Graduate Council Report
October 27, 2006

Graduate Council approved the request from the Department of Marine Biology at Texas A&M University Galveston, for the establishment of a Master of Science and Doctor of Philosophy Interdisciplinary Degree Program in Marine Biology (MB IDP), via electronic vote.
600. Field and Laboratory Methods. (3-0). Credit 3. Experience in field studies, organizing field notes, collecting and preserving vertebrate animals for teaching and museum purposes; methods for maintaining live animals and for identifying animals collected; training in preparing skeletons, corrosion models, cleared specimens and in plastic embedding. Prerequisite: Eighteen hours of biological sciences or approval of instructor.

601. Vertebrate Systematics. (1-6). Credit 3. Theory and practice of biological systematics and taxonomy; historical development of discipline, mechanisms of speciation, the origin of higher categories and major taxonomic philosophies (numerical taxonomy, phylogenetic systematics and evolutionary systematics); theory involved in the study of vertebrates.

603. Vertebrate Ecology (3-0). Credit 3. Examination of the philosophical perspectives and ecological paradigms associated with modern animal ecology studies; emphasis on community ecology including structure and organizing processes; theoretical foundations and applicability of ecosystem management discussed.

604. Systems Analysis and Simulation in Ecology and Natural Resources Management. (3-0). Credit 3. Philosophical basis, theoretical framework, and practical application of systems analysis and simulation within the context of ecology and natural resource management; emphasis placed on development, evaluation and use of simulation models by students. Prerequisite: Approval of instructor.

606. Systematic Herpetology. (2-3). Credit 3. Distribution, evolution, speciation and new systematics of amphibians and reptiles; extensive field studies of local problem groups and philosophy and role of herpetology as a science. Prerequisite: WFS 315.

607. Environmental Conflict Management*. (3-0). Credit 3. Students will be enabled to understand environmental conflict systemically, understand how communication contributes to environmental conflict and develop increased capacity as managers of environmental conflict.

608. Public Participation in Conservation Policy*. (3-0). Credit 3. Students will have the opportunity to become familiar with and critique theories and constructs as well as strategies and techniques for enhancing public participation in environmental conservation policy.

610. Evolutionary Ecology. (3-0). Credit 3. Survey the development of paradigms in evolutionary ecology; incorporates phylogenies into comparative analysis and macroecology; evaluates the roles of historical and local processes in determining species diversity; Prerequisite: Graduate classification.

611. Estuarine Ecology. (3-3). Credit 4. Principles governing the relationships of estuarine organisms to their environment; productivity, adaptations to the environment, community structure and factors affecting the distribution and abundance of biota. Prerequisite: Invertebrate zoology and ichthyology or approval of instructor.

612. Conservation Biology. (3-0). Credit 3. Examine the development of major areas in conservation-oriented research that includes patterns of biodiversity, extinction, conservation genetics, conservation of populations, communities and landscapes, and ecological sustainability. Prerequisite: Graduate classification.

613. Animal Ecology*. (2-3). Credit 3. Concepts of animal ecology which emerge at various levels of organization; the ecosystem, the community, the population and the individual; laboratories emphasis on the quantitative analysis of field data and the simulation of population dynamics.

615. Marine Biology. (3-3). Credit 4. Environmental, physiological, behavioral, legal and economic factors which determine the success of efforts to cultivate saltwater species having economic importance; practices employed in various parts of the world to produce fishes, mollusks and crustaceans. Prerequisite: Ichthyology and invertebrate zoology or approval of instructor.

616. Physiological Ecology of Vertebrates. (3-4). Credit 4. Effects of temperature, oxygen and other environmental factors on the distribution and abundance of animals; comparative behavioral and physiological adjustments to environment as an evolutionary response; students will be expected to develop and execute a research project in an appropriate subject area. Prerequisite: ZOOL 388 or WFS 417 or approval of instructor.

617. Biology of Fishes*. (3-3). Credit 4. Fishes’ physiological and morphological adaptations for life in aquatic systems; physiological and behavioral responses of fish to environmental variation. Laboratory emphasizes design, conduct and analysis of virtual experiments featuring “EcoFish,” a simulation model of fish ecology.

618. Wildlife Study Design and Analysis*. (3-0). Credit 3. Students will be exposed to fundamental and advanced aspects of study design applicable to terrestrial animals; analysis and review of the scientific literature related to study design; and the development of study design for written and oral presentations.

620. Vertebrate Ethology. (3-2). Credit 4. Mechanisms and control of vertebrate behavior in an ecological context, as shaped by natural selection; classical and current theories regarding the genetic basis, development, specialized sensory systems and organization of responses of changing environment; laboratory emphasizes observational skills and quantitative analysis of behavior occurring in natural settings.

622. Behavioral Ecology. (3-0). Credit 3. Integration of animal behavior with ecological and evolutionary principles; includes mating, predation, foraging ecology, social behavior, game theory and behavioral genetics; emphasis on quantification of behavior and strategy modeling. Prerequisites: Undergraduate ecology course; graduate classification.
Principle of fish production for stock enhancement and human food. Species of fish used for production, cross-breeding and selection; feeds and feeding of fishes and nutritional and environmental requirements for optimum productivity; effects of fish production on land and water uses as related to conservation.


628. Wetland Ecology. (2-3). Credit 3. Wetlands as ecological systems that are prime habitats for wildlife and fish; geomorphology, hydrology, limnology, plant and animal communities, and human use and management. Prerequisite: WFSC 403 or RLEM 316 or equivalent.

629. Lower Foodweb Dynamics of Aquatic Ecosystems. (2-3) Credit 3. Dynamics of the lower foodweb in estuaries, rivers and lakes, detailing the role and interactions between biota and how they are influenced by abiotic processes; effects of man's activities on natural succession patterns and ecosystem productivity, elucidating the potential for management practices. Prerequisite: Graduate classification. Cross-listed with OCN 629.

640. Human Dimensions of Wildlife and Fisheries Management. (3-0). Credit 3. Theory and applications for considering human dimensions in an integrated approach to wildlife and fisheries management; a social science perspective with emphasis to diversity of human values, role of constituency groups, wildlife and fisheries policy development, conflict management, management decision-making, research methods and management case studies.

647. Nutritional Biochemistry of Fishes. (3-0). Credit 3. Principles of nutritional biochemistry including nutrient metabolism and biochemical energies with special emphasis on finfish and shellfish. Prerequisites: BICH 410 or equivalent. Cross-listed with NUTR 647.

650. Aquatic Microbial Ecology. (3-0). Credit 3. Microbes in natural environments, including both water and sediment habitats in marine, fresh and ground water systems; process studies of microbial foodwebs and biogeochemical cycling; current methods and research directions. Prerequisite: WFSC 414 and OCN 620 or approval of instructor. Cross-listed with OCN 650.

Students will learn the rationale and mathematics behind upper-level biometrical methods; students will construct spreadsheets & analyze a common data set; topics to include multiple regression, principle components analysis, multivariate analysis of variance and others.

681. Seminar. Credit 1. each semester. Important current developments in wildlife and fisheries fields with special reference to literature. Students may register up to but no more than two sections of this course in the same semester.

689. Special Topics in...Credit 1 to 4. Special topics in wildlife ecology, fisheries ecology, vertebrate systematics, evolutionary biology of vertebrates and conservation education. May be repeated for credit.

Potential MB course offerings from TAMU-CC

The following courses may be applicable to the MARB course offerings. Courses beginning with a number 5 are Master's level; those beginning with a 6 are PhD level. [The prefixes used are: BIOL = Biology, CMSS = Coastal and Marine System Science, ESCI = Environmental Science, GISC = Geographic Information Science, MARI Mariculture, MATH = Mathematics.]

BIOL 5309. 3 sem. hrs. (3:0) SYSTEMATICS Theories, methods, molecular and evolutionary basis of systematic biology and rules and relationships of nomenclature used in classification.

BIOL 5310. 3 sem. hrs. (3:0) PHYSIOLOGICAL ADAPTATIONS IN ANIMALS A study of the physiological adaptations of animals to their environment, including osmoregulatory and temperature regulatory mechanisms. Prerequisite: BIOL 3430 Physiology.

BIOL 5335. 3 sem. hrs. (3:0) AQUATIC MICROBIOLOGY Types and distribution of microorganisms in aquatic environments. Interactions with other organisms. Role in nutrient cycling, degradation of organic substances, pollution, water purification. Prerequisite: BIOL 2421 Microbiology.

