



**Proposal for Flagship Program in  
Coastal Biology**

**Respectfully submitted by  
The faculty of the Department of Biology  
College of Arts and Sciences**

## I. EXECUTIVE SUMMARY

The Department of Biology proposes a Flagship Program in Coastal Biology. The geographic location of the University of North Florida and the current areas of faculty expertise make us exceptionally well suited to be a center of excellence in the study of coastal ecosystems. The campus is uniquely situated near the Atlantic Ocean, the St. John's River, and the Intracoastal Waterway. All of these bodies of water and their associated coastal habitats lie within 15 miles of campus. No other university in the country has all of these coastal habitats in such close proximity. Moreover, a Flagship Program in Coastal Biology will build upon strengths already present in the Department of Biology, and bring into **focus** an emerging theme that has been naturally developing within the department over the past several years. Specifically, the department has built a cadre of scientists whose research expertise covers a wide range of coastal biology, from genetics and molecular biology to ecosystem level aspects. These biologists have gathered at a university that is ideally situated for the study of coastal habitats. Thus the Biology Department at UNF is poised to become a regional leader in the study of coastal biology.

Marked increases in departmental course offerings, faculty grantsmanship, and scholarly publications have accompanied the development of an independent Biology Department and the addition of new faculty to the department. It is fair to say that our department is in the position to make a transition to national recognition for its programs, particularly in coastal biology.

The Biology Department has always been committed to **excellence** in the classroom, the lab, and in the field. By creating a focused program in coastal biology, additional opportunities to provide our students with excellent learning experiences will develop. A number of proposed collaborations have been motivated by our move towards a coastal emphasis. This in turn provides unique Transformational Learning Opportunities for our students, as championed by President Delaney. New undergraduate and graduate emphases in coastal biology will be offered to Biology Majors, which will provide our graduates with a unique competitive edge in related jobs and graduate programs, and an increased awareness of the need for stewardship of coastal ecosystems.

Never has coastal biology been more **relevant** than in this time and at this place. The Florida coast has been assaulted by man and nature in ways we are just beginning to understand. UNF is uniquely positioned to take a lead role in determining the impacts of many current risks to coastal systems, such as hurricanes, pesticide runoff, over fishing and invasive species. These impacts affect the aesthetics of the coast, recreation, development, and many commercial enterprises in both local and national communities. Recent algal blooms in the St. Johns River brought this to the attention of the Jacksonville community last summer, when recreational and commercial use of the river, and in some cases

simply proximity, led to illness among some Jacksonville residents. Why did these blooms occur? Why now? What can we do to prevent or lessen their impact in the future? The recent high profile hurricane seasons have also brought attention to coastal issues. We currently have little idea as to what the short- and long-term impacts of past and inevitable future hurricanes have on local and regional plants and animals. Other recent high-profile news items include the discussion of drilling for oil closer to Florida's Gulf Coast and wetlands development, both locally and nationally. These are the very issues that UNF Biology faculty members think about every day. With the focus afforded by Flagship status, our faculty's day to day research and teaching efforts can have a significant positive impact on the future of the First Coast. These are the types of important questions that a Flagship Program in Coastal Biology at UNF can begin to address. With the day-to-day importance of coastal issues on the First Coast, this Flagship program will generate consistent positive local publicity for UNF and the broader scientific community.

There is a great deal of energy and optimism among the faculty and students for continued development of a truly outstanding, nationally recognized Coastal Biology program at UNF.

## **II. OVERVIEW OF THE CURRENT BIOLOGY PROGRAM AND RATIONALE FOR FLAGSHIP STATUS**

### **OVERVIEW**

The UNF Department of Biology has reached a crossroads. The past five years have seen tremendous change and growth to our program. Major program advancements include:

- Forming an independent Biology Department that is no longer combined with the Physics and Chemistry
- More than doubling the tenure track faculty from five to eleven members.
- Developing and instituting a growing Masters Degree program.

Thus, UNF Biology is at a critical point in its growth and development. The focus of the university and especially of the Biology Department is developing a well-respected and thriving research program to complement the commitment to undergraduate education for which UNF has become known.

Since the Biology Department's separation from the former Department of Natural Sciences in 2001, the number of both biology majors and undergraduate contact hours has dramatically increased. The number of undergraduate biology majors has increased by 67% and the graduate program has grown from 4 students in its first year to more than 20 students only two years later. In addition, the Biology Department continues to offer its services to the university at large, by providing more than 16,000 student contact hours (SCH) each year. Many of these hours are dedicated to teaching students from other majors fulfilling general education requirements and providing necessary educational classes for students pursuing health related careers. In fact, the Biology department provides much of the basic biology education necessary for students of the first Flagship program, the Nursing program.

