UNIVERSITY OF NORTH CAROLINA
A SYSTEM OF HIGHER LEARNING

UNC Coastal and Marine Activities Review

June 13, 2013

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UNC Coastal & Marine Science Activities

Coast is important to NC

- 301 miles of Atlantic coastline
- 12,000 miles of estuarine coastline
- 1,019,000 people in 20 coastal counties
- 4th nationally in hurricane strikes (12 major, 47 total since 1851)
- 10.7 million short tons of cargo through NC ports (2009)
- 5,000 shipwrecks off NC over a 500 year period
- Integral part of the NC "brand"

UNC plays a key role in the discovery and dissemination of knowledge to protect and utilize this valuable resource

- Activities at 6 campuses and 4 field stations with state, with national, and international reach
- Recognized by BOG in as an "Area of Excellence" (*OTOF*, p. 61)
- Total expenditures of $65M for FY12

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UNC Coastal & Marine Science Activities

On May 15, 2012 President Ross called for a review of coastal and marine science activities:

> *"…to ensure we are operating as efficiently and effectively as possible without unnecessary redundancy and in a manner in which our programs demonstrate their complementary nature."*

Office of RGE led and coordinated this effort

- Engaged with AAAS Research Competitiveness Program
- Six universities, UNC CSI, and NC Sea Grant completed an extensive self study reports
- AAAS and UNC-GA conducted a week of site visits along the coast
- AAAS RCP submitted their independent external review

UNC Coastal & Marine Science Activities

UNC – Wilmington - **Dan Baden**, Director of the Center for Marine Science and William R. Kenan Distinguished Professor of Marine Science

UNC – Chapel Hill - **Rick Luettich**, Director of the Institute for Marine Sciences and Sewell Family Term Distinguished Professor of Marine Sciences

NC State - **Dave Eggleston**, Director of the Center for Marine Science and Technology and Professor of Marine Ecology and Conservation

East Carolina and UNC Coastal Studies Institute - **Nancy White**, Director of the UNC Coastal Studies Institute

North Carolina Sea Grant - **Susan White**, Director of the NC Sea Grant and Water Resources Research Institute

Elizabeth City State and Western Carolina - **Chris Brown**, Vice President for Research and Graduate Education at UNC GA

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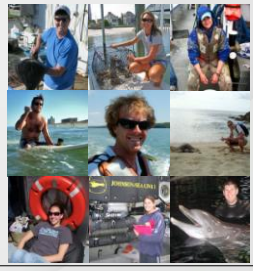
University of North Carolina Wilmington

4 Schools, 6 departments, 1 Center, 1 Translational Program: Marine Science Throughout the Curriculum

"To be a national and global leader in demonstrating how universities can serve their regions, we must come to understand and embrace the importance of our coastal location as a powerful metaphor for many of the most significant questions of commerce, human health, nutrition, the environment and social and cultural dynamics. In this way, we must serve the world even as we serve our region."

Inaugural address Chancellor Gary L. Miller, 20 April 2012



- Marine Science Activities at North Carolina's Coastal University:

Cameron School of Business	Biology & Marine Biology
Center for Marine Science	Chemistry & Biochemistry
College of Arts & Sciences	Environmental Studies
College of Health & Human Services*	Geography & Geology
MARBIONC	Physics & Physical Oceanography
Watson College of Education	Public & International Affairs

*developing

- Thematic Slides: **Collaborative Innovation**
  Ocean Discovery

Established:	**1972 (1968)**
Physical Assets:	**~300,000 sq. ft.**
# of Faculty:	**105**
# of Academic Programs:	**11 (12)**
K-12	**> 4,000 per yr**
Undergraduates:	**> 400**
Graduate:	**~ 112**
Grants:	**50% of marine $ in NC***
Publications:	**619**
Patents:	**5 (3 pending)**

*Federal, state and local grants

UNCW

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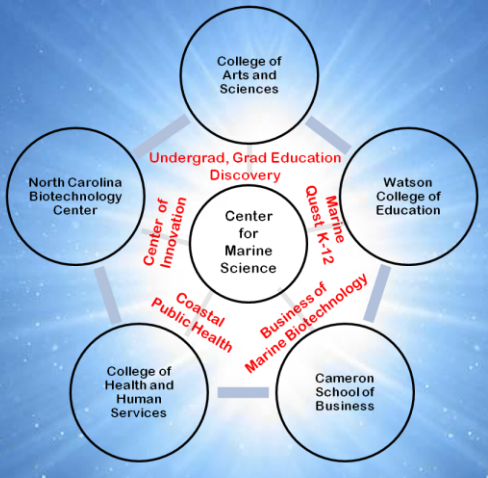
COLLABORATIVE INNOVATION