BIOL 5415. 4 sem. hrs. (3:3) BIOLOGY OF ESTUARINE ORGANISMS Life history and ecology of estuarine organisms. Special emphasis on the identification of local forms. Prerequisites: BIOL 3413 Invertebrate Zoology and BIOL 3428 Principles of Ecology.

BIOL 5425. 4 sem. hrs. (3:3) ADVANCED INVERTEBRATE ZOOLOGY In-depth study of selected invertebrate phyla. Field trips to sites along the Texas coast. Prerequisite: BIOL 3413 Invertebrate Zoology.
BIOL 5427. 4 sem. hrs. (3:3) COASTAL ECOLOGY OF TEXAS Study of the ecology and environmental issues of the Texas coast. Includes field trips along the entire Texas coastline. Prerequisites: BIOL 3428 Principles of Ecology, BIOL 3443 Environmental Biology, or BIOL 4436 Marine Ecology.

BIOL 5428. 4 sem. hrs. (3:3) FISHERIES BIOLOGY Advanced study of theory and techniques in fisheries science including behavior of fisheries populations and applications to resource management with emphasis on tidal-influenced waters. Includes readings in the current literature and a research project. The lab will emphasize practical sampling design and data interpretation.

BIOL 5430. 4 sem. hrs. (3:3) MARINE PLANKTON Investigation of the systematics, distribution and ecology of marine plankton.

BIOL 5436. 4 sem. hrs. (3:3) MARINE ECOLOGICAL PROCESSES Advanced studies in structure and habitats of marine environments. Emphasis on factors influencing distribution of marine organisms, including field trips to areas along the Texas coast. Prerequisite: BIOL 3428 Principles of Ecology.

BIOL 5632. 6 sem. hrs. (2:8) CORAL REEF ECOLOGY Examination of the ecology, zonation and community structure of coral reefs. Includes 2-3 week field study of a Mexican coral reef. BIOL 3413 Invertebrate Zoology, BIOL 3428 Principles of Ecology, or BIOL 4436 Marine Ecology. Permission of instructor required.

BIOL 6409. 4 sem. hr. (3:3) FIELD AND LABORATORY METHODS Experience in field studies, organizing field notes, collecting and methods of preserving organisms for teaching and museum purposes. The course includes field ecological sampling methods, environmental data collection, safety, logistics, and proper scientific equipment operation. Requires permission of the instructor.

BIOL 6420. 4 sem. hrs. (2:4) APPLICATION OF MOLECULAR TECHNIQUES Application of DNA-RNA technology to selected scientific problems. Emphasis on current research techniques. Prerequisites: BIOL 3403 Molecular Biology and CHEM 3411 Organic Chemistry I.

BIOL 6335. 3 sem. hrs. (3:0) AQUATIC MICROBIOLOGY Types and distribution of microorganisms in aquatic environments. Interactions with other organisms. Role in nutrient cycling, degradation of organic substances, pollution, water purification. Prerequisite: BIOL 2421 Microbiology.

BIOL 6415. 4 sem. hrs. (3:3) BIOLOGY OF ESTUARINE ORGANISMS Life history and ecology of estuarine organisms. Special emphasis on the identification of local forms. Prerequisites: BIOL 3413 Invertebrate Zoology and BIOL 3428 Principles of Ecology.

BIOL 6417. 4 sem. hrs. (3:3) MICROBIAL ECOLOGY Relationships between microorganisms and their biotic and abiotic environments. Role of microorganisms in biogeochemical cycling. Methodology in microbial ecology. Biotechnological aspects. Prerequisite: BIOL 2421 Microbiology.

BIOL 6427. 4 sem. hrs. (3:3) COASTAL ECOLOGY OF TEXAS Study of the ecology and environmental issues of the Texas coast. Includes field trips along the entire Texas coastline. Prerequisites: BIOL 3428 Principles of Ecology, BIOL 3443 Environmental Biology, or BIOL 4436 Marine Ecology.

BIOL 6428. 4 sem. hrs. (3:3) FISHERIES BIOLOGY Advanced study of theory and techniques in fisheries science including behavior of fisheries populations and applications to resource management with emphasis on tidal-influenced waters. Includes readings in the current literature and a research project. The lab will emphasize practical sampling design and data interpretation.

BIOL 6430. 4 sem. hrs. (3:3) MARINE PLANKTON Investigation of the systematics, distribution and ecology of marine plankton.

BIOL 6431. 4 sem. hrs. (3:3) PHYCOLOGY Study of the major groups of freshwater and marine algae; morphology, ecology, systematics, life cycles and physiology. Laboratories emphasize collection, identification and culturing techniques. Prerequisite: BIOL 4429 Marine Botany.

BIOL 6436. 4 sem. hrs. (3:3) MARINE ECOLOGICAL PROCESSES Advanced studies in structure and habitats of marine environments. Emphasis on factors influencing distribution of marine organisms, including field trips to areas along the Texas coast. Prerequisite: BIOL 3428 Principles of Ecology.
BIOL 6632. 6 sem. hrs. (2:8) CORAL REEF ECOLOGY Examination of the ecology, zonation and community structure of coral reefs. Includes 2-3 week field study of a Mexican coral reef. BIOL 3413 Invertebrate Zoology, BIOL 3428 Principles of Ecology, or BIOL 4436 Marine Ecology. Permission of instructor required.

CMSS 6303. 3 sem. hrs. (3:0) SYSTEMS ANALYSIS Statistical analysis for data collected in several variables. Topics include sampling from multivariate normal distribution, multivariate analysis of variance, discriminant analysis, principle components, and factor analysis. Prerequisite: Math 5315 Statistical Methods in Research I, undergraduate equivalent, or consent of instructor.

CMSS 6305. 3 sem. hrs (3:0) NATURAL SYSTEMS MODELING Parameterization of natural systems through the identification and characterization of input/output pathways, regulators, and sinks. Construction, testing, and use of various types of models: conceptual, ecosystem, and numeric. Prerequisites: MATH 5315 Statistical Methods in Research I and MATH 5316 Statistical Methods in Research II, or permission of instructor.

CMSS 6323. 3 sem. hrs. (3:0) EXPERIMENTAL DESIGN Fundamental concepts in the design and analysis of biological experiments. Various analysis of variance models will be introduced beginning with completely randomized designs and factorial treatment structures, and proceeding through block and split-plot designs. Related topics include analysis techniques, power, sample size and checking assumptions. Prerequisite: Math 5315 Statistical Methods in Research I, undergraduate equivalent, or consent of instructor.

CMSS 6333. 3 sem. hrs. (3:0) PALEOECOLOGY Study of the interrelationships of ancient organisms and their environment through interpretation of the fossil record and analog communities. Theories and methods in reconstructing terrestrial and aquatic biotic communities. Review of classic paleoecological studies and current research. Prerequisites: BIOL 3428 Principles of Ecology and GEOL 1404 Historical Geology, or BIOL 3428 and GEOL 3441 Invertebrate Paleontology, or GEOL 1404 and BIOL 3412 Invertebrate Zoology.

CMSS 6334. 3 sem. hrs. (3:0) MARINE GEOCHEMISTRY Review of the steady-state ocean concept, classification of different constituents according to their involvement in the biological particle cycle, geochemical processes at and near the seafloor, chemical exchanges between sea water and sediment, both at the interface itself and within the sediment. Prerequisites: GEOL 1403 Physical Geology, ESCI 3351 Oceanography, CHEM 1311/1312 General Chemistry I and II, and CHEM 3411 Organic Chemistry I (or equivalent).

CMSS 6335. 3 sem. hrs. (3:0) PALEOCEANOGRAPHY Reconstruction of the chemistry, biology, circulation, and temperature of the ocean and of climate systems throughout geologic time. Emphasis on interpretation of the marine sedimentary record and geochemical cycling. Prerequisites: GEOL 1403 Physical Geology and GEOL 1404 Historical Geology, ESCI 3351 Oceanography, GEOL 3441 Invertebrate Paleontology or BIOL 3413 Invertebrate Zoology, CHEM 1311 General Chemistry I.

