Bachelor of Arts in Marine Science
Program Review Report
2009

Prepared and Submitted by
Darren Rumbold, Ph.D.
Associate Professor of Marine Science
Marine Science Program Lead
drumbold@fgcu.edu
239. 590.7527

Table of Contents

I. INTRODUCTION

Program review is a process of systematic review and evaluation of programs within a university that takes place at regular intervals. In addition to fulfilling state mandates, a program review facilitates ongoing improvement and planning. Additionally, it contributes to the body of information on institutional effectiveness presented by the university in its self-study for the Southern Association for Colleges and Schools (SACS), its regional accrediting body.

This report presents the results of an internal self-study by the faculty of the Marine Science Program.

II. BACKGROUND

FGCU became Florida's tenth university when it opened its doors on August 25, 1997 with just over 100 instructional faculty, two academic buildings, a library and approximately 2500 students. The Southern Association of Colleges and Schools awarded FGCU accreditation candidacy later that year, and a comprehensive self-study was launched. The first commencement was held in May 1998, with 81 FGCU graduates. In the Fall of 2007, the University celebrated its tenth anniversary with an estimated enrollment of 10,000 students. Academic colleges at FGCU include: the College of Arts and Sciences, the College of Education, the College of Health Professions, the College of Professional Studies, the Lutgert College of Business and the U.A. Whitaker School of Engineering.

Evolving out of the then existing Earth Systems Science Program, the undergraduate degree in Marine Science was established in 2002 (under CIP 03.0205) as a framework to use the study of oceans and coastal systems for teaching the natural and physical sciences and mathematics. The Marine Science program is supported by the Department of Marine and Ecological Sciences within the College of Arts and Sciences.

III. MISSION STATEMENTS

University Mission Statement

"Established on the verge of the 21st century, Florida Gulf Coast University infuses the strengths of the traditional public university with innovation and learning-centered spirit, its chief aim being to fulfill the academic, cultural, social, and career expectations of its constituents.

Outstanding faculty uphold challenging academic standards and balance research, scholarly activities, and service expectations with their central responsibilities of teaching

and mentoring. Through these efforts, the faculty and University transform students' lives and the southwest Florida region.

Florida Gulf Coast University continuously pursues academic excellence, practices and promotes environmental sustainability, embraces diversity, nurtures community partnerships, values public service, encourages civic responsibility, cultivates habits of lifelong learning, and keeps the advancement of knowledge and pursuit of truth as noble ideals at the heart of the university's purpose" (http://www.fgcu.edu/info/mission.asp).

Program Mission Statement:

The undergraduate program in Marine Science integrates traditional scientific disciplines by focusing them on the study of the world's oceans and coastal waters. This interdisciplinary program combines aspects of biology, chemistry, geology, mathematics, and physics in order to provide a well grounded education in the natural sciences, and it applies a systems approach to identifying and understanding the roles that the oceans play in the functioning of our planet.

Marine Science is designed to train students so that they can obtain jobs related to science and technology in government and industry, jobs as educators in the natural and environmental sciences, and jobs in the expanding environmental field. Students completing the degree program will also be prepared for further graduate studies in a variety of sciences. Since the Marine Science major employs concepts from many different scientific disciplines students entering the program should already have had an introductory exposure to geology, biology, physics, chemistry, and mathematics. After completion of the interdisciplinary core of courses, the Marine Science program offers students a great deal of flexibility for individualized program design.

IV. STUDENT LEARNING OUTCOMES

University Undergraduate Learning Outcomes

"Florida Gulf Coast University is committed to the following learning goals and educational outcomes, believing they provide a foundation for lifelong learning and effective citizenship. The specific outcomes involving knowledge, understanding, analysis, evaluation and collaboration provide the basis on which the university and the learner, sharing responsibility, can measure progress toward reaching these goals." (http://itech.fgcu.edu/sacs/documents/cat%20p10-11.pdf)

Goal 1: Aesthetic sensibility*. Know and understand the variety of aesthetic frameworks that have shaped, and continue to shape, human creative arts. Analyze and evaluate the aesthetic principles at work in literary and artistic composition, intellectual systems, and disciplinary and professional practices. Collaborate with others in projects involving aesthetic awareness, participation and/or analysis.*

Goal 2: Culturally diverse perspective. *Know and understand the diversity of the local and global communities, including cultural, social, political and economic differences. Analyze, evaluate, and assess the impact of differences in ethnicity, gender, socioeconomic status, native language, sexual orientation and intellectual/disciplinary approaches. Participate in collaborative projects requiring productive interaction with culturally-diverse people, ideas and values.*

Goal 3: Ecological perspective. *Know the issues related to economic, social and ecological sustainability. Analyze and evaluate ecological issues locally and globally. Participate in collaborative projects requiring awareness and/or analysis of ecological and environmental issues.*

Goal 4: Effective communication. *Know the fundamental principles for effective and appropriate communication, including reading, writing, speaking and listening skills. Organize thoughts and compose ideas for a variety of audiences, using a range of communication tools and techniques. Participate in collaborative projects requiring effective communications among team members.*

Goal 5: Ethical responsibility. *Know and understand the key ethical issues related to a variety of disciplines and professions. Analyze and evaluate key ethical issues in a variety of disciplinary and professional contexts. Participate in collaborative projects requiring ethical analysis and/or decision-making.*

Goal 6: Information literacy. *Identify and locate multiple sources of information using a variety of methods. Analyze and evaluate information within a variety of disciplinary and professional contexts. Participate in collaborative analysis and/or application of information resources.*

Goal 7: Problem-solving abilities. *Understand the multidisciplinary and interdisciplinary nature of knowledge. Apply critical, analytical, creative and systems thinking in order to recognize and solve problems. Work individually and collaboratively to recognize and solve problems.*

Goal 8: Technological literacy. *Develop knowledge of modern technology. Process information through the use of technology. Collaborate with others using technology tools.*

Goal 9: Community awareness and involvement. *Know and understand the important and complex relationships between individuals and the communities in which they live and work. Analyze, evaluate and assess human needs and practices within the context of community structures and traditions. Participate collaboratively in community service projects.*

Program – Level Learning Outcomes

The current core learning outcomes for graduates of the B.A. in Marine Science program are as follows:

Content/Discipline Knowledge and Skills

Graduates will be able to:

1. Critically evaluate arguments and assumptions and interpret published data relating to marine science;
2. Apply basic knowledge from the core scientific disciplines (i.e., biology, geology, chemistry, physics, and mathematics) in an interdisciplinary fashion for the resolution of real-world problems in marine systems;
3. Utilize the scientific process to form hypotheses and design studies for gathering and analyzing data from which to draw scientifically valid conclusions;
4. Communicate effectively, using the language and concepts of marine science, employing appropriate presentation technologies.

Communication Skills

Graduates will be able to:

1. Employ the conventions of standard written English;
2. Select a topic, and develop it for a specific audience and purpose, with respect for diverse perspectives;
3. Select, organize, and relate ideas and information with coherence, clarity, and unity;

Critical Thinking Skills

Graduates will be able to:

1. Select and organize information;
2. Identify assumptions and underlying relationships;
3. Synthesize information, and draw reasoned inferences;
4. Formulate an appropriate problem solving strategy;
5. Evaluate the feasibility of the strategy;

V. CURRICULUM

2008-2009 Catalog Year

1. FGCU General Education Program (GEP) (36 hrs)

Visit the General Education Program web site for more information: http://www.fgcu.edu/general_education/

A. Communication (6 hrs)
    1. ENC 1101 (3)
    2. ENC 1102 (3)
B. Mathematics (6 hrs)
    1. STA 2023 (3)
    2. MAC 2311 (4) or STA 2122 (3) recommended
C. Humanities (9 hrs)
    1. HUM 2510

D. Social Sciences (6-9 hrs)
E. Natural Sciences (6-9 hrs)
    1. BSC 1011C (4)
    2. CHM 1045C (4)
    3. CHM 1046C (4)

2. Common Prerequisites

A. BSC 1011C General Biology w/Lab II (4) (GEP)
B. CHM 1045C General Chemistry I w/Lab (GEP)
C. CHM 1046C General Chemistry II w/Lab (4) (GEP)
D. GLY 1000C Physical & Historical Geology (4)
E. PHY 2053C College Physics I w/Lab (4)
F. STA 2023 Statistical Methods (GEP)
G. BSC 1010C General Biology w/Lab I (GEP) or PHY 2054C College Physics II w/ Lab (4) (GEP)
H. MAC 2311 Calculus I (GEP) or STA 2122 Social Science Statistics (3) (GEP) or an advanced mathematics course

NOTE: All combined lecture and laboratory courses (marked with a C) are equivalent to taking the lecture and laboratory separately as two courses.

3. Required Courses in the Major (18 hrs)

- IDS 3300 Foundations of Civic Engagement (3)
- IDS 3301 Issues in Culture and Society (3)
- IDS 3303 Issues in Science and Technology (3)
- IDS 4910 Integrated Core Senior Seminar (3)
- ISC 3120 Scientific Process (3)
- OCE 3008C Oceanography (3)

4. Electives in the Major (30 hrs)

Select one of the following:

a. ISC 4910 Senior Project Research (2) and ISC 4911 Senior Project Presentation (2)
b. ISC 4940 Internship in Interdisciplinary Natural Sciences (4)

Select 9 hours from the following:

- GLY 4700C Coastal & Watershed Geology (3)
- OCB 4633C Marine Ecology (3)
- OCC 4002C Marine Chemistry (3)
- OCP 3002C Physical Oceanography (3)

Select 2 hours in any combination from the following:

- BSC 4933* Current Topics (1)
- EVR 4920* Current Topics (1)
- ISC 4930* Current Topics (1)

*This course/prefix number can be repeated as long as the topic is different.

Select 12 hours from the following:

- BCH 3025C Analytical Biochemistry (3)
- EVS 4814 Environmental Toxicology (3)
- GLY 3603C Geobiology (3)
- GLY 4074C Meteorology & Climatology (3)
- GLY 4574C Coastal & Estuarine Sediment Dynamics (3)

- ISC 3145C Global Systems (3)
- PCB 3043C General Ecology (3)
- PCB 3414C Behavioral Ecology (3)
- PCB 3460C Ecosystem Monitoring and Research Methods (3)
- PCB 4303C Limnology/Wetlands (3)
- ZOO 4454C Ichthyology (3)

Select 3 hours from the following:

- BCH/BSC/EVR/EVS/GLY/MAP/PCB/PHY/ZOO 3-4000 — Upper division elective from any science/math major (3)

5. University Requirements (3 hrs)

- IDS 3920 University Colloquium (3)

6. Additional Electives (variable)

VI. ASSESSMENT OF LEARNING OUTCOMES FOR PROGRAM IMPROVEMENT

Assessment of Content/Discipline Knowledge and Skills

Content/discipline knowledge and skills are assessed at the college and departmental levels through papers, exams, proposals, and/or portfolios completed in the following required courses: ISC 3120 Scientific Processes; OCE 3008C Oceanography; OCB4043C Marine Ecology; and ISC 4910 and ISC 4911 Senior Project Research and Senior Research Presentation, or ISC 4940 Internship in Interdisciplinary Natural Sciences

Assessment of Communication Skills

Communication skills are assessed as part of the General Education Program through papers, exams, and projects completed in ENC 1101 Composition I, ENC 1102 Composition II, and HUM 2510 Understanding the Visual and Performing Arts. Communication skills are also assessed in the capstone courses.

Assessment of Critical Thinking Skills

Critical thinking skills are assessed as part of the General Education Program through papers, exams, and projects completed ENC 1101 Composition I, ENC 1102 Composition II, and HUM 2510 Understanding the Visual and Performing Arts. Critical thinking skills are also assessed in the capstone courses.

Assessment Plan and Timeline

The Marine Science Program will assess student performance of identified learning outcomes using direct measures such as evaluations of research proposals, research projects, and internships and an indirect measure in the form of a senior student survey.

First, student research proposals generated during the Scientific Process course (ISC3120) will be evaluated by 3 faculty members (objective outsiders) using a detailed scoring rubric for learning outcomes 1, 3 and 4. Second, student poster presentations describing either a senior internship or senior research project will be assessed using rubrics (specific to each) geared towards learning outcomes 1, 2 and 4 (if an internship) or 1, 3 and 4 (if a research project) by both classmates (a sample of six posters, 3

internship and 3 student project, picked at random) and by at least 2 faculty (will score all posters). Marine science students are required to design and carry out a senior research project or to complete an internship through a local employer in the environmental field. These students are also required to make a poster presentation describing their project or internship. For the latter the student must explain how the internship related to the curriculum. Third, student's completing an internship will also be assessed based on a report (consisting of a rubric scoring learning outcomes 1 and 2) completed by their internship supervisor (external). Lastly, students will be given a survey at the completion of one of their senior-level (4000-level) courses asking them to self-evaluate their own achievements with specific embedded questions geared toward each of the four learning outcomes.

Performance targets established for this assessment are as follows: all questions on the various rubrics are answered using a score from 1 to 5 (with 5 being the highest) - the program goal is that 95% of the responses will score a 3 or higher and 75% or more will score a 4 or higher.

Results from these assessments will be evaluated for both reliability (i.e., consistency in scoring by raters) and validity (i.e., in terms of how effectively they measure the learning outcome). For multi-rater systems (e.g., proposals and posters), the program will track inter-rater reliability among scorers. Additionally, the program will compare poster scores from students and faculty; this will be used to assess learning outcome 1. The Scientific Process proposal is completed by students early upon entering the program and provides a measure of their understanding of the scientific method. Assessment of a research project or internship, completed near the end of the program, provides a measure of their application of the scientific method. This early understanding and late application dichotomy will also be assessed for other outcomes. To evaluate validity, the program will determine if there is correlation between assessments designed to measure the same outcome including, but not limited to:

- correlation between scores on research proposal with scores on senior project poster as they reflect learning outcomes 1, 3 and 4;
- correlation between scores from internal assessments (by both student and faculty) of internship poster with assessment by internship supervisor as they reflect learning outcomes 1 and 2;

Temporal patterns will also be assessed to track the program's continuous improvement.

