, Enforcement and Post-Catch Handling was held October 22 from 6-9 p.m. Sponsors included NC Sea Grant, US Coast Guard, NC Division of Marine Fisheries, NOAA , and National Marine Fisheries Service.

The workshop is presented annually to help those targeting giant bluefin tuna commercially decipher some of the complex regulations in the fishery and to learn and understand safe handling techniques. Information from a NC Fisheries Resource Grant was provided with regards to current research from the NCSU Seafood Lab on cooling rates.

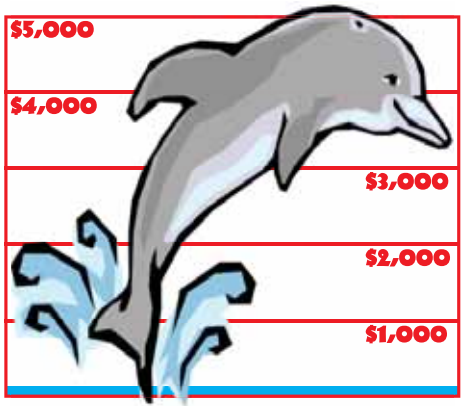
For more information about the future workshops planned contact **Brian Efland**, Sea Grant Marine Conservation and Enterprise Development Specialist, at 252-222-6314 or brian_efland@ncsu.edu

Fish Health Management Course

CMAST hosted a course on Fish Health Management October 9-11, 2008 presented by Dr. Greg Lewbart and **Dr. Craig Harms** of the College of Veterinary Medicine, Clinical Sciences. The course, intended for veterinarians and non-veterinarians alike, covered fundamental principles of ornamental fish and aquatic invertebrates management and medicine. Thirty participants took part in the two-day class which included lectures, laboratory work, and a nighttime, behind-the-scenes meeting at the NC Aquarium at Pine Knoll Shores.

Additional faculty and staff from NCSU CMAST, Marine Sciences, and the Environmental Medicine Consortium presenting the course included Jay Levine, Ed Noga, **Michael Stoskopf**, Cliff Swanson, **Chris Butler** and Shane Christian.

CMAST OPPORTUNITIES



Dolphin Skeleton Project Update

Fund raising efforts have started for the preservation and display of a striped dolphin skeleton for the CMAST lobby. (See Vol. 1 No. 4 for complete article.) Approximately $5000 is needed for the restoration. All contributions are tax deductible.

To contribute, make checks payable to PAMS Foundation and mail to Dolphin Project, CMAST, 303 College Circle, Morehead City, NC 28557.

CMAST STAFF NEWS

Doctoral Student Receives Award

Michelle Blickley, Marine Toxicology doctoral student, was awarded the North American SETAC Proctor and Gamble Fellowship for Doctoral Research in Environmental Science November 16, 2008 at the National SETAC meeting in Tampa, Florida. This prestigious award is only offered to one scholar in North America every three years. It is awarded on a three-year rotation to candidates in North America, Europe/Africa, and Asia Pacific/Latin America.

Blickley (l) with Annie Weisbrod (r) of the Proctor and Gamble Company, at the National SETAC meeting in Tampa, Florida.

Blickley was chosen for the award based on her current research project "Investigating the Bioavailability and Toxicological Effects of Engineered Nanomaterials, Quantum Dot, in Marine Teleosts."

The award provides funding for 2009 through the end of her doctoral studies. She received her BS degree in Marine Science in 2003 at the University of South Carolina at Columbia and is completing her graduate work through Duke University. Her NCSU co-advisor is Dr. Patricia McClellan-Green of CMAST.

SETAC (Society of Environmental Toxicology and Chemistry) is a not-for-profit, worldwide professional organization comprised of individuals and institutions dedicated to the study, analysis and solution of environmental problems, the management and regulation of natural resources, research and development and environmental education.

WHERE ARE THEY NOW?

Dr. Allison Tuttle, Staff Veterinarian and Director of Animal Care, Mystic Aquarium and Institute for Exploration, Mystic, CT, recently became board certified by the American College of Zoological Medicine.

Dr. Nate Bacheler, former CMAST graduated student researcher in Zoology, relocated to Oregon where he is a postdoctoral research assistant in the College of Oceanography and Atmospheric Sciences at Oregon State University in Corvallis. He'll be working on the distribution of larval fishes in the Eastern Bering Sea, Alaska.

CMAST College 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/

Zoology
www.cals.ncsu.edu/zoology

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/index.html

Population Health and Pathobiology
www.cvm.ncsu.edu/dphp