# Master of Science in Marine Science Program Review 2004-2010

University of North Carolina Wilmington

Center for Marine Science Education Committee
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EXECUTIVE SUMMARY

The marine science graduate program accepted its first class of two M.S. seeking candidates in the fall semester of 1998, with the first graduate in May 2001. Currently, 29 degree seeking students are enrolled in the program. Ninety-three students have received degrees to date, an average of > 10 graduates per year since 2002. The educational objectives of this degree program are 1) to provide a broad interdisciplinary understanding of marine science to students having strong undergraduate training in the sciences and mathematics and 2) to develop skills that will enable these students to utilize this knowledge to solve complex marine environmental problems. These problem-solving skills provide the foundation for future contributions by graduates in marine-related industries, environmental management, teaching, research, and other marine-oriented careers. Students are also well prepared to undertake additional graduate study. This program offers graduate students diverse research areas from which to choose within the traditional areas of marine science, as well as specialty areas including harmful algal blooms, marine biotechnology, aquaculture, water quality, estuarine marine science, and atmospheric marine science.

The marine science graduate program grew quickly to approximately 35 students since its inception in 1998. Factors contributing to this growth and success are the high quality of marine research conducted at UNCW, and faculty commitment to students, which results in close supervision and mentoring of students by faculty. The success of faculty in securing external funding has also contributed to our success because this funding provides research assistantships (RA) to support most of our graduate students. In addition, the continually increasing number of publications and presentations with graduate students as co-authors has significantly enhanced the visibility and reputation of the program.

The marine science graduate program still has areas of concern. These include:

- This program has only twelve teaching assistantships (TAs) that pay $11000 per academic year. There are no TAs for marine science students in summers, which means they are dependent on grant funding for summer support, or on competitive student stipends of $1000 offered through both the Graduate School and the Center for Marine Science in good budget years.
- Tuition support for both in-state and out-of-state students is insufficient. The program has eight tuition remissions for out-of-state students, and only $9500 for in-state tuition support. Twenty-one of our current students are out-of-state residents for tuition purposes, and 75% of our applications come from out-of-state students. Because of tuition increases, the in-state tuition fund now covers complete tuition costs for only two students.
- Our financial offers to prospective students are not competitive with other universities that offer more lucrative packages to superior students, so it is difficult to recruit the most highly qualified applicants.
- This program is overly dependent upon one person, the Associate Director for Education; part of an additional faculty member would ensure continuity when this person is out of the office for any reason, and also improve the efficiency of communications with students and applicants.
• The research vessel that supports this program is old and no longer supports the needs of the program.
• There is very little space for new faculty on the main campus, and no lab space or offices for new faculty in Dobo and Friday Halls, although space should become available at CMS in the next few years.
• The limited main campus space along with the small number of teaching assistantships and low tuition support limit the possibility for growth in the MS marine science program.

This report is the second review of the Master of Science in marine science graduate program. The first review conducted in the spring of 2004 was very constructive and yielded several important, concrete results. Two additional physical oceanographers have been hired, reducing this weakness. A concentration in marine policy has also been added, which makes our graduates more competitive in certain sectors of the job market. Some additional funding has been secured for graduate student support through the Center for Marine Science.

This document is a summary of the marine science graduate program for the period 2004-2010 and an evaluation of current strengths and weaknesses of the program. We have made great progress in our marine science graduate program since its inception in 1998 and we see great potential for continued success in the coming years.

UNCW GRADUATE PROGRAM IN MARINE SCIENCE

Brief History and Description of the Academic Unit

The Master of Science in marine science program is administered out of the Center for Marine Science and it reports to the Graduate School. This program builds on the strengths in the Departments of Biology and Marine Biology, Chemistry and Biochemistry, Environmental Studies, Geography and Geology, and Physics and Physical Oceanography, and complements existing MS programs in Biology, Marine Biology, Chemistry, and Geology, as well as the Master of Arts in Public Administration and the MA in Environmental Studies. This program is managed by the CMS Associate Director for Education with guidance from the CMS Education Committee, which is composed of 14 academic and research faculty in the various areas of marine science at UNCW, one first year graduate student and one second or third year graduate student in the program.

This program is truly an interdisciplinary program that does not have ownership by a single department. Almost all of the courses that marine science students take are taught through the academic science departments, and those departments receive credit for the credit hours produced. Because almost all faculty have primary affiliation in an academic department, this program does not need to generate credit hours to justify faculty positions, and the current arrangement benefits departments that contribute to the program. Whereas students can do similar research projects in either the marine science program or in one of the departmental programs, the marine science program is unique in that it is interdisciplinary, and students take courses in at least three different disciplines and have committees with faculty members from at
least two different academic disciplines. Faculty advisors for marine science students come from varied backgrounds: oceanography, marine science, aquaculture, biology, chemistry, economics, geography, geology, geophysics, and physics. Students also have diverse academic backgrounds; we have accepted students with undergraduate degrees in animal industries, anthropology, applied mathematics, biology, botany, marine biology, chemistry, biochemistry, geology, marine geology, engineering, environmental science, marine science, education, meteorology, natural resources, physics, wildlife and fisheries science, and zoology. Faculty and graduate students are housed in several facilities: the Center for Marine Science, which opened in 2000; Friday Hall, which was completely renovated in 2009; Dobo Hall, which opened in 1996; the new research shellfish hatchery which opened in the fall of 2010, and the older buildings DeLoach Hall and the Wrightsville Beach aquaculture facility.

Students in our Master’s program receive rigorous training and a first class education. Many students are part of research teams composed of several faculty members, sometimes a postdoctoral fellow and often several undergraduates. This team-based approach is beneficial both from an educational and research productivity viewpoint and also provides students with valuable team-working skills vital in today’s global society. Our graduates have been very successful in finding relevant employment and in gaining acceptance into doctoral granting institutions, as is documented on our webpage (http://uncw.edu/mms/graduates.htm).

The primary faculty included in this report include the 38 faculty members who advise current marine science students, or who have advised graduates of this program since 2004. These are the people most familiar with this program, and they all hold graduate faculty status at UNCW through their home departments, or, for several research faculty, through CMS. There are additional faculty who have contributed in various other ways, for example by teaching courses or serving on student committees. Input from both groups has been solicited in the preparation of this report, through email communications and open forums. Every attempt has been made to include all faculty who wish to be involved in this review process.

**Mission Statement**

The mission of the UNCW Center for Marine Science is aligned with the mission of the University to emphasize teaching, research and public service. The teaching function of the Center for Marine Science is accomplished through several courses that are taught at the Center, the general support the Center provides for UNCW courses (such as boat time) and the administration of the Master of Science degree in Marine Science. The Center excels at public service and hosts many events, lectures, seminars, meetings and other related activities aimed at individuals from K-12 to adults including senior citizens. Individuals at the Center routinely provide professional expertise that is used by various individuals and organizations whose work has broader societal impacts on our region. A strength of the Center for Marine Sciences is its dedication to providing an environment that fosters a multidisciplinary approach to questions in marine research. The Center is committed to training graduate students so that they have a strong multidisciplinary background to ensure their success in academic or professional opportunities after graduation.
Goals

The educational objectives of this degree program are 1) to provide a broad interdisciplinary understanding of marine science to students having strong undergraduate training in the sciences and mathematics; and 2) to help students to develop skills that will enable them to utilize this knowledge to solve complex marine environmental problems. These problem-solving skills provide the foundation for future contributions by the graduates in marine-related industries, environmental management, teaching, research, and other marine-oriented careers. Students are also prepared to undertake additional graduate study. The long range goals are to produce well-trained marine scientists in each of the four core areas, and to contribute to sustainable management of our coastal natural resources.

Dates New Degree Programs Were Established

The Master of Science in marine science program officially began in the fall of 1998. There have been no major changes in the structure of the academic program since it began.

The Master’s in Public Administration (MPA) began in 2001. The MPA program is an interdisciplinary professional degree program designed to provide a broad education for individuals expecting to enter government and nonprofit agencies and who aspire to management or policy positions. The MPA program provides courses of interest to MS marine science students, especially courses designed for the concentrations in marine policy and coastal management. One graduate from the MS marine science program has also completed requirements for the MPA degree. UNCW started a Ph.D. program in Marine Biology in 2002. This program provides students with a broad background and overview of the fields comprising marine biology and make use of the diverse interests of the marine biology faculty within the department. As is generally the case, the Ph.D. program is primarily a research degree. Students learn the process of identifying, defining and solving an original research problem. This Ph.D. program also includes a teaching practicum with classroom instruction in pedagogical techniques and technologies along with lecture experience under the guidance of a faculty mentor. No MS marine science graduates have entered the UNCW marine biology Ph.D. program to date, however one has been accepted for January 2011 admission.

Several new degree or certificate programs have begun since the previous review of the MS marine science program. Since Fall 2005 the Department of Mathematics and Statistics has offered a Post-Baccalaureate Certificate in Applied Statistics. The Certification Program in Applied Statistics is intended to help fill the need for qualified personnel trained in the proper use of statistical methodologies. The overall objective of the program is to teach working professionals the necessary skills to ensure their data-based inferences and decisions are based on sound statistical principles. One MS marine science graduate has also completed the requirements for this Certificate.

The Master of Arts in Environmental Studies began in 2008, with concentrations in Environmental Management, Environmental Education and Interpretation, and Coastal Management. This is an interdisciplinary graduate degree designed for professionals, practitioners, citizens and students who wish to strengthen their knowledge of the environment.
The multidisciplinary nature of this program provides the student with a unique balance of the scientific background necessary for sound environmental decision-making within the context of educational, political, sociological, economic and legal frameworks. The MA in Environmental Studies provides several courses of interest to MS marine science students. A post-baccalaureate Certificate in Environmental Science was established in fall of 2010; this program also has concentrations in Environmental Management, Environmental Education and Interpretation, and Coastal Management. The Certificate in Environmental Education and Interpretation currently has two MS marine science students pursuing this certificate in addition to their MS marine science degrees.

**New Degree Programs in the Planning Stages**

A Master of Science in Coastal and Ocean Policy is pending approval by the UNC Board of Governors; this proposal was submitted to the UNC System Board in 2009. A proposal requesting permission to plan a Ph.D. in Coastal and Marine Science at UNCW was submitted in May of 2010, with the approval of all the relevant UNCW administrators. Implementation of this program would enhance our capability to attract graduate students to the MS program, and would provide them with an additional pathway for doctoral education. This program would also help with recruitment and retention of new faculty.

**Changes to the Faculty since 2004**

**Department of Biology and Marine Biology**

**Gained:**
- Brian Arbogast, PhD: Vertebrate Ecology
- Stuart Borrett, PhD: Ecological Modeling
- Christopher Finelli, PhD: Biological Oceanography
- Arthur Frampton, PhD: Virology
- Sean Lema, PhD: Physiological Ecology
- Zachary Long, PhD: Coastal Ecology
- Sonya Pyott, PhD: Sensory Biology
- Richard Satterlie, PhD: Neurobiology
- Eric Schuettpelz, PhD: Plant Systematics
- Bongkeun Song, PhD: Marine Microbiology
- Amanda Southwood, PhD: Physiological Ecology
- Alison Taylor, PhD: Cell Biology
- Marcel van Tuinen, PhD: Molecular Biology
- William White, PhD: Fisheries Ecology

**Lost:**
- Stephen Brewer, PhD: Coastal plant Ecology
- Greg Chandler: Plant Systematic
- Courtney Hackney, PhD: Estuarine Ecology
- Laela Sayigh, PhD: Marine Mammalogy

**Department of Chemistry and Biochemistry**

**Gained:**
- Emmanouil Chatzakis, PhD: NMR Spectroscopy
FINDINGS OF PREVIOUS REVIEWS:

GRADUATE SCHOOL EXTERNAL REVIEW IN 2004

The previous review of the MS in marine science program was conducted in 2004 after the first five and one half years of operation. The external reviewers were Dr. Robert Christian, a marine biologist at East Carolina University and Dr. William Ullman, a marine geochemist in the College of Marine Studies, University of Delaware. They conducted a thorough and constructive review. Their summary follows:

The Master of Science in Marine Science (MSMS) is a vibrant graduate program at the University of North Carolina at Wilmington (UNCW). This program is housed administratively in the Graduate School of the UNCW and operates with the extensive support and cooperation of the Departments of Biology, Earth Science, and Chemistry and,
to a lesser extent, with the Department of Physics and Physical Oceanography. It also receives extensive support and cooperation from the Center for Marine Science.

The faculty who contribute to the MSMS program come from a number of different academic units including the Department of Economics and Finance in addition to the units mentioned above. The fluidity of the faculty roster, while unusual in an academic organization, seems to work very well in the MSMS program at UNCW. Faculty have commitments to their home departments and contribute to the MSMS program, as they are able. Since most of the courses required for the degree are offered in the various departments, the commitment to the MSMS program is largely in the areas of research and advising.

Given the present organization of the MSMS program, it is difficult to distinguish between the contributions of the program and the contributions of the associated units. All of the faculty with whom we consulted appear to participate actively in the teaching, service, and research activities of UNCW, but these contributions are often credited to their home departments or to CMS rather than to the MSMS program. There does not appear to be a strong need to change the present organization of the MSMS and associated programs as long as it is recognized that it may be difficult to properly attribute activities of active faculty to the MSMS program.

The current students in the program and the graduates of the program with whom we met seem to be generally pleased with the academic aspects of the program including advisement and coursework. The major issue for the current students is the lack of adequate stipend to meet their educational and educationally related needs. UNCW needs to find ways to better support their graduate student population if it desires to maintain and expand its graduate offerings. Students need to receive adequate stipends, tuition remission, medical insurance, and access to medical care.

The MSMS program and the marine components of the graduate programs of the Departments of Biology, Earth Science, and Chemistry support a motivated and active student population of 92 students (31 in the MSMS program, 41 in the MS programs in Marine Biology, 5 in Chemistry, and 15 in Earth Sciences). In terms of student numbers, UNCW is as large as many better known marine science institutions. It is probably the largest primarily MS granting marine science program in the US! UNCW should recognize the importance of this program to the University and to the State of North Carolina with the resources necessary to maintain, improve, and expand the opportunities for all of these students and other graduate students associated with the contributing departments.

Specific recommendations and responses to them follow.

1. **We recommend that the MSMS faculty offer more opportunities, in the form of seminars, field experiences, case-study courses, and interdisciplinary lecture courses, for their students to apply the disciplinary knowledge acquired in the core courses to truly interdisciplinary problems in coastal and marine science. Three potential areas for interdisciplinary courses that were discussed are**
biogeochemistry, ocean observation systems, and data assimilation and informatics.

We have not added any seminars, although each of the departments has a seminar series that occasionally has marine topics. We have not added a case study course, although case studies are a part of several existing courses. The core courses, while offered through individual departments, contain interdisciplinary topics. A course in biogeochemistry would be a good addition, however none of the departments has faculty time available to offer this course. The Department of Chemistry and Biochemistry has the necessary expertise, but the faculty are already teaching full loads. The Department of Environmental Studies has added several new courses, including a field methods course. Several MS marine science students have done internships through this department. The Department of Physics and Physical Oceanography has added several new courses, including one that incorporates ocean observing and data management. Descriptions for several new courses follow, and a complete list of new courses can be found in Appendix III.

EVS 515. Field Methods in Environmental Studies (3) A survey of methods, techniques and instrumentation used in environmental fieldwork. Focus is upon data gathering, analysis, interpretation and application to environmental management. Required field trips.

EVS 520. Foundations of Coastal Management (3) Interdisciplinary investigation into the relationship between human society and coastal ecosystems, focusing upon the political, economic, socio-cultural and scientific challenges facing coastal managers. Core principles of coastal management will be used to develop potential solutions to contemporary coastal issues. Required field trips.

EVS 598. Internship (1-3) Supervised experience with credentialed professional in environmental studies.

PHY 577. (477) Observational Methods and Data Analysis in Physical Oceanography (3) Prerequisites: Permission of instructor. This course will supply the student with a working knowledge of the use and operation of various physical oceanographic instruments and data reduction and analysis techniques.

PHY 579. (479) Ocean Circulation Systems (3) Prerequisite: PHY 475 or 575. Course focuses on results of World Ocean Circulation Experiment (WOCE), a multi-national, multi-decadal program designed to observe the global ocean. Explores large-scale circulation and properties of the ocean to lay the foundation for the challenge of understanding the future of the world oceans and their role in climate change.

PHY 580. (480) Coastal and Estuarine Systems (3) Prerequisite: PHY 475 or 575. An introduction to the physical processes operating within coastal and estuarine systems. The focus of the course will be on the dynamical description of topics such as gravity waves, surf zone hydrodynamics, storm surge, tides, estuarine hydraulics, sediment transport and morphodynamics.
2. We recommend that UNCW expand the number of researchers in the field of physical oceanography. We recommend that a minimum of two additional researchers be added in this area with at least one having full faculty status and privileges. The physical oceanographers should be co-located in order to share facilities and increase opportunities for collaboration for themselves, their students, and with other participants in the MSMS program. It is apparent that the current arrangement with the Physics and Physical Oceanography Department to host faculty in the field of physical oceanography is not serving the needs of the MSMS program as well as should be expected (see below).

UNCW has added two physical oceanographers partly in response to this recommendation, however one has a half time administrative position (Dr. John Morrison). Dr. Morrison has been added as a full professor with administrative duties, so he only teaches one course per semester. Dr. Dylan McNamara has been added as an assistant professor. The Department of Physics and Physical Oceanography has also added several new marine physics courses (described above and in Appendix III). The three physical oceanographers are co-located at CMS. They are among the most research active faculty in their department, however they receive very little credit or relief time for their research and graduate student mentoring, both of which benefit the MS marine science program.

3. We recommend that the MSMS program explore opportunities for collaboration with faculty in other UNCW units with interests in coastal and marine resource management to increase the opportunities for interdisciplinary courses and research for students with interests in the management/policy field. We note that the Certificate in Environmental Sciences and Masters of Public Administration programs both appear to have some faculty and coursework that could meet these needs.

The MS marine science program has added a marine policy concentration in response to this recommendation. Approximately one third of the students in the program complete the concentration as a part of their MS program. Concentration requirements follow:

**MARINE POLICY CONCENTRATION**

In addition to the core and other required courses, students seeking a Master of Science in marine science with a concentration in marine policy must also complete the following:

- PLS 543 Environmental Policy Analysis (3) OR EVS 564 Natural Resource Policy (3)
- AND PLS 544 Resource Economics (3), OR ECN 525 Environmental Economics (3) OR ECN 530 Natural Resource Economics (3)

AND two additional 500 level courses (6) in BIO, CHM, GLY, or PHY (excluding 599 thesis not more than 3 credit hours DIS)

AND one course (3) from the following:
Management Option: PLS 500 Managing Public and Nonprofit Organizations (3), PLS 520 Seminar in Coastal Processes and Problems (3), PLS 521 Legal Foundations of Coastal and Environmental Management (3), PLS 522 Field Seminar in Coastal Management (3), PLS 524 Managing Coastal Hazards (3), PLS 525 Managing Coastal Ecosystems (3), PLS 540 Environmental Management (3), EVS 520 Foundations of Coastal Management (3)

4. We see no problem with the current time required to complete the MSMS degree. A 2 to 2.5 year interval is consistent with the time required at many other MS granting institutions in the marine, earth, and environmental sciences fields. We do not see the need for a separate MSC501 course, but some culminating activity late in the second term that requires the students to prepare and present a public summary of proposed research would appear to be a useful pre-thesis event to ensure that all students are making timely progress toward their degrees.

The average time to degree for full time students over the last seven years is 2.7 years, or 32 months, slightly longer than for the time period of the previous review but shorter than the national average time for a MS marine science degree of 2.9 years (Consortium for Ocean Leadership data, October 2010). The previous review covered only three years in which there were graduates so it was a much shorter time period, and a smaller number of graduates (22 vs. 92). All students take MSC 595 Marine Science Seminar, usually in their second semester. In late April, there is a poster presentation in that course, and each student presents a poster with research ideas, objectives and results to date for their own thesis research project. All marine science faculty and graduate students are invited to this poster session, which has become a popular tradition.

5. We recommend that UNCW explore opportunities for distance learning for their MSMS and other graduate students using new interactive television technology. These opportunities may best be available through the UNC system and sister universities.

Although we have not added any distance courses, student committee meetings and defenses are often conducted using distance technology, especially when one committee member is at a remote site. The Department of Environmental Studies has added the following course as an online course:

EVS 525. Foundations of Environmental Education and Interpretation (3) Principles, philosophies and methodologies of environmental education and interpretation are examined within both formal and informal educational settings. Extensive field-based opportunities will allow students to not only develop foundational knowledge but to gain practical experience in
developing, implementing and evaluating environmental education and interpretation programming. Required field trips.

6. **We recommend that students who have had upper division, undergraduate courses with similar content to core courses be allowed to meet one or more of the core course requirements by alternative means. Potentially, such students would have to demonstrate the equivalence of course content of the previous course to the required course by either examination or the successful completion of a specialty course in the area of the core course but at a higher level. Students meeting the requirements by these alternative procedures should still be required to complete the same number of course credits for graduation. This option might give students with good initial preparation in marine sciences an opportunity to explore some other disciplinary areas or to enroll in additional interdisciplinary courses (see above).**

This question is being addressed on an individual basis, however there have been no requests to waive or bypass core courses. Students may not realize this is an option, or they may be hesitant to bypass a UNCW core course knowing they might have to take that section of the comprehensive exam in May of their first year.

7. **We recommend that mechanisms for the attribution of time and effort with appropriate credit be considered that formally recognize the activities beyond the departmental level. The continued success of this important program depends on a feedback system that properly rewards component units.**

There is very little credit given for research guidance or thesis credit hour production in any graduate program at UNCW. This problem is not unique to marine science.

8. **We recommend that departmental status for the marine science program not be considered for the near future unless some unforeseen conditions prompt strong faculty interest in this direction.**

Departmental status for marine science at UNCW was discussed during the brief tenure of our former provost, and there was little support for a department. Faculty have strong loyalties to their home departments, although membership in a virtual department of marine science had some interest.

9. **We recommend that the current administrative structure be maintained for now. In 2-3 years, a review of the structure may be worthwhile, perhaps in coordination with a review of assessments of the activities beyond departmental level (see above).**

No action has been taken on this topic.

10. **We recommend that an alternative faculty home be found for the one current physical oceanographer and for future colleagues to be hired in this area of**
oceanography. A number of alternative homes for the MSMS physical oceanography group are possible within UNCW: the Department of Earth Sciences, the Department of Environmental Studies, or directly to the Center for Marine Sciences.

Physical oceanography still resides in the Department of Physics and Physical Oceanography, however two new physical oceanographers have been added, and they are located in close proximity to each other at CMS. Dr. John Morrison has a one half time administrative position and teaches only one course per semester. Because this department does not have a Master’s degree program, the oceanographers are the only faculty who work with UNCW graduate students and they are among a very few who obtain external funding. This research time and effort is not fully appreciated or rewarded, and teaching assignments are excessive for research active faculty.

11. We recommend that the level of annual support guaranteed to a supported student be increased to better reflect student expenses and the stipend amounts offered to MS students at competing institutions. Students suggested that an annual stipend of $1000/month for a 12-month year would allow them to meet most of their expenses if tuition waivers were granted separately. All grants supporting students should be required to budget for this minimum level of support. This level of support should be the same for all collaborating departments and for all students, with the exception of students supported on specific outside fellowships where the mandated stipend is above the normal student level (for example, NSF and STAR fellowships). All graduate students should be separately granted support in the form of full tuition remission. We propose that one source of additional tuition remission support could be a requirement that all indirect (facilities and maintenance) costs derived from student stipend components of grant budgets be used to offset the tuition expenses of graduate students. This additional source of tuition funding, together with existing sources (current or slightly increased levels of in-state and out-of-state tuition remission) should be enough to meet the tuition expenses of all graduate students. Further, there is a larger context for the low stipends and other policies related to graduate student support, and we recommend that the UNCW upper administration coordinate efforts with other UNC System universities to meet the documented needs.

This is an ongoing challenge for all graduate programs at UNCW. Tuition increases have made this problem much worse over the last five years. The Center for Marine Science, under Dr. Dan Baden as director, has made some indirect cost funds available for student support. This was $60,000 per year, however for the last two years it has been cut to $49,000. This has been used in recruiting to offset some of the tuition and other student expenses. $32,000 of this money goes to support two Merritt Fellows, with one new Fellow entering each year. Marine science graduate students take almost all their courses in their first year, so tuition expenses in the second year and beyond are minimal. This lower expense is critically dependent upon the continuing availability of GRC 600, a no credit continuing graduate enrollment course that makes a student full time
and costs approximately $150 per semester for an in-state or out-of-state student. Students can only take GRC 600 after they have completed all program requirements and 30 credit hours.

12. We recommend that UNCW review the medical insurance and medical care available to graduate students to ensure that most are able to receive necessary care when ill and able to do so at a reasonable cost, given stipend levels. As with stipends, this may be best addressed at the UNC system level.

Medical insurance is now required of all UNCW students. Students who do not have insurance can buy insurance for $700 per year. However this expense comes out of their assistantship or other sources of income.

13. We recommend that the MSMS program (and perhaps CMS) find opportunities to gather all students with interests in marine sciences together for events that include some social activities including mingling. One student suggested that late afternoon seminars followed by an informal reception would go a long way to meeting this need. Also, consideration should be given to novel ways of providing transportation between the two locations.

There are several social events at CMS during the year: a ‘welcome new graduate students’ social, usually two graduation events (December and May), sometimes a summer graduation event, and a seasonal December feast. There still is no transportation between CMS and the main campus. When this service existed, there were very few users and so it was discontinued, however a shuttle service is being considered at the present time.

14. We recommend that students be better informed of exactly what student services are provided by UNCW and its Graduate Office and how to best access these services. The existing Graduate Student Handbook could be expanded to include this information or an indication of where to find current information on the web could be added to the Handbook. Graduate Office staff might be reminded of the respect they should show students.

The Graduate Handbook for marine science students was revised with the help of a current student during the spring semester of 2010, and it does contain information about the Graduate School and its functions. There have been some personnel changes at the Graduate School; hopefully this is helping improve attitudes there.

15. We recommend that UNCW develop career programs specifically for MSMS and other graduate students.

UNCW has not actively pursued this recommendation. Graduates have been successful in finding suitable placements, although it has taken longer for some with the current economy.

16. We recommend that active care be taken to maintain the relatively high level of facilities as the buildings and equipment begin to age. We also recommend that mechanisms be developed for enhanced communication between MSMS
students, particularly those located at CMS, and computer technical support staff and the UNCW library.

CMS has two very capable computer technicians. The librarians actively and enthusiastically offer their expertise to graduate students and faculty. Facility upgrades are happening on a regular basis.

CENTER FOR MARINE SCIENCE STRATEGIC PLAN 2007 – 2012
EDUCATION SECTION, PRIORITY GOALS

1. Establish a Ph.D. in Marine Science at UNCW

A faculty committee prepared a Request for Permission to Plan a Ph.D. program in Coastal and Marine Science during the academic year 2009-2010. This committee had members from all the relevant departments, and faculty input was sought throughout the process. This proposal has been endorsed by the UNCW administration and it was sent to the UNC Board of Governors in May 2010. The proposal has not yet been considered at the UNC system level.

There are several reasons why this degree is important to marine science at UNCW. The University has the faculty expertise and resource base to support a Ph.D. in marine science. The current Ph.D. program in marine biology can accommodate only about half the marine science faculty at UNCW. The lack of a marine science Ph.D. degree has made recruiting of highly qualified students into the MS marine science program much more difficult in the last five years.

2. Implement and fully develop the articulation agreement between UNCW and the University of Southampton (UK)

Progress has been made on this topic. There now is an undergraduate student exchange program. One MS marine science student has gone to Southampton, and one Southampton graduate student has come to UNCW for several months. Faculty linkages, which are critical to the success of this program, are being made, along with plans for faculty exchanges. The Gillings Family Foundation provides funding for both student and faculty exchanges between Southampton and UNCW. Southampton is planning a joint field education program for their Master’s in Oceanography students and the MS marine science students at UNCW, along with advanced undergraduates from both universities. The existing memorandum of understanding with Southampton will be reviewed next year.

Other relevant goals in the CMS Five Year Strategic Plan follow.

Goal E.3. Develop the Master of Science in Marine Science Program to its full potential.

The current number of students (29 degree-seeking students including six who have accepted positions and are not working on their theses full time) is at the low end of our optimal range. Five degree-seeking and two non-degree seeking students will begin in January 2011, and three will graduate in May 2011. This program is restricted from much growth by limits on faculty
resources (time for research supervision and obtaining research funding) and by funding for student support. Although faculty members active in the marine science MS program are expending considerable effort and are successfully obtaining research funding to support graduate students, institutional financial support for stipends and scholarships are deficient. Although the number of graduate teaching assistantships (TAs) has recently increased to twelve from eleven and the number of tuition remissions to eight, we have actually lost overall support because tuition has increased more than the recent increase in student stipends from $10,000 to $11,000, and the level of in-state tuition support from the Graduate School has not changed in twelve years. These stipend levels are not only non-competitive, but even with an out-of-state tuition remission do not cover the student’s expenses. Currently the projected graduate tuition for fall 2011 is $3,185/semester for in-state and $8,359 per semester for out-of-state students, or $6,370 per year and $16,718 per year, respectively, for a total estimated cost of attendance of $19,230 and $29,944 respectively (http://www.uncw.edu/finaid/costofattendance.htm). Once all 30 credit hours and all requirements are completed, students can enroll in Continuous Graduate Credit (GRC 600) for no credit hours. GRC 600 makes the students full time and costs approximately $150 per semester regardless of residency status, reducing total estimated cost of attendance to approximately $12,800 per year. Continuation of GRC 600 is essential in order to maintain the current size of this program.

