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PREFACE

Faculty, staff and administrators undertook a self-study of Coastal and Marine Sciences at UNCW to identify goals, priorities, strengths, and needs in this area broadly across the UNCW campus. Coastal and marine studies have been a wide-ranging emphasis at UNCW throughout most of its growth and currently are encompassed in all the university’s colleges. Examples of the diverse expertise include research and education related to coastal ocean policy, marine education, watershed research, barrier island work, coastal health, and other areas in addition to our excellent offshore marine expertise. The self-study process was overseen by the CMS Faculty Advisory Committee with support from the CMS administration. The process was conducted with input from, and in collaboration with, the Chairs’ Advisory Committee, Deans of the College of Arts and Sciences and Graduate School / Research, and the Provost’s Office. Each sub-committee had at least one representative from the Faculty Advisory Committee and the Chairs’ Advisory Committee as well as other faculty, staff and administrators. Sub-committee members are identified in Appendix I. Comments from faculty and staff on the entire document were solicited and incorporated from both electronic comments as well as from a general faculty / staff meeting. Final approval of this self-study was provided by email vote of the coastal and marine faculty and staff.

The following sub-committee areas and charges were established:

1. Vision: Where do we see ourselves now and where do we want to be in five years? What is the coastal and marine sciences program at UNCW (self-identity; identity we wish to project outwards)? How do we best communicate this identity externally?

2. Administrative organization.

3. Research: Strengths; areas requiring enhancement; how can we best position ourselves to do our research and to get appropriate funding? This may be informed by the discussions occurring in the research collaborative gatherings.

4. Infrastructure: What needs to be considered with respect to facilities, core resources areas, and other support for our research, educational, and engagement activities (both at the CREST campus and at department levels as appropriate for broad objectives)?

5. Teaching: Support of interdisciplinary programs (e.g., new inter-institutional Ph.D.; M.S. in Marine Science); infrastructure and facilities support that needs to be provided at CREST for other coastal and marine education programs.
6. Outreach and Engagement: Do we want to become the “go-to” university for coastal and marine issues in North Carolina (as has been suggested at some faculty meetings) and, if so, how do we achieve this goal? How can we better engage agencies, non-profits, governmental entities, businesses and the general public for the application of our work? How can we increase our community and state profile?

Each sub-committee was asked to consider the following as appropriate to their specific areas of concentration:

- What is encompassed by sub-committee area?
- Broad needs and target objectives for next 5 years (for Research, Infrastructure, Teaching and Outreach).
- Brief assessment of status and strengths.
- Discussion of challenges/needs for achieving objectives.
- Concise recommendations for the coming 5 year period.

Sub-committees were encouraged to look at / consult with:

- AAAS review (2013)
- Previous Strategic Plan (2008)
- Governance committees and consultation with other faculty/staff
- CMS Policies and Procedures handbook
- UNCW strategic plan
VISION STATEMENT

Coastal and marine sciences extend throughout the academic experience at the University of North Carolina Wilmington, our state’s coastal university. Coastal and marine sciences at UNCW involve the active participation of faculty and staff from all of our colleges and schools, and its foundation is the training of undergraduate and graduate students by their active engagement in discovery. These distinctive features, which form our identity, set UNCW apart both within our state and across the nation. Our vision is to build upon these strengths by enhancing faculty governance, processes, and resources that will support creative, multi- and cross-disciplinary approaches to research, scholarship, teaching, and service. These measures will continue to serve the citizenry of North Carolina well, and to help identify UNCW as a national leader and the preeminent coastal and marine university in our state.
### PROGRAM REVIEW FACILITATORS

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SECTION I: VISION

Preamble:

The University of North Carolina Wilmington is our state’s coastal university. For over 40 years, UNCW has significantly and consistently invested in coastal and marine sciences, leading to nationally-recognized excellence. This investment began with the traditional sciences, but over time, these themes have extended throughout every aspect of our academic experience. We seek not to “silo” coastal and marine science – we invite investigation and discovery across disciplinary interfaces, and involve students at every step. Faculty have driven this evolution and given our university its distinctive identity. Our vision is to build upon these strengths by:

- elevating our research profile so that we are recognized as the state’s preeminent coastal university and an international leader in coastal and marine sciences.
- enhancing faculty governance to facilitate growth and excellence.
- encouraging novel and efficient collaboration in both teaching and research across diverse disciplines.
- creating and clarifying a vision of coastal and marine sciences as integral to UNCW and publically projecting that vision.

Herein we describe our history and future steps to meet these goals.

Our History:

“The University of North Carolina Wilmington, the state’s coastal university, is dedicated to the integration of teaching and mentoring with research and service.”

So begins the Mission Statement for our university. UNCW is bounded by the Atlantic Ocean, the Cape Fear River, and the Intracoastal Waterway. As befitting the state’s coastal university, coastal and marine sciences and scholarship are woven into the academic fabric of each of our colleges and schools, including the College of Arts and Science, College of Health and Human Services, Cameron School of Business, Watson School of Education, the Graduate School, and Honors College. Regardless of discipline, a core value of our engagement in coastal and marine sciences is the active involvement of undergraduate and graduate students in the pursuit of knowledge, whether in the classroom, the laboratory, or the field. UNCW offers no fewer than 15 degree programs – both basic and applied – across our colleges and schools that impact the training of young coastal and marine scholars. These strengths have relied upon collaboration across autonomous departments, a process facilitated and coordinated through faculty governance. These distinctive features of our university’s identity were recognized by the American Association for the Advancement of Science in its Independent Review of the University of North Carolina System Marine and Coastal Activities (2013).
By building substantial and diversified expertise in coastal and marine sciences, UNCW has not just developed nationally-recognized strengths in a number of fields in the coastal and marine sciences, it has also created an academic environment in which the interfaces of disciplines can be explored and capitalized upon. Sharing the insights, tools, and techniques of multiple disciplines has led to creative solutions to existing problems and to the identification of new opportunities. Coastal and marine sciences at UNCW are collaborative efforts that well serve the citizens of North Carolina.

North Carolina’s coastal university has also been strategic in its investment in infrastructure and has outstanding facilities to support coastal and marine sciences. Best known is the Center for Marine Science’s Myrtle Grove campus, a state-of-the-art facility located on the Intracoastal Waterway, which is dedicated to fostering interdisciplinary approaches to discovery in our coastal and marine environments. UNCW also hosts the Publishing Laboratory (home of the journal *Ecotone*), Shellfish Research Hatchery, Microscopy Facility, MARBIONC Building, Oriole Burevitch Laboratory, GIS Lab, Aquaculture Facility, and advanced instrumentation both at the Myrtle Grove campus and across multiple academic departments. These resources offer unparalleled opportunity to carry out high-quality coastal and marine science education and research at UNCW. They also offer undergraduate and graduate students hands-on experience with tools, techniques, and technologies that will prepare them for their future as our next generation of academic, health, governmental, and business leaders.

**Our Future:**

To build upon these strengths, and to facilitate our continued growth and excellence in coastal and marine sciences, we propose the following:

**Create a new faculty governance structure – the Coastal and Marine Council**

Advancement and stewardship of the coastal and marine sciences at UNCW is the responsibility of the faculty. This requires greater input and more formal participation of all faculty and staff engaged in coastal and marine activities across our campus. One mechanism to ensure continued creative and efficient growth of our faculty-driven, collaborative efforts in coastal and marine sciences is formation of a university-wide council. This Coastal and Marine Council should be the governance organization tasked to help direct the evolution of coastal and marine sciences at UNCW and oversee implementation of this strategic plan. The Council can also encourage novel and efficient collaboration in both teaching and research, across diverse disciplines, to create a clarifying vision of coastal and marine sciences as integral to UNCW.

We recommend that the current Advisory Committees for the Center for Marine Science, composed of elected and *ex officio* representatives of many of the departments engaged in coastal and marine sciences, be tasked to facilitate the formation of the Coastal and Marine Council. Further discussion of the formation and charge of this Council follows in the next section.
Utilize extensive expertise on campus to create identifying imagery/symbol of our collaborative, student-centered, marine and coastal programs

The distinctive feature of our coastal and marine sciences at UNCW is that it is interwoven into the academic fabric of the university – across disciplines, colleges and schools – and that it actively involves undergraduate and graduate students. These features make us simultaneously (1) integrative, creative, collaborative, cross-cutting, and agile, but (2) difficult to succinctly describe and, thus, “brand” to communities within UNCW, our state, and our region.

We recommend that we utilize our abundant talents on campus to create powerful “images” of what we do here, through the development of stories, visual depictions, and symbols. This imagery will help publically project our university’s image as the state’s preeminent coastal university.

Commit to strengthening UNCW’s role as the state’s coastal and marine science leader

In a time of coastal change and challenge, this investment is vital. UNCW is poised to assume greater leadership in providing new knowledge critical to understanding environmental change, making informed predictions, and responding to hazards. We will deliver science products that inform decision making and resource management to support the health and economy of our state. We will advance technological innovation, improve ocean literacy, and inspire imagination and creativity across traditional disciplines. This commitment will require faculty, facilities, and funding.