New Modes of Operation are Paradigm-Shifting



"Study makes a scholar, action makes an entrepreneur"

P. Prendergast, Provost, Trinity College Dublin

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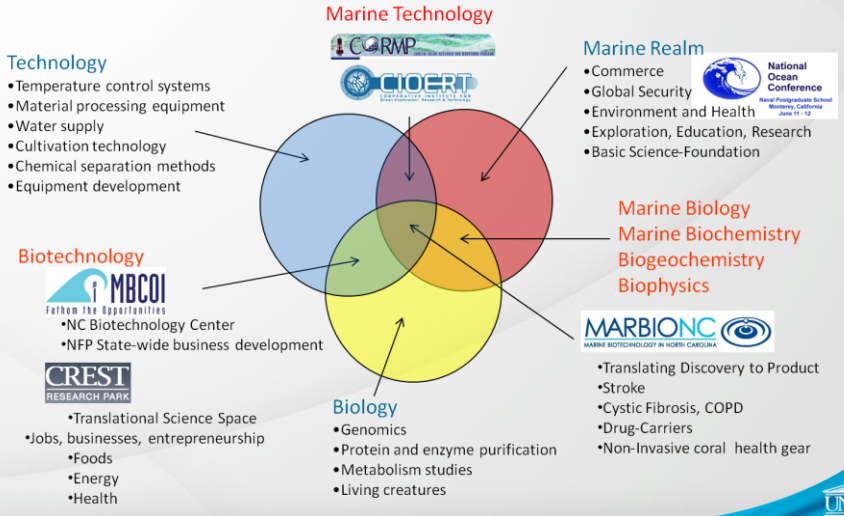
OCEAN DISCOVERY

. . .is at the Interface of Disciplines



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UNCW - OCEAN DISCOVERY

. . .is at the Interface of Disciplines

Problem: The pharmaceutical industry pipeline of new drug candidates is limited due to economic downturn

Approach: Cultivate bioactive marine organisms, and follow-up with selected bioassays to identify new drugs and create new pipeline candidates.

MARBIONC
MARINE BIOTECHNOLOGY IN NORTH CAROLINA

- •Translating Discovery to Product
- •Stroke
- •Cystic Fibrosis, COPD
- •Drug-Carriers
- •Non-Invasive coral health gear

Successes:

- 5 existing patents, 3 more in process
- Craig Venter Institute---synthetic biology
- Mount Sinai Medical Center---CF and COPD
- NC Biotechnology Center and UNCCH---Drug Carriers
- Batchelor Foundation---Preclinical Completion for CF drug
- Cystic Fibrosis drug is completing pre-clinical work
  - •New drug target in lung
  - •New non-toxic chemical scaffold
  - •Unprecedented drug potency

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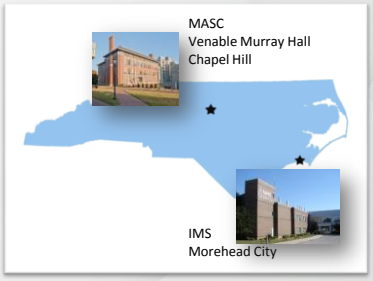
UNC Chapel Hill - MASC & IMS



UNC-CH MARINE SCIENCES MISSION
Service to NC, US & world thru cutting-edge fundamental and applied research, graduate training (MS/PhD), public service.

MARINE SCIENCES HISTORY
1894 – Summer field classes in marine zoology in Beaufort
1947 – Institute of Fisheries Research (IFR)
1967 – IFR → IMS
1971 – Curriculum (1998 Department) of Marine Sciences

FACILITIES
IMS: 6.33 acres; 60,000 sq ft office & lab; seawater system; outside ponds; boats; trucks
MASC: 40,000 sq ft office & lab; Joint Fluids Lab; Aquarium Res Center; Trace Metal Clean rm

SIZE / ON-CAMPUS REACH
IMS: 11 faculty; 125 total residential; 250 - 500 visitors
MASC: 16 primary faculty; 50 grad students; 60 undergrad research projects; minor; courses
OTHERS: ESE, CEE, Math, Phys, Geog, Geol, Bio, DCRP, RENCI, IE

