History: The university's focus on marine science has a history that spans over 30 years. In the 1970s, what is now CMS began as the Marine Biomedical Institute, then in the 1980s was called the Center for Marine Science Research (CMSR). After the Master of Science in Marine Science graduate degree was adopted in 2000, the center's name was shortened to the Center for Marine Science (CMS).

The turn of the new century brought increased marine science activity at the state, national and international levels, and in response to this a new 75,000 sq ft $17.5 million facility was completed in 2000. An operations wing of 25,000 sq ft was added in 2008. This main facility in the Myrtle Grove area of Wilmington is directly accessible from the Intracoastal Waterway, has docking facilities, and currently offers 100,000+ sq. ft. of net indoor space. The recent completion of the 16,000 square foot Oyster Hatchery addresses oyster restoration needs in the state. Another addition, the 69,000 square foot Marine Biotechnology Building MARBIONC, is slated for completion in 2012. This latter building has as its central focus economic development through translational research and development and it is a public-private partnership building with lease requirement of all tenants.

With the advent of UNCW’s millenium campus plan, the Center for Marine Science became affiliated as CREST South of the plan.
The Center for Marine Science is an interdisciplinary program populated by faculty and students from primarily 4 departments. In addition to those listed, faculty from Environmental Studies, the Cameron School of Business, and the Watson School of Education all act as participants members.

A support staff of technicians, research specialists, research faculty, and operations professionals all serve the faculty and students of the program. Over 400 undergraduate students call marine science their home degree, and 112 graduate students from several different departmental masters and doctoral programs.

An internal advisory committee comprised of the chairs of the above-mentioned departments, and 5 marine science faculty elected from the main campus (2) and from CMS residents (2), and a research faculty member (1) serve to advise the CMS administration on all matters of concern, including but not limited to strategic plan, pilot project review and award, equipment proposal review and award, faculty meeting agendas, and other items of interest as they develop. IAC members are elected or reappointed each August.
• In the time span of 1998-2004, the extramural grants and contracts awards grew exponentially. Beginning in about 2004, CMS awards leveled off and took a more arithmetic growth, fostered in parts by the continual injection of pilot project funds to gather preliminary data in preparation for major grant proposals.

• Over the same time period, Center investigators were encouraged to participate in interdisciplinary activities that would couple expertise, yield new knowledge, and make their collective work more marketable. The result was a decrease in the number of awards but the overall yield more than compensated for the reduction in awards.

• In FY 2010, a decrease in dollar yield was observed, a drop that coincides with the economic depression in the country. Another reinvestment in pilot projects and cost sharing boosted the yield back up (so far) in the remainder of FY 2011.

• Each program illustrated above has been in operation for more than a decade with the exception of CIOERT which is 3 years old. Individual annual budgets range from $2-5 million.

• The present research portfolio measures just under 65 active grants and $53.8 M
• CMS is an interdisciplinary program and supports the activities of each graduate program in the MS and PhD arena.

• Only the MS in Marine Science is a CMS specific academic program.

• UNCW has the distinction of being the largest Masters level Marine Sciences program in the USA.

• As illustrated above, the department of Biology and Marine Biology administer 2 marine programs, Chemistry and Biochemistry has a masters specialty in marine science as do Geology and Geography and Environmental Studies.

• The department of PoliticalScience is implementing a Marine Policy MS, and CMS has in process a permission to plan request for the PhD in Marine Science.
fast facts

CENTER FOR MARINE SCIENCE

RESEARCH

- Recognized as a national site for conducting research that contributes to understanding environmental processes and problems – particularly in the area of harmful algal blooms
- Graduate education in marine science: focus in biology, chemistry, geology and physics
- Unique pilot project program to ensure continued cutting-edge science – high risk, high payoff
- Research funding has grown from approximately $9 million in 2001 to more than $38 million active in 2010

HISTORY

- Marine science focus at UNCW spans over 30 years, across departments and schools
- Started as Marine Biomedical Institute in 1970s and renamed the Center for Marine Science Research (CMSR) in 1980s
- After the Master of Science in Marine Science was added in 2000, the name was updated to the Center for Marine Science
- Focus on collaborative interdisciplinary programs at state, national and international levels
- Myrtle Grove Facilities: directly accessible from the Intracoastal Waterway with docking facilities and facility cores for shared major equipment
- Over $50 million in facilities built using endowment, university, state, and federal sources
- A distinct Business of Biotechnology program, started in 2005, offers post-doctoral fellows the chance to work on the most advanced research in marine biotechnology while getting their Master of Business Administration degrees at UNCW

AREAS OF EXPERTISE:

Marine Biotechnology • Biodiversity
Natural Products • Oceanography
Harmful Algal Studies • Coastal Ecology
Estuarine and River Ecology
Coral Reef Ecology • Fisheries Biology
Marine Mammals

UNIVERSITY OF NORTH CAROLINA WILMINGTON
CENTER FOR MARINE SCIENCE
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I. Executive Summary

The UNCW Center for Marine Science strives to be a world-class facility that supports multidisciplinary approaches to research, education, technology transfer, public service and regional engagement in the marine sciences. Its mission is to promote basic and applied research, education, and public service in marine science by providing a state-of-the-art physical facility. Historically, marine science has been a focus area at UNCW, informally called the marine science program, which continues to be characterized by rapid growth and high productivity.

The strength of marine science at UNCW results from a common emphasis on marine science within the traditional science departments and cooperative interdisciplinary activities. The Center for Marine Science has also played a pivotal role in the growth of marine science to the point where now any strategic plan for the evolution of the Center must address issues of the broader marine sciences program at UNCW. Therefore, this strategic plan not only sets priorities and establishes goals, objectives and strategies for the Center; it establishes goals for the broader marine science program in so far as those goals are intimately linked to the growth and evolution of the Center.

The strategic plan is organized into five areas:

1. Administration, Infrastructure and Services
2. Research
3. Education
4. Service and Regional Engagement
5. Technology Transfer

We have established numerous goals in each area, most of which have indefinite completion dates because marine science is a dynamic rapidly evolving field and the goals represent our continuing commitment to the pursuit of excellence. However, we have also established two priority goals in each area that we believe should be completed within the next 2-3 years.

Priority Goals:

Administration, Infrastructure, and Services:
1. Formalize the Marine Science Program at UNCW
2. Establish a marine instrumentation core facility with technical support staff to operate and maintain instrumentation

Research:
1. Expand the CMS post-doctoral program by adding more post-doctoral fellowships
2. Reinstitute the Pilot Project and Instrumentation Acquisition Program

Education:
1. Establish a Ph.D. in Marine Science at UNCW
2. Implement and fully develop the articulation agreement between UNCW and the University of Southampton (UK)
Service and Regional Engagement:
1. Establish the Cape Fear Region Marine and Coastal Cooperative
2. Identify funding and begin planning a visiting scientists residence facility at CMS

Technology Transfer:
1. Build a marine biotechnology building adjacent to CMS
2. Establish a Biotechnology Center of Innovation at CMS with a grant from NC Biotech

II. Background for Strategic Planning at the Center for Marine Science

Introduction

Vision

The UNCW Center for Marine Science strives to be a world-class facility that supports multidisciplinary approaches to research, education, technology transfer, public service and regional engagement in the marine sciences.

Mission Statement

The mission of the Center for Marine Science is to promote education, basic and applied research, and public service in all fields of the marine sciences. The Center provides facilities and support primarily for faculty and students from the science departments at UNCW, but also for associated organizations and visiting students and scientists conducting marine science research. By providing a state-of-the-art facility, the Center fosters research programs of the highest quality, thereby enhancing the educational opportunities and experiences for students, and serving as an important regional node for technology transfer and public service.

Administration and Facilities at CMS

Appendix A gives a detailed description of the current administration and organization of the Center for Marine Science and of the facilities available there.

The Center for Marine Science Strategic Planning Process

In order to progress toward its vision and accomplish its mission, the Center maintains a long-term strategic planning and review process aimed at ensuring excellence in marine science research, education, service, and technology transfer. The Center for Marine Science strategic plan is developed and implemented in concert with guidance from several external sources, which include the Board of Governors Strategic Directions, the University of North Carolina at Wilmington Mission Statement, and UNCW Strategic Vision. Excerpts from these references are provided in Appendixes B-D. In addition, we seek and foster broad-based communication within CMS and with the entire marine sciences community at UNCW. Open and inclusive communication with key constituents and stakeholders is an essential priority.

As we develop our shared vision for the future of the Center, we must identify and build on our combined strengths. While this process necessarily entails some personal introspection, our goal is to be inclusive, not exclusive. We trust that through a collaborative approach, we will
develop a strategic plan that will be good for the Center and the University, and with which we can all align our efforts.

Strategic Planning is a process, not an event. As such, the process is itself an important vehicle for communication among the many individuals, academic disciplines, and partner organizations that make up CMS and the marine sciences community at UNCW. This strategic plan will be a living document that guides both long-term and daily activities. It takes the Vision (future state, or “there”) and the Mission (“here”) and connects them with priorities, goals, objectives and strategies (to get us from the “here” to the “there”). While the plan looks forward five years, we continually review our progress, make mid-course corrections when necessary, and update the plan as necessary. The following is a brief overview of the process for reviewing, implementing, and finally, integrating the strategic plan into the Center’s daily activities.

**Planning Process:**

1. Initially, an ad-hoc committee, the CRISP (Center Research Investigators for Strategic Planning) appointed by the CMS Director reviewed the previous strategic plan and produced a draft of a new strategic plan with updated and new priorities, goals, objectives and strategies.

2. The CRISP draft was forwarded to the Director who then sent the draft to the UNCW administration, the CMS Internal Advisory Committee, and the broader UNCW marine sciences community for review and comment.

3. Reviews and comments were returned to the CRISP committee which produced a revised draft that it sent to the Director who forwarded to the CMS IAC.

4. After review and approval by the CMS IAC, the draft was returned to the Director who then assembled the larger UNCW marine sciences community to consider and approve a final draft of the strategic plan.

5. The priorities, goals and objectives of the new approved CMS Strategic Plan will then be sorted and distributed to the responsible individuals, CMS standing committees, or newly formed ad hoc committees which will establish a plan to accomplish the new goals and objectives.

6. Each of the individuals or committees will regularly assess the progress toward reaching the new goals and make semiannual reports at regular CMS faculty/staff meetings on their progress.

**Marine Sciences at UNCW**

Historically marine science has been a focus area at UNCW that continues to be characterized by emphasis on marine science education at both the undergraduate and graduate levels, research productivity in diverse areas of marine science, and service at local, state and
Table of Contents

• Paul Reinmann  
  Assistant Director for Fixed Operations & Planning

• Strategic Building Plan  
  2020

• Core Resources  
  Spectroscopy  
  Water Quality and Nutrient Analysis  
  DNA Sequencing  
  Running Seawater  
  Ocean-Going Operations & Equipment  
  Stable Isotope Mass Spectrometry  
  Microalgal Culture
Paul F. Reinmann, PE  Assistant Director, Fixed Operations & Planning, CMS

Facilities Expertise: Licensed Mechanical Engineer, Licensed Contractor, Involved with all design and construction of new facilities and maintenance of existing facilities at The Center for Marine Science 70 acre Myrtle Grove and Wrightsville Beach campuses.
Principal funding Agencies: NIST (DOC) grant of $15M for MARBIONC $30M project.

Large project (>500,000) participation:
• Member of design and engineering teams for all large building projects focusing on specific needs of our researchers and support groups.
• Oversee construction administration with UNCW Facilities representative. Main focus is quality of construction, coordination with operating facility and daily involvement to ensure final project meets requirements.

Small project (<500,000) participation:
• Provide design and construction administration, at times with project manager from UNCW Project Mgt.
• Facilities include those at CMS-MG and CMS-WB

Facilities Maintenance support:
• As a senior engineer provide oversight of all operating equipment and infrastructure supporting three research buildings and outdoor facilities presently at CMS. Ensure any corrective maintenance is timely performed.
  • Buildings total over 110,000 Sq Ft indoor space at CMS-MG.
  • Outdoor areas include running sea water aquaculture areas at both CMS-MG and WB.
• Identify when large repairs are needed such as pier repairs, hopefully soon.
• Represent CMS for needed service expansions such as ITSD broadband/microwave implementation, hopefully soon.
Master Planning Meeting
Faculty Input Sessions
12 Nov 2010, 16 Nov 2010

• Center for marine science carried out one administrative consult meeting and 2 faculty meetings prior to Master planner mtg on 11/17/10
• Assessment priorities based on Internal Advisory Committee final rankings and consideration of suggestions
• CMS is an interdisciplinary program, and draws on Cameron School of Business, Watson School of Education, College of Arts and Sciences for faculty education and research
• Needs assessment follow 5 years of individual master planning (not originally part of UNCW master plan)
• Focusing on juniors & senior undergrad, graduate student & postdoctoral fellows.
• Thoughts about virtual teaching environment and high tech teaching applications
• NOTE: parking lots are part of the project development plans for buildings. This is acknowledged but not specifically addressed other than by reference
Present Plan with “in progress” MARBIONC Building shown at Top

• Present land outlined in yellow
• 3 buildings comprise current space
  • Main Building (1)
  • Operations wing (2)
  • Oyster Hatchery (3)
• Marine Biotechnology (4, in progress)
• Acreage of CMS is about 70 acres
• Property consists of 5 individual parcels, comprised of areas inside yellow lines
• Recent wetlands survey completed
• One additional building in the preconstruction CD phase, going to bid in early 2011
• Concerns for CMS are adequate research spaces, education space, utilities support
• CMS is located > 6 miles from S. College campus
• 1 class period is wasted for travel each direction—seek to optimize faculty time
Priority Ranking Process for Master Planning Facilities

- Two separate meetings of various parts of the faculty ranked priorities differently
- Vessel, housing, classrooms, dock, and running seawater are nominally ranked high
- All are priorities
- Priority is based on need, not cost
- We estimate that lower cost items may gain favor for execution
- Larger ticket items affect our ability to continue to grow at a 10-15% rate annually (actually 20% last year).
- Not only an educational mission but also an economic development mission
- NOTE: The entire CMS campus is classified Millennium Campus
- Items in red fall into 3 separate categories. Priorities are not assigned within category, but a general priority is implied within each category.
- Our growth will largely be dependent upon graduate student efforts, movement of existing or new faculty to CMS, and to undergraduate classes. All of these efforts require planning on behalf of other parts of UNCW.
- All of our priorities are linked in some fashion, and the development of each one implies the requisite execution of another of the priorities.
- Every new grant stimulates new needs. With a 15-20% growth annually, we can expect our plan as presented will be sufficient to execute for the next 8-10 years.
• The aerial vision for 2020
• Clarity of purpose
• Confluence of need
• Consistent with mission
• Capacity building to support excellence
Core Facilities

- Core facilities serve the needs of faculty, students, and the outside community as possible, to provide high technology expensive equipment and analyses.
- For each Core Facility of Resource, a Core Faculty Leader defends and administers the Core.
- A technical assistant is provided to assist in instrument manipulation, analysis of samples provided, or training new users to operate the equipment. Technical assistants also maintain the equipment in good working order.
- Service contracts are maintained by "insurance" policies that are financed by the Academic Affairs division.
- The Center for Marine Science identifies the need, and purchases the equipment. Core resources individually range from $250,000 to well over $1 million in resource purchase.
- The cost to users is often pennies on the dollar when compared to outside opportunities.
- The Core Facilities serve as a regional resource, as well as a cost-share opportunity for faculty in grant applications, offsetting the cost of analysis.
UNCW Center for Marine Science, Marine Operations Department

Assistant Director: Jay Styron

Ships: R/V Cape Fear - 65’ ocean going research vessel
R/V Seahawk - 35’ aluminum catamaran for use within 50 nm of shore
Over 20 trailerable boats (from 22’ center consoles to 16’ Jon boats)

Facilities: Machine Shop located at CMS
Small boat repair facility and boat yard at CMS
Aquarius Reef Base located in Key Largo, FL (funding for Aquarius provided by NOAA)

UNCW Marine Operations is responsible for all boating and research diving activities conducted under the auspice of the University, including the Center for Marine Science as well as Aquarius Reef Base in Key Largo, FL.

The wide variety of ships and small boats allows both UNCW and non-UNCW scientists to conduct research from the upper reaches of the Cape Fear River Basin to the Gulf Stream. Some examples of the projects that use CMS Marine Operations ships and/or divers include: water quality sampling for the Cape Fear River Monitoring Program; buoy recovery and deployments for the Coastal Ocean Research and Monitoring Program; U.S. Navy geophysical bottom surveys; and, maritime archaeology support for East Carolina University and other state agencies.

The Marine Operations Department contributes to the University teaching mission by providing at-sea lab facilities for UNCW students. UNCW is the only university in the UNC system that provides this type of undergraduate field experience. Annually, over 200 UNCW students participate on research cruises as part of their required lab courses. Additionally, MarineQuest, the University based K-12 science education program, uses the R/V Cape Fear to take over 300 students annually on coastal ocean sampling missions.

The biggest challenges within the Marine Operations Department are an aging research vessel (R/V Cape Fear) which is in need of replacement and our reduced number of staff due to budget cuts.
Table of Contents:

• Planning for the PhD in Coastal and Marine Science

• The Existing MS in Marine Science.
In response to the needs of the southeastern region of North Carolina, the University of North Carolina Wilmington's Strategic Vision Statement, as well as initiatives to identify national ocean research priorities, University of North Carolina Wilmington is developing a **Ph.D. Program in Coastal and Marine Science**. Continued advancement of marine science at UNCW relies on this program if we are to continue to attract world-class faculty and students to meet the needs of our region.

This program will combine direct observation of the coastal and marine environment with a systematic search for understanding of the processes that control it and their socioeconomic impacts; integrating the interests of social and natural scientists from a large number of departments across college and university boundaries.

The goal will be to train professionals to examine and solve challenges and problems in the marine environment using a comprehensive interdisciplinary approach that will treat the ocean as a dynamic global system and will not be aligned along disciplinary boundaries. While based on national needs, it will focus on regional engagement and the needs of the citizens of NC, especially in the southeastern region of the state.

Emphasis of the Ph.D. in Coastal and Marine Science will be on understanding interactions between humans and ocean ecosystems, focusing on the six key focus areas of U.S. Ocean Priorities Plan: **Stewardship of Natural and Cultural Ocean Resources; Increasing Resilience to Natural Hazards; Enabling Marine Operations; The Ocean’s Role in Climate; Improving Ecosystem Health; and Enhancing Human Health.**
The Master of Science in marine science program is an interdisciplinary, research based graduate program. Students take core courses in biological, chemical, geological and physical oceanography, which prepare them to tackle complex marine environmental research questions in their thesis work. Students can elect to take courses to earn a marine policy concentration, which helps prepare them for management and consulting positions. This program, with 35 current students, has produced 93 graduates since its inception in 1998, and has averaged more than ten graduates per year since 2002. Students conduct research in diverse subject areas, ranging from aquaculture, harmful algae blooms, geophysics, photochemistry, coastal processes to water quality, with projects based from Brazil, the Galapagos, Caribbean Sea, and Panama to our local Cape Fear River Estuary and tidal creeks. Master’s students often gain experience mentoring undergraduate students as they conduct their research. Shipboard training is a part of this program, and several students have experienced submersible dives or operated remotely operated vehicles. This program has an exchange program for students and faculty with the University of Southampton, which is adjacent to the National Oceanographic Centre at Southampton, UK.

Three graduates of the MS marine science program have been awarded a prestigious Dean John Knauss Marine Policy Fellowship (Sea Grant, NOAA) upon graduation. Graduates have worked in a variety of interesting research and technical positions, including working on a conservation program with the Maori in New Zealand; BP oil spill operations coordinator for NOAA in the Gulf of Mexico; GIS analyst at the Khaled bin Sultan Living Oceans Foundation; program coordinator for the Consortium for Ocean Leadership; New Zealand manager for aquaculture exports to the USA; as well as going into community college and higher school teaching. Approximately a fifth of the graduates enter a Ph.D. program, often in an internationally recognized university.
RESEARCH: [ri-surch, ree-surch]

Research can be defined as the search for knowledge, or as any systematic investigation, with an open mind, to establish novel facts, usually using a scientific method. The primary purpose for basic research (as opposed to applied research) is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe.

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• Sustainable Model of Grant Support

• Interdisciplinary programs

• Economic Development Programs

• International Facility Sites

• Individual Research Programs

• Popular Press Articles (2 per year selected, 2000-2011)
A Sustainment Model of Grant Support

Proper Grant Administration

1. Provide resources to allow faculty to develop ideas
   - More than one scientist,
   - combine several different expertise of faculty,
   - attack new problem
   - Involve students in the work

2. Identify and meet needs for equipment base common to many
   - Establish facility cores
   - Provide leadership and technical assistance, and training

3. Provide resources to bring new equipment to augment research
   - In response to reduced number of pilot project requests
   - Unique $25k - $50 k pieces to augment research, facility cores

4. Track results
   - Understand trends
   - Quantify numbers of grants, size, F&A yield

5. Identify game changers to reverse negative trends
   - Programmatic that builds on our interdisciplinary training
   - Major building infrastructure to position our science
   - Build a new "Sustainability Model"
Collaborative Interdisciplinary Programs
Lower Cape Fear River Research and Education Program
1995-Present

• JOINT UNCW and Community Program

• Members represent interests of the river from government, industry, environmental groups, port authority, education, recreation, and quality of life.

MISSION: To develop an understanding of processes which control and influence the Cape Fear River and to provide a mechanism for information exchange and public education.

Support for this research provided by: Dischargers; Foundations, Agencies and City, County and State Government

• Process: Numerous physical, chemical, and biological measurements are collected at thirty-five different sites on a regular basis so biologists, chemists, physicists, and geologists will be able to understand freshwater, estuarine, and near shore marine processes in the Cape Fear River basin and share this information with the citizens of this watershed.

• Four components 1 – DWQ in stream monitoring (Physical and Chemical); 2 – Comprehensive monitoring (Biological, benthic, fish); 3 – Research programs; 4 – Education programs

• Benefits: Coordinated monitoring program with NCDWQ to help improve basin wide plans; Collaboration among public and private groups; Protection and improvement of vital natural resources; Identification of critical research needs: Potential for positive economic impact; Forum for public education; Better understanding of point and nonpoint contributions.

• Educational activities include: Annual reports since 1995; Lower Cape Fear Web site; River Run web site (an interactive site for teachers with School of Education); Bronze informational signs on the downtown riverfront; presentations and displays for events.

• Committee members represent: Industries; cities; counties; state agencies; private groups; businesses, private citizens; and state government.

• Funding provided by: Discharger Members (Industries, cities, counties); Donors- (Industries, cities, counties, agencies, private groups, businesses, private citizens, state government); Grants (Z. Smith Reynolds, Cannon Foundation. Water Resources Research Institute).

• Five faculty members participate and graduate and undergraduate students are contributing to the research effort.

Dr. James F. Merritt, Coordinator
35 Collecting Locations
• Nutrients
• Toxicants
• Turbidity
• Dissolved Oxygen
• Sedimentation
• Water Volume
• Fecal Coliform
• Selected stations for Benthic and Fisheries Research.
Mr. Andrew Shepard, Associate Director, Cooperative Institute for Ocean Exploration, Research and Technology

Research Expertise: undersea technology, benthic ecology, deep sea coral ecosystems
Principal Funding Agencies: NOAA

For over 30 years, the NOAA sponsored National Undersea Research Center at UNCW was the largest marine science grant in the state, bringing over $50 million into the university to support undersea science and technology development. In 2008, the National Undersea Research Program was folded into the Office of Ocean Exploration and Research and in 2009, UNCW and Florida Atlantic University partnered to successfully compete for the next generation regional program, CIOERT. Regional focus is the US east coast, from the Great Lakes to the Gulf of Mexico, and Caribbean territories. Program goals include:

• Notion to Ocean©: innovate, incubate and transition-- technologies to operations and discoveries to management needs.
• Affordable exploration: improve pace, scope and efficiency of undersea exploration and research
• Next generation of ocean sampling: non-destructive, accurate, precise, efficient sampling systems.
• Share exploration experience: engage public and classrooms in experience and excitement of discovery, and provide hands-on learning for future ocean scientists.