The program goal is to achieve an 80% inter-rater reliability in our analysis of proposals and posters. The program goal is to obtain statistically significant positive correlation between multiple assessments of a given learning outcome.

Because all students must complete the Scientific Process course and will be required to complete the survey, these data will be compiled and analyzed annually. Alternatively, because students can opt to complete either an internship or a senior project, the sample size for the assessment is effectively cut in half (assuming 50-50 split, which is not the

case). Accordingly, data generated from internships and senior projects will be compiled on an annual basis but not analyzed and reported until sample numbers are determined to be adequate for statistical analysis. That is to say, in a given year, the program assessment will use one or the other tool but not likely both, given the current size of the program. Because they measure different outcomes, assessment of specific learning objectives will vary from year to year (i.e., focus on learning outcomes 1, 2 and 4 versus 1, 3 and 4).

Data will be gathered on an annual basis (compiled for an entire academic year) and analyzed by a faculty member at the start of the spring semester. Results will then be presented to the program's faculty so they may determine necessary changes to the program. The faculty will evaluate the above material to determine the program's success in meeting the objectives. The faculty will then identify courses or parts of courses that do not achieve desired goals and suggest improvements. Changes to program will be taken to curriculum teams in the fall, to be implemented in the following fall; changes to syllabi will occur in the spring, summer, or fall as possible.

The Marine Science Program carried out annual reviews during each of the past 4 years. The most recent assessment is attached as appendix A. Crucial findings from recent programs assessment will be highlighted in the Section titled: Summary of Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis. Since the last program review, student learning outcomes and the Integrated Program Matrix have been revised (Appendix B).

VII. PROGRAM IMPLEMENTATION

Resources

The Marine Science program is supported by the Department of Marine and Ecological Sciences within the College of Arts and Sciences. With a grant from the Whitaker Foundation and matching state and local funds the Whitaker Science Center for Science, Mathematics and Technology Education opened in the April, 2001. The 59,000 square-feet Whitaker Building includes classrooms, 10 teaching laboratories and faculty offices. It also includes laboratory preparation rooms, a walk-in refrigerated room (4º C), a walk-in freezer (-10º C), microscope lab, sedimentology lab, histology lab, wet lab and mud room, and a Geographic Information system lab. Many of these resources are shared across other science disciplines. Classrooms are also available in other academic buildings, AB 3 and AB 5, Reed and Griffon Halls. Construction of another academic building (AB 7), which will be dedicated to the College of Arts and Sciences, should be completed in late Fall 2009.

In June 2007, the FGCU Foundation acquired the Norm and Nancy Vester Marine and Environmental Science Research Field Station. The property (0.547 acres landward and 0.308 acres seaward) is located 14 miles from the main University on Little Hickory Island in Bonita Springs, Florida. The property consists of three buildings: 1) a main residence that includes a student classroom and faculty workspace, 2) an eight-unit apartment building and 3) another building with one additional apartment, a conference room and both a wet and dry lab. The site is surrounded by water on three sides and

includes 10 boat slips. Available boats for research and teaching include a 20 ft Pontoon boat, a 20 ft deck boat, a 25 ft C-Hawk, a 17 ft Center Console and 21 canoes and 2 kayaks.

Program Faculty

The faculty directly supporting the Marine Science program has increased from 3 to 9 faculty members over the past four years. In addition, FGCU's new Provost, Dr. Ron Toll, is a biological oceanographer and has found time to be a member of at least one graduate thesis committee. FGCU has designated that full-time faculty members teach a minimum of 9 contact hours per fall and spring semesters unless receiving administrative or other course release. FTE production is very high as program faculty support general education science courses such as Marine Systems (OCE1001C), as well as students from other departments taking upper level marine science courses.

The following is a list of Program Faculty (their Ph.D. granting institution; year of hire) and their research focus (CVs of program faculty are available on-line at http://www.fgcu.edu/CAS/MarineScience/faculty.html and on the enclosed CD).

- David Fugate, Assist. Prof. (VIMS; 2006): hydrodynamics and associated sediment transport
- Frank Gable, Assist. Prof. (URI; 2007): interface of marine/environmental science and policy esp. as it relates to large marine ecosystem approaches to fisheries science policy
- Ai Ning Loh, Assoc. Prof. (VIMS; 2003): sources and fate of natural organic matter and nutrients
- James MacDonald, Assist. Prof. (SUNY-Albany; 2007): plate tectonics, geochemistry and marine geology
- Michael Parsons, Assoc. Prof. (LSU; 2007): harmful microalgae, transfer of biotoxins into marine foodwebs, and the role of eutrophication in altering coastal foodwebs and promoting harmful algal blooms
- Darren Rumbold, Assoc. Prof. /Coordinator (UM-RSMAS; 2006). landscape ecotoxicology and risk assessment currently focusing on methylmercury in near coastal systems.
- Michael Savarese, Prof./Dir. Grad. Studies (UC – Davis; 1997): geobiology, combining disciplines from biology and geology to interpret the history of environmental change
- Ronald B. Toll, Prof./ Provost (UM-RSMAS; 2008): biological oceanographer with focus on comparative morphology and systematics of cephalopod
- Gregory Tolley, Prof./Dir. of Coastal Watershed Institute (USF; 1997): influence of freshwater inflow on estuarine ecosystems, the physiology of estuarine organisms, and the role of oysters in creating essential fish habitat.
- Aswani Volety, Prof./ Depart. Chair (VIMS; 1999): effects of watershed alteration, freshwater inflows and contaminants on the biochemical, physiological, and ecological responses of shellfish; effects of red tides on marine organisms, and habitat restoration.

Peer-Reviewed Publications 2007-2008

(faculty/staff in bold; * Denotes student author)

Herring, G, DE Gawlik, & **DG Rumbold**. In review. Physiological responses to methylmercury in Great Egret and White Ibis chicks in the Florida Everglades. *Sci. of the Total Environ*

Walls, LD* & **SG Tolley.** In review. Physiological responses to salinity stress in the flatback mud crab *Eurypanopeus depressus*. *Journal of Shellfish Research.*

Van Horn*, J, & **SG Tolley**. In review. Seasonal patterns of distribution along a salinity gradient in the flatback mud crab *Eurypanopeus depressus*. *Gulf of Mexico Science.*

Volety, **AK**, **M Savarese**, **SG Tolley**, WS Arnold, P Sime, P Goodman, RH Chamberlain, & PH Doering. In review. Eastern oysters (*Crassostrea virginica*) as an indicator for restoration of Everglades Ecosystems. *Ecological Indicators.*

Anderson, DM, JM Burkholder, WP Cochlan, PM Glibert, CJ Gobler, CA Heil, R Kudela, **ML Parsons**, JE Rensel, DW Townsend, VL Trainer, & GA Vargo. 2008. Harmful algal blooms and eutrophication: Examples of linkages from selected coastal regions of the United States. *Harmful Algae* 8: 39-53.

Erdner, DL, J Dyble, **ML Parsons**, RC Stevens, KA Hubbard, ML Wrabel, SK Moore, KA Lefebvre, DM Anderson, P Bienfang, RR Bidigare, MS Parker, P Moeller, LE Brand, & VL Trainer. 2008. Centers for Oceans and Human Health: a unified approach to the challenge of harmful algal blooms. *Environmental Health* 7: S2(S2).

Bienfang, PK, **ML Parsons**, RR Bidigare, EA Laws, & PDR Moeller. 2008. Ciguatera Fish Poisoning: A Synopsis from Ecology to Toxicity. In: Walsh, P.J., Smith, S.L., Fleming, L.E., Solo-Gabrielle, H.M., Gerwick, W.H. (Eds.). Oceans and Human Health. Elsevier, Inc., Academic Press, Burlington, MA., pp. 257 – 270.

Panko, C, V Encomio, J Barreto, & **AK Volety**. 2008. *In vitro* and *in vivo* evaluation of quinine as a potential anti-protozoal for the eastern oyster parasite *Perkinsus marinus*. *Journal of Shellfish Research* 27:789-793.

Parsons, ML, WJ Walsh, CJ Settlemier, DJ White*, JM Ballauer*, PM Ayotte*, KM Osada*, & B Carman. 2008. A multivariate assessment of the coral ecosystem health of two embayments on the lee of the island of Hawai‘i. *Marine Pollution Bulletin* 56:1138-1149.

Van Horn, JR*, VS Malhoe*, M Thies*, M Delvina*, L Betano*, **SG Tolley**, & T Ueda. 2008. Cloning of complete peroxiredoxin gene from the intertidal crab *Eurypanopeus depressus*. GenBank Accession EU684547.

Volety, AK. 2008. Effects of salinity, heavy metals and pesticides on health and physiology of oysters in the Caloosahatchee Estuary. *Ecotoxicology*. DOI 10.1007/s10646-008-0242-9.

Barnes, TK, **AK Volety**, K Chartier, FJ Mazzotti, & L Pearlstine. 2007. A habitat suitability index model for the eastern oyster (*Crassostrea virginica*), a tool for restoration of the Caloosahatchee Estuary, Florida. *Journal of Shellfish Research*. 26:949-959.

Conrad, CF, **D Fugate**, J Daus, CJ Chisholm-Brause, & SA Kuehl. 2007. Assessment of the historical trace metal contamination of sediments in the Elizabeth River, Virginia. *Marine Pollution Bulletin* 54:385-395.

Henshel, D, M Aschner, N Basu, W Bowerman, D Echeverria, M Gilbertson, N Ralston, **D Rumbold**, & M Wolfe. 2007. Roundtable Discussion Groups Summary Papers: New Bioindicators for Mercury Toxicological Assessment: Recommendations from the First International Bioindicators Roundtable. *Environmental Bioindicators.* 2:183-207.

MacDonald, J.H., Jr., Harper, G.D., Miller, R.B., Miller, J.S., Mlinarevic, A.N., and Schultz, C.E., 2008, The Ingalls ophiolite complex, central Cascades, Washington: Geochemistry, tectonic setting, and regional correlations, *in* Wright, J.E., and Shervais, J.W., eds., Ophiolites, Arcs, and Batholiths: A Tribute to Cliff Hopson: Geological Society of America Special Paper 438, p. 133–159.

MacDonald, J.H., Jr., Harper, G.D., Miller, R.B., Miller, J.S., Mlinarevic, A.N., and Miller, B.V., 2008, Geochemistry and geology of the Iron Mountain unit, Ingalls ophiolite complex, Washington: Evidence for the polygenetic nature of the Ingalls complex, *in* Wright, J.E., and Shervais, J.W., eds., Ophiolites, Arcs, and Batholiths: A Tribute to Cliff Hopson: Geological Society of America Special Paper 438, p. 161–173.

Rumbold, D.G., Lange, T.R., Axelrad, D.M., Atkeson, T.D. 2008. Ecological risk of methylmercury in Everglades National Park, Florida, U.S.A. Ecotoxicology 17:632-641

Tolley, **SG**, **AK Volety**, **M Savarese**, LD Walls*, C Linardich, & **EM Everham**. 2007. Impacts of salinity and freshwater inflow on oyster-reef communities in SW Florida. *Aquatic Living Resources*. 19:371-387.

Conference Presentations 2007-2008

(* denotes student author; faculty/staff in bold)

Invited

Evans, D.W., & **Rumbold, D.G.** 2008. Mercury Bioaccumulation in Florida Bay Fish: Why So High? Presented at the 2008 Florida Bay and Adjacent Marine Systems Science Conference. Naples, FL. December 8-11, 2008

Volety, AK, M Savarese, **SG Tolley**, L Haynes, AC Booth*, W Arnold, P Doering, P Sime, & P Goodman. 2008. Eastern Oysters (*Crassostrea virginica*) as an Indicator for Restoration of Everglades Ecosystems. Greater Everglades Ecosystem Restoration 2008 Conference. July 28 – August 1, 2008.

Tolley, **SG**, **AK Volety**, **M Savarese**, **L Haynes**, & **A Booth***. Science-based oyster reef restoration in Southwest Florida: considering freshwater inflow. 2007. Mark A. Benedict Symposium on Science, Conservation and Restoration of Southwest Florida Ecosystems. Naples, FL.

Savarese, **M**, **AK Volety**, & **SG Tolley**. Estuarine restoration design and performance in the Ten Thousand Islands using aspects of oyster physiology and ecology. 2007. Mark A. Benedict Symposium on Science, Conservation, and Restoration of Southwest Florida Ecosystems. Naples, FL.

Volety, AK, T Barnes, K Chartier, L Pearlstine, & F Mazzotti. 2007. The use of stressor response models in management decisions: oyster habitat suitability index model as a tool for the restoration of the Caloosahatchee estuary. Mark A. Benedict Symposium on Science, conservation, and restoration of SW Florida Ecosystems. December 6, 2007. Naples, FL.

Contributed

Bienfang, PK, PDR Moeller, S DeFelice, T Hemscheidt, K Hunick, DJ White*, & **ML Parsons**. Ciguatera: Characterization of a New Neurotoxin in Hawaiian Fishes. Ocean Sciences Meeting. March 3 – 7, 2008. Orlando, FL.

Dykes, EC*, **AK Volety**, & JT Winstead. 2008. Effects of heavy metals and pesticides on health and physiology of oysters in Hendry Creek, Estero Bay, FL: implications for management of water quality. Charlotte Harbor Watershed Summit. March 26, 2008. Punta Gorda, FL.