ACTIVE EXTRAMURAL RESEARCH PROJECT FUNDING
IMS: $28 million – strong coastal NC focus, bias toward applied research
MASC: $11 million – broader coastal and marine focus

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Rapid Molecular Methods for Water Quality

PROBLEM
- Currently used water quality tests based on growing cells - take ~24 hours from sample to results

UNC-CH RESEARCH
- New tests for E. coli and Enterococcus based on DNA amplification
- Yields results in less than 2.5 hours
- Already approved for beach water testing
- Working to validate for use in shellfish harvesting waters, ballast water, drinking water, and storm water

IMPACT
- Vital to commerce and tourism; dramatically reduce time required to reopen beaches, oyster beds, post-hurricane drinking water restrictions…
- 1st Patent issued 2012; others in pipeline
- Technology licensed to BioGX
- IMS Molecular Training Facility - train professionals from around the world in rapid molecular methods – startup assistance from Marine Biotech Center of Innovation / NC Biotech Center

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Coastal Hazard Modeling and Prediction

PROBLEM

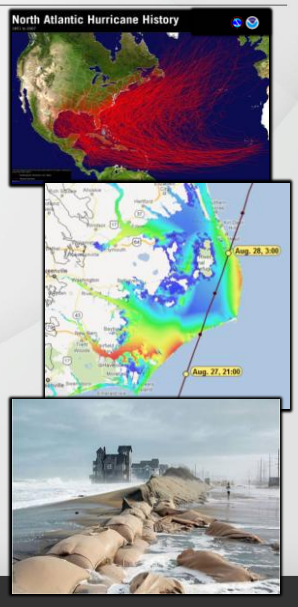
- Poor capability to predict storm surge, waves, inundation in vulnerable coastal areas

UNC-CH RESEARCH

- Development of ADCIRC computer modeling system
- High resolution, high accuracy coastal response & flooding
- Efficient, high performance computing / large data

IMPACT

- ADCIRC used post Katrina by US Army Corps of Engineers for hurricane protection system design for New Orleans
- ADCIRC used for risk analysis by FEMA National Flood Insurance Program from New York to Texas
- ADCIRC specified by Nuclear Regulatory Commission to assess risk at coastal nuclear power plants
- ADCIRC run for storms – Ike ('08), Irene ('11), Isaac ('12), Sandy ('12), Andrea ('13) – results to NHC, NWS, USCG, EMs
- DHS Coastal Hazards Center of Excellence ($16M) to advance prediction, planning, engineering (NCSU), recovery from coastal hazards



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North Carolina State University

IMPACT

- Coastal and Marine Science plays a critical role in fulfilling NC State's mission: teaching, research, and engagement
- Active extramural research funding for 60 faculty is $57M
- Over 100 publications/yr.
- Train over 30 graduate & 150 undergraduate students/yr.

Jordan Hall

THREE PROGRAMS

- *Marine, Earth and Atmospheric Sciences:* fundamental and applied research in the geosciences
- *Center for Marine Science and Technology:* coastal lab provides multi-college & inter-disciplinary discoveries
- *Multi-College, Inter-Disciplinary Faculty*: leadership for social, economic, & technological development

CMAST

DIVERSITY

- Veterinary Medicine, Seafood Technology, Habitat Restoration, Ocean & Climate Modeling, Resource Economics, Fisheries, Aquaculture, Engineering.

NC STATE UNIVERSITY | 125 YEARS

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MEAS: Integration of the Geosciences

PROBLEM
- Hurricane predictions need to be more accurate & earlier

NCSU RESEARCH
- Refinement of hurricane forecasting models
- Integration of 10,000 global "hot spots" for hurricane generation
- Integration of more accurate estimates of atmospheric moisture from air-sea interactions
- Efficient, high performance computing /large data

IMPACT
- Increase of 15% in accuracy of hurricane predictions
- All extreme events will become more extreme: (hurricanes, floods, droughts)
- 20-30% increase in maximum precipitation
- Results to NHC, NWS, USCG, EMS, Insurance Industry
- NC State Climate Office, CICS NC, USGS Climate Science Center, NSF

NC State University and the new USGS Climate Science Center

NC STATE UNIVERSITY 125 YEARS

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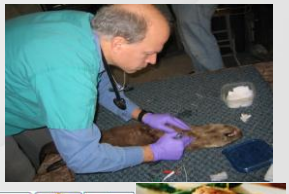
CMAST: *One Health*