CMSS 6343. 3 sem. hrs. (3:0) TRANSPORT OF POLLUTANTS IN THE ENVIRONMENT Fate and transport processes in the environment. Pollutant distribution among phases; solubility, volatilization, and absorption. Equilibrium partitioning among different phases; fugacity modeling. Modeling of physical transport mechanisms; advection, molecular diffusion, dispersion. Application of transport processes to surface waters, the subsurface and the atmosphere. Air-water exchange, non-aqueous phase liquids. Prerequisites: CHEM 1311 General Chemistry I and 1312 General Chemistry II.

CMSS 6350. 3 sem. hrs. (3:0) BIOENERGETICS The use of quantitative analysis of energy resource partitioning to study the evolution of adaptational strategy at the biochemical, cellular, individual, population and ecosystem levels, including quantitative analysis of physiological processes and life history adaptations in terms of energetic efficiency. Prerequisites: BIOL 2401 Anatomy and Physiology I or BIOL 3430 Physiology.

CMSS 6352. 3 sem. hrs. (3:0) ENVIRONMENTAL FORECASTING Statistical techniques (classic and Bayesian) and new artificial intelligence based techniques, such as neural networks, for the analysis of environmental systems with large datasets. Prerequisite: CMSS 6305.

CMSS 6355. 3 sem. hrs. (2:2) AQUATIC ECOTOXICOLOGY Principles and applications of toxicity testing in the aquatic environment for: water and sediment quality assessment and monitoring; characterization of liquid effluents and treatment procedures; development of water quality criteria; assessment of water quality in aquaculture facilities; assessment of environmental hazard of new chemicals. Prerequisites: BIOL 3413 Invertebrate Zoology and BIOL 3414 Vertebrate Zoology.
CMSS 6370. 3 sem. hrs. (3:0) COASTAL MANAGEMENT AND OCEAN LAW Intensive study of the 1972 National Coastal Zone Management Act and subsequent coastal management programs. The Texas program, which is administered by the General Land Office, will be dealt with in depth as the central focus of the course. Statutory law relating to citizen, state, and federal rights and duties as they impact coastal and maritime law will be studied including applicable Texas real property law. Students will use case law studies relating to those rights and duties and Public Trust Doctrine cases to gain an integral part of understanding the responsibilities of governments and rights of citizens.

CMSS 6407. 4 sem. hrs (3:3) DATA ACQUISITION AND INTEGRATION Principal component, mixing, and quantitative analysis of very large data sets. Database design, filtering and mining. Determination of appropriate sampling densities for multitemporal and multiscale acquisition campaigns. Standard mathematical techniques for resampling, rectification, and transformation. Preparation of normalized data sets for visualization and GIS applications. Prerequisite: CMSS 6305 or permission of instructor.

CMSS 6425. 4 sem. hrs. (3:3) GIS APPLICATIONS IN ECOLOGY Development of hierarchical spatial and temporal analyses relating to ecological phenomena using geographic information system approaches. Emphasis on identifying and evaluating available databases, incorporating databases at appropriate scales, constructing pertinent geospatial themes, and analyzing spatial and temporal changes with habitats and biological populations. Prerequisite: GISC 1470 Geographic Information Systems I and GISC 3421 Visualization for GIS.

CMSS 6445. 4 sem. hrs. (3:2) MARINE ENVIRONMENTAL PHYSIOLOGY Environmental approach to the study of physiological adaptation and evolution of physiological processes in marine organisms. Laboratory will emphasize practical measurement methodologies and principles of physiological measurement and instrumentation. Prerequisite: BIOL 2401 Anatomy and Physiology I or BIOL 3430 Physiology.

CMSS 6455. 4 sem. hrs. (3:2) ENVIRONMENTAL RADIOLOGICAL MEASUREMENTS Study of the basics in gamma, beta, alpha spectrometry with associated laboratory experiments. Applications including radiochronological dating, tracer studies, NORM contamination and mitigation, geological surveys, environmental measurements and mitigation of accidental releases from commercial and military radioactivity sources. Prerequisite: CMSS 6305 or consent of the instructor.

ESCI 5201. 2 sem. hrs. (2:0) ADVANCED SCIENTIFIC DIVING TECHNIQUES. Advanced study of the theory, science, and art of underwater diving technology and its application to scientific objectives. Course helps fulfill some training requirements of the Texas A&M University-Corpus Christi Guidelines for scientific diving. Prerequisite: PADI certification or permission of instructor.

ESCI 5302. 3 sem. hrs. (3:0) ADVANCED ENVIRONMENTAL REGULATIONS. Advanced study of case histories involving the application of state and federal environmental laws and regulations. Review of permits, waste registrations, manifests, self-reporting and inspection reports. Prerequisite: science background or permission of instructor.

ESCI 5314. 3 sem. hrs. (3:0) BIOGEOCHEMICAL PROCESSES. Water and element cycling in the atmosphere, hydrosphere and geosphere. Microbial interactions and physical processes will be emphasized. Prerequisite: Science major or permission of instructor.

ESCI 5412. 4 sem. hrs. (3:2) ENVIRONMENTAL MEASUREMENT AND DATA SYNTHESIS. Theory and concept of spatial and temporal analysis with description, reduction, and comparison of data sets. Intensive studies of the purpose, scope, and procedures used in quantitative environmental research with global environmental systems. Principal themes include spatial autocorrelation, spatial interpolation and trend surfaces. Statistical and GIS software packages are used with remote sensing and other applications for extracting descriptive and metric information from environmental datasets.

ESCI 5442. 4 sem. hrs. (3:2) ACOUSTIC ECOLOGY. Intended for students working in diverse research areas in which sound conveys information that has significant effects on the systems being studied. Topics include field data collection methods, recording devices and media, spectrographic analysis of acoustic signals using digital techniques, and an introduction to statistical evaluation of acoustic data. Prerequisite or corequisite: Math 5315 or permission of instructor.

ESCI 5480. 4 sem. hrs. (3:2) ENVIRONMENTAL ASSESSMENT. Interdisciplinary application of environmental regulations, risk assessment to specific examples. Knowledge of United States environmental regulations assumed; ESCI 4301 or ESCI 5302 recommended. Prerequisites: ESCI 5314 (Biogeochemical Processes) and ESCI 5412 (Environmental Measurement and Data Synthesis) or approval of student's graduate advisor.
ESCI 5xxx** 3 sem. hrs. (3:0) MARINE CHEMOSYNTHETIC ECOLOGY This course will review the geological/geochemical processes associated with venting of chemically enriched fluid from hydrothermal and cold seep sources. It will establish the biochemical basis for chemosynthetic production by bacteria/archaea and the symbiotic strategies that enable metazoan hosts to develop the high biomass in so-called chemosynthetic communities. Finally it will survey the global distribution of chemosynthetic communities and discuss the insight this give to evolutionary and tectonic processes.

GISC 5xxx** 3 sem. hrs. (3:0) MANAGEMENT OF SCIENTIFIC DATABASES Design and implementation of large scientific databases. Incorporating scientific data standards with automated quality control. Design of tools for public access to large databases. Issues involving Internet access to large data sets. Temporal and spatial information associated with large databases. Research into legal issues in the use of scientific data by the public. Copyright and open access to government data sets.

MARI 5315. 3 sem. hrs. (2:2) DISEASES AND PARASITES OF AQUATIC ORGANISMS Identification, epizootiology and control of viral, bacterial, fungal, parasitic and nutritional diseases of commercially cultured mollusks, crustaceans and fish.

MARI 6314. 3 sem. hrs. (3:0) AQUATIC ANIMAL NUTRITION The study of current concepts in aquatic animal nutrition including nutrient sources and requirements, deficiency effects, ingestive/digestive/metabolic processes, formulation and processing of feeds, and practical feeding considerations for selected aquatic species.

MARI 6432. 4 sem. hrs. (3:2) AQUATIC SYSTEM DESIGN The study of aquatic system engineering and design for aquaculture farms, hatcheries, recirculating systems and research facilities. Additional topics covered include aquaculture site selection criteria and use of computer-aided design software.

MATH 6370. 3 sem hrs. (3:0) MODELING OF NATURAL SYSTEMS This course is designed to expose science and technology majors to models of real problems arising in the environment and ecology. Students will learn how to create solvable models of the real world situations and how to find answers on the posted questions by using tools of mathematics and computing. There will be modeling and simulations of tides in the Gulf of Mexico, multi-species models of the food chains, circulation of carbon, water, and oxygen. Students will learn new tools based on calculus and elementary statistics such as numerical algorithms, Monte-Carlo methods, Markov Processes, multivariate analysis, evaluation of stability, methods of extrapolation (predictions) and interpolations. Prerequisite: MATH 2413 and MATH 2342 or the equivalent.