Vision Statement:
Coastal and marine sciences extend throughout the academic experience at the University of North Carolina Wilmington, our state’s coastal university. Coastal and marine sciences at UNCW involve the active participation of faculty and staff from all of our colleges and schools, and its foundation is the training of undergraduate and graduate students by their active engagement in discovery. These distinctive features, which form our identity, set UNCW apart both within our state and across the nation. Our vision is to build upon these strengths by enhancing faculty governance, processes, and resources that will support creative, multi- and cross-disciplinary approaches to research, scholarship, teaching, and service. These measures will continue to serve the citizenry of North Carolina well, and to help identify UNCW as a national leader and the preeminent coastal and marine university in our state.
SECTION II: ADMINISTRATIVE ORGANIZATION

Sub-Committee Charge and Philosophy

The Center for Marine Science (CMS) Administrative Structure Sub-Committee was charged with the design of an administrative structure for CMS to be proposed to UNCW marine science faculty and administrators as part of the 2017 CMS Self-Study and Strategic Planning process. If supported by the faculty, the proposed structure could be implemented as early as the 2017-2018 academic year. The inter-disciplinary and resource-intensive nature of the coastal and marine sciences at UNCW necessitate a breadth of foci that can reach across academic divisions while minimizing conflicts between CMS-affiliated faculty and their home departments. This sub-committee designed administrative structures with the guiding principal that CMS does not refer to any particular building, but rather to the coastal and marine science programs of the university as a whole; and is primarily a service unit best suited to support and coordinate a wide-range of coastal and marine science related academic activities. The committee also wishes to emphasize that any proposed changes to the administrative structure are purely related to organizational structure and not current personnel. In all instances, the committee fully recognizes that administrative organization is within the purview of UNCW upper administration. This document represents recommendations from a faculty perspective to enhance organizational strength, efficacy and efficiency via organizational structure.

Brief History of Recent Changes in CMS Positioning within the Greater UNCW Administrative Structure

Over the last few years, the upper administrative structure of CMS has changed significantly. We provide here a brief overview and history of these changes to place the changes proposed by this sub-committee in a broader context.

In 2013, an Ad-Hoc Committee on CMS Organization was formed by the marine science faculty in response to concerns regarding decreasing prominence of faculty governance within CMS and the perception of unequal resource allocations amongst disciplines in the coastal and marine sciences. The Ad-Hoc committee designed three potential administrative models in response to these concerns. Marine science faculty voted in overwhelming support for Model 2 presented by the Ad-Hoc Committee. Model 2 differed from existing administrative structures at the time by having the Director of CMS report to the Associate Provost for Research and Dean of the Graduate School, delineating a clear separation of the Director of CMS and Director of MARBIONC positions, and increasing the prominence of faculty governance with a representative marine science faculty board with voting powers.

In 2014, Chancellor Miller issued a formal memo regarding CREST Millennium Campus structure (including CMS administrative structure) in response to the Ad-Hoc Committee report. In this memo, Chancellor Miller assigned the Director of CMS as a SAAO Tier-1 position that would report directly to the Provost and Vice Chancellor for Academic Affairs. Additionally, the memo stated that the Director of CMS would ‘...provide oversight for all programmatic aspects of the Center for Marine Science, including the Shellfish Research Hatchery and the Marine Biotechnology Program’.
Following a change in personnel in the Chancellor, Provost and Vice Chancellor for Academic Affairs, and Dean of the College of Arts and Sciences positions in 2015, a new reporting structure was established. Chancellor Sartarelli and Provost Sheerer moved most of CMS under the purview of the Dean of the College of Arts and Sciences (CAS) to provide better integration and reporting structure within the college, because the majority of faculty and chairs that support various areas of coastal and marine science reside in CAS. Remaining CREST facilities and personnel (MARBIONC, Shellfish Research Hatchery, and Wrightsville Beach Aquaculture Facility) report to the Associate Provost for Research and Dean of the Graduate School. This is the current operating structure for CMS.

Sub-Committee Proposal for Internal CMS Administration Structure

The sub-committee recommends a restructuring of the CMS administrative organization that is primarily defined by 1) the inclusion of two full-time Associate Director assignments (Figure 1) to assist with CMS administrative duties that are excessive for a single Executive Director and part-time Associate Director of Education (current situation), 2) inclusion of all coastal and marine science entities (Finfish Aquaculture Facility; Shellfish Research Hatchery; Marine Biotechnology) under a single CMS Executive Director, and 3) establishment of a Coastal and Marine Council to assure faculty governance plays a strong role in the day-to-day operation and the long-term vision and strategic planning of coastal and marine sciences at UNCW. Listed below is a summary of key differences between the proposed and current structures along with reasoning for the modifications:

- In an effort to enhance faculty governance and the inclusion of the entire UNCW campus in the coastal and marine sciences, the sub-committee proposes dissolution of the Chairs’ Advisory Committee and Faculty Advisory Committee and the establishment of a Coastal and Marine Council in their place that would meet monthly within the academic year. This Council would be comprised of representatives elected by marine science stakeholders (faculty, staff, students) from all coastal and marine science-related disciplines and entities at UNCW (including all colleges, departments, degree programs, facilities, etc. with a demonstrable and vested interest in engaging in and enhancing the educational experience and international profile of coastal and marine sciences at UNCW). The exact structure and representation of the Council will be determined through further discussions among members of the current Advisory Committees. The envisioned charge of the Council will be to provide stewardship, vision, and oversight of all coastal and marine science activities by stakeholders across the UNCW campus. The Council would serve in a role similar to a board of directors (with voting powers) in relation to the Executive Director of CMS. In addition to close collaboration with CMS administration, we envision one meeting per semester between the elected Council and the Provost and Vice Chancellor for Academic Affairs to discuss the status and future plans of coastal and marine sciences at UNCW.

- The sub-committee supports the formation of an External Advisory Board comprised primarily of local and state community leaders and government representatives to advise the Executive Director concerning governmental and community outreach initiatives that can potentially increase the CMS profile and facilitate access to new funding opportunities.
• The sub-committee proposes implementation of a two Associate Director model to allow the Executive Director to maximize his or her efforts on (1) securing University resources for CMS, (2) maximizing the state and national profile of CMS, and (3) developing and aligning programs and initiatives across disciplines. Associate Directors would focus on day-to-day administration of CMS, coordinating and interacting with units across the campus as needed.

  o The Associate Director of Education and Outreach is responsible for the M.S. in Marine Science and, if implemented, the proposed joint Ph.D. in Integrative Coastal and Marine Science with ECU, is the point of contact for interfacing with Marine Quest and future semi-autonomous educational programs with CMS, and supports marine-related disciplinary and interdisciplinary undergraduate and outreach programs. The sub-committee supports the previous recommendation of the marine science faculty to form a Graduate Advisory Committee to assist the Associate Director of Education and Outreach with graduate curriculum, resource issues, policy, and program assessment. The Associate Director of Education and Outreach is also responsible for maintaining strong relationships with hosted entities and developing new relationships with regionally important governmental and non-governmental entities that could enhance research and education at CMS.

  o The Associate Director of Research and Infrastructure is responsible for facilitating research activities occurring within the Center for Marine Science buildings. We propose a name change of the main laboratory building to provide for a clearer separation between the building and the CMS program that encompasses numerous campus-wide entities. To emphasize this difference we have labeled the facility as the Myrtle Grove Marine Lab in Figure (1) including research operations, core facilities, faculty lab and office space, and faculty research collaboratives.

• The committee proposes that lead personnel of the Shellfish Research Hatchery, Marine Biotechnology Research, and Finfish Aquaculture programs report to the CMS Executive Director and work collaboratively to fulfill the missions of these critically important research programs and facilities. Lead personnel would continue to report to their respective department chairs for evaluation of teaching and scholarship, especially as necessary for tenure and promotion decisions. Formal reassignment of duties from home departments to CMS should be codified for each director.

Sub-Committee Discussions and Considerations for CMS Positioning within the greater UNCW Administrative Structure

The sub-committee discussed two models for upper administrative structure of CMS. The first mirrored the current structure with the Executive Director reporting to the Dean of the College of Arts and Sciences. However, the majority of the committee supported a second model, which has the Executive Director reporting directly to the Provost and Vice Chancellor for Academic Affairs. This second model was based largely on recommendations of the 2013 Ad-Hoc Committee on CMS Organization by
emphasizing shared faculty governance of CMS, maintenance of clear distinctions between academic and entrepreneurial endeavors, and minimization of perceived or real conflicts of interest. No matter the model ultimately adopted, the sub-committee strongly recommends that all budgetary processes and organizational structures be realigned with any administrative structure changes, including those that have already been implemented. Listed below is a summary of the pros and cons of maintaining the existing structure in which the Executive Director of CMS reports to the Dean of the College of Arts and Sciences vs. implementation of a new structure in which the Executive Director of CMS reports directly to the Provost and Vice Chancellor of Academic Affairs.