Dykes, EC*, **AK Volety**, J Nelson*, & JT Winstead. 2008. Effects of heavy metals and pesticides on health and physiology of oysters (*Crassostrea virginica)* in Hendry Creek, Estero Bay, FL: Implications for management of water quality. Annual National Shellfisheries Association Conference. Apr 6-10, 2008. Providence, RI.

Encomio, VG, M Goncalves*, H Abeels*, A Griffith*, & **AK Volety**. 2008. The effects of multiple environmental stressors on hard clam survival and physiology. Annual National Shellfisheries Association Conference. Apr 6-10, 2008. Providence, RI.

Evans, J*, J Nelson*, B Bachelor*, S Burghart, & **SG Tolley**. 2008. The effect of freshwater inflow on the spatial and temporal distribution of ichthyoplankton and gelatinous zooplankton in Estero Bay, Florida. Everglades Coalition Conference. January 10, 2008. Captiva, FL.

Evans, J*, J Nelson*, B Bachelor*, S Burghart, & **SG Tolley**. 2008. Influence of freshwater inflow on the spatial and temporal distribution of ichthyoplankton and gelatinous zooplankton in Estero Bay. Charlotte Harbor Watershed Summit. March 26, 2008. Punta Gorda, FL.

Evans, J*, J Nelson*, B Bachelor*, S Burghart, & **SG Tolley**. 2007. Spatial and temporal distribution of ichthyoplankton and gelatinous zooplankton in Estero Bay, Florida. Estuarine Research Federation. November 4 – 8, 2007. Providence, RI.

Goncalves, M*, P Soudant, VG Encomio, & **AK Volety**. 2008. Effects of *Karenia brevis* on the defense responses of the hard clam *Mercenaria mercenaria,* the oyster *Crassostrea virginica*, and the green mussel *Perna viridis.* Annual Shellfisheries Association Conference. April 6 – 10, 2008.
Providence, RI.

Loh, AN, EA Canuel, & JE Bauer. Lipid biomarker distributions in oceanic and estuarine dissolved and particulate organic matter: source and diagenetic signatures. Ocean Sciences Meeting. March 3 – 7, 2008. Orlando, FL.

MacDonald, J. H., Jr., Dragovich, J. D., Miller, R. B., and Metzger, E. P., 2008, Geology, geochemistry and possible tectonic and structural development of the Helena-Haystack mélange, north Cascades, Washington state: Geological Society of America, Abstracts with Programs, v.40, no. 1, p.87.

Miller, R. B., Schultz, C., Miller, J. S., and **MacDonald, J. H., Jr.,** 2008, Juxtaposition of Variably Depleted Ultramafic Rocks across a Mantle Mylonite Zone: Ingalls Ophiolite, Washington Cascades: Geological Society of America, Abstracts with Programs, v.40, no. 6, p. 516.

Nelson, J*, J Evans*, B Bachelor*, S Burghart, & **SG Tolley**. 2008. Influence of freshwater inflow on the distribution and community structure of decapods zooplankton in Estero Bay. Charlotte Harbor Watershed Summit. March 26, 2008. Punta Gorda, FL.

Nelson, J*, J Evans*, B Bachelor*, S Burghart, & **SG Tolley**. 2007. Influence of freshwater inflow on the distribution of decapods zooplankton in Estero Bay, Florida. Estuarine Research Federation. November 4 – 8, 2007. Providence, RI.

Nelson, J*, J Evans*, B Bachelor*, S Burghart, & **SG Tolley**. 2008. Influence of freshwater inflow on the distribution of decapod zooplankton in Estero Bay, Florida. Everglades Coalition Annual Conference. January 10, 2008. Captiva, FL.

Parsons, ML, Q Dortch, W Morrison, NN Rabalais, RE Turner, & A Maier-Brown*. Phytoplankton dynamics in the plume of the Mississippi River: responses to nitrogen enrichment, silica limitation, and phosphorus limitation (with new data analysis). Ocean Sciences Meeting. March 3 – 7, 2008. Orlando, FL.

Savarese, M, BR Hoye*, & SL Wohlpart*. 2008. Effects of sea-level rise and reef sedimentation upon estuary and coastal geomorphologic development: a comparison of oyster and coral reefs. 14th Symposium on the Geology of the Bahamas and Other Carbonate Regions. June 18, 2008. Gerace Research Centre, San Salvador, Bahamas.

Savarese, M, BR Hoye*, SL Wohlpart*, & **AN Loh**. 2008. Influence of late Holocene sea-level rise on the geomorphology of the Greater Everglades coast: implications for restoration and water management. Ocean Sciences Meeting. March 3 – 7, 2008. Orlando, FL.

Thera, J.C.*, Haynes, L. & **Rumbold D.G**. 2008. Fine Scale Spatial Variation in Total Mercury levels in Southwest Florida Molluscan Bivalves. Presented at Presented at the 29th Annual Meeting of Society of Environmental Toxicology and Chemistry. Tampa, FL November 16-20, 2008.

Tolley, SG, BM Bachelor*, J Evans*, J Nelson*, J Van Horn*, R Miner*, & S Burghart. 2008. Recruitment dynamics of commensal organisms on oyster reefs in Southwest Florida. Benthic Ecology Meeting. April 9 – 13, 2008. Providence, RI.

Van Horn* J, V Malhoe*, **SG Tolley**, & T Ueda. 2008. Cloning of peroxiredoxin stress genes in the estuarine crab *Eurypanopeus depressus*. Benthic Ecology Meeting. April 9 – 13, 2008. Providence, RI.

Volety, AK, P Doering, P Sime, & P Goodman. 2008. Role of shellfish in setting water quality targets in SW Florida estuaries. Charlotte Harbor Watershed Summit. March 26, 2008. Punta Gorda, FL.

Volety, AK, L Haynes, AC Booth*, PH Doering, P Sime, PK Goodman, **SG Tolley**, & **M Savarese**. 2008. Adaptive management and Comprehensive Everglades Restoration Plan: utilizing shellfish responses in setting water quality targets in SW Florida estuaries. Ocean Sciences Meeting. March 2 – 7, 2008. Orlando, FL.

White, DJ*, & **ML Parsons**. Ciguatoxin (CTX) in Hawaiian Archipelago Fishes: Toxicity Identified by Neuroblastoma (N2a) Assay. Ocean Sciences Meeting. March 2 – 7, 2008. Orlando, FL.

Booth, A*, & **M Savarese**. 2007. Taphonomic analysis of oyster shells: a technique to interpret the Holocene history of coastal environmental change. Geological Society of America. October 18 – 31, 2007. Denver, CO.

Booth, A*, **M Savarese**, RW Portell, DS Jones, & IR Quitmyer. 2007. Paleoenvironmental and sclerochronologic reconstruction of large oyster-bearing Pliocene reefs from Curaçao. 1st International Sclerochronology Conference. July 17 – 21, 2007. St. Petersburg, FL.

Hoye, BR*, & **M Savarese**. 2007. Historic distribution of reef-building organisms and their control on coastal geomorphology in the Everglades. Geological Society of America. October 18 – 31, 2007. Denver, CO.

Gilmour, C.C., Orem, W.H., Krabbenhoft, D., Aiken, G.R., **Rumbold, D.** 2007. Sulfur Contamination of the Everglades: Effects on Methylmercury Production and Implications for Ecosystem Restoration. Presented at the Annual meeting of the American Society of Limnology and Oceanography (ASLO), Santa Fe, New Mexico. February 4-9, 2007

Parsons, ML, CJ Settlemier, & JM Ballauer*. Observations on the epiphytic relationship between *Gambierdiscus* spp. and several macroalgal host species. Fourth Symposium on Harmful Algae in the U.S. October 29 – November 2, 2007. Woods Hole, MA.

Parsons, ML, Q Dortch, W Morrison, NN Rabalais, RE Turner, & A Maier-Brown*. Phytoplankton dynamics in the plume of the Mississippi River: responses to nitrogen enrichment, silica limitation, and phosphorus limitation. AGU Chapman Conference. October 8 – 12, 2007. Rovinj, Croatia.

Savarese, M, PH Kelley, & K Hagstrom. 2007. Anticipated versus real taphonomic biases associated with gastropod bore hole-weakened bivalves: keeping Dr. Pangloss away from experimental taphonomy. Geological Society of America. October 18 – 31, 2007. Denver, CO.

Volety, AK, S**G Tolley**, **L Haynes**, **A Bridges***, D Crean, & P Doering. 2007. Ecosystem management and restoration. North American Parasitology Congress. June 21 – 25, 2007. Merida, Mexico

Volety, AK, C Panko*, VG Encomio, & J Barreto. 2007. *In vitro* and *in vivo* evaluation of quinine as a potential anti-protozoal for the eastern oyster parasite *Perkinsus marinus*. Workshop for the Analysis of the Impact of ***Perkinsosis*** to the European Shellfish Industry. September 12-14, 2007. Vigo, Spain.

Westphal, MJ, SR Linsin*, MM Andresen*, RJ Harris*, BR Hoye*, HE Kline, CM Linardich, AC Mabe, MN McConnell, & **M Savarese**. 2007. Ecological succession within a Holocene oyster reef: an indicator of estuary development in Southwest Florida. Geological Society of America. October 18 – 31, 2007. Denver, CO.

Wohlpart, SL*, **M Savarese**, & D Surge. 2007. The development of estuarine systems in Southwest Florida: a perspective from the late Holocene history of oyster reef development. Geological Society of America. October 18 – 31, 2007. Denver, CO.

Technical Reports 2007-2008

Gabriel, M., G Redfield, & **D Rumbold**. 2008 Appendix 3B-2: Sulfur as a Regional Water Quality Concern. *In* 2008 South Florida Environmental Report Vol 1. South Florida Water Management District, West Palm Beach, FL.

Volety, AK, SL Wohlpart*, **M Savarese**, & **AN Loh.** 2008. Characterization of Community Assemblages in Oyster-Reef Habitats of the Estero Estuary Through the Late Holocene: Monitoring the Ecological Impact of Watershed Management and Sea-level Rise. Final Report submitted to SW Florida Regional Planning Council. 86 pages.

Savarese, M, **AK Volety**, L Haynes, & E Dykes*. 2007. Feasibility of oyster reef restoration in Naples Bay: a reef-building demonstration project. South Florida Water Management District and City of Naples, Technical Report. 10 p. + 8 figs.

Tolley, SG, EB Peebles, SE Burghart, B Bachelor*, J Evans* & J Nelson*. 2007. Freshwater inflow and utilization of the estuarine tributaries of Estero Bay. Report to the South Florida Water Management District, 227 pp.

Volety, A. K. **2007**. Caloosahatchee estuary oyster monitoring and research. Final Report, Submitted to the South Florida Water Management District. Contract # CP040626. 28

Grants and Contracts (Awarded FY 2007-2008)

Camp Dresser & McKee, Inc. $30,000. A retrospective impact assessment of the North County Resource Recovery Facility, Palm Beach County, Fl. PI: **Darren Rumbold**. Oct 2007 – Dec 2008.

City of Sanibel and Lee County. $769,083. Bioavailability and sources of nutrients and the linkages to nuisance red drift algae. PI: **AN Loh**; Co-PIs: L Brand, J Cassani, D Ceilley, **E Everham**, **D Fugate**, E Milbrandt, **M Parsons**, G Rawl, B Lapointe and P Bell. May 2008 – Aug 2010

Florida Department of Environmental Protection, Coral Reef Conservation Program.$215,638. Programmatic support and project coordination for the Coral Reef Conservation Program. Project Manager: **SG Tolley**. Aug 2007–Jul 2008

Florida Gulf Coast University, Office of Research and Sponsored Programs. $5,000. Gene expression in the intertidal, estuarine crab *Eurypanopeus depressus* in response to salinity and desiccation stress. PIs: T Ueda & **SG Tolley**. Jul 2007–Jun 2008

Florida Gulf Coast University, Office of Research and Sponsored Programs. $5,000. Fate of Caloosahatchee River ETM associated sediment. PI: **D Fugate**. Jul 2007-Jun 2008

Florida Institute of Oceanography. $8,400 Shiptime. Shiptime support for Florida Gulf Coast University's Marine Science curriculum. PI: **SG Tolley**. March 2008

Florida Institute of Oceanography. $5,000. Ecology of the Florida Keys and Florida Bay. PI: **A Volety**, Co-PI: **M Parsons**. Nov 2007

Florida Sea Grant. $454. Elise B Newell Seminar Series. PI: **D Fugate**. Spring 2008

Florida Sea Grant. $600. Elise B Newell Seminar Series. PI: **M Parsons**. Spring 2008

Rookery Bay National Estuarine Research Reserve. $355,754. Institute for Coastal Watershed Studies Partnership. Project Manager: **SG Tolley**. Jan 2008–Jun 2008

Rookery Bay National Estuarine Research Reserve. $375,929. Institute for Coastal Watershed Studies Partnership. Project Manager: **SG Tolley**. Jul 2007–Dec 2007

South Florida Water Management District. $50,000. The responses of turbidity, CDOM, benthic microalgae, phytoplankton and zooplankton to variation in seasonal freshwater inflow to the Caloosahatchee estuary. PI: **SG Tolley**; CoPIs: EB Peebles, **D Fugate** & **M Parsons**. Jan 2008-Jan 2009

South Florida Water Management District. $50,000. Historical distribution of reef building organisms and their control on coastal geomorphology in the Everglades PI: **A Volety;** Co-PIs: **M Savarese, AN Loh**. Aug 2007 – Sept 2008

South Florida Water Management District. $45,108. Mixing and degradation of riverine dissolved organic nitrogen in the Caloosahatchee Estuary. PI: **AN Loh**. Oct 2007–May 2008

South Florida Water Management District. $8,239. Support for Lower West Coast Environment Review Staff. PI: **AN Loh**. Jul 2007–May 2008

South Florida Water Management District. $21,750. Mercury – Sulfur Technical Support. PI: **Darren Rumbold**. Oct 2007 – Sept 2008.