MATH 5344. 3 sem hrs. (3:0) ENVIRONMENTAL STATISTICS Topics to include standard statistics used in environmental settings, geostatistics, Markov random fields. Statistical analysis of spatial point patterns, hierarchical models that cover empirical Bayesian and fully Bayesian methods, and the incorporation of a temporal component in spatial models. Prerequisites: Math 5342.

The list of courses is intended to be spread rather evenly though the different departments in which some aspect of marine biology is taught, with minimal creation of new courses. This increases the efficiency and minimizes duplication of effort among the three participating campuses.

2. If the program design includes multiple curricula (concentrations, emphases, options, specializations, tracks, etc.), identify courses unique to each alternative.

Multiple curricula are not planned.

3. Provide a semester-by-semester projection for offering of the required and prescribed courses during the first 5 years.

Table 1 Frequency of course offerings for the first five years of the program. * = course added within the past 3 years. Those courses left blank are offered on the basis of demand.

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Note: The frequency of course offerings may vary, depending on demand, from semester to semester. Those left blank are offered on no set schedule, but remain available to all Marine Biology IDP students on the campuses where they are taught.

4. Describe arrangements that would serve nontraditional students, e.g., non-traditionally scheduled classes, delivery of instruction by telecommunications and/or off-campus instruction sites, library services, student advisement, etc., if applicable.

Faculty involved in the proposed graduate program have offered courses via distance for over 5 years. The primary method has been interactive video (via the TTVN) system, but Internet-based technologies such as Centra and Camtasia are gathering momentum. Many faculty still use TTVN + web support for their distance courses. Like TAMU, TAMUG uses WebCT as its web-course management system. Thus, distance courses offer students a "common look and fee." TAMUG has 5 well-equipped distance learning facilities. One is located in the Williams Library, one in Kirkham Hall, two in the Classroom-Laboratory Building and a fifth in the recently renovated Sea Aggie Center. TTVN connections are located in the Evans Library, the Eller (Oceanography and Meteorology (O&M) Bldg.), Nagel Hall (WFSC) and the central TTVN facility (KBTX) for the System as well as Corpus Christi Hall Room CCH252 on the TAMUCC campus.

Galveston, College Station and Corpus library facilities are able to serve both distance and residence students. The chair of the student's committee will provide day-to-day guidance for distance education via e-mail and telephone. The Staff Graduate Coordinator on each campus will provide assistance on matters of deadlines, submission of degree plans, proposals, etc.

The program will adhere to the requirements of Chapter 4, Subchapter E of the Coordinating Board Rules for Distance Education. Specifically, distance students will be admitted under the same requirements as resident students. Faculty teaching resident students will also teach distance sections. Distance education and resident courses will have mostly the same requirements. Teaching will be assessed in the same way for both resident and distance classes. Distance students will be eligible for financial aid under the same rules as resident students.

The MB IDP ultimately seeks to offer the M.S. non-thesis option largely by distance, and also to allow M.S. thesis option and Ph.D. students to take selected courses by distance because many students will be working individuals. Courses will be offered in a variety of formats – resident, distance, resident + distant – to meet the needs of employed adults. Students who pursue their degrees principally by distance, will do so under the close scrutiny, advice and consent of their committees. Conventional laboratory courses will require time on campus, or in the field, on weekends or during summers; alternatively, laboratory work may be accomplished by distance, using simulation modeling to conduct virtual experiments. Courses will be converted for distance delivery as needed by students and as course content permits.
5. If the general education/core curriculum component of the proposed program differs from that required for all or most other undergraduate programs at the institution, indicate how and why.

This does not apply to the proposed graduate program.

E. Supporting Fields.

1. Identify existing programs and support areas in your institution which would complement this program; describe the relationship of each to the proposed program.

The MB IDP will draw upon the expertise of faculty in the Departments of Marine Biology (MARB), Marine Sciences (MARS) [TAMUG], Biology (BIOL), Oceanography (OCNG), Wildlife and Fisheries Sciences (WFSC) [TAMU], Physical and Environmental Sciences (PENS), Life Sciences (LSCI) [TAMUCC]. All IDP faculty for the most part already have graduate appointments in one or more departments in College Station or Corpus Christi, and have both taught graduate courses and mentored both M.S. and Ph.D. students under the aegis of their respective TAMU departments. Many of the proposed MB IDP faculty members also serve as external members of committees from other institutions, both within and outside the United States. Some courses in the departments of Rangeland Ecology and Management and the College of Veterinary Medicine at TAMU are also included in the list.

The Research and Graduate Studies Office (RGSO) was established at TAMUG to provide support for graduate students, both visiting and in residence, and to assist with the initiation of new programs such as that described herein. Additional support and guidance will be provided by the TAMU OGS.

In Galveston, research projects and undergraduate teaching are already supplemented by UTMB and NOAA/NMFS professionals in Galveston and by cooperating departments in College Station. The Flower Gardens National Sanctuary office has moved from College Station to the Galveston NOAA facility this year. It is expected that these organizations will also contribute to graduate student supervision through advisory committee membership and financial support when the new program is initiated. The TIO supplements graduate student research support directly and through additional facilities provided through the IMLS and the LOER. Because of the campuses' unique coastal locations on the upper and lower Texas coasts, the strengths of the faculty and the growing undergraduate enrollment in MARB at Galveston (ca. 500) which provides employment as Graduate Teaching Assistants and could provide a potential pool of new graduate students, the MB IDP is able to provide opportunities to graduate students that are unmatched anywhere else on the Gulf coast.

Graduate programs already exist at TAMU in WFSC, OCNG, BIOL, and at TAMUCC in BIOL, Coastal and Marine Systems Science (CMSS), Environmental Science (ESCI) and Mariculture (MARI) and an MB IDP will be complemented by these on-going, well-established efforts.

A variety of research programs are well established on the College Station campus that will complement this proposed interdisciplinary program, depending on student interests. Among the largest are the IODP, the GERG, and the Offshore Technology Research Center (OTRC). The Texas office of the National Sea Grant College Program, located in College Station, supports marine research, education and outreach along the state's coastal zone that usually involves graduate students.

Marine science studies began at the TAMUCC campus in 1957 at the undergraduate level when it was a private university (University of Corpus Christi). When the campus became a state university in 1973, the biology degree program had a marine biology/science emphasis area, and in 1975 the MS degree program was started, also with a marine research focus (90% of degrees awarded between 1975-2005 were marine oriented). In addition, other graduate degrees were added in 1988 (MS Mariculture), 1992 (MS Environmental Science with optional marine emphasis), and 2005 (Ph.D. in Coastal and Marine System Science).

The Corpus Christi campus already has a MS program in mariculture and a recently-approved PhD program in CMSS, both of which complement the proposed MB IDP. The Corpus Christi campus houses the Conrad Blucher Institute, the Center for Coastal Studies and the Harte Research Institute for Gulf of Mexico Studies, all of which are devoted to furthering knowledge of the Texas coastal zone and the wider Gulf of Mexico in general. These institutions provide a diverse spectrum of opportunities for graduate research, financial support and education.
2. If the existing programs or supporting fields would require updating or expansion because of the new program, explain how and why.

Existing programs and supporting fields require no expansion, other than adding several courses, as explained above.

It is the nature of science to be in a constant state of flux as new information is acquired and assimilated. Therefore, new courses will be offered, and major revision of existing courses will occur as the Program matures. The courses proposed for the degree program include for the most part those currently on the rosters of the respective participating departments.

F. Effect on Existing Programs.

1. Describe how existing courses would be affected by enrollment generated in the proposed program, including but not limited to, the potential need for additional sections or increased class sizes, faculty, library resources, equipment, supplies, and/or space.

Existing courses in the participating departments will see an increase in class size on the College Station campus, with the enrollment of new MARB graduate students in residence in Galveston or College Station. Teaching loads vary widely among the different departments involved in this program. In Galveston, for instance, some faculty currently teach two or three undergraduate courses per semester, while in some departments faculty are expected to teach a course a semester but often teach only one formal course per annum because of large graduate student supervision and support. Because of the diversity of the participating graduate faculty, the EC, working with the curriculum committees of the various departments, will be able to schedule course offerings to meet the needs of the students and minimize the impact on programs with teaching loads that are already above average. New faculty members may be required to meet the demands on each of the participating entities. The budget anticipates a total of three new faculty members, but the location will depend upon the enrollments at the respective campuses. For example Galveston’s flourishing undergraduate programs are expected to continue to demand the present level of faculty support so that areas such as zooplankton ecology, fisheries stock assessment and modeling that are parts of the planned MB IDP will require some new faculty or reprogramming.