Pros of maintaining existing structure in which the Executive Director reports to the Dean of the College of Arts and Sciences / Cons of a new structure in which the Executive Director of CMS reports directly to the Provost and Vice Chancellor of Academic Affairs

- The majority of faculty and departments engaged in coastal and marine science activities at CMS come from CAS; thus, the Dean of CAS is in an ideal position to integrate CMS-related activities and distribute resources to the primary entities involved with CMS.

- By housing CMS within the College of Arts and Sciences there are clear linkages between credit hour production and CMS-related academic and research activities, thereby making it easier to justify significant resource allocation to CMS as a multi-departmental entity. Since resources follow credit hour production by department faculty in the College, CAS will be able to invest more resources in the CMS to help support faculty.

- If the plan is to have academic programs in CMS, because all faculty currently teach in the college and graduate teaching assistantships (GTA) and faculty resources reside in the college, it is easier to coordinate curricular offerings and allocate resources to units offering courses to support academic programs.

Cons of maintaining existing structure in which the Executive Director reports to the Dean of the College of Arts and Sciences / Pros of a new structure in which the Executive Director of CMS reports directly to the Provost and Vice Chancellor of Academic Affairs

- As outlined by the CMS self-study Vision sub-committee, CMS faculty view the interdisciplinary/campus-wide reach of coastal and marine sciences as one of the primary strengths of CMS at UNCW. The positioning of CMS within CAS could (philosophically or in terms of real resources) hamper efforts to develop a truly inclusive Center that includes students, staff, and faculty from all UNCW colleges and degree programs. CMS faculty are also mindful of the fact that the proposed Integrative Coastal and Marine Science Ph.D. with ECU involves non-CAS entities.

- The elevation of a CMS Executive Director to an organizational position equivalent to that of a Dean or Vice Provost who reports directly to the Provost and Vice Chancellor for Academic
Affairs is consistent with the significance of the position and the centrality of marine sciences at UNCW. Such a reporting structure has the following benefits:

- it facilitates communication and enhances coordination among all four colleges involved in the marine sciences at UNCW. Because coastal and marine sciences touch all areas of UNCW, it is critical that the Executive Director is able to interact with all College Deans to develop programs and to discuss resource needs directly with the Provost.

- it mirrors the structure of numerous other successful marine science centers around the country (e.g. at NCSU the Center Director reports to the Vice Chancellor of Research, Innovation, and Economic Development; at ECU a new model has been approved in which the Center Director reports directly to the Provost and Vice Chancellor of Academic Affairs; at UNC-CH the Center Director reports to the Vice Chancellor for Research; at Scripps the Center Director reports directly to the Chancellor of UC San Diego). We envision that the Executive Director has primary responsibility to represent the unified marine science program to the external community, including to other coastal and marine programs around the country. It is helpful for the Executive Director to be seen to have similar credentials and authority as other Marine Science Directors when representing UNCW.

- it avoids potential misunderstanding of the history and function of CMS by a Dean coming from a discipline outside of the marine or natural sciences. We are cognizant that we are developing a structure for the future, not only for our current situation. Therefore, we must ensure that coastal and marine sciences continue to be visible and independent of the colleges as it draws upon units throughout the university.

In addition to the information above, the sub-committee also makes the following recommendations in terms of the position of CMS in UNCW’s upper administrative structure:

- The sub-committee proposes that maintenance of non-academic activities (leasing; business incubation; etc.) in the MARBIONC building fall under the purview of the Associate Provost for Research and Dean of the Graduate School as well as the Vice Chancellor for Business Affairs as these are non-academic activities.

- The sub-committee proposes that no matter the organizational structure chosen, direct connections among the CMS Executive Director, Deans of all four colleges, and the Associate Provost for Research and Dean of the Graduate School are essential to the coordination of academic research activities, marine science graduate programs, and resources shared among entities.
Figure 1. Committee Proposal for CMS Administrative Structure with Two Associate Directors
SECTION III: RESEARCH

Introduction

UNCW is the only campus in the UNC system with its complete resources located in the coastal zone. Research programs in the coastal and marine sciences have historically been foremost among UNCW’s scholarly mission, and continue to be characterized by rapid growth and high productivity. As a result, these programs have garnered significant competitive funding and achieved national and international recognition for UNCW. Coastal and marine science research programs are spread across departments and schools at UNCW, but resources are concentrated at the CMS’ Myrtle Grove campus and CREST, which strive to be world-class facilities that support multidisciplinary approaches to basic and applied research, education, public service and regional engagement. UNCW’s coastal and marine science research mission is best executed within the context of the broader mission of UNCW, which seeks the integration of teaching and mentoring with research and service, and a commitment to student engagement at a Masters Comprehensive regional University. The strength of coastal and marine science research at UNCW results from a common emphasis within the traditional science departments and cooperative interdisciplinary activities. The purpose of this self-study report is to identify broad and targeted objectives for enhancing the research effort in coastal and marine science over the next 5 years.

Assessment of strengths

- The marine science community is a cooperative group of scientists, staff and students that spans 11 departments and schools at UNCW (Appendix II and III), all engaged in high-quality research and education.
- UNCW’s mission incorporates a balance between research and teaching that affords a level of synergy absent from other academic institutions – this is a core institutional strength that must be preserved and promoted.
- Marine science research programs are in UNCW’s designated area of excellence, and use targeted infrastructural resources for coastal and offshore research, including seawater systems, finfish and shellfish aquaculture facilities, a fleet of research vessels and state-of-the-art pier facilities, remotely operated vehicles (ROVs), fabrication and repair facilities, dive operations, common core instrumentation, and laboratory-based biotechnology facilities for basic, applied and translational science.
- Marine science research programs across UNCW have historically accounted for a majority of extramural funding from state and federal sources. In 2010 there was >$30 million in research funding (continuing and new), though recently the total research funding per year has been less ($8-12 million per year).
Requirements for Success

- Although the marine science community is well represented across UNCW, with particular strength in the science departments, the community requires increased cohesion, clarified direction, and a clear administrative mandate for the future. For example, are we moving toward a more research-intensive model, and if so, what changes will take us there? How do we maintain our core strengths as we move forward?

- The process of one-time and annual resource pool allocations must be improved. The process remains confusing, opaque and non-targeted. Many funding decisions are made at the last minute without the ability to obtain consensus and fully vet needs.

- Our core facilities are an important strength, but are aging and require upgrading or replacement. In particular, the seawater system is over 15 years old and requires expansion, and there is a critical need for a new research vessel.

- Direct operation support funds must be restored to pre-economic downturn levels. Marine science programs lost more than $300K of permanent direct operations and support funds (rather than losing unfilled positions, as for some other units) during the economic downturn and subsequent cuts by the state, and these funds have never been restored. The impact of these losses remains a hindrance to fully achieving the university’s vision for marine sciences in general.

- A clear prioritization of faculty workload components must be established and align with departmental, college, and university goals. While the balance of research and teaching is a recognized strength of UNCW’s mission, the impact of increased research administrative duties and greater research expectations for marine science faculty, in terms of time and workload, have yet to be addressed or resolved. This burden includes grant writing and administration, HR and purchasing tasks, and ever-expanding compliance requirements.

- There is an historical and continuing lack of balance of disciplinary representation in the number of marine science faculty across the science departments, with disproportionate representation in the biological relative to the physical sciences (e.g. physics, chemistry, geology).

Objectives for next 5 years

- Return, or otherwise establish a method to reallocate, resources to marine science programs to bring them back to pre-recession levels of funding.

- Systemize and formalize the use of one-time and annual funds appropriations.
Identify sources of funds and resources, including unfilled salary lines, F&A (overhead), and graduate teaching assistants (TAs).

Identify and prioritize recipients, including summer salaries, postdoctoral support, pilot project funding, instrumentation grants and discretionary funds.

Develop mechanisms for earlier distribution of funds, based on projections, allowing greater opportunities for planning and consensus on needs.

Develop a method whereby marine science programs share in assets resulting from faculty lines allocated to UNCW by the UNC system, just as marine science programs annually share rescissions or cut-backs.

- Establish institutional protocol and direction for growth and development. For example, should discretionary funding be directed by discipline, by merit, or toward new areas of research or collaboration?

- Incentivize and assist the research and student supervision efforts of faculty who obtain overhead-generating grants.

- Incentivize new research directions and collaborations by formalizing the annual Pilot Projects Program with dedicated funding.

- Re-establish a dedicated support position at CMS for outreach, advancement and education to enhance the visibility of marine science programs in the community and among local legislators, and to secure local (donor) sources of funding.

- Re-establish a support position for marine science research advocacy at the federal level to enhance visibility of our programs and help secure large-program funding.

- Formally address workload issues for research-active marine science faculty, including incentives for securing grant funding, compensation (or balance) in time and effort for grant writing, grant administration and compliance tasks.

- Secure funding for replacement infrastructure, including a new off-shore research vessel, an upgraded and expanded seawater system and modernization of “core” instrumentation.