NURC and CIOERT sponsored discoveries and innovations include:

• Chemosynthetic communities associated with seafloor oil and gas seeps and gas hydrate beds
• Outbreaks and etiology of coral diseases
• Widespread destruction of deep coral ecosystems by fishing gear, and consequent management actions to protect remaining living reefs
• Transition of dive computers and closed circuit rebreathers to replace scuba gear for deep technical diving
• New species and bioactive compounds with potential for pharmaceutical development as drugs for treatment of cancer, arthritis and viral infections.
Aquarius Reef Base mission is to serve as a national asset for conducting marine ecosystem science, Long-Term Ecological Studies, coral observatory and sentinel site science, undersea technology development, extreme environment training and outreach and education.

Principal funding agencies: NOAA: $2.5M, NASA: $175K

The Aquarius undersea laboratory, located 4.5 km offshore Key Largo in 20 m of water, has been operated by the University of North Carolina Wilmington (UNCW) for the National Oceanic and Atmospheric Administration (NOAA) since 1990. The Aquarius habitat is the main component of the Reef Base, a unique ocean science and diving facility providing unparalleled means to study coral reefs and the ocean, to test state-of-the-art undersea technology, and to train students, astronauts, and scientific divers. From a rich history of supporting coral and marine ecosystem research, the Aquarius has evolved into a state-of-the-art multi-mission research facility. Sophisticated communications technology and advanced diving operational enhancements have enabled Aquarius Reef Base to provide exciting new capabilities for marine scientists while addressing NOAA’s expanding mission.

Over 350 projects have been conducted at the Aquarius Reef Base providing access to 2600+ participant, including hundreds of graduate and undergraduate students from over 260 institutions and agencies.
UNCW’s Coastal Ocean Research and Monitoring Program

Research Focus: Water Quality, Climate Change, Physical Oceanography, Fisheries Management, and Coastal Hazards.

Primary Investigator: Dr. Lynn A. Leonard, Professor and Chair, Department of Geography and Geology

Principal funding Agencies: NOAA

The Coastal Ocean Research and Monitoring Program (CORMP) is a research and observation program that focuses on the collection of data applicable to physical and ecological research, fisheries sustainability, and assessment of coastal habitat quality. The program began in 1999 and since inception, CORMP has received over $8,000,000 in funding to support research and educational opportunities for UNCW faculty, staff and students. Information collected hourly by CORMP real-time marine weather and oceanographic systems, deployed offshore of North Carolina and South Carolina, are used by partner organizations to enhance the prediction of conditions in the coastal ocean environment. In 2007, CORMP partnered with the University of South Carolina, the US Army Corps of Engineers, NOAA’s National Weather Service, the National Data Buoy Center, and the National Estuarine Research Reserve System to form the Carolinas Regional Coastal Ocean Observing System.

This project is contributing to the National Integrated Ocean Observing System (IOOS) by:

- Building strong partnerships with the National Weather Service, US Army Corp of Engineers, Department of Defense and State agencies;
- Integrating existing assets and observations specific to the development of tools, applications, and products for coastal managers, decision makers, and the general public in the Carolinas coastal region;
- Providing information and data products needed to establish baseline trends, predict changes, and mitigate problems associated with climate change, natural resource management and coastal hazards.
- Working with the local communities to provide oceanographic and meteorological data that is useful to a variety of coastal and marine interests.
Economic Development R & D Programs
**People:** Daniel Baden Executive Principal; Jeffrey Wright Principal, Steven Fontana Technology Development Officer; Steve Eitelman Business Consultant.

**MARBlONC** is in the business of translating discovery into marketplace. Three patents, 4 applications in process, one drug in pre-chorus license, and over $10 million in extramural research support since inception provide jobs to 22 skilled personnel, 3-4 postdocs per year, and student interns at all levels.

**MARBlONC** scientists use an efficient, three-step process to guide a product from the marine environment to the marketplace. First, they identify niche markets to ensure products are developed to meet specific needs. Second, MARBlONC researchers assemble teams from science, business and academia that match the needs of the product with the specific needs of their partners. Third, MARBlONC provides the infrastructure and support necessary to bring the new marine products to the marketplace.

**MARBlONC** is funded by line item from the State of North Carolina General Assembly. The program is one of economic development, and offers training, research discovery and translation to market, new jobs, new businesses, and new partnerships. A unique one-of-a-kind Business of Marine Biotechnology program combines 2 years of laboratory submersion coupled to an Executive MBA program at the Cameron School of Business. Graduates are employed by Business/biotechnology academic programs in the USA, Spain, and France. Other graduates work in the research cluster programs of Quintiles, Mayo Clinics, LSU, and the Research Triangle Park.
Steven A. Fontana, J.D. 
Senior Technology Development Officer; Manager MARBIONC Development Group, LLC

Area of Expertise: 
Creation and protection of intellectual property, product and business development and legal transactions

Principal funding Agencies: 
MARBIONC and the North Carolina Biotechnology Center

Fontana came to UNCW in 2008, having 10 years of experience in agro-chemical R&D and 20 years of experience as a registered U.S. patent attorney. Fontana primarily supports MARBIONC and MARBIONC Development Group, LLC activities while also assisting with IP, tech development and licensing issues that arise on main campus.

MARBIONC is an economic development program supported though a recurring grant from the NC state legislature and is managed through the Center for Marine Science. In addition to other program objectives, MARBIONC primarily focuses on the development and commercialization of innovative products and processes, with attendant intellectual property protection, as appropriate. MARBIONC’s products and processes include, for example, pharmaceuticals, unique imaging agents, biosensors, unique and/or difficult to produce marine toxins and other marine-generated chemicals used in biomedical research, ELISA kits, mariculture processes and novel feeds for mariculture and ornamental fin fish. MARBIONC Development Group, LLC was formed in December, 2009 as MARBIONC’s commercial arm.
Field Stations
Seaquarium in Curaçao as a UNCW Center for Marine Science Field Site

**Partners:** Seaquarium Arian “Dutch” Sheier, UNCW Daniel Baden and Alina Szmant

**Summary:** The Seaquarium in the Netherlands Antilles has a history of collaborative interaction with UNCW. Over the past decade, Professor Alina Szmant has taken student groups to the laboratory for semester-long, week-long, or summer excursions to study the coral reefs and biodiversity in this seamount country. The laboratory is a partnership between UNCW and Curacao, having been under development over the past 3 years. Together, the partners have begun design of the wet and dry laboratories, have assembled equipment lists for purchase by UNCW and Seaquarium, and have begun a business plan development for bringing other universities and research entities into the program as lease tenants on an annual basis. The present agreement is hand-shake, but is being developed into a MOU status in 2011, with draft documents under construction. A long-term partnership is envisioned.

**Opportunity:** The locale gives 24/7 365 day per year security. The site has student and faculty housing, affordable food and dive programs, and opportunities to provide our students with a complete cultural experience including religion exposure, past slave trade triangle education, geology, marine biology, deep sea exploration, and an international opportunity for “UNCWorld”. International Programs plays a role, too.
The JICMS is made up of the University of North Carolina Wilmington; the University of the Virgin Islands; Rutgers, the State University of New Jersey; and the University of South Carolina.

In 2009, the JICMS launched the process to develop a Strategic Business Plan for the MREC and has been working with NPS personnel at the park, regional and national levels to coordinate its activities with NPS.

The universities have been working with the U.S Department of Interior on funding and logistics to establish this laboratory in the U.S. Virgin Islands.

Final allocation of resources is pending.
Program Overview

The University of Belize (UB), located in the capital city of Belmopan, presents students with the unique opportunity to study in an English speaking country with a rich history and diverse culture. Belize is often called Mother Nature’s best kept secret and the campus is surrounded by many of the country’s true natural wonders, which provides a peaceful environment conducive to learning. UB is a student centered institution dedicated to excellence in higher education, research and service.

Academics

Students accepted into the UNC Wilmington exchange or study abroad program with the University of Belize will receive credit toward their degree requirements for most majors. Areas of study available include Sustainable Agriculture, Biology, Education, History, Information Technology, Marine Science, Mathematics, Nursing, Natural Resource Management, Pharmacy, Public Sector Management, and Social Work.

Program Facts

Location ........................................ Belmopan, Belize
City Population ........................................ 7,100

Type of Program ..................... Study Abroad

Program Dates

Fall
Mid August to Mid December

Spring
Mid January to Mid May

Application Deadlines

All .............................................................. April 1
Spring Semester ................................. October 1

Eligibility

Students are eligible to apply for this program if they meet the following eligibility criteria:

• Degree-seeking student
• At least Sophomore standing at time of participation
• Good judicial standing
• 2.50+ GPA at time of application
• Course and program pre-requisites

Learn more at www.uncw.edu/international
Housing

Students at the University of Belize typically have the option of living in the dorms, with a host family, or in off-campus housing. The Student Residence Hall includes bedrooms, a restaurant, a shopping center, and laundry facilities for your convenience. All rooms are furnished and include prepaid telephones and free internet access. The university will assist students with off-campus housing arrangements based on recommendations of previous students.

Student Life

There are a number of registered student organizations to join including, . The university also offers a wide range of recreation and sport. Intramural activities are organized in, volleyball, football, softball, basketball, canoeing, karate, tennis, and aerobics.

Surrounding Areas

Belize borders Mexico’s Yucatan Peninsula to the north, Guatemala to the west and south, and the Caribbean Sea to the east. The Caribbean is less than two hours from Galen University and along the 300 miles of the coastline lies the longest barrier reef in the Western Hemisphere, great for diving and snorkeling. Belize is a country of many cayes (small islands), inland tropical forests, pristine rivers, and ancient Maya temples and sacred caves. From the University of Belize all that the country has to offer is within reach.

Map & Images

Cost

This is a study abroad program, which means that the program fee will be paid to UNCW. Total cost for the program includes tuition, insurance, lodging, breakfast, two dinners per week with your host family and some excursions. There will be additional costs for international airfare, passport, visa and local transportation. Contact your Office of International Programs for the program fee.

Financial Aid & Scholarships

Federal and state financial aid may be applied toward this program. Even if you are normally ineligible for financial aid, you should submit a financial aid application (FAFSA). You may find that you are eligible for additional funding.

UNCW students may also apply for a UNCW Education Abroad Grant and additional study abroad scholarships. Grant applications and additional information are available at: www.uncw.edu/intprogs/abroad-financialaid.htm.

Web Sites

University of Belize:
http://www.ub.edu.bz/
Travel Belize:
http://www.travelbelize.org/
UNCW Office of International Programs:
www.uncw.edu/international

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Coastal Studies in Belize

Instructors: Dr. Martin Posey (Department of Biology and Marine Biology); Dr. Jack Hall (Department of Environmental Studies), and Eden Garcia (University of Belize)

Credit: BIO 480 (Field Studies in Biology) or EVS 431 (International Field Experience)

Location: University of Belize field station at Calabash Caye, Belize.

Description:
• In collaboration with the University of Belize, we will be offering a one week marine and coastal field course for UNCW and University of Belize students at the Calabash Caye field station 2-9 January 2012, followed by class projects in spring 2012 semester.
• This is intended as a precursor to further, perhaps longer, collaborative field experiences for our students at this station.
• Calabash Caye offers easy access to barrier coral reef systems, seagrasses, lagoons, mangroves, and other critical tropical marine habitats. Students will be exposed to an intensive study of these various ecosystems, and the particular uses and threats related to coastal habitats in tropical regions and developing economies. A unique aspect of this effort is integration of University of Belize students and faculty in a UNCW led course.
Program Overview
One of the United Kingdom’s leading universities, The University of Southampton is well-known for conducting cutting-edge research in the fields of marine and earth sciences. The School of Ocean and Earth Science (SOES) waterfront campus at the National Oceanography Centre (NOC) is listed as one of the top five oceanographic research institutions in the world. The NOC provides SOES students with state-of-the-art laboratories, access to the National Oceanographic Library and the opportunity to network with 520 leading research scientists.

Academics
Students accepted into the UNC Wilmington exchange program with Southampton University will receive credit toward their degree requirement for most majors. Areas of study available include marine biology, marine chemistry, physical oceanography and marine geology.

Program Facts
Location…………………………Southampton, England
City Population…………………………228,600
Campus Population…………………………20,000

Program Type
Exchange

Program Dates
Spring…………………………Early February to Mid-July

Application Deadlines
Spring Semester…………………………September 20

Eligibility
Students are eligible to apply for this program if they meet the following eligibility criteria:

- Degree-seeking student
- At least Sophomore standing at time of participation
- Good judicial standing
- 3.0+ GPA at time of application

Learn more at www.uncw.edu/international
Housing

The University offers more than twenty residence halls that provide a friendly environment where you can easily mix with fellow students. Set in pleasant, landscaped surroundings, all the halls have their own distinctive character and are either walking distance or a short bus journey from campus. Most rooms are single study bedrooms with voicemail and high speed internet access.

Student Life

Southampton provides a wealth of on-campus facilities to their students, including banks, theaters, concert halls, sporting facilities, cinema and bars. The Travel Centre, Southampton’s leading specialist in student and youth travel, is also located on campus. Rich in cultural heritage, Southampton is a south coast tourist destination. The city offers fine dining, high-end shopping, museums and a lively nightlife. Outdoor enthusiasts will enjoy miles of woodlands and coastlines, plus access to numerous marinas and wildlife facilities.

Surrounding Areas

A scant 75 miles from London, Southampton is ideally located for rail and ferry travel within the UK (Ireland, Scotland, and England) and continental Europe. Southampton International Airport offers service throughout the UK and major European destinations, while the nearby port of Portsmouth offers convenient, daily crossings to continental Europe.

Cost

This is a one-for-one student exchange program, which means you pay your regular tuition and fees to UNCW, and your room and board to Southampton. There will be additional costs for international airfare, passport, health insurance and local transportation.

Financial Aid & Scholarships

Federal and state financial aid may be applied toward this program. Even if you are normally ineligible for financial aid, you should submit a financial aid application (FAFSA). You may find that you are eligible for additional funding.

Specific travel scholarships are available through UNCW Center for Marine Science. For spring 2010 a stipend of $5,000 will be offered to qualified applicants, which will offset airfare to the UK and a significant portion of housing cost. For more information on these scholarships, contact Dr. Ron Sizemore at 910.962.2304 or sizemorer@uncw.edu.

UNCW students may also apply for a UNCW Education Abroad Grant and additional study abroad scholarships. Grant applications and additional information are available at www.uncw.edu/intprogs/abroad-financialaid.htm.

Web Sites

University of Southampton:
www.soton.ac.uk
Southampton Tourist Information:
www.southampton.gov.uk
UNCW Office of International Programs:
www.uncw.edu/international
United Kingdom — University of Southampton
Graduate Student International Exchange Research Program

Program Overview
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Academics
Graduate students accepted into the UNC Wilmington exchange program with Southampton University will receive credit toward their degree requirement. Areas of study available are marine biology, marine chemistry, marine science, physical oceanography or marine geology. Graduate students that are not presently enrolled in one of these disciplines will be considered under exceptional circumstances.

Program Facts
Location………………Southampton, England
City Population…………………..228,600
Campus Population………………..20,000

Program Dates
Fall: Early October to Mid-December
Spring: Early January to Mid-March
Summer: Mid-April to Late June

Application Deadlines
Rolling deadlines. Students interested in applying to this program are encouraged to speak with their graduate advisor as soon as possible to begin the application process.

Application Process
Graduate students in good academic and disciplinary standing with consent from their graduate advisor and graduate coordinator are eligible to apply for this program. The student will be responsible for working with his/her graduate advisor in developing a working relationship with a University of Southampton faculty member and a research objective. Acceptance is further based upon:
• Academic background
• Faculty recommendations
• Résumé
• Statement of work objectives
• Proposed three month research plan
• Interview

Learn more at www.uncw.edu/international
Housing
The university offers more than 20 residence halls that provide a friendly environment where you can easily mix with fellow students. Set in pleasant, landscaped surroundings, all the halls have their own distinctive character and are within walking distance or a short bus journey from campus. Most rooms are single study bedrooms with voicemail and high speed internet access.

Student Life
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Surrounding Areas
A scant 75 miles from London, Southampton is ideally located for rail and ferry travel within the UK (Ireland, Scotland and England) and continental Europe. Southampton International Airport offers service throughout the UK and major European destinations, while the nearby port of Portsmouth offers convenient, daily crossings to continental Europe.

Cost
This is a one for one student exchange program, which means you pay your regular tuition and fees to UNCW. Room and board at a catered residence hall, international airfare and salary for three months will be paid for by the UNCW Center for Marine Science from funds provided by the Gillings Family Foundation. You will have some additional costs for a passport, health insurance and local transportation. (Note: All rates based on tariffs, costs and exchange rates are subject to change.)

Financial Aid & Scholarships
Federal and state financial aid may be applied toward this program. Even if you are normally ineligible for financial aid, you should submit a financial aid application (FAFSA). You may find that you are eligible for additional funding.

UNCW students may also apply for a UNCW Education Abroad Grant and additional study abroad scholarships. Grant applications and additional information are available at www.uncw.edu/intprogs/abroad-financialaid.htm.

Web Sites
University of Southampton: www.soton.ac.uk
Southampton Tourist Information: www.southampton.gov.uk
UNCW Office of International Programs: www.uncw.edu/international
Individual Research Projects and Programs
Lewis J. Abrams, Ph.D. - Professor of Oceanography, Department of Geography & Geology
Research Expertise: Marine Geology & Geophysics
Principal funding Agencies: NSF, USGS NERHP

Research conducted in the Coastal and Marine Geophysics Laboratory at UNCW’s Center for Marine Science is global in scope and involves the collection and analysis of a broad range of geophysical data. Ongoing research programs include investigation of the tectonic, volcanic, sedimentary history and paleoclimate of the Caribbean basin and the tropical and sub-tropical Pacific Ocean.

Most recently Abrams has been conducting marine geophysical and coring expeditions in the North and South Pacific sub-tropical gyres. Life is previously unknown in the sub-seafloor sediment of these vast low-productivity regions that dominate the open ocean. These expeditions have resulted in the first ever sampling and characterization of sub-seafloor microbial ecosystems in these areas, expanding the ever growing inventory of life on Earth.
Aquaculture Nutrition: Development of eco-friendly (green), cost-effective and nutritionally balanced diets for sustainable aquaculture

Md Shah Alam, Ph.D. Research Assistant Professor, CMS
Research Expertise: Aquaculture Nutrition, Fish and Crustacean Feed Technology
Principal funding Agencies: NC Sea Grant, NOAA, USDA, until now more than 1 million dollar with Dr. Wade Watanabe
Graduate students: 3 MS

Dr. Alam is an Aquaculture Nutritionist with the UNCW-CMS. His main research and publication focus in finfish, crustaceans and ornamental fish nutrition and feed technology. Dr. Alam is involved with MARBIONC® (Marine Biotechnology in North Carolina) Aquatic Animal Nutrition, an aquaculture nutritional research and feed development program, UNCW-CMS. He is collaborating on aquaculture research projects with Dr. Wade Watanabe and other scientists funded by NOAA, USDA, North Carolina Sea Grant and MARBIONC. He has been with the UNCW-Aquaculture Program from May 2005. Dr. Alam completed his executive MBA in 2007 from UNCW under the Business of Marine Biotechnology Fellowship sponsored by MARBIONC®, UNCW. He published several papers in peer reviewed international journals and presented several papers in national and international aquaculture and fish nutrition related conferences in USA, Japan, Australia, China, Greece, Thailand and Malaysia.

Feed represents one of the largest operational costs in aquaculture businesses. Dr. Alam and the CMS aquaculture group are presently working on development of nutritionally balanced, environmentally sound and cost-effective diet for commercial marine fish culture and for ornamental fish. He is investigating lab and pilot-scale aquaculture with feed made from alternative feed stuffs such as soybean meal and poultry by-product meal to replace fish meal in black sea bass, flounder and red porgy (sea bream) fish diets, with promising results. Other ongoing research include development of formulated microdiets for fish larvae, optimization of macro-nutrients (protein, lipid and carbohydrates) in diets for the maximum growth of commercially important food fish in the Southeastern United States and development of green-feed for ornamental fish culture.
Daniel G. Baden, Ph.D.  Professor of Chemistry and Biochemistry; Biology and Marine Biology

Research Expertise: Marine Biotechnology, toxicology, molecular mechanisms, drugs from the sea

Agency Support: >30 yr NIH, 3 yr NOAA, 7 yr NC General Assembly

Dr. Baden entered graduate school at the University of Miami School of Medicine to study marine toxins. His graduate student work on Florida Red Tides earned him a PhD in biochemistry in 1977 and a world-wide reputation during his PhD degree days. His work has always concerned the reasons that marine toxins were poisons; that is to say, why are they so dangerous at the molecular level. In this field he has developed tools, tests, and methods that are used by NIH, DoD, FDA, state and federal regulatory bodies, and the legal community. His most recent past decade work on the effects of inhaled Florida red tide particles, in collaboration with 5 university, Federal and state partners, has been hailed as the most productive NIEHS (NIH) program project ever funded by the agency. In addition to characterizing the toxicological consequences of exposure, prevention paradigms and therapeutic protocols have been developed and revised from the points of view of public health and emergency rooms. The team carried out the longest running and most valuable human epidemiological study ever of the effects of red tides on people. Two new drugs from red tide are now being moved from laboratory into drug industry: “brevalen” a drug candidate for the treatment of cystic fibrosis and other mucociliary diseases, and “brevisin” as an Escortin™ of drugs that are poorly absorbed.
Frederick Bingham, Ph.D.  Professor of Physics and Physical Oceanography

Research Expertise:  Large scale ocean circulation and distributions of water mass properties.

Principal funding Agencies:  NASA

Bingham is on the science team for NASA's Aquarius mission to measure sea surface salinity from space.  His current interest is in global distributions of surface salinity and its variability in time and space.  He is also involved in the SPURS experiment, a 2012 field campaign to quantify the surface salinity balance in the subtropical North Atlantic.

Surface salinity is important to understand because it is a proxy for the global hydrologic cycle, the movement of freshwater around the Earth.  As the Earth gets warmer, the hydrologic cycle is expected to accelerate, changing the surface salinity as well as global patterns of rainfall, evaporation and runoff.  The Aquarius mission will help monitor how these changes impact our world.
Using quantitative and computational techniques to understand the processes that connect, constrain, and sustain ecological systems

Stuart R. Borrett, Ph.D. Assistant Professor of Biology and Marine Biology
Research Expertise: Systems Ecology; Ecoinformatics; Modeling, Simulation and Systems Analysis; Network Analysis; Ecosystems
Principal funding Agencies: NSF

I am a systems ecologist using quantitative methods to investigate ecosystem organization and transformation. The overarching goals of my research program are (1) to understand the fundamental processes that create, constrain, and sustain ecological systems and (2) to develop a formal science of environment that we can use to comprehend the causes and consequences of both local and global environmental changes. Researchers in my lab use a variety of quantitative, computational, and informatic methods to address questions such as “What role do indirect effects play in ecological and evolutionary interactions?” and “What is the relative importance of the annamox microbially mediated pathway of system nitrogen loss in the sedimentary nitrogen cycle in the Cape Fear River Estuary?”. 
Isolation and Characterization of biologically important compounds from marine microalgae

Example of research findings:

Uptake of Daunorubicin alone or conjugated to the polyether brevisin by muscle sarcoma cells

Andrea J. Bourdelais, Ph.D.  Research Associate Professor, Group leader for Bioassays and Biosensors Focus groups in MARBIONC

Research Expertise: Marine Natural Products, Pharmacology/Toxicology
Principal Funding Agencies: NIH (216K/year), State of North Carolina (200K/year)
Current Students: 1 undergraduate student honors student

For the past 12 years I have been interested in isolating and characterizing bioactive compounds from marine phytoplankton. Currently my research efforts are three fold: 1. discovering novel compounds from marine phytoplankton, 2. using bioassays in combination with live cell imaging to screen extracts of marine organisms for bioactivity and 3. derivatizing the marine phytoplankton derived compounds to make semi-synthetic derivatives for use as biological tools and drug therapies.

