

PROGRAM SUMMARY

Institution:	Coastal Carolina University
Academic unit involved:	College of Science
Name of proposed program:	Ph.D. in Marine Science
Proposed date of implementation:	Fall 2013
CIP Code	40.0607
New program or modification:	New program
Number of credit hours:	60 (30 post-Masters)
STEM designation:	Yes
Delivery mode:	Traditional

JUSTIFICATION OF NEED FOR THE PROPOSED PROGRAM

Developing technical understanding of the coastal zone and applying that knowledge to coastal resource management is important to society. This importance is a consequence of the pressure on both state and national resources brought about by the demographic shift of population to the coast, as well as the importance of coasts to the world economy. This system is particularly challenging to manage, as it exists at the interface of terrestrial, oceanic and atmospheric subsystems that are dynamic and influence the coastal zone through extremely complex interactions. Typically, aspects of this system are the focus of a range of academic programs (e.g., Marine Science, Atmospheric Science, Environmental Science/Engineering, and Biological Sciences) but with more limited focus on the interdependencies. A recent shift in the research approach (as indicated by the creation of new multidisciplinary funding programs, such as the NSF Margins and Frontiers in Earth System Science program) is to adapt an integrated, multidisciplinary view of such systems. As systems increase in complexity, properties and problems emerge that are not predicted by separate analyses of each of the subsystems and a systems approach is required for full understanding. The proposed Doctoral program in Marine Science is designed to apply an integrated systematic approach to the study of complex coastal ocean, earth, atmosphere, biosphere, societal infrastructure and the associated management applications. The program builds on Coastal Carolina University's focus on coastal zone environments, existing academic and research programs and a long-term commitment toward an integrated management of South Carolina's coastal systems. Furthermore, the proposed program is supported by a strong complimentary and synergistic partnership with Clemson University and potentially other institutions.

The increasing coincidence of environmental and economic interests related to sustainable and productive use of coastal natural resources (e.g., beaches, marine renewable energy, and water quality) and coastal adaptation to potential changes in this system will be important drivers for all coastal communities in the future. Coastal communities, states and industries are faced with an increasing array of challenges and costs requiring technical solutions that have historically been considered separately (e.g., beach erosion, energy production, storm water runoff, and coastal hypoxia). There is great potential for the coordination of efforts. Cost savings would be found in an integrated, multidisciplinary systems approach to regional coastal environmental management. This approach will provide a unique foundation to help meet increasing societal needs for professionals trained to consider this complex system holistically and to provide science-based guidance to society and industry.

ANTICIPATED PROGRAM DEMAND AND PRODUCTIVITY

Due to geographic location, degree offerings and facilities, Coastal Carolina University attracts large numbers of students who are interested in coastal marine science and environments. Students can pursue their interests from various perspectives: science, policy, recreation, and business. The B.S. in Marine Science and the M.S. in Coastal Marine and Wetland Studies are two successful degrees currently offered. Both of these programs are highly productive with five-year average enrollments of 563 and 37 students, respectively. The proposed Ph.D. degree in Marine Science represents the logical next step in the development of Coastal Carolina University as a hub for training students to identify and characterize important physical processes in the coastal zone. Such training is critical as coastal areas come under increasing stress due to human migration, as well as environmental factors such as sea level and climate change. We anticipate strong demand for the Ph.D. program based on the following factors. First, the program is academically broad but administratively narrow. As such, it will be desirable to students interested in a broad range of coastal zone issues, but at the same time these students will function as a cohort with a high degree of interaction. Second, graduate students in this program will have ample opportunities to hone their communication skills as they interact with undergraduates, M.S. students in Coastal Marine and Wetland Studies, their Doctoral colleagues, and stakeholders working within the coastal zone of South Carolina. The program will allow students to address issues involving interaction among the ocean, atmosphere, terrestrial and freshwater systems of the coastal zone. Lastly, the strong synergistic partnering between Coastal Carolina University and Clemson University (e.g. Restoration Institute and other programs) results in a

very strong, diverse and complimentary collection of academic and technical resources to support the study of coastal zone systems. We conservatively predict an initial cohort of three (3 FTE) new students the first year, increasing to four in the second year and four-to-five in each subsequent year. With an estimated degree completion period of 4 years, these predicted enrollments will allow the program to meet existing productivity standards.

ASSESSMENT OF EXTENT TO WHICH THE PROPOSED PROGRAM DUPLICATES EXISTING PROGRAMS IN THE STATE

Due to its unique focus and curricular structure, the program does not duplicate any existing program in the state. The basic tenet of the Ph.D. program in Marine Science at Coastal Carolina University is that challenges and issues in the coastal zone must be studied and approached within the coupled earth, atmosphere and ocean system (i.e., a system approach). Such challenges invariably involve human populations. A systems approach allows one to incorporate these populations as integral components of the various subsystems. While traditional Ph.D. programs have stressed the importance of basic research in the training of future scientists, it is now clear that scientists of the future, and specifically scientists dealing with challenges in the coastal zone, must also understand the intersection of various disciplines within science as well as science policy and human systems. As such, the Ph.D. program in Marine Science will include basic curricular and research experiences as well as education directed at developing predictive capabilities for future coastal system responses to natural and human-induced drivers. Rather than duplicate existing programs, the Coastal Carolina-Clemson cooperative affords an important opportunity to bridge a traditional divide between “environmental” natural sciences and engineering approaches to coastal problems, as well as leverage an academic focus that runs across the entire range of issues that are critical for understanding the coastal zone.