- Enhance recruitment of top MS, PhD and postdoctoral students by securing higher student stipend rates, funds to support in-state tuition fees, out-of-state tuition remissions, and summer salary support for students.
Challenges to achieving objectives

Administration must commit to a clear vision for the future of marine science programs at UNCW by establishing long-range goals for programmatic development that will not be subject to significant revision with each change in administration. Allocation of resources must be made transparent and subject to clear prioritization based on faculty consensus. Administration should incentivize and assist the research and student supervision efforts of faculty who obtain significant overhead-generating grants by matching 1 month of summer salary. Administration should also recognize the efforts of highly successful research-active faculty with merit increments in salary.

Faculty and Departments must commit to greater efforts toward securing grant funding that will support marine science programs by providing faculty and student salaries, funding equipment and supplies, and generating overhead. These efforts include hiring new faculty with active and fundable research programs that mesh well with available resources, encouraging existing faculty to seek new independent and collaborative funding opportunities, and expanding involvement in graduate research programs. Among marine science faculty, there should be an expectation of demonstrated, consistent applications for extramural funding, with a reasonable rate of success in securing such support.

Recommendations

- UNCW’s administration, in consultation with the CMS Director and faculty governance committee(s) should **develop a long-range strategy** for the direction of growth and development of coastal and marine science research programs.

- With development of a long-term strategy, the CMS Director or (Executive Director), in consultation with upper-level administration and the Faculty Advisory Committee (FAC) and Chairs Advisory Committee (CAC) or new Coastal and Marine Council, should **formalize and prioritize budget expenditures** related to UNCW’s marine science research programs, including the sources and recipients of one-time and annual funds appropriations, so as to advance the strategic goals and objectives.

- UNCW’s administration should recognize the workload requirements associated with active research programs, and **incentivize grant awards that generate F&A**.

- Marine Science faculty and departments should, in turn, recognize the efforts of administration in supporting marine science research by **enhancing efforts to secure grants** that support graduate programs and boost UNCW’s research prominence.
SECTION IV: INFRASTRUCTURE

Introduction

The Center for Marine Science (CMS) supports 11 departments with coastal and marine science research and education interests. CMS’ Myrtle Grove campus is located on the Intracoastal Waterway with extensive infrastructure to support faculty, staff, and students. This UNCW Coastal and Marine Science Self-Study included a broad, campus-wide, marine science facilities and capabilities review. This review focuses on five specific objectives related to facilities and infrastructure needs, which, once completed, will serve the UNCW campus community to guide the growth of the Myrtle Groove campus to increase the depth and breadth of support for marine science, increase its research capacity, and maintain UNCW’s role as a leader in marine and coastal research and education. This report focuses on the infrastructure located on the CREST and Wrightsville Beach campuses, including the main CMS building (Myrtle Grove Marine Lab), operations wing, outdoor research areas, Shellfish Research Hatchery, CMS dock, small vessel fleet and the R/V Cape Fear, and the Finfish Aquaculture Facility. Facilities within the departments on the main college road campus are generally overseen by those units but are referenced here as appropriate. For UNCW to keep pace with growing demands (e.g. marine science research, student recruitment, coastal policy) CMS infrastructure must be maintained and expanded to accommodate competing uses.

Infrastructure Vision

Enhance UNCW’s leadership status in coastal and marine issues through the prudent use of resources to expand facilities and capacity to meet the growing needs of the coastal and marine science community.

Notable Resources

UNCW already possesses considerable infrastructure to support current levels of use by faculty, staff, and students on the CREST (Myrtle Grove) and Wrightsville Beach campuses. This includes:

- Administrative space (office, research labs)
- Teaching space (teaching lab room 1209, classroom room 1109, auditorium room 1105)
- Small boat fleet (26 small boats) and boat operations management.
- R/V Cape Fear (63’) research vessel capable of medium range, multiple night operations as well as day trips. This vessel can accommodate day trip classes of ~30. For overnight research trips there are berths for up to 10 researchers/staff. (Note, however, that the vessel is nearing the end of its service life).
- R/V Seahawk, medium size vessel
- Boat maintenance facility machine shop
• Shellfish Research Hatchery
• Finfish Aquaculture Facility
• ROV/AUV facility
• Oceanographic support lab.

• Wet lab research space (CMS currently has 3 indoor research areas to support individual researcher efforts).
  o Rm 1210 (1455 ft²) is the original wet lab facility designated at the construction of the building- this room currently houses 10 independent research groups. This space is completely built out and has no additional capacity.
  o Rm 1211 (550 ft²) is a converted wet lab facility that was converted from marine research storage to active research space. This area houses a single researcher plus 2 environmental common use environmental chambers.
  o Rm 1203 (789 ft²) is also a converted wetlab space. This space houses 3 research areas as well as the building facilities office. This represents incompatible uses for this area.

• Staging/prep space room 1224 (390 ft²) a common use area to allow initial processing or prep for field based work that would otherwise take place in outdoor areas.

• Outdoor research areas. CMS has access to 2 large outdoor research areas, including a 30-acre research lease located just south of the mouth of Hewletts Creek. UNCW has overseen and maintained constant use of that area since the mid 1980’s when this area was designated for UNCW research. The second area is adjacent to located adjacent to the Myrtle Grove facility and the ICW. This is a ~10 acre research lease designed in 2011 to support independent research including the activities of the UNCW Shellfish Research Hatchery.

• Outdoor tank farm. This area supports 20 large circular (11ft diam.) flow through tanks to support research of both shellfish and finfish species. There are also 24 rectangular tanks (~180 gallon capacity). Most of these tanks were originally purchased as part of the independent research projects but have been maintained by the original research groups to support multiple research projects including support of undergraduate, MS and Ph.D. level student research and interdisciplinary research. These spaces are unique to this facility as they provide a high degree of flexibility in the use and the types of research that can take place.

• Diving support available to UNCW/CMS scientists. We currently maintain over 30 sets of dive gear, three nitrox systems, and multiple high-end underwater video and still photographic systems, all to support 34 active UNCW/CMS scientists as well as the EVS-479 and EVS 592 advanced diving courses held in the Fall and Spring respectively.

Key Objectives:
Objective 1: Replace the current R/V Cape Fear to support marine research efforts for the next decade.

In support of coastal and marine science, UNCW owns and operates the R/V Cape Fear as a research and education support facility. The 63’ (19 m), 28-year old vessel is nearing its serviceable lifespan and University research and educational needs have outgrown its capabilities. Its use is limited by inadequate lab space (i.e., salon/galley doubles as dry laboratory/training space that can only accommodate 8 persons), deck space (inadequate to carry modern interdisciplinary research instrumentation and a typical class of 10-20 students), and limited sea duration. Noise and other issues associated with the aging of this vessel may lead to safety concerns.

To meet the demands of the UNCW research and educational programs, faculty request support to replace the existing vessel with a modern ~ 65’ (20 m) research catamaran. The replacement vessel will be a state-of-the-art, high-tech platform. A catamaran offers many advantages, including greater stability and hence safety, as well as shallower draft, higher-speeds (~25 knots), and increased fuel efficiency. The wide beam provides deck and cabin areas that can accommodate 2 crew and 25–30 scientists/students for day trips and berth 10 scientists/students/crew for overnight cruises of 5 days or more. The stability of the catamaran will allow for work within 100 nm of the coast, while the shallow draft will allow for work in NC’s extensive sound, estuarine, and river systems. The vessel’s A-frame and scientific winch configuration will be used for a variety of projects including trawls, CTD casts, bottom sampling, and towing equipment. Extensive dive operations will be supported by onboard facilities and equipment. The wet and dry labs will allow on-board processing and analyses of samples and data. In summary, acquisition of a research catamaran will provide UNCW with a remote ocean classroom that will provide marine research and education at all levels.

Objective 2: Expand wet lab facilities and faculty/student research facilities.

Space needs at the CMS, operations building, and the Shellfish Research Hatchery have out-stripped existing space in those venues (Table 1). Future growth in faculty and support staff requires additional infrastructure. In particular, additional wet lab and associated research space is critically needed. Projected needs of multiple research programs and projected hires over the next 5+ years, indicate that an additional 10,000 ft² of conditioned wet lab space (independent of the Shellfish Research Hatchery and the Finfish Aquaculture Facility) will be needed. The Dean of the College of Arts and Sciences provided funding in FY 2016-17 to construct a 1000 ft² storage facility on the outside tank pad at CMS in response to some of these needs. Additional air conditioned seawater laboratory/teaching areas enable even greater efficiency and control of seawater parameters. Current spaces are fully occupied limiting expansion of activities associated with the recruitment of new hires and limiting the potential of expansion into new areas of research for existing faculty. Beyond the addition of conditioned wet-lab space, expanding the tank farm area will provide additional space for a variety of mesocosm–based experiments that will serve a number of disciplines, outreach groups, private entities, and as well as graduate and undergraduate researchers. Conditioned wet-lab space and outdoor tank space serve to train students and support programs beyond those specifically located at CMS, including students.
participating in university and departmental Honors and Directed Independent Study, “ETEAL: Experiencing Transformative Education through Applied Learning”, and Marine Quest, to name a few.