The department has seen rapid growth in hiring tenure track faculty members to keep up with consistent growth in student enrollment. A driving force for recent faculty hires has been to cover key department course offerings and to broaden the scope of research activities available to students. A number of these positions were filled by faculty whose research area or model system has a coastal emphasis. For example, our immediate past chair, Dr. Greg Ahearn, was hired under the broad research area of molecular biology. His specific research area happens to be in cellular physiology of ion transport in marine crustaceans. This is a natural fit for a focused program in Coastal Biology. More recently, we conducted a faculty search under the title of microbiologist, and hired Dr. Dale Casamatta. His research area is molecular systematics of blue-green algae,

again a natural fit to a program with coastal biology emphasis. In neither case was the department actively looking for marine or coastal biologists: they just happened to be the best candidates for the open positions, and we now have a strong core of faculty whose research and teaching interests provide a strong foundation for a Flagship Program in Coastal Biology. In fact, every tenured/tenure track faculty member expects to play a lead or supporting role in a Coastal Biology Flagship Program. (See below for faculty research summaries.) Flagship status will accelerate the department's burgeoning coastal focus and allow us to emerge as a regional and national leader in Coastal Biology.

Less than a decade ago, the majority of biology faculty were involved in very little scholarship activity. Now, every faculty member has a well-developed, active, and in many cases, externally funded research program. These programs support student research at both the undergraduate and graduate level, and have resulted in a publication rate many times that of only a few years ago. The number of peer-reviewed publications by the Biology faculty has steadily increased over the last 5 years. In 2000, there were only 3 peer-reviewed publications, but this number grew to 14 in 2005. Of the 2005 publications, nearly 70% of the publications related to coastal biology, either in organism or system studied. In addition, faculty members have been more aggressive and successful in obtaining external grants. With the new hires in recent years, the numbers of publications and grants per year are likely to increase at an even greater rate.

In an effort to promote faculty scholarship and to provide much needed opportunities for advanced training of biology students, the Biology Department added a Master's program in Fall 2003, which has experienced explosive growth since its inception. The level of enrollment in the Master's program is significantly ahead of any initial estimates, and gives an indication of the enthusiasm of the students for such a program. In terms of undergraduate students, UNF has maintained an enrollment of 250-350 Biology majors per year since the mid-1990s. This number is deceptive, however, as students are not required to declare a major until their junior year. Thus this number does not include all of the students served by the department. In fact, enrollment in the introductory biology courses has exceeded 1200 students in each of the last 5 years. Great progress has been made in recent years in building a high quality undergraduate and graduate program in biology at UNF.

## **RATIONALE**

### **1) Importance of Coastal Ecosystems**

Coastal wetlands including marshes and estuaries provide essential ecosystem services such as filtration of storm water runoff, and they provide an important buffer against tidal surges during hurricanes (Mitchell 1992). Moreover, wetlands provide critical habitat for a very diverse array of organisms

including invertebrates, fish and birds (Primack 1998). Coastal wetlands represent some of the most productive ecosystems on Earth.

## **2) Current Status of Coastal Ecosystems**

Despite their importance, wetlands ranging from isolated bogs to coastal ecosystems are being destroyed at an alarming rate (Hermann 1995). Within the continental U.S. wetlands have declined (almost exclusively caused by human destruction) by more than 50% in the last two hundred years. Owing to its mild wet climate and desirable real estate value, Florida's wetland ecosystems have suffered more than those in most other states. Florida's wetlands have decreased from 50-55% of its total land mass in the 1780's to approximately 35% in the 1980's (Dahl 1990). In addition, Florida's coastal ecosystems are often heavily invaded by exotic species including Brazilian pepper (*Schinus terebinthifolius*), paper bark tree (*Melaleuca quinquenervia*), Old World climbing fern (*Lygodium microphylla*) and the Asian green mussel (*Perna viridis*). For instance, within Everglades National Park, which is the jewel of Florida's nature preserves, 221 of the 850 recorded plant species (or 26%) are non-indigenous (Whiteaker and Doren 1989). Indeed, Everglades National Park is considered one of the four U.S. national parks most affected by exotic species (Loope 1992; Simberloff et al. 1992).

## **3) Need for Coastal Research**

Coastal ecosystems provide important research and funding opportunities from wetland function to dune stabilization studies. Establishment of a Coastal Biology Program would facilitate collaborative research and grant writing efforts among faculty members by creating a central clearing house for information relating to coastal ecosystems. Recent collaborative efforts to obtain both internal and external funding have increased dramatically within the department ranging from genetic studies of estuarine fish and marine mussels, to studies of the population dynamics of the diamond back terrapin and speciation of a gall midge on three coastal plant species. Creation of a Coastal Biology Program will place UNF at the forefront of dune, salt marsh and estuarine biology in northeast Florida, which should in turn increase research and funding for the science programs at the university.

## **4) Need for Education**

### **(A) Undergraduate and Graduate Level**

Producing scientifically literate graduates, who are capable of understanding complex environmental issues, is a goal of the Department of Biology. Addressing this goal requires a two fold approach. First, by offering undergraduates more class offerings and increasing their research opportunities, we produce students that are better scientists. In fact, several of our faculty have

a “coastal” focus to their research and we have recently begun to offer courses that are partially or completely focused on aquatic, coastal and wetland ecosystems including Conservation Biology, Methods in Restoration Ecology, Marine Ecology, Ichthyology, and Wetlands Ecology. These courses would be expanded, linked into a coherent sequence and offered to a wider selection of both undergraduate and graduate students at UNF through the Flagship Program. The second educational goal is increasing graduate level education at UNF. Our department recently (Fall 2003) developed a highly successful graduate program, which currently has approximately twenty-five full and part-time students enrolled. The graduate program offers both a research-based (M.S.) degree, which emphasizes design and analysis of original research, and a course-based (M.A.) degree, which is designed to provide local secondary school teachers with advanced training in biology.