My collaborators and I have isolated and characterized several ladder frame polyether compounds from the toxic marine dinoflagellate K. brevis. The compounds include novel brevetoxins, brevenal, brevisin and tamulamides. The brevetoxins are a suite compounds responsible for harmful effects of the majority of red tides in the Gulf of Mexico. Brevenal has been shown to be a functional antagonist to brevetoxin both in the cell and whole animal. Brevenal also increases mucociliary clearance in asthmatic sheep, suggesting possible utility as a treatment for mucociliary disorders such as asthma and cystic fibrosis. Brevisin, was found to have no activity in more than 55 receptor, enzyme and ion channel assays.

Recently, fluorescent conjugates of brevetoxin, brevenal and brevisin have been made to visualize the distribution of these compounds inside mammalian cells. The conjugates were found to be rapidly taken up by cells and localized to specific intracellular organelles. In further studies we have demonstrated that these compounds have the ability to escort large and charged molecules across cell membranes. Conjugating the non-toxic brevisin to chemotherapeutic agents such as the anti cancer drug daunorubicin has shown that brevisin can move therapeutic compounds with low cell permeability across cell membranes making it an ideal candidate for potential use in drug delivery.
My research is broad and diverse, including coastal oceanography and work on other aspects of aquatic ecology. The photo above illustrates our UNC Sea Grant-funded study of beach renourishment effects on the beach ecosystem, which has shown that the surf zone is a highly productive part of the coastal ocean ecosystem and likely very important as habitat for larval fishes and other organisms. We have also found that renourishment’s effects are greater at higher levels of the food chain and minimal at the base. Additional work has been proposed to NSF that would address primary production in the surf zone.

The photo below illustrates a swine waste lagoon dominated by carotenoid-producing purple phototrophic bacteria. Collaborative research efforts funded by several sources have identified one or more potentially valuable natural products that may be abundant in such swine waste lagoons, yielding the possibility of significant value-added prospects for producers and other benefits to the agricultural community.
Robert H. Cutting, J.D.  Associate Professor, Department of Environmental Studies

Research Expertise: Environmental Law, including regulatory, common law and constitutional issues, former white collar prosecutor and trial counsel (Member CA and NC Bars)

Mr. Cutting provides legal expertise to cross-disciplinary inquiries into law and policy, working with Dr. Cahoon & other scientists to craft alternative strategies. Research includes publication in the top tier journals in environmental law, The Coastal Society publications, GSA, and WRRI. Topics include:

- Constitutional Dimensions of Property Rights
- Common Law actions to supplement Regulation
- Actions to Redress the Effects of Global Warming
- Information as Efficient, Market-Based Regulation
- Forensic Environmental Science
- Environmental Issues in Real Property
- The Regulatory Framework
- White Collar Crime
- The Interface of Consumer and Environmental Protection
- Elections and Campaign Law Issues

Mr. Cutting also directs the Practicum program that focuses on the career goals of students to find the right placement (now over 800) in government, the private sector and NGO’s. http://uncw.edu/EVS/internshipPractica.html. Many students appear as co-authors and contributors.
Marine Botany Lab: Understanding the physiology and stress tolerance of marine photosynthetic organisms

Michael J. Durako, Ph.D.: Professor of Biology and Marine Biology
Research Expertise: Marine Botany, Seagrass Physiology and Ecology, Bio-optics
Principal funding Agencies: NOAA, US Dept. Interior, USEPA, FFWC, SFWMD
Graduate Students: 1 PhD, 2 MS, UG DIS

Research in my lab primarily centers on the physiological and ecology of seagrasses. For the past 15 years, my students and I have been involved in shoot- to landscape-level studies of subtropical seagrass communities. Shoot-level studies have examined effects of high light and light reduction, salinity changes, and microbial infection on physiological and demographic characteristics of seagrasses. The landscape-level research has provided spatially-explicit distribution, abundance, and structural data to assess responses of benthic macrophyte communities to possible future management alterations in the South Florida ecosystem related to the Comprehensive Everglades Restoration Program (CERP). Related seagrass research has been directed towards the assessment of potential macrophyte-based ecoindicators of estuarine condition and examination of the stress responses of small versus large-bodied seagrasses. This research has exposed my students to the interface between science and marine resource management.

More recent research efforts in my lab have dealt more broadly with light and photosynthesis in aquatic systems. Work in S.E. North Carolina has focused on an examination of the spatial and temporal variability in the bio-optical properties of the Cape Fear River plume and the coastal waters of Onslow Bay. This work involved spectral analyses of inherent and apparent optical properties of coastal waters using ship-board and lab-based instrumentation and satellite data. Work in south Florida has investigated the effects of light on photosynthetic characteristics and distribution patterns of seagrasses in Florida Bay, Biscayne Bay and along the lagoons systems of eastern Florida. These studies lead to the discovery of UV-absorbing pigments in a shallowly-distributed seagrass that may allow this species to exploit intertidal areas without competition from other seagrasses. In my 15 years at UNCW, I have supervised 4 Honor’s, 15 masters, 2 Ph.D., and 3 post-doctoral students and have received >$5 million in extramural funding through 31 grants.
Oyster Reefs & Coral Reefs: Critical Habitats in Coastal Ecosystems

Christopher Finelli, Ph.D.  Associate Professor of Biology and Marine Biology
Research Expertise:  Benthic Ecology, Ecological Fluid Mechanics
Principal funding Agencies:  NSF, NOAA, Sea Grant -- ~$100,000/yr
Current students:  1 PhD, 2 MS, several UG DIS and Honors

Dr. Finelli has 12 years of continuous funding from NSF, NOAA, and Sea Grant to support research that examines the critical role of water flow in marine systems.  He received a prestigious NSF CAREER Award, and has continued to secure external funding for projects in the Caribbean and along the NC coast.

Water flow is a “master variable” that influences almost every aspect of the life of marine organisms.  Finelli and his students work in a variety of habitats to understand these influences.  Finelli maintains two parallel research tracks, local and tropical, to provide sufficient opportunity for graduate and undergraduate students.  Locally, Finelli’s group studies oyster reef ecology, especially the role of currents in controlling filtration rates of oysters and recruitment of juvenile oysters to natural and restored reefs.  Due to the accessibility of the habitat, this work is especially well suited for undergraduate participation.  Tropical work in the Florida Keys, Bahamas, and Belize examines sponge filtration, coral physiology, and fish feeding ecology.

Dr. Finelli and his students have participated in five saturation missions aboard the Aquarius Undersea Habitat since 1999, and are regular participants in cruises throughout the Caribbean sponsored by NSF through collaborations with Dr. Joseph Pawlik’s group at UNCW.
D. Wilson Freshwater, Ph.D.  Research Specialist, Center for Marine Science  
Core Leader, Center for Marine Science DNA Analysis Facility  
Adjunct Faculty, Department of Biology & Marine Biology  
Associate Curator for Algae, WNC Herbarium  
Research Expertise: Molecular Systematics; Marine Algal Taxonomy & Floristics  
Principal funding Agencies: NSF, NOAA, NC BioTechnology  

Freshwater has been studying marine algae for nearly 30 years and has conducted research in the fields of ecology, molecular biology, evolution and taxonomy. He was one of the first to apply DNA sequence analysis to questions of marine algal evolution and more recently to algal floristic studies. This expertise in DNA analysis has also been applied to organisms as diverse as marine fungi and lionfish. Student training is also a focus and many UNCW undergraduate and graduate students have been active participants in this research.  

The Freshwater lab has had 15 years of consistent funding from NSF and NOAA. Our current NSF project combines the development of a marine algal flora for southern Central America with phycological training for Latin American researchers. We also have been collaborating with NOAA scientists on studies of the invasive lionfish and North Carolina’s offshore hardbottom reef communities. All of these projects require the expertise and support provided by UNCW’s Diving and Research Vessel programs as well as the CIOERT Technical Diving Program.
Coastal and Marine Geophysics Lab: Marine tectonics, seabed classification and submarine geohazards

people.uncw.edu/grindlayn/cmgl

Nancy R. Grindlay, Ph.D.  Professor of Geology, Associate Dean for Research CMS
Research Expertise:  Marine Geology and Geophysics
Principal funding Agencies:  NSF, NOAA, USGS, UPR-SeaGrant

Research conducted by Grindlay and her students in the Coastal and Marine Geophysics Laboratory at UNCW’s Center for Marine Science involves the collection and analysis of multibeam bathymetry, sidescan sonar, gravity, magnetics and single-channel seismic data. Major research focus areas include marine tectonics (mid-ocean ridge and subduction zone processes), seabed classification (estuarine and coastal ocean benthic habitats), and geohazards (active faults, submarine landslides and tsunamis, volcanic eruptions).

Ongoing research programs include investigations of the morphology, structure and tectonics of the Southwest Indian Ridge and the Caribbean-North American plate boundary. The similarities between the tectonic setting of the Puerto Rico trench and the Sumatra trench where the devastating December 2004 tsunami occurred, led Grindlay and her students to raise the awareness of the potential tsunami threat in the northern Caribbean. In 2010 Grindlay and United Kingdom colleagues discovered the deepest and hottest hydrothermal vents in the world along the Mid-Cayman Spreading center.

Coastal aspects of her research program include the use of high-resolution sidescan sonar and sub-bottom profiler systems to monitor storm-driven sediment dynamics and to characterize the seabed habitats in the near-shore and mid-continental shelf off the SE North Carolina and Florida coasts, and to identify active faults on the western and southern insular shelf of Puerto Rico.
Kelley studies evolutionary paleoecology of molluscs, particularly the role of ecological factors such as predation in evolution. With students and colleagues she has compiled a database on predation by shell-drilling gastropods in the Gulf and Atlantic Coastal Plain that includes ~200,000 specimens spanning about 80 million years. The data are used to test hypotheses about the evolutionary history of predator-prey interactions, predator-prey coevolution and escalation (enemy-driven evolution), the ecology of mass extinctions and recoveries of mollusc faunas, and spatial variation in predation (in part in collaboration with middle school teachers and students in the NSF-sponsored “Moonsnail Project”). Kelley enjoys collaborating with students at all levels, from undergraduate to PhD. Recent and current projects with graduate students include: ecological response of molluscs in Iceland to an invasion of predatory gastropods; preservation of a brittle star mass mortality bed in Mexico; geographic variation in drilling predation in Brazil and Argentina; relationship of drilling predation to prey diversity in the US Coastal Plain and Europe; conditions under which cannibalism by drilling predators occurs; metabolism and extinction susceptibility of bivalves; optimal foraging by shell-drilling gastropods. Kelley is principal investigator on the NSF project: “Research Experiences for Undergraduates in Biodiversity Conservation.” This program has brought nine students per year from across the US to UNCW during summers 2008-2010 to collect and compare data from the fossil and archeological record and modern marine communities to understand anthropogenic ecosystem change.
Chad S. Lane, Ph.D.  Assistant Professor of Geography and Geology

Research Expertise: Quaternary Environments, Stable Isotope Biogeochemistry, Biogeography, Paleoclimatology, Prehistoric Human-Environment Interactions, Rapid Climate Change

Principal funding Agencies: NSF, UNCW

The focus of Lane’s research and teaching is environmental change throughout the Quaternary period of Earth’s history, especially the Late Quaternary. Lane’s interests include the origins of environmental change and the resulting impacts of these changes on humans, biotic communities, biogeochemical cycles, and disturbance regimes. To develop and analyze records of environmental change in different areas of the world during the Late Quaternary Lane and his students undertake paleolimnological analyses of ancient lake sediments. Global environmental change is certainly a subject of the utmost importance in a world where exploding human populations are completely dependent upon stable resource availability and incredibly dynamic global environmental systems that are in a continual state of flux. This is especially true in the age of global warming, unprecedented pollution, shifting disturbance regimes, alarming rates of habitat destruction, and the multitude of other anthropogenic impacts currently underway.

To date, Lane’s research has been focused on sites throughout the circum-Caribbean region. Research undertaken by Lane and his students includes the detection of rapid climate change events, such as the ‘Little Ice Age’, in the Dominican Republic and linkages between these regional events and global climate dynamics, the assessment of prehistoric human activity in Costa Rica and the Dominican Republic, and the assessment of prehistoric hurricane strikes in the Dominican Republic and Nicaragua. Lane has also been engaged in a series of studies assessing carbon cycling in soil and aquatic systems under elevated temperature and nutrient regimes using stable isotope tracers in the United States and Canada.

Lane also serves as the supervisor/director of operations in the stable isotope laboratory, a core facility at the Center for Marine Science.
Leonard Lab: Sediment Dynamics of Coastal Systems

Lynn A. Leonard, Ph.D.  Professor of Geology
Research Expertise:  Marine Geology, Physical Sedimentology, Hydrodynamics, Ocean Observing
Graduate students:  4 MS, several UG DIS and Honors

Dr. Leonard’s areas of expertise are physical sedimentology and marine geology. She has received more than $10 million in extramural funding from NOAA, SeaGrant, and the U.S. Army Corps of Engineers for research on topics such as sediment transport dynamics of coastal and continental shelf systems, geological evolution of tidal wetlands, landscape development of the Everglades and assessing the causes and consequences of man-made (engineering activities) and climatic (hurricanes, floods, droughts) impacts on coastal morphology. Some of her current research projects include, sediment dispersal in tidal marshes and coastal wetlands of the southeast U.S., marsh restoration using dredge spoil material, hydrodynamics and sediment retention associated with created and natural oyster reefs, sediment transport during storms on the mid continental shelf, and the impact of river dredging on tidal amplitude and marsh sedimentation in the Cape Fear River. Undergraduate and graduate students are integral contributors to the Leonard Lab and her students frequently present and publish their work in both regional and international venues. In recognition of her work with students, Dr. Leonard won the College of Arts and Sciences Teaching Excellence Award in 2000.

Leonard is also the director of the UNCW Coastal Ocean Research and Monitoring Program (CORMP-www.cormp.org) which provides real-time oceanographic information to a variety of state and federal agencies as well as the general public. The CORMP has received more than $8 million in funding since 2000 and was awarded a Department of Commerce-National Weather Service Public Service Award in 2007.
Marine and Atmospheric Chemistry Research Laboratory

MACRL, the Marine and Atmospheric Chemistry Research Laboratory, is a unique group of collaborating marine chemists in the Department of Chemistry and Biochemistry at UNCW. The core members of this group and their areas of interest are Drs. Joan Willey (redox chemistry), Bob Kieber (photochemistry), Steve Skrabal (trace metal chemistry, sediment-water interactions), Brooks Avery (biogeochemistry) and Ralph Mead (organic geochemistry). By combining their individual strengths this group is able to address complex scientific issues of global and regional relevance. This group of marine chemists has been funded by the National Science foundation almost continuously since 1985, generating over five million dollars of external funding. Current National Science Foundation funded projects include:

“Impact of Changing Fuel Usage on the Atmospheric Cycling of Ethanol, Optically Active Organic Compounds and Iron (Fe) in Rainwater” $614,480, Atmospheric Chemistry

“Photobiogeochemistry of Resuspended Sediments in Coastal Environments: Impacts on Organic Matter and Trace Metal Cycling” $582,468, Chemical Oceanography

“Chemical Characterization and Reactivity of Chromophoric Dissolved Organic Matter (CDOM) in Rainwater” $532,752, Atmospheric Chemistry

“MRI: Acquisition of LC/MSn” $187,884, Chemistry

Their high profile research has provided support and research opportunities for seven postdocs, two Ph.D. students, approximately 50 master’s students, more than 100 undergraduate honors and directed independent study students, six high school students, and four high school teachers. Over the last five years, the work of these faculty and student researchers has resulted in 25 publications in high impact peer reviewed journals, including 14 students as authors, and over 25 presentations at national scientific meetings, almost all with student authors.
The Aquatic Ecology Laboratory at the UNCW Center for Marine Science
Dr. Michael Mallin

Michael A. Mallin, Ph.D. Research Professor, Center for Marine Science
Research Expertise: Freshwater, estuarine and marine water quality, plankton ecology, nutrients and algal blooms, land use and pollution
Principal funding Agencies: Water Resources Research Institute, NOAA, USMC, City of Wilmington, Lower Cape Fear River Program

The Mallin lab (Aquatic Ecology Lab) at the UNCW Center for Marine Science conducts research spanning the gamut from inland freshwater streams and lakes to large rivers and estuaries, estuarine tidal creeks, and coastal marine waters. Our studies include investigating sources and impacts of nutrients, fecal bacteria, sediments and polluting chemicals on the physical, chemical and biological structure and function of waters. Our MS students have produced theses as varied as tidal creek primary production, sediment oxygen demand, zooplankton grazing in marine waters, transport of nitrogen through aquatic food webs and determining sources of fecal pollution to coastal waters. We have also directed and trained numerous undergraduate and graduate students performing independent study projects as well as interns from various departments. Our students have gone on to work in state regulatory agencies, consulting firms, and academic laboratories. Results of our water quality research have been directly used by agencies to improve coastal development regulations and tighten pollution standards. We also have very active outreach and engagement with local and regional municipalities, citizen’s groups and State boards and commissions.
Michael A. McCartney, Ph.D.  Associate Professor, Biology and Marine Biology, CMS
Research Expertise: Marine molecular ecology and evolution, population genetics
Principal funding Agencies: NOAA, NC DMF, NSF Biological Oceanography

The causes of species range limits is a critical issue, particularly for harvested species in a warming ocean. Our work on *Mytilus* blue mussels is funded by NSF Biological Oceanography. We are studying how the Eastern Maine Coastal Current, a swiftly flowing cold water mass, sets the southern range limit of the northern species *M. trossulus*. We use detailed hydrographic and satellite drifter studies, we map the distribution and abundance of planktonic and settling larvae, perform subadult transplants, and larval physiological tolerance experiments, to contrast how thermal barriers and dispersal barriers set by currents form the range boundary, and address how it may respond to climate change.

At this range boundary, two *Mytilus* species overlap and hybridize. Our work examines this hybrid zone and its role in speciation. We perform gamete interaction experiments *in vitro* and study the molecular evolution of proteins that control sperm-egg recognition. More generally, our lab investigates rapid speciation in marine species complexes, such as mussels and hamlet fish that, like many coral reef fishes, use brilliant color patterns to help choose their mates.

Our lab works in fisheries and conservation genetics. Funded by NOAA Fisheries (black seabass) and NC Division of Marine Fisheries (southern flounder) we use DNA markers to examine stock structure within and between south Atlantic and mid-Atlantic regions in these, the #6 and #2 cash-value finfisheries (NC DMF, 2009).
Dylan McNamara, Ph.D.  
Asst. Professor of Physics and Physical Oceanography  
Research Expertise: Modeling coupled human-natural systems, coastal processes, complexity  
Principal funding Agencies: NSF  
Graduate students: 2 MS, 3 UG Honors

Early career professor McNamara has had significant publications and NSF funding related to using tools developed in complexity theory to understand how coastal systems with strong human alterations evolve in response to climate change. As this work is inherently interdisciplinary, McNamara has expertise in both physical science and economics. In addition, the McNamara lab has strong ties with economic and geomorphology collaborators at Duke university on this work.

Other work in the McNamara lab covers a wide variety of systems. Publications have resulted and are forthcoming that investigate the dynamics of flooding and response in New Orleans and the impact of climate change on fish abundance and fishery behavior. In collaboration with researchers at the University of Florida, Duke and UNC Chapel Hill, McNamara is investigating signals of climate change in coastline erosion data and models. Work with separate colleagues at the Scripps Institution of Oceanography has investigated the spatial dynamics of catastrophic phase shifts in coral reef as well as surf zone fluid dynamics on artificial reefs.

In total, McNamara has a wide ranging field of work that bridges gaps across disciplines and endeavors to contribute to our understanding of natural systems that have been severely impacted by human interactions.
Professor John M Morrison

GALAPAGOS ISLANDS
- Joint program between UNCW, North Carolina State Univ., NASA Goddard Space Flight Center, Charles Darwin Research Station and Galapagos National Park Service
- Connectivity and Upwelling Dynamics in the Galapagos Marine Reserve

GULF OF MEXICO
- Joint program between UNCW, North Carolina State Univ., Louisiana State University and EPA Gulf Breeze Lab.
- Benthic Dinoflagellate Migration (BenDiM) on the continental shelf in the northern Gulf of Mexico: Occurrence and Processes

Ocean Observing Initiative (OOI)
- What physical processes lead to exchange of heat, salt, nutrients, and carbon between the continental shelf and slope south?
- What aspects of variability (stratification, wind forcing, ring interactions, frontal instabilities) are most important to modulating shelf-break exchange?

Oceanographic Vessels & Instrumentation
- Malolo – Acrobat Towed-Undulation Profiler
- VideoRay Remotely Operated Vehicle
- R/V CAPE HATTERAS and R/V ????

John M. Morrison
CMS Associate Director for Academic Planning and Professor of Physics and Physical Oceanography

Research Expertise:
My research interests lie in descriptive physical oceanography; general ocean circulation; estuarine and coastal ocean processes; air-sea interaction, global ocean climate, long-term and systematic ocean observations and management of large oceanographic field activities

Principle Funding Agencies: NSF, NASA, NOAA

My principle research interests are interdisciplinary programs integrating the physical processes governing ocean water mass distributions and currents with chemical and biologic constituents using in situ and remote sensing techniques, as well as modeling. In addition, I am interested in the development of new instrumentation for surveying the ocean at finer resolutions over longer periods of time and in the evolution of oceanography from an exploratory science to an applied science. All of my projects involve student participation, both at the undergraduate and graduate levels, I feel that a major component of a student’s training involves going to sea and working with state-of-the-art instrumentation under the tutorage of highly qualified technical support. Finally, I have a great interest in advancing the academic marine science programs at UNCW, both at the undergraduate and graduate levels, as well as the use of marine science as a tool for STEM education at the K-12 levels.
Naar Lab: Red tides and environmental issues of water quality and food safety

Jerome P. Naar, Ph.D. Research Associate Professor
Research Expertise: Marine Biology, Immunology, red tides and Phycotoxins
Principal funding Agencies: NOAA, CDC, State of Florida; ~$3M for the past 10 years

Marine phycotoxins encompass a large class of typically low molecular weight and chemically different compounds ranging from polyethers to alkaloids and peptides or even amino acids. These powerful toxins are produced by phytoplanktonic organisms such as dinoflagelates and diatoms.

During plankton efflorescence also known as Harmful Algal Blooms (HAB) and red tides, toxins and toxic organisms can reach dangerous levels in seawater resulting in massive fish kills, and deaths of birds, marine mammals and other aquatic animals.

In humans, phycotoxins cause a variety of lethal and sub-lethal diseases. Intoxication predominantly occurs with the ingestion of contaminated fish and shellfish with bio-concentration and bio-transformation of toxins in aquatic food webs playing an important role in transmission of the diseases.

The objectives of our laboratory are: to develop sensitive assays to prevent and diagnose human and other animal exposure to marine toxins; to validate the use of these assays for regulatory monitoring purposes; to study toxins transfer, accumulation and biotransformation in aquatic food webs and assess impacts on human and environmental health; and to develop methods to mitigate red tides’ harmful impacts.
The goals of our program are to investigate the biology of marine mammals and to educate students through their active engagement in research and stranding investigations. Our basic research program asks how the mammalian body functions in a marine environment. Together with our undergraduate and graduate students, we have gained new insights into locomotory, respiratory, and thermoregulatory energetics of cetaceans - the whales, dolphins and porpoises. Much if our research is carried out on stranded marine mammals. The investigation of strandings also offers us the opportunity to gather data on the health of individuals, which over time, can build baselines for long-term monitoring of marine mammal and ecosystem health. For example, bottlenose dolphins are long-lived, resident species that rely upon the same coastal ecosystems we do – they are sentinels of coastal environmental health. We actively involve 40-50 student volunteer in this process each year. Our lab also investigates the distribution and abundance of marine mammals in North Carolina waters. We carry out aerial surveys to provide critical data on how marine mammals utilize both near- and offshore habitats. This information is of importance when considering the potential impacts that human activities, including commercial, industrial and military, may have on these protected species.
Joseph R. Pawlik, Ph.D.  Professor of Biology and Marine Biology  
Research Expertise:  Marine chemical ecology, invertebrate zoology  
Principal funding Agencies:  NSF, NOAA  -- ~$200,000/yr  
Graduate students:  2 PhD, 3 MS, several UG DIS and Honors

Pawlik has had over 20 years of continuous funding from NSF for the same project: “Chemical ecology of sponges on Caribbean coral reefs”. He and his students and collaborators have transformed our understanding of the importance chemical defenses to the ecology of reef sponges. Many commons sponge species produce unusual secondary metabolites that protect those species from predatory fishes or from overgrowth by other invertebrates. Other species rely on faster rates of growth or reproduction to maintain high abundances. The Pawlik group has yearly research cruises aboard UNOLS vessels, funded by NSF, to coral reefs in the Caribbean, particularly the Bahamas and Belize.