In addition to shared wetlab space there is a need to provide additional research lab space at the CREST campus (a new building providing faculty and common use research lab space, office space, and student research space). Existing laboratory space within the CMS (Myrtle Grove Marine Lab) building is fully committed, with additional requests for space for new hires already being indicated.

**Table 1.**—Existing space in the main building, Operations Building, and Shellfish Research Hatchery at the Center for Marine Science.

<table>
<thead>
<tr>
<th>CENTER FOR MARINE SCIENCE</th>
<th>MAIN BUILDING</th>
<th>OPERATIONS BDLG</th>
<th>SHELLFISH RESEARCH HATCHERY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ft²</td>
<td>%</td>
<td>ft²</td>
</tr>
<tr>
<td>Administrative¹</td>
<td>6,313</td>
<td>8.3</td>
<td>3,979</td>
</tr>
<tr>
<td>Instructional²</td>
<td>7,583</td>
<td>9.9</td>
<td>481</td>
</tr>
<tr>
<td>Faculty offices</td>
<td>4,009</td>
<td>5.2</td>
<td>631</td>
</tr>
<tr>
<td>Faculty labs³</td>
<td>18,267</td>
<td>23.9</td>
<td>1,465</td>
</tr>
<tr>
<td>Shared labs⁴</td>
<td>7,495</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>Grad bullpens</td>
<td>1,150</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Shops⁵</td>
<td>2,944</td>
<td>3.9</td>
<td>7,361</td>
</tr>
<tr>
<td>Non-programmable</td>
<td>28,716</td>
<td>37.6</td>
<td>7,914</td>
</tr>
<tr>
<td>Total</td>
<td>76,477</td>
<td>100.1</td>
<td>21,831</td>
</tr>
</tbody>
</table>

¹ includes reception, work area, staff offices, break room, storage, shipping & receiving , lactation room  
² includes auditoria, classrooms, teaching labs, conference, AV storage  
³ includes individual faculty laboratory spaces  
⁴ includes core facilities, support facilities, media prep & autoclave, culture room, equipment storage  
⁵ includes shops, environmental chambers & freezers, clean room, dark room, greenhouse  

**Objective 3:** Expand the seawater system currently supplying seawater to the Myrtle Grove main building and co-located Shellfish Research Hatchery and the Finfish Aquaculture facility. This will provide greater flexibility in the volume of water delivered, flexibility in specific water quality parameters, and additional capability to deal with interruptions in water supply.

UNCW operates and maintains two separate seawater systems to support multidisciplinary research, collaboration, and education: one system on the CMS campus and a second at the Finfish Aquaculture Facility. The Finfish Aquaculture Facility, located on Wrightsville Beach, provides constant oceanic
filtered seawater to support controlled-environment brood stock holding systems, a larviculture laboratory, a nutrition laboratory, an experimental hatchery with live feeds production systems, and a variety of experimental recirculating grow-out tank systems. In addition, a public use seawater tap provides free access to this resource.

The CMS seawater system draws water from the Intracoastal Waterway. This system supports both indoor and outdoor research and education efforts, including the Shellfish Research Hatchery, Coral Research Group, Aquatic Ecology Lab, Benthic Ecology Lab, Oceanographic Instrumentation Lab, Teaching Research Classroom, environmental chambers, seawater aquaria room and annex, greenhouse, MARBIONC, and Marine Quest. The source water is extremely dynamic primarily due to the influence of the Cape Fear River and reflects brackish water characteristics much of the year. Filtering efforts focus on sediment removal with no large scale chemical adjustments. Small scale seawater chemical adjustments are fine-tuned for individual research needs.

As seawater based research continues to grow, demands on the existing seawater infrastructure will approach the systems’ current capacity and dictate a system-wide assessment for future expansion. Modifying the infrastructure to reduce water overflow (i.e., spillover of water that is not being used) will maximize the systems’ efficiency and provide a cost-effective means of meeting seawater demand increases. In addition, adopting recirculating system strategies with minimal overflow conserves seawater and allows for an increase in seawater quality control.

Future areas of opportunity may include the relocation of the Finfish Aquaculture Facility at Wrightsville Beach to CMS. This will allow for a consolidation of sea water services to one location and provide an overall cost savings for system expansion and up-grades. Additionally, CMS can capitalize new technologies that will provide better seawater quality for research and teaching needs and build capacity to support grant funded research.

**Objective 4: Establish dorm facilities.**

CMS currently lacks facilities to support visiting scientists, students, or student groups for overnight accommodations. Dorm facilities will provide visiting scientists and students with accommodations for short-term and semester-long housing. Currently the UNCW main campus can accommodate visiting scientist and students, but typically only during the summer months when on-campus dorm facilities are not filled. A CMS dorm will enable collaborative opportunities for off-campus researchers and students to participate in residency programs and showcase UNCW’s coastal and marine sciences capabilities. Dorms are critically needed to house students in the proposed UNCW-ECU joint Ph.D. program, including those participating in summer courses and research. They will also be essential as UNCW expands its collaborations internationally in the area of coastal and marine science.

**Objective 5: Upgrade current CMS Core Facilities.**
The descriptions below are not meant to be a comprehensive list of CMS Core facilities. Rather, this description addresses a subset of core facilities / equipment identified by the Infrastructure self-study subcommittee as needing upgrades or future support.

**DNA Analysis**: provides UNCW with the state-of-the-art infrastructure and expertise needed to generate and analyze DNA data for research and education. In December 2016, CMS acquired a new capillary electrophoresis Genetic Analyzer (Applied Biosystems 3500), bringing CMS up to the state-of-the-art in Sanger sequencing technology. However, this new technology has higher operating costs compared to the old equipment and will require enhanced future support.

CMS currently provides baseline funding for the Genetic Analyzer which has enabled the facility to maintain the cost per run at $1.00 for sequencing and $1.50 for fragments. Unfortunately, there have been numerous disposable supplies cost increases and the newly acquired instrumentation is more expensive to operate. There will either need to be an increase in CMS baseline funding to maintain our current pricing or there should be review of operating costs and a new pricing structure agreed upon. Additionally, the DNA Analysis Core does not have a dedicated technician; however, a part-time technical assistant would greatly help in its operation. Two possible solutions would be to have a shared technician that could work part-time in the DNA Analysis and part-time in another core facility or fund a graduate student RA who would be assigned to assist in the Core.

**Nutrient Analysis**: supports studies on biogeochemical nutrient and carbon cycling and water quality monitoring in a variety of aquatic environments. The instruments in the nutrient analysis core facility are operational but most are approaching 15 years of age and maintenance is becoming more difficult. The purchase of new continuous flow or discrete nutrient analyzers will enable long-term viability of this core facility.

**Sediment Analysis**: provides access to a Camsizer XT and the BeckmanCoulter LS200 particle grain size analyzer for faculty and student use. There is a need to purchase standards for QA/QC of grain size analyses. This facility has received investment of ~$120K in 2015-2016 for the purchase of the Camsizer XT. This facility receives high use but is in critical need of technical support to help maintain the equipment, supervise user training, and act as coordinator for this multi-use facility.

**Isotope Ratio Mass Spectrometry (UNC-WIRMS Core Facility)**: provides access and training on the utilization of nuclear magnetic resonance and liquid chromatography-mass spectroscopy. Two of the main current systems are in need of replacement in order to meet the spectroscopic and quantitative analysis needs of the coastal and marine science faculty. This core facility is showing signs of failure in one of the key vacuum pumps and with some electronics hardware on one of the isotope mass spectrometers. Additionally, one of the primary peripheral units (Costech Elemental Analyzer) is starting to show signs of failure. This is our workhorse instrument and peripheral and as such, funding is required to purchase new turbo pumps for the mass spectrometer and new furnaces for the elemental analyzer. Prior failures with vacuum pumps were not covered by Remi service contracts.
Spectroscopy (UNC-WIRMS Core Facility): provides access and training on the utilization of nuclear magnetic resonance and liquid chromatography-mass spectroscopy. The current system, QTRAP 2000 LC-MSMS, needs replacement. A new QTRAP 4000 LC MSMS is a good replacement unit, capable of meeting the quantitative analysis needs of the coastal and marine science faculty.

Oceanographic Instrumentation: supports estuarine and coastal ocean research by operating and maintaining a suite of specialized field instrumentation and providing technical and electronics support to faculty, staff and students. One major concern for this facility is the lack of a functional oceanographic winch for deployment/recovery of CTD/sidescan systems on the R/V Cape Fear. To maintain capabilities, a new winch will need to be purchased (example: AGO Environmental CSW-7B).

Temperature-Controlled Rooms: support estuarine and coastal ocean research with 4 adjustable experimental temperature-controlled rooms, two of these specifically for seawater. These are widely used facilities and require upkeep and maintenance to assure they meet campus research needs.

CMS Greenhouse: supports estuarine and coastal ocean research with a 450 ft² greenhouse equipped with running seawater. This facility is in addition to the Kresge Greenhouse located on the UNCW main campus. Reserve funds are needed to provide basic repairs, upkeep, and maintenance.