### **(B) K-12 Education**

Clearly, scientific literacy is highly linked with a society’s standard of living and studies have found a significant correlation between scientific proficiency and standard of living. Moreover, as Meffe et al. (1997) point out, scientific literacy should start early in a student’s education and, especially during early ages, it is possible to exploit a child’s curiosity about the natural world. By educating the teachers responsible for molding children’s awareness of the scientific and natural world, we help to increase awareness of scientific principles in general and coastal ecosystems in particular. The Coastal Biology Program would allow us to expand both undergraduate and graduate science courses specifically focused on coastal ecosystems, which will produce more informed secondary school instructors. In addition, we will hold summer workshops in which secondary school teachers will be educated in local coastal ecosystems and given ideas on how to generate experiments and field trips to educate their students about coastal ecosystems.

### **(C) Public Education**

It is especially important that UNF, which is north Florida’s public state institution of higher learning, becomes a leader in public education. The Coastal Biology Program will also be responsible (possibly in association with the UNF Environmental Center) for presenting public seminars on science in general and coastal biology in particular. Educational initiatives may involve workshops for local students and senior citizens, field trips to coastal ecosystems and seminars regarding coastal biology and research being conducted by UNF faculty.

### **III. ACCOMPLISHMENTS AND RESEARCH**

#### **PUBLICATIONS AND PRESENTATIONS**

Since the creation of an independent Biology department in 2001, members of the department have published 34 articles in peer-reviewed journals and presented 29 talks and posters at local and national meetings. In addition, faculty members are active in the scientific community by reviewing for more than 30 different scholarly journals and contributing to or reviewing for seven books.

#### **EXTERNAL GRANTS:**

- 2006. St. John's River Water Management District, **\$38,000.**
- 2005. National Science Foundation, **\$600,000.**
- 2005. Fish and Wildlife Research Institute, **\$141,659**
- 2005. Beckman Coulter, **\$50,000.**
- 2005. United States Fish and Wildlife Service, **\$39,000.**
- 2005. Florida Department of Health, **\$33,720.**
- 2004. Fish and Wildlife Research Institute, **\$198,101.**
- 2004. North American Snake Institute, **\$20,838.**
- 2004. St. John's River Water Management District, **\$34,400.**
- 2003. National Oceanic and Atmospheric Administration, **\$51,733.**
- 2003. National Fish and Wildlife Foundation, **\$20,413.**
- 2002. National Institute of Health, **\$133,825.**
- 2002. Florida Sea Grant, **\$25,000.**

#### **INTERNAL GRANTS**

- 2006. Transformational Learning Opportunities Grant, **\$29,800.**
- 2006. Two Environmental Center Fellowships, **\$10,000.**
- 2006. Four UNF Summer Scholarship Grants, **\$20,000.**
- 2006. UNF Summer Proposal Grant, **\$5,000.**
- 2006. College of Arts and Sciences Faculty Fellowship, **\$4,000.**
- 2005. Environmental Center Fellowship, **\$5,000.**
- 2005. Four UNF Summer Scholarship Grant, **\$20,000.**
- 2005. UNF Summer Teaching Grant, **\$5,000.**
- 2005. Dean's Leadership Council Fellowship, **\$4,600.**
- 2004. Two UNF Summer Development Grant, **\$10,000**
- 2003. UNF Summer Scholarship Grant, **\$5,000.**
- 2002. UNF Summer Development Grant, **\$5,000.**
- 2002. UNF Summer Scholarship Grants, **\$5,000.**
- 2001. UNF Summer Scholarship Grants, **\$5,000.**

## COASTAL BIOLOGY FACULTY AND RESEARCH

### **Dr. Gregory Ahearn**

My laboratory is using electrophysiology, membrane vesicle techniques, cell culture, dissociated tissue cell suspensions, and molecular biology to investigate the physiology of molecular transport by epithelial cell membranes of fish and crustacean gastrointestinal and renal organs. Recently we have focused our work on investigating ion transport processes of crustacean epithelial cells and have discovered a novel  $2\text{Na}^+/1\text{H}^+$  transport protein in crustacean cell membranes which significantly differs physiologically from its mammalian counterpart. We are currently investigating this interesting invertebrate protein with molecular biology techniques which will allow us to identify the gene that codes for the protein and compare it to the DNA sequences responsible for analogous proteins in vertebrates.

### **Dr. Joe Butler**

I have been studying the ecology of diamondback terrapins (*Malaclemys terrapin*) for over a decade. Terrapins are the only species of turtle in North America to actually prefer the brackish waters of the coastal eastern United States. In 1995 I was awarded the first of my two Nongame Wildlife Program grants from the Florida Fish and Wildlife Conservation Commission (FFWCC) which allowed me to locate and assess terrapin populations in northeastern Florida. Since that time my students, colleagues and I have located a nearby important terrapin nesting beach and have been able to study nesting habits and requirements, clutch sizes, hatching success, and predation on both adults and hatchlings. One of the major circumstances adversely affecting terrapin populations is drowning in crab pots. I have received funding from Florida Sea Grant, National Wildlife Foundation, and NOAA to study the use and effectiveness of by-catch reductions devices, which are designed to prevent terrapins from entering crab pots without lowering crab catch. I pursued this study in eight Florida counties and am currently in negotiations with FFWCC to implement statewide regulations requiring these devices be used on all crab pots in Florida.