Pawlik’s research group has continuously used NOAA’s Aquarius habitat, and the facilities associated with it, since UNCW began operations in the early 1990s, with yearly competitive funding from NOAA. They permanently monitor the demographics of coral reef sponges on Conch and Pickles reef, focusing on the giant barrel sponge (pictured above). They have recently determined the growth rate, age and population structure of these large animals, determining that the largest are over 2000 years old. At a time of global climate change and ocean acidification, sponges are rapidly becoming the dominant organisms on Caribbean coral reefs. Pawlik’s group will have a saturation mission in Aquarius in June 2011.
Benthic Ecology Laboratory

Martin H. Posey and Troy D. Alphin; Department of Biology and Marine Biology and Center for Marine Science

- Research expertise: benthic ecology; wetlands restoration; biology of shrimp and crabs; shellfish biology, oyster reef habitat function and restoration; ecological interactions in coastal systems.
- Principal funding agencies: NOAA, NSF, U.S. Army Corps of Engineers; NC Division of Marine Fisheries; SeaGrant; private funding sources; >$8 million external funding

- Recent research projects:
  - Biology of Oysters; strategies for enhancing shellfish aquaculture in NC water, functions of oyster reefs; best practices for restoration of oyster reefs to meet target functions.
  - Salt Marsh Function; best practices for restoration and creation of marsh habitat; impacts of human development and sea level rise on wetland communities.
  - Blue Crab and shrimp biology; critical factors for maintenance of blue crab fisheries; blue crab and shrimp habitats.
  - Impacts of development and pollutants on coastal ecosystem; impacts of shoreline stabilization structures (bulkheads, revetments and sills) on coastal ecosystems and fisheries; living shoreline alternatives.

- Involvement of students:
  - 10-15 undergraduates involved in research projects annually (independent study, honors, research assistants); 3-5 graduate students mentored annually. Students trained in basic scientific techniques and provided experience with meeting stakeholders, managers, and presenting at scientific meetings.
  - both undergraduate and graduate students co-authors on presentations and publications.
Steve W. Ross, PhD, Research Professor

Research expertise: Ichthyology, estuarine, marine and deep-sea ecology

Principal funding agencies: NOAA, BOEM, USGS -- ~ $340,000/yr

Graduate students & employees: 1 MS, 2 full time technicians (varies with grants)

Dr. Ross, a native of NC, has spent most of his career involved in marine science of the southeast region. He earned degrees in zoology from Duke Univ (BS), UNC-Chapel Hill (MA), and NC State Univ (PhD). He was the Research Coordinator for the NC Coastal Reserve Program for 13 years. As a research professor at UNC-W he leads offshore studies for the US Geological Survey and is lead PI for a multiagency, multidisciplinary, international research group. His area of specialization is ichthyology, particularly ecology and life history studies. He has conducted numerous, diverse projects in estuaries and offshore waters and has served as chief scientist on many research cruises (usually 2-4 per year), including those using submersibles and ROVs. The current work of Dr. Ross’s team involves assessment of the communities of unique deep water habitats off the southeastern US, in the Gulf of Mexico, and in the Middle Atlantic Bight (see study sites above). In particular, they are looking at energy flow (trophodynamics) and relationships of animals to various habitats, including coral banks, canyon systems, and rocky areas. Over the nearly 20 years of Dr. Ross’s association with UNCW, numerous students have been trained and most have gone on to productive careers. Dr. Ross is also involved with European scientists in conducting deep-sea trans-Atlantic ecosystem studies. One ultimate goal of this research program is to provide information for poorly known areas that will facilitate management and protection of productive and vulnerable habitats. As a result of this work, the largest deep-sea marine protected area in US waters was recently approved by NOAA off the southeastern US.
Peter W. Schuhmann, Ph.D.  Professor of Economics
Research Expertise:  Non-market valuation of natural resources

Schuhmann has been a faculty member of the Cameron School of Business since 1999. Schuhmann’s research focus is primarily in the area of non-market valuation of environmental amenities and natural resources, including fisheries policy analysis, recreation demand, tourism demand, welfare analysis of environmental issues, and sustainable development. Other areas of research include effects of natural disasters on real estate values, bioeconomic modeling, natural resource damage assessment, student behavior and pedagogy.

Through an affiliation with the Centre for Resource Management and Environmental Studies (CERMES) University of the West Indies – Cave Hill, Schuhmann’s research has informed policy in the Caribbean related to the economic value of commercial fisheries, the value marginal changes in beach width (erosion), setback regulations for lodging, the value of endangered species protection and the economic consequences of beach litter. Schuhmann supervises numerous masters and PhD students at UNCW and UWI.

Along with Rob Burrus, Dr. Schuhmann organizes and hosts a regional economics teaching conference, entering its 11th year this fall.
Bongkeun (BK) Song, Ph.D.  Associate Professor of Biology and Marine Biology  
Research Expertise: Microbial ecology and biogeochemistry  
Principal funding Agencies: NSF, USDA, NC Sea Grant, NC WRRI, NC Biotech  
Graduate students: 1 PhD, 4 MS, and several undergraduate DIS  

Song’s primary research is in the study of anaerobic ammonium oxidation (ANAMMOX) and denitrification in biogeochemical nitrogen cycle. He has received seven research grants from different funding agencies including the NOAA/North Carolina Sea Grant (2), USDA(1), NSF(3) and North Carolina Pork Council(1) to investigate ANAMMOX and denitrification in rivers, estuaries, agricultural fields, groundwater and animal waste storages. Both microbial processes are highly important to diminish eutrophication in rivers and estuaries as well as to remediate nitrogen contaminated water resources. His research group developed new molecular and stable isotope techniques to detect and quantify ANAMMOX and denitrification in various environmental samples. He has examined the relationship between diversity and function of ANAMMOX and denitrifying bacterial communities in rivers and estuaries as well as alteration of sedimentary nitrogen cycle under the influence of sea level rise. ANAMMOX research has been extended to the soil communities in collaboration with a soil scientist at NCSU. Song and his collaborators have investigated the importance of ANAMMOX in soil nitrogen cycle. He also collaborated with several USGS scientists to remediate a nitrogen contaminated aquifer at Cape Cod, MA by stimulating ANAMMOX process. In addition, Dr. Cahoon and he have studied the application of ANAMMOX in ammonia odor remission in hog lagoon waste systems in North Carolina. Song established several international collaborations on the study of biogeochemical nitrogen cycle.  

Many undergraduate (20 for DIS and 2 for undergraduate honors ) and graduate students (4 for masters and 2 for Ph.D) have been involved in the studies of ANAMMOX and denitrification. A research technician and a postdoctoral research fellow also work on the projects. Several achievements were already made with publications in microbiology journals and book chapter as well as thesis completion of graduate and undergraduate students.
Dr. Szmant is a pioneer in the study of the reproductive ecology and larval biology of Caribbean reef corals. Specific topics include larval development, factors that affect coral recruitment, and the application of genomic tools to the study of coral symbiosis, development and stress reactions. Additional areas of expertise include the calcification and nutritional physiology of reef corals, ecological interactions central to coral reef function, and nutrient dynamics of coral reef ecosystems. Current emphasis in her laboratory are the effects of two climate change environmental variables: elevated seawater temperature and carbon dioxide enrichment (which reduces seawater pH) on larval development and calcification of adult corals. Her undergraduate and graduate students are conducting experiments to study how calcification rates respond to seawater chemistry to better understand the abilities of corals to regulate their internal physiology against outside disturbance. She has started to develop tissue culture to be used for experiments in ion transport.

Szmant has also developed field courses for UNCW students, in which they design and execute their own research projects, based at laboratories in the Caribbean. These hands-on experiences prepare the students for graduate school and enhance their conceptual and quantitative skills, and research independence.
Protists such as diatoms, dinoflagellates and coccolithophores comprise the major eukaryote photosynthetic groups in our oceans; underpinning global biogeochemical cycles and the marine microbial loop. The success of autotrophic, heterotrophic and mixotrophic marine microbial species is critically dependent on being able to perceive and respond to a wide range of chemical cues and physical conditions in spatially and temporally heterogeneous aquatic environments. Moreover, photosynthetic marine protists can contribute up to 50% of annual global primary productivity. Nevertheless, unlike well recognised animal and plant models, very few marine protists have been studied in detail at the cell physiology and sub-cellular level. Our research is therefore aimed at understanding the cellular and molecular mechanisms that underlie processes that govern sensory biology, nutrient acquisition, biomineralisation, internal homeostasis, chemical ecology, and interactions with predators and prey. How rapid changes in climate and physio-chemical properties of the oceans is also of current concern and our work seeks to address how such changes may influence these cellular processes. Marine protists also continue to yield extraordinary insights into the evolution of eukaryote cells and metabolism as well as providing new opportunities for nano- and biotechnological applications.

Our research is supported by European (NERC and EU FP7) and US funding agencies (NSF and NSF REU) and is conducted by undergraduate and graduate students. In the last 4 years at UNCW, 3 MS, a PhD and 10 undergraduate students (including 4 honors and 8 female and 2 from underrepresented groups) have participated in our research program. We apply advanced electrophysiology, live cell imaging and molecular approaches that ensure a cross-disciplinary training encompassing advanced cell biology and marine environmental science.
Teresa Thorpe, Ph.D. Biologist
Research Expertise: Fisheries bycatch and mitigation, elasmobranch life history
Principal funding Agencies: NC Sea Grant, NOAA, Ocean Foundation

The research that I undertake focuses primarily on ways to reduce the bycatch of a variety of marine animals in commercial fisheries. To this end, most research focuses on modifying commercial gear; gillnets, crab pots, and longlines. My primary focus has been on reducing the unwanted bycatch of sharks. These are top marine predators that are often ignored in terms of bycatch reduction. Recently it has become apparent that even small coastal sharks are showing signs of population decline. Bycatch, overfishing, and the wasteful practice of shark finning are all contributing to this decline.

Research requires extensive fieldwork and graduate and undergraduate students are an important component. They receive hands-on experience including working with members of the fishing industry, boat experience, and valuable field skills measuring, handling, and necropsy of a range of marine animals. Students learn about the biology of sharks, sea turtles, terrapins, fish and crustaceans. Sharks are also tagged with NOAA tags for growth and migration studies and students learn these techniques. All of these skills prepare students for a career in biological sciences that require field experience, quick thinking, team work, and an understanding of the functional biology of a range of marine animals.
Carmelo R. Tomas, Ph.D.  Professor Biology and Marine Biology
Research Expertise: Harmful Algal Species; Marine Biotechnology, Algal Products from the Sea
Principal funding Agencies: NIH, NOAA, NC Biotechnology Foundation

The presence of toxic species in our local waters is becoming more and more common. With climate change, new species previously unknown are becoming residents in our region posing threats to human health, natural resources and economic challenges. Our laboratory is principally involved with the accurate identification of these species, their cultivation, studies related to their proliferation. In collaboration with toxin chemist, we examine the nature and structure of potentially important bioactive compounds. Our 300+ strain living culture collection serves as a resource for undergraduate, graduate and professional collaborations within the U.S. and abroad. As this is a global problem, our activities include international collaborations, teaching and workshops and exchange of personnel with foreign institutions. The major thrust of our work deals with the accurate identification of the harmful species including examination via electron microscopy and analytical methods defining the potency and effects of the biotoxins. These efforts include undergraduate and graduate students, Post Doctoral exchanges and professional visits. Our findings are published in peer reviewed scientific journals and are presented in state, national and international meetings. In addition to our global perspective, we not only serve as mentors for our own university students but also to local high schools, elementary schools and participate in the summer Marine Quest workshops for young scientists. Our laboratory offers opportunities in training of individuals wanting to experience these organisms and their role in the environment. In this regard, we present opportunities for young scientists to obtain specialized training in the development of careers in marine science, marine biology and marine biotechnology.
Marcel van Tuinen, Ph.D. | Assistant Professor of Biology and Marine Biology

Research Expertise: | Ancient DNA, marine mammal and bird conservation genetics, avian genomics

Principal funding Agencies: | NSF, FWS, NPS

Our lab uses genetic and genomic techniques to address several evolutionary and ecological questions pertaining to life in aquatic and terrestrial environments. Our research falls into three broad categories: (1) using phylogenomic techniques in bird systematics; (2) using ancient DNA techniques in wildlife forensics of birds and mammals; and (3) using a combination of fossil and genetic data in reconstructing the evolutionary timescale of aquatic vertebrate radiations. Our research continues to involve both graduate and undergraduate students, which has assisted many students in preparing for career tracks in human health, veterinary science, forensics and academics. Our academic interests, as shown by our most recent publications in leading Molecular Ecology and Evolution journals, emphasize application of our results in systematics and evolution on the one hand and conservation and ecology on the other.
Wade O. Watanabe, Ph.D. Research Professor of Biology and Marine Biology
Research Expertise: Aquaculture
Principal Funding Agencies: USDA-NIFA, NC Sea Grant, NOAA Marine Aquaculture Program, NC Fishery Resource Grant Program, NC Biotechnology Center, NMFS S-K Program ~$350,000/y.
Current students: 7 Masters of Marine Science program, 1UG DIS, 6 UG interns

Watanabe leads the UNCW Aquaculture Program and is also Mariculture Program leader for MARBIONC, a private-public business incubator at UNCW-CMS. Primary biotechnical constraints to the development of a viable mariculture industry include (1) hatchery technologies that can supply high-quality fingerlings to growout operations and (2) growout technologies for producing marketable size fish that mitigate high cost of coastal land and environmental permitting requirements. The program addresses these constraints and teaches environmental responsibility in conjunction with mariculture technology development. The goals are to develop and transfer to commercial users safe and effective methods for marine food production, mitigate depletion of marine populations, and create economic opportunities through commercial cultivation. Research focuses on high-value, high-demand species that are threatened by overfishing such as flounder and black sea bass and seeks to control the life cycle of fish production (from egg to market) addressing the biotechnical challenges to commercial cultivation: breeding and culture, waste management, and economics and marketing. Technology is transferred in direct cooperation with commercial end users and through multi-stakeholder partnerships to leverage resources and minimize risks. Through graduate and undergraduate student involvement, research, education and technology transfer to the commercial end user are closely integrated. The fruition of this work is the emergence of startup commercial marine fish farms for flounder and black sea bass in NC and in VA.
J. Wilson White, Ph.D.  Assistant Professor, Dept. of Biology and Marine Biology

Research Areas:  Marine metapopulations, coral reef fishes, predator-prey interactions, mathematical modeling

Principal funding Agencies:  NSF, NOAA, SeaGrant

The primary focus of the White lab is the influence of ocean currents and larval dispersal on connectivity and source-sink dynamics in marine populations and communities. This work follows two main avenues. First, we use spatially realistic models to simulate the consequences of no-take marine protected areas on fished species. We then compare model outputs to field monitoring data to guide adaptive management. Second, we use a combination of field observations and multispecies models to study the influence of larval dispersal patterns on predator-prey dynamics in reef fishes.

Dr. White arrived at UNCW in Fall 2010, so the lab’s research program is still starting up, and graduate and undergraduate students will begin working in the lab in Fall 2011. Dr. White’s research takes place both in the Florida Keys, where he will be utilizing the UNCW-NOAA Aquarius Reef Base facility to study coral reef fishes, and in local North Carolina waters, where is collaborating with other UNCW researchers on estuarine fish population dynamics. Dr. White also maintains an international network of collaborators and has developed models to investigate species from barnacles to bluefin tuna. Most recently, his modeling work has been used to guide the development of a statewide network of marine protected areas in California.
The Nutrient Analysis Core facility at the UNCW Center for Marine Science is well equipped to support the center’s mission of basic and applied research in the fields of oceanography, coastal and wetland studies, marine biomedical and environmental physiology, marine biotechnology and aquaculture. In particular, the nutrient core facility is heavily utilized for studies on biogeochemical nutrient cycling and water quality monitoring in a variety of aquatic environments. Many of the center’s research groups, such as the Lower Caper Fear River Program, CMS Aquaculture, CORMP, MACRL and Coral Reef Ecology, use the facility and more than 10,000 samples are analyzed annually at a fraction of the cost of outside contract labs. Dr. Rob Whitehead is responsible for management and operation of the lab as well as training and supervision of the lab’s users.

The lab is a valuable training facility with many of the samples analyzed being part of the research work of undergraduate and graduate students in Marine Science, Chemistry and Biology. The lab houses six main instruments with a combined value of over $250,000: a Bran+Luebbe AutoAnalyzer III, a Shimadzu TOC 5050, an Antek 9000N, a CE Elantech NC2100, an ANTEK NoxBox and a Turner 10AU fluorometer. The AutoAnalyzer is a multi-channel continuous flow analyzer that is capable of simultaneously measuring up to four parameters from an individual sample. It is commonly set up to analyze nitrate, ammonia, phosphate and silicate, but can be converted to run other chemistries when needed. The Shimadzu and Antek are run in tandem to analyze dissolved organic carbon (DOC) and total dissolved nitrogen (TDN), respectively, in water samples. The CE Elantech is used to measure carbon and nitrogen in solid samples such as phytoplankton or sediment samples. The ANTEK NoxBox can measure nitrate or nitrite in samples with volumes as small as 10 µL. The Turner fluorometer is a versatile instrument that can be used to measure chlorophyll either in the laboratory or in the field. Most of these instruments are equipped with autosamplers, which greatly contribute to the lab’s productivity.
UNCW’s Shellfish Research Hatchery is a new, state-of-the-art facility that initiated operations in February, 2011. This ~12,000 square foot facility was built through a partnership with the North Carolina Division of Marine Fisheries in response to recommendations made by an interagency committee appointed in 2005 in response to legislation by the NC General Assembly.

This mission of the facility is to conduct and facilitate research that will both inform and contribute to north Carolina’s efforts to restore declining populations of ecologically and commercially important shellfish, and to build a sustainable shellfish aquaculture industry.

Infrastructure includes a microalgal culture facility designed to produce ~4,000L/day, a seawater system capable of delivering 130GPM filtered and temperature controlled seawater, and a larval production capacity designed to produce >20,000,000 larvae every 6 weeks during reproductive season. Additional resources include wet and dry support labs and quarantine room for work on non-local species.
The Wilbur Lab Group focuses on the application of molecular genetic approaches to address questions about the management, conservation, and restoration of shellfish. Many shellfish populations have experienced catastrophic declines in response to habitat degradation, overfishing and disease. Our research utilizes genetic analysis to better understand population connectivity which is critical to effective management, we monitor and evaluate the impacts of shellfish pathogens, and we investigate strategies for the effective restoration of these economically and ecologically important resources.

Students in the lab gain experience not only in the field methods necessary to evaluate the status of shellfish populations, but also acquire valuable laboratory skills, due in part to their use of the DNA analysis core at the CMS, that provide them with marketable skills utilized by the biotech industry.
Chemical and Molecular Diversity Group (Wright Laboratory)

Jeffrey L.C. Wright, C.M., Ph.D. FCIC. Carl B. Brown Distinguished Professor of Marine Science and Professor of Chemistry and Biochemistry
Research Expertise: Natural Products Chemistry, Marine Biotechnology
Principal funding Agencies: NIH, NOAA, NSF, CDC, NC Biotechnology Center

Research in the Wright laboratory is directed towards exploring the chemical diversity of culturable marine microorganisms with the goal of identifying new therapeutic leads for drug discovery and the identification of naturally-occurring marine toxins that can contaminate seafood.

A main focus is in student training and mentorship. Currently, there are three masters level graduate students and one honors undergraduate student, as well as two postdoctoral fellows who are concurrently enrolled in the Business of Biotechnology MBA program in the Cameron School of Business. As research in the Wright laboratory straddles the fields of organic chemistry, microbiology, and biomedical science, students in this group acquire a unique breadth of knowledge which makes them highly competitive in today's increasingly integrated scientific world. Students also have the rare opportunity to gain hands-on experience with cutting edge techniques and equipment critical to analytical chemistry and microbiology.

The second area of focus in the Wright laboratory is the translation of its discoveries into practical applications in the areas of drug discovery. The small molecules produced by marine microbes often possess extremely potent biological activity and thus are ideal drug lead candidates. The laboratory has developed a new process of molecule isolation from the crude extract of these cultured organisms which enables the lab's culture collection to be rapidly screened in a range of biological assays looking at diseases such as cancer as well as viral, bacterial and fungal infections. Through its association with the UNCW MARBIONC (Marine Biotechnology in North Carolina) program, the laboratory is able to seamlessly partner with biotech and pharmaceutical companies ensuring its discoveries can be translated through the pipeline toward drug development, a feat rarely achieved in academia.

The Wright laboratory also has an international reputation in the discovery and identification of new naturally occurring seafood toxins arising from red tide blooms that can severely impact human health and the seafood industry. Methods and standards have been developed for almost 10 different toxin groups and are available to Federal and State regulatory authorities such as the FDA, CDC, and the EPA which monitor threats to human, animal, and environmental health caused by toxin-producing organisms.
Press Coverage
Investigating a fish kill in Delaware's coastal waters, UNCW researchers discovered algae that produce the same poisons as the red tide phenomenon that plagues the Gulf of Mexico.

Daniel Baden, director of the Center for Marine Science at the University of North Carolina at Wilmington, said on Friday the results of the research were shared with Delaware environmental authorities and will be published soon in a scientific journal.

A team of UNCW researchers discovered that *Chattonella cf. verruculosa*, a microscopic algae common in East Coast bays and rivers, produces the same nerve-damaging poison, called brevetoxin, produced by the tiny organism that causes red tides. The discovery is important, scientists said, because it shows a new danger to animal and human health in East Coast estuaries and provides more evidence that the toxic algae problem continues to spread and become more complex.

Officials with Delaware's Department of Natural Resources and Environmental Control said they had worked closely with UNCW researchers through August and early September. The Agency will issue a news release next week to share the information with the public.

"You don't often have moments like this in science, where you can quickly provide information to protect human health," said Dr. Baden, who was on a team of five that conducted the research.

The organism, which looks like a lumpy green slipper under a microscope, is not directly related to the much-publicized *Pfiesteria piscicida*, which can also kill fish and cause neurological problems in the humans that eat infected animals.

"As a matter of fact, there were no *Pfiesteria* in the samples we obtained from Delaware," said Carmelo Tomas, a UNCW research professor. "The samples had incredible concentrations of *Chattonella*."

"Chattonella now joins a growing list of harmful algae identified by scientists. Brevetoxin was discovered by scientists in 1981 and successfully recreated in laboratories only recently.

Red tides are caused by toxins released by certain forms of life called phytoplankton. They get their name from the pigment of some algae that cause the water to appear red or brown.

That *Chattonella* produces toxins already identified and under study may make it easier to develop identification and treatment strategies.

UNCW researchers were contacted by Woods Hole Oceanographic Institute, which had been called in to help solve the mystery of August fish kills in Delaware's Rehoboth Bay and reports from bathers at nearby Indian Inlet Beach, who complained of numbness, muscle spasms and respiratory irritation.

Research included several types of chemical analysis of water samples, including work sent to laboratories of the Medical University of South Carolina, Dr. Baden said.

A 13-page scientific report, to be published in the journal Environmental Health Perspectives, also credits UNCW researchers Andrea Bourdelais, Jerome Naar and Julia Kubanek.