Objective 6: Upgrade aquaculture facilities.

Shellfish Research Hatchery: The Shellfish Research Hatchery (SRH) is a ~12,000 ft², state-of-the-art facility for the propagation of the early life stages of marine bivalves. The mission of the SRH and its programs 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. Current projects involve the selective breeding of oysters, research on the performance advantages derived from triploidy, and crop diversification through the development of culture practices for bay scallops, pen shells and sunray Venus clams. The SRH has been in year-round operations since early 2011.

Future needs for the SRH include access to better quality seawater (objective 3) and the addition of equipment to monitor possible pollutants (objective 2). Currently, water quality at the SRH is subject to tidal influence, wind, and output of the Cape Fear River. During hatchery spawning periods, access to the best quality (salinity, low anthropogenic/tannic influenced) seawater is crucial to success. There is also a need for quality raw water to greatly expand the capabilities of the SRH for grow-out of juvenile shellfish. Currently, by the time the water reaches the SRH it has no food value. Possible fixes for this would be an onshore system located at the edge of the CMS pier, or a separate system supplying the SRH alone.

As SRH programs grow, there is also a need to expand the intertidal and subtidal research lease/farm area located adjacent to the CMS dock. Currently an aquaculture demonstration lease is up for approval.
by the state, which expands our current lease to 2.8 acres. Within five years, another lease at a separate site nearby would allow us to spread out our selected brood stock lines in case of a catastrophic event.

**Finfish Aquaculture Facility:** The Finfish Aquaculture Facility (FAF) is a state of the art facility located in Wrightsville Beach, NC. This facility has multiple research facets such as breeding and spawning of commercially valuable finfish as well as formulating feeds using unique and novel components. One challenge faced with this facility and its researchers is lack of a long term MOU with the Town of Wrightsville Beach (the owner). As water view property values continue to rise the land currently occupied by the FAF becomes more appealing to sell. The FAF needs a system-wide backup generator as well as an upgraded feed storage building. Higher storage capacity of filtered seawater along with adding 1,000 ft² to the hatchery building and indoor brood stock system would help meet anticipated and current needs.
SECTION V: TEACHING

Scope

For the purposes of this report, coastal and marine science-related education at UNCW is defined as encompassing all activities that are directly or indirectly associated with studies of the coastal and/or marine environment. The majority of these activities take place in the science departments (Biology and Marine Biology, Chemistry and Biochemistry, Earth and Ocean Sciences, Environmental Sciences, Physics and Physical Oceanography), and Public and International Affairs (see Table 2). However, marine related activities are also undertaken in the departments of English and Creative Writing (e.g., writing on coastal and marine themes), Cameron School of Business (e.g., studies in marine economic issues), College of Health and Human Services (e.g., recreation in coastal and marine settings), and Watson College of Education (e.g., the K-12 Marine Quest program).

Overview

A distinctive characteristic of the coastal and marine sciences at UNCW (“the state’s coastal university”) is its involvement and integration in undergraduate and graduate programs in many different disciplines, including the physical, biological, environmental, and mathematical sciences, and public and international affairs. Marine science-related degree programs at UNCW include the M.S. in Marine Science (CMS), B.S., M.S. and Ph.D. in Marine Biology (BMB), B.S. in Oceanography (EOS), and B.S. in Physics with an option in physical oceanography (PPO). Other undergraduate and graduate programs with significant involvement in marine science-related studies, with coursework and faculty and student research, include the B.A., B.S. and M.S. in Chemistry (CHM), B.S. in Geology, B.A. in Geography, B.A. and M.S. in Geosciences (EOS), B.A., B.S., and M.S. in Environmental Studies (EVS), and the master’s in Coastal and Ocean Policy (MCOP, PIA). Other departments and colleges with student and faculty involvement in marine-related teaching and research include the departments of Mathematics and Statistics and Creative Writing, Cameron School of Business, the Watson College of Education (including the Marine Quest K-12 program), and the College of Health and Human Services.

Some measures of the considerable undergraduate and graduate involvement in marine-related programs in the various departments are shown in Tables 2 and 3. These numbers do not include students working on marine-related issues outside of CAS. Total figures for these activities indicate that in any given year, on average, over 400 students conduct marine-related studies at the undergraduate or graduate level at UNCW and over 150 students complete marine science-related degrees.
Table 2. Overview of undergraduate students enrolled in marine-related degrees and involved in research activities in the science departments at UNCW. Estimated averages over the past 5 academic years (2011-2016). Department abbreviations: BMB = Biology and Marine Biology; CHM = Chemistry and Biochemistry; EOS = Earth and Ocean Sciences; EVS = Environmental Studies; PIA = Public and International Affairs; PPO = Physics and Physical Oceanography. n/a = data not available.

<table>
<thead>
<tr>
<th>Dept./ program</th>
<th>Degree</th>
<th>Avg. # of undergrads in program per year</th>
<th>Avg. # of undergrads. graduating per year</th>
<th>Avg. # of undergrad. researchers per year (honors + DIS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB</td>
<td>B.S. Mar. Biol.</td>
<td>200</td>
<td>85</td>
<td>70</td>
</tr>
<tr>
<td>CHM</td>
<td>B.A., B.S.</td>
<td>10</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>EOS</td>
<td>B.S. Oceanography</td>
<td>38</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>EOS</td>
<td>B.A., B.S. (Geog., Geol., Geosci.)</td>
<td>15</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>EVS</td>
<td>B.A., B.S.</td>
<td>75</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>PPO</td>
<td>B.S. (Phys. Oc. option)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td><strong>341</strong></td>
<td><strong>134</strong></td>
<td><strong>101</strong></td>
</tr>
</tbody>
</table>

Table 3. Overview of graduate students enrolled in marine-related degrees in the science departments and for the master’s in coastal and ocean policy program (MCOP) at UNCW. Estimated averages over the past 5 academic years (2011-2016). PIA = Public and International Affairs; other abbreviation as in Table 2.

<table>
<thead>
<tr>
<th>Dept./ program</th>
<th>Degree</th>
<th>Avg. # grad. students in program per year</th>
<th>Avg. # grad. students graduating per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB</td>
<td>M.S. Mar. Biol.</td>
<td>32</td>
<td>11</td>
</tr>
<tr>
<td>BMB</td>
<td>Ph.D. Mar. Biol.</td>
<td>17</td>
<td>2-3</td>
</tr>
<tr>
<td>CHM</td>
<td>M.S.</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>EOS</td>
<td>M.S. Geoscience</td>
<td>23</td>
<td>5-6</td>
</tr>
<tr>
<td>EVS</td>
<td>M.S. (Coast. Mgt./Mar. and Coast. Ed.)</td>
<td>12</td>
<td>7-8</td>
</tr>
<tr>
<td>CMS</td>
<td>M.S. Mar. Sci.</td>
<td>25</td>
<td>9-10</td>
</tr>
<tr>
<td>PIA</td>
<td>MCOP</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td><strong>135</strong></td>
<td><strong>47</strong></td>
</tr>
</tbody>
</table>
The success of mentoring in the marine sciences at UNCW is also well reflected by the 22 NOAA Hollings fellowships that have been received by UNCW students over the past 5 years. In fact, UNCW had the most Hollings awards in the country in 2016.

The inclusion and interweaving of coastal and marine studies across the many different academic disciplines received praise in the 2013 AAAS report\(^1\) on marine science activities in North Carolina:

> **UNCW, in particular, has embraced marine science as the signature theme for the entire university, and is explicitly reflected in traditional disciplinary areas (e.g., Departments of Physics & Physical, Oceanography, Biology & Marine Biology, and Chemistry & Biochemistry). UNCW engages students, particularly at the undergraduate and master’s level (and at the Ph.D. level in Marine Biology), in a significant experiential-learning process that builds on faculty research and innovative partnerships (e.g., Marine Biotechnology).**

The opportunity for both undergraduate and graduate students to study in international settings is a hallmark of UNCW. Existing overseas programs include exchange programs with 60 universities in Asia, Australia, Europe, New Zealand, and South America, and other programs such as Semester at Sea. This sub-committee fully supports UNCW administration plans to increase these international exchanges and interactions.

This report considers the strengths and challenges facing education in marine science-related areas at UNCW and offers recommendations for improvement of these endeavors for the future.

**Broad needs and target objectives**

Sub-committee concerns were mainly focused on the following areas:

- Improve resources that are needed to enhance marine science education.
- Maintain discussion of how to coordinate teaching efforts in marine science-related activities across disciplines.
- Address governance and advisory issues for marine science-related education.
- Consider and manage the impact and feasibility of future programs.

Particular issues within each of these areas of concern will be discussed in detail.
Challenges and needs to fulfill objectives

1. Resources

The AAAS report\(^1\) specifically acknowledged that an exceptional strength of UNCW’s education and research efforts in marine sciences (integrating biological, physical and social disciplines) is our focus on student-centered learning and research, with an equal emphasis on undergraduate and graduate students. UNCW prides itself on providing students with individual, quality learning experiences. CMS offers interdisciplinary opportunities for course-based education as well as applied learning that are complementary to the discipline-specific marine education that takes place in the departments on main campus. Support of such student opportunities should continue and expand in the future.