The Ph.D. programs in Marine Science and Geological Sciences at USC have traditionally focused on some aspects of the coastal system. However, the Marine Science program at USC draws on several disciplines, including biology, and is most noted for its research accomplishments at the Baruch Marine Field Laboratory where scientists study a relatively pristine ecological system. The Geological Sciences program at USC is within the realm of traditional geology although it does include aspects of the ocean system and is most noted for research accomplishments elucidating geological processes across the broader global geologic framework.

RELATIONSHIP OF PROPOSED PROGRAM TO EXISTING PROGRAMS AT THE PROPOSING INSTITUTION

With the recognition that coastal resources are important to the region’s economy, history and culture, Coastal Carolina University committed to studying coastal environments with the formation of the Center for Marine and Wetland Studies in 1988. The Center has established a strong research capacity particularly within coastal geologic and applied geophysics, environmental quality/watershed planning and coastal ocean/atmospheric observations and modeling. Coastal Carolina faculty and students from several academic programs (i.e., Marine Science, Physics, Archaeology, Computer Science and Biology) are facilitated through the Center and work cooperatively with Center staff.

In 2003, the University established a Master of Science degree in Coastal Marine and Wetland Studies, further formalizing the interdisciplinary focus on coastal environmental issues and science at the graduate level. The Coastal Marine and Wetland Studies program is supported by faculty from several different academic departments, principally Biology and Marine Science, as well as staff from the Center for Marine and Wetland Studies.

RELATIONSHIP OF THE PROPOSED PROGRAM TO OTHER INSTITUTIONS VIA INTERINSTITUTIONAL COOPERATION.

The program will favorably complement some well-regarded programs at Clemson University and other universities and research centers. Coastal Carolina University presently maintains a cooperative MOU with Clemson University building on eight years of leveraging respective strengths and initiatives related to renewable energy development and water quality studies. There is also a Cooperative Dual-Degree engineering program between Clemson and Coastal Carolina; an area of particular mutual opportunity for merging integrated basic and applied science in coastal systems with improve options for societal response to change.

There are several other existing cooperative activities between Coastal Carolina University faculty and students with regional universities and research centers with the goal of better understanding coastal systems; including:

1. Clemson University’s Restoration Institute, Strom Thurmond Institute and Carolina Clear program as part of the state wind and hydrokinetic renewable energy team as well as water quality, and management, research, technology and education. Clemson University’s cooperation with Coastal Carolina University in offering a 3-2 dual-degree engineering program.

2. USC’s Baruch Marine Field Laboratory related to marine biological and ecological studies within the pristine environments at North Inlet, recently expanding to adjacent coastal waters leveraging the disciplinary focus and capabilities of each program (e.g. interdisciplinary study of coastal hypoxia events).
3. Department of Natural Resources Marine Resources Research Institute where Coastal Carolina University’s coastal geologic and applied marine geophysics group works to better characterize and manage the state’s coastal natural resources related to beach erosion and beach nourishment.
4. Savannah River National Laboratory - coastal wind resource observations and advanced coupled modeling of the coastal ocean/atmosphere system oriented to renewable energy research.
5. U.S. Geologic Survey’s Coastal and Marine Geology program and Water Resources Division - geologic framework, coastal erosion, natural resource characterization.

Coastal Carolina University faculty and students routinely work cooperatively with colleagues at Clemson and USC at the Belle W. Baruch Foundation’s Hobcaw Barony in Georgetown, SC focusing on saltmarsh and forest systems, respectively. The proximity of Coastal Carolina University to the Hobcaw Barony and to Clemson’s Restoration Institute in Charleston offer opportunities for expanded cooperation and access, including graduate student engagement by Clemson and USC scientists based along the coast. Coastal Carolina University also maintains a coastal reserve at Waties Island that is more directly embedded within the heavily developed setting. A short drive from the Coastal Carolina University campus, Waties Island is located in North Myrtle Beach. Collectively, the pristine setting at Baruch and the more human-influenced settings at Waties Island and Myrtle Beach provide strong opportunities to cooperate and to pursue significant multidisciplinary research ventures.

The proposed Ph.D. in Marine Science will leverage previous cooperative research ventures with Clemson and others and will be developed as the first Focused Collaborative Doctorate (FCD) program in the State of South Carolina. For students entering with a B.S. degree, this collaborative degree would begin with core and elective classes currently offered through the M.S. degree in Coastal Marine and Wetland Studies, followed by course work, doctoral seminars and colloquia offered collaboratively with Clemson and others, culminating in a dissertation completed at CCU but with committee representation by faculty from Clemson and other research institutions. The approximate credit distribution will be as follows:

Marine Science Ph.D. Program – Curricular Outline

Course	Credits	
Transfer of Masters or equivalent graduate credits (or CMWS MS program)	30	
Ph. D. Program Curriculum	30+	
1. Earth/Coastal Systems Science	3	Required core course of all doctoral students
2a. Coastal and Marine Processes, Ecology or Policy, Modeling Natural Systems, and/or Temporal and Spatial Analysis	3-12	Coastal, Marine or Systems content as required by program/dissertation committee
2b. Coastal Systems Issues and Applications (Colloquia/Seminar)	6	Three graduate colloquia (2 cr-hr each)
2c. Specialized coursework – Advanced topics supporting dissertation research	3-12	
3. Directed Study	1-5	Supplemental tutorial coursework
4. Dissertation research	6	
5. University Teaching Practicum	3	
Total Credits	60+	

TOTAL NEW COSTS ASSOCIATED WITH IMPLEMENTING THE PROPOSED PROGRAM

Coastal Carolina University continues to invest and develop resources and capabilities in the area of coastal science. To date these investments have generated significant returns in grant productivity while increasing instrumentation and research opportunities for undergraduate and graduate students. Likewise, the university will reallocate funds to cover faculty, startup needs, facilities, and graduate assistantships required for the Ph.D. program in Marine Science.