The research conducted from late August until mid-September, was funded by portions of existing grants, Dr. Baden said, including one from a study of threats to human health provided by the National Institutes of Health.

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Scientists study deep sea creatures

BY ERIC ALAN BARTON
N.Y.T. Regional Newspapers

KEY WEST, Fla. – Scientists filled a moving truck Tuesday with mussels and bacteria found in the Gulf of Mexico’s depths that they say may help erase pollution and cure diseases.

The organisms that live in deadly poisonous pools nearly two miles below the surface were found during a two-week, $2 million expedition led by University of North Carolina at Wilmington marine biologist Andy Shepard.

The team of scientists, funded by the National Undersea Research Program, plans to return next year for further research.

The scientists used the deep-water submarine Alvin to snatch spaghetti pot-sized samples of the organisms off Florida’s coast and to study deep gashes in the Gulf’s floor caused by mysterious underwater storms. The research into the fissures off Florida and the discovery of frozen methane gas pockets off the Mississippi coast are expected to help oil companies searching for new fuel sources and to protect the foundations of oil rigs from the underwater storms.

The organisms, stored in formaldehyde and on dry ice, will be shipped to laboratories for months of study. The mussels and gigantic clouds of bacteria found in the Gulf’s depths during the expedition are expected to help erase pollution and cure diseases.

The first results of tests on the creatures pulled up from the Gulf’s depths during the expedition are expected back by February. Results are expected to be published in the journal Science.

The mussels and gigantic clouds of bacteria floating nearby hold microscopic parasites that could yield secrets on how to convert the pools of poison into energy. Such a discovery could be used to treat pollution by using the organisms, said Joan Bernhard, a biological oceanographer with the University of South Carolina.

Ripples and fissures found along the Gulf bottom have long been a mystery to researchers, and dives during the trip also found man-sized piles of sediment. The furrows indicate that the ocean current at such depths could reach speeds that would rip up anchors from oil platforms. The currents, reaching perhaps 3 knots, pack a punch that’s multiplied by the ocean’s depth and can send a submarine crashing across the bottom.

“It’s really like finding an oasis in the barren desert of the ocean bottom,” said Cheryl Jenkins, a research scientist for the College of William & Mary. “No one ever expected to find such a thing. They’re novel, and they’re things you can’t find anywhere else.”

For UNCW’s Mr. Shepard, who coordinated the expedition, going 8,000 feet deep in Alvin was like living a boyhood dream. He had never been below 1,000 feet deep before.

“I’m looking out the window gasping,” he said. “I’m seeing things I’ve only heard about in ecology books before.”

Life among the chemicals seeping from the ocean bottom was discovered in 1979 by a crew also using Alvin.

“When they first found this stuff, they had to pickle it in gin because they didn’t have any formaldehyde, because no one knew it would be there,” Mr. Jenkins said.

Scientists now compare the diversity of life on the Gulf floor to a rainforest and its colonies. They liken it to cities where inhabitants must work together to survive extreme pressure, the poison that’s used as food and the lack of light.

“It really is otherworldly,” said Mr. Shepard. “This trip was really a gold mine.”

Mr. Shepard said he was struck by the similarities between organisms found at each of the sites.

“Somehow or other these animals are moving back and forth and exchanging across the Gulf,” he said.

Among the creatures pulled up and preserved during 14 deep-water dives were mussels that will be studied to determine whether there are traces of pollution in the systems they use to filter food from the water. Scientists fear pollution may be infiltrating even the ocean depths. Gulf mussels will be compared to others found across the globe.

Andy Shepard, a marine biologist at the University of North Carolina at Wilmington, explains how the deep-water submarine Alvin works after an expedition in the Gulf of Mexico on Tuesday.
Most scientists studying global warming can only dream of testing their theories.

Not so at the University of North Carolina at Wilmington.

Powerful dredges deepening the Cape Fear River shipping channel by 4 feet over the next three years will unintentionally create a 10,000-acre laboratory for researchers such as Courtney Hackney, a UNCW marine biologist.

Dr. Hackney wants to know how a predicted swell in the Atlantic will change the swamplands flanking the river north of Wilmington. He expects to see freshwater swamps begin turning into saltwater marsh, information that could lead to better projections of global warming's effect on low-lying sections of the U.S. coastal plain.

The $377 million harbor-deepening project will add another 4 inches to the tidal surge that stretches more than 25 miles upstream above Wilmington with high tide twice a day. That translates into about 33 years of the rise expected in the Atlantic due to global warming, Dr. Hackney said.

“We would probably ever get a permit to raise the sea level experimentally in 10,000 acres of swamp,” he said. “This is just lucky for us.”

The Atlantic bulges naturally by about 1 foot per century along most of the East Coast because the dry land is sinking. But global warming—the theory that man-made methane, carbon dioxide and other heat-trapping gases will warm the earth’s atmosphere several degrees over the next century—is exacerbating the situation, most scientists believe.

If temperatures keep rising, the ocean’s waters will expand, and polar ice caps will melt into the seas. The result, the theory goes, will be a rise of more than 2 feet over the next century.

The effects could be particularly severe for North Carolina, which will lose more wetland acreage than any other state but Louisiana and Florida, according to a 1998 report by the Environmental Protection Agency.

The ocean will inundate roughly 1,000 square miles of wetlands in North Carolina over the next century if the Atlantic rises 2 feet, the EPA found. Much of Hyde County, for example, would be underwater.

Unlike the high-priced real estate on barrier islands and sounds, swamps aren’t likely to be walled off against the encroaching water if sea level rise accelerates.

The early changes won’t necessarily be bad, either. More salt-water creeping upstream would mean more marsh habitat for fish and crabs. The loss of hardwood swamps, on the other hand, would kill the trees used by warblers and other birds.

“The bottom line is that we’ll get a good glimpse into what sea level rise can do to plant communities,” Dr. Hackney said. “It’ll be up to the policymakers to decide if that’s good or bad.”

Wednesday, a mud-covered window into the future was in the hands of Dawn Carroll, a graduate student in UNCW’s marine science program. A bottomland belch broke the silence as she yanked an acrylic board from the mud along the Northeast Cape Fear River.

Maverick Raber, a UNCW undergraduate, thrust syringes into the so-called “peeper” and took samples from each of six slots. Over the next eight years, the samples will tell the tale of the river deepening in terms of sulfate and methane.

Sulfate, a salt found in seawater, feeds the bacteria that eat away the organic muck at the bottom of a swamp. Eventually, the land level drops, killing cypress and sweet gums while creating more open water.

High methane concentrations mean the freshwater swamp is enduring.

“If we get a lot of sulfate in our samples, we know we’re getting inundation from the salt wedge,” Ms. Carroll said, crouching on a gnarled hammock.

She and Mr. Raber pulled five more peepers from ground that is underwater at high tide, working their way back to the piney uplands hundreds of feet from the river. Wearing waders, they walked a tightrope of moss-covered cypress roots zigzagging through the Cape Fear’s version of quicksand.

A float at the edge of the river rises and falls in a metallic pipe, recording data that are automatically transmitted to the lab by call phone.

In all, there are nine such stations in the river system, as well as three previously existing tidal gauges and a baseline monitor off Fort Caswell at the river’s mouth. The sites, which include elevation markers tracked by satellite, will allow UNCW to monitor the tide it moves up and down the river and spreads laterally across its swampy fingers.

The Army Corps of Engineers expects to pay about $2.5 million for the research over the next seven or eight years, said Frank Velverton, a biologist with the corps.

The agency agreed to fund the research after members of the local scientific and environmental community said they wanted to know exactly what happens to the Cape Fear system as a result of the dredging, he said.

While the corps’ models show the tidal range increasing four inches at Wilmington, they don’t indicate any increase in saltwater upstream.

“Of course, there’s no perfect model, so we’re testing to see if it’s correct,” he said.

Dr. Hackney suspects the salt will indeed make it farther up the river channel. And he’ll be the first to know, save a few mud-caked grad students, if it does.
REEF RESCUE Algae-eating animals may help coral save itself

BY BRIAN FEAGANS
Staff Writer

Known for their prickly ways, sea urchins have long been one of the most maligned creatures on the reef. Now scientists are testing whether the spine-covered creatures could help save coral systems that are withering at an alarming rate around the globe.

Alina Szmant, a marine biologist at the University of North Carolina at Wilmington, is leading a research team that plans to place about 200 laboratory-grown sea urchins onto a struggling coral reef in the Florida Keys as early as Friday.

Diadema antillarum, which is black with spines striped in white, eats the algae that often smother sick or dead reefs. But following a mysterious die-off of the sea urchin’s Caribbean populations in 1983, fish that also eat the algae couldn’t keep up with its growth.

“Every time a coral dies, it’s not being replaced by new coral; it’s being replaced by algae,” Dr. Szmant said.

The trend has made it nearly impossible for larvae from the remaining healthy coral reefs to colonize sick reefs and revive them.

Dr. Szmant and research partner Thomas Capo of the University of Miami want to see if help can be raised in a laboratory.

They have raised about 200 sea urchins that will be placed in 8-foot-wide net corrals designed to keep the urchins in one spot. By the time the September full moon arrives and triggers larvae release by the corals, they expect to see large bare patches of reef ready to be re-seeded. The research team will use a fine mesh net to capture larvae from healthy reefs and dump them onto 16 test sites on Little Grecian Reef, nestled between two marine reserves in the Florida Keys.

Earlier in the summer, they rounded up about 200 sea urchins from the wild and placed them on the reef as well. By next year, Dr. Szmant plans to have thousands, perhaps tens of thousands, of sea urchins ready for introduction to the reef.

It will take roughly five years of measuring coral growth to see if the method works, Dr. Szmant said.

Sea urchins may look intimidating – they grow to 4 inches wide and have spines a foot long – but they’re vulnerable to crabs, puffer fish and other predators.

So the researchers also want to study how the sea urchins die so they can select habitat types with the least mortality. That means plenty of graveyard shifts for researchers bent on monitoring the movements of a creature that hides in crevices all day and feeds at night.

The reefs’ fate may depend on the urchins.

Scientists estimate that about one-third of the world’s coral reefs have died or deteriorated in the past quarter century. That figure is closer to three-quarters in and around the Florida Keys, Dr. Szmant said.

Hurricanes, disease and other natural phenomena have always killed reefs. Boats that smack into the coral and manmade pollution also have wiped out sections. But many scientists believe another factor, perhaps global warming, is behind the accelerated pace of bleaching, whereby vibrant brown corals turn white with death. Studies have shown coral to be particularly sensitive to warmer waters and sudden shifts in ocean temperature.

“Even remote places like Palau and Fiji lost more than half of the coral,” Dr. Szmant said, despite being far removed from any intensive human activity that could cause the problem.

If successful, introducing sea urchins could give the algae-eaters a foothold in the Caribbean, she said.

“To raise enough to repopulate the Caribbean we’re talking about billions of urchins,” Dr. Szmant said. “We could never do that. We want to create many small populations that can breed on their own.”

National Sea Grant has given $412,000 for the research while about $250,000 is coming from UNCW, the University of Miami, The Nature Conservancy, the Institute for Marine Science in Fort Lauderdale and the National Oceanic and Atmospheric Administration.
Rare & Precious

Find will help scientists learn more about elusive fish

BY GARETH MCGRATH
Staff Writer

Tom Lankford Jr and Mike Williams struggled to lift the frozen remains of the huge prehistoric fish recovered from the Cape Fear River late last week onto the examination table at the Center for Marine Science.

“It’s tragic that this happened,” said Dr. Lankford, a marine biologist at the University of North Carolina at Wilmington, inspecting the clean cut that carved off the rear third of the estimated 7 1/2-foot-long female Atlantic sturgeon. “But what a golden opportunity.”

Although the largest fish found in the Cape Fear River, the sturgeon is one of the rarest visitors – an aquatic wanderer encountered so infrequently that scientists know little about it.

But for the first time, researchers at UNCW now have a mature sturgeon specimen they hope will help them answer some of those scientific mysteries. During the past six years, researchers conducting fish surveys as part of the Lower Cape Fear River Program have been able to examine – but not take away – sturgeon, finding an average of 20 to 25 a year.

“These fish are too precious, too valuable to be outright killed for scientific purposes,” said Mr. Williams, a research technician, adding that the species is listed as threatened by both the federal and state governments and off limits to fishermen.

But what scientists know about the local sturgeon population is vastly outweighed by what they don’t.

“This is probably one of the least-known fish on the East Coast,” Dr. Lankford said as he examined the sturgeon’s vacuum-like, toothless mouth that the big fish uses to suck crustaceans and other organisms off the river bottom.

The question at the top of scientists’ list is how many sturgeon are left in the watershed.

Although Atlantic sturgeon are found in most major river basins along the Eastern Seaboard, each local population is considered unique because of the fish’s propensity to return to certain watersheds to spawn.

That characteristic has resulted in genetic traits unique to each sub-population, Dr. Lankford said.

“Due to the independent nature of these fish, we can’t automatically assume our local population is doing well even if sturgeon populations are doing well, or relatively well, in other rivers,” Dr. Lankford said.

“Moreover, it’s safe to say that based upon past research they’re not abundant.”

Mr. Williams said researchers know that sturgeon return from the ocean to freshwater habitats to spawn, but they don’t know how successful the fish are in navigating the dams along the Cape Fear River to reach historical breeding grounds well inland.

Lose the fish and you lose those traits.

He said officials have high hopes that a fish bypass channel the Army Corps of Engineers intends to build at Lock and Dam No. 1 in Bladen County will help restore upstream fisheries.

Dr. Lankford said the sturgeon, which was found by another researcher conducting water quality sampling near the mouth of the Cape Fear River, was probably killed by a cargo ship propeller or a bucket dredge as the fish was returning to the sea after spawning.

Along with proving that at least a few big ones still trawl the river’s murky bottoms, Mr. Williams said researchers hope to use tissue, blood and organ samples from the sturgeon to gauge its health before it was killed.

That could help officials determine how water quality issues affect the large fish.

Dr. Lankford said species like the sturgeon, which have remained basically unchanged for 70 million years, are a good gauge of how well – or badly - we are preserving the river.

“It would be a shame for them to disappear because of our actions,” he said. “When we lose these long-living species, that’s a sign that we’re not doing something right.”

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Battling with nature
Encroaching ocean puts Figure Eight properties in danger of destruction

BY GARETH MCGRATH
Staff Writer

FIGURE EIGHT ISLAND) For about a dozen homeowners near the north end of this private island, time and options appear to be running out.

Homeowners here have spent the past two years watching the beach and dunes in front of their houses slowly disappear, washed away by a surf sent crashing into the escarpment by a wandering inlet that separates Figure Eight Island from neighboring Hutaff Island.

The scouring has left irrigation pipes sticking out of sandy bluffs, the shrubs they were supposed to support now just vegetative debris on the beach below. Beach-access stairways 15 feet high stretch across empty space, the protective dunes they once crossed long since washed away.

Island officials and homeowners have tried several measures to rebuild the precious beach in front of their homes, including pumping sand from an inland channel onto the beach. But the actions have done little to stop the seemingly relentless march of Mother Nature, the new sand often hardened structures shift erosion to neighboring shorelines.

Now the homeowners are making their last stand – sandbags. They hope the sand-filled fabric bags will buy enough time for Rich Inlet – or, more specifically, its primary channel – to begin its shift back toward Figure Eight, thereby reversing the trend that has robbed the beach of its sediment.

The inlet’s ebb channel reached its northern-most orientation ever recorded in late 2000. “It is moving back, albeit very slowly,” said Bill Cleary, an inlet specialist with the University of North Carolina at Wilmington, “but there are still a lot of other variables that could alter its track.”

“But I will tell you there’s a much greater potential for positive changes on Figure Eight Island than there was a year ago.”

The first sandbags appeared on the island’s beach last winter. Another home received state approval for bags this spring.

Seven other property owners along Comber and Inlet Hook roads applied for sandbags last month, but their variance request to the Coastal Resources Commission was rejected. State regulations generally only allow sandbags in situations where the erosion has crept to within 20 feet of a building’s foundation or septic tank. Several of the homes had much more beachfront than that when the hearing took place.

But Ed Brooks, interim district manager for Coastal Management’s Wilmington office, said that later inspections found the situation rapidly eroding. “In some cases they had lost 18 feet since that meeting, so we permitted them at that time,” he said.

Now sandbags – some of which have yet to be filled – line a several-hundred-foot stretch of beach, the large beachfront homes towering above the thin fabric barrier protecting them.

State law usually only allows sandbags to remain in place for two years unless they’ve been completely covered by sand and stable vegetation. Mr. Brooks said that regulation is in line with North Carolina policy against permanent beachfront protective devices, the rationale being that hardened structures shift erosion to neighboring shorelines.

“They’re only available in emergency situations, which is what we had here,” he said, adding that it was pretty obvious what was going to happen if something hadn’t been done. But because the Figure Eight Island Homeowners Association has a permit for a renourishment project along the northern third of the island, the sandbags can stay in place until 2008, Mr. Brooks said.

So will the bags buy the homes enough time to allow the beach in front of them to rebuild? “Certainly they’ve got time if they don’t have any major storms,” Dr. Cleary said.

As Rich Inlet moves toward Figure Eight Island, the protective offshore sandbars that used to protect the eroded beachfront should start reforming.

Dr. Cleary said the sandbars absorb the wave energy and, as pieces of the shoal break off and wash ashore, renew the beach.

“The difficult part of that is no one knows how long that’s going to take,” said island homeowners association attorney William Raney Jr., “and that’s really dependent on the weather.”

Mr. Brooks said the sandbags should work, but that stating anything for certain when you’re dealing with a dynamic barrier island isn’t advisable.

“I think what’s been done appears to address the current erosion problem,” he said. “But sandbags are certainly not a panacea, an answer to all beach renourishment problems.”

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SAD DAY AT THE BEACH

BY GARETH MCGRATH
Staff Writer

CAROLINA BEACH | After touching the unusual stranger, Jamie Burge declared it felt like rubber. “It’s like a live version of the Animal Planet,” the 12-year-old from Carolina Beach said excitedly as researchers from the University of North Carolina at Wilmington began cutting apart the beached whale.

“Except it’s dead,” added 9-year-old Brad Rose of Halifax, another one of the throng of beachgoers that had been drawn to the huge carcass. Thursday’s discovery of the 36-foot Sei whale along the undeveloped north end of Carolina Beach was both a sad event and an opportunity, said Ann Pabst, a marine mammal biologist with UNCW.

“We don’t know a lot about these whales because we rarely see them,” she said, noting decades can pass between reports of Sei whales washing ashore from the deep waters they frequent.

Without a specimen, and since hunting the endangered whales is illegal, it’s very hard to study them. Dr. Pabst added that most of the information scientists have on Sei whales comes from whalers - which isn’t much since the animal’s biology wasn’t very high on the hunter’s list.

Thursday’s event was so rare that the Smithsonian has requested tissue samples and the whale’s skull.

But Dr. Pabst said there was an equally important reason, beyond the scientific, foradventuring to the pod of carcass to study the Sei whale for so long that the animal’s skin had begun to grow around the line that had been attached to the whale’s head.

Pointing to the whale’s emaciated midsection, Dr. Pabst said the marine mammal - which would have weighed around 36 tons if healthy - had slowly starved to death.

“With it carrying this line, it wasn’t able to feed like it should have been doing,” she said.

The whale carcass was discovered early Thursday morning, leading officials to believe the animal became stranded sometime early that morning.

A few hours later the team from UNCW was scampering around the carcass as curious visitors took pictures and playfully touched the giant animal.

“It’s sad, but cool,” young Jamie Burge said as the whale’s skin was washed down to remove sand and other material that had gathered on it from its extended stay on the beach.

After Carolina Beach crews used a backhoe to move the carcass away from the encroaching tide, Bill McLellan began measuring the whale’s body, flippers, mouth and checking its sex.

“It’s a sad opportunity because we don’t often have chances like this to study them,” said the head of the state’s Marine Mammal Stranding Network, which is based at UNCW.

As other members of the eight-person team surrounded the carcass, - their moisture-resistant overalls duct-taped over their boots to prevent any whale liquid or pieces from getting inside - Mr. McLellan sharpened his knife.

He began cutting back the whale’s thick outer layer of blubber. Eventually, the backhoe was used to pull back the skin in one large chunk, unveiling the muscles underneath.

It looked a little bit like a banana being peeled. The research technicians and students from UNCW then began taking samples from the whale’s blubber, muscle, tissue and organs. Dr. Pabst said the samples would eventually be distributed to research labs around the country and the world.

The animal autopsy, called a necropsy, was expected to last most of Thursday.

With the carcass much too large to move, Mr. McLellan said the team would bury the whale’s skeleton in the nearby dunes until the Smithsonian could come down and pick up what it needs.

“Hopefully this should give us a much bigger, more detailed picture about these animals than we have now,” he said.
From staff reports

Earlier this month, 17 high school teams from across the state came to the University of North Carolina at Wilmington’s Center for Marine Science to compete in the National Ocean Sciences Bowl, locally called the Blue Heron Bowl. The Consortium for Oceanographic Research and Education, a federal agency, sponsors a bowl in each state.

Each member of the winning team, East Carteret High School in Beaufort, won a laptop computer, a $1,000 scholarship to N.C. State University (if they attend the school) and an all-expenses paid trip to the national finals April 23-25 in San Diego. Their coach, Barbara Waters, received a scholarship to the National Marine Educators Conference July 19-23 and a weekend getaway package at the Wilmington Hilton Riverside.

“The winning teams on the national level will be awarded college scholarships,” said UNCW MarineQuest director Diane Talley, who oversaw the statewide program along with Ron Sizemore, associate director for the marine science center; and Nancy Elden, assistant director for MarineQuest.

About 275 people attended the event at the marine science center’s Dobo Hall, including 85 students, their coaches and many parents. The previous evening, participants were treated to a tour and catered dinner at the N.C. Aquarium at Fort Fisher.

Local high schools taking part were Ashley High under coach Sandie Cecelski, Hoggard under coach Valerie Dugan and Cape Fear Academy under coach Judy Gibson. About 45 volunteers officiated the quiz bowl-style format.

Individual teams practiced after school from September through February, learning hundreds of facts to prepare for the competition.

In North Carolina, the bowl rotates every two years among UNC-Chapel Hill, N.C. State and UNCW, which will host it again in 2004.

Other teams were from Falls Road Baptist Church School in Rocky Mount, John Holmes in Edenton, Myers Park in Charlotte, Raleigh Charter School, S.W. Guilford in High Point, St. Mary’s in Raleigh, Walter Williams in Burlington, Washington High in Washington and West Lincoln in Lincolnton.

Other top finishers were Myers Park, which won Palm Pilots for its second place, Washington High in third, Raleigh Charter in fourth and John Holmes for Best Sportsmanship.

IKA Works awarded participating teams $650 worth of science equipment for each of their schools. For more information about next year’s bowl or the UNCW Center for Marine Science programs, call 962-2386.

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The foreign creature with the feather-like spines stared out from the fish tank at UNCW’s Center for Marine Science.

“With this one and the increased number of sightings, I think it’s pretty good proof that these things are here to stay,” said research technician David Wells. He was talking about Leo, as researchers have dubbed the lionfish – a beautiful but potentially harmful stranger to the waters off our coast.

Lionfish sightings off the coast of North Carolina, although still extremely rare, have been on the rise for years. That has researchers worried about what impact the top predator in its native environment might have on critters that sit high on the food chain on this side of the world.

Only two “North Carolina” specimens have previously been captured, in part because of the deep waters the interloper from the Pacific and Indian oceans inhabits.

Researchers from the Coastal Ocean Research and Monitoring Program, an arm of the National Oceanic and Atmospheric Administration based at the University of North Carolina at Wilmington, had seen the poisonous exotic fish hanging around their submerged instruments on previous dives.

“We saw him again on our way down this time, but didn’t have time to mess with him,” said fellow research technician Morgan Bailey.

But with a few minutes left in their air tanks, the divers decided Wednesday to try to catch the colorful fish. Using a flipper, Mr. Bailey and diver Steve Hall corralled the lionfish into a mesh bag and then aboard the R/V Cape Fear.