OPPORTUNITY
- Maintain & improve the health of wild & captive animals
- Minimize negative feedback between animals, humans & environment

NCSU RESEARCH
- Benefits of habitat restoration
- Improved understanding of best handling practices for captive animals (Aquariums & Aquaculture)
- Seafood safety and value-added products
- Improved understanding of linkage between animals, humans & the environment



IMPACT
- Largest oyster restoration project in US ($7 million)
- Provide clinical support for entire NC Aquarium System, NC Sea Turtle Hospital, Marine Mammal Stranding Network, State/Federal agencies, other Universities
- Training & technology transfer to 100s of seafood businesses
- Minimize exposure of humans and coastal food webs to diseases

NC STATE UNIVERSITY 125 YEARS

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East Carolina University's Coastal Enterprise

To be a national model for public service and regional transformation…

We educate
Coastal Studies Minor (1976, 185 graduates)
MA Maritime Studies (1981, 201 graduates)
PhD Coastal Resource Management (1999, 35 graduates)
MS Sustainable Tourism (2009, 9 graduates)

We discover
About 50 faculty members, $4-5 million in external awards
Natural Sciences, Social Sciences, Professional Disciplines
Partnership with UNC CSI provides efficient accessibility for our place-based approach to education and research.

We integrate
Institute for Coastal Science and Policy (ICSP), 1973
Center for Sustainable Tourism (CST), 2007
Center for Natural Hazards Research (CNHR), 2004

We serve
We collaborate with federal, state, and local communities to assist with the resiliency and the sustainability of our coastal development.

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Dynamic Coastal Processes and Development

The Problem
Uncertainty and risk associated with coastal change in the context of sea-level rise, storms, sediment supply, and human modifications to coastal landscapes.

ECU Research
Formation of the North Carolina Coastal Geology Consortium. Led by ECU Geological Sciences in collaboration with USGS, NCGS, U Penn, VIMS, William & Mary. Approximately $1.5 million in external funding. Established the natural history and current coastal processes of the northern portion of the NC coast.

Impact
Results of these coastal findings used by DOT, NCEM, coastal counties, and municipalities context for future sustainable development.

Results used as a basis for Kenan Institute involving students, faculty, administrators, and public officials.

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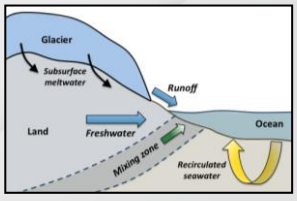
Melt Water & Iron Dynamics in the Antarctic

PROBLEM

- The Western Antarctic Peninsula is warming more rapidly than any other location. The introduction of massive amounts of fresh water and nutrients (like iron) will influence the ecology of the Southern Ocean and the entire global ocean ecosystem.

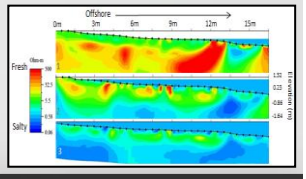
ECU-CSI RESEARCH

- Quantify the amount of melt water entering the coastal ocean, delineating direct runoff from water moving through the continent
- Evaluate the amount of iron and other nutrients delivered to the ocean through this new source of water
- Establish the connection between the iron-rich melt water and offshore production



IMPACT

- This NSF funded project provided the first ever images of groundwater discharge in the Antarctic
- Preliminary data has shown direct influence of continental melt water across the continental shelf
- Through outreach efforts of CSI, the scientific team did a live feed from the Antarctic into NC K-12 classrooms, interacting directly with 1000's of students then and since their return



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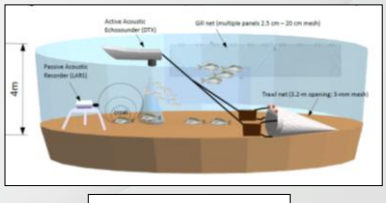
Acoustic Survey of Fish Spawning Habitats

PROBLEM

- Valuable fish (red drum, spotted seatrout) but unknown nursery habitats and spawning areas.
- Vessel noise is potential disturbance to spawning fishes.