Objective E.3.2: Increase diversity and maintain balance of disciplines among students in this program

There are no fellowships for minority graduate student so recruiting of minorities is extremely difficult at UNCW. To date, the program has had one black student (from Ghana), and three Hispanic students. One Asian American student will begin in January 2011. Recruiting students with backgrounds in geology and physics has also been difficult; most applications come from students with backgrounds in biology, followed by chemistry. The Department of Physics and Physical Oceanography is adding a combined BS physics and MS marine science with the hopes of retaining some of their superior undergraduates. A new BS in oceanography degree program is approved and will be implemented soon, and this should also produce students trained in geological and physical oceanography, some of whom may enter the MS marine science program.

The entire CMS Strategic Plan can be found in Appendix VII.

GENERAL PROGRAM CHARACTERISTICS

Administration

The Master of Science in marine science program is administered out of the Center for Marine Science and it reports to the Graduate School. This program is run by the CMS Associate Director for Education with guidance from the CMS Education Committee, which is composed of fourteen academic and research faculty and two graduate students in the various areas of marine science at UNCW.
This program is very dependent upon the Associate Director for Education; part of an additional faculty member’s time as an Assistant Director would ensure continuity when this person is out of the office for any reason, and also improve the efficiency of communications with students, applicants and faculty. The management of this program has become increasing complex with many different responsibilities, which include recruiting, resource allocation and justification, data management, course scheduling and advising for all new students, administration of the comprehensive exam, compiling various reports (Graduate School, SACS, CMS), frequent communication with students and faculty, and program assessment in addition to teaching and mentoring graduate students (Appendix V). Additional staff support would also be helpful.

**Time to Degree**

The average time to achieve a MS degree in marine science nationwide is 2.9 years, or 35 months (Consortium for Ocean Leadership data, October 2010). This long time frame reflects the challenges and unpredictability of doing field based research in marine science. The average time to degree in this program is 2.7 years, or 32 months. The time to degree at UNCW is therefore three months shorter than the national average, which is a whole summer, or almost a whole semester.

**Curriculum**

The curriculum is reviewed every year or two as questions or suggestions are received by the CMS Education Committee. There are four three-credit-hour core courses offered each year: BIO 564 Biological Oceanography, CHM 575 Chemical Oceanography, GLY 550 Marine Geology, and PHY 575 Physical Oceanography. Each course is graduate-only except for physical oceanography, which is cross-listed. Each graduate student must take at least three of these courses in order to graduate. Typically, we have approximately 10 to 15 graduate students in each of the core courses. These courses are rigorous; students often have to do additional work outside of class in order to strengthen their backgrounds in courses not in their undergraduate major. Students also must complete a course in scientific research methods, which can be taken through courses in the Department of Biology and Marine Biology (BIO 501), Department of Chemistry and Biochemistry (CHM 501) or Department of Geography and Geology (GLY 501), plus the seminar in marine science (MSC 595), and between three and six thesis hours (BIO 599, CHM 599, GLY 599 or PHY 599). Students also must obtain expertise in sampling and other field work because this is central to marine science. This is achieved in one of three ways: through research activities, by taking MSC 526 “Cruise and Field Sampling” or by taking CHMPHY 575 “Chemical and Physical Analysis of Seawater.” Students, after conferring with their faculty committees, select the balance of their required credit hours from courses offered by the participating departments.

**Required Courses**

**BIO 501. Methods in Scientific Research (2)** Scientific manuscript preparation and communication techniques: manuscript format, graphics, design of experiments, library use, oral presentation, and writing techniques. Two lecture hours each week.
OR


OR

GLY 501. Research Methods in Geology (2) Scientific proposal preparation, experimental design, scientific ethics, library use, safety, project management, data analysis, quality assurance and computer applications. One lecture and two laboratory hours per week.

Three of the following Core Courses:

BIO 564. Biological Oceanography (3) Prerequisite: Permission of instructor. Discussion of the recent oceanographic literature concerning nutrient cycling, distribution and regulation of oceanic productivity, and advances in methodologies used to study oceanic processes and controlling factors. Three lecture hours per week.


GLY 550. Marine Geology (3) Prerequisite: Consent of instructor. Topography, sediments, structure and geologic history of the marine and estuarine environment. Three lecture and three laboratory hours per week. Field trips.

PHY 575. Physical Oceanography (3) Prerequisite: Permission of instructor. An introduction to the descriptive and dynamical features of ocean circulation. Topics include: the physical properties of seawater; oceanic heat budget; dynamics of ocean currents; descriptive oceanography; waves and tides.

AND

MSC 595. Graduate Seminar (1) Discussion of research ideas and results by students and faculty. Preparation and presentation of research prospectus by student.

AND

BIO, CHM, GLY or PHY 599 (3-6) Thesis hours.

Other Marine Science Courses
**MSC 526. Cruise or Field Sampling (1)** Prerequisite: Permission of program director. Cruise and/or field sampling not covered by other courses. Participation in the planning and sampling phases of major marine or environmental research programs.

**MSC 579. (CHM 579)** Role of the Oceans in Human Health (3) Prerequisite: CHM 212, BIO 110, or consent of instructor. Discovery, structure, and biological activity of marine bioactive compounds, chemotaxonomy, pharmaceutical leads, marine biotoxins, structure, mode of action, regulation and monitoring, the producing organisms, how (biosynthesis) and why these compounds are made. Two lectures per week.

**MSC 591. Directed Independent Study (1-3)**

Although several new courses have been added that are important for marine science students (Appendix III), several have also been lost. The Department of Chemistry and Biochemistry has stopped offering two courses that were of interest to marine science students, CHM 578 Aquatic Toxicology (due to retirement) and CHM 574 Aquatic Chemistry. The Department of Geography and Geology has lost several marine faculty members, and they are currently in the process of recruiting and hiring. Depending upon their hires, several marine courses could be lost.

**Time Frame for Courses**

Students usually complete 25 to 30 credit hours of course work in their first year in order to make the best use of tuition support. Credit hours above nine in one semester have no additional cost. Once all 30 credit hours and all requirements are completed, students can enroll in Continuous Graduate Credit (GRC 600) for no credit hours. GRC 600 makes the students full time and costs approximately $150 per semester regardless of residency status. Continuation of GRC 600 is essential in maintaining the size of this program. After the completion of courses, students can focus completely on their research and any teaching responsibilities.

**Indicators of Success in the Graduate Program**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2004-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of graduates</td>
<td>69</td>
</tr>
<tr>
<td>External research funds (38 faculty advisors)</td>
<td>&gt;$65.4 million</td>
</tr>
<tr>
<td>External research funds (CMS 2010 only)</td>
<td>&gt;$38 million</td>
</tr>
<tr>
<td>Number of peer-reviewed publications with graduate students as authors or co-authors</td>
<td>&gt;43</td>
</tr>
<tr>
<td>Number of professional presentations with graduate students as authors or co-authors; approximately half have published abstracts</td>
<td>&gt;160</td>
</tr>
</tbody>
</table>

Students and faculty advisors have been very active in giving presentations, including many with published abstracts, with more than two per thesis on average. Most theses produced in this program result in one publication; many result in two (Appendix II). Because of the time lag in
publications, we expect to see more publications over the next two years from this group of graduates. The following plot shows the number of peer-reviewed publications per year since the program first in 2002 (closed symbols), which has increased steadily \( p = 0.02 \). The number of graduates per year has not increased (open symbols) hence the increase in publications reflects greater productivity per student. 2010 publications include those through October of 2010, and the number of graduates for 2010 assumes that three students will graduate in December of 2010.

Further evidence of our program’s success is from the retention and graduation rate of the 100 students enrolled between 2004-2010. Only three students have left the program during this time. Two students left for personal reasons and one will probably return to the program. One student left because he decided he was more interested in teaching than research, and he was accepted into a MA in teaching program at UNCC which allowed him to continue working as a high school science teacher while having all his tuition expenses paid by his graduate program. This 3% loss compares with a 10% loss during our first five years.

Students have been supported by many sources between 2004 - 2010: National Science Foundation, National Institute of Health, Sea Grant, NC Marine Biotechnology, and the Carolina Beach Fishing Club. The success of the program is also indicated by the acceptances of our graduates in doctoral programs at Duke University, Purdue University, the University of North Carolina at Chapel Hill, NC State University, the University of South Carolina, the University of Maryland, the University of Southern California, Stony Brook University (NY), VIMS, UVA Charlottesville, the University of Utrecht (the Netherlands), the University of Heidelberg (Germany), University of Ulster, and University of Victoria in Wellington, New Zealand. Graduates have also been successful in finding a variety of relevant positions upon graduation (see the graduates section of the program webpage www.unew.edu/mms).
CERTIFICATION, INTERDISCIPLINARY AND OTHER PROGRAMS

Two marine science students are also pursuing a Certificate in Environmental Studies. They can be enrolled in both programs at the same time, and some of the courses count in both programs. One graduate completed a Master’s in Public Administration and a MS in marine science. One graduate completed both a Certificate in Applied Statistics along with the MS in marine science. There has been a cooperative Ph.D. program in marine science between UNCW and North Carolina State University; however, there is no funding for this program, so it is not active at this time and has not been for many years. Using adjunct faculty status, several faculty members supervise or have supervised Ph.D. students who are enrolled at other universities including NCSU and UNCCCH. No MS marine science graduates have enrolled in the UNCW Ph.D. program in marine biology to date, although one will enter in the spring of 2011. One other graduate applied; however, there was limited funding available for her at the time, so she accepted a position at the Johns Hopkins University.

FACILITIES AND EQUIPMENT

Center for Marine Science

The Center for Marine Science (CMS) on Masonboro Sound along the Intracoastal Waterway south of Wrightsville Beach, North Carolina, was occupied in 2000. The original facility had 75,000 square feet of indoor research space. A new operations wing opened in 2008 with almost 20,000 square feet of space. The three physical oceanographers are housed in close proximity to each other in the OPS wing. CMS has a 700 ft pier capable of accommodating an 80 foot research vessel as well as a host of other smaller vessels. The RV Cape Fear, an aged 63-foot research vessel, operates out of the Center for Marine Science. A flowing seawater facility (capacity 450,000 gallons per day) provides scientists with raw, filtered and treated seawater for a host of research applications, including a recently renovated greenhouse. CMS also has several classrooms, a large auditorium and graduate student space. Currently 5 marine science graduate students are housed at CMS. Several students in the Master of Science in Marine Biology, Chemistry and Geology are also housed at CMS. A new 11,000 square foot research shellfish hatchery has recently opened (October 2010) on the CMS campus. One of the five MS marine science students will conduct her research at this hatchery. A new marine biotechnology MARBIONC building (69,000 square feet) is in the final design and planning stages, and is scheduled to open in 2012. MARBIONC is UNCW’s state supported economic development program for marine biotechnology research and development. The new building will house university scientists along with public and private groups interested in developing natural marine-based products for a wide variety of uses. Completion of the MARBIONC building will free up several faculty office/laboratory suites in the original CMS building; these could accommodate expansion and new faculty in marine disciplines.

Dobo Hall

Dobo Hall, occupied in 1996, is located on the College Road campus, and houses most of the Department of Chemistry and Biochemistry and much of the Department of Biology and Marine Biology. There are approximately 100,000 square feet of laboratory space. Dobo Hall has a large
instrument laboratory, clean room, environmental chambers, cold rooms, and many classrooms of various sizes. Dobo Hall houses an NMR spectroscopy facility with a 600 MHz NMR and a microscopy facility designed to accommodate light and electron microscopes. Dobo Hall currently houses seven marine science students, as well as graduate students in marine biology, biology and chemistry.

**DeLoach Hall**

DeLoach Hall houses the Departments of Geography and Geology and Physics and Physical Oceanography. Currently five marine science students currently reside there. Several graduate students in the geology MS program are housed in DeLoach Hall; the Department of Physics and Physical Oceanography does not have a graduate program at this time.

**Friday Hall**

Three marine science students are housed in Friday Hall. Friday Hall houses the department of Environmental Studies and part of the Department of Biology and Marine Biology. The Department of Biology and Marine Biology maintains a modern 2250 square foot greenhouse adjacent to Friday Hall, as well as a vertebrate range; an herbarium adjacent to Friday Hall. The greenhouse provides facilities for faculty and student research projects and for laboratory exercises. The vertebrate range provides a place for preparation and storage of vertebrate research and teaching collections and provides for research and study involving vertebrate animals. The herbarium is the repository for dried collections of algae, fungi, bryophytes and vascular plants. The function and activities of the herbarium include documentation of the vegetation of the regions in which the specimens are collected, serving as a source of teaching and research material, engaging in exchange programs with selected universities, providing loans of specimens to other institutions and individuals in taxonomic research and serving as a source of information to persons interested in the identification of plants.

**Wrightsville Beach Aquaculture Facility**

Marine science students with interests in aquaculture conduct their research at the UNCW Aquaculture Facility at Wrightsville Beach. Currently there are six students working with one faculty advisor and one research faculty member at the Aquaculture Center; their offices are located a short distance (1 mi) from the Aquaculture Facility. Other faculty advisors active in aquaculture and their students are housed at CMS or on the main campus. Research at the Aquaculture Facility currently focuses on the controlled breeding of marine finfish, larval and juvenile culture, the development of recirculating technologies for the land-based production of marine species to marketable sizes, and integrated polyculture as a means of reducing the environmental impacts of aquaculture. There are several broodstock holding systems, a larviculture laboratory, a pilot scale hatchery with live feeds production systems, and a variety of experimental and pilot scale recirculating growout tank systems. Culture facilities are supported by on-site laboratories for water quality analyses, feeds preparation, and biochemical analyses of fish feeds and tissues.
With the exception of those housed in DeLoach Hall, marine science faculty and students for the most part are housed in new and well maintained buildings with excellent laboratories. Faculty and students are scattered among seven buildings on three different campuses, which hinders a sense of cohesiveness in the program. Also, there is little space available for growth, or for new faculty, on the main campus.

**Library Facilities**

Library facilities are more than adequate for this program; librarians are keeping up-to-date with new search methods and many journal articles are available electronically.

**Equipment Available to Graduate Students**

A list of equipment available to graduate students in this program can be found in Appendix IV.

**PERSONNEL**

The table on the following two pages lists the 38 current tenured and tenure track faculty members who are currently serving or have recently served (since 2004) as advisors for marine science graduate students. These advisors include 13 faculty in marine biology, 8 in marine chemistry, 8 in marine geology/geography, 3 in physical oceanography, one in environmental economics, and 4 CMS research scientists in biology or aquaculture. Curriculum vitae for these faculty members are located in Appendix I to this document. Part of one administrative assistant’s time is assigned to this program. There have also been 23 postdoctoral fellows who have been involved in the teaching and research missions of the program over this time period, including 10 through the Business of Biotechnology program and three supported by CMS in support of this master’s program, with the rest supported by research grants to individual faculty members. There have also been numerous faculty from other institutions who have served on committees; this information can be found on the Graduates webpage (http://uncw.edu/mms/graduates.htm).

Faculty members who serve as advisors for current marine science graduate students or who have been advisors for graduates of the program since 2004.

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Date of Hire</th>
<th>Highest Degree Earned</th>
<th>Graduating Institution</th>
<th>Areas of Expertise and Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewis Abrams</td>
<td>Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>University of Rhode Island</td>
<td>Coastal Geology and Geophysics</td>
</tr>
<tr>
<td>G. Brooks Avery</td>
<td>Associate Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>UNC-Chapel Hill</td>
<td>Biogeochemical cycling in sediments, the water column, and the atmosphere</td>
</tr>
<tr>
<td>Daniel G. Baden</td>
<td>Professor</td>
<td>1999</td>
<td>Ph.D.</td>
<td>University of Miami</td>
<td>Isolation and structural identification of toxins from bloom algae.</td>
</tr>
<tr>
<td>Jeffrey</td>
<td>Associate</td>
<td>1997</td>
<td>Ph.D.</td>
<td>Louisiana State</td>
<td>Cell biology, evolution, and</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Year</td>
<td>Degree</td>
<td>Institution</td>
<td>Research Area</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
<td>------</td>
<td>--------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>Craig Bailey</td>
<td>Professor</td>
<td>2007</td>
<td>Ph.D.</td>
<td>University</td>
<td>systematics of marine and freshwater algae.</td>
</tr>
<tr>
<td>Frederick Bingham</td>
<td>Professor</td>
<td>1994</td>
<td>Ph.D.</td>
<td>Scripps Institute of Oceanography</td>
<td>Physical Oceanography</td>
</tr>
<tr>
<td>Stuart Borrett</td>
<td>Assistant Professor</td>
<td>2007</td>
<td>Ph.D.</td>
<td>The University of Georgia</td>
<td>Quantitative ecology, ecosystem modeling</td>
</tr>
<tr>
<td>Lawrence Cahoon</td>
<td>Professor</td>
<td>1982</td>
<td>Ph.D.</td>
<td>Duke University</td>
<td>Benthic microalgal production, nutrient cycling, water quality</td>
</tr>
<tr>
<td>William Cleary</td>
<td>Professor (retired)</td>
<td>1972</td>
<td>Ph.D.</td>
<td>University of South Carolina</td>
<td>Coastal Geology</td>
</tr>
<tr>
<td>Christopher Dumas</td>
<td>Associate Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>U. of California - Berkeley</td>
<td>Environmental and Natural Resource Economics</td>
</tr>
<tr>
<td>Michael Durako</td>
<td>Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>University of South Florida</td>
<td>Restoration, physiological ecology of seagrasses</td>
</tr>
<tr>
<td>Wilson Freshwater</td>
<td>Research Analyst</td>
<td>1995</td>
<td>Ph.D.</td>
<td>UNC-Chapel Hill</td>
<td>Molecular systematics and evolution of marine plants and algae</td>
</tr>
<tr>
<td>Douglas Gamble</td>
<td>Associate Professor</td>
<td>2000</td>
<td>Ph.D.</td>
<td>University of Georgia</td>
<td>Applied Climatology</td>
</tr>
<tr>
<td>Nancy Grindlay</td>
<td>Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>University of Rhode Island</td>
<td>Tectonics of submarine transform, convergent, and divergent plate boundaries</td>
</tr>
<tr>
<td>Joanne Halls</td>
<td>Associate Professor</td>
<td>1999</td>
<td>Ph.D.</td>
<td>University of South Carolina</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>Eric Henry</td>
<td>Associate Professor</td>
<td>2002</td>
<td>Ph.D.</td>
<td>University of Arizona</td>
<td>Hydrology, Water Resources</td>
</tr>
<tr>
<td>Paul Hosier</td>
<td>Professor</td>
<td>1972</td>
<td>Ph.D.</td>
<td>Duke University</td>
<td>Plant Ecology, Ecology of Coastal Vegetation</td>
</tr>
<tr>
<td>Patricia Kelley</td>
<td>Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>Harvard University</td>
<td>Invertebrate Paleontology</td>
</tr>
<tr>
<td>Robert J. Kieber</td>
<td>Professor</td>
<td>1989</td>
<td>Ph.D.</td>
<td>University of Maryland</td>
<td>Air/sea exchange processes; Metal ion speciation in natural waters</td>
</tr>
<tr>
<td>Thomas Lankford</td>
<td>Associate Professor</td>
<td>2000</td>
<td>Ph.D.</td>
<td>University of Delaware</td>
<td>Ichthyology and Fish Biology</td>
</tr>
<tr>
<td>Lynn Leonard</td>
<td>Professor</td>
<td>1994</td>
<td>Ph.D.</td>
<td>University of South Florida</td>
<td>Coastal Hydrology and Sedimentology</td>
</tr>
<tr>
<td>Michael Mallin</td>
<td>Research Professor</td>
<td>1992</td>
<td>Ph.D.</td>
<td>UNC-Chapel Hill</td>
<td>Aquatic and Estuarine Ecology</td>
</tr>
<tr>
<td>Dylan McNamara</td>
<td>Assistant Professor</td>
<td>2008</td>
<td>Ph.D.</td>
<td>University of California San Diego</td>
<td>Physical oceanography. Coupled human-environmental systems;</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
<td>Year</td>
<td>Degree</td>
<td>Institution</td>
<td>Field</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------</td>
<td>------</td>
<td>--------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Ralph N. Mead</td>
<td>Assistant Professor</td>
<td>2007</td>
<td>Ph.D.</td>
<td>Florida International University</td>
<td>Marine Organic Geochemistry</td>
</tr>
<tr>
<td>John Miller</td>
<td>Professor</td>
<td>2006</td>
<td>Ph.D.</td>
<td>Texas A&amp;M University</td>
<td>Descriptive physical oceanography, general ocean circulation, Ocean Observing Systems</td>
</tr>
<tr>
<td>D. Ann Pabst</td>
<td>Professor</td>
<td>1995</td>
<td>Ph.D.</td>
<td>Duke University</td>
<td>Marine Mammalogy</td>
</tr>
<tr>
<td>Martin Posey</td>
<td>Professor</td>
<td>1989</td>
<td>Ph.D.</td>
<td>University of Oregon</td>
<td>Estuarine Ecology</td>
</tr>
<tr>
<td>Steve Ross</td>
<td>Research Associate</td>
<td>2003</td>
<td>Ph.D.</td>
<td>North Carolina State University</td>
<td>Deep sea ichthyology, deep corals</td>
</tr>
<tr>
<td>Richard Satterlie</td>
<td>Professor</td>
<td>2004</td>
<td>Ph.D.</td>
<td>University of California, Santa Barbara</td>
<td>Control of locomotion, and Locomotory speed, in marine invertebrates</td>
</tr>
<tr>
<td>Frederick Scharf</td>
<td>Associate Professor</td>
<td>2003</td>
<td>Ph.D.</td>
<td>University of Massachusetts</td>
<td>Fisheries Biology</td>
</tr>
<tr>
<td>Pamela Seaton</td>
<td>Professor</td>
<td>1988</td>
<td>Ph.D.</td>
<td>University of Vermont, Burlington</td>
<td>Bioorganic chemistry</td>
</tr>
<tr>
<td>Ronald Sizemore</td>
<td>Professor</td>
<td>1981</td>
<td>Ph.D.</td>
<td>University of Maryland</td>
<td>Marine Microbiology</td>
</tr>
<tr>
<td>Stephen A. Skrabal</td>
<td>Professor</td>
<td>1996</td>
<td>Ph.D.</td>
<td>University of Delaware</td>
<td>Trace metal estuarine and sediment marine science</td>
</tr>
<tr>
<td>Bongkeun Song</td>
<td>Associate Professor</td>
<td>2004</td>
<td>Ph.D.</td>
<td>Rutgers</td>
<td>Marine microbial communities dynamics in C and N cycles</td>
</tr>
<tr>
<td>Carmelo Tomas</td>
<td>Professor</td>
<td>1999</td>
<td>Ph.D.</td>
<td>University of Rhode Island</td>
<td>Marine Phytoplankton</td>
</tr>
<tr>
<td>Wade Watanabe</td>
<td>Research Professor</td>
<td>1997</td>
<td>Ph.D.</td>
<td>University of Hawaii</td>
<td>Finfish Aquaculture</td>
</tr>
<tr>
<td>Ami Wilbur</td>
<td>Associate Professor</td>
<td>1999</td>
<td>Ph.D.</td>
<td>University of Delaware</td>
<td>Shellfish Genetics and Mariculture</td>
</tr>
<tr>
<td>Joan D. Willey</td>
<td>Professor</td>
<td>1977</td>
<td>Ph.D.</td>
<td>Dalhousie University</td>
<td>Trace metal speciation in rain and seawater, air-sea exchange processes</td>
</tr>
<tr>
<td>Jeffrey L. Wright</td>
<td>Professor</td>
<td>2000</td>
<td>Ph.D.</td>
<td>University of Glasgow</td>
<td>Isolation and identification of bioactive compounds from marine organisms</td>
</tr>
</tbody>
</table>
Faculty from other institutions who have served on UNCW Master of Science in marine science student committees since 2004.

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Home Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeffrey A. Buckel</td>
<td>Department of Biology</td>
<td>NCSU</td>
</tr>
<tr>
<td>John S. Burke</td>
<td>National Marine Fisheries Service</td>
<td>NOAA, Beaufort, NC</td>
</tr>
<tr>
<td>Gregory P. Dietl</td>
<td>Department of Zoology</td>
<td>NCSU</td>
</tr>
<tr>
<td>Daniel Kamykowski</td>
<td>Marine, Earth and Atmospheric Sciences</td>
<td>NCSU</td>
</tr>
<tr>
<td>Mark Helvey</td>
<td>National Marine Fisheries Service</td>
<td>NOAA, CA</td>
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<tr>
<td>Thomas Losordo</td>
<td>Department of Biological and Agricultural Engineering</td>
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<tr>
<td>Len Pietrafesa</td>
<td>Marine, Earth and Atmospheric Sciences</td>
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</tr>
<tr>
<td>Parke A. Rublee</td>
<td>Biology</td>
<td>UNC Greensboro</td>
</tr>
<tr>
<td>John Schoolfield</td>
<td>NC Division of Marine Fisheries</td>
<td>NC Dept. of Natural Resources and Environment</td>
</tr>
<tr>
<td>Harvey E. Seim</td>
<td>Department of Marine Sciences</td>
<td>UNC Chapel Hill</td>
</tr>
</tbody>
</table>

GRADUATE STUDENTS

Student Application Data

The Master of Science in marine science program at UNCW has enrolled students from almost all of the UNC campuses, several private schools in NC and universities in many other states. Thirty seven percent of the students and graduates during this time period completed their undergraduate degrees at UNCW. International students have come from Finland, Italy, England, Cyprus, Ghana, and Puerto Rico.

Application data are shown below by year in the following graph.
Several observations can be made from these data.

1. The program has become more selective, going from approximately a 90% acceptance rate in the first two years to an acceptance rate of one third to two thirds in the two most recent years.

2. Most students who are accepted enroll in the program.

3. The number of applications peaked for admittance in academic years 2001-2002 and 2002-2003, probably because this was the time period when the Glaxo Wellcome Oceans and Human Health grant was active, and this was advertised on the program website.

Grade point average (GPA) and Graduate Record Exam (GRE) scores for full time students enrolled for the time periods indicated are listed below. The Master of Science in marine science program does not require a subject test because our students come from many different backgrounds, some of which do not have GRE subject tests, for example marine science or environmental science.

**Average GPA and GRE scores for all applicants, for all full time students who enrolled, and for the current students and the graduates for the Master of Science in between 1998-2003. n = number, NR = not relevant.**

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>GPA last 60 hrs</th>
<th>GRE V</th>
<th>GRE Q</th>
<th>GRE A</th>
<th>GRE new A</th>
</tr>
</thead>
<tbody>
<tr>
<td>All applicants</td>
<td>165</td>
<td>3.27</td>
<td>491</td>
<td>603</td>
<td>625</td>
<td>4.69</td>
</tr>
<tr>
<td>Enrolled</td>
<td>55</td>
<td>3.34</td>
<td>487</td>
<td>596</td>
<td>629</td>
<td>4.75</td>
</tr>
<tr>
<td>Current</td>
<td>32</td>
<td>3.38</td>
<td>493</td>
<td>595</td>
<td>637</td>
<td>4.75</td>
</tr>
<tr>
<td>Graduates</td>
<td>23</td>
<td>3.00</td>
<td>481</td>
<td>610</td>
<td>642</td>
<td>NR</td>
</tr>
</tbody>
</table>
Average GPA (last 60 credit hours) and GRE scores for all applicants, for all students who enrolled, and for the current students in the Master of Science in between 2004 - 2010. n = number. The two numbers for the GRE A are the newer scores vs the older scores. nd = data not compiled. The average UNCW graduate school GPA for the 69 graduates is 3.68.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>GPA Last 60 Hrs</th>
<th>GRE V</th>
<th>GRE V %</th>
<th>GRE Q</th>
<th>GRE Q %</th>
<th>GRE A</th>
<th>GRE A %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All applicants</td>
<td>161</td>
<td>3.37</td>
<td>487</td>
<td>56</td>
<td>627</td>
<td>55</td>
<td>4.2</td>
<td>47</td>
</tr>
<tr>
<td>Enrolled</td>
<td>100</td>
<td>3.45</td>
<td>496</td>
<td>58</td>
<td>631</td>
<td>55</td>
<td>4.3</td>
<td>48</td>
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<tr>
<td>Current</td>
<td>31</td>
<td>3.40</td>
<td>506</td>
<td>60</td>
<td>633</td>
<td>56</td>
<td>4.4</td>
<td>53</td>
</tr>
<tr>
<td>Graduates</td>
<td>69</td>
<td>3.43</td>
<td>499</td>
<td>nd</td>
<td>622</td>
<td>nd</td>
<td>4.4, 612</td>
<td>nd</td>
</tr>
</tbody>
</table>

The ETS (Educational testing Service) reports that for the approximately one and a half million students that took the test between 2006 and 2009, the mean scores were 456 (V), 590 (Q) and 3.8 (A), for students in the life sciences the means were 453 (V), 574 (Q) and 4.0 (A), and in the physical sciences 482 (V), 691 (Q), and 4.0 (A) (www.ets.org/gre/stupubs). The current students and graduates of this program had scores above the means of each of these three groups except for the quantitative mean of the physical science majors.

These data show:

1. Applicants are of good quality and in general are acceptable as students based on test scores and GPA.
2. The GPA of students enrolled in this program has improved over time ($p < 0.001$); test scores do not show a trend ($p > 0.05$).

3. Students who enroll are as qualified as the applicant pool in general, so this program is not disproportionately failing to recruit good students, nor settling for the less qualified students.

**Admission Criteria**

Applicants seeking admission to the graduate program in marine science are required to submit the following to the Graduate School:

1. An official application for graduate admission
2. Official transcripts of all college work (undergraduate and graduate)
3. Official scores on the Graduate Record Examination (verbal, quantitative, and analytical)
4. Three recommendations by individuals in professionally relevant fields
5. Statement of research interests, including names of several faculty members who are conducting research of interest to the applicant.