### **Dr. Dale Casamatta**

My research interests fall into two main categories: cyanobacterial systematics and aquatic microbial ecology. Many of my research projects utilize cyanobacteria due to their ubiquitous presence in freshwater and terrestrial systems (never problematic to find test organisms), profound evolutionary history and significant ecological role. I utilize a variety of molecular techniques such as the direct sequencing of the 16S rRNA gene and analysis of the secondary structure of the 16S-23S ITS region in order to elucidate phylogenetic, or evolutionary, relationships. I am currently involved in revisions of genera in the

Oscillatoriales, and am interested in describing and understanding cyanobacterial distribution and endemism. In addition to phylogenetics, my lab and I are currently addressing basic questions in aquatic microbial ecology. For example, students in my lab are currently working on projects such as addressing algal growth response to cultural eutrophication, understanding the range and nature of algal phenotypic plasticity and describing algal diversity from a variety of ecosystems.

### **Dr. Matt Gilg**

I am an ecological geneticist and evolutionary biologist that works to a large extent on marine, estuarine and coastal organisms. My students and I are currently working on: 1) determining the processes involved in the evolution of reproductive barriers in marine species, 2) measuring the dispersal of pelagic larvae, their subsequent recruitment and how environmental factors govern these processes, and 3) understanding the interaction between closely related species and the factors involved in determining the limits of their geographic ranges. Most of my work involves the use of genetic markers to identify species, measure genetic diversity and identify the timing and outcome of natural selection, genetic drift and migration on populations.

### **Dr. John D. Hatle**

I study the physiological regulation of arthropod life histories. Arthropods are key organisms in coastal systems, including both insects inhabiting marsh grasses and crustaceans in estuarine waters. Major life history events for arthropods include molting and reproduction. For insects, reproduction is typically limited by the amount of protein they can ingest and store. My colleagues and I have hypothesized that insects feed until they accumulate a threshold level of protein stores, then they initiate egg production. Data on the levels of storage protein during reproduction support this hypothesis. My students and I have quantified the threshold as a cumulative amount of food eaten and characterized the hormonal responses to attaining the feeding threshold. Our next goal is to determine which storage proteins make up the threshold, by using molecular biology to knock out specific proteins in live animals and examining effects on reproduction. These studies will shed light on how arthropods adjust to a variable coastal environment.

### **Dr. Michael R. Lentz**

I have had an active research program to investigate papillomavirus DNA replication. This project was initiated almost 20 years ago, and has been consistently funded and yielded numerous peer-reviewed publications. We use biochemical and genetic methods to attempt to unravel molecular mechanisms that regulate viral and cellular DNA replication. Recently, my research has taken a new direction with the initiation of a collaborative project with Dr. Dale Casamatta, whose main research focus is on molecular systematics of marine and freshwater algae. Their recent discovery of virally infected strains of algae has led to a joint project to isolate and characterize algal viruses from freshwater

and marine environments in Northeast Florida. Once a new virus is identified, I plan to carry detailed molecular analysis of algal virus genome replication mechanisms using the biochemical and genetic procedures we have developed in other systems. Dr. Casamatta and I recently received a President's Transformational Learning Opportunities Grant to initiate this project with undergraduate student support. This funded project will provide the preliminary data necessary to submit a competitive application for external support from agencies such as Florida Sea Grant and the National Science Foundation.

#### **Dr. Daniel Moon**

Research in my lab centers on the ecology of coastal and upland communities such as salt marshes, wetlands, coastal dunes, and upland hammocks. I am primarily interested in how variation in environmental factors influences community dynamics such as plant and insect species diversity and abundance, and the relative importance of food sources versus predation and parasitism on herbivores. The studies on coastal communities that my students and I conduct are important both theoretically and practically. We have applied our findings to evaluating current theories and models of community ecology, as well as to habitat restoration and species conservation. Current projects include examining the effects of elevated CO<sub>2</sub> levels on a scrub oak forest ecosystem, investigating food web structure and species diversity in constructed wetlands, and studying the interplay between environmental stress levels and intraguild predation in salt marsh communities.

#### **Dr. Judith Ochrietor**

My laboratory will utilize the Coastal Biology Flagship program as a resource for obtaining organisms for an evolutionary study of the Basigin gene. Presently, we do not know the function of the two Basigin gene product, although numerous studies suggest that Basigin participates in cell-cell interactions. It is well documented that a strain of mice, in which the Basigin gene was deleted, is both reproductively sterile and blind, which infers important functions for the Basigin gene products. RNA would be isolated and documented from multiple organisms collected from coastal ecosystems by graduate and undergraduate students working in my lab. The Basigin sequences obtained from the coastal organisms would be analyzed and compared to generate a phylogenetic - and evolutionary - representation of Basigin expression.