UNCW students seeking international opportunities need increased support in the form of financial assistance and improved advertisement of overseas opportunities. By the same token, visiting students and faculty require dormitories at the CREST/Myrtle Grove campus. This is particularly urgent during the summer, which is peak tourist season for the Wilmington area. The acquisition of a modern research vessel to replace the aging R/V Cape Fear is critical to support student research and education. The UNCW coastal and marine science community will gain from considering additional options to teach more undergraduate classes at the CREST campus so that CMS resources become more visible and available to undergraduate students. Increasing accessibility of the CREST campus to students will require considerations in scheduling and transportation.

2. Coordination of teaching efforts

UNCW has programs with potentially significant overlaps in focus. Faculty have expressed concern that courses in different departments, primarily at the undergraduate level, may be construed as having similar content. The proper ways to address these issues require careful deliberation among the involved departments, as any changes could impact individual departments’ teaching credit allocations, ability to hire new faculty, and resource allocations. It is desirable to increase collaborative efforts between departments when developing and implementing marine-related programs across campus.

Another challenge is a need for undergraduate academic advising specifically for students interested in marine science at UNCW. There are undergraduate programs related to marine sciences in the departments of Biology and Marine Biology, Physics and Physical Oceanography, Earth and Ocean Sciences, Chemistry, Environmental Sciences, and Public and International Affairs. Faculty have expressed concern that beginning undergraduates find it very difficult to understand the distinctions between these programs. Training for University College advisors should address this issue and consideration should be given to having a dedicated marine science advisor within University College as is done for certain other subject areas.
3. Governance and advisory

Establish a new coastal and marine science education advisory committee to assist the Associate Director of Education with issues regarding educational programs (e.g., curricula, resources, coordination) in marine studies at UNCW. The committee would be composed of faculty representatives from the various coastal and marine science-related disciplines.

4. Future programs

Planning and development of the proposed joint Ph.D. program in Integrative Coastal and Marine Science with East Carolina University commenced in Fall 2014 and Appendix A was approved in Summer 2016. Negotiations are ongoing; however, should the Appendix C implementation proposal for the joint ECU-UNCW PhD not progress, the planning committee recommends development of our own PhD.

The university has proposed the development of an undergraduate coastal engineering program at UNCW. The implications of resourcing such a program and its potential impacts on and interactions with existing marine-related programs need to be carefully and deliberately addressed, hopefully including the advisory committee proposed above.

There is a perception that many science majors are disadvantaged by the current university curricular structure. Recommendation for minimizing these disadvantages should be addressed by the proposed marine science education committee.

The university’s well-stated goals of entrepreneurship and regional engagement need to be more fully part of and available to students engaged in marine-related studies.

Recommendations

- Acquire a research vessel suitable for supporting marine-related teaching and research.

- Build dormitories at the CREST/Myrtle Grove campus to house students and visiting faculty to facilitate and enhance teaching and research opportunities in marine-related studies, especially in summers.

- Establish an advisory council to oversee undergraduate and graduate educational programs in marine-related studies at UNCW. This body would address challenges such as integration of courses and programs, assessment and development of new programs (e.g., Ph.D. in marine studies, coastal engineering), resource requirements for existing and proposed activities, and assessing changes in marine science curricula or education in general.
SECTION VI: OUTREACH and ENGAGEMENT

The Outreach and Engagement vision is to increase awareness of coastal and marine science education and research activities within the UNCW campus, across the state, and nationally. This will enable UNCW marine science departments to become the “go-to” resource for coastal and marine sciences within the state. UNCW will need to address the following objectives, specific to outreach and engagement:

- The UNCW campus community will become more aware of the coastal and marine sciences research capabilities, facilities, and graduate and undergraduate student opportunities offered by UNCW.
- Through targeted outreach and engagement activities, all departments associated with coastal and marine sciences, will work cooperatively to showcase both education and research excellence, thereby increasing UNCW’s profile within the community and state, as well as nationally.
- Identify opportunities to support coastal and marine science through expanded funding from financial ventures and partnerships with community, regional, and national businesses and organizations.

An analysis of each objective is provided. This analysis identifies UNCW’s current strengths and captures growth opportunities that will further the vision for coastal and marine sciences.

The UNCW campus community will become more aware of the coastal and marine science research capabilities, facilities, and graduate and undergraduate student opportunities offered by UNCW.

UNCW offers marine science degree programs at all degree levels. We offer undergraduate and graduate educational and research opportunities through multiple campus departments. Our proximity to the Cape Fear River, Intracoastal Waterway, and Atlantic Ocean provides unique and valuable experiential opportunities for basic and applied coastal and marine field and laboratory work within individual courses/research. The UNCW research vessel, the R/V Cape Fear, allows undergraduate and graduate students to gain at-sea experience while completing their degree programs. Students within the coastal and marine science programs can experience full, immersive educational opportunities at UNCW unlike many other colleges and universities due to our facilities and ideal geographic location.

Coastal and marine sciences core facilities are located at the CREST campus and on the main UNCW campus. These facilities provide services to all UNCW coastal and marine researchers by providing general use facilities that may not normally be attainable by the individual faculty member. Core facilities are developed to address research support needs of groups of faculty. Each core facility is charged with providing equipment, research expertise, and occasionally technical staff support to assist or train laboratory personnel in their use. A full evaluation of core facilities is available within this larger
document; however, it should be noted that the outreach and engagement strategy includes promotion of these facilities so that target audiences, both on and off campus, are more fully aware of coastal and marine science research capabilities.

There are several outreach and engagement opportunities that the coastal and marine science community can take advantage of in order to increase awareness of our programs, research efforts, and student opportunities. UNCW’s Center for Innovation and Entrepreneurship and the Small Business and Technology Development Center should collaborate more closely with the coastal and marine sciences. These organizations could help identify entrepreneurial activities, work with faculty, students, and staff on small business start-ups, and identify next generation growth opportunities based on current research efforts.

Open house events sponsored by CAS, and hosted either at a College Road campus location or at the CREST campus are used to build awareness and recognition of coastal and marine science and highlight new and on-going research efforts. Additionally, CAS departments can increase volunteer, intern, and/or DIS opportunities for students within research labs so that they gain first-hand experience and increase their knowledge, skills, and abilities required for career placement post-graduation. These types of experiences would help overcome the impression that marine science careers are difficult to find or that a Ph.D. is required for job placement.

In order to present a united coastal and marine science community, we must overcome issues that cause outreach and engagement to be fragmented and occur on a department by department basis. Departmental goals and objectives should be aligned in regards to how coastal and marine sciences are represented across campus and there should be an evaluation of competing resource demands in order to best identify strategies for targeted campus-based outreach and engagement. Involvement and recognition of faculty, staff, and students is needed to ensure that a meaningful and prolonged effort of engagement is maintained.

Through targeted outreach and engagement activities, all departments associated with coastal and marine science will work cooperatively to showcase both education and research excellence, thereby increasing UNCW’s profile within the community and state, as well as nationally.

State of the art coastal and marine science campus facilities are integral for faculty, staff, and student research. These facilities are valuable for extramurally funded research due to their accessibility and the cost savings they provide over out-sourced sample processing. Additionally, students trained on instrumentation and equipment in core facilities learn valuable job skills. This is a strength for UNCW students and helps demonstrate UNCW education and research excellence.

UNCW administration, faculty, and staff hold appointments to state, regional, and federal commissions and boards (e.g., South Atlantic Fisheries Management Council, National Association of Marine Laboratories, Southern Association of Marine Labs, East Coast Shellfish Growers Association, NC state resource advisory committees). This highlights UNCW faculty and staff excellence within their fields and
provides the opportunity for faculty and staff to highlight UNCW research excellence to diverse audiences. Unfortunately, due to the fragmented nature of the coastal and marine sciences, upper administration, faculty, and staff are frequently unaware of who participates on commissions and boards. This represents missed opportunities for UNCW as it is likely appointees are not fully aware of the breadth and depth of coastal and marine science research talent on campus. Efforts should be made to advertise and highlight this participation both on campus (to attract students) and in the media to illustrate the value of UNCW/CMS educational and research efforts.

UNCW coastal and marine science departments offer a robust suite of external programming, and these events are widely publicized within the campus community, though not publicized broadly within the county or southeastern region (e.g., departmental speaker series and lectures). The Bluefish Society is an annual giving program associated with CMS. Membership fees and donations to the Bluefish Society are used for CMS public outreach efforts, Planet Ocean Seminar Series, and other community enrichment program. Open house events, such as the 2016 CMS open house, target the local community and provide them with a better understanding of UNCW coastal and marine science research and programs. Finally, the MarineQuest K-12 education program has been a premiere K-12 academic enrichment program for North Carolina and the nation. For more than 35 years, MarineQuest, in conjunction with CMS and the Watson School of Education, has provided exciting summer and classroom based educational opportunities for young people interested in the marine environment.