A bachelor's degree with a concentration in a natural science or mathematics from an accredited college or university in this country or its equivalent in a foreign institution based on a four year program is required for admission, along with a "B" average or better in the student's major. In general, students must have a faculty advisor agree to accept them before they can be admitted. Undergraduate grades, GRE scores, recommendations and statements of research interest are used in concert in making admission decisions, which are made by the program director and the faculty advisor. Occasionally, students with low GPA or GRE scores are accepted provisionally (or as non-degree seeking students) and are required to prove that they can succeed in our program by earning a B or better on all graduate course work taken during their first semester or year. The majority of these students become very successful graduate students and graduate.

**Recruiting**

The marine science program recruits students primarily through maintaining a current and interesting web site, which includes a page with information and photos of current students and one for graduates including their placement upon graduation (http://www.uncw.edu/mms/). This web site describes our program and has links to individual faculty web pages and to the Graduate School for direct access to application materials. Prospective students often visit UNCW before they decide to come; they talk with faculty and graduate students. Most enroll at UNCW after their visit.

Recruiting physical oceanography students has been extremely difficult because of the low numbers of physics majors nationwide, the low financial package offered by UNCW and the lack of a marine science Ph.D. at UNCW. The Department of Physics and Physical Oceanography is in the process of implementing a combined BS/MS program to try to alleviate the low graduate student numbers in this area. Students in this program begin research projects as young
undergraduates and take a carefully planned sequence of courses, with the goal of obtaining a BS degree in physics and a MS degree in marine science in approximately five years.

Degree Requirements

The degree requirements for the marine science graduate program as defined in the Graduate Catalogue are:

1. The Master of Science in marine science will require a minimum of 30 semester hours of graduate study. These credits may come from the student's major area of study as well as graduate courses offered by other departments as approved by the student's advisory committee. The student's advisory committee should include a minimum of three faculty members from at least two departments.

2. The courses most appropriate for each student will be determined by the student's advisory committee, with the expectation that a student will usually take no more that 12 credit hours from those courses cross-listed as 400/500. Each student must complete at least three of the following core courses: biological oceanography, chemical oceanography, marine geology and physical oceanography.

3. Transfer work must be equivalent to a "B" or better, and courses must be acceptable to the student's advisory committee. A minimum of 24 semester hours of graduate study must be completed in residence.

4. The student must successfully complete a written comprehensive examination based on their core courses, and an oral exam on their research area. Students must also submit a prospectus that includes a course plan, literature review and research proposal, and that is acceptable to the student’s advisory committee.

5. Each student must complete a thesis, based on original research, acceptable to the student's advisory committee and to the Graduate School. Each student will present a public seminar on his or her research project. The seminar will be followed by an oral defense of the thesis, conducted by the student's advisory committee.

6. The program shall be completed within five years of the date of first registration for graduate study.

Students must also acquire field sampling experience, which can be documented in one of three ways: through research activities, or through taking either MSC 526 “Cruise and Field Sampling” or CHM/PHY 576 “Chemical and Physical Analysis of Seawater.”

Advising

Students are provided with two orientation sessions, a general one through the Graduate School prior to the start of classes, and one specifically for marine science students given by the program director during the first week of classes. The Marine Science Graduate Student
Handbook is provided to all new students; this was revised in the spring of 2010 and can be found in Appendix VI. If the new student has a faculty advisor when they enroll, and most do, the faculty advisor and the program director both give advice on courses to take. All students have a faculty advisor by the end of their first semester in residence.

All full time students also enroll in an introduction to scientific research course (BIO, CHM or GLY 501) during their first year, usually in their first semester. This course helps students define a research project for their thesis work. During this time, the student selects a thesis committee, which also provides the student with advising and mentoring. Through this advising network, every effort is made to help students remain in good academic standing and move steadily towards thesis defense and graduation.

**Student Expenses and Support**

Currently the projected graduate tuition for fall 2011 is $3,185 / semester for in-state and $8,359 per semester for out-of-state students, or $6,370 per year and $16,718 per year, respectively, for a total estimated cost of attendance of $19,230 and $29,944 respectively (http://www.uncw.edu/finaid/costofattendance.htm). Once all 30 credit hours and all requirements are completed, students can enroll in Continuous Graduate Credit (GRC 600) for no credit hours GRC 600 makes the students full time and costs approximately $150 per semester regardless of residency status, reducing total estimated cost of attendance to approximately $12,800 per year. Continuation of GRC 600 is essential for maintaining the current size of this program.

This program receives funds for twelve graduate teaching assistantships (TAs) from the Graduate School each year, which are split between first and second year students. The TA stipend is $11,000 for the academic year. This is substantially less than TAs receive in MS programs at most other UNC campuses. Students can be supported by a TA for a maximum of five semesters, and there are no TAs in the summer months. Additionally, many students are funded by research assistantships provided by faculty with research grants. A few students typically are supported by internships or fellowships. Occasionally students are fully employed throughout their graduate work and do not request additional support.

Partial tuition support is provided for full time students through tuition scholarships awards and out-of-state tuition remissions. The Graduate School allocates 8 out-of-state tuition remissions per year to this program. Out-of-state remissions are preferentially given to first year students; students are encouraged to complete most of their coursework in the first year so their tuition is greatly reduced after that. The tuition scholarship money from the Graduate School ($9,500 per academic year) typically is awarded to in-state students, however occasionally it is given to an especially qualified out-of-state student as a recruiting tool. A new Scholar Award ($1,000) is also provided by the Graduate School to assist with recruitment of a highly qualified student each year. In the last few years, CMS has provided additional research support to this program which helps to cover tuition and living expenses; however, very few students have full tuition coverage. CMS provides funds for two Merritt Fellowships each year. These are named for our former director of CMS, and they pay $16,000 per 12 month year, plus (with the help of tuition remissions from the Graduate School) all tuition expenses.
Summer financial support has been provided to most full-time graduate students through research grants to faculty. Occasionally one student per summer is awarded a Summer Research Scholarship ($1,000) from the Graduate school. Between one and five students typically receive a CMS summer stipend of $1,000. Several students have no support in the summer; some work on their research and some take summer jobs.

Graduate students can receive up to $400 from the Graduate School and an additional $400 from CMS for travel to professional meetings to present their research. Most students go to meetings and receive support from both of these sources.

Support of graduate students also includes providing each full time student with office space and access to computers, either directly in their office or in a computer lab.

**Graduate Teaching Assistant Assignments**

Marine science graduate teaching assistantships are divided approximately equally among the five participating departments. Marine science graduate teaching assistantships are nominally 20 hours per week. Students are assigned to teach in the subject area closest to their undergraduate major. Their teaching assignments are made by the graduate coordinator of that department, and they undergo the same training as the TAs in that department. TAs usually teach laboratory sections, assist in laboratory preparations, grade papers, or conduct help sessions. TAs do not individually conduct classroom instruction. Most of our TAs enjoy teaching the labs and find that they must more thoroughly learn the material to be able to teach it to the students. Formal teaching experience is also an important feature in resumes.

**Student Placement**

The marine science Master of Science program has been very successful in placing graduates in relevant positions over the lifetime of this program. The placement of our graduates in relevant employment or in Ph.D. programs is close to 100%, even for the December 2010 graduates, as shown on the graduates webpage (http://uncw.edu/mms/graduates.htm). Two graduates have been awarded and completed NOAA Dean John Knauss Marine Policy Fellowships and one more will begin in February 2011. Of the 69 graduates between 2004 – summer 2010, 30 remained in NC after graduation (43%) and 39 went elsewhere (53%). Placement by job category is shown in the following table. Teaching includes high school and community college.

<table>
<thead>
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<th>Government</th>
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<td>= 10</td>
<td></td>
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<td>Non-profits = 3</td>
<td>Home = 1</td>
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<tr>
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AFFIRMATIVE ACTION

UNCW STATEMENT ON DIVERSITY IN THE UNIVERSITY COMMUNITY

Revised January 1, 2010

In the pursuit of excellence, UNC Wilmington actively fosters, encourages, and promotes inclusiveness, mutual respect, acceptance, and open-mindedness among students, faculty, staff, and the broader community. Diversity is an educational benefit that enhances the academic experience and fosters free exchange of ideas from multiple perspectives. Diversity includes, but is not limited to race, sex, age, color, national origin (including ethnicity), creed, religion, disability, sexual orientation, political affiliation, veteran’s status, gender, educational disadvantage, socio-economic circumstances, language, and history of overcoming adversity. More information can be found on the UNCW Human Resources webpage

http://www.uncw.edu/hr/employment-affirmative.html

The MS marine science program supports the above statement and strives to maintain diverse student populations. However, diversity is very low in marine science programs nationwide.

“The geosciences, including oceanography and ocean sciences, trail all other science, engineering, technology and math fields in numbers of degrees granted to underrepresented minorities (African Americans, Hispanic/Latinos, Native Americans and Pacific Islanders). Approximately 4% of all earth, atmospheric and ocean science degrees are conferred to minorities (or 5.5% for oceanography, specifically.) Considering that underrepresented minority students comprise nearly 25% of all university degrees earned in the US, our fields are far behind in engaging minority students as majors and in maximizing the full human resources potential of students entering the geoscience workforce” (Cindy Martinez, American Geological Institute, 2010, Ocean Science Education Retreat, Consortium for Ocean Leadership, Washington DC, October 20, 2010).

The MS marine science program at UNCW has had 3.25% minority enrollment as defined by the National Science Foundation (African Americans, Hispanic/Latinos, Native Americans and Pacific Islanders) over the 13 year history. The program is currently around 60% female, and the graduates are also approximately 60% female. Both numbers are consistent with the Consortium for Ocean Leadership data for marine science programs nationwide. When a minority student self-identifies as minority on the application, and the applicant meets admission standards, every effort is made to find full funding for that applicant. All minority students, like all our students, are carefully mentored by their faculty advisors and by the program director.

SUMMARY OF RESEARCH AND SCHOLARSHIP IN MARINE SCIENCE

Publications and Presentations

Copies of abbreviated faculty members’ vitae including lists of publications during the preceding five to seven years are included in Appendix I. Appendix II contains a list of publications with
MS marine science graduate students as co-authors. Most theses result in at least one publication, and an average of two presentations at regional, national or international scientific meetings. As evidenced from Appendices I and II, the marine science faculty have an impressive record of publication which is appropriate for active researchers. Many of these publications appear in the most prestigious journals in the field, including Aquaculture Research, Biogeochemistry, Deep Sea Research, Global Biogeochemical Cycles, Harmful Algae, Hydrobiologia, Journal of Geophysical Research, Limnology and Oceanography, Marine Biology, Marine Chemistry and Microbial Ecology. The impact of the marine science faculty is not limited to journal articles; the faculty has also published a variety of reports, abstracts, book chapters and instructor’s manuals. The breadth and scope of scholarly activity is a testament to the high caliber of research conducted by our faculty and graduate students.

**External Support, Faculty Research Grants**

The 38 marine science faculty advisors have received more than $65.4 million in external funds between 2004 and 2010. The Center for Marine Science has received more than $38 million in 2010 alone. Many students are supported by grants as research assistants, and their research expenses are usually funded by external grants to individual or groups of faculty members. The funding received in marine science has been broad-based and spread over many research areas, which reflects the breadth and depth of our interdisciplinary research programs. Grants have been obtained from a wide array of funding sources including both federal and state agencies. Many of these awards have come from the most competitive programs in the country including but not limited to the National Science Foundation, the National Institute of Health, US Department of Agriculture, National Institute of Environmental Health Sciences, National Marine Fisheries, Sea Grant and NOAA, many of which typically have funding success rates less than 30 percent.

**Faculty Review Activity and Leadership Roles**

The marine science faculty play leadership roles in their discipline through a variety of different activities. Marine science faculty advisors review many manuscripts per year for over one hundred different journals, including Marine Biology, Marine Chemistry, Marine Geology, the Journal of Physical Oceanography, the Journal of Geophysical Research, Science, Organic Geochemistry, Estuarine Coastal Shelf Science, Nature Geosciences and many specialized journals. Faculty have served on editorial boards for Harmful Algae, Transitional Waters, Annals of Biology, Marine Ecology PZN, Marine Ecology Progress Series (MEPS), Palaios, the Journal of the World Aquaculture Society, the Journal of Aquaculture (Korean Aquaculture Society), Journal of the Elisha Mitchell Scientific Society, Ecology and the Journal of Experimental Marine Biology. Faculty commonly also review manuscripts for book chapters as well. Marine science faculty advisors also review grant proposals for over 40 different federal and state granting agencies, including NSF, NASA, NIH, national Sea Grant, many state Sea Grants, EPA, National Geographic Society, NOAA and US Department of Agriculture. Marine science faculty advisors serve on many different advisory boards for example International Council for Exploration of the Sea, Coral Advisory Panel of South Atlantic Fishery Management Council, National Oceanographic Partnership Program review panel, D/UNCOC Advisory Board, Science Advisory Council to NOAA Cooperative Institute for Ocean Exploration, Research, and

International Activities

Marine science is and always has been an inherently international endeavor. Every ocean borders on many different countries and cultures. Management of global marine challenges requires international cooperation. In keeping with this idea, marine scientists at UNCW are very involved in international collaborations. A few examples follow, and all of these have involved students.

**Dr. Carmelo Tomas** currently has an EPA grant to run training workshops on identification of harmful algae in the Gulf of Mexico in five different Mexican states. He also collaborates with colleagues at the University of Oslo and the Norwegian Institute of Water Studies on invasive harmful algae species in Norwegian coastal waters. Dr. Tomas has ongoing projects with the University of Salento in Lecce, Italy, and the Zoological Station in Naples, Italy. **Dr. Wilson Freshwater** has an NSF grant to update the marine algal flora of Panama, and to develop phyecological expertise and collaboration among Central American researchers. Two Central American marine algal workshops have been held as part of the second goal; these workshops included researchers from Venezuela, Columbia, Costa Rica, Nicaragua, Mexico, Cuba, Egypt, Malaysia, Germany, France and the US. An additional workshop emphasizing the participation of Panamanian students (at the University of Panama) will be held this coming summer 2011. The Marine and Atmospheric Chemistry Research Laboratory (**Drs. Brooks Avery, Robert Kieber, Ralph Mead, Stephen Skrabal and Joan Willey**) has an ongoing rainwater-seawater interaction study, and they have collected rain and seawater samples from Bermuda, New Zealand, and India, and they soon will be collaborating with scientists at the University of São Paulo, Brazil on the effects of ethanol combustion on rainwater composition. This group is also working with a colleague at Southampton University, UK, planning an estuarine chemistry project. **Dr. Patricia Kelley** has a grant from the National Geographic Society to study latitudinal variation in shell-drilling gastropod predation along the coast of Brazil and Argentina in collaboration with Argentinian colleagues. **Dr. John Morrison** is conducting research at the Charles Darwin Research Station, Galapagos Islands, Ecuador designed to build climate relevant criteria into Galápagos Management design based on high resolution nested-grid hydrodynamic modeling. Other faculty linkages include collaborations with colleagues in Puerto Rico, France, Spain, Belgium, Chile, Belize and Curaçao.
The Center for Marine Science at UNCW has an exchange program with the University of Southampton’s School of Ocean & Earth Science, which is based at the National Oceanographic Center, United Kingdom. This program, which is still evolving, includes student exchanges at the BS, MS and PhD level, as well as exchanges for faculty. Planning is underway for an exchange of field training courses at the MS level. This program enjoys financial support through the Gillings Family Foundation.

Community Service Related to Program Goals

The marine science program is committed to community outreach in our local region. Faculty provide exemplary community service to southeastern North Carolina consistent with the mission of the university and CMS. Many of the projects conducted by marine science faculty are good examples of science in service to the community. Several of the faculty serve as science advisors to local television and radio stations and newspapers. Many of our faculty also do outreach to local elementary, middle and high schools where they try and instill in these young students a sense of wonder about scientific discovery. Some faculty serve as mentors to individual students or science projects. Other faculty serve as judges in local science fairs and conduct other program evaluations for several non-profit organizations. UNCW was host to the statewide Ocean Science Bowl for high school students for the last two years. In addition to faculty participation in the Ocean Science Bowl, many marine science graduate students have contributed by serving as judges, moderators or recorders for this large event.

STRENGTHS, NEEDS AND CHALLENGES

Strengths

1. The professional energy, expertise, accomplishments and reputation of the faculty in this program are the greatest strengths of the program.

2. Success of the graduates as indicated by the close to 100% placement in relevant positions even for the December 2010 graduates (http://uncw.edu/mms/graduates.htm).

3. Access to core facilities at CMS plus instrumentation on campus. Unlike many marine programs which have their marine labs located several hours away from the main campus, the UNCW Center for Marine Science is only seven miles from the main campus.

4. Diversity of research areas and access to a wide variety of marine environments in which to conduct research, including riverine, estuarine, coastal, and open ocean waters, as well as fresh and salt water marshes and barrier island habitats.

5. Diverse student backgrounds including animal industries, applied mathematics, biology, botany, marine biology, chemistry, biochemistry, geology, marine geology, engineering, environmental science, marine science, education, meteorology, natural resources, physics, wildlife and fisheries science and zoology bring different points of view to this program.

6. Graduate students have many opportunities to teach undergraduate labs and mentor younger
students in research, including undergraduates and new graduate students.

7. Many postdoctoral fellows bring new scientific expertise to UNCW, and extensive international collaborations provide students with unique opportunities and exposure to new ideas.

Needs

1. UNCW needs to increase assistantship amounts and tuition support in order to offer prospective students a competitive package. This is necessary to attract and retain highly qualified students. This program needs to have 20 teaching assistantships, as compared to the current 12. Additional assistantship and tuition support would allow growth in the number and improvement in the quality of students in this program. Concomitant with this need is the need for increased numbers of students to be covered by research assistantships from faculty research grants. Faculty who have research grants can pay students more than the TA amount, but usually do not. More grant supported research assistantships could ultimately lead to relaxation of TA stipend need, instead offering the TA opportunity as a training opportunity instead of a funding need.

2. Graduate faculty time for mentoring graduate students is threatened by high and increasing teaching loads, increasing undergraduate class sizes, and increasing administrative duties. Administrators who formerly assisted faculty with their teaching, research, and grant applications have become consumed with assessment and accountability.

3. In support of marine science, UNCW/CMS owns and operates R/V CAPE FEAR as a research and education support facility. The R/V CAPE FEAR, originally designed and used as a commercial fishing vessel, was purchased by UNCW in 1996 and converted to a research vessel. The 63’ (19 m), 23-year old vessel is nearing its serviceable lifespan and our research and educational needs have outgrown its capabilities. Its use is limited by inadequate lab space (salon/galley doubles as dry laboratory/training space that can only reasonably 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 levels on deck when the ship is in motion do not meet OSHA work standards without protection, which is not only hazardous but contrary to a modern research/classroom environment. A credible marine science program needs a reliable, well equipped vessel to provide access to the marine environment. However, research need (which translates into operating funds) remains to be identified to justify acquisition of a vessel. The vessel should be recognized by UNCW Academic Affairs as vital to undergraduate and graduate training in marine science, and Academic Affairs should provide adequate support for shiptime to support education, in addition to continuing to use the grant-funded research for graduate student training.

4. More administrative support is needed for this program. Part of a faculty position could be allocated to an assistant director position to assist the associate director with the multitude of tasks associated with running this program. Additionally, a full time staff position (presently part time) could be devoted to the program. This would have the benefit of making the running of this complex program less dependent upon one person, and also relieve some of the ever expanding
assessment responsibilities from the associate director. This need for expanded administrative support will become more pressing as the proposed Ph.D. in coastal and marine science goes through planning and eventual implementation.

5. The marine science program has little if any input into the fields of expertise of new faculty hires, so the needs of marine science are secondary to the needs of the departments. A mechanism for including the needs of this program into departmental faculty hires needs to be developed and implemented. Certainly the original positions that CMS had at its disposal for placement within the academic departments should revert to the Center for reallocation if the positions become vacant for whatever reason (retirement, faculty departure, etc).

6. It is critical if this interdisciplinary program is going to survive and thrive in the next decade, that teaching and research expertise be acquired in the areas of biogeochemical and hydrodynamical modeling because many federal and state calls for proposals require a strong biogeochemical and/or hydrodynamic modeling component. In general, the balancing of disciplines is essential to future success.

Challenges

1. Marine science faculty are all associated with academic departments. The marine science program can request that marine science courses be taught, but decisions are up to the departments. Some graduate courses that are listed in the UNCW Graduate Catalogue are infrequently taught, due to lack of availability of faculty to teach them and occasional low enrollment.

2. Communication is a challenge in this program because faculty come from five different departments housed in six different facilities. There currently is no shuttle between CMS and the main campus, which in combination with the difficulty of parking on the main campus makes meetings difficult to orchestrate.

3. The size of this graduate program at approximately 35 students is set by the availability of faculty time and energy as well as by financial resources to support students. It is unlikely that this program will grow substantially without the addition of new marine science faculty, and there is no space for new science faculty allocated on the main campus. Space will become available at CMS in the next few years, and this could help provide space for additional marine faculty. This program needs to devise a plan to utilize new space at CMS effectively.

4. The supporting departments need to get some credit for the MS marine science students that their faculty supervise. Departments receive credit for courses taught and thesis hours produced, but not graduates. In this era of increasing accountability, this may become a problem, especially for smaller MS programs in the sciences.

5. In general, a formal mechanism for interdisciplinary programs at UNCW would go far to alleviate many of the perceived or actual problems/shortcomings. The CMS Internal Advisory Committee could propose solutions, but a wider UNCW buy-in will be necessary for future success. A variety of mechanisms should be explored, because future allocation, credit, time,
effort, and student coursework will emerge as the proposed Ph.D. program in coastal and marine science develops and is implemented.
Biographical Sketch of LEWIS J. ABRAMS (2003-2010)

Lewis J. Abrams  
Professor of Oceanography  
Tel: (910)962-2350  
University of North Carolina, Wilmington  
Fax: (910)962-2410  
5600 Marvin Moss Lane  
email: abramsl@uncw.edu  
Wilmington, NC 28409

Education
1992  Ph.D.  Oceanography, Graduate School of Oceanography, URI
1986  M.S.  Oceanography, Graduate School of Oceanography, URI
1980  B.A.  Geology, University of Colorado, Boulder.

Oceanographic and Geophysical Expeditions (last 5 – 7 years)

Jan.-Feb. 2009  R/V Knorr KN195-3 – Multibeam bathymetry, Seismic, Piston and multicoring to investigate life in sub-seafloor sediments of the Equatorial Pacific, NSF.

Dec.-Jan. 2006-07  R/V Revelle KNOX02-RR – Multibeam bathymetry, Multichannel Seismic, Piston and multi coring to investigate life in sub-seafloor sediments of the South Pacific, NSF.


July-Sept. 2004  Ground penetrating radar-archeological investigation of the 1815 eruption of Tambora, Tambora Volcano, Sumbawa, Indonesia, Discovery Channel.

Jan-Feb. 2004  R/V T. Thompson TN165 – Multibeam bathymetry, deep-tow sidescan sonar, JASON ROV, Endeavor Deep, southeast Pacific, NSF.

Publications  (refereed articles in the last 5 – 7 years)


2005  Mann P., C. Prentice, J.C. Hippolyte, N.R. Grindlay, L. J. Abrams, D.L.Davila, Reconnaissance study of Late Quaternary faulting along the La Cadena de San Francisco mountain front (Cerro Goden fault zone), western Puerto Rico, Geological Society of


Publications (Contribution to documentary film of an expedition to Tambora volcano, Indonesia)

2005 The documentary film entitled “The Year Without a Summer” was broadcast worldwide on the Discovery Channel beginning April 2005. The film includes some of the highlights of our successful discovery and excavation of a portion of the kingdom of Tambora buried during the 1815 eruption of Tambora volcano.

Research Grants Awarded


2005 A Collaborative U.S./Indonesian Geophysical and Archeological Investigation of the Great Tambora Eruption of 1815, Charles Cahill Award for faculty research and development, UNCW $2,500.

2004 Use of high-resolution seismic and sidescan sonar to locate historic and ancient oyster beds in southeastern North Carolina, Center for Marine Science-UNCW, Pilot Project, $30,589.

Consulting/sub-contracts

July-Sept. 2004 Ground penetrating radar-archeological investigation of the 1815 eruption of Tambora, Tambora Volcano, Sumbawa, Indonesia, Discovery Channel.

MMS Students graduated in the last 5 years

Kassy Rodriguez, *Use of high-resolution sidescan sonar and seisms to map historic oyster reefs in the Lower Cape Fear River*. Now at Exxon-Mobil, Houston, TX.

MSS Student Publications (abstracts, non-refereed articles with MSS student in the last 5 years)


G. Brooks Avery Jr.
Curriculum Vitae

Education
B.S., Chemistry, The University of North Carolina at Greensboro 1985
M.S., Coastal Biology, The University of North Carolina at Wilmington 1990.
Ph.D., Marine Sciences, The University of North Carolina at Chapel Hill 1997.

Employment
2009 present –Associate Professor University of North Carolina Wilmington
2004- 2008 Assistant Professor University of North Carolina Wilmington
2001-2003, Visiting Assistant Professor University of North Carolina Wilmington
1997-2001, Postdoctoral Research Associate, University of North Carolina Wilmington
1990-1996, Teaching and Research Assistant University of North Carolina Chapel Hill
1987-1990, Teaching and Research Assistant University of North Carolina Wilmington
1984-1986, Analytical Chemist, Burlington Research, Burlington, N.C.

Teaching Experience
Advanced Analytical (CHM 536, UNCW) 2001-2009
General Chemistry (CHM 101 and CHM 102, UNCW) 1999-present,
Environmental Chemistry (CHM 377, UNCW)1999-present
Environmental Chemistry Labs (CHM 377L) 1999-present

Specific Research Interests
Global carbon cycling in the atmosphere, water column, and sediments.
Effect of global warming and sea level rise on the remineralization of organic matter in coastal and estuarine sediments.
Use of stable and radiogenic isotopes to determine source and fate of organic carbon.

Honors
Million Dollar Club, UNCW 2005
Camille and Henry Dreyfus Post-Doctoral Fellow, 1997 - 1999
Phi Kappa Phi, UNC-Wilmington, 1990

Publications since 2004 (peer reviewed) (total 29)

2009 Avery, G.B., Kieber, R.J. and Taylor, K. “Nitrogen Release From Surface Sand of a High
Energy Beach Face Along the Southeastern Coast of North Carolina, USA” *Biogeochem* 89, 357-365.


**Grants obtained since 2004**


Daniel G. Baden, Ph.D.

**Academic Positions Held**

2005-present  
William R. Kenan Jr. Distinguished Professor in Marine Sciences  
Professor of Chemistry (primary), University of North Carolina at Wilmington, NC;  
Professor of Biological Sciences (secondary), University of North Carolina at Wilmington, NC

1999-present  
Professor of Marine Biology and Fisheries (primary), Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, FL;  
Professor of Biochemistry and Molecular Biology (secondary), University of Miami School of Medicine, Miami FL

1991-1999  
Associate Professor of Biology and Living Resources (primary), Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, FL;  
Associate Professor of Biochemistry (secondary), University of Miami School of Medicine, Miami FL

1984-1991  
Research Associate Professor of Biochemistry (primary) University of Miami School of Medicine, Miami FL;  
Research Associate Professor of Marine and Atmospheric Chemistry, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, FL.

1979-1983  
Research Assistant Professor of Biochemistry, University of Miami School of Medicine, Miami FL

1978-1979  
Research Assistant Professor of Marine and Atmospheric Chemistry, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, FL

1977-1978  
Post-Doctoral Research Associate, Marine and Atmospheric Chemistry, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami FL

**Education**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Institution</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.A. Chemistry</td>
<td>Hamline University, St. Paul MN</td>
<td>1969-1973</td>
</tr>
<tr>
<td>Ph.D. Biochemistry</td>
<td>University of Miami, Miami FL</td>
<td>1973-1977</td>
</tr>
</tbody>
</table>
# Administrative Responsibilities and Positions Held

## Principal Executive, MARBIONC, the Marine Biotechnology Initiative in North Carolina (1 July 2004–present)
Center for Marine Science, UNCW

## Director, Center for Marine Science (15 July 1999–present)
University of North Carolina at Wilmington
5600 Marvin Moss Lane
Wilmington NC 28409

## Founding Director and Principal Investigator (1991-1999)
National Institute of Environmental Health Sciences
Marine and Freshwater Biomedical Sciences Center, University of Miami
Grant #: P30ES05705

## Chairman (1994-1998)
Division of Marine Biology and Fisheries
Rosenstiel School of Marine and Atmospheric Sciences
University of Miami

## PI and Executive Coordinator (1998)
National Institute of Environmental Health Sciences Exhibits at World EXPO “Year of the Ocean”
Oceans and Human Health, USA Pavilion, Lisbon Portugal

## Honors and Awards
- NIH Predoctoral Trainee in Molecular Enzymology, 1973-1977
- NIEHS Toxicology Study Section Young Environmental Scientist Awardee, 1979-1982
- Harbor Branch Oceanographic Institute Distinguished Lecturer, 1987
- William B. Kinter Lecturer, Mount Desert Island Biological Laboratory, 1996
- Member, Flag Day Congressional Delegation Party, World Expo 98, Lisbon Portugal, 1998
- Keynote Speaker at the 100th Anniversary of Mount Desert Island Biological Laboratory, 1998
- Sigma Xi Professor of the Year, 1999 University of Miami Section.
- William R. Kenan Distinguished Professor of Marine Science, 2005-present.