#### **Dr. Anthony M. Rossi**

My research focuses primarily on ecology and evolution of plant-insect interactions. In particular, I am interested in the factors that affect host range expansion and sympatric divergence in the gall midge, *Asphondylia borrichiae*, which attacks three native coastal plants in the aster family. Specifically, students in my lab are currently examining whether host-specific differences in larval development time are capable of producing genetic divergence in populations of *Asphondylia* associated with each host species. Such a scenario is possible, even in sympatry, if gene flow is greatly reduced between temporally

isolated host-associated populations. In addition, I am interested in coastal ecosystem diversity, function and conservation.

**Dr. Kelly Smith**

My current research interests focus on juvenile fish ecology in estuarine environments. I am especially interested in the interaction between habitat structure and quality, and population size and species diversity of estuarine resident fishes. I am currently investigating the effects of salt marsh habitat types and geographic location on abundances of juvenile killifishes in Northeast Florida. The northeast region of Florida represents a transition zone between two closely related species of killifishes (both *Fundulus* spp.). Students in my lab are working on projects examining factors that affect distribution of these species within their habitats. Much of my research has direct implications for management and conservation of estuarine habitats and resources. I am also interested in the impacts of invasive species on coastal ecosystems, and have become involved in a project examining dispersal patterns of the invasive green mussel.

#### **IV. ACTIVITIES REQUIRED TO ACHIEVE FLAGSHIP GOALS**

##### **EDUCATION**

- **Develop a Coastal Biology emphasis for Undergraduate and Graduate Programs**

The primary mission of the University of North Florida is education, and the Coastal Biology program is committed to furthering education at all levels. First, developing a Flagship Program in coastal biology will allow for the expansion of undergraduate and graduate education and course offerings. This enhancement of undergraduate education would be realized through the development of Coastal Biology emphases for the Bachelors and Masters degrees offered by the Biology Department.

The coastal biology emphasis can be applied to either of the currently existing tracks (Ecological and Evolutionary Biology and the Cellular and Molecular Biology), and will be based upon the fundamental core courses required for a well-rounded and complete degree in the biological sciences. The upper level required and elective courses for this emphasis, however, would focus on aspects of coastal biology and include courses currently offered by the department that have a coastal focus as well as new courses.

Many of the courses currently offered by the department already have a coastal focus. For example, the Methods in Ecological Restoration course, team taught by Dan Moon and Tony Rossi, emphasizes the restoration of coastal habitats such as salt marshes and beach/dune communities. Similarly, Kelly Smith's Marine Ecology course focuses on salt marshes, estuaries, and near-shore habitats. A number of other classes such as Community Ecology, Limnology, and Microbial Ecology also emphasize coastal habitats either in the lecture or the lab, and even more classes such as Herpetology, Botany, and Advanced Evolution could be modified to focus on coastal systems. During the four year candidacy period, the curricula for these courses would be revised to further emphasize coastal habitats, while still teaching fundamental biological concepts, making them ideal for any of the three tracks from which an undergraduate student could choose.

- **Broaden the current faculty course and research offerings and address real-world issues in Coastal Biology**

While many current courses already fit or can be modified to suit the coastal biology emphasis, some additional courses would be necessary to provide a broad curriculum focused on coastal biology. In particular, two courses which

would be offered by the new faculty member requested in the flagship proposal would be Biological Oceanography, which focuses on the interaction between chemical, geological and biological properties of coastal and marine systems, and an upper level coastal course in the new faculty member's area of expertise. The requested faculty line would provide the department with a new member whose research and teaching specialties would harmonize well with current faculty research and provide additional classes to round out the Coastal Biology curriculum. A course in Coastal Management taught by an adjunct from a state or federal management agency would allow students to connect the science taught in the class room with current government management mandates, strategies and practices for coastal ecosystems.

- **Summer Coastal Biology programs**

Summer workshops for undergraduate students and K-12 educators will be developed which will consist of two to three week courses, specifically designed to be immersive investigations of Coastal Biology. Classes would be attended daily, with days alternating between classroom, field and lab activities. Faculty members would teach in their area of expertise and present techniques commonly used in their research. An ecology-based class may teach students how to do aquatic biodiversity surveys by using class time to familiarize students with the systematics of the organisms they may encounter and ways to evaluate diversity. The field component of the course might train students in techniques to sample aquatic diversity, while lab time might be devoted to teaching macroscopic and microscopic techniques for identification of the collected organisms.

- **K-12 educator summer program**

The goals of a flagship program are not just to create the best possible education for current UNF students, but to also increase the reputation and recognition of UNF on a local, national and international level. The Biology department has often been approached by K-12 teachers from Duval, Nassau and St. John's counties who express a need for education about the flora, fauna and ecology of local habitats. By educating teachers, we are helping the local community to educate its children, and by extension their families, about our natural resources. The Biology department plans to institute summer workshops for local K-12 teachers to fill the needs expressed by local educators. For these workshops, classes would focus on natural history, guided walks and the development of simple studies or experiments (and field trips) that they can do with their students to teach them about coastal habitats. An example of one such class could be a class about the biology and conservation of local turtles, including diamondback terrapins and sea turtles. The initial funding for creating and implementing the summer educator workshops will be provided by flagship funding; however, the later workshops would come from external sources, such as local company sponsorship or external science education grants.