The Evans Library has numerous holdings in the field of marine biology and large acquisition of material is not expected. The library in Galveston, not only has extensive marine-related holdings, but is electronically connected to Evans, providing the marine-oriented branch campus with unusually rich library resources. The Bell Library on the TAMUCC contains numerous marine biology holdings on campus and provides access to various databases that the MB IDP students could use. Students enrolled in the MB IDP would have access to the library resources on each campus. Equipment and supplies will be needed for new faculty members.

There is adequate space at all campuses to support the new program. New facilities in Corpus at the Harte Research Institute for Gulf of Mexico Studies, in Galveston in the Sea Aggie Center, and in College Station in the new life sciences building (currently under construction) are sufficient to meet the demands of the new programs.

The proposed program is not expected to impact existing courses in a negative way. The program will, in fact, allow a greater variety of classes to be offered in Corpus Christi, College Station and Galveston, enriching the existing programs with new electives.

2. For a graduate program, describe how related undergraduate programs would be affected by enrollment in the proposed program, including changes anticipated in the rank and/or credentials of faculty teaching in the undergraduate program, and use of GATs, Graduate Assistants, Assistant Instructors, etc., and their credentials. Provide evidence that faculty (full-time, part-time or TA’s) in the proposed program, or who would replace current faculty reassigned to the proposed program, would meet SACS minimum standards for credentials and experience.

The current faculties in the colleges involved teach, and have taught for many years, a mix of both graduate and undergraduate courses, and this is not expected to change. Combining faculty expertise in Corpus Christi, Galveston and College Station will result in greater depth and a greater array of courses for both
undergraduates and graduates. It will not affect the teaching load per faculty member to any appreciable degree and thus will not affect the undergraduate programs negatively in any of the participating departments.

All full-time faculty members hold the Ph.D. degree and meet the standards of the SACS. All faculty teaching graduate courses will be members of the PGF. Part-time Instructors hold the M.S. degree at a minimum and are in compliance with the SACS 18-hours-in-the-subject rule. The only classes taught by GATs are laboratory sections; these teaching activities have always been under the direct supervision of a faculty member and this will not change.

G. Accreditation.

1. If there is a professional program procedure in this field, attach current standards.

   There is no professional program accreditation for the proposed degree.

2. State intention regarding accreditation.

   The program will be accredited through the Southern Association of Colleges and Schools. All entities in the MB IDP are currently accredited through this mechanism.
III. EVALUATION AND ASSESSMENT

A. Describe planned procedures for evaluation of this program and its effectiveness in the first five years of the program, including admission and retention rates, program outcomes, assessments, placement of graduates, changes of job market need/demand, ex-student/graduate survey, or other procedures. How would evaluations be carried out?

TAMU initiated a Doctoral Program Review protocol several years ago. These reviews are conducted by a select group of well-known academicians and administrators from prestigious institutions as well as industry leaders. The reviews are undertaken on campus over a three or four day period. Prior to the reviews, extensive documentation collected through a department self-study is provided to the review team. This includes faculty CVs, teaching loads, budgets, extramural funding, faculty publications, graduate student qualifications, student time-in-residence, student retention, and student employment after graduation, among others. The self study as well as the review will also focus on specific student learning outcomes developed by the faculty emphasizing TAMU’s commitment to research, technology, diversity, and internationalization as defined by the University’s original Quality Enhancement Plan (QEP). In addition, the faculty will assess their contribution and relationship within the context of the University’s Strategic Plan, Vision 2020. The reviewers supply to the dean or vice president an in-depth evaluation of the program in question, including suggestions for program improvement. A review of the graduate program including both the masters and doctoral levels, following the TAMU OGS protocol, will be undertaken at the end of the first five-year period of operation, under the supervision of the COPD and will be repeated every three years.

The graduate program will also be evaluated on an on-going basis by the MB IDP faculty at least annually and will be documented in the institutional effectiveness process. The institutional effectiveness process currently in place requires each degree program to identify at least 3-4 student learning outcomes, develop appropriate measures, report results annually, and determine any program modifications needed. In addition, the COPD will monitor admission, retention, and academic progress. Students will be interviewed upon completion of degree requirements to determine their future plans and how they perceive the program’s effectiveness. Further, many of the MB IDP faculty members have maintained contact with their former graduate students to inform them of potential jobs, monitor their employment, and learn if any changes in the degree program need to be effect. This informal system will be formalized with a program in which former students are contacted at two and five years post-graduation to determine what benefits they received from the degree, what suggestions they can make for further improvements in the program and to update their employment history since graduating.

The focus of the evaluation process is on assessing the marine biology programs by determining and documenting objective student learning outcomes for each program level within the themes of research, technology, diversity, and internationalization. The assessment shall indicate the extent to which the program has achieved its objectives and outcomes. These findings will provide an appreciation of the specific program planning, the decisions made to improve the program, what revisions, if any, to the MB IDP objectives have occurred to date, and the resources allocated and budget requests conducted to enhance the Program. The process will provide specific plans, goals and metrics. Once the program is approved, a working committee will be formulated to refine and update specific learning outcomes and measures.

This committee will be charged to clearly define the knowledge, skills, or attitudes that a student should have by graduation and answer the following questions:

1) How effective is our program in linking our research to our students’ learning?
2) How effective are our efforts to diversify our student learning community?
3) How effective are our efforts to ensure that our students have the technological expertise they need?
4) How effective are we in helping our students understand the reality of globalization?

Indirect measures will include:

- Student interviews upon completion of degree requirements
- Graduate surveys at minimum 2 and 5 years post graduation
- Development of a departmental database to track graduates
- Employer surveys
- Focus groups
Direct measures will include:

- Faculty assessment of student qualifying exams
- Internship evaluations
- Development and assessment of thesis/dissertation
- Demonstration of appropriate use of technology related to marine biology curriculum

In addition, the assessment process will address progress toward achievement of TAMU Vision 2020 goals as well as the goals for TAMUCC Momentum 2015, of strengthening graduate programs, enhancing the undergraduate academic experience, diversifying and globalizing, and increasing access to knowledge resources (research and technology).
IV. PROGRAM NEED/DEMAND

A. Identify similar programs.

A search of the web site www.gradschools.com produced a listing of graduate programs at both public and private institutions offering graduate degrees in MB. Many institutions were listed that offer degrees in biology, biological oceanography, biological sciences, ecology, environmental sciences or marine sciences in which a student can specialize in, but not receive a degree in, MB.

1. At Texas public and independent universities.

There are currently no graduate degrees in MB offered by Texas institutions of higher learning.

The Institute of Marine Science of the University of Texas at Austin, located in Port Aransas, Texas, offers graduate degrees in Marine Science through its Department of MARS. The Department of OCNG in College Station offers graduate degrees in OCNG, with specialization in any of the subdisciplines of oceanography, including biological oceanography. They offer several undergraduate courses but no undergraduate degree. TAMUCC started a graduate program in Coastal and Marine Systems Science which has a marine environmental focus in September 2006.

2. At out-of-state universities.

There are no other universities on the Gulf of Mexico offering either a M.S. or a Ph.D. in MB. Interdisciplinary degree programs in marine science and oceanography are offered at Florida State University, University of South Florida, University of Alabama, University of Southern Mississippi and Louisiana State University. These all include biology.

The M.S. and/or Ph.D. degrees in MB are offered at the following institutions on the East Coast:

- The College of Charleston, Charleston, SC: M.S.
- Florida Institute of Technology, Melbourne, FL: M.S. and Ph.D.
- Nova Southeastern University, Dania, FL: M.S.
- University of Maine, Orono, ME: M.S. and Ph.D.
- University of Miami, Miami, FL: M.A., M.S. and Ph.D.
- University of North Carolina – Wilmington: M.S.
- Univ. of Newfoundland, St. Johns, NF, Canada: M.Sc. and Ph.D.

The M.S. and/or Ph.D. degrees in MB are offered at the following institutions on the West Coast:

- University of Calif., San Diego (Scripps): Ph.D.
- Greenwich University, Mill Valley, CA: M.S. and Ph.D.
- University of Alaska – Fairbanks: M.S. and Ph.D.