South Florida Water Management District. $21,750. Technical Support for Southwest Florida Feasibility Study. PI: **Darren Rumbold**. Jan 2008 – Dec 2008.

South Florida Water Management District. $686,085. Oyster monitoring network for the Caloosahatchee Estuary. PI: **AK Volety**; CoPIs: **SG Tolley** & **AN Loh**. Oct 2007–Jun 2010

South Florida Water Management District. $49,900. Dynamics of the Estuarine Turbidity Maximum (ETM) in the St Lucie Estuary. PI: **D Fugate**.

South Florida Water Management District. $25,550. Dynamics of the Estuarine Turbidity Maximum (ETM) in the Caloosahatchee River. PI: **D Fugate**.

South Florida Water Management District. $34,600. Restoration of oyster reefs in Estero Bay. PI: **A Volety**. April 1, 2008 – Sep 30, 2008.

USF Florida Biodefense Research Consortium. $366,625. Enhancement of Public Health Preparedness for Dealing with Bioterrorism: New Biocides and Decontaminating Agents for Biodefense. PI: Barreto, J.; Co-PIs: D. Bondehagan, S. Corticone, T. Dubetz, **M. Parsons**, **A. Volety**, T. Beatty. May 2008 – May 2010

Students

Demand for a Marine Science degree has been demonstrated over the past five years by increasing student enrollment in the Marine Science Program (Figure 1).

Students progress through lower division courses meeting the common prerequisites set forth by the State University System as well as meeting their general education requirements. Based on bimodal grade distributions and high attrition rates in lower level classes, the perception of the general CAS faculty is that many students are under-prepared upon arrival to FGCU or are not ready to accept responsibility for coursework at the university level. The university has a Supplemental Instruction (SI) program designed to help students refine study skills and indications are that participation in SI leads to higher retention and better grades. Students enter the upper division courses in the core curriculum as juniors.

Program faculty have recently taken steps to foster better communication and better track students progress. In an attempt to foster better communication between faculty and students, students were invited in the Fall2007 (via an email) to select and make an appointment with a Program faculty. The invitation included the following statement:

> "We have a wealth of knowledge to offer on possible careers in marine science, senior science projects, internships and the research being conducted within the department. We invite you to come in and take advantage of this wealth of knowledge. At the same time, we can learn from you how to make your tenure as a student as productive and as pleasant as possible."

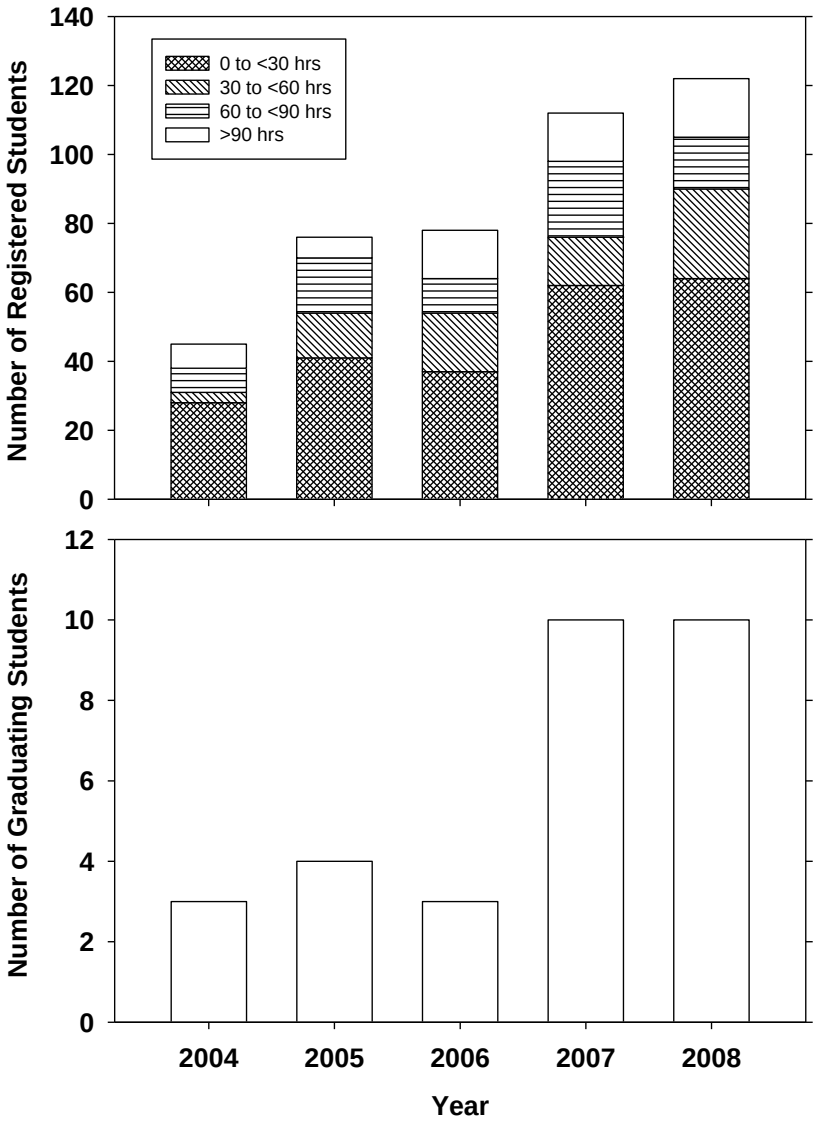

Figure 1. Number of Marine Science students registered in the fall (grouped by undergraduate hours previously earned; top panel) and graduating (bottom panel) each year.

Graduates

Number of graduating seniors increased in 2007 and will likely continue to increase as students matriculate (Figure 1). Graduates are employed with governmental agencies, local school districts, environmental consulting firms, and non-governmental organizations with which the University has developed partnerships. Others have gone on to graduate schools. Below is a list of just a few of the graduates, date of graduation, and their current activities:

- Brian DeSanti, 2008, applying FGCU M.S. Environmental Science
- Mark Hartman, 2008, currently, a graduate student USF
- Rheannon Ketover, 2008, applying FGCU M.S. Environmental Science
- Marcia Berry, 2007, US Geological Survey
- Anthony Myers, 2007, GIS Manager, City of Naples
- Mallory Young, 2007. Marine Mammal Observer, National Marine Fisheries Service and Minerals Management Service
- Miranda Westphal: , 2007. Fisheries management PhD program at University of Alaska Fairbanks (Juneau Center).
- Mary McMurray, 2007, Florida Department of Environmental Protection
- Raymond Leary, 2006, Florida Department of Environmental Protection
- Christi Linardich, 2006. Marine Region Fish and Wildlife Scientific Aid, California Department of Fish and Game
- Noel Wingers, 2006, US Geological Survey, Ft. Myers
- Christian Ercolani, 2005, Rookery Bay National Estuarine Research Reserve
- Andrew Erickson, 2005, US Geological Survey, Ft. Myers
- Abby Walthier, 2005, Lee County, Environmental Planner
- Amanda Booth: , 2004; M.S. Environmental Science 2008 ; US Geological Survey, Ft. Myers. FL
- Susan Cone, 2004, Education Coordinator, Rookery Bay National Estuarine Research Reserve
- Lacey Smith, 2004. Lee County School district, as of 2008 - Coastal Watershed Institute (CWI), FGCU

VIII. STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS (SWOT) ANALYSIS.

The SWOT analysis is widely used in higher education and provides a sound infrastructure for strategic planning. The analysis identifies and discusses implications of program *strengths* (S) and *weaknesses* (W), both of which are internally derived and therefore within the Program's control, as well as *opportunities* (O) and *threats* (T), which are functions of external environment and therefore, to varying extents, outside of the Program's control.

Strengths

Faculty

As discussed above, the program faculty has grown over the past few years. Although much of this growth was driven by demand for instruction at the lower levels, new hires were selected deliberately to bring in faculty with specific expertise. The objective has also been to assemble a research group that could collaboratively study the coastal and estuarine marine environments of the southwest Florida, conduct applied experiments, and share its data and information with federal, state, and county agencies. In addition to being first-rate scholars, the faculty would be committed to providing world-class education in Marine Science. The curriculum of the Marine Science Program has a breadth and focus on multidisciplinary training that distinguishes it from B.S. programs offered in Marine Biology at University of West Florida (UWF) and Florida International University. It differs also from the distance-learning program in Oceanography offered by UWF. The faculty feel that interdisciplinary training in chemical, physical, geological, and biological oceanography along with policy is necessary to tackle complex problems (e.g., water quality, harmful algal blooms, invasive species, over harvesting of recreational and commercially values species, etc.) that face career professionals.

Affiliation with Coastal Watershed Institute

Many of the Marine Science Program faculty are also affiliated with the Coastal Watershed Institute (CWI). Founded in 2004, the CWI has four main goals:

1. Address regional concerns regarding the use and conservation of coastal watersheds.
2. Support undergraduate and graduate education in marine science and coastal watershed study.
3. Focus and coordinate university research on coastal environments and the conservation of natural resources.
4. Disseminate information to Southwest Florida citizens to engage and inform them about the health of coastal watersheds and related issues.

In FY 2006-2007, the CWI budget totaled $1,881,994 with 98.5% of the funding coming from external grants and contracts as well as private funds. Of the total expensed in FY 2006–2007, $1,316,770 was directed toward salaries and benefits (faculty, A&P, and USPS positions): course releases and summer salary for faculty, 7 full-time faculty/staff

positions at the Coastal Watershed Institute, 16 full-time positions at the Rookery Bay National Estuarine Research Reserve, and 4 full-time positions at the Department of Environmental Protection's Coral Reef Program in Miami. Another $154,935 was used to support undergraduate interns working with the Institute on faculty directed research programs as well as graduate students working on their thesis research. In addition, $9,724 was provided to pay for tuition of graduate students working with the Institute.

The most important strength of this affiliation with CWI is that it fosters multidisciplinary approaches in tackling research issues and environmental problems.

Affiliation with the Florida Institute of Oceanography

The Florida Institute of Oceanography (FIO) was established by the State University System (SUS) to support and enhance Florida's coastal marine science, oceanography and related management programs through education, research, and public outreach. The FIO facilitates the activities of educators, scientists, and agencies responding to state, regional, national, and international issues through provision of centralized facilities and research vessels. Specifically the Institute:

- Develops and promotes education and research initiatives, and provides infrastructure for state and regional marine education and research programs which expand opportunities for the SUS and other members of the Institute;

- Supports existing State educational programs and members' research programs with centrally maintained facilities and research vessels to avoid the establishment and maintenance of duplicative oceanographic and marine science facilities and capital equipment;

Marine Science faculty routinely utilize FIO ship time for training students in the use of marine scientific equipment and instrumentation onboard oceanographic research vessels. FGCU faculty are members of the FIO advisory board.

Graduate Program

Another strength of our undergraduate program is our current (M.S. Environmental Science), and future, graduate programs. The graduate program in environmental science appears to have enriched our undergraduate program, offering additional research opportunities to our undergraduates and exposing them to a larger group of environmental professionals.

Community Partnerships

Faculty partnerships with federal, state and local resource agencies and non-governmental organizations have translated into research and internship opportunities for students; undergraduate students are required to complete an internship or a senior research project.

The FGCU Guiding Principles include a charge of "Service to Southwest Florida." The

highly applied nature of the pedagogy and research in the program is designed to meet this charge in several ways: 1) by performing research (in collaboration with regional agencies) and classroom studies on problems of the local marine environment utilizing existing resources, such as the Vester Field Station; 2) by providing educational opportunities for professionals employed by regional agencies to advance their knowledge and understanding of the field; and 3) will produce graduates with education grounded in this field who may elect to pursue careers in Southwest Florida. This direction seems only appropriate given the unique charge included in the FGCU Mission Statement: "practices and promotes environmental sustainability."

Weaknesses

Curriculum

Several annual cycles of assessment have demonstrated that while most program-level objectives were being achieved satisfactorily, many students are not successfully employing the scientific process to form hypotheses and are not able to design experiments to gather and analyze data to test these hypotheses. Analysis of student self-evaluations indicates that the students themselves realize that there are gaps in these areas regarding program expectations and their performance.

As previously discussed, a number of Marine Science graduates are employed with governmental agencies, local school districts, environmental consulting firms, and non-governmental organizations with which the University has developed partnerships. The feedback from these current and potential employers is that they would like to see additional skill sets in our graduates.

The most recent Program Assessment (dated February 2008, Appendix A), found students were communicating the general concepts but lacked the necessary tools to apply them. It concluded: "based on results from this and previous assessments, the faculty feel substantive changes to the program curriculum are required." That report concluded with following recommended changes to the curriculum:

1. that all 4 core marine science courses be required (currently only 3 of 4 are required): GLY 4702C Coastal Watershed Geology, OCB 4043C Marine Ecology, OCC 4002C Marine Chemistry, OCE 3003 Physical Oceanography
2. A senior capstone course for presenting the results of research and internship experiences will be added to the curriculum. As part of the development of this capstone class, internship presentation guidelines and the internship rubric will be revised
3. The addition of a biometry class; each of the core marine science classes will also increase emphasis on statistics and begin to develop a coordinated module across core classes.

Opportunities

New leadership

The university has both a new President, Dr. Wilson G. Bradshaw, and a new Provost, Dr. Ronald B. Toll. Since their arrival, both have already demonstrated their intention to challenge faculty and engage in sustainable practices, environmental education and scholarship.