## Other Professional Activities
• Member, NOAA Science Advisory Board, Working Group on Oceans and Health 2008-2009.
• Member, NC Governor’s Steering Committee Growing North Carolina’s AgBiotech Landscape Marine Biotechnology Co-Chair, 2008-2010.
• North Carolina Department of Commerce development program with Scandinavia (Sweden, Norway, and Denmark) for Biotechnology implementation. Member of the NC Core team, specialist in Marine Biotechnology, April 2008.
• Center of Innovation in Marine Biotechnology, North Carolina. Member, planning and implementation committee, 2006-present.
• Special Consultant to the Research Council of the Sultanate of Oman, Marine Biotechnology, 2007-present.
• Consortium for Ocean Leadership, Member Board, 2007-present.
• Treasurer for CORE, and member of the Executive Committee, 2004-2007.
• Consortium for Oceanographic Research and Education, Board of Governors, 1999-2007.
• “New Jobs Across North Carolina, a strategic plan for growing the economy statewide through biotechnology.” Member, University Research and Infrastructure Work Group, 2003-2004.
• National Association of Marine Laboratories, Institutional Representative, 1999-present.
• Southern Association of Marine Laboratories, Institutional Representative, 1999-present.
• Arctic Research Commission Academic Advisory Board. 1996-2000.
• National Institute of Environmental Health Sciences; Research Triangle Park, North Carolina
  o Special Review Consultant (Developmental Centers of Excellence)
  o Program Development Panel (Environmental Health Sciences Training for Nurses) 1993
  o Internet Services Committee (Optimizing Web Pages and Communication) 2001-preset
  o Marine Toxins as Emerging Diseases (Program Development, Intramural and Extramural) 2001


National Academy of Sciences “Ocean’s Role in Human Health” ad hoc Committee, 1998 [publication “From Monsoons to Microbes”].

Association of University Environmental Health Sciences Centers, NIEHS, 1992-1999.

Ad Hoc Environmental Health Sciences Training for Nurses Working Panel, National Institute of Nursing and National Institute of Environmental Health Sciences, 1993.

National Science Foundation Site Visit Team Chair, EPSCoR program, University of Puerto Rico. 1992.


Conference Organizing Committee and Scientific Committee, 3rd International Conference on Ciguatera Fish Poisoning, Puerto Rico, 1990.


Independent Reviewer for: NSF (Biological Oceanography; Cellular, Molecular and Metabolic Biology).

Independent Reviewer for: NOAA, Sea Grant (Florida and Federal).

Independent Reviewer for Cottrell College Science Grants Program.

Independent IRG member, Bioorganic Chemistry, NIH.


Biometric Systems, Inc. Eden Prairie, Minnesota (pro bono toxin immunoassays consulting).

• Expert Consultant on Ciguatera Fish Poisoning and Seafood Safety: 12 Local and District court jurisdictions.

**Grants and Contracts since 2004**

08/00 to 07/05
NIEHS, NIH, DHHS, “Effects of Inhaled Florida Red Tide Brevetoxins”
$6.08 million P01 ES 10594, [D.G. Baden, P.I., program project involving 2 universities, 3 research institutions, one state agency and one Federal agency].

07/04 – present (recurring)
State of North Carolina “MARBIONC, Marine biotechnology in North Carolina”
$2 million annual with inflationary increments. [D.G. Baden, Executive Principal; Jeffrey Wright, Director of Research]. An economic development program aimed at using marine biotechnology to increase economic diversity in North Carolina. Products include new businesses, new jobs, newly trained individuals. Mariculture, drug discovery, and tests and bioassays are focus areas.

07/06 to 06/11 (renewal)
NIEHS, NIH, DHHS, “Effects of Inhaled Florida Red Tide Brevetoxins”
$8.47 million P01 ES 10594, [D.G. Baden, P.I., program project involving 2 universities, 3 research institutions, one state agency and one Federal agency].

07/09 to 06/11 (ARRA funding related to above) “Preclinical Studies Related to Brevenal and β-Naphthoyl Brevetoxin”
$799,000 P01 ES 10594S1 [D.G. Baden, P.I., W.M. Abraham and J.M. Benson, investigators].

01/08 – 12/13
North Carolina Biotechnology Center, Center of Innovation in Marine Biotechnology.
$100,000 planning grant, prelude to a $2.5 million economic development grant. [Al Delia project lead, DG Baden, Chairman of the Board and 6 others serve as programmatic developers for this state-wide program].

07/09 to 06/12
NIST Department of Commerce “Marine Biotechnology Research Facility – 60NANB9D9142”
$15 million Federal plus $15 million University match [D.G. Baden, P.I., Paul Reinmann Co-PI].

07/09 to 06/14
NOAA OER “Cooperative Institute for Ocean Exploration, Research, and Technology (CIOERT)
$22.5 million [S.A. Pomponi FAU P.I., D.G. Baden, UNCW managing PI].
Publications since 2004 (> 170 domestic and international presentations and abstracts not listed)

2004

1. Benson, Janet; Hahn, Fletcher; March, Thomas; McDonald, Jacob; Sopori, Mohan; Seagrave, JeanClare; Gomez, Andrea; Bourdelais, Andrea; Naar, Jerome; Zaias, Julia; Bossart, Gregory; Baden, Daniel. Inhalation toxicity of brevetoxin 3 in rats exposed for 5 days. Journal of Toxicology and Environmental Health, Part A (2004), 67(18), 1443-1456.


2005

18. Fleming, Lora E.; Kirkpatrick, Barbara; Backer, Lorraine C.; Bean, Judy A.; Wanner, Adam; Dalpra, Dana; Tamer, Robert; Zaias, Julia; Cheng, Yung Sung; Pierce, Richard; Naar, Jerome; Abraham, William; Clark, Richard; Zhou, Yue; Henry, Michael S.; Johnson, David; Van De Bogart, Gayl; Bossart, Gregory D.; Harrington, Mark; Baden, Daniel G.. (2005) Initial evaluation of the effects of aerosolized florida red tide toxins (brevetoxins) in persons with asthma. Environmental Health Perspectives 113(5), 650-657.


28. Fleming Lora E; Kirkpatrick Barbara; Backer Lorraine C; Bean Judy A; Wanner Adam; Dalpra Dana; Tamer Robert; Zaia Julia; Cheng Yung Sung; Pierce Richard; Naar Jerome; Abraham William; Clark Richard; Zhou Yue; Henry Michael S; Johnson David; Van De Bogart Gayl; Bossart Gregory D; Harrington Mark; Baden Daniel G (2005 ) Initial evaluation of the effects of aerosolized Florida red tide toxins (brevetoxins) in persons with asthma. Environmental Health Perspectives 113(5), 650-7.


2006


2007


2008


2009


2010


**Patents**

1. **Title: Fused Pentacyclic Polyethers**
   
   **Patent Agent:** McDonnell Boehnen Hulbert & Berghoff LLP - Chicago, IL, US  
   **Inventors:** Daniel G. Baden, William M. Abraham, Andrea J. Bourdelais, Sophie Michelliza  
   **Application #:** 20050148539  **Class:** 514050000 (USPTO).
   
   Status: granted # US 7,202,271; 4/10/2007. Divisional use claims for cystic fibrosis and other mucociliary diseases related to the original granted patent are pending.

2. **Title: Polyether brevetoxin derivatives as a treatment for cystic fibrosis, mucociliary dysfunction, and pulmonary diseases**
   
   **Patent Agent:** McDonnell Boehnen Hulbert & Berghoff LLP - Chicago, IL, US  
   **Inventors:** Daniel G. Baden, William M. Abraham, Andrea J. Bourdelais  
   **Application #:** 20050124686  **Class:** 514450000 (USPTO)
3. Title: Polyether brevetoxin derivatives as a treatment for neurotoxic shellfish poisoning and ciguatera fish poisoning

Inventors: Daniel G. Baden, Kathleen S. Rein, Lynne Fieber, Sherry P. Parker
Application #: 20050124685 Class: 514450000 (USPTO)

Status: Pending, FDA approval for use in marine animals intoxicated with red tide

4. Title: Methods of Stimulating Neuronal Growth Using Brevetoxins

Patent Inventors: Daniel G. Baden, Thomas F. Murray
Provisional Application #: 60/913484 filed 23 April 2007 Class: 514050000 (USPTO)

Status: conveyed to Creighton University as primary inventor

5. Title: Ladder Frame Polyether Conjugates

Patent Inventors: Andrea J. Bourdelais, Daniel G. Baden, Steven A. Fontana, and Allan J. Goodman
Application #: 12893344

Status: pending
Frederick M. Bingham

Center for Marine Science
University of North Carolina at Wilmington
601 S. College Rd.
Wilmington, NC  28403-5928
Phone: (910)962-2383, Fax (910)962-2410
e-mail: binghamf@uncw.edu
Home Page: http://people.uncw.edu/binghamf

Vita

1984   B.A. in Physics, Oberlin College
1984-1990  Research Assistant, Scripps Institution of
Oceanography, University of California, San Diego
1990   Doctor of Philosophy, Physical Oceanography
University of California, San Diego
1990-1991  Postdoctoral Fellow
Tohoku University, Sendai, Japan
1992-1994  Assistant Researcher
University of Hawaii at Manoa
1994-1999  Assistant Professor, Department of Physics
University of North Carolina at Wilmington
1996-present  Adjunct Associate Professor, Department of Marine Science
University of North Carolina at Chapel Hill
1997-present  Interinstitutional Adjunct Faculty
Department of Marine, Earth and Atmospheric Sciences
North Carolina State University
1999 - present  Associate Professor, Department of Physics and Physical Oceanography
University of North Carolina at Wilmington
2005    Visiting Associate Professor, Tohoku University, Sendai, Japan
2007 - present  Masters Candidate, Computer Science and Information Systems,
University of North Carolina Wilmington
2008-present  Professor, Department of Physics and Physical Oceanography
University of North Carolina at Wilmington

Professional Affiliations

American Geophysical Union; American Meteorological Society; The Oceanography Society,
Oceanographic Society of Japan; American Association of Physics Teachers

Recent Publications

Distributions of larval Fishes among Water Masses in Onslow Bay, North Carolina: Implications


Sethuram, A., E. Patterson, K. Ricanek, F. Bingham (2009), The Aging Face: Developments in AAM Based Synthetic Age Progression. Submitted to CAIP 2009: The 13th International Conference on Computer Analysis of Images and Patterns.


Recent Grant Funding

a. Professional Preparation

Austin College, B.A. Biology 1997
University of Georgia, Ph.D. Ecology 2005
Postdoctoral Research: Stanford University and the Institute for the Study for Learning and Expertise, Biological Oceanography and Computer Science, 2005-2007

b. Appointments

2007-present. Assistant Professor, Dept. of Biology and Marine Biology, University of North Carolina Wilmington.

c. Peer Reviewed Publications, 2007 - 2010


d. Grants


e. Synergistic Activities

Developed and published a MATLAB function for Ecological Network Analysis. This function is now used by researchers in multiple ecology laboratories.

Developed and now teach an Ecological Modeling course for graduate students that builds upon insights gained from both ecological network analysis and inductive process modeling research.

Manuscripts reviewed for Ecological Modelling; Environmental Modeling & Software; Estuarine, Coastal, and Shelf Science; Oikos

Serve on the Cape Fear Museum of Science and History Advisory Board, Wilmington, NC.
CURRICULUM VITAE

LAWRENCE B. CAHOON

CAMPUS ADDRESS:
Department of Biology and Marine Biology
University of North Carolina Wilmington
Wilmington, North Carolina 28403-5915
Phone: (910) 962-3706 FAX: 910-962-4066 E-mail: Cahoon@uncw.edu

EDUCATION:
Ph.D., 1981, Duke University (Zoology)
B.S., 1975, summa cum laude, Washington & Lee University (Biology)

POSITIONS HELD:
Professor, 1993-
Associate Professor, Dept. of Biological Sciences, UNC Wilmington, 1987-1993
Assistant Professor, Dept. of Biological Sciences, UNC Wilmington, 1982-1987

PUBLICATIONS (2006-2009, peer-reviewed and co-authored by MS students only (of 80; plus 90 other)). MS students in bold.
GRANTS funded (only those supporting MS students)

2010: Response to BP Oil Spill: Baseline Beach Sampling for North Carolina (Cahoon, Lankford and Alphin, $6000, Sea Grant)
   Bacterial consortia in swine waste lagoons: The role of purple phototrophic bacteria and anaerobic ammonium oxidation (anammox) in odor control and natural products synthesis. NC Pork Council (Cahoon and Song, $25,000; Year 2)

2009: Bacterial consortia in swine waste lagoons: The role of purple phototrophic bacteria and anaerobic ammonium oxidation (anammox) in odor control and natural products synthesis. NC Pork Council (Cahoon and Song, $25,000; Year 1)
   Key parameters for assessing beach functionality, UNC Sea Grant (Cahoon, Posey, Leonard, Lankford, and Alphin, $14,357 + $23,395 + $21,762, year 2)

2008: Key parameters for assessing beach functionality, UNC Sea Grant (Cahoon, Posey, Leonard, Lankford, and Alphin, $14,357 + $23,395 + $21,762, year 1)

2007: Microbial anti-oxidants from swine waste lagoons, UNC Research Competitiveness Fund, w/Song, Halkides, M. Williams, and G. Dubay, $116,507, 1 year
   Is there a relationship between phosphorus and fecal microbes in aquatic sediments, UNC Water Resources Research Institute ($50,000, w/Mallin)
   Effects of sediment phosphorus concentration on fecal pathogen indicators in estuarine sediments, UNC Sea Grant, ($70,728, w/Mallin)

Marine science graduate students directed (2005-2010):
34. Michelle L. Ortwine, “The impacts of rainfall runoff on tidal creek algal and bacterial production”, M.S. 2007
35. Renee N. Harrington, “Investigation of microbial contamination of sediment and water at boat ramps”, M.S. 2007

Current students:
   Kelly Stull (’07-), Melody Knowles (’07-),*Yosef Shirazi (’08-)
* students admitted originally by another faculty member.
Christopher F. Dumas, Ph.D.

**Contact Information**

Professor of Economics  
Department of Economics and Finance  
University of North Carolina -- Wilmington  
601 South College Rd.  
Wilmington, NC  28403  
TEL: 910-962-4026  
FAX: 910-962-7464  
EMAIL:dumasc@uncw.edu

**Education**


**Awards and Honors**

2007. UNCW “Million Dollar Club” member. Achieved over $1 million in cumulative grant awards at UNCW.  

**Teaching**

**Undergraduate:** ECN 221 Principles of Microeconomics, ECN 321 Intermediate Microeconomics,  
ECN 325 Environmental Economics, ECN 422 Econometrics, ECN 495 Economic Impact Analysis  
**Graduate:** ECN 525 Environmental Economics, PLS 501 Quantitative Methods for Public Administrators,  
MBA 533 Game Theory for Managers  

**Journal Articles since 2004**

2010. Whitehead, J. C., Phaneuf, D. J., Dumas, C. F., Herstine, J., Hill, J., Buerger, B.  


**Book Chapters since 2004**


Research Grants and Contract Research since 2004
2009. Dumas, Christopher F (Principal), "Markets for Marine Biotechnology Products," Sponsored by UNCW Center for Marine Science, University of North Carolina Wilmington, $20,000.00. (June 1, 2009 - Present).
2009. Dumas, Christopher F (Co-Principal), Watanabe, Wade (Principal), "Establishing a pilot hatchery for production of juveniles to support the finfish mariculture industry in North Carolina," Sponsored by North Carolina Biotechnology Center, State, $66,842.00. (July 1, 2009 - June 30, 2010).
2009. Dumas, Christopher F (Co-Principal), Hall, William W (Principal), Schuhmann, Peter W (Co-Principal), "Economic Impact Study of the Production of a 'Mid-Major' Motion Picture on the Economy of Southeastern North Carolina," Sponsored by Wilmington Regional Film Commission, Inc., Local, $9,060.00. (March 20, 2009 - September 30, 2009).
2009. Dumas, Christopher F (Principal), Hall, William W (Co-Principal), Graham, J E (Co-Principal), "Economic Impact Study of Proposed Project in Sampson County, North Carolina," Sponsored by Sampson County Economic Development Commission, Local, $10,000.00. (June 2009 - July 2009).
2007. NC Sea Grant. “Economic Impacts of the North Carolina For-Hire Recreational Fishing Fleet.” Joint project with Jim Herstine, UNCW, John Whitehead, Appalachian State University, Craig Landry, East Carolina University, and Tim Hatcher, NC State University. (Dumas lead PI) $70,348.

2006. NC Sea Grant. “An Assessment of Public Awareness of Rip Currents in New Hanover County, NC.” Joint project with Jim Herstine, Doug Gamble, Mark Imperial and Steve Meinhold, UNCW. $3,982.


2005. NC Sea Grant, NC Dept. Environment and Natural Resources, and NC Beach, Inlet and Waterways Association. “Atlantic Intracoastal Waterway Economic Impacts and Economic Benefits Study.” Joint project with Jim Herstine and William Hall, UNCW, and John Whitehead, Appalachian State University. $112,000.

2005. Dare County, NC. “The Economic Benefits of Oregon Inlet.” Joint project with William Hall, UNCW, John Whitehead, Appalachian State University, and Moffat and Nichol Engineers. $75,000.


2005. Brunswick County Community in Schools Program. “The Economic Impacts of the Brunswick County Community in Schools Program.” Joint project with Mark Imperial, UNCW. $6,800.


ABBREVIATED CURRICULUM VITAE

Michael J. Durako
Professor
Department of Biology and Marine Biology
Center for Marine Science
Telephone: (910) 962-2373
E-mail: durakom@uncw.edu; http://people.uncw.edu/durakom/index.htm

Professional Preparation
Ph.D. Marine Science, 1991 University of South Florida, St. Petersburg, FL 33701
M.A. Botany, 1978 University of South Florida, Tampa, FL 33620
B.S. Biology, 1975 Florida Atlantic University, Boca Raton, FL 33432

Appointments
Aug. 2004- present Professor, Department of Biology and Marine Biology, UNCW
Aug. 1997- July 2004 Associate Professor, Department of Biology, tenured 8/00
May 1995- July 1997 Senior Research Scientist, Florida Marine Research Institute

Selected Peer-Reviewed Publications (79 total) (Student authors in bold)

Most Recent Funding (52 Awards totaling >$7,00,000; 31@UNCW: >$5,000,000)
2010-2011
Measuring photosynthetic characteristics of Turtlegrass for the South Florida Fish Habitat Assessment Program. Florida Fish & Wildlife Conservation Commission. ($85,000)
2009-2011

2009-2010
Measuring photosynthetic characteristics of Turtlegrass for the South Florida Fish Habitat Assessment Program. Florida Fish & Wildlife Conservation Commission. ($60,000)

2008-2010

2007-2008

2005-2008
Florida Fish & Wildlife Conservation Commission. Measuring photosynthetic characteristics of Turtlegrass for the South Florida Fish Habitat Assessment Program. ($200,000)

2005-2007

2005-06
NOAA/UNCW. Coastal Ocean Research and Monitoring Program. ($2,770,694)

Academic Activities
Undergraduate Honor’s Thesis Advisor: Eckerd College - Craig Rose F91/S92
UNCW - Andrea Wimmers, F97/S98; Amy Dixon, F98/S99; Darin Crew, F98/S99; Steven van Sluyter S02/F02.


Graduate Students (Ph.D.) Supervised: UNCW - Amanda Kahn, 2008


Graduate Student (Ph.D.) Committees: USF - Eva Maria Wysk Koch; FIU – Justin Campbell.

Post-doctoral Research Fellows supervised
CHRISTOPHER M. FINELLI

Associate Professor
Department of Biology and Marine Biology
University of North Carolina Wilmington
601 S. College Rd
Wilmington, NC 28403
Voice: (910) 962-2137; Fax: (910) 962-4066; Email: finellic@uncw.edu

EDUCATION:
1997    Ph.D. Marine Science Program, University of South Carolina
Dissertation title: The influence of behavior and physics on ecological processes.
Advisor: Dr. David S. Wethey.
1990-1991  East/West Marine Biology Program, Northeastern University, Boston, MA
1991   B.S. in Biology, Magna Cum Laude, Honors Program Graduate,
St. Francis College, Loretto, PA

PROFESSIONAL EXPERIENCE:
2009 to Present   Associate Professor, University of North Carolina Wilmington
Biological-Physical Coupling, Oceanography, Marine Biology
2006 to 2009  Assistant Professor, University of North Carolina Wilmington
Biological-Physical Coupling, Oceanography, Marine Biology
2005 to 2006  Associate Professor, Louisiana Universities Marine Consortium (LUMCON).
Biological-Physical Coupling, Benthic Ecology, Marine Science
1999 to 2005  Assistant Professor, Louisiana Universities Marine Consortium (LUMCON).
Biological-Physical Coupling, Benthic Ecology, Marine Science
1997 to 1999  Postdoctoral Research Associate, Academy of Natural Sciences
Organism-flow interactions, stream ecology
1991-1996  Graduate Instructional Assistant:

RESEARCH INTERESTS
Research in my lab continues along two parallel tracks: ecology of reef dwelling benthic suspension feeders and chemoreception in predator-prey interactions. I typically try to work both locally, in oyster reefs and marshes, and in the tropics, on coral reefs, to widen the funding base and the opportunities for student involvement. Much of my research, especially that conducted on oyster reefs, has distinct application to environmental or fisheries problems (e.g. oyster reef restoration).

PROFESSIONAL AWARDS and FUNDING since 2004:
2009    UNCW Cahill Award;
Development of a high speed motion analysis system for biological research and education at UNCW. $3000; PIs: Alison Taylor & Christopher Finelli
2009    NC Sea Grant;
To seed or not to seed: The value of seeding restored oyster reefs for ecosystem function. $100,000. PIs: Christopher Finelli, Troy Alphin, Martin Posey, Ami Wilbur.
2008    National Undersea Research Program/Coral Reef Conservation Program;
Sponges on Florida Reefs: Basic data for conservation and management. $69,000; Co-PI with Joseph Pawlik 2008-2011 National Science Foundation; Pumping rates of the giant barrel sponge Xestospongia muta on Caribbean reefs: size scaling, environmental controls, and bleaching effects. $193,617; PI: Christopher Finelli. 2008 UNCW Cahill Award; Preliminary investigations of the boring sponge, Cliona chelata, and its effects on the eastern oyster Crassostrea virginica. $3000; PI: Christopher Finelli 2008 NC SeaGrant Minigrant Program; Application of Chemical Cues to Artificial Reef Substrate: Enhanced oyster recruitment or increased predation. $1640; PI: Christopher Finelli 2006 Entergy Environmental Stewardship Program; Expanding and Enhancing the Bayouside Classroom Science and Stewardship Program. $22,257. 2003-2007 National Science Foundation; Collaborative Research + RUI: The effects of water movement and zooplankton escape behavior on planktivory by coral reef fishes in different microhabitats. $383,724 ($81,243 to LUMCON); Co-PI with Ed Buskey, University of Texas Marine Science Institute and Ray Clarke, Sara Lawrence College 2003-2008 National Science Foundation; Supplement to Career development plan: Interdisciplinary research and education in marine habitats. $44,800; PI: Christopher Finelli 2002-2005 National Science Foundation; Faculty Institutes for Reforming Science Teaching (FIRST) II. $30,000; Team Leader: Christopher Finelli 2001-2008 National Science Foundation Career development plan: Interdisciplinary research and education in marine habitats. $506,955; PI: Christopher Finelli Optimal design of oyster reefs for erosion control. $89,201; PI: Christopher Finelli w/ Tom Soniat (Nicholls State University)

PUBLICATIONS since 2004 (Including those in review or in press):


Finelli, C.M. In revision. A two dimensional map of the sample volume of an acoustic Doppler velocimeter. In revision for Limnology and Oceanography: Methods.


**PROFESSIONAL SERVICE**

Associate Editor: Limnology and Oceanography (2008 to Present)


Panelist: National Science Foundation Biological Oceanography, National Science Foundation Education and Human Resources GK-12

Grant Reviewer: National Science Foundation (BIO, GEO, EHR, ENG, OPP, IBN), Hudson River Foundation, Marsh Ecology Research Program/New Jersey SeaGrant, Maryland SeaGrant, Florida SeaGrant

Organizer: Special symposium on turbulent mass transfer, 2001 meeting of the American Society of Limnology and Oceanography; Special Session for FIRST Project in Louisiana, 2004 and 2006 meetings of the Louisiana Academy of Sciences
PROFESSIONAL PREPARATION:

UNC-Wilmington  
Marine Biology  
B.S.  
1985
North Carolina State University  
Botany  
M.S.  
1987
UNC-Chapel Hill  
Biology  
Ph.D.  
1993
University of Miami  
Marine Biology  
Post-doc  
09/93-08/94
UNC-Wilmington  
Marine Botany  
Post-doc  
08/94-10/95

OTHER TRAINING

1995  Workshop on Molecular Evolution  
MBL, Woods Hole
1996  Summer Institute in Statistical Genetics  
NCSU
1997  Summer Institute in Statistical Genetics  
NCSU
2006  IANTD Technical and TriMix Dive Training  
NURC

APPOINTMENTS

1995-present  Research Specialist, Center for Marine Science  
Adjunct Faculty, Dept. Biology, UNC-Wilmington
2000-present  Core Leader, DNA Analysis Core Facility, Center for Marine Science
2005-present  Associate Curator, Algal collection, UNCW herbarium (WNC)
2009  Instructor, NSF Pan-American Studies Institute, STRI, Panama
2008  STRI Collaborator, Smithsonian Tropical Research Institute, Panama
2008  Instructor, Training in Tropical Taxonomy Workshop, STRI, Panama
2002  Visiting Research Fellow, Royal Botanic Gardens Sydney

FUNDING AND AWARDS (last 5 years only)

2010–2012  National Science Foundation/Biodiversity Surveys & Inventories (PI)  
REU Supplement: Collaborative Research: Marine Algal Diversity of Southern Central America

2009–2012  National Science Foundation/Biodiversity Surveys & Inventories (PI)  
REU Supplement: Collaborative Research: Marine Algal Diversity of Southern Central America

2009  2007-2008 Hilda Canter-Lund Photomicrograph Award from the British Phycological Society

2008-2012  National Science Foundation/Biodiversity Surveys & Inventories (PI)  
RUI: Collaborative Research: Marine Algal Diversity of Southern Central America

2008  Marine Science Network (coPI)  
MSN Workshop: Taxonomy, phylogeny, and DNA barcoding of Bocas del Toro seaweeds

2007-2008  National Science Foundation/Major Research Instrumentation Program, Research Opportunity Award (ROA) Supplement (PI)  
Acquisition of instrumentation to enhance the capabilities for research and teaching of the DNA Analysis Core Facility at the Center for Marine Science

2006-2008  National Science Foundation/Major Research Instrumentation Program (PI)  
Acquisition of instrumentation to enhance the capabilities for research and teaching of the DNA Analysis Core Facility at the Center for Marine Science

2006-2007  National Oceanographic and Atmospheric Association (NOAA) (PI)  
Genetic analysis of invasive lionfish

2005-2006  National Science Foundation/Systematics PEET Program (PI)  
REU supplement: Monographic research and phylogenetic investigations of the Ceramiales (Rhodophyta)

2004-2006  National Undersea Research Center (coPI)  
Assessment of the Status and Risk Posed by the Invasive Lionfish in North Carolina Hardbottom Communities
2003-2009 National Science Foundation/Systematics PEET Program (coPI)
*Monographic research and phylogenetic investigations of the Ceramiales (Rhodophyta)*

2003-2005 North Carolina SeaGrant (coPI)
*Identification, distribution and seasonality of a Gracilaria species that is hampering commercial fishing operations in southeastern North Carolina*

**PUBLICATIONS** *(Only those coauthored with MS in Marine Science [in bold] or Marine Biology [underlined] students included)*

**Stuercke, B. & D.W. Freshwater.** 2010. Two new species of *Polysiphonia* (Ceramiales, Florideophyceae) from the western Atlantic. *Botanic Marina* 53:301-311


**Mamoozadeh, N.R. & D. W. Freshwater.** submitted. Taxonomic notes on five species of *Polysiphonia sensu lato* (Ceramiales, Florideophyceae) from the Caribbean. *Botanica Marina*.

**Mamoozadeh, N.R. & D.W. Freshwater.** (in prep.) Morphological and molecular assessment of Caribbean Panama *Polysiphonia* and *Neosiphonia* (Ceramiales, Florideophyceae) species. *Nova Hedwigia*. 
Biographical Sketch: Douglas W. Gamble

Associate Professor of Geography and Director
Laboratory for Applied Climate Research
Department of Geography and Geology, University of North Carolina Wilmington
Wilmington, NC 28403

Education
University of Georgia   Geography     PhD 1997
University of Georgia   Geography    MA 1993
Miami University  International Studies   BA 1989

Appointments
2006-Present        Associate Professor, Department of Geography and Geology, UNC Wilmington
2000-Present        Extended Faculty, Center for Marine Science, UNC Wilmington.
1997-2000           Assistant Professor, Department of Geosciences, Mississippi State University.
1991-1997           Teaching Assistant, Lab Coordinator, and Part-Time Instructor, Department of Geography, University of Georgia.
1995-1996           Part-Time Instructor, Department of Geography, Georgia State University.

Publications
Five most closely related:

Five other significant publications:

Synergistic Activities
Chancellor’s Teaching Excellence Award, UNC Wilmington, 2010.
Excellence in Teaching Award, Southeastern Division Association of the American Geographers, 2009.
Co-leader, *Geography Faculty Development Alliance Workshop, National Science Foundation/Department of Geography, University of Colorado*, 2004 and 2005.