Venom rarely fatal

“We were definitely careful,” Mr. Bailey said, alluding to the fish’s poisonous spines. “But we were more excited than anything else.”

The lionfish’s venom can produce localized and abdominal pains, but fatalities are rare.

Caught in roughly 130-foot-deep water 50 miles off Masonboro Inlet, the fish’s location corresponds to past lionfish sightings, said Paula Whitfield, a biologist with the NOAA lab in Beaufort.

It also is the second report of lionfish skulking around submerged instrument stations in an otherwise barren, sandy stretch of ocean bottom.

“What that tells me is that they’re probably everywhere at that depth,” Ms. Whitfield said.

But she said an even more noteworthy – and potentially worrisome – observation is that the fish was caught in the middle of winter.

Worrisome impact

That probably ends any question as to whether the fish is established and wintering here, Ms. Whitfield said, noting the fish can’t survive in an environment much colder than the 63-degree waters in which it was found.

It also raises the question of what impact the hunter might be having here on other apex predators who might not know what to make of the spiny pterois volitans.

“Theyir arrival could crowd out smaller groupers, snappers and other reef-dwelling species, but we just don’t know at this point,” Ms. Whitfield said.

Theories abound as to how the fish, a warm-water creature normally found in the oceans off Southeast Asia and Australia, reached the North Carolina coast.

It could have been brought to U.S. waters in ballast water carried by merchant ships traveling from the Far East. Ballast is used to stabilize ships during transit.

But Ms. Whitefield said a more plausible guess is the foreign fish, which is popular with aquarium owners, was released into the ocean and rode the Gulf Stream up the coast.

Staring at the 6-inch-long lionfish, Mr. Bailey said UNCW plans to put Leo on display in the center’s lobby.

“It’s not something you see out here every day,” he said.
By Gareth McGrath

If you like seafood caught in North Carolina’s sounds, tidal creeks and close ocean waters, then you better like oysters - and not just as an appetizer or aphrodisiac.

It sounds simplistic, but that’s how important the oyster is to the state’s estuarine environment and - consequently - commercial and sport fishing industries, experts say.

Sloshing through the shallow mud flats near Hewletts Creek, Cape Fear Coastkeeper Ted Wilgis said the humble oyster can tell us a lot about the health of our marine environment.

“They really are a bellwether species,” he said as he checked out some test oyster reefs established in the shallow waters by the N.C. Coastal Federation.

That’s because a market-size, 3-inch oyster can cleanse roughly 50 gallons of water a day, pumping water at the rate of 1,500 times its body volume per hour.

But the booming development along the coastline, along with agricultural runoff from inland areas, has created more polluted runoff than Mother Nature’s natural filters can handle.

That’s led to scores of waterways - like most of New Hanover County’s tidal creeks - that have dead or dying oyster reefs and are closed to swimming and shellfishing.

Stuck in a vicious cycle, poor water quality means fewer oysters, which in turn means even more polluted water - even as development pressures on coastal waters increase.

But it’s not just coastal development that’s decimated the shellfish to about 5 percent of their historic range.

Craig Hardy, with the N.C. Division of Marine Fisheries, said disease and overharvesting have helped further erode oyster numbers.

“It’s been a bad confluence of factors,” he said.

Next week, the Coastal Federation will join 30 other public and private groups in hosting a conference that will look at the state of North Carolina’s oyster population and what can be done to bring it back.

Mr. Wilgis said all a person has to do to know the shellfish is in trouble is to look at the state’s oyster harvests in the 19th century were counted in the millions of bushels.

Harvests in recent years have been hard pressed to break 50,000 bushels.

“Our oyster population has stabilized in recent years,” Mr. Hardy said.

“Unfortunately, though, it’s stabilized at a very low level.”

But as he overlooked another set of test oyster reefs near the mouth of Hewletts Creek, University of North Carolina at Wilmington marine biologist Troy Alphin said a healthy oyster population means a lot more than cleaner water and a local source for a good meal.

The researcher said oyster reefs create important nursing and a juvenile habitat for a slew of critters that otherwise would struggle to find a home on the bare tidal mudflats.

“If it’s not there, then that habitat’s not there, and those animals likely aren’t going to be there,” Mr. Alphin said.

But officials admit reversing the oyster’s downward trend isn’t going to be easy and will require as much work on land as in the water.

“If you don’t stop what’s coming into the water in the first place, then it doesn’t really matter what you do in the water,” Mr. Wilgis said.

One proposed method to save - and rehabilitate - the state’s oyster population is to take a watershed approach to the problem.

In that respect, Hewletts Creek could offer a model for the rest of the state with Wilmington and New Hanover officials working onshore to limit runoff washing into the headwaters of the tidal creek, and the Coastal Federation and UNCW working in the water to rebuild oyster reefs.

“We think these kinds of multi-pronged approaches offer the best chance for a recovery,” Mr. Wilgis said.

Mr. Hardy said whatever initiatives are proposed, it’s going to take cooperation among a number of groups - including developers - to bring the unglamorous, but environmentally important, mollusk back.

“We didn’t get here in just five or 10 years,” he said. “It’s been over a hundred years of impacts to get us where we are.

“Hopefully it won’t take us 100 years to get us back, but it’s not going to be a quick fix either.”
BY CHERYL WELCH
Staff Writer

Red tide is usually a killer – one of the surest things to decimate marine wildlife and erode the tourism and fishing industries.

But researchers at UNCW’s Center for Marine Science have found a potential lifesaver from the deadly algal blooms.

For the past five years, researcher Daniel Baden and his team have studied the toxins the red tide produces and their health effects.

What they found was an antitoxin that is 100 times more effective than any other drug for treating cystic fibrosis.

“This is truly bench-to-bedside research,” Dr. Baden, director of the University of North Carolina at Wilmington’s Center for Marine Science. “We weren’t looking for this. It’s one of those things where you put observation together with opportunity and you make discoveries.”

Three years into the study, research assistant professor Andrea Bourdeilais was testing the toxins from red tide on mosquito fish swimming in 50 milliliter beakers of water. The small multicolored fish usually died within seven minutes. But in one toxin sample, the fish lived about 17 minutes.

“That was almost a shot in the dark,” she said.

Calling the fish experiment a “eureka moment,” Dr. Baden said his research assistants ran down to his office, telling him he had to see their accidental discovery.

After further study, the research team discovered that red tide produces at least two antitoxins to help neutralize its own toxins.

Since the red tide’s toxins contaminate shellfish and cause respiratory irritation similar to asthma in humans and other marine wildlife, the team guessed the antitoxin would have the exact opposite effect.

So they tried the antitoxin out on asthmatic sheep, and it effectively opened breathing passages.

“Not only did it work, but it works at a million times lower concentrations than any other drug,” Dr. Baden said.

And it works in an entirely different way than current drugs that treat lung ailments. That means the discovery could lead to a whole new set of drugs.

“Their job is to create a lot of mucus build-up associated with cystic fibrosis and similar lung diseases.

Fred Tyson, program administrator at the National Institute of Environmental Health Sciences, which provided funding for Dr. Baden’s research.

This could be big because cystic fibrosis, the most common cause of chronic lung disease in children and young adults in America, kills 60 percent of the children who have the genetic disease before they reach adulthood. There are few treatments for the condition.

The discovery could also be of use to the Department of Defense. Dr. Baden said he is discussing the potential use with defense representatives, since many chemical toxins that could be used by terrorists negatively affect the lungs. The red tide’s antitoxins could be used to quickly clear the lungs of people exposed to irritants.

UNCW is working with aaiPharma, a pharmaceutical drug company in Wilmington, to develop the potential use of the discovery.

Together, they have three patents pending and are in the early stages of development.

“We can take the innovative discoveries from the public universities and bring them in house to a private industry that specializes in the development of these candidates to potentially therapeutic drugs,” said Steve Fontana, vice president of patents and intellectual property at aaiPharma. He declined to give the terms of the agreement between the two.

Despite UNCW and aaiPharma’s collaborative research efforts, it could be years before any form of the antitoxin is on the market for human use.

“It’s too soon to be able to put a realistic time frame on it,” Mr. Fontana said.
By Gareth McGrath
Staff Writer

When Steve Pfaff sits down to make rip current forecasts for Southeastern North Carolina, he has to rely on data from the Frying Pan Shoals buoy 35 miles offshore or from information gathered even farther out to sea.

The marine program leader for the National Weather Service’s Wilmington office admits it’s not the best method, but it is the best one he’s had at his disposal to date.

“Wave energy offshore changes as it comes inshore, and a lot can happen in that time,” Mr. Pfaff said as he bobbed up and down on the bow of the University of North Carolina Wilmington research vessel Cape Fear.

But officials are hoping this summer’s deployment of a series of new near-shore buoys, along with two pier-based stations, will help increase the accuracy of marine forecasts by transmitting weather and oceanographic information in almost real time.

“It’s a huge step for everybody, whether at UNCW or not, because this information is going to be available on the Web,” said Marvin Moss, co-director of the Coastal Ocean Research and Monitoring Program, or CORMP, a federally supported effort to protect and enhance the coastal marine environment. The installation of the real-time buoys is part of a larger national effort to improve inshore coastal forecasting and monitoring.

With a swing of its large A-frame, the R/V Savannah lifted a 10-foot yellow buoy off its stern Monday and deposited it into the relatively flat 48-foot-deep water five miles off Wrightsville Beach.

The buoy, dubbed ILM2, was the second one dropped by the Savannah on Monday. The other buoy was dropped 27 miles offshore in 110-foot-deep water.

Full of instruments above and below the waterline and with a satellite modem to transmit the information, the buoys will help fill in that data gap between offshore and land-based instruments, officials said.

That means better – and faster - forecasting of weather conditions ranging from rip currents to tropical storms blowing in from the Atlantic.

The added information also is expected to help officials better establish storm-surge modeling, a serious concern for emergency officials as more people crowd the coastline.

“It’s a quantum leap in capabilities for us,” Dr. Moss said, ticking off the scientific uses of the new data. “But it’s also going to be important information for everyone, from fishermen to surfers or swimmers going to our beaches.”

Two anchors, both weighing more than 3,000 pounds, are attached to each buoy to prevent it from moving and as a redundancy in case one is accidentally cut – a common problem for ocean buoys.

On the yellow buoy itself, instruments measure air temperature, wind speed and direction, pressure, solar radiation and humidity.

Below the waterline, a series of oceanographic instruments are attached to one of the anchor lines to record water temperature, salinity, current speed and direction, and eventually wave data.

A low-tech mixture of cayenne pepper and Vaseline is smeared on some of the underwater instruments to keep barnacles and other crustaceans off, although officials said each buoy will have to be taken out of the water, cleaned and serviced about every six months.

Plans call for deploying two additional buoys this summer near Camp Lejune – to help the Marines with forecasting and amphibious planning – along with data stations at the end of Johnnie Mercers Fishing Pier in Wrightsville Beach and at Long Beach Pier in Oak Island.

Dr. Moss said construction and deployment for each buoy costs $200,000, funded as part of a roughly $2.2 million grant from the National Oceanic and Atmospheric Administration.

He said he hopes additional federal funding will help UNCW deploy two more buoys farther up the North Carolina coast next summer.

A similar program, led by the University of South Carolina, is helping South Carolina increase the coverage of its shoreline.

Pointing to the buoy bobbing in the light seas, Mr. Pfaff emphasized the importance of the new instruments and the data they will gather.

“When you’re dealing with a data-sparse area, any little bit of information helps, and these new buoys are going to fill in a lot of holes,” he said.

“I don’t think the general public realizes how important that is to accurate forecasting.”

Officials hope to have the buoy’s real-time data available on the CORMP Web site by next week.
Arctic seal’s long journey comes to a sad end

By Gareth McGrath
Staff Writer

A wayward ice seal found stranded on Wrightsville Beach last week was put to death Tuesday evening at the Virginia Aquarium.

The move was ordered by the Virginia state veterinarian after the hooded seal, estimated to be younger than 18 months old, bit an aquarium staff member over the weekend.

The animal will now be tested for rabies, although the fatal neurological disease is very rare in seals. The only known method of rabies testing is an examination of brain tissue.

While not the fate anyone envisioned when the seal was taken to Virginia for rehabilitation, officials with the marine mammal stranding networks in both Virginia and North Carolina said they whole-heartedly supported the decision.

“The most important thing is that we have to put human health and safety first, and this is a very wise and judicious decision,” said Ann Pabst, a marine biologist with the University of North Carolina Wilmington and member of the state’s stranding team.

“This is just an unfortunate incident and the kind of thing that can happen to any person who is doing rehabilitation with wild animals.”

Susan Barco, the Virginia Aquarium’s stranding response coordinator, said the incident had left a somber atmosphere around her facility.

But she said everyone understood why the decision was made.

“Although there’s a low risk of the animal having rabies, there’s no doubt that this is the right thing to do,” Barco said.

“The staffer and all of us feel terrible. But it is the right decision.”

Ricky Langley, a medical epidemiologist with the N.C. Department of Health, said killing wild animals after a bite incident isn’t unusual.

He said that while domestic and agricultural animals are sometimes quarantined, wild animals ranging from bats to coyotes are almost always euthanized because an animal can have rabies and not exhibit signs.

“I don’t know any that aren’t put down, and unfortunately that’s the only way we can test,” Langley said of a brain exam.

Treatment for a potential rabies bite can be long and painful, and Barco said the seal would have been put down even if the staffer had agreed to go through the series of shots.

But what made Tuesday’s action tough to swallow was that Bald Bill - so named due to the seal molting its hair and alleged similarity to UNCW - was put to death Tuesday afternoon.

The seals, which rely on Arctic pack ice for habitat, don’t normally venture too far south of the Canadian Maritime provinces.

But Bald Bill was just one of several hooded seals that have been found stranded well outside their normal range this year, including a pair that were rescued in Florida on Sunday.

Pabst said the seal’s death won’t be in vain.

“It will definitely continue to help us learn more about the species and potentially offer us unique insight into what’s going on with these animals this year,” she said.

While speculation has ranged from global warming to overfishing as reasons for the seals’ wandering tendencies this summer, Pabst said researchers haven’t come up with a smoking gun.

Barco also said Bald Bill’s fate would prompt her office to be more pro-active with the state veterinarian’s office about adopting new policies for dealing with rehabbing marine mammals, including possibly a pre-rabies application for staffers.

But both researchers said those benefits would do little to soothe the sting for those who had invested so much in the seal’s recovery.

“We’re going to have a bunch of sad people tomorrow,” Pabst said late Tuesday afternoon.
Sewer spills bring calls for action

Total closure of creeks, halt to system hookups are among suggestions

By Patrick Gannon
Staff Writer

The N.C. Coastal Federation and a UNCW professor urged officials Monday to take stronger steps to protect public health until Wilmington’s sewer problems are addressed.

Meanwhile, more raw sewage spilled into Hewletts Creek on Sunday and Monday as crews tried to fix the latest leaky sewer pipe, which was discovered Saturday off Holly Tree Road. The professor called for the closing of two area creeks to all human contact until sewer repairs are made and the creeks are healthy.

The Coastal Federation, which is the largest nonprofit coastal conservation group in the state, is urging a moratorium on sewer hookups to the Northeast Interceptor, more frequent water testing in creeks adjacent to the interceptor and the creation of a citizens’ advisory panel to monitor progress on sewer improvements.

The group also wants the city and the N.C. Division of Water Quality to enter into an agreement – known as a “special order by consent” – to establish a timetable for adequate repair or replacement of the Northeast Interceptor and other parts of the sewer system, with penalties if the city doesn’t comply.

Ted Wilgis, Cape Fear Coastkeeper with the N.C. Coastal Federation, said an agreement would be a good faith commitment by the city to solving its sewer problems quickly.

A moratorium would help ensure that problems don’t worsen before the Northeast Interceptor is replaced, he said. With spills already occurring, adding volume exacerbates the problem, he said.

The Northeast Interceptor – which carries wastewater from Wrightsville Beach, New Hanover County and parts of Wilmington to a treatment plant off River Road – is responsible for three large spills since July that sent an estimated 4 million gallons of untreated sewage into Hewletts Creek.

City Manager Sterling Cheatham said Monday the sewer problems are mainly the result of deteriorating pipes, not capacity, so he’s not sure a moratorium makes sense.

Cheatham also said an agreement with the state to ensure timely sewer repairs wouldn’t be necessary. The city is spending about $1.5 million on assessments of the North-east Interceptor and the overall sewer system. Both assessments are just beginning, and New Hanover City Council already gave Cheatham a clear directive to make improvements recommended by the studies, he said.

“I don’t know that I could feel any more bound than I am now,” he said.

“We want to improve the system, too,” Mayor Spence Broadhurst declined to comment on Wilgis’ specific recommendations but said the city is taking a proactive approach to finding long-term solutions. “His solutions and input are welcome just as anyone else’s are,” the mayor said.

Ed Beck, supervisor of Water Quality’s Wilmington office, said a special order by consent is one tool the division could use to ensure improvements are made. But Water Quality hasn’t decided whether to seek one, he said. Currently, there is no legal agreement in place binding the city to improvements, Beck said.

Is it safe to swim?

Meanwhile, Larry Cahoon, a professor of biology and marine biology at the University of North Carolina Wilmington, said Hewletts Creek and Bradley Creek should be closed to all human contact until sewer issues in those areas are corrected.

“Plugging up holes after the fact, in some cases months after the fact, does not protect public health,” Cahoon said, referring to the spill discovered Saturday, which officials believe was leaking for weeks or months.

Testing done by the University of North Carolina Wilmington has indicated harmful bacteria from sewer spills remain in sediments on creek bottoms for long periods, he said. “As far as research goes, we’ve found what we need to know,” Cahoon said.

Swimming and shellfishing advisories are in place for the creeks.

State environmental regulators can keep shellfishing waters closed or issue swimming advisories as long as tests show bacteria levels in the waters outside of safe thresholds, usually over several testing cycles, the added regulations are generally lifted.

To fully close a waterway to human contact requires action by the state health department, which usually would work with county health officials to reach a consensus in such situations.

The N.C. Department of Health used this authority to close the Neuse River after an outbreak of pinfisher, a fish-eating organism blamed for massive fish kills, in the mid-1990s.

David Rice, head of the New Hanover County Health Department, said health departments are granted broad powers to take action when the public’s health and well-being is at stake.

But in the case of an action involving state waters, he said county officials would generally wait to take their cue from state health officials.

“We certainly would work in partnership with them on any issue like that,” he said.

Rice added that his office was already monitoring the situation in Hewletts Creek prior to the most recent spill. “The concerns are there,” he said, alluding to last year’s massive spills. “We’ve had some meetings on this already.”

Gallons unknown

The latest spill, discovered Saturday, sent an undetermined amount of wastewater into Hewletts Creek from a hole in a NortheastInterceptor pipe off Warlick Drive.

Residents had complained of odors in that area for months, but exactly how long the pipe was leaking is unknown.

Crews plugged the hole during the weekend, but problems Sunday evening and Monday morning led to additional discharges into Hewletts Creek, city and state officials said.

Both times, the work area flooded and water spilled into the creek, while additional sewage had to be pumped into a swampy area that empties into the creek, officials said.

On Monday morning, the plug blew out, said Hugh Caldwell, city Public Utilities director.

Some sewage was redirected into a separate line parallel to the Northeast Interceptor, but that pipe reached its capacity and some wastewater was pumped directly into Hewletts Creek, he said.

The plug was replaced, and city officials hope it will hold until a cast-iron sleeve is placed over the failed section of pipe, likely today.

Water samples taken Sunday show little effect from the leak, city officials said. However, they expect samples taken Monday will indicate higher levels of harmful bacteria because of spills during the repair process.

Caldwell said the city might never know how many gallons of wastewater entered the creek from the spill off Warlick Drive. A report due this week to Water Quality might include an estimate.
Town officials ask UNC Wilmington to study problem at Banks Channel

By Brittany Butcher
Staff Writer

On Sept. 29, about 1,200 triathletes will take to the water in Banks Channel at Wrightsville Beach. As part of the YMCA-hosted event, participants complete a 1,500-meter swim.

But how safe are the waters they’re entering?

Over the past several years, a number of swim advisories have been issued for the channel, said Steve Dellies, stormwater manager for Wrightsville Beach.

High levels of enterococcus, a fecal form of bacteria that’s an indicator for organisms that can cause gastrointestinal and skin problems in swimmers, is the cause for concern from recreational water quality and town officials.

Those advisories prompted town officials to allocate $25,000 for a study that’s just begun by the University of North Carolina Wilmington Center for Marine Science to discover the source of the bacteria, specifically to determine if it’s human, animal or fowl waste. The study will run through mid-summer 2008, Dellies said.

The N.C. Department of Environment and Natural Resources, or DENR, tests the water in Banks Channel about once a week during the spring and summer months.

Stan Sherman, an environmental technician for DENR, said he issued three swim advisories for Banks Channel over the summer: July 11 following a sewer spill, and Aug. 1 and Aug. 30 after heavy rainfall. Sherman said the enterococcus bacteria levels were higher after the August storms than after the sewer spill.

After rainstorms are typically the worst times for elevated bacteria levels because of the stormwater runoff, said J.D. Potts, with DENR’s recreational water quality department.

“Stormwater runoff is really magnified by the more impervious surface that you have,” said Mike Mallin, a UNC Wilmington research professor and water quality specialist who is heading the Banks Channel study.

Impervious surfaces are roofs, sidewalks, roadways - basically any surface covered by an impermeable material like concrete. Mallin said he conducted a study published in 2000 that found the more impervious the surfaces, the higher the bacteria count in six New Hanover County tidal creeks.

“It’s a huge problem,” Mallin said. “There are numerous storm drains from Waynick Boulevard that spill into Banks Channel, sending untreated runoff directly into the channel. Adding to the problem is bird and pet waste being washed from yards and roadways into the water, Potts said. Also, a large number of pigeons and ducks spend time in the wet sand on the banks of the channel, with high tide picking up their waste from the shores, he said.

Wrightsville Beach officials have been addressed about the stormwater runoff problem, Potts said, but to treat stormwater there has to be no leaks have been found.

Despite the research taking place, Dellies and DENR’s Sherman agreed that any significant amount of rainfall just before the upcoming triathlon could mean health hazards for the swimmers.

YMCA officials wouldn’t comment on what they would do in the event of heavy rain just prior to the race or whether there is an alternate swim location.

If a swim advisory is issued by DENR, the New Hanover County Health Department would stand behind it, said Dianne Harvell, the environmental health services manager.

The health department wouldn’t close the channel to swimmers unless there were an imminent health threat, she said.
By Shelby Sebens  
Staff Writer

It’s brown and smelly and has blanketed some area beaches.

In recent weeks, the unwelcome seaweed called sargassum has invaded Oak Island, Ocean Isle Beach and Topsail Island, among others.

At Oak Island, a thick layer covers much of the sand, especially near the Ocean Crest Pier. “I suppose it’s sort of a pesky situation, at least,” said Dave Cooper, the pier’s chief operating officer.

He said fishermen have been complaining about the seaweed, which is also floating close to shore, fouling their lines. Beachgoers try to scrape a patch of sand clear for their umbrellas and coolers - and to stay upwind of the smelly seaweed.

Experts can’t predict whether the seaweed mass will diminish, increase or invade other beaches. But here are a few facts they do know.

What is it?
Sargassum is a brown algae found in large masses in the Sargasso Sea, a region in the middle of the North Atlantic Ocean, and in tropical waters around the world. It is distinguished by its brown color and small leaves resembling appendages that allow it to float.

What brings it ashore?
Southerly and southeasterly winds break up the seaweed and bring it toward shore via the Gulf Stream current. “It’s a natural occurrence,” said Michael Durako, professor of biology and marine biology at the University of North Carolina Wilmington. He added sargassum often comes ashore in the summer because winds typically come out of the south in the hot months and the north in the winter. Durako said sargassum comes ashore every year along the East Coast beaches.

Why is it so thick now?
Cooper said in his five years at the Ocean Crest Pier, this is the most seaweed he has seen come ashore. Durako said wind patterns dictate just how much sargassum comes ashore and where it will land.