New facilities

Many of the past challenges in finding space for both teaching and research will be alleviated when Academic Building 7, a 62,000 sq ft building with state of the art facilities, opens in late 2009 and by the Vester Field Station, as it continues to be retrofitted into a working lab. With the Vester Field Station coming online, FGCU is in the process of joining the National Association of Marine Laboratories (http://www.naml.org/).

Location

An ever-present opportunity available to the program is being located in southwest Florida. Sandwiched between Everglades and the Gulf of Mexico, this is a perfect location for a major marine research center studying some of the most productive estuaries in the world including Charlotte Harbor, the Caloosahatchee River and estuary, Estero Bay, Naples Bay, Rookery Bay and the Ten Thousand Islands. These coastal resources are invaluable to the character of Florida and its economic vitality. The link between estuarine habitat and fish production in the Gulf of Mexico is clear. At the same time, SW Florida coastal resources are being subjected to environmental impacts from human population growth. Accordingly, the Marine Science program continues to strive to take advantage of this opportunity and at the same time provide public dissemination of relevant coastal environmental data to assist decision-makers in policy formulation.

Threats

The Economy

The State of Florida budget cuts began in the 2007-08 fiscal year. FGCU and the other state universities received two budget cuts that year. For FGCU the budget cut for the 2007-08 year was $2.83 million. Additional cuts were made as of July 1, 2008, that eventually resulted in another cut of $2.13 million. In addition to cuts in the operating budget, the investment portfolio in the FGCU Foundation was also impacted resulting in reduced earnings for eminent scholars, student scholarships and other such programs. There has also been a negative impact on FGCU's ability to raise private funds. The worsening economy will likely result in declines in funds also available to granting agencies and especially NGOs.

Growth

Lower cost of tuition in the Florida State University System (SUS) relative to other states in combination with the current jobs market, may allow for continued rapid growth without adequate increases in resources and infrastructure.

Service Demands

As a young university, the needs for faculty service are great. Although the faculty collectively has expanded, the internal service demands seem to have outstripped the growth of faculty. A number of program faculty have taken on rolls in the administration, e.g., Director of Graduate Studies, Department Chair, Director of CWI. Consequently, remaining in-unit faculty are facing increasing requests to fill university and college service requirements, at the same time that the student population is burgeoning.

Continued Perception that a BA degree is Less Marketable than a BS degree

Prospective students and their families have in the past expressed concern about the relative value of a BA in Marine Science as compared to a BS degree. These students have expressed concern that a BA is not really a science degree and as such will not help them obtain the type of job they want or get them accepted into a graduate program to continue their education. Faculty and staff explain that a BA degree can be just as rigorous and valuable as a BS degree in the sciences (for an example response, see Appendix D); nonetheless, this perception is prevalent and may negatively impact recruitment of higher caliber students to the program.

IX. RECOMMENDATIONS FOR PROGRAM CHANGES

Since the Program's inception in 2002, we have learned a great deal about how professionals in the community value program graduates, how prospective students view the program, and how students in the program perform and rate their own performance (i.e., through several cycles of annual assessment). This information was used in charting a course for further program development that ensures a rigorous and enriching learning environment—one that will serve our students well upon graduation.

The program faculty are proposing to replace the existing B.A. Program in Marine Science with a B.S. in Marine Science. This recommendation was not made lightly, and it was not made without recognition of the value of a liberal arts education.

Replacing the existing B.A. with a B.S. will primarily involve making existing, elective upper-division science courses new requirements, which will also provide students additional laboratory and field experiences. Compared to the current B.A., the B.S. in Marine Science will include additional prerequisite courses in science and mathematics (e.g., CHM1084 Environmental Chemistry w/Lab (4 hrs) BSC1010C General Biology with lab (4 hrs)), upper-division coursework in the sciences, and laboratory experiences for students (a draft catalog copy is attached as Appendix C)

The curriculum will consist of 120 undergraduate semester hours distributed as follows:

- 60 hours of general education and common prerequisites
- 29-30 hours of required courses in the major (variable depending on courses taken as common prerequisites)
- 23 hours of electives in the major
- 3 hours of University requirements
- variable hours of additional electives

There are no concentrations, tracks, or specializations within the proposed degree program.

The program faculty believes that the proposed Program will better prepare students so that they may obtain jobs related to science and technology in both government and industry, and jobs as educators in the natural and environmental sciences. Students completing the degree program will also be better prepared for further graduate studies in a variety of sciences.

The curriculum changes have been approved by both the College Curriculum Team and the University-wide Curriculum Team. Final determination of the curriculum change is expected at the April 2009 meeting of the FGCU Board of Trustees.

APPENDICES

Appendix A: 2007 Program Assessment
Appendix B: Draft Integrated Program Matrix for Proposed B.S.
Appendix C: Draft revised Catalog copy for Proposed B.S.
Appendix D: Sample Questions and a Sample Response regarding B.S. vs. B.A. degree

Appendix A: Annual Program Assessment – Academic Year 2007

Program Assessment Form

Name of Program: Marine Science

Degree Designation: B.A.

Name of Program Leader: Darren Rumbold, Ph.D.

Date: February 8, 2008

As of the Fall Term, there were 112 undergraduate students majoring in marine science (Figure 1). Overall this represents a 44% increase from the previous year; the largest increases occurred in 1st and 3rd year students (Figure 1). Of the 112 students, only 14 were in their senior year (same number as last year).

LEARNING OUTCOME(S)

The performance measures used in this year's assessment focused on two of the four programmatic learning outcomes:

> Learning Outcome 3. Utilize the scientific process to form hypotheses and design studies for gathering and analyzing data from which to draw scientifically valid conclusions;
>
> Learning Outcome 4. Communicate effectively, using the language and concepts of marine science, employing appropriate presentation technologies.

ASSESSMENT PLAN

The Marine Science Program assessed the performance of upper-level students in 2007 using the following direct and indirect measures: 1) student research proposals generated during the Scientific Process course (ISC3120), 2) student self-evaluations and 3) internship posters.

Following the Spring and Fall terms, all research proposals submitted by Marine Science students (n = 6) in partial fulfillment of the Scientific Process class were collected and assessed by three faculty members external to the class using the rubric shown in Table 1. At the end of the Fall term, students in upper-level marine science core-courses (3000-4000 level) were given a survey asking them to evaluate their own achievements (to prevent double counting, students were told not to complete the survey if they had already done so in another class). The survey with explicit scoring criteria is shown in Table 2. Marine Science students are required to carry out a senior research project or to

complete an internship through a local employer in the environmental field. These students are also required to make a poster presentation describing their project or internship. For the latter, the student must explain how the internship related to the curriculum. At the completion of the Fall term, only two Marine Science students presented posters describing their internships; no senior project posters were presented. The two posters were scored by a faculty member, who had not been mentor to the student or involved in any way with the internship, using the rubric shown in Table 3.

DATA ANALYSIS

Scores of student proposals are tabulated in Table 4. Average intraclass correlation among the three reviewers scoring the proposals was 0.79 ($df = 41$, $F = 7.8$, $p < 0.0001$**, SPSS Inc.) approaching the program goal of 0.80 inter-rater reliability. Performance targets established for this assessment are as follows: all questions on the various rubrics are answered using a score from 1 to 5 (with 5 being the highest) - the program goal is that 95% of the responses will score a 3 or higher and 75% or more will score a 4 or higher. The first performance target was met or approached in 3 of 7 areas (Table 4). The second goal was achieved in 4 of 7 areas (Table 4). The areas where the proposals were scored lowest were: research question and hypothesis, methods, and approach. These deficiencies link back to Learning Objective 3. The area where proposals were scored highest link back to Learning Objective 4. In other words, the students were communicating the general concepts but lacked the necessary tools to apply them. Although this assessment is based on a small sample size ($n = 6$), due to the small Marine Science student population at this relatively young program, these results are consistent with findings of previous program assessments.

Scores of student self-evaluations are tabulated in Table 5. The program target that 95% score 3 or higher was achieved in surveys completed by students in both the junior and senior year. Students in their junior year did not score themselves as high as seniors; they did not meet the second program target (i.e., 75% score 4 or higher) in two areas, whereas the seniors met this target in all four areas. More importantly, as evidenced by a slightly greater frequency of scores of less than 4 in Learning Objective 3 as compared to Learning Objective 4, some students recognized a deficiency in their ability to formulate a clear hypothesis and develop an approach and specific methods to test that hypothesis. It is interesting that a few students gave themselves a score of 5 in these areas, suggesting a wide variation in how students viewed themselves (Table 5). As evident from scores tabulated in Table 6, Internship posters were scored very poorly in four areas: method, approach, results and conclusions.

In conclusion, this assessment is consistent with the findings of previous assessments and indicates that steps should be taken to improve student learning in regards to Learning Objective 3 (steps identified below).

USE OF ASSESSMENT FINDINGS TO IMPROVE STUDENT LEARNING

- Results of this assessment were presented to the program faculty on January 28, 2008 for consideration in on-going discussions of how to improve the program (meeting minutes from the latter are appended to this report as Appendix A).

- Based on results from this and previous assessments, the faculty feel substantive changes to the program curriculum are required. These changes will include, among others (to be determined within the next two months by program faculty), the following:

4. that all 4 core marine science courses be required (currently only 3 of 4 are required): GLY 4702C Coastal Watershed Geology, OCB 4043C Marine Ecology, OCC 4002C Marine Chemistry, OCE 3003 Physical Oceanography
5. A senior capstone course for presenting the results of research and internship experiences will be added to the curriculum. As part of the development of this capstone class, internship presentation guidelines and the internship rubric will be revised
6. The addition of a biometry class; each of the core marine science classes will also increase emphasis on statistics and begin to develop a coordinated module across core classes.

- To access the effectiveness of these changes, the Program assessment will be revised as follows:

a. an entrance exam will be given in Oceanography (an early prerequisite) and then again at the completion of the above Senior Capstone class as a direct measure to assess student achievement of Content/Discipline Knowledge and Skills.
b. all rubrics will be revised so that they are scored from 1 to 4 rather than 1 to 5 (to reduce bias toward selecting 3 or average).
c. the senior exit survey will be revised to cross-link it more closely with specific assessments being carried out by faculty.

Figure 1. Number of Marine Science students (grouped by undergraduate hours previously earned) enrolled in classes in the Fall term over the past four years.

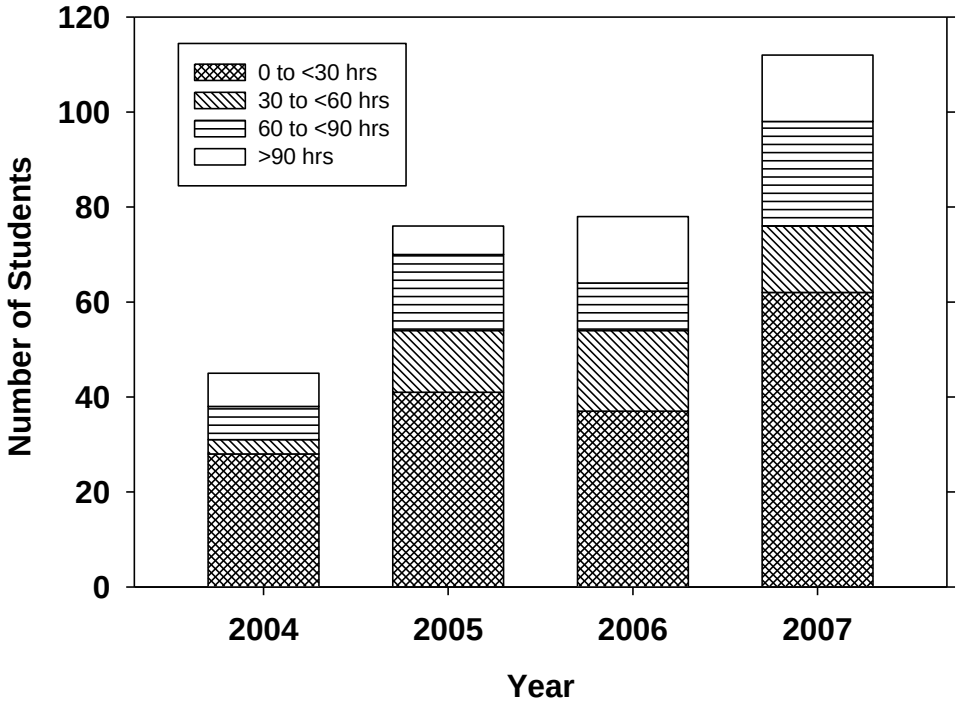

Table 1. Scoring rubric for scientific proposals (as revised in Fall 2006).