A number of institutions initiated graduate programs in the interdisciplinary field of oceanography, including biological oceanography, in the early 1950's, with support from the Office of Naval Research (ONR), among them the OCNG Department on the TAMU College Station campus. These include Woods Hole Oceanographic Institution, in association with MIT, Columbia University, University of Rhode Island, Florida State University, University of Miami, Scripps Institution of Oceanography at the University of California at San Diego, Oregon State University and the University of Washington. All include graduate degree programs that encompass interdisciplinary degrees in oceanography, with specialization in biological oceanography.

A large number of universities and colleges located in close proximity to the extensive coastline of the USA have established marine laboratories and initiated programs that include marine biology in response to the student demand that has paralleled the persistent continuing growth in the environmental movement that began in the 1960's. Many of these programs have flourished and become leaders in research and training of marine scientists, including marine biologists. The more prominent of these include University of New Hampshire, University of Maine, MIT, University of Massachusetts at several campuses, University of Connecticut, Rutgers University, University of Delaware, Virginia Institute of Marine Science, University of North Carolina, North Carolina State University, Duke University, University of South Carolina, Skidaway Institute in Savannah serving Georgia universities, Nova University, Florida Atlantic University, University of South
Florida, University of Southern Mississippi, University of Alabama, and Louisiana State University and LUMCON serving Louisiana universities, all on the East or Gulf coasts. The University of Georgia at Athens has had a long-standing reputation as a leader in marine ecology and the Georgia Tech campus in Atlanta has a strong incipient marine science program. A similar growth has occurred among the schools of the California State University System, although UCSD, with the Scripps Institution of Oceanography, remains the flagship oceanic research institution of the state. Both the University of Oregon and Oregon State University offer graduate programs in marine-related subjects, including biology. The University of Washington is among the top three schools in oceanography and related disciplines. The University of Hawaii includes biology in ocean-related graduate programs and the University of Alaska Fairbanks offers both Ph.D and M.S. degrees in Marine Biology. The more prominent state universities in the mid-west, with strong reputations in aquatic ecology, have created interdisciplinary programs that focus on the Great Lakes. The Ivy League schools too have had a long history of training in the general area of marine biology, although specific programs outside their biology departments have not been so designated. Not surprisingly, the most important of these over the last century have been in the Ivy League, including Brown, Princeton, Harvard and Yale.

B. Describe justification for the proposed program in terms of the following, as applicable:

1. Local, regional, national, and international needs (as appropriate).

Regional demographics of the Houston/Galveston and Corpus Christi areas, along with the worldwide growth of the environmental movement and the popularization of marine biology, have both contributed to the increasing demand for the proposed program. Galveston Bay and the nearby coastal zone are leaders in commercial landings of shrimp and oysters. Recreational fishing among the four million or so residents is of very significant economic importance. The Houston area is the leading petrochemical industrial complex in the United States. Coexistence of a large population and industry with a healthy environment presents numerous challenges.

The coastal environment is under increasing stress due to reductions in freshwater inflow and to habitat loss resulting from continued expansion of urban areas into wetlands. Bodies of water along the Texas coast, and coastal areas throughout the United States, are recipients of residential and industrial wastes and pollutants. At the same time commercial fishermen depend on these habitats for livelihood, and others turn to them for recreation. Trained marine biologists are needed to provide information to regulatory agencies trying to judge the tradeoffs between development and healthy ecosystems.

The proposed program will contribute knowledge of marine habitats and the organisms living therein by producing needed researchers, educators and resource managers who will work regionally on the continuing problems of sustainable development of the Texas coastal zone.

Teachers trained in the marine biological field are needed in public and private schools to provide correct information to their students. This information is absolutely essential to make informed choices, both personal and political. Environmental managers need to be similarly trained so they can make informed decisions about water and/or land use. Public schools at K-12 are introducing more and more "marine biology" and "marine science" courses into new, evolving science curricula. Summer SEA CAMP for pre-teens at the TAMUG campus provides potential teachers in the MB program with first-hand experiences presenting life in the sea to the state's youth. Incorporating distance education into the M.S. non-thesis program should enable more K-12 science teachers to enroll in the program. The aquatic education program in the Center for Coastal Studies at TAMU-CC has an extensive informal education program (Wetlands Explorer boat trips, Wonders of Wetlands school program, Wetlands and Wheels trailer) to reach K-12 in the Texas Coastal Bend.

The Galveston and Corpus campuses are ideally suited to perform the field and laboratory hands-on experience involved in this program. Galveston, on the upper Texas coast, is situated near the entrance to Galveston Bay, giving students easy access to a wide variety of coastal ecosystems and organisms that are of commercial, recreational and/or ecological importance. Corpus Christi, on an island within Corpus Christi Bay and surrounded by urban development, at the northern margin of the Laguna Madre Bay and barrier island system, covers a more remote coastal region challenged by limited freshwater supplies to the coastal zone. Many of these habitats are threatened or have been altered, which provides students with ideal research projects.

The College Station campus, much larger than the two cooperating coastal locations, houses a program entitled Sustainable Coastal Margins, an interdisciplinary approach to the multiple problems that coastal
environments face as populations continue to move to the coastal zone. Living resources are a required point of focus in the project, providing links between the proposed program and related efforts in hydrology, urban development, recreation, and industry.

2. The long-range academic plan of the institution.

The strategic plan of Texas A&M University was developed in the well known Vision 2020 process.

In 1999, the Texas Legislature added a significant graduate mission to the role for TAMUG in cooperation with TAMU (HB 188) and planning authority was granted by the Coordinating Board in January, 2001. The Marine Biology Department is the largest on the Galveston campus, and the MB IDP is a cornerstone of its strategic planning for the coming decades.

In addition, TAMUCC’s Momentum 2015 plan calls for alignment with the State of Texas Closing the Gaps Initiative which calls for increased access to higher education by supporting and expanding existing programs with the needed faculty and staff, facilities and capital resources. The MB IDP proposal will allow for increased opportunities for students, faculty and staff through shared expertise and research collaboration.

3. Demand from prospective students.

Over the past 5 years the MARB Department has received an estimated 300+ inquiries from potential graduate students interested in pursuing advanced degrees in marine biology. Since the department began keeping records in late June 2002, it has received an average 5 per month (170 total at last count, which does not include inquiries directly to faculty members), requesting information about graduate programs in MARB. These requests come principally from institutions of higher learning outside of Texas. Many come from outside the US. On the other hand, a number of the upper division students in the TAMUG MARB undergraduate program and students at TAMUCC have expressed interest in remaining in Texas within the TAMUS to pursue graduate degrees in MARB.

4. Job market needs (identify specific potential employers and supply names, addresses and phone numbers where possible).

State, federal, local and private entities at which former students are, or have been, employed are listed in Appendix C. Recent e-mail job postings are listed in Appendix D. Appendix E contains a large number of employers’ letters of support for the degree program, and these people may be contacted for additional information regarding employment in this area.

Texas is a coastal state with large economic and cultural dependence on fisheries and environmental quality. Students graduating from closely-related graduate programs have obtained a broad variety of positions, including the following: teaching and research positions in institutions of higher education within Texas and in other parts of the United States; professional positions (medicine, dentistry, law); employment in private, non-profit, state or federal entities; and teaching positions in public or private schools.

5. Educational and cultural needs of the community.

The geographic area surrounding TAMUG and TAMUCC includes the metropolitan areas of Houston and Corpus Christi. These areas contain hundreds of public and private elementary and secondary schools, many of which have a marine biology or marine science course or curriculum. It is expected that many teachers at these institutions will strive to further their education by completing a M.S. degree in marine biology using either the thesis option or non-thesis option. The program may attract teachers from greater distances as well, particularly if courses are offered via the Internet. In the late 1980’s, TAMUG offered primary and secondary school teachers weekend career ladder workshops in several disciplines. These workshops attracted teachers from as far away as Ft. Worth and San Antonio. Some courses could be taught via distance learning with perhaps two to three weekends devoted exclusively to field and lab activities. This would enable teachers to complete a course without having to travel to the campuses weekly.