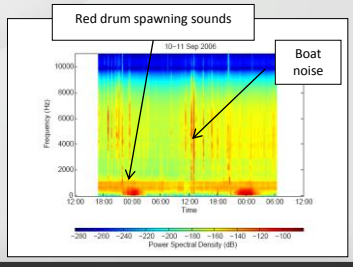
ECU-CSI RESEARCH

- Species make spawning sounds in Pamlico Sound each year.
- ECU recorders and algorithms used to identify species from sounds.
- Juvenile fishes and nursery habitat surveyed acoustically
- Experiments being conducted now to examine impact of vessel noise on fish reproduction.



IMPACT

- ECU Fish Acoustic Research Team produced maps of spawning areas based on these sounds
- Maps of seagrass and SAV nursery habitat produced
- Maps used by NC Division of Marine Fisheries and NOAA to manage fishing. Potential for sand mining and wind farm studies
- Interdisciplinary research team includes Biology, Physics, Geology, ICSP, and CSI.



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UNC Coastal Studies Institute

Established 2003 bringing knowledge and resources of UNC system to address unmet public service and academic programming needs in coastal engineering, coastal processes, estuarine ecology and human health, maritime heritage, economics and public policy.

- Twenty faculty and staff in residence.
- Legacy partnerships with 7 UNC campuses and other universities.
- Served >10,000 students and 12,000 people in academic and public programs.
- Eight excellence in programming awards.
- Community Anchor Partner with MCNC
- Hosted >2000 people for meetings/events since 12/12 campus opening.
- Guided by Board of Directors appointed by UNC President

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UNC CSI + ECU Maritime Heritage Program

Maritime Heritage Program

- The only coastal focused Maritime Heritage Program in the US conducts research on the WWII Battle of Atlantic, history of the US Coast Guard, Life Saving Service, OB Heritage, and the Graveyard of the Atlantic.
- Partners include ECU, UNC CSI, Currituck County, Whalehead Preservation Trust, Outer Banks Conservationists, US Coast Guard, NOAA

Outcomes

- Currituck County Maritime Heritage Park
- Heritage Trails Phone APP
- Maritime Heritage Graduate Student Fellowship, a public-private partnership.
- POC Dept. of Cultural Resources for artifact management.
- UNC CSI awarded Department of Interior Partners in Conservation Award in 2009.

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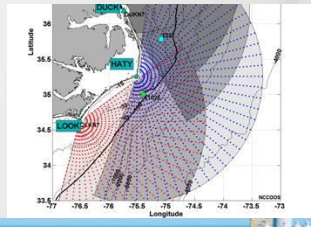
Ocean Energy for North Carolina

Working with private sector, government, and academic experts to develop the potential of waves, tides, and currents for the creation of new economies for North Carolina. Provides solutions to:

- Technological challenges in the ocean energy sector
- Regulatory, environmental and economic issues



- 12 Faculty, 24 students (UG & G)
- Two Patents
- Business pending w/ Navy, Chevron, Norway and others.
- Supports CDIP buoy 192, CODAR, ADCP monitoring critical to National Weather Service, NAVY, and commercial fishing fleet
- UNC CSI, NCSU, NCA&T, UNCC, RENCI

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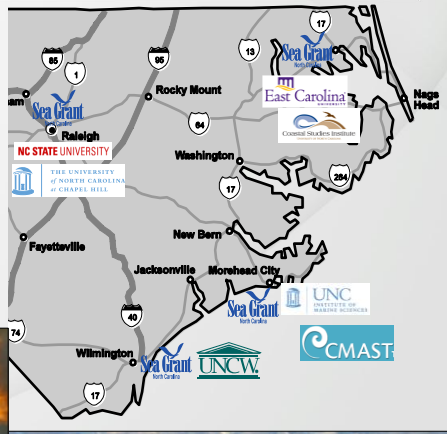
North Carolina Sea Grant

- 2012 Review: Ranked in top 4 of 33 Sea Grant programs.
- Total leveraged funds beyond NOAA base: $6,144,332 from 2010-12.
- Student engagement
  - K-12: 43,250 students in 2012
  - Graduate and undergraduate: 100 students/year average



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Extending Seafood Availability

- NCSG's **aquaculture** research offers healthy protein for consumers and economic diversity for fishermen and famers.
- NCSG collaborates with
  - **Commercial** fishermen to reduce bycatch and improve stock assessments.
  - **Recreational** anglers to update catch-and-release practices and gear.