**Collaborators & Other Affiliations**

**Collaborators and Co-Editors in the last 48 months:**

**Thesis Advisees**
Tim Metevelis, MS Marine Science 2010, UNC Wilmington
Sarah Beth Jenkins, BA Geography (Honors Thesis) 2006, UNC Wilmington
Michael A. Crump, MS Geology 2002, Dept of Earth Sciences, UNC Wilmington
Marck Oduber, MS Geosciences 2000, Dept. of Geosciences, Mississippi State University
Kathy Sherman, MS Geosciences 1999, Dept. of Geosciences, Mississippi State University
Wayne Verno, MS Geosciences 1999, Dept. of Geosciences, Mississippi State University
PROFESSIONAL PREPARATION:
Postdoctoral Fellow, University of Rhode Island 1991-1993
Ph.D., Oceanography (Marine Geology and Geophysics), University of Rhode Island, 1991
B.A., Earth Sciences, Dartmouth College, 1983

APPOINTMENTS:
2006 Summer Visiting Scientist, Institute for Marine Science, Bologna, Italy
2005-2008 Graduate Coordinator, Master of Science in Geology program, University of North Carolina Wilmington
2004 Summer Visiting Scientist, Woods Hole Oceanographic Institute, Woods Hole, MA
2003-pres. Professor, Department of Geography & Geology, University of North Carolina Wilmington
2000-2003 Associate Professor with tenure, Department of Earth Sciences, University of North Carolina Wilmington
1997-2000 Associate Professor, Department of Earth Sciences, University of North Carolina Wilmington
1995-1997 Assistant Researcher, Department of Geology, University of Puerto Rico Mayagüez
1993-1995 Assistant Professor, Department of Geology, University of Puerto Rico Mayagüez
1990 Lecturer, Department of Geology, University of Rhode Island
1984-1990 Graduate Research Assistant, Graduate School of Oceanography, University of Rhode Island
1983-1984 Geologist, National Oceanographic and Atmospheric Administration

OCEANOGRAPHIC EXPEDITIONS:
From 1984 to present I have sailed as participant (13) or Chief Scientist (6) on 19 deep-water oceanographic expeditions to the South Atlantic, Caribbean, eastern and western Pacific, and Southwest Indian oceans. In addition, I have conducted numerous (20+) high-resolution marine geophysical surveys in the southeastern North Carolina coastal ocean and Cape Fear River.

RELEVANT PUBLICATIONS REGARDING SIDECAN SONAR AND SEISMIC DATA:

**OTHER SIGNIFICANT PUBLICATIONS:**

**SYNERGISTIC ACTIVITIES:**
Graduate Coordinator, UNCW Masters in Geology Program Jan. 2005-June 2008
Advisor, Cape Fear History and Science Museum *Oceans. Explore. Discover* Exhibit, 2007
National Underwater Research Program Review Panel Member, 2005
Member, UNOLS *R/V Marcus Langseth* Scientific Oversight Committee, December 2005-present

**EXTERNAl FUNdING DURING PASs SEVEN YEARS**
A pilot study to investigate the possible linkages between submarine groundwater fluxes and amphitheater-shaped scarps on the northern insular margin of Puerto Rico, University of PR Sea Grant Program, $118,983, 03/01/04-02/28/08, Principal Investigator.
Collaborative research: An investigation of the effects of cold, thick lithosphere on deformation of slowly slipping mega-transforms: The Andrew Bain transform, SW Indian Ridge, National Science Foundation, $80,368, 09/01/03-08/31/09, Principal Investigator.
JOANNE N. HALLS
Associate Professor of Geography
UNC Wilmington Department of Geography & Geology

Educational Background
Ph.D., Geography, University of South Carolina (USC), Columbia (May 1996)
MS, Geography, USC, Columbia (May 1990)
BA, Geography, University of Denver, Denver, Colorado (1985)

Diplome Education du College, Social Sciences, Champlain Regional College, Lennoxville, Quebec (1982)

Professional Experience
2005 – present:  Associate Professor of Geography
1999 – 2005 Assistant Professor of Geography, Director, Spatial Analysis Lab, University of North Carolina at Wilmington.
1994-1999 Director, Geographic Information Systems Department, Research Planning, Inc. 1121 Park Street, Columbia, South Carolina 29201.
1990-1994 GIS Project Manager, Humanities and Social Sciences Computing Lab, University of South Carolina, Columbia, South Carolina.
1988-1990 Research Assistant, Humanities and Social Sciences Computing Lab, University of South Carolina, Columbia, South Carolina.
1984 Geological Assistant, Century Oil & Gas Corporation, Englewood, Colorado

Recent Refereed Journal Articles and Book Chapters:
Zavalaga, Carlos B., Giacomo Dell’Omo, Joanne N. Halls, and Scott A. Taylor, 2009, At-Sea Movement Patterns and Diving Behavior of Peruvian Boobies Sula Variegata in Northern Peru, Marine Ecology Progress Series


Dr. Eric Henry  
Associate Professor  
University of North Carolina Wilmington,  
Department of Geography and Geology  
601 S. College Rd.  
Wilmington, NC 28403

Ph.D. Hydrology (minor Soil, Water, and Environmental Science),  
University of Arizona, 2001  
M.S. Civil Engineering, University of New Mexico, 1995  
B.S. Civil Engineering, University of New Mexico, 1993  

Associate Professor, Geography and Geology, University of North Carolina Wilmington, 2007-Present.  
Assistant Professor, Geography and Geology, UNCW, 2002-2007.  
Faculty Research Associate, Civil and Environmental Engineering, Arizona State University, Jan.-Dec. 2001.  

Publications (* indicates student co-author):  


Paul E. Hosier  
Department of Biology and Marine Biology  
University of North Carolina Wilmington

Professional Preparation
B. S. 1967 Biology State University of New York, New Paltz, New York  
M. S. 1969 Botany University of Massachusetts, Amherst, MA  
Ph. D. 1973 Botany Duke University, Durham, North Carolina

Professional Experience
1972-Present Assistant, Associate, Professor, Department of Biology and Marine Biology, UNC Wilmington  
2002-2008 Interim, Provost and Vice Chancellor for Academic Affairs, UNC Wilmington  
1985-1992; 1995-2002 Assistant, Associate Vice Chancellor for Academic Affairs, UNC Wilmington  
1972 Research Ecologist, National Park Service, Cape Lookout National Seashore, Beaufort, North Carolina

Publications
Cleary W. J. and **P. E. Hosier,** 1987, Geomorphology and Shoreline Changes along Bald Head Island, NC (12 p. + appendices).  

**UNCW student

Past Grant Activity
North Carolina Office of Sea Grant. 1980. The Impact of Off-Road Vehicles on Beach, Dune and Grassland Ecosystems on the Barrier Islands of North Carolina.
North Carolina Office of Sea Grant. 1978. Vegetation Patterns and Succession in Overwash Environment: Cape Lookout to Cape Fear, North Carolina (with W.J. Cleary).

Society Memberships
Sigma Xi, American Institute of Biological Sciences, Torrey Botanical Society

Theses Directed
Advisor for 6 M.S. in Marine Biology
Co-Advisor for 2 M. S. in Marine Biology/Geology
Advisor for 4 Honors Theses
BIOGRAPHICAL SKETCH
PATRICIA HAGELIN KELLEY

(a) Professional and Academic Essentials

Professional Preparation
College of Wooster Geology B.A., 1975
Harvard University Geology A.M., 1977, Ph.D., 1979

Appointments
University of North Carolina Wilmington: Chair, Dept. Earth Sciences, 1997-2003, Professor, 1997-present; joint appointment in Biology & Marine Biology
University of North Dakota: Professor and Chair, Dept. Geology and Geol. Engr., 1992-1997
National Science Foundation: Program Director for Geology & Paleontology, 1990-1992
New England College, Instructor, 1979

Courses taught (last 3 yrs): Invertebrate Paleontology, Paleocology, Stratigraphic Paleontology, Prehistoric Life, Sedimentary Environments; The Earth Through Time; various Directed Studies.

University Service: 78 different departmental or university committees since 1979.

Synergistic activities
K-12 collaboration: PI on National Science Foundation grant, “Integrating Research and Education in Paleontology and Marine Ecology: An Inquiry-based Grade 6 – 8 Curriculum that Investigates Spatial and Temporal Patterns in Naticid Gastropod Predation”: research collaboration with middle school students and teachers, testing authentic paleontological hypothesis; advisor and field trip leader for Maryland Summer Center for Paleontology/Calvert County Public Schools


Proponent of evolution education: member of National Center for Science Education; Geological Society of America Geology & Public Policy Committee, 1999-2002, including panel that wrote GSA public policy statement on evolution; coauthored Paleontological Society public policy statement on evolution; organized Paleontological Society Short Course on evolution and creationism and edited short course notes; frequent speaker on evolution/creationism at universities across the U.S. (Distinguished Speaker for National Association of Geoscience Teachers and for Paleontological Society, 2006-2012); Director of UNCW Evolution Learning Community, 2006-2009


Received 2003 Association for Women Geoscientists Outstanding Educator Award in recognition of my achievements in education, particularly as mentor and role model for women geoscience students
(b) Peer-Reviewed Publications (last seven years)


(d) Funding (last seven years)

National Science Foundation, “Integrating Research and Education in Paleontology and Marine Ecology: An Inquiry-based Grade 6 – 8 Curriculum that Investigates Spatial and Temporal Patterns in Naticid Gastropod Predation,” -- $53,170 (UNCW subcontract), 2000-2001 (collaborative project with Jack Hall and Thor Hansen); $23,672 supplement and extension received through 1/31/03. (This successful proposal began as a CMS Pilot Project.)


National Geographic Society, “Latitudinal variation in drilling predation of South American Mollusks: Spatial implications for patterns of evolution in the fossil record,”(supports field work with PhD Marine Biology student Christy Visaggi) -- $17,500, 2009-2010

National Science Foundation, “RET Supplement to REU Site: Research Experiences for Undergraduates in Biodiversity Conservation,” -- $9,908, 2010-2011 (supports MS Marine Biology student Bradley Parnell); related in part to 2003-2004 CMS Pilot Project
ROBERT J. KIEBER

Department of Chemistry and Biochemistry                        Tel. (910) 962-3865
University of North Carolina Wilmington                      Fax (910) 962-3013
601 S. College Road                                    E-mail: kieberr@uncw.edu
Wilmington, North Carolina 28403-3297

Education
Rutgers Univ.   B.S.  Chem     1982
Univ. of MD    Ph.D. Chem.     1987
Univ. of Miami-RSMAS  Post Doc Mar./Atmos. Chem  1988-1989

Professional Experience
Adjunct Professor Marine Sciences Department, UNC Chapel Hill 2007-present.
Professor of Chemistry, University of North Carolina Wilmington 1999 - present.
Associate Professor of Chemistry, University of North Carolina Wilmington 1994 - 1999.
Assistant Professor of Chemistry, University of North Carolina Wilmington 1989 -1994.

Publications last three years


**Recent grant activity**


VITAE
Lynn Ann Leonard
Department of Geography and Geology
University of North Carolina at Wilmington
601 S College Road
Wilmington, NC 28403

Education:
College of William and Mary, Williamsburg, VA
August 1982 - May 1986
B.S. (with high honors) in Geology, 1986.
Senior research topic: Stratigraphy and development of the Goodwin Islands, Virginia.

Duke University, Durham, NC
August 1986 - August 1988
M.S. in Geology, 1988.
Area of research: Beach replenishment on U.S. Atlantic Coast barrier islands.

University of South Florida, St. Petersburg, FL
August 1988 - 1994
Ph.D. in Marine Science (5/4/94)
Area of research: Sediment dynamics and surficial hydrodynamics in an open marine marsh.

Professional Experience:
July 2004 - present: Chair, Department of Geography and Geology, UNCW
August 2005 - present: Director, Coastal Ocean Research and Monitoring Program, UNCW
August 2004 - present: Professor with Tenure, University of North Carolina Wilmington,
Department of Geography and Geology.
August 2004-July 2005: Assistant Chair, Department of Geography and Geology
August 1999-2004: Associate Professor with Tenure, University of North Carolina Wilmington,
Department of Earth Science.
August 1999-2004: Graduate Coordinator, University of North Carolina Wilmington,
Department of Earth Science.
August 1994-1999: Assistant Professor, University of North Carolina Wilmington,
Department of Earth Science.
January 1994-August 1994: Post-doctoral Research Associate, University of South Florida,
Department of Marine Science.
August 1988-January 1994: Graduate Research Assistant, University of South Florida,
Department of Marine Science.
May 1987 - August 1988: Research Assistant, Duke University, Department of Geology.
August 1986 - December 1987: Teaching Assistant, Duke University, Department of Geology.
May 1986 - July 1988: Physical Science Technician GS/5, Office of Minerals Management,
Department of the Interior, Vienna, VA.
Management/Department of the Interior, Vienna, VA.

Research Grants (>$10M):
2010. Observing and Data Management in Support of SECOORA (PI-Leonard), SC SeaGrant ($200K)
2009. Year 3 Carolinas Regional Coastal Observing System (PI – Leonard) NOAA CSC ($1,484)
2008. Key Parameters for Assessing Beach functionality (PI-Calhoon; Co-PIs: Leonard, Posey, Alphin Lankford) NC SeaGrant ($14,357)
2008. Key Parameters for Assessing Beach Functionality (PI-Calhoon; Co-PIs: Leonard, Posey, Alphin Lankford) NC SeaGrant ($23,395)
2008. Key Parameters for Assessing Beach Functionality (PI-Calhoon; Co-PIs: Leonard, Posey, Alphin Lankford) NC SeaGrant ($21,762)
2008. Implementation of RCOOS support of RCOOS development for SECOORA: Data Management (PI-Leonard) SC SeaGrant ($13,914)
2008. Year 2 Carolinas Regional Coastal Observing System (PI – Leonard) NOAA CSC ($1,484)
2007. Year 1 Carolinas Regional Coastal Observing System (PI – Leonard) NOAA CSC ($1,484)
2006. Year 5: Coastal Ocean Research and Monitoring Program (PI-Leonard) NOAA CSC ($413,000)
2006. Field Test of the AIS ASWSS Buoy System (PI-Leonard). General Dynamics ($17,000)
2005. Coastal Ocean Research and Monitoring Program (PI-Leonard) Co-PIs: Bingham, Cooper, Calhoon, Durako, Lankford, Moss, Mallin and Posey) NOAA CSC ($2,160,000)
2004. Coastal Ocean Research and Monitoring Program (PI-Moss; Co-PIs: Bingham, Cooper, Calhoon, Durako, Lankford, Leonard, Mallin and Posey) NOAA-CSC ($2,400,000)
2003. A Collaborative Coastal Ocean Research and Monitoring Program (PI-Moss; Co-PIs: Bingham, Cooper, Calhoon, Durako, Lankford, Leonard, Mallin and Posey) NOAA ($1,192,200)
2003. Monitoring of the Cape Fear River Widening and Wilmington Harbor Dredging Project (PI-Hackney, Co-PIs: Leonard, Posey, Avery) USACE ($365,000)
2003. Marsh Fragmentation and Extent Versus Barrier Island Topography: An Investigation Using Aerial Photography, Digital Terrain Modeling and GIS. (w/ Dr. J. Halls) NC Sea Grant ($50,000)
2002. The Influence of Flow Dynamics and Particle Dispersion on the Everglades Landscape (PI-Leonard) FIU ($70,000)
2001. Monitoring Sedimentation and Currents on a Muddy Shoreface: The Impact of Dredge and Fill Projects on the Oak Island Nearshore Zone. Center for Marine Science Research, UNCW Center for Marine Science ($45,000; PI-Cleary, Co-PIs: Leonard, Posey and Alphin)
2000. Monitoring of the Cape Fear River Widening and Wilmington Harbor Dredging Project (PI-Hackney, Co-PIs: Leonard, Posey, Avery) USACE ($350,000)
Accepted with minor revisions:

Published:


CURRICULUM VITAE

Michael A. Mallin

Present Position: Research Professor, Center for Marine Science, University of North Carolina at Wilmington, 5600 Marvin K. Moss Lane, Wilmington, NC 28409. Telephone (910) 962-2358; Email: mallinm@uncwil.edu
Lab website: http://www.uncw.edu/cmsr/aquaticecology/laboratory/

Research Interests: Ecology of phytoplankton and zooplankton; urban and rural pollution sources; nutrient impacts; water quality management issues.

Education:

Professional Experience:
University of North Carolina at Wilmington. Research Professor 2001-present.
Research Associate Professor 2000 – 2001; Research Scientist 1998-1999;
Research Associate 1993-1998; Visiting Assistant Professor 1992 –1993

College of Charleston, Adjunct Professor of Environmental Studies, appointed 2003


Awards: Elected Fellow, American Association for the Advancement of Science, 2007
UNC Wilmington Information Technology Innovation Award 2002
Aldo Leopold Environmental Leadership Fellow 2001 (Ecological Society of America)
Large Community Comprehensive Planning Award 2000, New Hanover County Tidal Creeks Program (American Planning Association)

Editorial Board Member: Journal of Experimental Marine Biology and Ecology; Coastal and Estuarine Science News (CESN)

Presentations to Professional Organizations: 190 total

Peer Reviewed Articles: (2004-2010)


Dr. Dylan Erin McNamara
Assistant Professor
Center for Marine Science / Department of Physics and Physical Oceanography
University of North Carolina - Wilmington
601 S College Rd
Wilmington, NC 28403
(910) 962-2588: e-mail: mcnamarad@uncw.edu

Education
• 1999, M.S., Physics, San Diego State University, Thesis Paper: Characteristics and Applications of a Zero Degree Twist Nematic Liquid Crystal Spatial Light Modulator.
• 1996, B.S., Physics, Salisbury University, Phi Beta Kappa, Summa Cum Laude (3.9 GPA).

Appointments
• August 2008 – Present, Assistant Professor, Department of Physics and Physical Oceanography, University of North Carolina - Wilmington.
• Dec 2006 – March 2007, Postgraduate Researcher, Rohwer Laboratory, San Diego State University, Supervisor – Dr. Forest Rohwer.
• 2001 – 2002, Adjunct Oceanography Instructor, Palomar College, Supervisor – Alan Trujillo.
• 1996 – 1999, Teaching Assistant, San Diego State University Physics Department (Outstanding teaching assistant award 1998).

Publications
Grants

- McNamara, D. E. (Principal), Grant, "Collaborative Proposal: Modeling New Behaviors Emerging from Coupling Physical Coastal Processes and Coastal Economies", NSF, Federal, $100,000.00, FUNDED. (sub: July 15, 2009, start: June 1, 2010, end: June 1, 2013).
- McNamara, D. E. (Principal), Grant, "Collaborative Proposal: Collaborative Research: Coastal Geomorphic Consequences of Wave Climate Change", NSF, Federal, $95,000.00, In Review.

Conference and Invited Presentations

- “What will the North Carolina Coastline Look Like in 50 years?” Invited presentation given at the UNCW Geology Dept, 2009.
- “Emergence in Coupled Human Landscape Systems” Invited presentation given at the National Center for Earth Surface Dynamics, 2008.
- “Emergence in Coupled Human Landscape Systems” Invited presentation given at EOS Department, Duke University, 2008.
- “Emergence in Coupled Human Landscape Systems” Invited presentation given at the San Diego State University, Computational Science Research Center, 2007.
- “New Orleans after Hurricane Katrina: An Unnatural Disaster?” Given at the Fall 2005 American Geophysical Union Meeting in San Francisco, California.
- “Emergent Behavior of Coupled Barrier Island - Resort Systems” Given at the Fall 2004 American Geophysical Union Meeting in San Francisco, California.

Synergistic Activities

- Scientific Advisor on the Environmental Issues Team and member of the Surfrider Foundation
- Coach of the UNCW surf team
- Member of the American Geophysical Union
- Coastal Working Group Member for the Community Surface Dynamics Modeling System
- Organizing committee for Complex Systems Group at Scripps
- Frequent appearances on community radio station radioActive San Diego to explain the science of complexity

Collaborators/References

- Dr. Giovanni Coco, New Zealand Institute of Water and Atmospheric Research.
- Dr. Brad Murray, Nicholas School of the Environment and Earth Sciences, Duke University.
- Dr. Martin Smith, Nicholas School of the Environment and Earth Sciences, Duke University.
- Dr. Stuart Sandin, Scripps Institution of Oceanography, University of California - San Diego.
- Dr. Brad Werner, Cecil and Ida Green Institute of Geophysics and Planetary Physics, University of California - San Diego.
Ralph N. Mead

Department of Chemistry and Biochemistry
University of North Carolina Wilmington
601 S. College Road
Wilmington, North Carolina 28403-3297
Tel. (910) 962-2447
Fax (910) 962-3013
E-mail: meadr@uncw.edu

Education
Florida State Univ.   B.S.  Chemistry   1998
Florida International Univ.  Ph.D. Chemistry   2003
University of South Carolina  Post Doc Marine Chemistry  2003-2005

Professional Experience
Assistant Professor of Chemistry, University of North Carolina at Wilmington 2007 – Present. Assistant Professor of Marine Chemistry University of Miami-RSMAS 2005-2007

Research Interests
Use of organic geochemistry to study the source, transport and diagenetic fate of organic matter in aquatic and other marine environments.

Publications
Five most relevant to the project


Other Publications


**Synergistic activities:**

- I currently have several undergraduate and graduate students in my laboratory
- I have given interviews to public media outlets such as the public magazine *CoastWatch* and a local news station discussing scientific topics
- I give seminars at local community events including schools that highlights science where I try and instill a love and curiosity for it at an early age
- I review manuscript for *Organic Geochemistry, Estuarine Coastal Shelf Science, Marine Chemistry, Limnology and Oceanography*
- I have reviewed proposals for NSF, Sea-Grant and NOAA

**Collaborators Within the Past 48 Months** Drs. Brooks Avery (UNCW), Robert Kieber (UNCW), Steve Skrabal (UNCW), Joan Willey (UNCW), Pam Seaton (UNCW)

**Ph.D. Advisor** Rudolf Jaffé (FIU)

**Postdoctoral Advisor** Miguel Goni (Oregon State University)

**Current Graduate Students Supervised** Lauren Thompson, Aleksandra Kirk, Beth Miller, Aleksandra Kirk, Donna Glinski

**Other Personnel Supervised** Post-Doctorial Associates Dr. Mellissa Southwell and Dr. Kate Mullaugh
Curriculum Vita 2004 - 2010
Professor John M. Morrison
University of North Carolina Wilmington
Physics & Physical Oceanography
(910) 962-2333
Email: morrisonj@uncw.edu

Education

Ph D, Texas A&M University, 1977.
Major: Physical Oceanography
Dissertation Title: Water Mass Properties Used as Flow Indicators within the Eastern Caribbean Sea During the Winter of 1972 and Fall 1973
ADVISOR: Worth D. Nowlin, Jr.

MS, Texas A&M University, 1974.
Major: Physical Oceanography
Dissertation Title: Nutrient and Dissolved Oxygen Distributions in the Gulf of Mexico and Adjacent Regions
ADVISOR: Worth D. Nowlin, Jr.

BA, College of the Holy Cross, 1971.
Major: Physics

Professional Positions

Academic

Adjunct Full Professor, North Carolina State University. (January 1, 2006 - Present).
Tenured Full Professor, University of North Carolina Wilmington. (January 1, 2006 - Present).
Tenured Full Professor, North Carolina State University. (July 1, 2000 - December 31, 2005).
Director, Oceanographic Remote Sensing Facility, North Carolina State University. (March 1, 1992 - December 31, 2005).
Director, Facility for Oceanographic Modeling and Visualization (FOAMv), North Carolina State University. (January 1, 1994 - December 31, 2002).
Tenured Associate Professor, North Carolina State University. (July 1, 1989 - July 31, 2000).
Associate Professor, North Carolina State University. (October 1, 1985 - July 31, 1989).
Visiting Scientist / Lecturer, University of Miami. (January 1, 1987 - May 31, 1987).
Assistant Research Scientist, Texas A&M University. (September 1, 1978 - June 30, 1982).
Staff Associate, National Academy of Sciences. (September 1, 1980 - February 28, 1982).

Government

Associate Program Director for Physical Oceanography, National Science Foundation. (March 1, 1985 - October 31, 1985).
Program Director for Ocean Dynamics, National Science Foundation. (August 1, 1983 - March 31, 1985).
Assistant Program Director for Ocean Dynamics, National Science Foundation. (June 1, 1982 - July 31, 1983).

Military

Awards and Honors
Antarctic Service Medal of the United States, Awarded by Congress, 1983
Outstanding Performance Award, Ocean Science Division, National Science Foundation, 1986
Special Service Award, National Science Foundation, Contributions to Presidential Science and Technology Initiative, November 1985.
Faculty Fellow, US Navy - American Society Engineering Education, Summer 1991
Senior Faculty Fellow, US Navy - American Society Engineering Education, Summer, 1992

RESEARCH

Published Intellectual Contributions

Refereed Journal Articles since 2004


Contracts, Grants and Sponsored Research

Funded Grants

Morrison, John M (Principal), Kamykowski, Dan (Supporting), Xie, Lian (Supporting), Banks, Stuart (Supporting), "Biodiversity and Upwelling Dynamics of the Galápagos Marine Reserve," Sponsored by NASA, Federal, $1,066,000.00.

Morrison, John M (Co-Principal), Kamkowski, Daniel (Principal), Janowitz, Gerald (Co-Principal), Sinclair, Geoffrey A (Co-Principal), Thomas, Carrie (Co-Principal), "Supplement to Benthic Dinoflagellate Migration (BenDiM): Occurrence and Processes," Sponsored by National Science Foundation, Federal, $656,422.00.

Pending Grants

Morrison, John M (Principal), Kamkowski, Daniel (Co-Principal), Banks, Stuart (Co-Principal), Feldman, Gene (Co-Principal), Xie, Lian (Co-Principal), "NASA BIOCLIM Type B: GALAPAGOS AND ADAPTATION TO CLIMATE CHANGE - A FIRST VULNERABILITY ASSESSMENT," Sponsored by National Aeronautics and Space Administration, Federal, $462,815.00.

Morrison, John M (Principal), "The Dynamics of the Ocean Circulation in the Galapagos Marine Reserve," Sponsored by National Science Foundation, Federal, $760,000.00.


Morrison, John M (Co-Principal), Baden, Daniel G (Principal), Styron, Jay (Co-Principal), Willey, Joan D (Co-Principal), "Upgrade/Replacement of oceanographic research and education facilities, University of North Carolina Wilmington.," Sponsored by NSF-SRI-R2, Federal, $3,263,125.00. (January 1, 2010 - December 31, 2013).
**Intellectual Contributions in Submission**

**Refereed Journal Articles**


Liu, Yanyun, Lian Xie, John M. Morrison, Daniel Kamykowski (2010c), How the climate change may affect the ocean circulation of the Galápagos Archipelago. *Journal of Climate.* (In Preparation)


McCulloch*, Anita, Daniel Kamykowski, John M. Morrison. ENSO-related variability in phytoplankton community structure of the Galápagos Marine Reserve. (In Final Preparation)

McCulloch*, Anita, Daniel Kamykowski, John M. Morrison. Spatial and temporal variability of phytoplankton community structure of the GMR based on pigment analysis. (IN Preparation)

McCulloch*, Anita, Daniel Kamykowski, John M. Morrison. Inter-seasonal variability of plankton community structure of the Galápagos Marine Reserve. (In Final Preparation)

**Research in Progress**

"BenDIM Cruise in Gulf Of Mexico"
Third of BenDIM cruises. July 6 - July 16, 2009

"Benthic Dinoflagellate Migration (BenDIM): Occurrence and Processes" (On-Going)
Most applications of the standardized dinoflagellate diel vertical migration (DVM) hypothesis consider a surface goal in daylight and a subsurface nutrient goal at night
because of the visibility of surface blooms. The sub-surface nutrient source, however, can be so deep that dinoflagellates are unable to reach the surface during a 12 h ascent. At least three literature reports document a sediment-oriented expression of an alternative DVM pattern characteristic of continental boundaries with wider, more gently sloping shelves that can yield high biomass, near-bottom dinoflagellate accumulations. The targeted dinoflagellate niche, here termed ‘Benthic Dinoflagellate Migration’ or ‘BenDiM’, is influenced by light and nutrient gradients but is unique in that a DVM exists between a nutrient source near or at the sediment-sea interface and a light intensity in the lower euphotic zone that supports a net increase in population size. The research questions in this proposal specifically deal with: 1) the different dinoflagellate species that occupy the BenDiM niche on the continental shelf off Panama City, FL between the 60 m and 20 m contours between May and Nov; 2) the light acclimation, the nutrient uptake capabilities, and the behavioral patterns required of different dinoflagellate species that occupy the BenDiM niche; and, 3) the effect of representative physical water motion on the formation, transport and fate of the different BenDiM dinoflagellate species populations. The proposed integrated study includes: 1) a pelagic/benthic field program with three 7-day cruises during different months between May and Oct in 2008 and Jul-Aug 2009; 2) laboratory studies on the light, nutrient, and behavioral characteristics of BenDiM dinoflagellates that allow successful competition with near-bottom pelagic diatoms and the microphytobenthos; and 3) a physical biological modeling study to plan, integrate and extend the field and laboratory results.

"Dynamics of the Ocean Circulation in the Galápagos Marine Reserve" (On-Going)
The proposed effort continues analysis of dynamics of oceanographic variability in Equatorial Pacific Ocean from mesoscale to basin spatial scales and seasonal to climatic time scales as they influence biodiversity and community structure of the marine ecosystems of the Galápagos Marine Reserve (GMR). This effort will make use of an extensive set of physical, biological and chemical data collected during 2004 – 2008; a high-resolution hydrodynamical model; a series of ecological and trophic models; and satellite remote sensed data. The water mass characteristics and currents around the GMR are being studied in an effort to better understand the physical environment influencing the Galápagos Archipelago and evaluate impacts of climatological perturbations, such as ENSO. We aim to better understand structuring of marine communities and their resilience to perturbations such as climate change or ENSO through improved understanding of the biophysical oceanographic environment.

Professional Service

Committee Member (National Election), University National Oceanographic Laboratory System (UNOLS) Council, Washington, DC. (2007 - Present).

Member Sub-Committee Reviewing NSF Shiptime Plan for 2010 (2009)

Nominating Committee for Ocean Observing Science Committee (2010)

Committee Member, National Science Foundation RVRC Ship Selection Committee, Washington, DC. (August 2009 - August 2010).

Committee Member, NASA Biodiversity and Environmental Forcasting Research Team. (2004 - Present).

Committee Member, NASA Ocean Color Research Team. (2000 - Present).


Member, South Atlantic Bight (SAB) Physical Oceanography and Meteorology (POM), 2006 – present.


Reviewer, Grant Proposal, National Aeronautics and Space Administration. (2000 - Present).


Reviewer, Grant Proposal, National Science Foundation (4 Divisions). (1990 - Present).

Committee Member, Executive Committee, Southeast Coastal Ocean Observing System (SE-COOS) Planning Committee. (2004 - 2007).