The Galveston campus is located adjacent to the largest petrochemical complex in the United States and at the same time adjacent to one of the largest coastal bay ecosystems. The need for trained marine biologists in the local community – capable of ensuring the healthy coexistence of these entities – is of great local importance. A similar need exists in the Corpus Christi area. In the broadest sense of community, namely statewide, a
cooperative PhD program encompassing faculty and researchers familiar with the problems of both the upper and lower Texas coasts, is a resource of significant potential value to coastal planners and managers in such organizations as the Texas General Land Office.

C. Campus (College, Research Institute and Department) needs.

Graduate students are needed as GATs in undergraduate biology courses. Graduate students are also needed as GARs in extramurally-funded research programs. A variety of research institutes and programs both in Galveston, College Station and Corpus will benefit from the association with the MB IDP. These include the Texas Institute of Oceanography, the Harte Research Institute for Gulf of Mexico Studies, the Conrad Blucher Institute, Center of Coastal Studies, the Laboratory for Oceanographic and Environmental Research, the Geochemical and Environmental Research Group, and the Institute of Marine Life Sciences. These organizations (and others) currently employ graduate students and will continue to have needs that will be met by the MB IDP.
V. PROGRAM POTENTIAL

A. Estimate the cumulative headcount and full time equivalent (FTE) enrollment for each of the first five years (majors only, considering expected attrition and graduation) and indicate the number expected to be new to the institution each year.

Table 2. Estimated number of M.S. and Ph.D. students enrolled in the MB IDP for the first five years.

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</table>

NOTE: These totals include only students enrolled in the MB TAMUS Interdisciplinary Graduate Degree Program. Students enrolled in one of the departments within the program but who are not a part of the MB IDP are not included. It is assumed that the initial growth will be at the Galveston campus, but ultimately will be equally divided among the three campuses.

B. Explain assumptions used in making these estimates.

Based on interviews with current graduate students, it is assumed that ten students in residence in other biological sciences graduate majors will transfer into the new IDP graduate program in the first year. For the first few years of the program, the graduate student body in Galveston will consist of a combination of graduate students completing their degrees in College Station departments (Oceanography and Wildlife and Fisheries Sciences) and graduate students will also be recruited into the new program. There is the anticipation that departments in College Station and Corpus Christi will also attract new students, but with fewer transfers. As new students are recruited by existing faculty in Galveston, College Station and Corpus Christi, and as new faculty members enter the program and begin to recruit students, the number of students is expected to increase on all three campuses. The number of part-time students is expected to increase as the program becomes better known in the urban areas of Harris County, in and around Corpus Christi and around the state of Texas.
VI. RESOURCES

A. Personnel.

1. Describe any personnel additions or changes in the past three years made in anticipation of the program.

No new faculty members have been hired solely to provide courses for the proposed degree. The TAMUG MARB faculty, along with that in MARS, BIOL, WFSC, OCNG and LSCI (TAMUCC) have the expertise to offer the wide variety of courses required in a discipline as broad as marine biology. The newest recent hires in Galveston, a marine ecologist, a mariculturist/geneticist, a vertebrate biologist, a marine botanist, and a new Department Head, and those planned for the next two years, are/were to fill needs in the undergraduate program. Each of these individuals is/will be expected to establish a research program and mentor graduate students as well, and thus will expand the offerings of the graduate program. The reinvestment program in the participating departments in College Station are recruiting faculty that can be MB IDP participants, in particular in the area of remote sensing in OCNG. The Corpus Christi faculty is experiencing significant growth associated with the new Harte Research Institute for Gulf of Mexico Studies, many of whom will participate in the MB IDP if it is approved.

2. Indicate for the first five years the cumulative number of FTE personnel who would be involved in delivery of the program in each of the following categories:

Table 3. Number of FTE personnel involved in delivery of the Marine Biology graduate program.

<table>
<thead>
<tr>
<th>Year</th>
<th>Administrative FTE</th>
<th>Full Time FTE</th>
<th>GAT FTE</th>
<th>Support Staff FTE</th>
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<td>26</td>
<td>16</td>
<td>1</td>
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</table>

Notes: Administrative FTE’s include the MARB SGA and graduate program directors in the RGSO. Support staff FTEs include MARB staff, and RGSO staff. GAT are estimates of students involved only in teaching graduate course laboratories, not undergraduate course instruction.

3. List current faculty members who would be qualified to participate, indicating highest earned degree and institution, field of study, current teaching and research assignments, dates of appointment, and anticipated contribution to the program. Specify course(s) faculty members teach which could be available to participating students.

Alvarado-Bremer, Jaime, Associate Professor of Marine Biology-TAMUG.
Faculty member since 1999
Ph.D.:1994, University of Toronto.
Field of study: Conservation biology of aquatic organisms, especially pelagic fauna; molecular systematics and biogeography.
Courses offered: MARB 613 (Molecular Techniques in Marine Biology); MARB 620 (Marine Biological Resources).

Amon, Rainer, Assistant Professor of Marine Science-TAMUG
Faculty member since 2003
PhD 1995, University of Texas at Austin
Field of study: Biogeochemical fluxes of dissolved organic matter (DOM) in the Arctic Ocean; Land - ocean transport of carbon and nitrogen in light of environmental change in the Arctic; Land - ocean transport of carbon and nitrogen in light of environmental change in the Arctic; The role of bacteria for the carbon

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cycle in the ocean, estuaries, and rivers; Relationships among DOM composition, UV-radiation, trace elements, and microbes
Courses offered: Cell Biology, Physiology, Physiological Ecology, Fish Physiology, Animal Behavior, Sociobiology of Reproduction, Comparative Animal Physiology, Evolutionary Biology, Biochemistry.

Armitage, Anna R., Assistant Professor of Marine Biology-TAMUG
Faculty member since 2006
Ph.D.: 2003 University of California-Los Angeles
Field of Study: Coastal and wetlands community ecology in salt marshes, tidal mudflats, and seagrass beds, with particular focus on changes in trophic structure following habitat restoration, nutrient enrichment, and other human disturbances.
Courses offered: Coastal Plant Ecology

Biggs, Douglas C., Professor of Oceanography-TAMU
Faculty member since: 1977
Ph.D.: 1976, Massachusetts Institute of Technology
Field of study: Physical and biological habitat use by sperm whales and other apex predators in the Gulf of Mexico; Biogeochemical processes in Gulf of Mexico mesoscale eddies; Zooplankton stock estimation from ADCP backscatter intensity; Zooplankton stock estimation from ADCP backscatter intensity
Courses offered: OCNG 620 Biological Oceanography

Brinkmeyer, Robin L., Lecturer in Marine Biology-TAMUG
Ph.D.: 2003, University of Bremen, Germany
Field of study: Molecular microbial ecology; Molecular systematics and phylogeny of prokaryotes; Biogeography of prokaryotic populations; Role of bacteria in biogeochemical processes
Courses offered: MARB 301 Genetics

Campbell, Lisa, Associate Professor of Oceanography-TAMUG
Faculty member since 1996
Ph.D.: 1985, State University of New York at Stony Brook
Field of study: phytoplankton ecology
Courses offered: OCNG 654 Plankton Ecology

Cammarata, Kirk, Associate Professor of Biology-TAMUCC
Faculty member since: 2000
Ph.D.: 1987, University of Kentucky
Field of Study: Plant Physiology, Biochemistry and Molecular Biology
Courses offered: Bioremediation, Botany, Plant Physiology, Environmental Science, Biochemistry, Molecular Biology, Genetics, Cell Biology, Genomics

Cifuentes, Luis A., Executive Associate Dean, Geosciences-TAMU
Faculty member since 1988
Ph.D.: 1987, University of Delaware
Field of study: stable isotope geochemistry
Courses offered: OCNG 649 Estuarine Biogeochemistry

Davis, Randall W. Professor of Marine Biology-TAMUG.
Faculty member since 1990
Ph. D.: 1980, University of California at San Diego
Field of study: Cellular, physiological and behavioral adaptations for swimming and diving in marine mammals and birds. Ecology of marine mammals, especially effects of natural and man-made perturbations on marine ecosystems.
Courses offered: MARB 401 (Marine Mammal Physiological Ecology).