- **Undergraduate summer program**

The Coastal Biology program will also address a national need by providing a curriculum that offers a truly coastal program. Through a summer workshop program offering a series of both field and lab courses in coastal biology. UNF is ideal for such a summer program because coastal access requires only local travel. From the university, students can conduct studies on coastal, intracoastal and St. John's River ecosystems. All of the field, lab and classroom components of the course could be done in Jacksonville, unlike similar summer programs sponsored by other universities, which often require extensive travel to field locations. The summer workshop series allows students from other universities, as well as UNF students, to benefit from the unique location and teaching emphasis provided by the UNF Coastal Biology program. By recruiting students from other universities for the summer programs, we will create increased awareness of UNF and enhance the reputation of both the Biology department and UNF. In addition, we will use these summer workshops as a way to recruit quality graduate students into the relatively new graduate program. While in the beginning summer workshops would require flagship funding to initial supply equipment and personal. In later years, these workshops would be funded by student enrollment and grants from public and private agencies.

- **Seminars to educate the public regarding Coastal Biology**

The Coastal Biology program at UNF will also have a deep commitment to public education. A coastal science seminar series will be established in the candidacy period for flagship status. Two special evening seminars will be held each year, one in the fall, and one in the spring, in which a national or international expert on some aspect of coastal biology will be invited to UNF to speak to the public.

## **RESEARCH**

Research opportunities, which are an integral part of undergraduate and graduate education, would increase during the advancement to flagship status. Flagship status would aid in increasing research opportunities by adding a new faculty member, obtaining course releases for active faculty research and providing equipment for research. In 2005, more than 75 students registered for nearly 200 hours of undergraduate research with biology faculty members. By providing hands-on knowledge, both in the lab and field, undergraduate research presents students with an invaluable resource for future endeavors, whether it be graduate school or immediate employment. Involvement in research is an essential part of undergraduate education, as it provides novel and transformational experiences that can not be gained in the classroom. In addition to the practical knowledge derived from undergraduate research, forged

partnerships with local businesses and governmental agencies will enable students to form networks with future employers and allow local businesses to witness the high quality future employees produced by UNF.

Increased research opportunities for both faculty and students will be created using multiple approaches. An in-house grant fund using flagship funding would create opportunities for faculty to apply for small equipment or student research stipends. Often grant agencies, among them NSF and NIH, require a set of preliminary research data before a larger project will be funded. In fact, in recent years, several faculty proposals to these agencies have been deemed meritorious, but in need of more preliminary data. These in-house grants would provide research funds to gather the preliminary data necessary to be competitive for large external grants. These in-house grants, along with the addition of another faculty member, will allow the Biology Department to increase not only its dedicated faculty research time, but also allow more time for the supervision of both undergraduate and graduate research projects. Increased research by both faculty and students would result in not only an increase in scholarly reputation through increased publications and presentations, but also in increased grant income for the department and UNF.

## **FORGING PARTNERSHIPS**

Coastal biology requires an interdisciplinary approach and is the purview of many organizations ranging from civil and local organizations to federal and international agencies. Establishing partnerships with these groups is critical to comprehensive study and research on coastal systems. Making these connections will increase the value of such studies to the public, thereby, making the Coastal Biology program at UNF more competitive for external funding.

- **UNF Collaborations**

Numerous collaborations between Biology Department faculty and faculty from other departments and colleges within UNF have already been established that would be further facilitated by the inception of a flagship program in Coastal Biology. For example, Stuart Chalk from the Department of Chemistry and Physics has worked with Biology faculty previously, and would play an important role in conducting analyses of environmental chemicals such as nutrients, toxins, and pollutants in coastal systems. Geographic Information Systems (GIS) technology is also an important tool for investigation of coastal biology on a landscape scale, and David Lambert in Engineering will be an important collaborator with Biology in this regard. With his help, sophisticated and detailed geographic maps could be constructed that would display coastal habitats most at risk of degradation from sources such as non-point source pollution or storm surge. Additionally, collaborations may be fostered with the College of Health. Both Kerry Clark and Cynthia Nyquist-Battie investigate human health issues that can be related to coastal habitats, and would be valuable collaborators on

studies investigating red tides and other coastal phenomena that have significant health implications.

The recent creation of the Environmental Center is a tremendous asset and will enhance the ability of Coastal Biology to obtain funding through public and private connections. For example, Ray Bowman and the Environmental Center have already facilitated a partnership between the City of Jacksonville and faculty members from the Biology Department (Rossi and Moon) to plan and undertake restoration of City of Jacksonville land. The Environmental Center has been instrumental in procuring funding for the project from CoJ, Preservation North Florida, and US Fish and Wildlife Service. Achievement of flagship status will greatly enhance the reputation of the Coastal Biology program at UNF, and facilitate the development of such partnerships both directly and through the professional relationships being developed by the Environmental Center.