Student Major: a. Marine Science; b. Environmental Studies;

Student academic year: a: Freshman; b. Sophomore; c: Junior; d: Senior;

		SCORING CRITERIA						
		1	2	3	4	5	Not Applicable	Score (1-5)
Presentation	**Language usage**	Inappropriate tense; many spelling, punctuation or grammatical errors	Inappropriate tense; a few spelling, punctuation or grammatical errors	Appropriate tense; no spelling or punctuation errors, but grammatical errors present	Appropriate tense; all grammar and spelling correct; yet poor readability.	Appropriate tense; all grammar and spelling correct; high readability.		
Content	**Use of scientific terminology**	language informal - too little use of the language and concepts of marine science	Language demonstrates basic knowledge from the core scientific disciplines; however, some Incorrect use of scientific terms	Language demonstrates basic knowledge from the core scientific disciplines; however, excessive use of jargon, acronyms not defined	Language demonstrates basic knowledge from the core scientific disciplines; appropriate use of jargon, but acronyms not defined	Language demonstrates basic knowledge from the core scientific disciplines; jargon is minimized and all acronyms defined.		
	Introduction	provides information unrelated to the study.	introduction and background that is only somewhat related to the study	provides information related to the study; but gives too much information	provides adequate background, using a broad range of information; justification for the study is more than adequate	presents rationale and significance of proposed research in the form of a well structured, logical argument.		
	Research question and hypothesis	Research question or hypothesis is not provided.	States a vague, untestable research question.	question is testable, but not clear	Hypothesis is testable and understandable, may or may not be written as a null hypotheses or specify what variables are being measured or analyzed.	Research question is written as a testable relationship (which includes the specific variables and the time span), and includes a null hypothesis which specifies exactly what variables are to be measured and analyzed.		
	Methods	Methods not provided	Methods are clear but does not address the research question.	Methods will answer question but are unclear	Methods are written clearly and specifically enough so that you could replicate the investigation. Methods will provide data that answers the research questions, can be tied to existing data, and allows for comparisons.	Methods are written clearly (to allow replication), will provide data that answers the research questions, and are **achievable given training and environment**		
	Approach	Approach is unimaginative and outdated	Approach is unimaginative but up to date	approach adequately developed, well-integrated, and appropriate to the aims of the project	Applies basic knowledge from the core scientific disciplines in an interdisciplinary fashion in formulating this approach for the resolution of this real-world problem	Approach is **unique or innovative - challenge existing paradigms** ; yet **acknowledges potential problem areas and considers alternative approach**		
	References	references not provided	references provided but improperly cited	references cited properly but some were non-scientific sources or were out of date	references cited properly and most were reliable scientific sources	All reference were reliable, up-to-date scientific sources and cited properly		

Table 2. Scoring rubric for student self evaluations (as revised in Fall 2006).

Student Self Evaluation Sheet

Student Major: a. Marine Science; b. Environmental Studies;

Student academic year: a: Freshman; b. Sophomore; c: Junior; d: Senior;

	Item Text	SCORING CRITERIA					SCORE
		1	2	3	4	5	
1	Do you feel capable of critically evaluating arguments and assumptions and interpreting published data relating to your field of science?	Often lack the ability to follow arguments or can not identify underlying assumptions and, consequently, cannot properly interpret data	can recognize logic of argument and underlying assumptions but have difficulty in interpreting data	follow logic of argument and underlying assumptions; capable of interpreting data	recognize flaws or strengths in argument or underlying assumptions; often can suggest alternative interpretations to data	have successfully applied results of reanalysis of published data to evaluate (or challenge) existing paradigms	
2	Do you have the necessary training to allow you to apply basic knowledge from the core scientific disciplines (i.e., biology, geology, chemistry, physics, and mathematics) in an interdisciplinary fashion for the resolution of a real-world problem?	often lack basic knowledge	have the basic knowledge but find it difficult to apply it to real world situation	posses college-level knowledge and, with supervision, capable of applying it to resolve problems	possess college-level knowledge and ability to apply standard tools to resolve problems	knowledge and ability to integrate from various disciplines; have applied tools from one field to another in an innovative way without direction.	
3	Do you feel confident in your ability to utilize the scientific process to form hypotheses and design studies for gathering and analyzing data from which to draw scientifically valid conclusions?	lack ability to frame questions using the scientific method	can form questions that are testable but always vague	can frame question as a testable hypothesis, but require some guidance in developing study design	capable of framing questions to test relationships (including framing it as a null hypothesis); specifying exactly what variables needed to be measured and analyzed.	capable of framing questions to test relationship (including framing it as a null hypothesis), specifying exactly what variables needed to be measured and analyzed. Can recognize implications and remaining uncertainties and suggest future studies.	
4	Do you feel confident in you ability to communicate effectively, using the language and concepts of your field of science, and also capable of employing appropriate presentation technologies?	I have poor communication skills, either verbal or oral. Often lack basic scientific terminology to succinctly express myself	Language demonstrates basic knowledge from the core scientific disciplines; however, I sometime use incorrect scientific terms or jargon	Language demonstrates basic knowledge from the core scientific disciplines; however, I sometimes hear complaints that I use excessive jargon, which I have difficulty translating into terms understandable by untrained individuals, or am uncertain of definitions of certain acronyms	Language demonstrates basic knowledge from the core scientific disciplines; appropriate use of jargon.	I feel that because of my training, I have an exceptional capability to communicate scientific concepts for different audiences	

Table 3. Scoring rubric for student internship posters (as revised in Fall 2006).

Scoring Rubric for Internship Poster

Student Major: a. Marine Science;

Student academic year: a: Freshman; b. Sophomore; c: Junior; d: Senior;

		SCORING CRITERIA						
		1	2	3	4	5	Not Applicable	Score (1-5)
Presentation	**Layout / navigation**	poster layout is difficult to follow	poster is organized in vertical columns; however, sections are out of sequence	poster is organized in vertical columns and sequence of sections appropriate	poster is organized in vertical columns, sequence or flow of information is appropriate; however, space is incorrectly allocated to unimportant information	poster is organized in vertical columns, sequence or flow of information is easy to follow; important sections given more space.		
	Overall visual appeal	excessive use of text - little or no graphics; font too small	appropriate use of graphics and text; however, font is too small	appealing combination of graphics and text; using appropriate font (visible from 4 to 5 ft); however, color or background picture is distracting	appropriate use of graphics and text (of appropriate size) but little color or pictures	appealing combination of graphics and text; using appropriate font (visible from 4 to 5 ft); color is used to emphasize and does not distract		
	Language usage	Inappropriate tense; many spelling, punctuation or grammatical errors	Inappropriate tense; a few spelling, punctuation or grammatical errors	Appropriate tense; no spelling or punctuation errors, but grammatical errors present	Appropriate tense; all grammar and spelling correct; yet poor readability.	Appropriate tense; all grammar and spelling correct; high readability.		
Content	**Abstract**	abstract not provided	abstract is provided, but is not clear and easily understandable	abstract is clear and understandable but is incomplete	abstract is clear, understandable, complete but excessively long	abstract is clear, understandable, complete, succinct and generates interest		
	Use of scientific terminology	language informal - too little use of the language and concepts of marine science	Language demonstrates basic knowledge from the core scientific disciplines; however, some Incorrect use of scientific terms	Language demonstrates basic knowledge from the core scientific disciplines; however, excessive use of jargon, acronyms not defined	Language demonstrates basic knowledge from the core scientific disciplines; appropriate use of jargon, but acronyms not defined	Language demonstrates basic knowledge from the core scientific disciplines; jargon is minimized and all acronyms defined.		
	Introduction	provides information unrelated to the study.	introduction and background that is only somewhat related to the study	provides information related to the study; but gives too much information	provides adequate background, using a broad range of information; describes real world problem succinctly	provides adequate background, using a broad range of information; describes real world problem succinctly - relates it back to curriculum		
	Methods	Methods not provided	Methods are clear but does not address the stated problem.	Methods addressed problem but are unclear	Methods are written clearly and specifically enough so that you could replicate the investigation. Methods will provide data that answers the research questions, can be tied to existing data, and allows for comparisons.	Methods are written clearly (to allow replication), will provide data that addressed problem - student has revised methodology and improved on a useful tool for future research		
	Approach	Approach is unimaginative and outdated	Approach is unimaginative but up to date	approach adequately developed, well-integrated, and appropriate to the aims of the project	Applies basic knowledge from the core scientific disciplines in an interdisciplinary fashion in formulating this approach for the resolution of this real-world problem	Approach is unique or innovative - challenge existing paradigms ; yet acknowledges potential problem areas and considers alternative approach		
	Results	No data provided	Data provided does not address problem or lead to statistical analysis.Tables and graphs are labeled incorrectly.	Data are recorded, but not organized as effectively as they could be, and it is difficult to determine metadata for the data.	Data are recorded in multiple formats (tables and graphs). There is a description of the analysis and statistical tests performed.	Data are recorded in an organized manner that show trends. A rationale is provided for determining the kind of analysis performed and the statistical tests conducted to determine the significance of the results.		
	Conclusions	Conclusions are inconsistent with data provided	The conclusion is based on the data presented but inadequately supported by statistical analysis	The conclusion statement is based on the data presented and the statistical analysis conducted, but student appears to only partial understand the implications of the results and does not place them into context of currently accepted paradigm	The conclusion statement is worded so that the null hypothesis is either accepted or rejected; provides relevant external evidence to support conclusions.	The conclusion statement is worded so that the null hypothesis is either accepted or rejected; provides relevant external evidence to support conclusions. Implications and remaining uncertainties were expressed;		
	References	references not provided	references provided but improperly cited	references cited properly but some were non-scientific sources or were out of date	references cited properly and most were reliable scientific sources	All reference were reliable, up-to-date scientific sources and cited properly		

Table 4. Scores from three outside reviewers of scientific proposals (n = 6 students) from Spring and Fall 2007 Scientific Process classes (for explicit scoring criteria, see Table 1)

Question	Score			
	≥ 2	≥ 3	≥ 4	= 5
Language usage	100%	89%	78%	50%
Use of scientific terminology	100%	89%	78%	44%
Introduction	100%	94%	78%	22%
Research question and hypothesis	100%	94%	67%	0%
Methods	100%	83%	33%	11%
Approach	100%	78%	44%	6%
References	100%	100%	94%	56%

Average intraclass correlation among the three reviewers scoring the proposals was 0.79 (SPSS, df = 41, F = 7.8, p < 0.0001**).

Table 5. Scores of student self-evaluations by juniors (n = 6 students, 27% of year-class) and seniors (n = 11, 78% of year-class) in Fall 2007 (for explicit scoring criteria, see Table 3)

	Score: Juniors				Score: Seniors			
	≥ 2	≥ 3	≥ 4	= 5	≥ 2	≥ 3	≥ 4	= 5
Do you feel capable of critically evaluating arguments and assumptions and interpreting published data relating to your field of science?	100%	100%	83%	0%	100%	100%	100%	36%
Do you have the necessary training to allow you to apply basic knowledge from the core scientific disciplines (i.e., biology, geology, chemistry, physics, and mathematics) in an interdisciplinary fashion for the resolution of a real-world problem?	100%	100%	50%	0%	100%	100%	91%	36%
Do you feel confident in your ability to utilize the scientific process to form hypotheses and design studies for gathering and analyzing data from which to draw scientifically valid conclusions?	100%	100%	50%	33%	100%	100%	82%	55%
Do you feel confident in you ability to communicate effectively, using the language and concepts of your field of science, and also capable of employing appropriate presentation technologies?	100%	100%	100%	0%	100%	100%	91%	9%

Table 6. Scores of student internship posters (n = 2 students) presented in Fall 2007 (for explicit scoring criteria, see Table 5)

	Score				
	≥ 1	≥ 2	≥ 3	≥ 4	= 5

Appendix A.a. Marine Program Meeting Minutes, January 28, 2008
WH 227 4:15 -5:30
In attendance: Aswani Volety, Greg Tolley, Mike Savarese, James MacDonald, Mike Parsons, David Fugate, Darren Rumbold

1. Review results of 2007 Program Assessment
Discussion points

- need to develop program to track attrition rates of different year-classes
- student proposals improved in some areas from last year but still deficient in formulating and testing hypothesis.
- students need to take Sci. Process class earlier; need to strengthen and enforce prerequisites
- need to entice more students to opt for Senior Research Projects over internships; need to gain more control of Internship and improve presentations. The solution would be a capstone class for both research and internships.
- In addition to study design – need a rigorous biometry course.

2. Discussion regarding transforming the program from BA to BS was continued from meetings on Nov 12, 2007 and Dec 7, 2007:
Discussion points

- need to revise curriculum with increase in core requirements –will need to make hours available for requisite courses.

- Greg Tolley and Mike Parsons would draft a memo to BOT requesting authorization to transform the Program from BA to BS (in time for BOT's April meeting).

- In parallel, a subcommittee (Rumbold, Fugate and Loh) would develop a draft proposal of curriculum changes in time to submit forms by the spring deadline.

Discussed curriculum changes – create a senior capstone for research and internship presentations: poster, oral and/or written paper (as determined by faculty mentor); internship 1- 3 hours, one hour would be class with students opting for senior research project. Continue working towards developing a statistics class; additionally, each of the core classes should include heavy emphasis on statistics (possibly a coordinated module across classes).

- ✓ Revise Program assessment to include an exam given in Oceanography and then again in the above Senior Capstone class as a direct measure to assess student achievement of Content/Discipline Knowledge and Skills; if necessary, establish and enforce prerequisites so that these two classes are bookends in the student's time in the program.
- ✓ Revise ALC#2: insert "address" for "for the resolution of" real world problems.
- ✓ Revise Senior Exit Survey cross-linking it more closely with specific assessments being carried out by faculty

Appendix B: Draft Integrated Program Matrix for Proposed B.S.

1. Aesthetic Sensibility (University Level) A. Know and understand the variety of aesthetic frameworks B. Analyze and evaluate aesthetic principles at work C. Collaborate in projects involving aesthetic awareness and/or analysis Aesthetic Sensibility (Program Level) Students will be able to: • Demonstrate the development of a knowledge base that includes the prevailing scientific paradigms, the historical nature of these paradigms, and the aesthetic considerations of that knowledge, including the origin of life on earth, and the mechanisms of evolution that shape that life, including an emphasis on natural selection. (BCS 1010C, BSC 1011C, GLY 1000C, OCE 3008C, OCB 4043C, GLY 3603C, ISC 3145C, PCB 3043)	Plan: This learning outcome will be assessed through a program standardized Pre- and Post-Test. Questions specifically addressing the prevailing scientific paradigms within Marine Science, and their historical development, will be included on this Pre- and Post-Test. The standardized Pre-Test will be administered to Marine Science students when they enter Oceanography (OCE 3008C). The standardized Post-Test will be administered during the Capstone Course at the time the students complete the program. Criteria: Students will not be notified before they are giving this standardized test; also, student's scores on the Pre- and Post-Test will be compared statically in order to track their learning as it applies to this specific learning goal. It is the goal of the program that the students will retain or improve their scores on these tests. If students are not learning or retaining this information, which would be reflected by student's scores being lower on the Post-Test than the Pre-Test, then course content will be adjusted with the hope that this rectifies the failure to meet this learning goal.