Sea Grant North Carolina

NOAA

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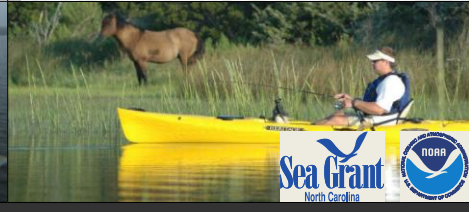
Strengthening Coastal Communities

- NCSG facilitated workshops to train evaluators to certify homes under NC's Community Rating System.
- Resulted in savings of $1 M on wind insurance premiums over past 3 years.
- NCSG supports **tourism** efforts that attract income to coastal communities, broaden economic options and increase earnings with a positive trickle-down impact for NC.



Sea Grant North Carolina

NOAA

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Elizabeth City State University

A key component of ECSU's mission is "*to facilitate sustainable economic growth while safeguarding the unique culture and natural resources of the region.*"

- Providing opportunities for under-represented students in coastal and marine science
- Developing strong inter-institutional partnerships

Marine Environmental Science Program

- *4 faculty, 8 undergraduates, $920K active extramural grants*

Center for Remote Sensing of Ice Sheets

- *2 faculty, 2 staff, $1M active extramural grants*

On April 12, 2012, the US Board on Geographic Names officially approved **Elizabeth City State University Bay**, a former Antarctic ice shelf

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Western Carolina University

Program for the Study of Developed Shorelines

- **Resource for UNC universities, WCU students & state/national public at large:**
  - Only national storm surge database & most comprehensive beach nourishment database in U.S.
  - Extensive library of historical coastal research literature

- **Key communication link between coastal science, educational outreach & public policy:**
  - "Go to" source for national media pertaining to major coastal disasters (BP oil spill, Hurricane Sandy, etc.)
  - Hundreds of interviews and consultations with New York Times, NPR, USA Today, NBC Nightly News, CNN & others
  - Contributions to Native American Science Ed: Eastern Band of Cherokee Indians in WNC, Lower Elwha Klallam Tribe, WA

- **Serves WCU strategic goals:**
  - Interdisciplinary teaching, experiential student learning & applied research (biology, geology, public policy)
  - Leadership in environmental science & policy

- **PSDS stats:**
  - WCU since 2006, founded at Duke in 1985
  - 5 Full-time staff (3 fully grant supported)
  - $7 M in grants & significant federal & state partnerships (NSF, NPS, NOAA, NCDC, USGS, ECU, RENCI, ASU)

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AAAS Research Competitiveness Program

- **American Association for the Advancement of Science**
  - World's largest general scientific society
  - Established 1848
- **Research Competitiveness Program**
  - Expert advice for science and technology programs
  - Established 1996
- **Dr. Chris D'Elia**
  - Professor and Dean, School of the Coast and Environment, LSU
- **Dr. Rieko Yajima**
  - Project Director for RCP
  - PhD , Chemical Biology, Penn State

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AAAS

Independent Review of UNC Marine and Coastal Science Activities

Presentation of the Final Report
to the UNC-GA Board of Governors
June 13, 2013

Conducted by the
American Association for the Advancement of Science (AAAS)
Research Competitiveness Program

Rieko Yajima, Ph.D., AAAS Project Director
Christopher F D'Elia, Ph.D., Louisiana State University, Dean and Professor
School of the Coast and Environment

Presentation Outline

- AAAS Review Process
- AAAS Review Panel Members
- Major Findings and Recommendations

Charge to the AAAS

- Understand the impacts of UNC coastal and marine science activities
- Identify opportunities for coordination, leverage, and avoidance of unnecessary duplication of effort or resources
- Identify what must be done, institutionally or at the systems-level, to maximize the impact of North Carolina's coastal and marine science activities

AAAS Review Panel Members

Christopher F. D'Elia

Dean and Professor
Louisiana State University
School of the Coast and Environment

Jacqueline Dixon

Dean and Professor
University of South Florida
College of Marine Science

Steven E. Lohrenz

Dean and Professor
University of Massachusetts-Dartmouth
School for Marine Science & Technology

Nancy Targett, (Chair)

Dean and Professor
University of Delaware
College of Earth, Ocean, and Environment

Two-Stage Review

1. Analysis and assessment of UNC Activities based on self-study reports
2. On-site interviews with representatives from all 26 Activities, facility tours, university administrators

Note: Map displays locations of all seventeen UNC institutions.