- **External Collaborations**

The Coastal Biology program and its research can directly benefit local and regional agencies and organizations. For example, David Beall at the Florida Department of Health has expressed interest in collaborating with Biology faculty to study toxins in coastal systems. Dr. Rick Gleeson, the research director of the Guana Tolomato Matanzas (GTM) site of the National Estuarine Research Reserve (NERR) System is very interested in the establishment of a Coastal Biology program at UNF. He has indicated the need for UNF to conduct coastal research of NERR sites, and has mentioned the possible establishment of a field station to be used at GTM. This field station would require renovation of existing facilities to accommodate teaching and research labs. Achievement of Flagship status would make UNF more competitive for obtaining the necessary external funds from the federal NERR system and agencies such as NSF to fund these renovations and the development of UNF's state-of-the-art field station at GTM.

Biology faculty already have strong collaborative relationships with personnel at a number of state and national parks in nearby coastal areas which would facilitate the use of these parks for research and educational purposes. For example, Drs. Joe Butler and Dan Moon have worked closely with Bob Joseph, the director of Talbot Island State Park, who is excited about greater interaction with UNF faculty. Similarly, Drs. Butler, Rossi, and Smith have worked extensively with National Parks Service personnel at Timucuan Ecological and Historical Preserve on projects funded by the Department of Environmental Protection and the Florida Fish and Wildlife Conservation Commission. These relationships will be significantly strengthened with the creation of a Flagship Program in coastal biology, and will provide incredible opportunities for education of students and research activities.

Drs. Casamatta and Smith have already worked closely with Dr. Dean Doberfuhl at St. Johns River Water Management District (SJRWMD), and he will be an

important partner with Coastal Biology program. Creation of a flagship program in Coastal Biology would significantly benefit SJRWMD by providing a group of scientific leaders in coastal biology that would be relied upon to conduct research on the St. John's River and the estuaries where it meets the intercoastal waterway and the Atlantic Ocean. In return, SJRWMD would provide UNF with valuable resources such as funding for research, the use of boats and sampling equipment, and volunteers for field labor or laboratory technical assistance.

Achieving flagship status will greatly enhance the reputation and capabilities of the Biology faculty, and recognition of UNF as a leader in coastal biology. Faculty expertise that covers all aspects of coastal biology, as well as the collaborations mentioned above would make the UNF Coastal Biology program very competitive for funding from agencies such as Sea Grant, National Institute of Health, National Science Foundation, Environmental Protection Agency, US Fish and Wildlife Service and Department of Interior Coastal Program, which emphasize interdisciplinary studies of practically applicable science. The Coastal Biology program will also provide indispensable services to the community through research and consulting on issues such as development of the cruise ship industry at Jaxport, as well as minimizing ecological impact and maximizing yield of recreational and commercial fishing. As the reputation and recognition of the Coastal Biology program grow, so too will the partnerships developed with many public and private agencies.

**V. PROPOSED BUDGET**

ITEM	DETAILS	BUDGET			
		Year 1	Year 2	Year 3	Year 4
Faculty Line	Assistant Professor (Biological Oceanography) \$48,000 + benefits + 3% yearly raise	\$3,000 (Search Funds)	\$61,440	\$62,880	\$64,363
Course Development	Adjunct faculty for course in Coastal Management	-----	\$4,000	-----	\$4,000
	Faculty course releases for development of summer workshops (educator and undergraduate)	\$10,000	-----	\$10,000	-----
Marketing	Design, produce and distribute marketing release for summer undergraduate and educator workshop programs	-----	\$5,000	-----	\$5,000
	Advertising for new Coastal Biology Undergraduate Tract and Graduate Emphasis	-----	-----	\$1,000	\$1,000
Summer Workshop	Initial support to fund summer workshops (Faculty salary & necessary materials for classroom and lab)	-----	\$20,000 (Undergrad)	-----	\$20,000 (Educator)
Seminar Series	Open to the public seminars to encourage student and community awareness and knowledge of coastal biology.	\$3,000	\$3,000	\$3,000	\$3,000
Equipment	12 passenger van for use in transporting students in lab courses and summer workshops.	\$35,000			
In-House Grants	In-house grants for research advancement, including equipment funds and student research stipends.	\$30,000	\$10,000	\$10,000	\$10,000
Meeting and Publication Expense	Expenses for the presentation of research at national meetings and in scholarly journals.	\$4000	\$4000	\$4000	\$4000
<b>Total Budget</b>		<b>\$85,000</b>	<b>\$107,440</b>	<b>\$90,880</b>	<b>\$111,363</b>