2. A Culturally Diverse Perspective (University Level) A. Know and understand diversity in local/global communities B. Analyze and evaluate the impact of cultural differences C. Participate in projects involving interaction with diverse people, ideas, & values A Culturally Diverse Perspective (Program Level) Students must demonstrate: • Ability to understand and appreciate the development and implementation of public policy. (ISC 3120, ISC 4930, ISC 4940, IDS 3303) • Ability to solve problems in individual and group settings and incorporating a diversity of values and approaches (All core & elective courses)	Plan: The ability to understand and appreciate public policy will be assessed directly at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they will design a research project, compose a written proposal, and then defend it in an oral presentation. This proposal will be evaluated by 3 faculty members (objective outsiders but former instructors of the course) using a detailed scoring rubric for learning outcomes. The second is the Capstone course where students will present as a poster, oral presentation or paper describing either a senior internship or senior research project which will be assessed using rubrics by at least 2 faculty members. Criteria: All questions on the various rubrics will be scored using a 1 to 4 scale, with 4 being the highest. The program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher. Plan: The ability to solve problems in individual and group settings will be assessed through: 1) direct in-class assessment of the student's individual and group work in the Major's Capstone Corse; and 2) indirectly with the Senior Course Survey. The direct measurements of student's ability to problem solve in individual and group setting will include: group and individual projects and presentations, and group or individual assignments/lab work. Course syllabi will detail the nature of these assignments. These materials have yet to be assembled. The Senior Course Survey will ask the students to self-assess their awareness of the scientific method and its impact upon society. This survey will be administered in one of their 4000-level undergraduate courses. This measure will complement the direct measure of achievement at the program's completion. Criteria: Direct assessment materials will be developed in a subsequent round for the assessment of student's group work within the Major's Capstone Course. For the Indirect Assessment, 75% of students will score an "agree or strongly agree" on the appropriate questions of the Senior Course Survey.

3. An Ecological Perspective (University Level) A. Know issues of ecological/ economic sustainability B. Analyze and evaluate local & global ecological issues C. Participate in ecological/environmental projects An Ecological Perspective (Program Level) Students must demonstrate: (public policy was removed from here because it is in the previous section) 1) The development of a knowledge base that includes prevailing scientific paradigms, the historical nature of these paradigms, and the aesthetic considerations of that knowledge. This will include the origin of life on earth, and the mechanisms of evolution that shape that life with an emphasis on natural selection. (BSC 1010C, BSC 1011C, GLY 1000C, OCE 3008C, OCB 4043C, GLY 3603C, ISC 3145C, PCB 3043) 2) A basic knowledge of the core scientific disciplines (i.e., biology, geology, chemistry, physics, and mathematics) and how they are employed in an interdisciplinary fashion to study processes within the oceans (Academic Learning Compact 1.2) (All core & elective courses) 3) An appreciation of coastal environmental problems, their management and restoration (OCE 3008C, ISC 4930, OCB 4043C, GLY 4702C, GLY 4574C, OCC 4002C, OCP3002C, EVR 4605C, PCB 4303C, ISC 3145C)	Plan: This learning outcome will be assessed through a program standardized Pre- and Post-Test. Questions specifically addressing the prevailing scientific paradigms within Marine Science, their historical development, which specifically address the origin of life on Earth, and evolution, will be included on this Pre- and Post-Test. The standardized Pre-Test will be administered to Marine Science students when they enter Oceanography (OCE 3008C). The standardized Post-Test will be administered during the Capstone Course at the time the students complete the program. Criteria: Students will not be notified before they are giving this standardized test; also, student's scores on the Pre- and Post-Test will be compared statically in order to track their learning as it applies to this specific learning goal. It is the goal of the program that the students will retain or improve their scores on these tests. If students are not learning or retaining this information, which would be reflected by student's scores being lower on the Post-Test than the Pre-Test, then course content will be adjusted with the hope that this rectifies the failure to meet this learning goal.

4) Acquire an historical perspective of Earth change throughout the planet's history (GLY 1000C, GLY 4574C, GLY 4702C, GLY 3603C, OCP 3002C, ISC 3145C)	See above

4. Effective Communication (University Level) A. Know principles for effective communication B. Organize thoughts and compose ideas C. Participate in collaborative communication projects Effective Communication (Program Level) All Marine science students will demonstrate: 1) The ability to evaluate and implement the scientific process, its application in different settings and creative alternative problem solving approaches that are explored within the context of standard scientific conventions. This will include the following: A) Ability to effectively communicate in a professional setting, including technical writing, oral presentations and use of available technology (Academic Learning Compact 1.4) (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) B) Ability to solve problems in individual and group settings and incorporating a diversity of values and approaches (All core & elective courses) 2) Ability to initiate and complete an independent scientific research project (ISC 3120, ISC 4910/4911, ISC 4940)	Plan: These learning outcomes will be assessed directly using: 1) the Scientific Process course, taken early in the program, where they will design a research project, compose a written proposal, and then defend it in an oral presentation. This proposal will be evaluated by 3 faculty members (objective outsiders but former instructors of the course) using a detailed scoring rubric for learning outcomes; 2) in the Capstone course where students will present as a poster or oral presentation describing either a senior internship or senior research project which will be assessed using rubrics by at least 2 faculty members. Criteria: the program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher.

5. Ethical Responsibility (University Level) A. Know and understand ethical issues B. Analyze and evaluate ethical issues in a variety of contexts C. Participate in collaborative projects involving ethical analysis and/or decisions Ethical Responsibility (Program Level) All science students must demonstrate: • Awareness of the ethical aspects of: 1) science; 2) their conduct as scientists; and 3) their conduct as citizens. (ISC 3120, IDS 3303) • Ability to understand and appreciate the development and implementation of public policy. (ISC 3120, ISC 4930, ISC 4940, IDS 3303)	Plan: Student awareness of the ethical aspects of science, conduct as scientists, and conduct as citizens and their ability to understand and appreciate the development and implementation of public policy will be assessed using: • Scientific Process Proposal and Capstone Project (Direct Assessment): Marine Science students demonstrate their awareness of the scientific method and its impact upon society at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they design a research project, compose a written proposal, and then defend it in an oral presentation. Student research project papers or posters, for their capstone Senior Project Research & Presentation courses or their capstone Internship experience, will be presented within a college-wide forum and evaluated. Criteria: In the Direct Assessment, the program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher. Achievement difficulties for awareness of ethical aspects of science and implementation of public policy reflect curricular shortfalls in the Scientific Process and other of our junior- and senior-level courses. The Marine Science faculty will assemble to better emphasize these aspects of the curriculum within our courses.

6. Information Literacy (University Level) A. Identify and locate sources of information B. Analyze and evaluate information in a variety of contexts C. Participate in collaborative analysis/application of in formation Information Literacy (Program Level) All science students must demonstrate: • The ability to gather and critically evaluate information utilizing library research skills; apply experimental design in laboratory or field settings, and use technology to gather information. (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) o Ability to analyze information both qualitatively and quantitatively. (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) o Ability to synthesize information via the formation of hypotheses, the use of statistical techniques, the use of simulation models, and the ability to apply a system approach (Academic Learning Compact 1.3) (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) • Ability to initiate and complete an independent scientific research project. (ISC 3120, ISC 4910/4911, ISC 4940)	Plan: The ability to gather and critically evaluate information; analyze information both qualitatively and quantitatively; synthesize information via the formation of hypotheses;, use statistical techniques and simulation models, apply a system approach, and initiate and complete an independent scientific research project will be assessed. These goals will be assessed through: • Scientific Process Proposal and Capstone Project (Direct Assessment): Marine Science students demonstrate their ability to gather, synthesize, and discuss scientific information at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they design a research project, compose a written proposal, and then defend it in an oral presentation. The second is the capstone project, where students present research project papers or posters in a college-wide forum. • Senior Course Survey (Indirect Assessment): Students will be asked to self-assess their capability in obtaining, digesting, and synthesizing scientific information at the completion of one of their 4000-level undergraduate courses. This indirect measure will complement the direct measure achievement at the program's completion. Criteria: For Direct Assessment, Scientific Process Proposal and Capstone Project, the program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher. For the Indirect Assessment, 75% of students will score an "agree or strongly agree" on the appropriate questions of the Senior Course Survey. The foundations of information literacy are developed in the Scientific Process course and then re-emphasized in all subsequent courses. Problems of achievement will be addressed by faculty teaching the course; those faculty members will work through consensus to improve the course's structure and application.

7. Problem-Solving Abilities (University Level) A. Understand multi/interdisciplinary nature of knowledge B. Apply critical, analytical creative and systems thinking C. Work individually and collaboratively to recognize and solve problems Critical Thinking and Problem-Solving Abilities (Program Level) All science students must demonstrate: • Ability to evaluate and to implement the scientific process, its application in different settings and, create alternative problem solving approaches that are explored within the context of standard scientific conventions o Ability to gather and critically evaluate information through library research skills and experimental design in laboratory or field settings. (Academic Learning Compact 1.1) (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) o Ability to analyze information both qualitatively and quantitatively. (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) o Ability to synthesize information via the formation of hypotheses, the use of statistical techniques, the use of simulation models, and the ability to apply a system approach. (ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) • Ability to initiate and complete an independent scientific research project. (ISC 3120, ISC 4910/4911, ISC 4940)	Plan: The ability to gather and critically evaluate and analyze information both qualitatively and quantitatively, synthesize information via the formation of hypotheses, use statistical techniques and simulation models, apply a system approach, and initiate and complete an independent scientific research project will be assessed through: • Scientific Process Proposal and Capstone Project (Direct Assessment): Marine Science students demonstrate their critical thinking and problem-solving skills at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they design a research project, compose a written proposal, and then defend it in an oral presentation. The second is the capstone project, where students present their research project papers or posters within a college-wide forum. • Senior Course Survey (Indirect Assessment): Students will be asked to self-assess their ability to think critically and problem solve by completing a survey at the completion of one of their 4000-level undergraduate courses. This indirect measure will complement the direct measure achievement at the program's completion. Criteria: For the Direct Assessment, Scientific Process Proposal and Capstone Project, the program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher. For the Indirect Assessment, Senior Course Survey, 75% of students will score an "agree or strongly agree" on the appropriate questions of the Senior Course Survey. The foundations of critical thinking, particularly in science, are developed in the Scientific Process course and then re-emphasized in all subsequent courses. Problems of achievement will be addressed by faculty teaching the course; those faculty members will work through consensus to improve the course's structure and application. In addition, teaching techniques and exercises in all courses will be evaluated by the Marine Science faculty.

8 Technological Literacy (University Level) A. Develop knowledge of modern technology B. Process information through use of technology C. Collaborate with others using technology tools Technological Literacy (Program Level) All science students must demonstrate: The ability to gather and comprehend scientific/technical information, design experiments to test hypotheses developed through the scientific method, analyze information both qualitatively and quantitatively.(ISC 3120, ISC 4930, ISC 4910 / ISC 4911, ISC 4940, plus most core & elective courses) • Effectiveness in both laboratory and field settings (All core & elective courses.) • Ability to initiate and complete an independent scientific research project (ISC 3120, ISC 4910/4911, ISC 4940)	Plan: The ability to gather and comprehend scientific/technical information, design experiments to test hypotheses developed through the scientific method, analyze information both qualitatively and quantitatively and the ability to initiate and complete an independent scientific research project will be assessed through: • Scientific Process Proposal and Capstone Project (Direct Assessment): Marine Science students demonstrate their ability to comprehend and apply technological information at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they design a research project, compose a written proposal, and then defend it in an oral presentation. The second is the capstone project, where students present their research project papers or posters within a college-wide forum. • Senior Course Survey (Indirect Assessment): Students will be asked to self-assess their ability to comprehend and apply technological information in a survey at the completion of one of their 4000-level undergraduate courses. This indirect measure will complement the direct measure achievement at the program's completion. Criteria: For the Direct Assessment, Scientific Process Proposal and Capstone Project, program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher on rubrics. For the Indirect Assessment, Senior Course Survey, 75% of students will score an "agree or strongly agree" on the appropriate questions of the Senior Course Survey. Plan: Effectiveness in both laboratory and field settings will be assessed using Course Performance & Products. The effectiveness of the program's ability to provide marine science-specific content knowledge will be evaluated through student performance within individual courses. Measures include: examinations, and group and individual projects and presentations. Course syllabi detail the nature of these assignments. Criteria: This assessment tool will be developed in a subsequent assessment round. Most of the program's courses are laboratory and field based. Students have numerous opportunities to work with instruments in both settings. Consequently, failure in this outcome reflects a major shortcoming of the program, and a major revision of the curriculum would be required.