Ocean Research Interactive Observatory Networks (ORION) Planning Workshop. San Juan, Puerto Rico, January 4-8, 2005.


Southeast Coastal Ocean Observing Regional Association (SECOORA)/SouthEast U.S. Atlantic Coastal Ocean Observing System (SEA-COOS), Workshop, Jacksonville, FL, September 12-13, 2006.
D. Ann Pabst

Department of Biology and Marine Biology and Center for Marine Science
University of North Carolina at Wilmington
601 South College Road
Wilmington, NC 28403

EDUCATION
1984-1989 Ph.D., Zoology, Duke University (with Stephen A. Wainwright)
1978-1982 B.S., Zoology, University of Maryland

POSITIONS
2004-present Graduate Coordinator and Assistant Chair, Department of Biology and Marine Biology
2002-present Professor, Department of Biology and Marine Biology and Center for Marine Science, University of North Carolina Wilmington
2002-07; 2009 Adjunct Faculty, Old Dominion University
2001-present Adjunct Scientist, Mote Marine Laboratory
1998-2002 Associate Professor, Department of Biological Sciences and Center for Marine Science, University of North Carolina at Wilmington
1995-1998 Assistant Professor, Department of Biological Sciences and Center for Marine Science Research, University of North Carolina at Wilmington
1991-1995 Assistant Professor, Department of Biology, James Madison University.
August 1994 Visiting Instructor, School of the Environment, Duke University Marine Laboratory. co-taught: Marine Mammals
1987-1989 Cocos Training Grant in Morphology Fellow, Department of Zoology, Duke University
1984-1986 Research Assistant, S.A. Wainwright, Department of Zoology, Duke University
1983-1984 Coordinator, Marine Mammal Events Program, a joint program with the Smithsonian Institution and the Cousteau Society, Smithsonian Institution, Washington, D.C.

FELLOWSHIPS, SCHOLARSHIPS AND GRANTS (past 5 years)

- 2010 US Fish and Wildlife Service. Co-Principal Investigator with William A. McLellan: UNC Wilmington Pilot Study to organize past manatee sightings and to collect future manatee sightings data from North Carolina; $11,525
- 2010 Parsons (through Duke University), Co-Principal Investigator with Andrew Read (PI), Charles Borchers and William A. McLellan: Long-term monitoring of protected species in the USWTR; Onslow Bay and Jacksonville, FL; 8 month continuation, $416,023.
- 2009 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Principal Investigator: Enhancing Stranding Response in Northern North Carolina; 1 year study, $99,890
- 2009 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Co-Principal Investigator with William A. McLellan: Response to and Necropsy of Stranded Large Whales in North Carolina and Virginia; 2 year study; $99,890
- 2009 Parsons (through Duke University), Co-Principal Investigator with Andrew Read (PI), Charles Borchers and William A. McLellan: Long-term monitoring of protected species in the USWTR; Onslow Bay and Jacksonville, FL; 1 year study, $351,035.
- 2009 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Principal Investigator: Building stranding response capacity in northern North Carolina; 1 year study, $99,930.
2009 Parsons (through Duke University), Co-Principal Investigator with Andrew Read (PI), Charles Borchers and William A. McLellan: *Long-term monitoring of protected species in the USWTR; Jacksonville, FL*; 1 year study, $287,050.

2008 Geo-Marine Incorporated (through Duke University), Co-Principal Investigator with Andrew Read (PI), Charles Borchers and William A. McLellan: *Long-term monitoring of protected species in the USWTR*; 1 year study, $316,375.

2008 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Principal Investigator: *Enhanced tissue collection and health monitoring of stranded marine mammals in North Carolina and Virginia*; 1 year study, $99,974.

2007 National Atmospheric and Oceanic Administration, Co-Principal Investigator with Principal Investigator W.A. McLellan: *Seasonal occurrence of north Atlantic right whales along the mid-Atlantic coast*; 1 year study, $264,919.

2007 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Principal Investigator: *Enhanced tissue collection and health monitoring of stranded marine mammals in North Carolina and Virginia*; 1 year study; $98,240.

2006 Geo-Marine Incorporated (through Duke University), Co-Principal Investigator with Andrew Read (PI), Charles Borchers and William A. McLellan: *Long-term monitoring of protected species in the USWTR*; 1 year study, $295,965.

2006 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Principal Investigator: *Enhanced tissue collection and health monitoring of stranded marine mammals in North Carolina and Virginia*; 1 year study; $98,587.

2006 National Atmospheric and Oceanic Administration, Co-Principal Investigator with Principal Investigator W.A. McLellan: *Right whale data collection along the mid-Atlantic coast*; 1 year study, $437,849.

2006 National Atmospheric and Oceanic Administration, Prescott Stranding Grant, Principal Investigator: *Enhanced tissue collection and health monitoring of stranded marine mammals in North Carolina and Virginia*; 1 year study; $99,986.

2006 National Marine Fisheries Service, Prescott Stranding Grant, Co-Principal Investigator with Principal Investigator W.A. McLellan: *Enhancing response to and necropsy of stranded large whales in North Carolina, Virginia and South Carolina*; 1 year study, $92,830.

2005 National Atmospheric and Oceanic Administration, Co-Principal Investigator with Principal Investigator W.A. McLellan: *Data collection on the seasonal occurrence of north Atlantic right whales along the mid-Atlantic coast*; 1 year study; $393,764.

2005 NOAA-Fisheries, Office of Protected Resources, Principal Investigator: *UNCW Participation in St. Joseph’s Bay bottlenose dolphin bio-monitoring program*; 1 year study, $56,823.

2005 EarthTech, Marine protected species baseline and long-term monitoring plan for the East Coast Shallow Water Training Range; 1 year study, $15,412.

2005 National Marine Fisheries Service, Prescott Stranding Grant, Principal Investigator: *Enhanced tissue collection and health monitoring of stranded marine mammals in North Carolina and Virginia*; 1 year study; $98,587

**PUBLICATIONS** *(past 5 years; undergraduate, graduate and post-doctoral students with whom I have worked in bold)*


CURRICULUM VITAE

MARTIN H. POSEY

Department of Biology and Marine Biology
University of North Carolina Wilmington
601 S. College Road
Wilmington, N.C. 28403
(910) 962-3471

EDUCATION:
Ph.D. 1985 Biology, University of Oregon
B.A. 1980 Zoology with highest honors, University of North Carolina, Chapel Hill
A.A. 1978 General Studies, Charles County Community College, LaPlata, Maryland

PROFESSIONAL EXPERIENCE:
2004-present Chair and Professor, Department of Biology and Marine Biology, University of North Carolina Wilmington
1998-2004 Professor, Department of Biological Sciences, University of North Carolina at Wilmington
1994-1998 Associate Professor, Department of Biological Sciences, University of North Carolina at Wilmington
1989-1994 Assistant Professor, Department of Biological Sciences, University of North Carolina at Wilmington
Summers 1990-91; Visiting Scientist/Postdoctoral Fellow, Smithsonian Environmental Research Center.
1987-1989 Research Center.
1985-1987 Postdoctoral Research Associate, University of Oregon
1985 Course Assistant, Marine Biological Laboratory, Woods Hole
1980-1985 Graduate Teaching Fellow/Research Assistant, University of Oregon
1980 Natural Heritage Inventory Specialist, State of North Carolina

Professional Service and administrative experience:
Commissioner/Trustee for Southern Association of Colleges and Schools Commission on Colleges (SACS/COC). 2008-2010. Duties include biannual review of college and university accreditation files, including those requesting substantive changes, requiring monitoring reports, or under disciplinary action. Also includes training on accreditation requirements, review and voting on changes to accreditation standards, and participations in SACS/COC business.
Advisory Board for Carteret Community College Mariculture Program and Brunswick...
Community College Aquaculture Program; served on SWOT programmatic review team for Carteret Community College Aquaculture and Biology programs
North Carolina Crustacean Fisheries Advisory Committee (appointed twice); Chair of NC Division of Marine Fisheries Blue Crab Scientific Technical Advisory Committee
Invited participant in Southeast Atlantic Fisheries Council Ecohab workshop – subsequently asked to develop model metrics for benthos
North Carolina Division of Coastal Management Estuarine Biological and Physical Processes Work Group, NCDCM Sea Level Rise Impacts work group
North Carolina Oyster Restoration Steering Committee; SE Oyster Regional Recovery Team; Participant in North Carolina ARRA oyster restoration effort
North Carolina Division of Water Quality ad hoc work group on coastal swamp indicators
Co-organizer of 2000 Benthic Ecology Meetings (UNC-Wilmington; ~800 participants)
2010 Benthic Ecology Meetings (~750 participants); Organizer for Health and Related Sciences Symposia in 2009 and 2010 (UNC Wilmington); Organizer for Environmental Stewardship Symposium (2010, community symposium)
Participant in U.S.A.C.E. National Tidal Fringe Workshop
N.C. Sea Grant Assistant Director search committee
Adjunct faculty with North Carolina State University, University of North Carolina at Chapel Hill, and University of South Alabama.
Served on the editorial staff for the journals Marine Ecology Progress Series, Journal of Experimental Marine Biology and Ecology, and Journal of Shellfish Research.
Society Memberships: American Association for the Advancement of Science; Estuarine Research Federation; North Carolina Academy of Sciences; Southeastern Estuarine Research Society; Sigma Xi (President of local chapter 2000-2001); Ecological Society of America; National Shellfisheries Association

Academic Awards:
Voted 2008 recipient of the UNCW Graduate Mentor Award
Voted 2000 recipient of the UNCW Faculty Scholarship Award
UNCW Million Dollar Club (recognition for grant success)
UNCW 5 Million Dollar Club (recognition for grant success)
PUBLICATIONS since 2004:


GRANTS AND AWARDS:

South Carolina Department of Natural resources. 2010. “Student internship at Waddell Mariculture Center”. $1717. (P.I.)

North Carolina Sea Grant program. 2010-2012. Linking variation in egg quality to hatching success and larval survival in blue crabs. $9545 (co-P.I.).

North Carolina Sea Grant Program. 2010-2012. “To seed or not to seed: the value of seeding restored oyster reefs for ecosystem function”. $88,597 + graduate student support. 2010-2012. (co-P.I.)

Dial Cordy and Associates. 2009-2010. “Monitoring effects of a potential increased tidal range in the Cape Fear Ecosystem.” $415,599. (lead P.I.)


North Carolina Department of Environment and Natural Resources (CICEET), 2009-2010, “Sustainable estuarine shoreline stabilization”. $117,694. (lead P.I.) (part of larger project administered through NC Department of Natural Resources, $688,478, overall project co-PI)


Elizabeth City State University (U.S. Army Corps of Engineers), 2008-2009, “The Cape Fear River Ecosystems Project”. $293,373. (lead P.I.)


Elizabeth City State University (U.S. Army Corps of Engineers), 2007-2008, “Biochemistry and
Benthic infauna in swamps and Marshes along the NE Cape Fear and Cape Fear Rivers” $46,281. (P.I.)

Elizabeth City State University (U.S. Army Corps of Engineers), 2007- 2008 “Service, Maintain and calibrate remote data collection platforms in swamps and channels in the Cape Fear Basin” $43,421. (P.I.)


Cape Fear Memorial Foundation, 2005-2006, “Teaching kits for Physiology Laboratories”, $48,000 (co-P.I.)

North Carolina Sea Grant, Blue Crab Research Program, 2005-2006, “Assessment of blue crab distributions in the Cape Fear River estuary”. $47,264 (co-P.I)


North Carolina Sea Grant Program, 2005, “Monitoring and evaluation of settlement and subsequent community development on oyster sanctuaries”, $5232 (co-P.I.)

NOAA Office of Oceanic and Atmospheric Research, 2004-2005, “Coastal Ocean Research and Monitoring Program (CORMP) at the University of North Carolina at Wilmington”, $2,100,000 (co-P.I.)


CURRICULUM VITAE

STEVE W. ROSS

PERSONAL
Date of birth: 16 December 1951
Birthplace: Wadesboro, NC
Home address: 309 Foxwood Ln., Wilmington, NC 28409

EDUCATION
High school: McCallie School, Chattanooga, TN (graduated May 1970)
College: Duke University, Durham, NC (BS in Zoology-1974)
Graduate: University of North Carolina, Chapel Hill, NC (MA in Zoology-1978)
North Carolina State University, Raleigh, NC (PhD in Zoology-1992)
   Dissertation: Comparisons of Population Dynamics of Juvenile spot (L. xanthurus), Atlantic croaker (M. undulatus), and Atlantic Menhaden (B. tyrannus) Among Diverse North Carolina Estuarine Nursery Areas.

PROFESSIONAL EXPERIENCE
Nov 2003 - present: Research Associate Professor - UNCW, Center for Marine Science 5600 Marvin Moss Ln., Wilmington, NC 28409
   phone: 910-395-3905, email: rosss@uncw.edu
May 1990 - Oct 2003: Research Director - North Carolina National Estuarine Research Reserve Program and NC Coastal Reserve Program, Adjunct Faculty (UNCW)
Sep 1977 - Dec 1978: Teaching Assistant, Zoology Dept., UNC-Chapel Hill, NC
May 1975 - Aug 1977: Research Assistant, UNC-Institute of Marine Sciences, Morehead City, NC

ONGOING PROJECTS (partial list)
Description of NC offshore reef ichthyofauna and mapping of reefs.
Community structure and biology of continental slope fishes.
Distribution and taxonomic status of Aulopus.
Biogeography of NC & SEUS marine waters.
Description of the marine fishes of North Carolina (technical book).
Processes affecting fish utilization of and recruitment into estuarine nursery areas.
Distributions and community ecology of southeastern US and Gulf of Mexico deep coral banks.
Trophodynamics of midwater communities over deep-sea cold seeps and reefs.
Paleoecology along the Gulf Stream system using deep-sea corals as proxies.

HONORS-AWARDS-APPOINTMENTS-COMMITTEES
Field Associate, Florida State Museum, Gainesville, FL (appointed Nov 1984)
Research Associate, North Carolina Museum of Natural Sciences, Raleigh, NC (appointed July 1985)
Certified Fisheries Scientist, American Fisheries Society (Jan 1985).
Chairman, Marine Fish Endangered/Threatened Species Committee for NC Museum Natural Sciences (1985-1986)
Adjunct Program and Research Associate, UNC-W, Center for Marine Science & Biology Dept. (appointed July 1990)
Adjunct Assistant Professor & Associate Member Graduate Faculty, N.C. State Univ. (appointed Oct 1994)
Member, Legislative Fisheries Moratorium Steering Committee (1994-96)
UNC-W Million Dollar Club award (1996)
Marine Hall Exhibits Committee, NC Museum Natural Sciences
Water Conservationist of the Year-1996, by NC Wildlife Federation (along with other members of a committee)
South Atlantic Fisheries Management Council GIS Species and Habitat Sub-Group (appointed 1997)
SEAMAP-South Atlantic Bottom Mapping Workgroup (appointed 1997)
Member, NERRs Central Data Management Committee (1995-2002)
Member, NC Outer Continental Shelf Technical Review Team (appointed 1998)
Third place for GIS article annual competition in GPS World magazine (1999)
Invited member of Federal Review Team for Sapelo Island NERR (Jan 2000)
Natl. Undersea Res. Center-SE Region grant review panel (invited Nov 2000)
Chairman, SEAMAP deepwater reef technical sub-committee
Natl. Undersea Res. Center-Western Region grant review panel (invited Nov 2002)
Appointed to UNCW graduate faculty in marine science (June 2004, reappointed July 2009)
SEADESC steering committee (2005-2007)
Member, Working Group on Deep-Water Ecology, International Council for Exploration of the Sea (appointed Jul 05)
Member, Coral Advisory Panel of S. Atl. Fishery Management Council (appointed Oct 2005)
Tar Heel of the Week (Raleigh News & Observer, 22 Nov 2009)
Scientific Steering Committee for 5th International Deep-sea Coral Symposium (invited Feb 2010)

GRANTS-CONTRACTS since 2004

2004: PI, NURC rapid response grant to survey shelf edge reefs in proposed MPA off NC.
2004-2005: PI, MMS grant to facilitate analysis of deep coral bank data.
2005: PI, NC Sea Grant Student Research Award.
2005: Co-PI, NOAA grant to write status of deep corals report regional chapter.
2005: Co-PI, NURC rapid response grant to initiate fish acoustic monitoring & continue fish surveys on a deep reef.
2006-2007: PI, S. Atl. Fisheries Management Council grant to revise deep coral report and produce research DVD.
2006-2009: Lead PI, NOAA NURC grant for mapping deep-sea benthic habitats.
2007-2009: PI, Environmental Defense Fund grant to continue SEADESC habitat mapping project.
2006-2009: Lead PI, USGS grant - midwater/benthic trophodynamics studies over Gulf of Mexico deep seep sites.
2008: Lead PI, USGS four year grant for Gulf of Mexico deep reef ecosystem studies.
2008: PI, NOAA grant to study Essential Fish Habitat designations in deep-sea environments.
2009: PI, SAFMC grant to continue SEADESC project.

PROFESSIONAL ORGANIZATIONS
American Society of Ichthyologists and Herpetologists, Estuarine Research Federation, Southeastern Fishes Council,
Association of Southeastern Biologists, American Fisheries Society

PUBLICATIONS (Peer Reviewed) since 2004


Name: Richard Satterlie

Education:
Sonoma State University (California) B.A. 1973
University of California, Santa Barbara Ph.D. 1978
University of Alberta (Canada) Post-Doc 1978-1980

Appointments:
UNCW - Frank Hawkins Kenan Distinguished Professor of Marine Biology 2004 – present
Arizona State University Professor 1991 – 2004
Arizona State University Associate Professor 1985 – 1991
Arizona State University Assistant Professor 1980 – 1985
University of Alberta Lecturer 1979 – 1980

Publications since 2004:
2007 Pirtle, T.J. and R.A. Satterlie. The role of postinhibitory rebound in the locomotor central pattern generator of *Clione limacina*. Int. Comp. Biol. 47: 451-456

Grants:
1999 National Science Foundation – (Co-PI) “IGERT: Musculo-Skeletal and Neural Adaptations in Form and Function” – 5 years, $2,699,999.

2000 NIH – RO1 – “Neural Control of a Ballistic Startle Response” 3 years, $471,529

2001 John Simon Guggenheim Memorial Foundation Fellowship – “Modular and Multifunctional Nature of Arousal Systems” - 1 year, $26,161

2004 National Science Foundation – “Acquisition of a Confocal Microscope” (co-PI) 3 years, $310,173

2009 National Science Foundation – “Control of Directional Swimming in Cubomedusae” 3 years, $400,181.

2009 National Science Foundation – “Expansion of the Seawater System of the Center for Marine Science” 3 years, $109,920.

Honors and Awards:

2002 John Simon Guggenheim Memorial Foundation Fellowship (Academic Year 2002-03)

Other Creative Activities:

Novels published and under contract:

- **Phoenix**: Historical Fiction, Whiskey Creek Press, July 2006
- **Something Bad**: Horror, Medallion Press, October 2007
- **Agnes Hahn**: Psychological Suspense, Medallion Press, August 2008
- **Imola**: Psychological Suspense, Medallion Press, September 2009


**Frederick S. Scharf**

Department of Biology and Marine Biology
University of North Carolina Wilmington
601 South College Rd., Wilmington, NC 28403-5915
Tel. (910) 962-7796; Fax. (910) 962-4066
email: scharff@uncw.edu

**Education**


1997 M.Sc., Wildlife and Fisheries Biology, University of Massachusetts, Amherst. Thesis: Predator size-prey size relationships and predator dynamics of marine fish on the Northeast U. S. Continental Shelf

1994 B.Sc., Biology major/Marine Sciences minor, State University of New York at Stony Brook.
**Research areas**
Recruitment processes in marine and estuarine fishes, mortality estimation, early life history, sampling and experimental design, population assessment, behavioral ecology of fishes, fish associations with structured habitats, predator-prey interactions, fish physiology and growth dynamics, fish reproduction

**Recent Professional experience**
Aug 2008 – present  
Associate Professor, Department of Biology and Marine Biology, University of North Carolina Wilmington, Wilmington, NC

Jan 2003 – 2008  
Assistant Professor, Department of Biology and Marine Biology, University of North Carolina Wilmington, Wilmington, NC

Sep 2001 – Dec 2002  
National Research Council Postdoctoral Fellow, National Marine Fisheries Service, Sandy Hook, New Jersey

**Professional service**
Reviewed articles for:

**Peer-reviewed publications since 2003** (student authors are in bold; 1 = undergraduate, 2 = MS, 3 = PhD)

Submitted or accepted:
**Smith, W.E.*,** F.S. Scharf. *In press* (accepted May 2010). Demographic characteristics of southern flounder (*Paralichthys lethostigma*) harvested by an estuarine gill net fishery. *Fisheries Management and Ecology*

Published:


**Bacheler, N.M.**, L.M. Paramore, J.A. Buckel, and F.S. Scharf. 2008. Recruitment of juvenile red drum in


**Extramural funding**

National Science Foundation – UBM Group: BioMaSS: Biological and Mathematic Synergistic Science.
Borrett, S., Freeze, M., Scharf, F.S. (co-PI), Simmons, S. and Van Tuinen, M. Requested $239,546 for 6/15/10 – 6/14/13; pending

NC Division of Marine Fisheries Marine Resources Fund: Stock structure of southern flounder (*Paralichthys lethostigma*) in North Carolina and US South Atlantic waters

North Carolina Sea Grant: Updating size and age at maturity schedules for southern flounder through examination of reproductive tissue and otolith microchemistry (year 2)
Scharf, F.S. and Taylor, J.C. Funded at $47,221 for 8/1/10 – 7/31/11

North Carolina Sea Grant: The physiological basis of winter-induced stress and mortality in juvenile red drum

North Carolina Sea Grant: Effects of habitat alteration and biotic interactions on survival of juvenile estuarine fish
Funded at $120,000 for 2/1/2010 – 1/31/2012

North Carolina Sea Grant: Laboratory validation of field-based estimates of red drum foraging rates  
Scharf, F.S. (sole PI)  
Funded at $1,725 for 8/1/09 – 7/31/10

North Carolina Sea Grant: Updating size and age at maturity schedules for southern flounder through examination of reproductive tissue and otolith microchemistry  
Scharf, F.S. and Taylor, J.C.  
$94,441 for 8/1/09 – 7/31/11 – funded at $47,221

North Carolina Sea Grant: Does density-dependent mortality in a juvenile estuarine fish limit recruitment?  
Funded at $116,849 for 2/1/2008 – 1/31/2010

NOAA Cooperative Research Program: Batch fecundity and spawning frequency as a function of size, age, and season for black sea bass and red porgy in the US South Atlantic  
Scharf, F.S. (co-lead PI w/Baker), Baker, M.S., Wyanski, D., Burgess, T., and Shertzer, K.  
Funded at $222,716 for 8/1/07 – 7/31/09

North Carolina Sea Grant: Predation by red drum on juvenile blue crabs: estimation of daily ration and seasonal and ontogenetic variation in the contribution of blue crab to the diet  
Scharf, F.S. (sole PI)  
Funded at $46,041 for 8/1/07 – 7/31/09

North Carolina Sea Grant: Catch potential and condition of shrimp and bycatch associated with a new RCGL shrimp trap design, and evaluation of commercial traps in different regions of SE NC  
Thorpe, T.E. and Scharf, F.S. (co-PI)  
Funded at $15,416 for 6/1/06 – 12/31/07

North Carolina Sea Grant: Post-release mortality of sub-legal sized southern flounder in the North Carolina gill net fishery  
Smith, W.E., Sullivan, F., and Scharf, F.S. (co-PI to help with design and analysis)  
Funded at $21,365 for 6/1/07 – 8/1/08

North Carolina Sea Grant: Estimating mortality of age-0 red drum: an educational partnership to examine factors affecting recruitment  
Scharf, F.S. (lead PI) and Harrill, P.  
Funded at $64,071 for 8/1/06 – 5/31/08

North Carolina Sea Grant: Exploitation rate and demographics of southern flounder in the New River gillnet fishery  
Scharf, F.S. (lead PI) and Sanderford, B.R.  
Funded at $78,325 for 5/1/05 – 4/30/07  
Received supplement of $8,360 in March 2007 for 5/1/07 – 10/30/07

North Carolina Sea Grant: Post-settlement growth and winter distribution of juvenile red drum  
Scharf, F.S. (sole PI)
Funded at $5,000 for 10/1/04 – 12/31/05

North Carolina Sea Grant: Relative abundance of early juvenile and sub-adult red drum in the Cape Fear River estuary: an evaluation of the contribution of a southeastern North Carolina estuary to fishery recruitment
Scharf, F.S. (lead PI) and Beresoff, D.A
Funded at $41,150 for 4/1/04 – 12/31/05

UNCW Center for Marine Science: Characterizing red drum populations in North Carolina waters: Identification of estuarine nurseries and contribution to fishery production
Scharf, F.S. (lead PI) and Lankford, T.E.
Funded at $24,863 for 8/1/03 – 12/31/04

NOAA – National Research Council: The effects of structural habitat complexity on the functional response of marine fish predators: testing for general patterns across species assemblages
Scharf, F.S. and Fabrizio, M.C.
Funded at $72,000 for 10/1/01 – 12/31/02

NOAA Bluefish-Striped Bass Dynamics Research Program: Impact of prey abundance and size-structure on growth of spring- and summer-spawned juvenile bluefish in the Hudson River estuary: an individual-based modeling approach
Funded at $49,170 for 1/1/2000 – 12/31/01
Biographical Sketch - Pamela J. Seaton
Department of Chemistry and Biochemistry, University of North Carolina – Wilmington
601 South College Rd., Wilmington NC 28403 Phone: (910) 962-3279; e-mail: seatonp@uncw.edu

Education
B. S.; Chemistry, Biology, 1974, University of Washington, Seattle

Professional Experience
Graduate Teaching and Research Assistant, (1980 - 1985) Dept. Chemistry, University of Vermont
Graduate Teaching Assistant, (1977 - 1979) Department of Microbiology - Biochemistry, Univ. Vermont

Selected Publications since 2004
Christopher D.; Watanabe, Wade O.; Rezek, Troy C.; Seaton, Pamela J. 2009, Preliminary investigations on the effects of dietary lipid on the spawning performance and egg quality of black sea bass Centropristis striata L
Aquaculture Research, 40, 1873-1883.

Miller, Carrie; Gordon, Kelly G.; Kieber, Robert J.; Willey, Joan D.; Seaton, Pamela J. 2009, Chemical characteristics of chromophoric dissolved organic matter in rainwater. Atmospheric Environment, 43, 2497-2502


Selected Grants:
March 2010
"Acquisition of a 400 MHz NMR for the Departments of Chemistry and Biological Sciences, UNC-Wilmington", Pamela J. Seaton and James J. Kiddle, North Carolina Biotechnology Center's Institutional Development Grants Program, March, 1996, Awarded $171,429.


“Acquisition of a 600 MHz NMR,” Pamela J. Seaton, NSF MRI: 08/01/2008 to 07/31/2011, Awarded, $ 700,000.

“Institutional Development Grant. Calorimetry instrumentation” North Carolina Biotechnology Center., 2009-2010, Awarded $ 171,500. (Co-PI contributed to 3 out of 8 projects).

"MRI: Acquisition of an LC/MSn," Ralph Mead and Pamela Seaton, submitted to NSF-MRI on 04/20/2010 $187,884.00 (pending).

Membership in Professional Societies

* American Chemical Society
* Sigma Xi
Professional Preparation:

College of William and Mary, B.S. Geology (high honors), 1984.
University of Delaware, Ph.D. Oceanography, 1993.
Old Dominion University, Postdoctoral, Oceanography and Chemistry & Biochemistry, 1993-1995.

Appointments:

Adjunct assistant (1997-2002) and associate (2002-present) professor, Department of Marine Sciences, University of North Carolina at Chapel Hill.
Postdoctoral research associate, Departments of Oceanography and Chemistry & Biochemistry; Old Dominion University, 1993-1995.
Graduate research assistant, College of Marine Studies, University of Delaware, 1987-1993.
Laboratory instructor, Dept. Geology, College of William and Mary, 1984-1985.

Publications (last 5 years; student co-authors denoted by *):


**Grants (last five years):**


Lower Cape Fear River Program (UNCW), 2008. *Persistent Indicators of Anthropogenic Inputs to Tidal Creeks in New Hanover County, NC*, $1,500.


Bongkeun Song

Associate Professor
Department of Biology and Marine Biology
Center for Marine Sciences
University of North Carolina Wilmington
5600 Marvin K. Moss Lane, Wilmington, NC 28409
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EDUCATION:
2000 Ph.D., Environmental Science, Rutgers the State University of New Jersey, New Brunswick, New Jersey. Dissertation title: Diversity of bacteria capable of degrading halobenzoates under denitrifying conditions. Advisor: Dr. Max M. Häggblom
1997 M. S., Environmental Science, Rutgers the State University of New Jersey, New Brunswick, New Jersey. Thesis title: Microbial diversity of toluene degraders under denitrifying conditions Advisor: Dr. Norberto J. Palleroni
1994 B. S., Agriculture Biology, Dongguk University, Seoul, Korea.

PROFESSIONAL EXPERIENCE:
2010 – Present Associate Professor, Department of Biology and Marine Biology, University of North Carolina Wilmington.
2004 - 2010 Assistant Professor, Department of Biology and Marine Biology, University of North Carolina Wilmington.
2000 - 2004 Research Associate, Department of Geosciences, Princeton University.
1996 - 2000 Graduate Research Assistant, Department of Environmental Science, Rutgers the State University of New Jersey, New Brunswick, New Jersey.

ACTIVE GRANTS:
2010-2013 NSF Geobiology and Low Temperature Geochemistry: Collaborative Research: Anammox in a shallow coastal aquifer - combining in situ stable isotope and molecular approaches to examine controls on rates and communities. $650,000, PI: C. Tobias (UCONN) & Co-PI: B. Song (UNCW), R. Smith (USGS), J. Bohlke (USGS)
2009-2012 NSF Biological Oceanography: Collaborative research: Implication of ANAMMOX community structure and microbial interactions in estuarine
*N* removal processes. $515,800. PI: B. Song & Co-PI: C. Tobias (UCONN) and G. O’Mullan (SUNY).