How long will it stay?
The seaweed dries out and breaks down in the sun and eventually disappears, but how long it’s around - and whether it spreads to other beaches - depends on how long the clumps continue to wash up. And that depends on the wind and currents. “It’s relatively unpredictable,” Durako said.

What is the significance of sargassum?
It may be a nuisance to many on the beach, but sargassum in the water shelters small fish, crabs and shrimp. Durako said fishermen offshore often look for islands of sargassum because game fish are often nearby. He also said the seaweed makes great mulch for gardening. And that also helps get it off the beach.
Scientists campaign to save reefs off of Cape Fear Coast

By Gareth McGrath

They are some of the world’s oldest, richest and least understood underwater habitats, full of coral mounds sprouting hundreds of feet high and species scientists have never seen before.

And they happen to be in our backyard, a three-hour boat ride off the Cape Fear Coast.

Now environmentalists want to see these deepwater reefs protected, and they’re hoping a president possibly looking to spruce up his environmental legacy before he leaves office might help them do it. The reefs cover an area nearly the size of South Carolina.

“What we think exists now is the same opportunity in the deep sea that existed in the American West in the early 20th Century,” said Doug Rader, Environmental Defense Fund’s chief oceans scientist, referring to the establishment of many of the country’s most famous national parks.

That the waters off the Southeast have deepwater coral reefs has been known for decades. But it’s only recently that the deep-sea reefs have attracted scientific attention, largely because researchers previously had no way of getting to them.

“What they’re finding has left them amazed. ‘We’re just scratching the surface down there,’” said Steve Ross, a research professor at the University of North Carolina Wilmington who has been exploring the reefs for nearly a decade. “Almost every dive, every expedition, we’re finding something new.” That includes new species of coral-like hydroids, crabs and even fish.

Ross said scientists also are finding that the flora and fauna at each reef cluster could be genetically distinct, much like the uniqueness found among species in the Galapagos Islands. “It’s almost the same type of thing on a scale that we didn’t expect,” he said, his eyes getting a bit bigger as he sat in his office at UNCW’s Center for Marine Science.

But the same technology aiding scientists in their research also could allow these largely untouched deep-sea areas to be explored and potentially mined for oil, gas or mineral deposits to feed the country’s seemingly insatiable appetite for energy. Increased fishing, especially for deep-sea species, is also a worry. “They’re very fragile, slow-growing, and it wouldn’t take much to really damage them,” Rader said of the reefs and their animal inhabitants.

The South Atlantic Fishery Management Council, which manages fishing in federal waters in the South- east, is looking at declaring the coral reefs “Habitat Areas of Particular Concern.” But a presidential declaration, such as one declaring the reefs national monuments, would add even more layers of protection – although Rader stressed that no one was pushing to have fishing outlawed around the reefs.

Holding a small piece of Lophelia coral, the predominant deepwater coral, Ross said the reefs are found in water about 52 degrees and colder and at depths starting at about 1,000 feet and going much deeper. Along with extensive coral formations, the reefs can include massive, million-year-old mounds formed by a mix of coral and trapped sediment.

In the Cape Fear Lophelia Bank, located about 60 miles off Bald Head Island, these natural columns extend nearly 250 feet up from the ocean bottom.

But exploring an underwater area well away from shore that’s only reachable with remote-operated vehicles is very expensive, with research expeditions costing as much as $30,000 a day.

A federal designation for the area could open up more funding sources for reef research, Ross said, along with raising public awareness about the rich but fragile habitats just off our shores.

President Bush hasn’t exactly been seen as a friend of the environmental movement during his nearly eight years in office. Presidents, however, have a history of wanting to leave a lasting legacy, and that’s why the environmental community is banking on.

There also is recent precedent for this. Two years ago, Bush created the 140,000-square-mile Northwestern Hawaiian Islands Marine National Monument, which is the world’s largest protected marine area.

The White House has yet to take a position on the idea of designating the Southeast’s reefs a marine national monument. But last month South Carolina’s Republican Gov. Mark Sanford came out in favor of the proposal, calling the deepwater habitats a “national treasure on par with Yosemite Valley and the North- west Hawaiian Islands.”

Rader said officials also have been in touch with Gov. Mike Easley here in North Carolina and his comparisons in Georgia and Florida to see about garnering their support.

“We think this is the perfect time to start shaping the thinking about these commonly held resources as exploitation proceeds instead of trying to plug holes in the dyke as situations develop,” he said. Ross agrees.

“Yes, it’s hard to get to. Yes, few people will ever get a chance to see it. And yes, we don’t know a lot about these reefs right now,” Ross said. “But I don’t think we’re going to find out we’ve made a mistake if we do this.”
By Jennifer Roush
Staff Writer

The University of North Carolina Wilmington (UNCW) Aquaculture Center in Wrightsville Beach, working with other institutions like N.C. State, is fine-tuning a pilot program that will get its cultivated black sea bass onto restaurant tables and into the marketplace.

Since last spring, approximately 80 restaurants across the state have tried the harvested fish and have been part of a marketing survey to determine market price, market demand and market potential, said Dr. Wade Watanabe, research professor and aquaculture program coordinator for UNCW. This project has been nine years in the making.

“We’ve gradually, over the years, been able to work out the techniques for spawning these fish in captivity and raising the eggs to full marketable stages,” Watanabe said. “…We’ve reached a point where there’s commercial interest in our progress, and a couple of potential commercial practitioners are serious enough that they want to establish start-up farms.”

One pilot project being incubated at the center is a collaboration with Aquaplantations, a Wilmington company, led by proprietor Ted Davis.

“We’re doing a pilot project on site … to demonstrate growing these fish out at the marketable sizes, and by working with us, he would receive training in raising these fish,” Watanabe said. “He’s going to support all the operational costs, and he’s also going to derive the benefit of selling the fish at the end. But because we are working together, we get the benefit of all the hard data on production and operational characteristics of the system. … So, in the end, we go up the learning curve together, and this information is going to be useful as we try to extend it to other prospective practitioners down the road.”

Davis has a site in Wilmington to harvest the fish but is holding off until the pilot program is running smoothly. He is also doing his own marketing trials with restaurants like the Bridge Tender, which is getting the black sea bass at a promotional cost.

UNCW’s Dr. Daniel Baden, executive principal for the MARBIONC program, is part of the program that provides the funding to the aquaculture center, which is one of three focus areas of the MARBIONC program.

MARBIONC is an economic development engine that has become associated with UNCW, seeking to create new jobs, new business and newly trained individuals using marine resources, Baden said.

“One of the reasons that one looks at cultivating fish in closed cultivated settings, is we are releasing pressure on wild-caught stocks of fish,” he said. “… The ocean food source is diminishing, diminishing, diminishing. And that’s because we have increasingly efficient fishing gear and increasing pressure by the number of boats that are out there collecting, catching fish for consumption. And so this is a way that if one can cultivate, you can reduce the pressure on the wild-caught stocks.”

He also said the aquaculture center is on the leading edge of science with the research and sale of flounder larvae. Since flounder start out with one eye on each side, and one eye later migrates to the other side, the tissue remodeling that takes place has potential in regards to humans.

“It (flounder larvae) is developing as a biomedical model for human disfigurement, so this is potentially a pretty big deal,” Baden said.

The cultivation of ocean fish, he said, is on the brink of becoming a huge commercial market, but it is still in its initial stages.

“This (pilot program) is attempting to make commercially viable the cultivation of fish,” Baden said.
Titan plant project:
Toxic mercury a conundrum

By Chris Mazzolini
Staff Writer

The boy came to Dr. Karen Harum suffering from a range of symptoms: Severe allergies, an abnormally small head, gastric problems, stunted growth and brain development.

He was tagged as “failure to thrive,” a label doctors use for children who don’t grow and develop like they should.

Harum, a local pediatrician who treats toxicity and development problems, performed tests and found high levels of toxic heavy metals, including mercury.

Many of Harum’s patients come to her afflicted with health problems linked to mercury exposure, but isolating it as the culprit is often difficult, she said.

“It’s an obscure problem that’s not always easy to get at,” Harum said.

That’s no surprise. Mercury has stumped scientists for decades.

The liquid, silver-hued and toxic metal has received renewed attention in Southeastern North Carolina since Titan America announced plans to build a cement plant in Castle Hayne.

Environmental groups and some local residents say mercury pollution from the plant could cause health problems in children – the kinds Harum sees in her patients – and harm local wildlife.

Opponents say introducing a new mercury source here is a backward step since the local environment already has mercury problems.

“These are things that are based on pretty strong scientific evidence developed by a lot of people,” said Stephen Skrabal, a University of North Carolina Wilmington chemistry professor who has studied mercury in the region. “In many ways, it seems you are piling on an area that already has concerns about mercury.”

Titan has applied to release up to 263 pounds of mercury each year. That amount is based on current regulations, but company officials say actual emissions wouldn’t be that high.

“We will meet any applicable current and future emission limits and very likely be under those standards,” said Bob Odom, general manager of Titan subsidiary Carolinas Cement Co. “In building one of the safest and cleanest cement plants in the world, we have taken a lot of measures to ensure environmental stewardship and public safety.”

Odom said the company takes the community’s concerns about mercury seriously. That’s why Titan hired Intertox, a scientific consulting firm, to evaluate the health risks of mercury emissions from the proposed plant, he said. That study’s results are expected soon.

Harum said current scientific knowledge makes it difficult to link mercury pollution in our region to health impacts, but we should still strive to reduce our exposure to mercury.

“The state of the science simply isn’t there to make this a clear-cut picture,” Harum said. “But what we do know is that mercury is one of the most neurotoxic agents known to man.”

A coastal problem

Most people are exposed to mercury by eating contaminated fish, though the EPA says typical consumption habits don’t warrant health concerns.

But developing fetuses and young children are especially vulnerable to mercury poisoning since their brains and nervous system are still developing.

Kathryn Mahaffey, formerly a top mercury researcher at the EPA, estimated in 2005 that “several hundred thousand” babies are born each year after being exposed to risky levels of mercury in the womb.

These risks have prompted mercury advisories in many states, including North Carolina.

State health officials warn women of child-bearing age and children to completely avoid eating fish with high mercury levels, including large-mouth bass, king mackerel, tuna and 21 other kinds.

Many of these impaired fish are found in the waters of Southeastern North Carolina.

About 123 miles of rivers and streams and 82 miles of coastline in New Hanover, Pender and Brunswick counties are considered impaired because of high mercury levels in certain fish species, according to the most recent state data, from 2006.

“This is pretty much the story for the whole coast,” said Jeff DelBerardinis, a state environmental biologist who samples mercury levels in fish. “The coastal area is extremely sensitive to mercury. Those bugs just love it.”

The “bugs” are bacteria that help transform mercury into methylmercury, a toxic form that accumulates in wildlife. Fish absorb methylmercury from eating plants or smaller organisms. Small fish are gobbled up by bigger fish, absorbing that mercury in their tissue.

The large fish that humans catch and eat end up with the highest mercury levels.

Coastal environments often contain the stew of bacteria, low-oxygen waters and rich organic matter that promotes methylmercury creation, said Jane Guentzel, a marine chemist at Coastal Carolina University.

Guentzel’s research in South Carolina has found a strong correlation between mercury levels in fish and the amount of wetlands within a geographic area.

Here at home, Skrabal and a team of researchers at UNCW have spent several years studying mercury in the Cape Fear estuary. They found mercury concentrations comparable to other “moderately impacted” estuaries along the East Coast.

That doesn’t mean mercury isn’t a problem here, Skrabal said. Even trace amounts in the water – the equivalent of a few cents in a pile of trillion pennies – can accumulate exponentially through food webs and reach potentially toxic levels in fish.

Skrabal said his research also indicates that rising sea levels could introduce more salt water and make our area an even better incubator for methylmercury.

Local impact?

While mercury ultimately is a global problem environmentalists warn that local impacts shouldn’t be ignored.

“You can’t look at mercury just as a global or a national problem,” said Jim Pew, an attorney for environmental law firm Earthjustice. “Mercury does tend to deposit locally.”

One case study is the Florida Everglades.

In the 1990s, fish and other wildlife in the expansive wetlands were discovered with high concentrations of methylmercury.

Those levels dropped about 85 percent between 1991 and 2000, according to 2005 paper authored by leading mercury researchers in Florida. The reason? Stringent regulations cut mercury emissions from nearby trash and medical waste incinerators by 90 percent.

While the researchers caution that the results may not translate perfectly to other regions, they conclude that “local atmospheric mercury emission sources can contribute substantially to local contamination.”

There’s other evidence as well. A study co-sponsored by the EPA and published in 2006, found that the majority of mercury deposited at an Ohio research site were from nearby industries. About 70 percent were attributed to burning coal – the process used by coal-fired power plants, cement kilns and other industries.

But cutting local pollution to zero won’t solve the problem since mercury does have global reach. The solution is to cut emissions across the board, Guentzel said.

“Mercury coming out of the sky is a mixture from local, regional and global sources,” she said. “If we really want to reduce the amount of mercury that’s coming down in the rainfall, it’s important to control emissions at all three levels.”
A new marine biotechnology facility is coming to the University of North Carolina Wilmington after five years in limbo, thanks to a $15 million matching grant from federal stimulus funds announced Monday.

A grant from the National Institute of Standards and Technology announced Monday will fund construction on a new facility for UNCW’s Marine Biology in North Carolina program (MARBIONC), providing much-needed extra laboratory space.

“This facility will help us aggressively develop the next generation of biotechnology platforms and technologies,” Center for Marine Science Director Daniel Baden said.

Construction on the new 69,000-square-foot building is scheduled to begin in November, and should be ready for move-in by 2011.

The new building will sit next to the marine operations building on the 70-acre Marine Science campus on Masonboro Loop Road. It will include 12 laboratories, three large incubator laboratories for cultured research organisms, offices and other spaces for holding meetings and housing materials.

The current laboratories available are at maximum capacity and operating in multiple shifts, said Paul Reinmann, assistant director for fixed operations and planning at the center.

“We are hemmed in now with our existing facilities, and we just can’t do it anymore,” Reinmann said. “Having a state-of-the-art laboratory facility will give us great opportunities for attracting the best researchers and talent.”

The new facilities will also help optimize university and industry interaction and expedite the transfer of technology from lab to marketplace, according to Steve Fontana, senior technology development director for UNCW and MARBIONC.

Planning for the project started in 2004, Baden said. The project made it through the design phases, but lost momentum due to lack of funding.

To receive the grant, which is funded through the American Recovery and Reinvestment Act, applicants had to meet specific goals related to scientific and technical merit, as well as other objectives outlined in the Recovery Act that address job creation and preservation and long-term economic development benefits. The new facility is expected to create 281 construction jobs when work starts in November.

The matching $15 million for the project will come from indirect research costs and private partner participation, covering the estimated $30 million price tag attached to the new facility, Baden said.

The award marks the second major funding the marine science program has received this year, and the second construction project slated to start in the next four months. The new Cooperative Institute for Ocean Exploration, Research and Technology received a five-year, $22.5 million award from the National Oceanic and Atmospheric Administration in May. Construction on a $4.3 million oyster research facility is just a month away.

“The atmosphere was pretty bubbly here this afternoon,” Reinmann said. “Everybody’s very optimistic, and looking at next steps.”
Researchers take samples to measure ecological changes

By Julian March
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At first glance, Chad McPeters and his team members don’t look like scientists.

They wear bathing suits like everyone else on Wrightsville Beach.

But the sand in his bucket isn’t for sand castles. McPeters is part of a team of University of North Carolina Wilmington researchers collecting baseline samples of ocean water, sediment and fish.

If oil from the Gulf of Mexico spill reaches North Carolina, they want to be ready to scientifically evaluate the impact.

“If any gets here and fouls our beach, we’re going to have an excellent baseline set of what a healthy beach looks like ecologically,” said Larry Cahoon, a professor in the school’s Department of Biology and Marine Biology.

Cahoon has been the lead investigator in a two-year study of the ecological impact of beach nourishment.

Sea Grant, a federal and state partnership, granted $72,000 to the researchers for that study. When Cahoon contacted them about continuing the study to get baseline samples in case oil came, they agreed to grant an additional $6,000.

The researchers plan to take samples along the coast, from Cape Hatteras to Sunset Beach.

Cahoon said it is important to get the baseline samples. He said people often focus on birds covered in oil, but that oil also kills small organisms.

“You’re wiping out the entire food chain,” Cahoon said.

He said there would probably be a lawsuit if oil came to North Carolina and the state would need more than pictures to prove damages.

Cahoon said there is only a small risk oil would reach the N.C. coast, but it is not unreasonable.

“One it makes it down to the Florida Keys, it can be picked up by the Gulf Stream pretty quickly,” he said.

Behind Cahoon, researchers squatted in the sand and collected sediment samples.

Kelly Stull, a master’s student studying marine science, will use a microscope to examine the amount of zooplankton in the sediment. Zooplankton is an important source of food for birds and fish.

Meanwhile, McPeters and others collected the sediment samples, sometime diving down in chest-high water.

Cahoon said early work like this will be well worth it if oil comes.

“I think it’s pretty unlikely,” he said. “But we want to be prepared.”
Research cruise in gulf turns focus to oil effects

By Gareth McGrath
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The oil that has been spewing into the Gulf of Mexico for three months has yet to make it to North Carolina, and most experts think it’s unlikely it ever will reach local waters in any meaningful amount.

But that hasn’t stopped one UNCW-based researcher from heading to the gulf to help gauge the effects of the spill of the fragile deepwater ecosystems down there that share many of the same flora and fauna as the habitats off the Cape Fear coast.

Andy Shepard is in the midst of a four-week research cruise onboard the R/V Seward Johnson, a 204-foot-long research vessel that comes equipped with its own mini submersible.

He’s the associate director of the Cooperative Institute for Ocean Exploration, Research and Technology, which is a partnership between UNCW, Florida Atlantic University and the National Oceanic and Atmospheric Administration.

One of the main goals of the mission is to try and establish baseline water quality and ecological information for reef habitats up to 100 miles offshore. The data will then be used to help measure short- or long-term environmental consequences from the millions of gallons of oil and dispersants now sloshing around in the warm waterway.

“You’ve got to know how things looked before anything happens to see what the impacts are,” said Shepard, who was reached last week during a stopover in Key West.

The scientists are also using the opportunity to explore deepwater reef habitats that, like the ones found off the Southeast coast, are among the richest ecological treasures in U.S. territorial waters but among the least known because of their inaccessibility.

“These are hard places to study, and we need this kind of advanced technology to get down to perform that research,” Shepard said, referring in particular to the Seward Johnson’s mini-sub, which can carry up to four researchers to depths of up to 3,000 feet.

Exploring the reefs, including seeing how well some of the areas recently closed to fishing are doing in helping stocks recover, was the original goal of the mission. Then the Deepwater Horizon blew up.

Shepard said the crew of roughly 40 is glad to be on the front line of the response to one of the biggest environmental disasters in the nation’s history.

“I think we’re more excited than anything else because we now have a chance to do something about it, not just sit on our hands and watch it unfold on television or read about it,” he said.

Among the advanced “toys” onboard the Seward Johnson is a remotely operated vehicle from the University of North Carolina Wilmington.

Shepard said the Phantom 300 is used to check shallow-water areas for any residue of oil or dispersants before divers or sensitive equipment is sent into the water.

He is also using his time onboard to collect samples for researchers back at UNCW.

They include examples from various levels in the water column and rainwater to see if any of the chemical dispersants used to break up the oil are evaporation into the atmosphere and then coming back down.

So far the crew has yet to come across any visible oil or tar balls, and Shepard said they hadn’t expected to see this early in the cruise. Favorable eddies are keeping the slicks mostly out of the gulf’s Loop Current that could send oil down and around the Florida keys.

But as the Seward Johnson moves up the coast, closer to where the broken wellhead lies on the ocean floor, the researchers know that could change.

“These are frontier areas,” Shepard said of the deepwater reefs, “and we’re excited to be able to explore them, even if we’re very worried about the impacts this spill will have on them.”

Gareth McGrath: 343-2384
Red tide hurts, but could it also cure diseases?

By Kate Spinner

SARASOTA - Ten years of research on red tide in Southwest Florida produced several groundbreaking discoveries, some of which promise to improve public health and could lead to new treatments for debilitating respiratory illnesses.

Overall, findings from the research, funded by a $15.8 million federal grant, underscored that red tide — caused by toxic algae in the Gulf of Mexico — poses significant health problems, especially for people with asthma and other respiratory disorders.

Even brief exposure for the most sensitive people can make them sick for a week or longer.

“It’s an environmental, chemical intoxication. Prior to this study we had no idea what people were being exposed to,” said Daniel Baden, who directed the research program. He also is director of the Center for Marine Science at the University of North Carolina in Wilmington. “People get sick and we have the numbers to show that.”

Red tide algae are naturally occurring, but in large concentrations — known as blooms — they kill fish, sea turtles and marine mammals, such as dolphins. The toxins make shellfish poisonous to eat and also become airborne. Onshore breezes can push the toxins more than a mile inland, research showed.

A large number of severe red tide outbreaks occurred between 2000 and 2006 in Southwest Florida, triggering concern over public health. The concern prompted extensive research, including the health studies led by Baden.

For reasons scientists cannot explain, red tide has been largely absent from area beaches for about five years.

A trip to the beach during red tide is an unpleasant experience. Most people complain of coughs, itchy, eyes and wheezing. For those with asthma, too much red tide exposure can result in a visit to the emergency room.

“The next time we have red tide, we’ll have a much better health message on how to keep people healthy during red tide,” said Barbara Kirkpatrick, a senior scientist with Mote, who led field research for the study.

The studies, along with additional on-going research, will improve upon the state’s beach monitoring program run by Mote. Mote developed the program to warn people in real-time when and where red tide is present. In the future, the program will give an account of how much red tide toxin is lingering in the air at any given time — much like national warning systems for smog, mold and pollen.

Even during periods without red tide, trace amounts of red tide toxins are sometimes present in the air, the research showed. Scientists, including Kirkpatrick, are just beginning to establish the threshold at which people react to the toxin.

For asthma the threshold is extremely low.

Sarasota’s lifeguards acted for years as lab rats for the research, showing that red tide causes breathing problems and lung constriction even in healthy people. Those symptoms went away the lifeguards left the beach or when red tide disappeared.

For those with asthma, the effects were much worse and lingering, said Lora Fleming, professor in the Department of Epidemiology and Public Health at the University of Miami. Fleming recently finished analyzing seven years of data, which shows just one hour on the beach can make an asthmatic person sick for a week or longer. Additionally, in the days following that hour of exposure, asthmatic people became more sick before the symptoms went away.

“To us that means you need to take that seriously,” Fleming said. She said the toxins do not seem to cause longer-term damage, at least for healthy people and those with mild or moderate asthma. About 6 to 10 percent of the population has asthma.

In addition to improving scientific understanding about the way red tide wreaks havoc on people, researchers discovered a potentially life-altering treatment for cystic fibrosis and chronic obstructive pulmonary disorder.

Red tide algae produce 12 different toxic substances, but they also produce three non-toxic substances, one of which — called Brevenal — is actually beneficial. It blocks irritants from causing reactions in people with cystic fibrosis and chronic obstructive pulmonary disorder.

Baden said Brevenal is a million times more effective than any other existing treatment for cystic fibrosis and is now undergoing clinical trials to ensure its safety.

Brevenal also shows promise for treatment of seafood poisoning from red tide and the algae that causes ciguatera poisoning, both of which are potent neurological toxins that cannot be cooked out.

“It’s a shift in the toxicology paradigm, to have a toxin and an anti-toxin in an organism,” Baden said.

Going forward, the research focusing on asthma, Brevenal and enhancements to Mote’s beach conditions report will continue as long as other sources of funding become available, scientists said.

If one related grant comes through for Mote, Sarasotans could soon see a robotic child strolling the beach each day, taking air and sand samples to supplement the beach conditions report.

Fleming said red tide scientists were fortunate that the federal grant, made by the National Institute of Environmental Health Sciences, lasted as long as promised. The institute also is funding additional research for several red tide projects related to health, including further Brevenal research.

“Funding is going to be an issue, but the expectation was never that this would go beyond 10 years,” Fleming said.