9. Community Awareness and Involvement (University Level) A. Know and understand relation- ships between individuals and their communities B. Analyze, evaluate and assess human needs and practices C. Participate collaboratively in community service projects Community Awareness and Involvement (Program Level) All science students must demonstrate: • Awareness of the societal aspects and implications of science on everyday life. (ISC 3120, IDS 3303) • Ability to understand and appreciate the development and implementation of public policy. (ISC 3120, ISC 4930, ISC 4940, IDS 3303) • Ability to solve problems in individual and group settings and incorporating a diversity of values and approaches. (All core & elective courses.)	Plan: Knowledge of the interaction between science and society, and the ability to understand and appreciate the development and implementation of public policy will be assessed using: • Scientific Process Proposal and Capstone Project (Direct Assessment): Marine Science students demonstrate their awareness of the scientific method and its impact upon society at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they design a research project, compose a written proposal, and then defend it in an oral presentation. Students will present their research project papers or posters developed for their capstone Senior Project Research & Presentation courses or their capstone Internship experience, within a college-wide forum. Criteria: In the Direct Assessment, program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher on rubrics. Plan: The ability to solve problems will be assessed using: • Course Performance & Products (Direct Assessment): The effectiveness of the program's ability to provide marine science-specific content knowledge will be evaluated through student performance within individual courses. Measures include: examinations, and group and individual projects and presentations. Course syllabi detail the nature of these assignments. These materials have yet to be assembled. • Senior Course Survey (Indirect Assessment): Students will be asked to self-assess their awareness of the scientific method and its impact upon society by completing a survey at the completion of one of their 4000-level undergraduate courses. This measure will complement the direct measure of achievement at the program's completion. Criteria: Direct Assessment, Course Performance & Products assessment materials will be developed in a subsequent round. See comments under Ethical Responsibility. For the Indirect Assessment, 75% of students will score an "agree or strongly agree" on the appropriate questions of the Senior Course Survey. Community awareness and involvement is implicitly derived in many introductory and upper-division courses. If this is not being achieved, an effort to explicitly consider community awareness will be developed. As the program adopts more responsibility for service learning, community involvement will become more intimately tied to Marine Science courses.

	Plan: Knowledge of the interaction between science and society, and the ability to understand and appreciate the development and implementation of public policy will be assessed using: 1) the Scientific Process course, taken early in the program, where they will design a research project, compose a written proposal, and then defend it in an oral presentation. This proposal will be evaluated by 3 faculty members (objective outsiders but former instructors of the course) using a detailed scoring rubric for learning outcomes; 2) in the Capstone course where students will present as a poster describing either a senior internship or senior research project which will be assessed using rubrics by at least 2 faculty members. Criteria: The program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher on rubrics. Plan: The ability to understand and appreciate public policy will be assessed directly at two critical points within the program. The first is within the Scientific Process course, taken early in the program, where they will design a research project, compose a written proposal, and then defend it in an oral presentation. This proposal will be evaluated by 3 faculty members (objective outsiders but former instructors of the course) using a detailed scoring rubric for learning outcomes. The second is the Capstone course where students will present as a poster describing either a senior internship or senior research project which will be assessed using rubrics by at least 2 faculty members. Criteria: The program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher on rubrics. Plan: The ability to effectively solve problem will be assessed directly using: 1) the Scientific Process course, taken early in the program, where they will design a research project, compose a written proposal, and then defend it in an oral presentation. This proposal will be evaluated by 3 faculty members (objective outsiders but former instructors of the course) using a detailed scoring rubric for learning outcomes; 2) in the Capstone course where students will present as a poster describing either a senior internship or senior research project which will be assessed using rubrics by at least 2 faculty members. Criteria: program goal is that 95% of the responses will score a 2 or higher, and 75% will score a 3 or higher on rubrics.

Appendix C: Catalog copy for proposed BS Marine Science

Degree Requirements 2009-2010 Catalog Year

1. FGCU General Education Program (GEP) (36 hrs)

Visit the General Education Program web site for more information: http://www.fgcu.edu/general_education/

A. Communication (6 hrs)
    1. ENC 1101 (3)
    2. ENC 1102 (3)
B. Mathematics (6 hrs)
    1. STA 2023 (3)
    2. MAC 2311 (4) recommended
C. Humanities (9 hrs)
    1. HUM 2510
D. Social Sciences (6-9 hrs)
E. Natural Sciences (6-9 hrs)
    1. BSC 1011C (4)
    2. CHM 1045C (4)
    3. CHM 1046C (4)

2. Common Prerequisites

A. BSC 1011C General Biology w/Lab II (4) (GEP)
B. CHM 1045C General Chemistry I w/Lab (4) (GEP)
C. CHM 1046C General Chemistry II w/Lab (4) (GEP)
D. GLY 1000C Physical & Historical Geology (4)
E. PHY 2053C College Physics I w/Lab (4)
F. STA 2023 Statistical Methods (4) (GEP)
G. BSC 1010C General Biology w/Lab I (4) (GEP) or PHY 2054C College Physics II w/ Lab (4) (GEP)
H. MAC 2311 Calculus I (4) (GEP) or STA 2122 Social Science Statistics (3) (GEP) or an advanced mathematics course

NOTE: All combined lecture and laboratory courses (marked with a C) are equivalent to taking the lecture and laboratory separately as two courses.

3. Required Courses in the Major (29-30hrs)

- BSC 1010C General Biology w/Lab I (4) or an additional 3 credits from the Electives in the Major listed in #4 c and d below.
- CHM1084C Environment Chemistry w/Lab (4)
- GLY 4700C Coastal & Watershed Geology (3)
- IDS 3300 Foundations of Civic Engagement (3)
- ISC 3120 Scientific Process (3)
- OCB 4xxx Senior Seminar in Marine Science (1)
- OCB 4633C Marine Ecology (3)
- OCC 4002C Marine Chemistry (3)

- OCE 3008C Oceanography (3)
- OCP 3002C Physical Oceanography (3)

4. Electives in the Major (23hrs)

a. Select one of the following:

- EVR 4910 Senior Project Research Environmental Studies(3)
- EVR 4940 Internship in Environmental Studies (3)

b. Select 2 hours in any combination from the following:

- BSC 4933* Current Topics (1)
- EVR 4920* Current Topics (1)
- ISC 4930* Current Topics (1)

*This course/prefix number can be repeated as long as the topic is different.

c. Select 15 hours from the following:

- EVS 4814 Environmental Toxicology (3)
- GLY 3xxxC Tectonics and Marine Geology (3)
- GLY 3603C Geobiology (3)
- GLY 4074C Meteorology & Climatology (3)
- GLY 4244C Biogeochemistry (3)
- GLY 4574C Coastal & Estuarine Sediment Dynamics (3)
- ISC 3145C Global Systems (3)
- PCB 3043C General Ecology (3)
- PCB 3414C Behavioral Ecology (3)
- PCB 3460C Ecosystem Monitoring and Research Methods (3)
- PCB 3463C Marine Eco Monitoring and Research Methods (3)
- PCB 4303C Limnology/Wetlands (3)
- STA 3163 Applied Statistics (3)
- ZOO 3205C Invertebrate Zoology (3)
- ZOO 4454C Ichthyology (3)

d, Select 3 hours from the following:

- BCH/BSC/EVR/EVS/GLY/MAP/PCB/PHY/ZOO 3-4000 — Upper division elective from any science/math major (3)

5. University Requirements (3 hrs)

- IDS 3920 University Colloquium (3)

6. Additional Electives (variable)

TOTAL SEMESTER HOURS REQUIRED 120 HRS

Additional Graduation Requirements

- A minimum of 120 credit hours.
- A minimum of 48 of the 120 hours must be at the upper division (3000 and higher) level.
- A cumulative GPA of 2.0 for all coursework attempted at FGCU.
- A minimum grade of C for each course used to satisfy the following categories: common prerequisites, required courses in the major, and electives in the major.
- Satisfaction of CLAST, Gordon Rule writing and computation, and foreign language entrance requirements.
- Satisfaction of the Service Learning requirement. See www.fgcu.edu/connect/

- Thirty of the last sixty credits must be completed at FGCU.
- Completion of the summer course enrollment requirement.
- Submit an application to graduate to CAS Advising by the deadline listed in the FGCU Academic Calendar.

Transfer Notes and Acceptable Substitutes

The following substitutions are acceptable for common prerequisites and must be completed with a grade of C or better.

- BSC 1010C may substitute BSC 1010 and BSC 1010L
- BSC 1011C may substitute BSC 1011 and BSC 1011L
- CHM 1045C may substitute CHM 1045 and CHM 1045L
- CHM 1046C may substitute CHM 1046 and CHM 1046L
- GLY 1010C may substitute for GLY 1000C
- PHY 2053C may substitute PHY 2053 and PHY 2053L
- PHY 2054C may substitute PHY 2054 and PHY 2054L

Appendix D: Sample Questions and Sample Response regarding BS. vs. BA degree

From: Rumbold, Darren
Sent: Thursday, September 21, 2006 10:00 AM
To: 'APedone@aol.com'
Subject: RE: BS vs. BA degree

Ms. Pedone:

You raise an excellent question regarding a BA vs. BS, one that has been the subject of considerable debate. I would encourage you to read a report done a couple of years ago by the Howard Hughes Medical Institute (available at http://www.hhmi.org/bulletin/summer2004/wellspring/wellspring2.html).

I don't think I can say it any better than the report, but I do want to add or reiterate a couple of points.

One, if you look at the degree requirements for the BA in Liberal Studies with a Marine Science Major here at FGCU, you (or someone in graduate admissions) will find the depth and breadth of science courses needed to train your daughter. The flexibility of the program is a crucial advantage over many BS programs at other institutions. I earned a BS in biology; however, the program was so rigid that I found that I could not count a few extra chemistry classes (which I felt I needed) toward my BS. So, I went ahead and earned a BA with a major in chemistry (in addition to the BS in biology).

If your daughter already has the focus to realize that she wants to attend grad school, I suspect she will enjoy the freedom to design her own tract.

At the same time, focused individuals often need help in realizing there is more to life than science. Further, you would be amazed at how much of the business of science (and it is a business – requiring publishing and obtaining funding) is done outside of the laboratory (one of the most desired qualities for a scientist to have is the ability to write well – to publish and write grant proposals). There are a lot of focused individuals that end up as lab technicians, which is fine if that was their goal.

I do want to emphasize a point made in the HHMI report. There is a difference in attitude toward teaching and interacting with undergraduates at institutions with a strong liberal arts program. I was speaking to colleague that is a professor at another South Florida university (on the east coast) just yesterday – he teaches one 2 hr class a semester and more importantly, has 3 post-docs running his lab. How much time do you think he spends interacting with undergraduates? Those undergrads could be at a disadvantage because getting into grad school (which is often much more difficult than getting into college) is typically about who you know, and how much hands on experience (gained outside of the classroom) you have to offer.

For more information on the way a BA degree is viewed versus a BS, I would recommend you search a couple of other websites:

http://www.sciencemag.org

This is the American Association for the Advancement of Science website for their journal; if you do a search on liberal arts you will find a number of articles. You will not be able to access all the articles without a membership password, but you will see titles and a few summaries.

You might also go to their career forum and do a search of "BA vs. BS"
http://sciencecareers.sciencemag.org/career_development/tools_resources/forum/home

In closing, I want to wish you and your daughter good luck in whatever direction you two decide to take (though it doesn't sound like you will need it given the effort you are putting in upfront).

Darren
Darren Rumbold, Ph. D
Associate Professor of Marine Science
Depart. of Marine and Ecological Sciences
Florida Gulf Coast University
10501 FGCU Blvd. South
Fort Myers, FL 33965
Phone 239. 590.7527
Fax: 239-590-7200
drumbold@fcgu.edu

From: APedone@aol.com [mailto:APedone@aol.com]
Sent: Wednesday, September 20, 2006 4:00 PM
To: Rumbold, Darren
Subject: BS vs. BA degree

Good Afternoon,

My daughter, Erin, is quite interested in attending FGCU. She is a junior in HS and we toured FGCU this past summer. Erin would like to persue a degree in Marine science. I noted that FGCU's degree is a BA versus the BS degree that several other Florida Universities offer. I understand and appreciate offering a student a well rounded education to prepare them for the global market but was concerned that the sciences courses offer the depth and breadth that would also prepare her for graduate work. Would you be able to offer an opinion on this?

Thank you,
Arleen Pedone

From: Barnes II, Bennie B (Bennie Barnes) [mailto:Bennie.Barnes@ElPaso.com]
Sent: Monday, February 09, 2009 4:18 PM
To: Rumbold, Darren
Subject: Dual Degree Options

My son has been accepted to FGCU in the Marine Science major for Fall of 2009. Is it possible to work toward a dual degree with a BS in Biology along with the BA in Marine Science?

How successful have students with the BA in Marine Sciences been in gaining acceptance to good MS and Phd programs in Marine Biology/Science?

Regards,
Bennie Barnes
Manager, Corrosion Control Services
and Special Assistant to the Sr. VP of Operations for Consent Decree Compliance
719.520.4677 (Office)
719.237.4393 (Cell)

From: Mark Barton [mb_barton@hotmail.com]
Sent: Thursday, August 21, 2008 3:32 AM
To: Rumbold, Darren
Subject: Marine Science

Greetings Dr. Rumbold,

My name is Mark Barton. I am a prospective student for FGCU, I am looking at following the Marine Science program. I have been looking at a number of other Universities such as UC Santa Barbara, University of Florida and FLorida State University. My question to you is how would you compare your program to the programes of other schools? And what makes your program different from theirs?

I want to make sure that the program for Marine Science is just as strong as FGCU is said to be in overal. I plan to go on to a Master's after my Bachelor's and I want to make sure that if I choose to follow a Master's program at another University that they will accept the FGCU Marine Science program as a high quality education.

Thank you for your time,
Kind Regards,
Mark Barton

From: melissa gillett [mailto:mgillett0806@yahoo.com]
Sent: Sunday, September 02, 2007 2:56 PM
To: Rumbold, Darren
Subject: Marine Science B.A.

Hello Professor Drumbold,

My name is Melissa Gillett....I will be a transfer student from Illinois....Is there any way to receive a B.S. in the Marine Science program?...Thanks for your time...Melissa...