**COMPLETED GRANTS:**


2005 UNCW Marine Science Equipment Pilot Projects: *High throughput robotic instrument for genomic and proteomic research.* $20,000. PI: B. Song.

**PUBLICATIONS since 2004:**

*Peer-reviewed journal articles*


Carmelo R. Tomas
Center for Marine Science
University of North Carolina Wilmington
5600 Marvin K. Moss Lane
Wilmington, NC 28409
Phone: 910-962-2385
Fax: 910-962-2410
e-mail tomasc@uncw.edu

Education:
Ph.D. Biological Sciences, University of Rhode Island, Kingston, RI, 1977
M.S. Botany, University of Rhode Island, Kingston, RI, 1971
B.A. American International College, Springfield, MA 1964

Employment
2004-2010 Professor, Dept. of Biology and Marine Biology, University of North Carolina Wilmington, NC.
1999-2004 Associate Professor, Dept. of Biology and Marine Biology, University of North Carolina, Wilmington, NC
1993-1999 Research Scientist, Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL
1989-1993 Research Administrator, Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL
1986-1989 Research Scientist, Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL
1982-1986 Head of Marine Botany, Zoological Station, Naples, Italy
1980-1982 Marine Scientist, Graduate School of Oceanography, URI, Kingston, RI
1979-1980 Fulbright Hays Fellow – Zoological Station, Naples, Italy
1977-1979 Research Associate, Graduate School of Oceanography, URI, Kingston, RI (Post Doctoral Fellow)
1971-1977 Research Assistant and Doctoral Student, GSO, URI, Kingston, RI
1969-1971 Teaching Assistant, Dept. of Botany, URI, Kingston, RI
1967-1971 Science Teacher, Pilgrim High School, Warwick, RI
1964-1967 Science Teacher, Lenox High School, Lenox, MA

Related Publications


**Other Publications**


Dr. Wade O. Watanabe
University of North Carolina Wilmington, Center for Marine Science
601 S. College Rd., Wilmington, NC 28403-5927

Education
B.S.: 1973, Zoology, Oregon State University, Corvallis.

Professional Experience
1999-present Research Professor, University of North Carolina Wilmington;
Coordinator, Aquaculture Program, Center for Marine Science
Program Leader, Mariculture (MARBIONC, Marine Biotechnology in North
Carolina)
1997-1999 Associate Research Scientist, University of North Carolina Wilmington
1996 Chief Scientist, Sea Change Foundation, Vero Beach, Florida
1991-1994 Adjunct Graduate Faculty, Dept. of Biological Sciences, Florida Institute
of Technology.
1986-1995 Chief Scientist, Caribbean Marine Research Center, Vero Beach, Florida and Lee
Stocking Island, Bahamas.
(ICLARM), Manila, Philippines (Rockefeller Foundation Post-Doctoral Research
Fellow)
1983-1984 Visiting Lecturer in fish reproductive physiology, National Sun Yat Sen
University, Kaohsiung and National Taiwan University, Taipei, Taiwan.
1978-1981 Jessie Smith Noyes Foundation Pre-doctoral Fellow, Oceanic Institute, Hawaii.

recirculating system for ongrowing of captive wild black sea bass Centropristis striata in

Tilapia: Biology, Culture, and Nutrition. Editors: C. Lim, and C. D. Webster. Haworth
Press.
www/cabicompendium.org/ac


Rezek, T.C., W.O. Watanabe, M. Harel and P.J. Seaton. 2010. The effects of dietary docosahexaenoic acid (22:6n-3) and arachidonic acid (20:4n-6 on growth, survival and stress resistance in black sea bass (Centropristis striata) larvae.


Watanabe, W.O. and H.V. Daniels. 2010. Chapter 18, Practical Flatfish Culture and Stock Enhancement: Summary and conclusions, pp. 323-354: In Practical Flatfish Culture and


**Grants and contracts (2005-present):**

2005  Grant from the U.S. Department of Agriculture: Controlled breeding, larviculture and intensive growout of high-value marine finfish species for US agriculture. $297,123.

2006  Grant from the U.S. Department of Agriculture: Controlled breeding, larviculture, intensive growout and marketing of high-value marine finfish species for US agriculture, with C.F. Dumas and M.S. Alam. $293,745.


2006  Grant from North Carolina Sea Grant: Commercial production of southern flounder: control of sex reversal and transfer of technology to industry, with H.V. Daniels, R.J. Borski, J. Godwin and T.M. Losordo (NCSU). $45,313.


2007  Grant from the North Carolina Fishery Resource Grant Program: Practical diet development for intensive cultivation of southern flounder in North Carolina using an alternative protein source, with S. Longfellow and M. S. Alam. $39,964.

2008  Grant from NC Sea Grant: Enhancing commercial aquaculture of southern flounder in North Carolina: requisite tools for broodstock husbandry and expanded all-female fingerling production, with H.V. Daniels and M.S. Alam. $96,401.

2008  The red porgy (*Pagrus pagrus*): optimizing prey enrichment and artificial microdiet applications for expanded hatchery production of fingerlings, with F. Montgomery and J. Morris (NOS). $49,918.

2008  Controlled breeding, larviculture and intensive growout of high value marine fish species for U.S. agriculture, with M.S. Alam, $219,350.

2009  Flounder Farming in North Carolina: Developing Improved Strains and Enhancing Marketability for Economic Success, with H.V. Daniels (NCSU), Golden Leaf Foundation subaward from NCSU. $21,622.

2009  Establishing a Pilot Hatchery for Production of Juveniles to Support the Finfish Mariculture Growout Industry in North Carolina, with C.F. Dumas, North Carolina Biotechnology Center, Regional Development Grant Program, $66,842.

2009  Controlled breeding, larviculture and intensive growout of high value marine fish species for U.S. agriculture, with M.S. Alam and C. Dumas. $205,920.

2009  Species Profile: Black sea bass. Southern Regional Aquaculture Center. $2,000.

2010  Pilot commercial scale testing of promising diets for intensive cultivation of southern flounder and black sea bass in NC using an alternative protein source, with M.S. Alam. $52,162

2010  Optimizing All-Female Southern Flounder Culture in Low Saline Waters, with M.S. Alam, R. Borski (NCSU) and H. Daniels (NCSU). North Carolina Sea Grant Sub Award from NCSU. $42,055.
Joan D. Willey

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University of North Carolina Wilmington
601 S. College Road
Wilmington, NC 28403-5932

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E-mail: willeyj@uncw.edu

Education
Duke University, North Carolina, 1965-69, B.Sc. in Chemistry
Duke University, Marine Laboratory, summers of 1968 and 1969
Dalhousie University, Nova Scotia, 1969-75, Ph.D. in Chemical Oceanography
Memorial University of Newfoundland Post-doctoral Fellowship, 1974-75, in Geochemistry

Appointments
Associate Director for Education, UNCW Center for Marine Science, 1999-present
Professor of Chemistry, University of North Carolina at Wilmington, 1986-present
Adjunct Faculty, Department of Marine Sciences, University of North Carolina at Chapel Hill, 1994 - present
Interim Dean of the Graduate School, UNCW, 1994-95
Graduate Program Coordinator, UNCW Department of Chemistry, 1988-94
Oceanography Program Coordinator, UNCW Center for Marine Science Research, 1989-94
Associate Professor of Chemistry, University of North Carolina at Wilmington, 1982-1986
Assistant Professor of Chemistry, University of North Carolina at Wilmington, 1977-1982

Scholarships and Awards
Exemplary Rating, UNCW Five Year Post Tenure Review, 2001 and 2006
UNCW Graduate Mentor Award 2004
Camille and Henry Dreyfus Scholar 1997-1999
Research Reassignment, August 1995 - May 1996, Guest Investigator at the Woods Hole Oceanographic Institution, and the University of Rhode Island
DeLoach Professor of Chemistry, UNCW, 1991-96
UNCW Award for Faculty Scholarship 1994

Five Most Recent Publications

Five Other Relevant Publications

Research Grants, Last Ten Years
Camille and Henry Dreyfus Foundation Scholar/Fellow Program for Undergraduate Institutions, $60,000, 1997-1999
Publications

Graduate Student or Graduates Names are in Bold

2010

**Stuercke, B.** & D.W. Freshwater. 2010. Two new species of Polysiphonia (Ceramiales, Florideophyceae) from the western Atlantic. Botanic Marina 53:301-311


2009


2008


2007


2006


2005


2004


Relevant Graduate Classes Added Since 2004

**Department of Biology and Marine Biology**

**BIO 530. Advanced Topics in Evolutionary Biology (3)** The study of adaptation and diversity from both a micro- and macro evolutionary perspective. Principles of population genetics, molecular evolution, phylogeny and systematics are among the topics that will be addressed in lecture and readings. Applications in behavior, physiology, ecology, medicine and conservation are stressed throughout. Three lectures per week. May be taken more than once for credit under different topics.

**BIOL 530. Advanced Topics in Evolutionary Biology Lab (1)** Co- or pre-requisite BIO 530. An introduction to analysis and interpretation of experimental and comparative work in evolution. Generation of new data sets, analysis of new and/or existing data sets and computer simulations will be used in laboratory studies of micro- and macro evolution. Three laboratory hours each week. May be taken more than once for credit under different topics.

**BIO 601. Oceanography and Environmental Science (2-3)** Prerequisite: BIO 564 or permission of instructor. Topics and methods in biological oceanography and environmental science. Required of all Ph.D. candidates. May be repeated under different subtitles.

**BIO 602. Ecology (2-3)** Prerequisite: permission of instructor. Topics and methods in marine ecology. May be repeated under different subtitles.

**BIO 603. Physiology and Biochemistry (2-3)** Prerequisite: permission of instructor. Topics and methods in the physiology and biochemistry of marine organisms. May be repeated under different subtitles.

**BIO 604. Cellular and Molecular Biology (2-3)** Prerequisite: permission of instructor. Topics and methods in the cellular and molecular biology of marine organisms. May be repeated under different subtitles.

**BIO 605. Evolution and Diversity (2-3)** Prerequisite: permission of instructor. Topics and methods in the evolution and diversity of marine organisms. May be repeated under different subtitles.

**Department of Chemistry and Biochemistry:**

**CHM 512. Nuclear Magnetic Resonance Spectroscopy (2)** Prerequisite: Two semesters of organic chemistry. Interpretation and acquisition of proton and carbon, one and two dimensional NMR spectra. Molecular structure elucidation of organic molecules using NMR spectroscopy. One hour of lecture and two hours of lab per week.

The following two courses while still in the catalogue are no longer offered due to low enrollment or retirement of faculty

**CHM 574. Aquatic Chemistry (3)** Prerequisite: Permission of the instructor. The chemistry of aqueous solutions, including use of activity coefficients, acid-base and buffer concepts, gas solubility, results of carbon dioxide dissolution, trace metal speciation, oxidation-reduction processes, photochemistry and mineral solubility. Concepts will be applied to laboratory solutions and natural waters.

**CHM 578. (478) Aquatic Toxicology (3)** Prerequisite: Organic Chemistry. Topics in aquatic toxicology, including toxicity testing; transport, transformation and ultimate distribution and fate of chemicals in the aquatic environment; and the performance of hazard risk assessments on aquatic ecosystems exposed to chemical insult.
Department of Environmental Studies

EVS 505. Advanced Environmental Studies (3) Interdisciplinary examination into the scope of environmental studies. Emphasis will be placed upon integrated analysis of environmental principles through investigation of current environmental issues.

EVS 515. Field Methods in Environmental Studies (3) A survey of methods, techniques and instrumentation used in environmental fieldwork. Focus is upon data gathering, analysis, interpretation and application to environmental management. Required field trips.

EVS 518. Research Methods in Environmental Studies (3) Prerequisite: STT 501 or permission of Instructor. Introduction to select research processes used in environmental studies, throughout project development, research implementation, data analysis and reporting. Scientific ethics, quality assurance and investigator safety will be emphasized. Students will gain experience in both quantitative and qualitative approaches to research.

EVS 520. Foundations of Coastal Management (3) Interdisciplinary investigation into the relationship between human society and coastal ecosystems, focusing upon the political, economic, socio-cultural and scientific challenges facing coastal managers. Core principles of coastal management will be used to develop potential solutions to contemporary coastal issues. Required field trips.

EVS 525. Foundations of Environmental Education and Interpretation (3) Principles, philosophies and methodologies of environmental education and interpretation are examined within both formal and informal educational settings. Extensive field-based opportunities will allow students to not only develop foundational knowledge but to gain practical experience in developing, implementing and evaluating environmental education and interpretation programming. Required field trips.

EVS 530. Tropical Environmental Ecology (3) An in-depth introduction to the issues, debates, and conservation of tropical environments, especially focusing on current ecological, social, and economic environmental problems. Emphasis will be on the Neotropics, located in Central and South America and the Caribbean, though all tropical locations, Asian, African, Australian, and Polynesian will be covered.

EVS 540. Foundations of Environmental Management (3) Policies and processes related to environmental management are examined within the context of the political, economic, socio-cultural and scientific challenges facing environmental managers today. Both regulatory and non-regulatory approaches to environmental management are examined within the public and private sectors. Required field trips.

EVS 554. Remote Sensing For Environmental Management (3) Prerequisite: GGY 520 or GGY 522 or Permission of Instructor. Principles of remote sensing and its use in assessing and enhancing environment management. Students will learn concepts pertaining to remote sensing, principal sensors, data available, utility of the data for environmental management, data acquisition and processing, output data interpretation and use for management decision-making.

EVS 555. Geospatial Analysis for Environmental Management (3) Prerequisite: GGY 520 or GGY 522 or EVS 554 or Permission of Instructor. A problem-based approach to GIS, wherein students develop a GIS, manage data acquired from different sources, create new data, derive data and generate desired/required outputs. Students will enhance/develop geospatial analysis skills, ranging from basic GIS analysis to use of different extensions and remote sensing data
while working on their own projects. Students will cover all aspects of a geospatial project, ranging from elaboration of a proposal, to presenting their results to the public.

EVS 560. (EVS 460) Using Advanced Technologies to Teach About the Environment (3) This course will focus on the use of new technologies to teach about the environment; current issues and trends in environmental education; the development, implementation, and assessment of new technologies; and effective instructional strategies to teach key environmental principles and concepts.

EVS 564. Natural Resource Policy (3) Existing natural resource laws, institutions and programs are summarized in their historical context and in relation to current natural resource issues. Philosophical underpinnings of policy positions are examined and discussed to facilitate greater understanding of implicit goals. Class presents models of policy creation, implementation, and reform, with specific examples focusing on natural resource management.

EVS 570. Advanced Environmental Law and Policy (3) Prerequisite: EVS 501. Analysis of issues related to the regulatory process, including research methods and current topics in environmental law and policy. Methodology and impacts of current and proposed policies will also be reviewed.

EVS 572. Coastal Protected Areas Management (3) Prerequisite: EVS 520 or permission of Instructor. Study of resource management focused on protected areas maintained by government agencies and by private non-profit organizations. Emphasis will be on natural area significance, site selection, management plan development, policy formulation, protection options, use conflicts and public relations.


EVS 578. (EVS 478) Hazardous Waste Operations and Emergency Response (HazWOpER) (3) Study of the physical and chemical hazards present at hazardous waste sites and those encountered during environmental clean-ups, as well as OSHA regulations pertaining to those sites. The class will meet the 40 CFR 1910.120 requirements for 40+ hours of training and OSHA certification will be issued.

EVS 580. Research Diving (3) Prerequisite: SCUBA certification, medical exam and permission of Instructor. Training in advanced diving, research diving enriched air nitrox, rescue diving and oxygen administration techniques. Students will receive AAUS (American Academy of Underwater Science) Completion of Training Certificate.

EVS 597. Practicum in Environmental Studies (1-6) Prerequisite: Permission of Instructor. Advanced field placement and experience in non-profit, governmental or private sector. Provides extended opportunities for fieldwork, research or creative projects and includes related theory to practical applications.

Substantively revised since 2004

EVS 501. Introduction to Environmental Problems and Policy (3) Introduction to critical and practical skills necessary to identify, analyze, and assess environmental problems. Includes study and review of environmental policy issues.

EVS 595. Seminar/Final Project (3) Field, laboratory or literature-based research on selected topics in environmental planning and policy developed, implemented and presented in collaboration with selected faculty, staff and/or environmental professionals.

To be added to 2011-12 catalog (awaiting approval)
EVS 576. Issues for a Sustainable Society (3) Current topics in sustainability will be analyzed in relation to sociocultural, economic and political frameworks. Individual and societal responses to environmental issues, ranging from local to global, will serve as the foundation for examining future trends and issues in sustainability.

Department of Geography and Geology
GLY 573. Isotope Geochemistry (3) Prerequisite: Two semester of college calculus and two semesters of college chemistry. Introduction to the use of radio and stable isotopes for studying environmental processes; radio decay and the applications of radioisotopes at daily to earth-history timescales; isotopic fractionation, and applications of stable isotopes in modern and paleo-environments. Three lecture hours per week.

GGY 520. Fundamentals of Geographic Information Systems (3) Purpose, use, and development of GIS. Theoretical basis for spatial data models and the integration of these data to solve problems. Two lecture and two laboratory hours each week.

GGY 524. (424) Advanced Geographic Information Systems (4) Prerequisite: GGY 328 or GGY 520 or consent of instructor. Advanced theory and application of the use of Geographic Information Systems (GIS), spatial data collection, data structures, data management and relational databases, spatial analysis, and display of geographic information in a computer-based environment. Lectures, demonstrations, and lab exercises. Two lecture and three laboratory hours each week.

GGY 526. (426) Environmental Geographic Information Systems (4) Prerequisites: GGY 328 or GGY 520 or consent of instructor. Overview of environmental applications of GIS and completion of a GIS project; planning a GIS project; development and analysis of the data, and oral and written presentation of the results. Research topics may include atmospheric studies, oceanographic, hydrology, ecology, biology, resource management, and hazard risk assessments. Two lecture and three laboratory hours each week.

Department of Physics and Physical Oceanography
PHY 550. Fluid Mechanics (3) Permission of Instructor. A comprehensive account of fluid dynamics that emphasizes fundamental physical principles. Fluid statistics; fluid kinematics; integral and differential forms of the conservation laws for mass, momentum and energy; Bernoulli equation; laminar flows; potential flows; vorticity dynamics; dynamic similarity; boundary layers; turbulence.

PHY 577. (477) Observational Methods and Data Analysis in Physical Oceanography (3) Prerequisites: Permission of instructor. This course will supply the student with a working knowledge of the use and operation of various physical oceanographic instruments and data reduction and analysis techniques.

PHY 578. (478) Geophysical Fluid Dynamics (3) Prerequisite: PHY 550, Corequisite: PHY 475 or 575. The fundamental principles governing the flow of a density-stratified fluid on a rotating planet, with applications to the motions of the ocean and atmosphere. Equations of state, compressibility, Boussinesq approximation. Geostrophic balance, Rossby number. Poincare, Kelvin, Rossby waves, geostrophic adjustment.

PHY 579. (479) Ocean Circulation Systems (3) Prerequisite: PHY 475 or 575. Course focuses on results of World Ocean Circulation Experiment (WOCE), a multi-national, multi-decadal program designed to observe the global ocean. Explores large-scale circulation and properties of
the ocean to lay the foundation for the challenge of understanding the future of the world oceans and their role in climate change.

**PHY 580. (480) Coastal and Estuarine Systems (3)** Prerequisite: PHY 475 or 575. An introduction to the physical processes operating within coastal and estuarine systems. The focus of the course will be on the dynamical description of topics such as gravity waves, surf zone hydrodynamics, storm surge, tides, estuarine hydraulics, sediment transport and morphodynamics.
Appendix IV – Equipment Available to Students in this Program

A. Center for Marine Science

DNA Analysis Core Facility – Dr. Wilson Freshwater

Core Description: The DNA Analysis Core Facility provides the UNCW community with the infrastructure and expertise to generate and analyze DNA data for research and education. The facility also buys BigDye sequencing chemistry in bulk, which saves users over $300/tube. Dr. D. Wilson Freshwater is the Core Leader and has one of his graduate students helping with instrument maintenance, but there is no technician for the facility. Just over 23,000 reactions were analyzed on the facilities main instrument during 2009.

Approx # of users/Student Training: Twelve UNCW PIs have utilized the main instrument during the first 5 months of this fiscal year, and additional PIs have used other instruments in the facility. The vast majority of DNA Core facilitated research is being carried out by students (it is a rare site to see PIs using the instruments). The DNA Core also important for student training through its use by graduate and undergraduate classes.

IRMS Core Facility – Dr. BK Song

Core Description: The IRMS facility is for stable isotope analysis, which is maintained by Dr. Song as an interim leader and Kim Duernberger as a lab technician. Kim’s position will be terminated by the end of March due to lack of funding.

Approx # of users and or other metric of use: So far, there are five user groups including BK Song, Steve Emslie, Chris Finelli, Steve Ross, and Patricia Kelly.
Student training: At least 8 graduate students were trained to use the IRMS facility.

CMS Nutrient Core Facility – Dr. Alina Szmant

Core Description: The nutrient analysis core facility at CMS is supervised by Dr. Alina Szmant. Dr. Rob Whitehead is responsible for management and operation of the lab as well as training and supervision of the lab’s users. The lab houses seven main instruments for nutrient and organic analyses: a Bran+Luebbe AutoAnalyzer III, a Shimadzu TOC 5050, an Antek 9000N, an Antek 7000 NoxBox, a CE Elantech NC2100, a Shimadzu UV1410 spectrophotometer and a Turner 10AU fluorometer. Most of these instruments are equipped with autosamplers, which greatly contribute to the lab’s productivity.

Approx # of users/Student Training: Currently at least eight different research groups use the facility and more than 10,000 discrete samples are analyzed annually. The major users are the Lower Cape Fear River Program, Song Lab, Marine and Atmospheric Chemistry Research Laboratory, Benthic Lab, and Coral Reef Ecology. The lab is a valuable training facility and most of the samples are analyzed by students as part of their research work in Marine Science,
Chemistry and Biology. Students are also trained in the lab during CHM 576 “Chemical and physical analysis of seawater”.

**Oceanographic Instrumentation Core Facility – Dr. John Morrison**

**Core Description:** Oceanographic Instrumentation Core Group encompassing side scan sonar, sub-bottom profiler, rosette and MET suite. Faculty lead is John Morrison with John Murray as lead tech.

**Approx # of users/Student Training:** Past recent use has generally been as a teaching aid in the Marine Geo and Physical Oceanography lab trips. Due to the extensive set up and fickleness of the software students haven't been involved in the set up or use of this equipment. I could see training students to help the tech with this and post processing of data gathered. Student training for a single use would be difficult due to the complexity of the systems. If the equipment were to be used for a research project or thesis with multiple uses this might be more appropriate.
B. Biology and Marine Biology Department

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<tr>
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Department of Geology and Geography Instrument list

X-ray diffractometer
side scan sonar
ground penetrating radar
high precision GPS
surveying equipment.
assorted light microscopes
rock preparation equipment

Physics Instrument Inventory

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Physics Instrument Inventory – Cont.

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Other Instruments

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INTRODUCTION

A review of the Master of Science in Marine Science (MSMS) Program at the University of North Carolina Wilmington was carried out on March 31 and April 1, 2011 to evaluate the structure and function of the program and to make suggestions on its future development. During the review, the review committee, consisting of Professor Fred Dobbs, Old Dominion University, and Professor Bruce Corliss, Duke University, met with university and marine science administrators, faculty, undergraduate and graduate students, and alumni of the program. Observations and recommendations of this review are presented in three sections: Strengths, Needs, and Challenges.

The Master of Science in Marine Science Program was created in 1998 and has averaged >10 graduates per year since 2002. There are currently ca. 35 graduate students and 38 faculty members that make up the program. Facilities used by the program include the Center for Marine Sciences (CMS), located 7 miles from the main campus, and facilities within the Departments of Biology, Chemistry, Physics and Physical Oceanography, Environmental Studies, and Geography and Geology.

STRENGTHS

1. The program is characterized by a high level of collegiality between faculty and students within the program, and with faculty and administrators outside of the program. This spirit of collaboration and commitment to a graduate program is exemplary.

2. The faculty research activities and the associated student research are very broad and cover many different topics in marine science. In parallel with this, the course offering in the program is also very broad.

3. We noted a high level of institutional loyalty amongst students, faculty, and alumni of the program. This characteristic stood out in many conversations we had during our visit. All of the students we spoke with impressed us with their commitment, motivation, and appreciation for the educational experience they were receiving.

4. The MSMS Program gives students a holistic view of the oceans and an earth system perspective, which is highly valuable. At the same time, students learn job skills in their courses or research experiences, and most students are employed in the field of marine science after graduation.
5. Students have diverse research opportunities and experiences, reflecting the diversity of faculty interests, and ready access to state of the art equipment in CMS and various facilities in the departments. The availability of shared facilities with technical support is a huge asset for students in the program.

6. Students take advantage of several “value added” certificates, e.g., in GIS, marine education, and marine policy. These relatively short educational sequences enhance their learning and eventual marketability.

7. The age structure of the program’s faculty advisors is such that most (>80%) have been at UNCW for fewer than 20 years (Fig. 1). We see no looming “retirement crisis” evinced in these data.

![Figure 1. Age structure of UNCW MSMS advisors. The histogram indicates the year of hire for faculty members who serve as advisors for current marine science graduate students or who have been advisors for graduates of the program since 2004 (data from pp. 23—25 of the 2011 review document).](image)
NEEDS

The MSMS Program is a strong educational unit that works well and is a credit to the University of North Carolina Wilmington. In our review, we did find certain needs that exist and, if addressed, would improve the program. They include:

1. **Increased Interaction:** We believe that increasing the interactions within the marine science community would benefit faculty, staff, and students and foster a stronger sense of community. These interactions might include a Friday afternoon seminar at CMS on a general topic of interest. It is our understanding that this was done some years ago and was quite successful. Once a month, the home departments would not schedule a seminar and instead would organize a seminar at CMS. A social event would follow the seminar and be supported by CMS or the Marine Science Program. In addition, we think it important to have bus service established for this event, in addition to the transportation system currently being planned. There was strong enthusiasm from faculty and students for this idea in our discussions.

A second idea we discussed was to have a student-organized lunch seminar, in which students would give, once a year, a short (20-30 minute) summary of their research plans (if in year 1) or research progress (>1 year in residence). Lunch would either be a brown-bag seminar or be provided by the Marine Science Program. Again, the students were enthusiastic about pursuing this idea.

The aquaculture facility at Wrightsville Beach is remote from other facilities associated with the MSMS program. We suggest some combination of the above two ideas (or other ones) will increase interaction with that facility’s faculty and graduate students.

A third idea to promote interaction is to have a 2 or 3 day cruise for the incoming students. Especially if done as a credit-earning exercise (1 credit?), there is nothing like a cruise to get to know fellow students and create a common experience. This experience, however, must await acquisition of a suitable coastal vehicle (see our suggestion later in this report.).

Finally, we think it is important to re-start some sort of routine transportation system between the main campus and CMS. It is our understanding that this will be done in the near future, and we highly support this as a way to foster more interactions.

2. **Assistant Director:** The review document stressed the need for administrative support for Dr. Willey, director of the MSMS program. We concur wholeheartedly. The need is pressing not only to relieve Dr. Willey of increasing day-to-day tasks and expand the size of the program, but also to prepare for the future. She will retire eventually, so it is important to codify her knowledge and understanding of the MSMS program to facilitate its eventual transfer to someone else. In the
“Leadership” section of the “Challenges” portion of this report (below), we consider the strategic reasons for appointing an Assistant Director.

3. **Communications:** As with any organization, lines of communication could be improved within the MSMS program and more expansively, among MSMS, CMS, and the program’s affiliated academic departments. We have two specific suggestions:

*Revisit the Graduate Student Handbook:* We understand the Marine Science Graduate Student Association is finishing a revision to its handbook, a laudable effort that will help students better to understand the workings of the University. In this and future iterations of the handbook, we encourage the graduate students to make clear to their fellow students which administrator or faculty member is to be contacted about this or that question.

*Codify the money flow for students:* Faculty members are urged to make clear to themselves, and subsequently to the students, how graduate-student support is determined and distributed. This task will require coordinating the “philosophies” of the MSMS program, affiliated academic departments, and CMS.

4. **Miscellaneous:**

*Parking and Access Issues for Graduate Students:* The parking policy for graduate students at CMS is convoluted and inhibits the interaction suggested above. More importantly, perhaps, access issues largely preclude students engaging in late night and weekend research. We suggest the CMS Director and Graduate School Dean consult with the Provost, change this policy, and allow grad students parking privileges at CMS and card access to the facility after hours. This would be a small, but very significant improvement for the graduate students.

*Redundant courses:* Students feel Biol 501 was a frustrating course, redundant to Dr. Willey’s marine science equivalent, but not as applicable.

**CHALLENGES**

1. **Academic Structure:** The present MSMS program consists of a large group of marine scientists who have tenure in home departments and collaborate on academic issues related to the Master of Science Program. This approach has worked very well; faculty members receive TA support from their home departments and the students in the Marine Science program have the same opportunities as students in the home departments. But, the question arises whether this is the best structure for the long-term evolution of marine sciences at UNCW?

The present structure does not allow the diverse marine scientists to develop and execute a faculty development plan, but instead, they must rely on convincing home departments that a particular hire is desirable and should be given priority. In
addition, the present structure focuses entirely on the MSMS Program, but does not provide as much of an opportunity to develop a marine science community, as would be the case if there were a marine science department.