## Budget Justification

1. *Faculty Line* – The new faculty line will be used to hire a biological oceanographer. This new faculty member will help meet the goal of providing an excellent and comprehensive program in coastal biology by expanding course offerings and increasing student research opportunities. The current Biology faculty have expertise in terrestrial, freshwater and estuarine habitats, but currently there is no faculty member who specializes in near-shore oceanic habitats, thus a biological oceanography would fill a current gap in the breath of expertise in coastal ecosystems in the department.
2. *Course Development* – Course development funds will be utilized in two ways: First, an adjunct instructor will be hired to teach a class in Coastal Management. The course will combine the scientific knowledge students have acquired following the Coastal Biology emphasis with real-world knowledge of the implementation of theories to management practices in local coastal systems. Students of this course would be exposed to local and regional practitioners of coastal biology management to reinforce application and strengthen local ties. Secondly, course development funds will be used to give faculty course releases to develop both the graduate and undergraduate workshops. In the future all of these courses will become self-sufficient due to student tuition.
3. *Marketing* – To initially attract participants to the Coastal Biology programs (undergraduate and graduate) and summer workshops, it is necessary to advertise these new programs. Posters with information on the summer programs would be sent to undergraduate institutions across the country and to local schools in Duval and St. John's counties. In time, as recognition of these programs spreads, marketing funds will no longer be necessary to attract students.
4. *Summer Workshop* – Flagship funding will be used during the first years of the summer workshops to provide faculty salaries and to procure the initial lab and field equipment necessary for the course.
5. *Seminar Series* – The seminar series will be used to bring in nationally recognized speakers to present coastal biology topics to the public. Funds will be used for travel and lodging expenses for the speakers.
6. *Equipment* – The passenger van is necessary to transport students to field sites throughout Duval County for classes and research both during the regular academic year and during the summer workshops.
7. *In-House Grants* – These grants will allow faculty to gather the preliminary data necessary to be competitive for large external grants. Some areas of research, particularly molecular biology, require expensive lab work to gather the necessary data to present competitive grants proposals. These grants will allow faculty members to have the equipment and/or laboratory help, via student research stipends, to do necessary research to increase the external grant money awarded to the Biology Department.

8. *Meeting and Publication Expense* – As the Coastal Biology research program grows, there will be an increase in the publication and presentation of research results, including results from undergraduate and graduate research projects. Funds from the flagship program will be used to pay publication, travel and meeting fees associated with presenting research findings.

## **VI. BENCHMARKS AND ASSESSMENT OF BENCHMARKS**

### **Year 1 Benchmarks (2006-2007)**

1. Search for assistant professor who will augment the current offerings, both teaching and research, in Coastal Biology.
2. Develop a curriculum plan for the Coastal Biology emphasis for undergraduate biology majors. Focus groups and surveys for both students and faculty will be used to identify important facets of the curriculum plan.
3. Develop a summer workshop program in Coastal Biology for undergraduate students.
4. Begin developing and enriching partnerships both within UNF and outside of UNF, with the ultimate goal of creating internship opportunities for undergraduates in Coastal Biology.

### **Annual Assessment**

- An advertisement for a new faculty member will be posted in Fall 2006, with hiring to occur in March 2007.
- Development of the undergraduate Coastal Biology emphasis and undergraduate summer workshops will be completed by Spring 2007.
- The fulfillment of item 4 will begin immediately but will require additional time to complete and will be assessed by an increase in student internships during the following years.

### **Year 2 Benchmarks (2007-2008)**

1. New faculty member implements new course in Coastal Biology (Biological Oceanography).
2. Design, produce, and distribute advertising poster for summer undergraduate workshop in Coastal Biology.
3. First summer semester workshop for undergraduates in Coastal Biology.
4. Begin a series of seminars on Coastal Biology geared towards increasing community knowledge and involvement.
5. Increase undergraduate research opportunities, both within the Biology department and through partnerships with outside agencies.

### **Annual Assessment**

- The new faculty member will start in Fall 2007 and teach Biological Oceanography in Spring 2008.
- The first summer semester workshop for undergraduate students will occur in Summer 2008. The workshop will continue in alternate years.
- Begin open to the public seminars on coastal biology once a semester.
- Increasing undergraduate research opportunities will begin immediately and will be evaluated by an increase in registered undergraduate research hours.

### **Year 3 Benchmarks (2008-2009)**

1. Implement new Coastal Biology Tract for undergraduate biology majors.
2. New faculty member implements new course in Coastal Biology (Upper level course in faculty specialty).
3. Adjunct instructor hired to teach a course in Coastal Ecosystem Management.
4. Develop a curriculum plan for MS emphasis in Coastal Biology. Focus groups and surveys for both students and faculty will be used to identify important facets of the curriculum plan.

### **Annual Assessment**

- The new Coastal Biology emphasis will be implemented in Fall 2008.
- The new faculty member will implement course in specialty field in Spring 2009.
- An adjunct instructor will be hired to teach Coastal Ecosystem Management in Fall 2008.
- The new MS emphasis curriculum plan will be completed by Spring 2009.
- Increased research efforts, on the part of faculty and students, will be measured by an increase in peer-reviewed publications and presentations at national meetings.

### **Year 4 Benchmarks (2009-2010)**

1. Implement MS emphasis in Coastal Biology.
2. Develop summer workshops for the education of K-12 grade teachers to increase local awareness and knowledge of coastal ecosystems.
3. Design, produce, and distribute advertising poster for summer educator workshop in Coastal Biology.
4. First summer workshops in Coastal Biology for local educators. (Begin to alternate undergraduate and educator workshop programs during summers.)

### **Annual Assessment**

- The new MS emphasis in Coastal Biology will be offered in Fall 2009
- The summer workshops for educators will be developed by Spring 2010 with the first workshops occurring in Summer 2010. The program will then alternate years with the undergraduate summer workshops.
- Increased research efforts, on the part of faculty and students, will be measured by an increase in peer-reviewed publications and presentations at national meetings.

## VII. REFERENCES

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