Provided by Office of UNC GA

AAAS Panel Site Visit:

Wilmington (Jan 27 – 28)
Morehead City (Jan 29 – 30)
Manteo (Jan 31 – Feb 1)

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

AAAS Panel Major Findings

- ***Rich assemblage*** of intellectual assets, facilities, and capabilities that underlie research, education and outreach in marine sciences
- UNC System's marine-related programs have many ***forward-looking elements and best practices*** upon which to build
- AAAS panel ***did not identify any areas where there was excessive redundancy or overlap in programs***

AAAS Panel Major Findings

Institutional and Program Diversity

- Each UNC Activity fills a ***unique niche***, consistent with the institution's culture and mission, to serve a distinct set of stakeholders (research intensive, teaching intensive, cross-state programs including NC Sea Grant and UNC CSI)
- Marine-related programs within the state have self-selected into niches that largely ***complement each other rather than compete***

AAAS Panel Major Findings

- Grass roots collaborations exist on a project/individual basis
- Awareness of the *totality* of UNC marine-related assets is yet to be fully realized
- Limited communication and strategic planning occur across UNC marine-related activities
- AAAS panel report focuses on system-wide efforts to leverage and enhance assets

AAAS

Changing Landscape for Higher Education and Research …and for Ocean and Coastal Science

They Never Saw It Coming

EDITORIAL

RECENTLY, A HIGHLY REGARDED NEWSPAPER PUBLISHER, PERHAPS THINKING OF DINOSAURS WHILE speaking of his own profession, remarked to me that "We are all dead; some of us just don't realize it yet." He is of course not alone in his lament: Remember videocassette recorders, carbon paper, and mechanical typewriters? Various writers have warned that it is not the strongest of the species that survives, or the most intelligent, but rather the one most adaptable to change.

Science Vol 339 (2013)

AAAS

Four Categories of Recommendations

- Fostering System-Wide Planning and Coordination
- Reducing Barriers for Research and Collaboration
- Enhancing Marine Science Activities Planning and Communication
- Building on Development and Diversity Efforts

Recommendations

System-Wide Planning and Coordination

UNC System is encouraged to:

- Provide greater leadership and coordination of UNC Activities
- Commission studies on economic valuation of coastal ecosystem services
- Foster the development of a clear brand or identity for the major marine-related assets and programs

Recommendations

Reducing Barriers for Research and Collaboration

UNC System is encouraged to:

- Foster stronger research collaborations and communicate the economic and societal benefits of that research
- Remove barriers to academic collaboration
- Enhance coordination of online or hybrid course curriculum in marine science

Recommendations

Reducing Barriers for Research and Collaboration

UNC System is encouraged to:

- Foster undergraduate research and encourage efforts to ensure that undergraduate and graduate student mentoring is valued
- Consider building and maintenance of dormitories to foster academic programs at the three coastal locations (Wilmington, Morehead City, and Manteo)

Recommendations

Marine Science Activities Planning and Communication

UNC Marine-related Activities are encouraged to:

- ***Develop unit-level strategic plans*** that articulate with their home institutions and the UNC System
- Develop and execute a ***systematic and coordinated communication plan***

Recommendations

Marine Science Activities Planning and Communication

UNC Marine-related Activities are encouraged to:

- Recognize and fully utilize the well-developed communication and outreach capabilities of NC Sea Grant and UNC CSI
- Use **modern communication and social media technology** to improve inter-unit communication and enhance the undergraduate and graduate curriculum

Recommendations

Building on Development and Diversity Efforts

UNC System should encourage:

- All units to develop fund-raising strategies and plans in coordination with their home institutions, enhance external development programs and to engage external advisory committees and boards
- Diversity initiatives for students and faculty in marine science

UNIVERSITY OF NORTH CAROLINA
A SYSTEM OF HIGHER LEARNING

Going Forward

- AAAS review of our coastal/marine academic and research programs tells us:
  - UNC has formidable assets in coastal and marine science
  - UNC has the opportunity to be world-class in coastal and marine science by strengthening key areas of excellence, coordinating activities, and exploring operational efficiencies
  - Our universities, faculty, and administrators are eager to work together to implement positive changes.

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Going Forward

- In step with the BOG emphases on coastal and marine science and operational efficiencies in *Our Time Our Future*, we will
  - Consider recommendations with stakeholders and develop a forward-looking implementation plan
  - Explore operational efficiencies identified by AAAS, including
    - Shared dormitories
    - Course sharing and collaborative academic programs
    - Fleet management
    - Shared personnel and/or resources for public relations, development, and student recruitment
  - Report our implementation plan back to the Board by the end of the year

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