Earlier

Aside from making healthy people cough and wheeze, red tide can have serious health consequences, scientists have documented after a decade of research. Just one hour of exposure to red tide causes health problems, especially for people with asthma — about 6 to 10 percent of the population — to suffer breathing problems for up to a week.

Red tide is a type of harmful algae that naturally occurs in the Gulf of Mexico. Occasionally, the algae accumulate and grow into a bloom that emits toxins that kill fish and marine mammals. Wind can also blow the toxins toward the beach and more than a mile inland.

The research, discussed today by scientists congregating at Mote Marine Laboratory, puts scientific evidence behind assertions that red tide causes health problems, including weaker immune function and long-lasting breathing problems in people with asthma.

In addition to documenting red tide’s harm, scientists discovered a unique anti-toxin also produced by red tide. Surprisingly, the substance could be used to help people with chronic respiratory problems, such as cystic fibrosis, asthma and COPD.
UNCW students write about their field trip for research

By Lindsay Key
Graduate Student, Creative Writing

EDITOR’S NOTE: The StarNews Neighbors section is devoting this week to celebrating the works and accomplishments of students at the University of North Carolina Wilmington. All of the stories running in this space March 21-27 are about students and are written by students.

For a budding biologist, it’s the opportunity of a lifetime: an almost fully-funded trip to study the tropical ecosystems of Bermuda, one of Earth’s most mysterious places.

This spring break, eight University of North Carolina Wilmington students – Ashley Whitt, Heather Page, Jennifer Idol, Rachel Dixon, Renee Fucella, Zachary Siders, Robert McNeil and Laura Flessner – participated in “Field Methods in Tropical Marine Biology,” taught by biology faculty members Sean Lema and Alison Taylor.

The 10-day course, hosted by the Bermuda Institute of Ocean Sciences, is part of an exchange program with the University of Southampton’s School of Ocean and Earth Science in the United Kingdom, with students and faculty from both institutions involved.

Student teams explored the island’s rich variety of habitats, including coral reef, seagrass and mangrove communities. Each student was expected to identify a research topic, collect and analyze data, and present findings orally and in written form.

The course introduces students to the professional lives of field researchers.

“This is a landmark experience in terms of how our students approach research and outreach for the rest of their lives,” Lema says.

A donation from the Gillings family provides financial support for students to participate in the exchange program. Competition for the opportunity is fierce.

Below are student excerpts from a daily trip blog. Click here to read the whole blog.

Friday, March 11: We started the morning learning about Bermuda’s geology and history, as well as aspects that come with living on an island. Each home is required to trap rainwater from the roof and store it in underground tanks beneath the house. It is then disinfected with bleach and rid of mosquito and fly larvae by introducing guppies into the tanks.

Afterwards, we walked to Whalebone Bay to snorkel and explore. The bay was teeming with life including sea cucumbers, parrotfish, angelfish, sea hare and even an octopus! Although the bay was beautiful, the shoreline was littered with plastic, broken glass and other debris. Even though Bermuda seems like a paradise from afar, this level of marine pollution reminded us of the severity of anthropogenic impacts on the marine environment.

– Laura, Rachel & Renee

Monday, March 14: We started the morning learning about Bermuda’s geology and history, as well as aspects that come with living on an island. Each home is required to trap rainwater from the roof and store it in underground tanks beneath the house. It is then disinfected with bleach and rid of mosquito and fly larvae by introducing guppies into the tanks.

Afterwards, we walked to Whalebone Bay to snorkel and explore. The bay was teeming with life including sea cucumbers, parrotfish, angelfish, sea hare and even an octopus! Although the bay was beautiful, the shoreline was littered with plastic, broken glass and other debris. Even though Bermuda seems like a paradise from afar, this level of marine pollution reminded us of the severity of anthropogenic impacts on the marine environment.

– Laura, Rachel & Renee

Monday, March 18: By afternoon we were in a furious scramble completing our statistical analyses and PowerPoint presentations for the final reports. Inter-university collaboration was at an all-time high.

Afterwards, still brimming with thoughts of corals and reef fish, we convened for a night of planning the free day. The conclusion: cave exploring, whale watching and sightseeing.

Most importantly, however, the field course has turned out to be a challenging and collaborative experience. Together, the experiments we conducted have been both inclusive internationally and relevant ecologically.

– Robbie and Zach

The field course is one of seven Spring Break education abroad programs conducted this year by UNCW faculty and the Office of International Programs. Other destinations included Belize, Costa Rica, Curacao, Czech Republic, El Salvador and Guatemala.
Senior’s project details hidden dangers of consuming fish

By Amy Hotz
Amy.Hotz@StarNewsOnline.com

Warnings about the dangers of consuming raw or undercooked shellfish are common on menus. Some restaurants even have the signs posted on their walls.

But one local high school student is trying to raise awareness about another hidden danger of the sea, ciguatera syndrome, that people can become the victim of if they eat certain popular table fish.

“One of the ways to protect the public is to get out there and tell people about it,” said Hoggard High School student Amanda White.

White, 17, has created two posters about the tropical fish poisoning for her senior project. Part of that assignment is to incorporate community service, so she recently displayed the posters at a booth during the New Hanover County Arboretum’s Master Gardener Plant Sale. She also plans to take the posters around to classrooms at Hoggard and talk about the issue.

The first poster illustrates the “culprits,” microscopic dinoflagellates, in bright photos. It shows the snake skeleton-like chemical thumbprint of a ciguatoxin and a world map pinpoints where the fish poisonings are found.

White’s poster also explains what ciguatera is. It starts when small fish, such as anchovies, eat the toxic microscopic algae which are predominately found 20-degrees below and 20-degrees above the equator. Bigger fish eat those fish until it finally affects the predator fish found on most seafood restaurant menus.

Although it’s not common off North Carolina’s coast, ciguatera is a concern for anyone vacationing in Florida and the Caribbean. It does not physically affect the fish and White said local fishermen in areas where ciguatera has occurred know where to toss their lines to avoid an affected catch.

The second poster describes some of the common fish that carry the syndrome—king mackerel, grouper, redfish. White said a common rule of thumb is, if a fish weighs more than four pounds it has lived long enough to accumulate enough ciguatera toxins to hurt humans.

“It’s kind of weird because a lot of the popular fish that we like to eat, like grouper and snapper, are affected by it,” she said. “It can be a life-long disease. . . . The symptoms can come back periodically.”

The symptoms in humans who eat the affected fish, according to Dr. Carmelo Tomas, start out much like food poisoning. But they also include aching joints, hyper sensitivity, muscle weakness, vertigo and temperature reversal – this is when things that are hot feel cold and vice versa. These symptoms usually go away after a few days, but can re-emerge in full force without warning.

Tomas said that when he worked for the state of Florida, he interviewed an airline pilot who could no longer fly because he never knew when the ciguatera symptoms would reoccur.

Scientists don’t know why the syndrome reoccurs or what triggers it, although some believe that because it is a lipid soluble toxin, alcohol consumption could affect it in some way.

White said she became fascinated with harmful algal blooms, such as red tide and brown tide, while taking an oceanography class at Hoggard. When she began discussing a senior project with Tomas and learned about ciguatera, an invisible algal bloom, she wanted to learn more.

Reactions to her project when it was on display at the plant sale ranged from those who had heard about it but forgotten, she said, to those who had no idea what ciguatera is.

“I got more surprise than anything,” White said.

When White’s senior year ends, she said she hopes to attend a college with a strong marine biology program, such as UNCW. She would like to become a marine microbiologist.
Outreach and Education 2001 - 2011
September 4: Scott Nixon, University of Rhode Island Professor of Oceanography, “Replacing the Nile: Is Human Development Providing the Fertility Once Delivered By a Great River?”

November 6: Alina Szmant, UNCW Professor of Biological Sciences, “Can We Reverse the Decline of Florida Coral Reefs? A 2-Step Attempt at Ecological Restoration”

March 5: Steven Miller, Director National Undersea Research Center (NURC) “SeaLab, Tektite, Hydrolab, and UNCW’s Aquarius: The Story of the U.S. Underwater Space Program”

May 7: Ann Pabst, UNCW Associate Professor of Biological Sciences, “Bottlenose Dolphins: North Carolina’s Local Marine Mammal”

For reservations, call: UNCW Center for Marine Science 5600 Marvin K. Moss Lane Wilmington, NC 28409 910.962.2300

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September 18, 2002
Dr. Rita R. Colwell
Director, National Science Foundation
“Oceans, Climate and Health: The Cholera Paradigm”

November 12, 2002
Dr. Roger Hanlon
Senior Scientist, Woods Hole Marine Biological Laboratory
“Squid Pro Quo: The Behavioral Ecology of Cephalopod Predators in a Fish-dominated Ocean”

March 4, 2003
Dr. Joseph Pawlik
Professor of Biological Sciences, UNCW
“How the Spineless Protect Themselves: Chemical Warfare on Coral Reefs”

May 6, 2003
Dr. William Cleary
Professor of Geology, UNCW
“Migrating Inlets and Shifting Shorelines: The Fate of Southeastern North Carolina Beaches”

Accommodations for disabilities may be requested by contacting CMS three days prior to the event.
September 9, 2003
Daniel G. Baden, PhD
Director, UNCW Center for Marine Science
“Florida Red Tide: A Whiff, a Sniff and a Sneeze”

Throughout his career, Dr. Baden has been interested in harmful algal blooms and the toxic materials they produce. He has gained worldwide acclaim for his work, and his research group has been responsible for identification of eight of the 10 known Florida red tide bреветоксинов.

November 11, 2003
John Broadwater, PhD
Manager, Monitor National Marine Sanctuary
“Retrieving the Monitor: Marine Technology and Archaeology”

Dr. Broadwater has directed four major expeditions to the remains of the Civil War ironclad USS Monitor, in 240 feet of water, 16 miles off Cape Hatteras, North Carolina. He has been working in the field of underwater archaeology full-time since 1978, and has participated in numerous national and international underwater archaeological expeditions throughout his career.

March 2, 2004
Lora E. Fleming, MD, PhD
University of Miami Department of Epidemiology & Public Health
“Harmful Algal Blooms and You: It’s a Bloomin’ Nuisance”

Dr. Fleming is the only board-certified Occupational and Environmental Medicine physician and epidemiologist in South Florida. Her areas of research and teaching are Occupational and Environmental Medicine and Epidemiology - she is currently involved in a study of the health effects and exposure of humans and other animals to aerosolized red tide toxins.

May 4, 2004
Vice Admiral Conrad Lautenbacher
NOAA Administrator
“NOAA’s Ocean Sciences for the 21st Century”

A graduate of the U.S. Naval Academy, Vice Admiral Lautenbacher has served in a broad range of operational, command and staff capacities. His areas of expertise include Anti-submarine Warfare, Anti-air Warfare, and Naval Surface Fire Support, with expertise gained during a number of deployments to the Western Pacific and Southeast Asia during the Vietnam War.

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September 21, 2004
Richard A. Satterlie, Ph.D.
Frank Hawkins Kenan Distinguished Professor of Marine Science
“When Molluscs Fly”

A recent addition to the UNCW faculty, Dr. Satterlie studies how the nervous system controls movement. His unlikely ally in this important research is a fascinating, inch-long organism known as Clione limacine, sometimes called the naked sea butterfly. Dr. Satterlie’s research into the neurobiology of this tiny mollusc has possible implications for the fields of robotics and computer-generated muscle stimulation.

November 16, 2004
Martin H. Posey, Ph.D.
Chair, UNCW Department of Biological Sciences
“Oysters - Not Just Food on the Half-Shell: Ecological Importance and Restoration of a Key Coastal Ecosystem”

It’s a dirty job, but somebody has to do it. Dr. Martin Posey spends a fair amount of his time knee-deep in mud, working to restore and conserve vital oyster reefs. His interest goes beyond a fondness for Oysters Rockefeller or an appreciation for pearls. His research highlights other economic values of the oyster which include biofiltration for estuaries, critical habitats for commercial and recreational fish as well as plant and animal species.

March 1, 2005
Richard A. Lutz, Ph.D.
Director, Center for Deep Sea Ecology and Biotechnology, Rutgers University
“Voyage Into the Abyss”

Dr. Richard Lutz is one of the foremost authorities on the ecology of deep sea hydrothermal vents and their geological succession. He boards Alvin, a deep sea submersible, to dive miles below the ocean’s surface to conduct ecological research and collect deep sea organisms for molecular genetic analysis, which could have significant biotechnological impact.

May 3, 2005
Bess B. Ward, Ph.D.
William J. Sinclair Professor of Geosciences, Princeton University
“Clues to Ocean Chemistry Found in Permanently Ice-Covered Antarctic Lakes”

Throughout her career, Dr. Ward’s research has focused on many aspects of biogeochemistry and the molecular biology of the nitrogen cycle in many parts of the world. The Antarctic project is based in lakes, but the rationale for working in that exotic environment is to learn about the nitrogen cycle, which occurs only in certain regions of the ocean and is an essential link in the global nitrogen cycle.

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October 4, 2005
Samuel H. Wilson, M.D.
Deputy Director, National Institute of Environmental Sciences
“Oceans in Human Health”

Dr. Wilson joined NIEHS in the mid-1990s, where he has worked to foster basic medical research and disease prevention research. He helped develop programs in genetic susceptibility, functional genomics, children’s health, minority institution’s research and community involvement. He currently serves as the principal investigator for the DNA Repair and Nucleic Acid Enzymology division of the NIEHS Laboratory of Structural Biology.

November 15, 2005
Jeffrey L. C. Wright, Ph.D.
Carl B. Brown Distinguished Professor of Marine Science
University of North Carolina Wilmington
“Undersea Treasure: The Promise of Marine Biotechnology”

As a recognized world expert on marine toxins, Dr. Wright has been called upon to spearhead research teams to identify deadly toxins, to submit to the Order of Canada and awarded the Queen Elizabeth II Golden Jubilee Medal for his work in the field. He joined the UNCW Chemistry and Biochemistry faculty in 2000 and has established new programs at the Center for Marine Science in the chemistry and biochemistry of culturable marine organisms.

March 21, 2006
William Todd
NASA Extreme Environment Mission Operations Team Lead
“The NEEMO Project: How NASA Uses the Habitat Aquarius as an Analog for Space Exploration”

Aquanaut William Todd is responsible for managing the NASA Underwater Research Team NEEMO. He provides simulation training of the NASA Astronaut and Flight Control Teams, which have utilized the Aquarius undersea habitat as a research analog for space missions to develop concepts for long-term space habitation.

May 9, 2006
John M. Morrison, Ph.D.
UNCW Professor of Physics and Physical Oceanography
“The Galapagos Marine Reserve: Islands of Change”

Dr. Morrison joined the faculty of the Center for Marine Science at UNCW after 20 years with the Department of Marine, Earth and Atmospheric Science at North Carolina State University. His current research activities include studies of the Oman Upwelling Zone in the Indian Ocean, the northern Gulf of Mexico, and the Galapagos Islands.

Accommodations for disabilities may be requested by contacting CMS three days prior to the event.
Dr. Cindy Lee Van Dover
Director, Duke University Marine Laboratory

*The Top Five Deep-Ocean Discoveries in Recent Decades*

Dr. Van Dover's area of expertise lies in invertebrate biology and the ecology of deep-sea hydrothermal vents and other chemosynthetic communities. She has served as pilot on several submersible missions and written extensively about her journeys to the bottom of the ocean. She earned her Ph.D. from Massachusetts Institute of Technology/Woods Hole Oceanographic Institute.

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September 11, 2007

Dr. Lorraine Backer
Centers for Disease Control and Prevention
“Epidemiology at the Limits of Detection: Harmful Algal Blooms and Public Health”

Dr. Backer’s research interests include accessing the human environmental health impact of harmful algal blooms, including blue-green algae and red tide, drinking and recreational waters, and oceans and human health. For the past seven years, Backer has led the National Center for Environmental Health’s Emerging Environmental Threats Team.

November 13, 2007

George Kieffer
Director of Dolphins and Programs
Curacao Sea Aquarium and Dolphin Academy
“The Dolphin Cooperative: Discovering the Mammal Behind the Myth, the Science Behind the Smile”

Kieffer is currently facilitating a Caribbean-wide research project to access the geographic distribution of different lineages of the dolphin genus Tursiops in the Caribbean using morphological techniques.

March 11, 2008

Dr. D. Wilson Freshwater
Research Specialist and Core Leader,
UNCW Center for Marine Science
“Lionfish: Kings of the Offshore Jungle? A Comprehensive Look at a Marine Fish Invasion”

Dr. Freshwater has been Core Leader of the center’s DNA analysis facility since 2000. An expert in marine algae, he has pioneered the use of DNA analysis for studies of seaweeds, leading to research on a diversity of organisms from marine fungi to woodrats. His current research includes taxonomic studies of red algae and marine floristics of North Carolina and Panama, and genetic analyses of lionfish, with an emphasis on using such projects to train students.

May 13, 2008

Dr. Nancy Grindlay
Professor, Department of Geography and Geology
University of North Carolina Wilmington
“The Risk of Tsunamis: Where, How, When?”

Dr. Grindlay uses high-resolution geophysical and swathmapping instruments to locate active faults, volcanoes and landslides on the seafloor. She has participated on, or led oceanographic expeditions to five of the world’s seven seas and has collaborated with scientists from many different countries including Russia, Italy, South Africa, France, Germany, Britain, Brazil, and Japan.
For reservations, call:
UNCW Center for Marine Science
910.962.2301

**Seminar Series**

**September 9, 2008**

**Dr. Donald F. Boesch**  
Professor and President,  
University of Maryland Center for Environmental Science  
"Climate Change and the Coast: What Are We in For?"

Boesch is a biological oceanographer who has conducted research on coastal and continental shelf ecosystems in the Chesapeake Bay and along the Atlantic Coast, the Gulf of Mexico, eastern Australia and the East China Sea.

**November 11, 2008**

**Dr. Thomas Lankford**  
Associate Professor  
UNCW Department of Biology and Marine Biology  
"The Wrightsville Beach Nourishment Project: Implications for Surf-Zone Ecosystem Health"

As an ichthyologist specializing in research on the marine and estuarine fishes of the Atlantic coast, Lankford and his students conduct fish research in a variety of local habitats, including the ocean surf zone, estuaries, tidal creeks and inner continental shelf waters.

**February 10, 2009**

**Dr. Stanley Riggs**  
Distinguished Professor,  
East Carolina University Department of Geological Sciences  
"North Carolina’s Coasts in Crisis: A Vision for the Future"

Dr. Riggs is a coastal and marine geologist who has conducted research on modern coastal systems since 1964. His areas of interest lie in sedimentation, coastal and mineral resources and their inter-relationship with the development of human civilization. Riggs has been involved actively in numerous technical coastal and mineral resource issues at the federal, state and local levels.

**April 14, 2009**

**Spencer Rogers**  
Coastal Engineering Extension Specialist,  
North Carolina Sea Grant  
"How the Beach Works"

As a coastal engineering extension specialist, Spencer Rogers holds expertise in hurricane-resistant construction techniques, coastal management and marine construction. Some of his recent work includes participation in FEMA’s Hurricane Katrina Mitigation Assessment Team and damage assessments following Hurricanes Katrina and Ike.

**Accommodations for disabilities may be requested by contacting CMS three days prior to the event.**
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September 15, 2009
Dr. Amanda Southwood
Assistant Professor
UNCW Department of Biology and Marine Biology
“Diamonds in the Rough: Biology and Conservation of Diamondback Terrapins”

Through her research, Dr. Southwood investigates how animals respond physiologically and behavior to changes in their environment. She specializes in the thermal biology of marine vertebrates, particularly sea turtles.

February 9, 2010
Dr. G. Brooks Avery
Assistant Professor
UNCW Department of Chemistry and Biochemistry
“Coffee, Collaboration and Climate Change: Marine Chemistry at UNCW”

As a biochemist, Dr. Avery’s research interests include studies of the atmosphere, water column and sediments. His recent work on sediments has focused on expanding our understanding of the cycling of carbon as it relates to both local and global issues.

November 10, 2009
Dr. Jonathan Copley
Lecturer in Marine Ecology
National Oceanographic Centre, University of Southampton, UK
“Islands in the Abyss: Exploring Life at Volcanic Vents on the Ocean Floor”

Dr. Copley’s research investigates the ecological patterns at deep-sea volcanic vents, where lush “islands” of marine life thrive on mineral-rich water erupting from the ocean floor. Exploring these depths yields surprises, from benefits for our everyday lives, to clues towards some of the big unanswered questions in science.

April 13, 2010
J. Glenn Morris, Jr., M.D., M.P.H. & T.M.
Director, Emerging Pathogens Institute and Professor of Medicine
University of Florida
“Changing Climate, Changing Oceans: Vibrios and Other Emerging Disease Risks”

As an infectious disease expert and physician, Dr. Morris maintains an active research program in emerging pathogens and enteric diseases including cholera, other vibrio diseases and ciguatera - all human health risks transmitted via contamination of water or seafood.
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910.962.2301

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**Seventeen Ocean**

**Seminar Series**

**September 14, 2010**

**Dr. Otis B. Brown**
Director, Cooperative Institute for Climate and Satellites 
NC State University and NOAA’s National Climatic Data Center  
“Climate Change: Where Are We Now?”

Dr. Brown’s research has focused on study of the mesoscale oceanic phenomena using ocean observations obtained from instruments aboard earth-orbiting satellites. His background includes a broad understanding of space-based remote sensing instrumentation and concepts of operation.

**November 9, 2010**

**Dr. John D. Rummel**
Director, Institute for Coastal Science and Policy and Professor of Biology 
East Carolina University  
“Mitigate, Adapt or Suffer? Preparing North Carolina’s Coasts for a Changing Climate”

Dr. Rummel’s research interests have included ecosystems ecology, community ecology, and evolutionary biology, the ecology and biogeography of deep sea hydrothermal vents, and the potential for life elsewhere in the universe.

**February 8, 2011**

**Dr. Douglas Gamble**
Associate Professor and Director, The Laboratory for Applied Climate Research  
Department of Geography and Geology, UNCW  
“Climate Change or Coastal Change? The Future of the Carolina Coast”

Dr. Gamble’s research and teaching interests include applied climatology, coastal and island environments of the Caribbean and southeastern United States as well as hydrologic hazards.

**April 12, 2011**

**Dr. Larry Cahoon**
Professor of Biology and Marine Biology 
University of North Carolina Wilmington  
“Responding to Climate Change: Exploring Future Scenarios”

Dr. Cahoon’s research interests include many aspects of coastal oceanography, freshwater ecology, water quality issues, climate change effects on coastal ecosystems, and the intersection of environmental law and science.
Affiliated Programs
North Carolina Sea Grant:

Through research, outreach and education programs, North Carolina Sea Grant provides unbiased, science based information to enhance the sustainable use and conservation of ocean and coastal resources to benefit communities, the economy and the environment.

Sea Grant has funded a variety of UNCW researchers over the years, on topics from inlet dynamics, to oyster diseases and reef morphology, and new aquaculture opportunities.

Spencer M. Rogers - Coastal Erosion and Construction Specialist
Scott Baker - Fisheries Specialist
Principle Funding - NOAA ~ $200,000/yr

Spencer has been a coastal engineering specialist with North Carolina Sea Grant since 1978. As an extension specialist, he uses his expertise to advise private property owners, builders, designers, and governmental agencies on hurricane-resistant construction methods, shoreline erosion alternatives and marine construction techniques. Current projects include GIS analysis from Hurricane Ike damage, shoreline erosion, and new property insurance regulations on homeowners’ wind insurance premiums. Spencer serves on the North Carolina Coastal Resources Advisory Council and is often asked by FEMA to review hurricane damage.

Scott has been with Sea Grant since 2003. His primary responsibility is to create and deliver extension programming to address the needs and concerns of recreational and commercial fishermen in North Carolina and the South Atlantic region. Scott’s programming is varied and includes projects tailored to the specific needs of the marine fishing community. Current projects include video monitoring on board fishing vessels, development of a text message based approach for recreational anglers to submit data to managers and development of a workshop series for North Carolina seafood dealers to learn about direct and alternative marketing strategies for fresh seafood. Scott serves on state and regional marine fisheries panels.