We considered this situation with faculty during our visit and found that they were, for the most part, open to a discussion of restructuring the marine sciences. We emphatically do not envision that all marine scientists would be moved into a new department, but rather that new tenure-track appointments could be made to a department and faculty that did want to migrate into the new department would be allowed to do so. Other faculty would remain in home departments, but could have joint or secondary appointments in the marine science department. Marine science faculty would continue to teach in home departments, as well as developing new courses in the marine science departments, and graduate students would continue to teach in the home departments and receive TA support. We think this idea is worthy of consideration, as a distinct academic unit would give more visibility and autonomy to UNCW's marine scientists. During our discussions, one suggestion presented to us was to start a marine science program with a director or chair, with the idea that this program would be a precursor to a department within a few years. This approach seems reasonable, as it would provide adequate time to resolve some of the questions raised by faculty and chairs of the home departments.

2. Leadership: Dr. Joan Willey has done an outstanding job as director of the MSMS program. She has universal support from faculty and students and has worked tirelessly to make this program a success. Students and alumni all are appreciative of her efforts on their behalf. Her commitment and hard work is a significant factor in the success of the program. Given her accomplishments, it is important for the Administration to think about a transition to a new MSMS Director when Dr. Willey steps down, possibly two years hence. As indicated earlier in this report, we support the review document's request to appoint a faculty member as assistant director to Dr. Willey. This faculty member might or might not become director of the MSMS program in the future, but the appointment would facilitate transfer of program information that Dr. Willey has accumulated. It would also help to increase documentation of the program and related procedures. This has been done to some extent, but a number of students noted that some information (e.g., who to see for a wide range of questions or problems) was not clear and the default was to go to Dr. Willey.

In a similar vein, Dr. Baden has provided outstanding and exemplary leadership in developing the Center for Marine Science and has been successful at building excellent analytical and laboratory facilities. When he steps down from the Director's position, there will be a critical leadership position to fill. If a marine science department exists at that time, it would be worthwhile to consider having someone appointed as CMS director and chair of the department. This approach has worked very well in other venues, for example, at the Duke University Marine Laboratory.
3. Stipends: All parties acknowledge that graduate-student stipends are low in comparison to other marine-science programs with which we are familiar. Indeed, this very same concern was expressed by the external reviewers in 2004. Since that time, there has been a $1,000 increase per academic year, but this increase is largely inconsequential in light of increased tuition costs and the high fees assessed graduate students. The review document, as well as faculty members with whom we met, noted stipends were low across the UNCW graduate-student community and the MSMS program was, therefore, not atypical. Here, we offer some suggestions for increasing stipends in particular and the overall level of support for MSMS graduate students in general.

a) Increase IDC funds distributed by CMS to the MSMS program. IDC allocations from CMS have decreased from $60K in previous years to $49K in the past two years. It is in CMS’s best interests to have the best possible MSMS graduate students contributing to its research operations. Therefore, we suggest CMS revert to $60K per year (or more) of IDC investment in graduate education in the most research-intensive unit at UNCW.

b) Redistribution of Merrit Fellowship support. Fully $32K of the annual allotment from CMS is used to support two Merritt Fellows ($16K each), leaving only $17K to be distributed among tens of potential and existing students to offset tuition and other expenses. More students would be better supported were the Merritt Fellowships pooled and distributed evenly to raise all stipends. The downside of this strategy is that MSMS’s most attractive inducement to top-tier students would be lost. However, we believe that it would be more desirable for the program to raise the tuition support for all students at this time and to revisit funding Merrit Fellowships in the future.

c) Explore philanthropy. There can be no expectation that state support will increase in the next several years, so new venues need be found for new money. We encourage the MSMS program to explore philanthropy as an option. Such support is deserved and should be forthcoming; the program has much to boast about and its goals are fully congruent with UNCW’s as a whole. Indeed, the University’s mission statement invokes the words “marine” and “coastal” once and twice, respectively (see http://uncw.edu/planning/mission.htm).

There were concerns raised both by the CMS Director and some faculty about the “entitlement” mentality other faculty members displayed about research assistantships. These concerns were directed principally at faculty members who identify little to no outside funds and, thus, are unable to support students adequately (or at all) during the summer. We urge the UNCW upper-level administration to raise its expectation that graduate students be supported during the summer on grants. Doing so is the first step in a transition toward a norm of funding students year-round on grants.

There was discord among students regarding the equity of stipends paid to teaching assistants and those paid to research assistants. Furthermore, there seemed to be
substantial differences among stipends awarded to research assistants. At least some of these differences result from different expectations as to the students’ time commitment. We suggest making more transparent the stipends and time commitments for all graduate assistantships and, furthermore, putting into place a mechanism for monitoring and enforcing equity. If such a mechanism already exists, then it needs to be re-examined; it seems not to be working.

4. Coastal Research Vessel: UNCW/CMS currently owns the R/V Cape Fear, but due to its age, the vessel needs to be replaced. The faculty has identified the need for a reliable and safe vessel that can work on the continental shelf out to the Gulf Stream, as well as in the shallow coastal regions, and be able to carry out a wide range of oceanographic missions. An initial attempt to fund such a vessel through the state was unsuccessful, but the proposal highlighted the need for a fast, capable coastal vessel. The needs documented by the UNCW marine scientists are very similar to those of other UNC and Duke coastal facilities. Given these commonalities, we suggest the acquisition and operation of a new coastal vessel be carried out as part of the Duke/University of North Carolina Oceanographic Consortium (DUNCOC). DUNCOC is charged with operating the NSF-owned Cape Hatteras and promoting marine science in the State of North Carolina. It has the expertise and infrastructure to operate a coastal vessel, which would benefit all of the consortium members. We believe that a new vessel would be a tremendous asset to the consortium and would provide access for coastal oceanography over the next 20-30 years.

5. Ph.D. Program in Coastal and Marine Science: MSMS has proposed to develop a Ph.D. program that would expand their educational activities and strengthen their overall educational program. We believe this is highly desirable and support moving forward with this initiative. It is in the best interests of UNCW to pursue developing this new program with UNC-GA as soon as possible.

SUMMARY

We are very impressed with the quality of the MSMS Program, and the progress that has been made over the last thirteen years. The commitment of the faculty, together with the wide range of research experiences and facilities available to graduate students, have created a strong and diverse academic program that serves UNCW well. Our observations and suggestions are made in the spirit of contributing to the continued evolution of this impressive program. We appreciated the hospitality given to us by all those that we met during our two-day visit and thank UNCW for the invitation to participate in this review.

Sincerely,

Fred C. Dobbs                  Bruce H. Corliss
Professor, Old Dominion University  Professor, Duke University
CMS Education Committee Response to Reviewers’ Comments
UNCW Master of Science in Marine Science Program Review
Joan D. Willey, Committee Chair and Associate Director Education, CMS

A review of the Master of Science in Marine Science (MSMS) Program at the University of North Carolina Wilmington was carried out on March 31 and April 1, 2011 to evaluate the structure and function of the program and to make suggestions on its future development. During the review, the review team, consisting of Professor Fred Dobbs, Old Dominion University, and Professor Bruce Corliss, Duke University, met with university and marine science administrators, faculty, undergraduate and graduate students, and alumni of the program. Observations and recommendations by these reviewers were presented in three sections: Strengths, Needs, and Challenges. The CMS Education Committee prepared the original review document, participated in the review, and prepared the response to reviewers’ comments. This committee consists of faculty members from the Department of Biology and Marine Biology (Drs. Larry Cahoon, Ron Sizemore, Carm Tomas, and Ami Wilbur), Chemistry and Biochemistry (Drs. Brooks Avery, Steve Skrabal and Joan Willey, committee chair), Environmental Studies (Dr. Jeff Hill), Geography and Geology (Drs. Nancy Grindlay, Joanne Halls and Richard Laws), Physics and Physical Oceanography (Drs. Fred Bingham and John Morrison) and CMS research faculty Dr. Mike Mallin. Committee responses to reviewers’ comments are written in italics.

The Master of Science in Marine Science Program was created in 1998 and has averaged >10 graduates per year since 2002. There are currently ca. 35 graduate students and 38 faculty members that make up the program. Facilities used by the program include the Center for Marine Sciences (CMS), located 7 miles from the main campus, the UNCW Aquaculture Facility at Wrightsville Beach, and facilities on main campus within the Departments of Biology and Marine Biology, Chemistry and Biochemistry, Physics and Physical Oceanography, Environmental Studies, and Geography and Geology.

Reviewers’ Assessment of STRENGTHS

1. The program is characterized by a high level of collegiality between faculty and students within the program, and with faculty and administrators outside of the program. This spirit of collaboration and commitment to a graduate program is exemplary.
2. The faculty research activities and the associated student research are very broad and cover many different topics in marine science. In parallel with this, the course offerings in the program are also very broad.
3. We noted a high level of institutional loyalty amongst students, faculty, and alumni of the program. This characteristic stood out in many conversations we had during our visit. All of the students we spoke with impressed us with their commitment, motivation, and appreciation for the educational experience they were receiving.
4. The MSMS Program gives students a holistic view of the oceans and an earth system perspective, which is highly valuable. At the same time, students learn job skills in their courses or research experiences, and most students are employed in the field of marine science after graduation.
5. Students have diverse research opportunities and experiences, reflecting the diversity of faculty interests, and ready access to state of the art equipment in CMS and various facilities in the departments. The availability of shared facilities with technical support is a huge asset for students in the program.
6. Students take advantage of several "value added" certificates, e.g., in GIS, marine education, and marine policy. These relatively short educational sequences enhance their learning and eventual marketability.

7. The age structure of the program's faculty advisors is such that most (>80%) have been at UNCW for fewer than 20 years. We see no looming "retirement crisis" in these data.

**Committee response:** The CMS Education Committee appreciates the recognition of these strengths, and will continue to work to preserve them.

**Reviewers' Assessment of NEEDS**

1. **Increased Interaction:** We believe that increasing the interactions within the marine science community would benefit faculty, staff, and students and foster a stronger sense of community. These interactions might include a Friday afternoon seminar at CMS on a general topic of interest. It is our understanding that this was done some years ago and was quite successful. Once a month, the home departments would not schedule a seminar and instead would organize a seminar at CMS. A social event would follow the seminar and be supported by CMS or the Marine Science Program. In addition, we think it important to have bus service established for this event, in addition to the transportation system currently being planned. There was strong enthusiasm from faculty and students for this idea in our discussions. A second idea we discussed was to have a student-organized lunch seminar, in which students would give, once a year, a short (20-30 minute) summary of their research plans (if in year 1) or research progress (>1 year in residence). Lunch would either be a brown-bag seminar or be provided by the Marine Science Program. Again, the students were enthusiastic about pursuing this idea.

The aquaculture facility at Wrightsville Beach is remote from other facilities associated with the MSMS program. We suggest some combination of the above two ideas (or other ones) will increase interaction with that facility's faculty and graduate students.

A third idea to promote interaction is to have a 2 or 3 day cruise for the incoming students. Especially if done as a credit-earning exercise (1 credit?), there is nothing like a cruise to get to know fellow students and create a common experience. This experience, however, must await acquisition of a suitable coastal vehicle (see our suggestion later in this report.). Finally, we think it is important to re-start some sort of routine transportation system between the main campus and CMS. It is our understanding that this will be done in the near future, and we highly support this as a way to foster more interactions.

**Committee response:** The Committee agrees that more interaction would be beneficial, and several actions have been taken. The recently formed MS Marine Science Graduate Student Association has organized research luncheons, where graduate students talk informally about their research with each other and faculty. The first was October 3 and was held at the Aquaculture Facility. The pizza lunch was hosted by CMS, and a tour of the facility followed lunch. Four of the students who work at the Aquaculture facility then gave short talks on their research. This first session was attended by 13 students (out of a total of 30 resident students). The students were very pleased with this event. A second event was held at CMS in November and was also very well attended.

The topic of seminars in marine science was discussed at a CMS Internal Advisory Committee (IAC) meeting on September 21, 2011. CMS hosts four Planet Ocean seminars per year in which renowned scientists give presentations to a general audience in the evening. The IAC
recommended that a separate seminar could be scheduled for the graduate students during the day, since the evening sessions are full. The seminar could be preceded by a lunch for graduate students and the speaker. The first seminar and lunch was November 15, 2011 with speaker Dr. Terry Hazen from the Lawrence Berkeley National Laboratory, UC Berkeley, who spoke on “Microbial Ecogenomic Response to the Deepwater Horizon Oil Spill - New Insights to Old Problems.” This event was very well attended, with approximately 15 graduate students and several faculty members in attendance. The practice of having a seminar for graduate students by Planet Ocean speakers will be continued in the future. The individual departments also agree to do a better job of advertising existing opportunities to marine science students.

We agree that an introductory research cruise for new students would be a good experience; we also agree that a new vessel is needed before this can be done.

We also strongly agree that routine transportation between CMS and the main campus is important for communication, and a shuttle now runs between the campuses throughout the day on Tuesdays and Thursdays. Carpooling could also help. A mechanism for coordinating this needs to be developed, however this is beyond the responsibility of the CMS Education Committee.

2. Assistant Director: The review document stressed the need for administrative support for Dr. Willey, director of the MSMS program. We concur wholeheartedly. The need is pressing not only to relieve Dr. Willey of increasing day-to-day tasks and expand the size of the program, but also to prepare for the future. She will retire eventually, so it is important to codify her knowledge and understanding of the MSMS program to facilitate its eventual transfer to someone else. In the "Leadership" section of the "Challenges" portion of this report (below), we consider the strategic reasons for appointing an Assistant Director.

Committee response: The committee (especially Dr. Willey) concurs with this recommendation. The vacant administrative assistant position has now been filled with a very capable person (Melissa Dionesotes), and after a transition period, she will be able to better assist the MS marine science program. Dr. Willey, along with Ms. Dionesotes, is currently exploring ways that Melissa will be able to contribute. Tasks may include responding to potential new student inquiries, conducting degree audits for students about to graduate, sending out information to graduate students about departmental seminars and student thesis presentations, and filling out tuition forms. Melissa is already interacting well with the graduate student organization. Dr. John Morrison, Associate Director for Academic Planning, CMS, has agreed to take over all assessment responsibilities including SACS, and also management of fellowships, which include the Public Service Fellowship, the Merritt Fellowship (which is in transition), summer research stipends for graduate students, and the CMS Postdoctoral Fellowship.

3. Communications: As with any organization, lines of communication could be improved within the MSMS program and more expansively, among MSMS, CMS, and the program's affiliated academic departments. We have two specific suggestions:

Revisit the Graduate Student Handbook: We understand the Marine Science Graduate Student Association is finishing a revision to its handbook, a laudable effort that will help students better to understand the workings of the University. In this and future iterations of the handbook, we encourage the graduate students to make clear to their fellow students which administrator or faculty member is to be contacted about this or that question.
Committee response: The CMS Graduate Student Handbook was revised in the spring of 2010 and so is current: http://www.uncw.edu/mms/docs/2010.GradHandbook.pdf

Codify the money flow for students: Faculty members are urged to make clear to themselves, and subsequently to the students, how graduate-student support is determined and distributed. This task will require coordinating the "philosophies" of the MSMS program, affiliated academic departments, and CMS.

Committee response: The Committee discussed this extensively and has put together a two page document entitled “UNCW MS Marine Science Student-Mentor Philosophy” which is attached to this document and will be placed on the mms web page for new and current students. This document explains that every graduate student funding situation is unique, depending upon the source of the funding. It also defines the student and faculty responsibilities that come with various types of support.

The initial allocation of TAs and tuition support is often a part of our recruiting effort, and so depends on the quality of the application, the area of expertise and the timing of the application (earlier is better). RA support depends on grants to individual faculty members and so does vary from student to student and even from year to year for the same student. In addition, students, especially when they are in the application process, often do not know how funding works or what questions to ask. Faculty advisors are encouraged to take responsibility for support for their students, and in general, they do so.

4. Miscellaneous:

Parking and Access Issues for Graduate Students: The parking policy for graduate students at CMS is convoluted and inhibits the interaction suggested above. More importantly, perhaps, access issues largely preclude students engaging in late night and weekend research. We suggest the CMS Director and Graduate School Dean consult with the Provost, change this policy, and allow grad students parking privileges at CMS and card access to the facility after hours. This would be a small, but very significant improvement for the graduate students.

Committee response: The MS Marine Science Graduate Student Association has agreed to look into this and give a report to this committee. Access may be a problem at facilities other than CMS in addition to CMS.

Redundant courses: Students feel Bio 501 was a frustrating course, redundant to Dr. Willey's marine science equivalent, but not as applicable.

Committee response: The course outlines for BIO 501 and MSC 595 do overlap considerably, however the course outlines for CHM 501, EVS 501 and GLY 501 do not, so MSC 595 cannot be significantly altered without content loss for the majority of the students in the program. There are several additional problems with the 501 courses in general. There is no PHY 501. Students who enter in January (approximately one third of all students) take a 501 course in their second semester, after their first summer of research. At that point in the programs, students should already be immersed in their research programs and at home at UNCW, and the 501 course is not as useful to them as it is to the August cohort. Therefore, the committee recommends that taking a 501 course (BIO, CHM, or GLY) be recommended rather than required. The faculty advisor could assist the student in making the decision of whether this would be a useful course for the individual student.
1. Academic Structure: The present MSMS program consists of a large group of marine scientists who have tenure in home departments and collaborate on academic issues related to the Master of Science Program. This approach has worked very well; faculty members receive TA support from their home departments and the students in the Marine Science program have the same opportunities as students in the home departments. But, the question arises whether this is the best structure for the long-term evolution of marine sciences at UNCW? The present structure does not allow the diverse marine scientists to develop and execute a faculty development plan, but instead, they must rely on convincing home departments that a particular hire is desirable and should be given priority. In addition, the present structure focuses entirely on the MSMS Program, but does not provide as much of an opportunity to develop a marine science community, as would be the case if there were a marine science department.

We considered this situation with faculty during our visit and found that they were, for the most part, open to a discussion of restructuring the marine sciences. We emphatically do not envision that all marine scientists would be moved into a new department, but rather that new tenure-track appointments could be made to a department and faculty that did want to migrate into the new department would be allowed to do so. Other faculty would remain in home departments, but could have joint or secondary appointments in the marine science department. Marine science faculty would continue to teach in home departments, as well as developing new courses in the marine science departments, and graduate students would continue to teach in the home departments and receive TA support. We think this idea is worthy of consideration, as a distinct academic unit would give more visibility and autonomy to UNCW's marine scientists. During our discussions, one suggestion presented to us was to start a marine science program with a director or chair, with the idea that this program would be a precursor to a department within a few years. This approach seems reasonable, as it would provide adequate time to resolve some of the questions raised by faculty and chairs of the home departments.

Committee response: The committee agrees that exploration of ways to strengthen the continuing development of the marine science program at UNCW is worthwhile, however formation of a department, if it were housed in the College of Arts and Sciences (CAS), would not bring increased visibility to marine science because it would be one of 23 departments. CAS of necessity has many interests and directions, and marine science is not a high priority, as indicated by the lack of consultation with marine science faculty in the recent proposed merger of the Departments of Geography and Geology and Physics and Physical Oceanography, and the lack of consideration for the potential impact of this merger on the ability of physical oceanography to contribute to marine science at UNCW. A related challenge is the current proliferation of marine science programs within CAS. There are marine science-oriented degrees that already exist in other departments (B.S., M.S and Ph.D. in Marine Biology in the Dept. of Biology and Marine Biology, a B.S. in Oceanography in the Dept. of Geography and Geology, an M.A. in Environmental Studies with a concentration in coastal management in the Department of Environmental Studies, and an M.P.A in Public Administration with concentrations in coastal management or marine policy in the Department of Public and International Affairs).

The committee agrees that the topic of the structure of marine science at UNCW is extremely important and should be pursued in an organized fashion. It may be that the CMS Education Committee or the IAC could have more input into new faculty hires through some other avenue
than formation of a new department. Perhaps a school of marine science could be created at UNCW that would allow faculty to maintain affiliation with home departments, but also show commitment to development of marine science at UNCW, for example as joint appointments. A school of marine science would add visibility and cohesiveness to marine science at UNCW.

2. Leadership: Dr. Joan Willey has done an outstanding job as director of the MSMS program. She has universal support from faculty and students and has worked tirelessly to make this program a success. Students and alumni all are appreciative of her efforts on their behalf. Her commitment and hard work is a significant factor in the success of the program. Given her accomplishments, it is important for the Administration to think about a transition to a new MSMS Director when Dr. Willey steps down, possibly two years hence. As indicated earlier in this report, we support the review document's request to appoint a faculty member as assistant director to Dr. Willey. This faculty member might or might not become director of the MSMS program in the future, but the appointment would facilitate transfer of program information that Dr. Willey has accumulated. It would also help to increase documentation of the program and related procedures. This has been done to some extent, but a number of students noted that some information (e.g., who to see for a wide range of questions or problems) was not clear and the default was to go to Dr. Willey.

Committee response: This has been discussed in part in a previous section of this report. There have been some changes to help with this issue. Transfer of information and increased documentation however have not been addressed by these changes, and these are important issues. Perhaps this could be discussed at an IAC meeting to see if any of the department chairs could free up some faculty time for increased participation by interested individuals, or perhaps some alternative mechanism could be developed for funding a partial release for a faculty member, until the budget situation improves to allow an assistant director position to be formed.

In a similar vein, Dr. Baden has provided outstanding and exemplary leadership in developing the Center for Marine Science and has been successful at building excellent analytical and laboratory facilities. When he steps down from the Director's position, there will be a critical leadership position to fill. If a marine science department exists at that time, it would be worthwhile to consider having someone appointed as CMS director and chair of the department. This approach has worked very well in other venues, for example, at the Duke University Marine Laboratory.

Committee response: The committee agrees that Dr. Baden has provided exemplary leadership for CMS. Decisions about filling his position when he decides to step down will be made by the UNCW upper administration based on the situation and needs at that time.

3. Stipends: All parties acknowledge that graduate-student stipends are low in comparison to other marine-science programs with which we are familiar. Indeed, this very same concern was expressed by the external reviewers in 2004. Since that time, there has been a $1,000 increase per academic year, but this increase is largely inconsequential in light of increased tuition costs and the high fees assessed graduate students. The review document, as well as faculty members with whom we met, noted stipends were low across the UNCW graduate-student community and the MSMS program was, therefore, not atypical. Here, we offer some suggestions for increasing stipends in particular and the overall level of support for MSMS graduate students in general.

a) Increase IDC funds distributed by CMS to the MSMS program. IDC allocations from CMS have decreased from $60K in previous years to $49K in the past two years. It is in CMS's
best interests to have the best possible MSMS graduate students contributing to its research operations. Therefore, we suggest CMS revert to $60K per year (or more) of IDC investment in graduate education in the most research intensive unit at UCW.

Committee response: The $60K mentioned is not indirect cost funds; it is money allocated as general funds by the state for support of the MS marine science program. The full amount of $60K has been restored for this year; the future is uncertain because it depends on the state budget. CMS IDC funds do support graduate students in marine science in this program as well as in the departmental programs through the funding of pilot projects, which usually include graduate student support.

b) Redistribution of Merritt Fellowship support. Fully $32K of the annual allotment from CMS is used to support two Merritt Fellows ($16K each), leaving only $17K to be distributed among tens of potential and existing students to offset tuition and other expenses. More students would be better supported were the Merritt Fellowships pooled and distributed evenly to raise all stipends. The downside of this strategy is that MSMS's most attractive inducement to top-tier students would be lost. However, we believe that it would be more desirable for the program to raise the tuition support for all students at this time and to revisit funding Merritt Fellowships in the future.

Committee response: The committee discussed this topic extensively, and there is agreement that a change is needed. The Merritt Fellowship amount of $16K per academic year plus tuition expenses (tuition expenses in part through Graduate School tuition remissions) is no longer an attractive offer, so although top-tier students are applying, they are not accepting this Fellowship. For the last three of four years, the third student offered the Fellowship was the one that accepted it, and these students, although well qualified, were not outstanding relative to the other incoming students. As the reviewers stated, funding these two Fellowships consumes most of the available student support. Nevertheless, there is some benefit in having a named Fellowship in terms of program visibility and attracting top students. The committee therefore proposes the following change:

The Merritt Fellowship would continue to exist as a named fellowship, however it would be awarded to a second year student, based upon performance in their first year, including coursework, performance on comprehensive exams, advisor recommendation and development of a research prospectus. One Merritt Fellowship would be awarded each year to a second year student, at a rate of $25K per calendar year plus tuition. Tuition expenses for second year students would be small, and Graduate School tuition remissions could help with this for out-of-state students. This would decrease the expenditure of student support funds to approximately $26K (one $25K Fellowship plus $1000 tuition per year) from approximately $34.5K (two Fellowships plus first year in-state tuition per year) and it would free up an additional $5K in tuition and stipend support (Graduate School and CMS). This approach would keep the visibility of the Fellowship on the web page to attract high quality students, but leave somewhat more support for other students. The student selected would have demonstrated superior performance at UNCW, and so would be known to be outstanding. Any funds remaining could be used to provide summer stipend support for graduate students.

c) Explore philanthropy. There can be no expectation that state support will increase in the next several years, so new venues need be found for new money. We encourage the MSMS program to explore philanthropy as an option. Such support is deserved and should be forthcoming; the
program has much to boast about and its goals are fully congruent with UNCW’s as a whole. Indeed, the University's mission statement invokes the words "marine" and "coastal" once and twice, respectively (see http://uncw.edu/planning/mission.htm).

Committee response: Dr. Baden has been active in this arena, much more so than the UNCW Advancement Office. He has a commitment from a private donor for a $10K Fellowship for a graduate student. We propose that this Fellowship be named after the donor, and be given to an incoming student in addition to whatever other support is offered to that student (TA, RA and tuition). Adding this amount on to our typical offer will make the offer much more competitive, and would allow us to add another named fellowship to our web page.

There were concerns raised both by the CMS Director and some faculty about the "entitlement" mentality other faculty members displayed about research assistantships. These concerns were directed principally at faculty members who identify little to no outside funds and, thus, are unable to support students adequately (or at all) during the summer. We urge the UNCW upper-level administration to raise its expectation that graduate students be supported during the summer on grants. Doing so is the first step in a transition toward a norm of funding students year-round on grants.

Committee response: The committee agrees that faculty need to provide support for their graduate students, however we also acknowledge that grant support is difficult to obtain in today’s budget climate. Several investigators who have a long history of providing support for students have struggled in recent times. Preventing faculty who lack support from advising students does not seem like a valid approach because it diminishes the expertise pool and research opportunities available to students.

There was discord among students regarding the equity of stipends paid to teaching assistants and those paid to research assistants. Furthermore, there seemed to be substantial differences among stipends awarded to research assistants. At least some of these differences result from different expectations as to the students' time commitment. We suggest making more transparent the stipends and time commitments for all graduate assistantships and, furthermore, putting into place a mechanism for monitoring and enforcing equity. If such a mechanism already exists, then it needs to be re-examined; it seems not to be working.

Committee response: There are differences in stipend amounts awarded to individual students depending on the source of the support, especially RA support. There are also different expectations in research labs. In some labs, like the Aquatic Ecology Lab and the Aquaculture facility, students are paid a stipend to work 20 hours per week on projects not related to their own research. This slows their progress on their own research, however they do learn different things and build their resumes. Other students work only on their own research projects. The committee sees this as the nature of research in marine science, and not really as a problem, except perhaps in communication of relative benefits to students of the various approaches. The document previously mentioned “UNCW MS Marine Science Student-Mentor Philosophy” was designed to clarify this question for students.

Coastal Research Vessel: UNCW/CMS currently owns the R/V Cape Fear, but due to its age, the vessel needs to be replaced. The faculty has identified the need for a reliable and safe vessel that can work on the continental shelf out to the Gulf Stream, as well as in the shallow coastal regions, and be able to carry out a wide range of oceanographic missions. An initial attempt to fund such a vessel through the state was unsuccessful, but the proposal highlighted the need for a fast, capable coastal vessel. The needs documented by the UNCW marine scientists are very
similar to those of other UNC and Duke coastal facilities. Given these commonalities, we suggest the acquisition and operation of a new coastal vessel be carried out as part of the Duke/University of North Carolina Oceanographic Consortium (DUNCOC). DUNCOC is charged with operating the NSF-owned R/V Cape Hatteras and promoting marine science in the State of North Carolina. It has the expertise and infrastructure to operate a coastal vessel, which would benefit all of the consortium members. We believe that a new vessel would be a tremendous asset to the consortium and would provide access for coastal oceanography over the next 20-30 years.

Committee response: The committee agrees enthusiastically with this recommendation. The state of North Carolina needs a vessel to support research in the vast and complex coastal regions of North Carolina, especially with potential environmental challenges like offshore drilling and wind farm development in the near future. Through operation of the RV Cape Fear and smaller vessels over many years, UNCW has demonstrated the expertise and infrastructure to operate a new coastal vessel, with Wilmington as home port. This vessel ideally could be shared with the Duke UNC Oceanographic Consortium, and perhaps with Cape Fear Community College.

5. Ph.D. Program in Coastal and Marine Science: UNCW has proposed to develop a Ph.D. program that would expand their educational activities and strengthen their overall educational program. We believe this is highly desirable and support moving forward with this initiative. It is in the best interests of UNCW to pursue developing this new program with UNC-GA as soon as possible.

Committee response: The committee completely agrees with this comment, and we urge the UNCW administration to keep this as a very high university priority. The committee would very much like to see forward progress on this Ph.D. proposal.

SUMMARY

We are very impressed with the quality of the MSMS Program, and the progress that has been made over the last thirteen years. The commitment of the faculty, together with the wide range of research experiences and facilities available to graduate students, have created a strong and diverse academic program that serves UNCW well. Our observations and suggestions are made in the spirit of contributing to the continued evolution of this impressive program. We appreciated the hospitality given to us by all those that we met during our two-day visit and thank UNCW for the invitation to participate in this review.

Committee response: The CMS Education Committee would like to express our appreciation and gratitude to the external reviewers, Dr. Fred C. Dobbs, Professor, Old Dominion University and Dr. Bruce H. Corliss, Professor, Duke University for their thorough and constructive review of the last seven years of the UNCW MS marine science program. They were enthusiastic and conscientious throughout the review process. It was a pleasure for us to able to host them on our campus.

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