UNCW should take the opportunity to market our strengths in coastal and marine science research, engagement, K-12 education programs, and student opportunities through the development of a marketing plan. This marketing plan would need to incorporate each of the colleges and departments that are part of the broader on-campus coastal and marine science community and it would need to include marketing strategies to increase awareness of UNCW’s excellence for both on and off campus target audiences. Other, more centralized opportunities include:

- Evaluation of the Bluefish Society to determine if there are opportunities to grow and expand the programming offered to the local community.

- Review and evaluation of K-12 efforts to date. Use this review to determine best practices for engagement with the K-12 community (e.g., GK12 grant funded program, MarineQuest, individual researcher initiatives). Some basic ideas include campus and CMS tours for local county schools to raise awareness of coastal and marine science research opportunities and careers and increase interest in UNCW as their university of choice.

- Improve website design with meaningful content related to coastal and marine science. Improvements to the CMS website (http://www.uncw.edu/cms/index.html) could then be used as a template for other departments.
• Development of daily/weekly “Marine Minute” information post for local NPR/radio/TV stations to highlight some aspect of our marine science work.

• Use of social media to communicate research endeavors and associated benefits to NC and the region, outreach/engagement activities, scholarships, fellowships, MarineQuest opportunities, etc. Additionally, social media could be used to highlight recent faculty publications with short descriptions of why the work is meaningful to the public.

• Faculty and students could establish a regional program to visit schools and organizations to highlight both the educational and research opportunities available while informing the public and governmental leaders of the value and importance of a strong coastal and marine science program.

• In collaboration with the Watson College of Education and MarineQuest, creation of coastal and marine science research-based lesson plans. The curriculum could be made available on our website to educators around the country.

• Finally, there is an expressed need from across the coastal and marine science community for a modern research vessel. Not only would a new vessel provide valuable research support, but it could also be used as a marketing tool, and be showcased at events for the Board of Visitors and Board of Trustees.

UNCW needs a streamlined coastal and marine science marketing plan that will allow us to promote our strengths so that we can better recruit faculty, staff, and students. This may also enable us to better compete for resources (e.g., state appropriations) and donor gifts.

**Identify opportunities to support coastal and marine sciences through expanded funding from financial ventures and partnerships with community, regional, and national businesses and organizations.**

UNCW has a long history of extramurally funded coastal and marine science research. Since the extramural funding climate is frequently tied to shifting political agendas, other funding opportunities should be identified in order to increase funding diversification. Examples include:

• Business/entrepreneurial activities whereby research discoveries are moved into business ventures. Designation of the CREST Millennial Campus provides the framework under which this could occur.

• Establish fundraising events tied to areas of expertise (e.g., oyster roast to support the NC Shellfish Research Hatchery)
• Public-private partnerships to facilitate teaching, training, and other engagement activities

• Fully develop the Bluefish Society or another 501(c)(3) Friends of Coastal and Marine Sciences organization to conduct fund-raising activities that will help support student scholarships and fellowships and potentially provide seed funding for multi-disciplinary research activities.

• Currently there are no dedicated staff focused on coastal and marine science marketing, fundraising, engagement, etc. The overall campus fundraising activities don’t necessarily focus on coastal and marine science needs. A dedicated staff person who can help shepherd these activities across campus departments is needed in order to move these efforts forward.

Overall recommendations include:

• The development of a marketing plan specific to UNCW’s coastal and marine sciences. This includes, but is not limited to, identification of target audiences and communication materials based on audience needs (e.g., decision-makers, managers), website review and redesign, effective social media presence, and legislative communications.

• Better coordinate the coastal and marine science departments with the UNCW’s Center for Innovation and Entrepreneurship and the Small Business and Technology Development Center. Use these resources to identify entrepreneurial activities, work with faculty, students, and staff on small business start-ups, and identify next generation growth opportunities based on current research efforts.

• Grow the marine science web presence and increase social media campaigns related to coastal and marine sciences. Use both resources to actively promote how UNCW research, grant awards, and publications are meaningful to the state, region, and nation.

• Continue efforts to fund a new research vessel. The vessel will provide valuable research support and can be used as a marketing tool.
APPENDIX I: Subcommittee members and affiliations

Vision Subcommittee Members:
- Jennifer Biddle (Public and International Affairs)
- David Gessner (Creative Writing)
- Lynn Leonard (CAC, Earth and Ocean Sciences)
- D. Ann Pabst (Biology and Marine Biology)
- Larry Cahoon (FAC, Biology and Marine Biology)
- Andrea Hawkes (Earth and Ocean Sciences)
- Dylan McNamara (CAC, Physics and Phy. Oceanography)
- Steve Skrabal (FAC, CAC, Chemistry and Biochemistry)

Administrative Organization Subcommittee Members:
- Anne Beach (Center for Marine Science)
- Doug Gamble (Earth and Ocean Sciences)
- Chad Lane (FAC, Earth and Ocean Sciences)
- Pam Seaton (CAC, Chemistry and Biochemistry)
- Chris Finelli (CAC, Biology and Marine Biology)
- Heather Koopman (Biology and Marine Biology)
- Alison Taylor (Biology and Marine Biology)
- Martin Posey (CMS), Ex-Officio

Research Subcommittee Members:
- Brooks Avery (FAC, Chemistry and Biochemistry)
- Jim Blum (FAC, Math and Statistics)
- Stephanie Kamel (FAC, Biology and Marine Biology)
- Scott Noon (Earth and Ocean Sciences)
- Narcissa Pricope (Earth and Ocean Sciences)
- Wade Watanabe (Finfish Aquaculture Facility)
- Jeff Wright (Chemistry and Biochemistry)
- Dan Baden (MARBIONC; Chemistry and Biochemistry)
- Wilson Freshwater (Center for Marine Science)
- Dylan McNamara (CAC, Physics and Physical Oceanography)
- Joe Pawlik (FAC, Biology and Marine Biology)
- Wendy Strangman (FAC, MARBIONC)
- Ami Wilbur
  (Shellfish Research Hatchery; Biology and Marine Bio.)
- Rob Whitehead (CMS)

Infrastructure Subcommittee Members:
- Jay Styron (Center for Marine Science)
- Andrew Duskie (Facilities)
- Amy Finelli (Shellfish Research Hatchery)
- Lance Horn (Center for Marine Science)
- Susanna Lopez-Legentil (Biology and Marine Bio.)
- Hope Sutton
  (NC National Estuarine Research Reserve)
- Troy Alphin (CMS and Biology and Marine Biology)
- Devon Eulie (FAC, Environmental Sciences),
- Steve Hall (Center for Marine Science)
- Ai Ning Loh (Earth and Ocean Sciences),
- Ronald Moore (Center for Marine Science)
- David Webster
  (CAC, Associate Dean, College of Arts and Sciences)
Teaching Subcommittee Members:
Fred Bingham (FAC, Physics and Physical Oceanography)  Kate Bruce (Honors College)
Doug Gamble (Earth and Ocean Sciences)  Jeff Hill (CAC, Environmental Studies),
Dennis Kubasko (Watson College of Education)  Steve Kinsey (Biology and Marine Biology)
Steve Skrabal (FAC, CAC, Chemistry and Biochemistry)  Alison Taylor (Biology and Marine Biology)
Jessica Weinkle (FAC, Public and International Affairs)

Outreach and Engagement Subcommittee Members:
Brooks Avery (FAC, Chemistry and Biochemistry)  Jennifer Dorton (Center for Marine Sciences)
Mike Durako (Biology and Marine Biology)  Chris Dumas (Cameron School of Business)
Sue Kezios (Watson College of Education; MarineQuest)  Mark Lanier (Chancellor’s Office)
Dan Masters (CAC, Public and International Affairs)  Lori Messinger
   (Associate Vice Chancellor for Outreach and Engagement)
John Morrison (Physics and Phy. Oceanography)  Spencer Rogers (North Carolina Sea Grant)
Roger Shew (Earth and Ocean Sciences)  Tricia Vance (Office of University Relations)
APPENDIX II: UNCW Units involved with Educational, Research, and/or Outreach activities in the Coastal and Marine Sciences

Biology and Marine Biology (CAS)
Cameron School of Business
Chemistry and Biochemistry (CAS)
Center for Marine Science (CAS)
College of Arts and Sciences (Dean’s Office)
School of Health and Applied Human Sciences (CHHS)
Creative Writing (CAS)
Earth and Ocean Sciences (CAS)
Environmental Sciences (CAS)
Finfish Aquaculture Facility
MARBIONC
MarineQuest (Watson School of Education)
Mathematics and Statistics (CAS)
Office of Research and Graduate School
Physics and Physical Oceanography (CAS)
Public and International Affairs (CAS)
Shellfish Research Hatchery

APPENDIX III: Affiliated Organizations Resident at CREST Campus

NC Estuarine Research Reserve
North Carolina Sea Grant
MBCOI

*adopted by coastal and marine faculty on 11 May, 2017