Davis III, Stephen E, Assistant Professor of Wildlife and Fisheries Science-TAMU
Faculty member since 2001
Ph.D.: 1999, Florida International University
Field of study: estuarine ecology and nutrient dynamics
Ditton, Robert Browning, Professor of Wildlife and Fisheries Sciences and of Recreation, Park and Tourism Sciences-TAMU

Faculty member since 1974
Ph.D.: 1969, University of Illinois
Field of study: marine policy and law

Edwards, Patty, Lecturer in Marine Biology-TAMUG

Faculty member since 2004
Field of study: wetlands
Courses offered: MARB 303 Biostatistics

Fox, Joe, Professor of Biology-TAMUCC

Faculty member since: 1998
Ph.D.: 1992, Texas A&M University, College Station
Field of Study: aquatic animal nutrition
Courses offered: Aquatic animal nutrition, diseases and parasites of aquatic organisms, aquaculture economics

Gatlin III, Delbert M., Professor & Interim Head of Wildlife and Fisheries Sciences and of Nutrition-TAMU

Faculty member since 1987
Ph.D.: 1999, Mississippi State University
Field of study: mariculture and food quality

Gold, John Rush, Professor of Wildlife and Fisheries Sciences and of Genetics-TAMU

Faculty member since 1975
Ph.D.: 1973, University of California, Davis
Field of study: fish genomics

Grant, William E., Professor of Wildlife and Fisheries Services-TAMU

Faculty member since 1976
Ph.D.: 1974, Colorado State University
Field of study: ecosystem and food web modeling

Hickman, Graham, Professor of Biology-TAMUCC

Faculty member since: 1990
Ph.D.: 1975, Texas Tech University
Field of Study: Vertebrate Biology, Ecology, Behavior
Courses offered: Vertebrate Biology, Animal Behavior, Ecology

Hilfie, Thomas M., Professor of Marine Biology-TAMUG

Faculty member since 1989
Ph.D. 1977, University of Texas Medical Branch.
Field of study: Biology and ecology of marine caves; scientific diving.
Courses offered: MARB 603 (Marine Ecology); MARB 616 (Introduction to Methods in Scientific Diving); MARB 617 (Research Diving Methods); MARB 656 (Tropical Marine Ecology).

Jones, Adam, Assistant Professor of Biology-TAMU

Faculty member since 2004
Ph.D.: 1998, University of Georgia
Field of study: evolutionary genetics, including molecular ecology, sexual selection, quantitative genetics, and molecular evolution.
Courses offered:

Kanz, James M., Associate Professor of Marine Biology-TAMUG.

Faculty member since 1978
Ph.D.: 1973, Tufts University
Field of study: Invertebrate neuroethology and behavior.
Courses offered: Cell Biology, Physiology, Physiological Ecology, Fish Physiology, Animal Behavior, Sociobiology of Reproduction, Comparative Animal Physiology, Evolutionary Biology, Biochemistry.

Knock, Susan L., Lecturer in Marine Science-TAMUG
Faculty member since 1996
Ph.D.: 1988, University of Texas Medical Branch
Field of study: Coastal Marine and Aquatic Birds
Courses offered: MARB 438 Coastal Ornithology

Landry, Andre' M., Jr., Professor of Marine Biology-TAMUG
Faculty member since 1977
Ph.D.: 1977, Texas A&M University
Field of study: fisheries ecology and sea turtle biology.
Courses offered: MARB 651 (Shore and Estuarine Fishes of the Gulf of Mexico); MARB 656 (Tropical Marine Ecology).

Lehman, Roy, Associate Professor of Biology-TAMU-CC
Faculty member since: 1993
Ph.D.: 1993; Texas A&M University
Field of study: Distribution and Ecology of Benthic Marine Algae; Meteorology; Ecology; Natural and Man-Made Hazard Mitigation; Systematics; Environmental Science; Coastal Development; Ecological Indicators; Endangered Species; Habitat Loss; Harmful Algal Blooms; Invasive Species; Pollution; Public Health; Biochemistry and Molecular Structure and Function; Biological Oceanography
Courses offered: BIOL 5431

Linton Sr., Thomas, Lecturer Marine Science, Resource Management and Policy-TAMUG
Faculty member since 1981
Ph.D.: 1965, University of Michigan
Field of study: resource management
Courses offered:

Marshall, Christopher D., Assistant Professor of Marine Biology-TAMUG
Faculty member since 2001.
Ph.D.: 1997, University of Florida
Field of study: Ecological morphology and functional organismal biology.
Courses offered: MARB 601 (Biology of Marine Vertebrates).

MacDonald, Ian, Professor of Oceanography-TAMU-CC
Faculty member since: 2002
Ph.D.: 1990, Texas A&M University
Field of study: biogeochemistry of methane seeps and hydrothermal vents
Courses offered: BIOL 5431 Global Geochemical Cycles and Change

McKee, David, Professor of Biology-TAMU-CC
Faculty since: 1985
Ph.D.: 1986, Texas A&M University
Field- of study: Mariculture, Marine Ecology, Fisheries
Courses: Marine Ecology, Ichthyology, Marine Mammals, Mariculture

MacKenzie, Duncan S., Associate Professor of Biology-TAMU
Faculty member since 1983
Ph.D.: 1980, University of California at Berkeley
Field of study: comparative endocrinology of reproduction and thyroid function in fish, amphibians, and reptiles.
Courses offered:

McEachran, John D., Professor of Wildlife and Fisheries Sciences-TAMU
Faculty member since 1973
Ph.D.: 1973, College of William and Mary
Field of study: ichthyology
Courses offered: WFSC 311

Montagna, Paul, TAMU-CC, Harte Research Institute- Endowed Chair
Faculty member since: 2006
Ph.D.: 1983, University of South Carolina
Field of study: Marine ecology, Estuarine Ecology, Benthic Ecology
Courses offered: Marine Ecosystem Dynamics, Marine Ecology & Marine Invertebrates

Morse, John W., Professor of Oceanography and Holder of the Louis and Elizabeth Scherck Chair of
Oceanography-TAMU
Faculty member since 1981
Ph.D.: 1973, Yale University
Field of study: marine geochemistry, carbonate chemistry
Courses offered: OCNG 652 Sediment Biogeochemistry

Mott, Joanna
Faculty member since 1994 (adjunct 1985-1994)
Ph.D.: 1976, University of Aston, U.K.
Field of study: Soil Science (Microbiology) Environmental/Public Health Microbiology, microbial water
quality of coastal waters
Courses offered: BIOL 5335 Aquatic Microbiology, BIOL 5417 Microbial Ecology

Neill, William H., Professor of Wildlife and Fisheries Sciences-TAMU
Faculty member since 1975
Ph.D.: 1971, University of Wisconsin
Field of study: Fish biology and ecology
Courses offered: WFSC 604 (Systems Analysis and Simulation in Ecology and Resource Management);
WFSC 616 (Physiological Ecology of the Vertebrates); WFSC 689 (Special Topics in Biology of
Fishes).

Nipper, Marion, Senior Research Scientist-TAMU-CC
Faculty member since 1997
Ph.D.: 1985 University of São Paulo, SP, Brazil Biology
Field of study: Marine ecotoxicology, water and sediment quality assessments,
Biological effects of marine pollution
Courses offered: CMSS 6355 Aquatic Ecotoxicology

Overath, R. Deborah, Assistant Professor of Biology-TAMUCC
Faculty member since: 2005
Ph.D.: 1998, University of Georgia
Field of Study: Population genetics, ecological genetics, population biology
Courses offered: Evolutionary Genetics

Packard, Jane M., Associate Professor of Wildlife and Fisheries Sciences-TAMU
Faculty member since 1985
Ph.D.: 1980, University of Minnesota
Field of study: animal behavior
Courses offered:

Pezold III, Frank, Dean College of Science and Technology, Professor of Biology-TAMUCC
Faculty member since: 2006
Ph.D.: 1984, University of Texas
Field of Study: Fish systematics, diversity, and conservation; emphasis on gobiod fishes
Courses offered:

Quigg, Antonietta., Assistant Professor of Marine Biology-TAMUG
Faculty member since 2003
Ph.D.: 2000, Monash University, Australia.
Field of study: Impact of trace metal and nutrient (N,P) enrichments, cycling and dynamics on physiology, primary productivity and community composition in coastal ecosystems; Development of bioassays using ecologically relevant marine fauna, for toxicity studies and bioremediation; Understanding phytoplankton evolution through interdisciplinary research.
Courses offered: MARB 603 (Marine Ecology).

Ray, Sammy M., Professor Emeritus of Marine Biology-TAMUG
Faculty member since 1959
Ph.D.: 1954, Rice University
Field of study: Parasites and diseases of marine shellfish.

Roelke, Daniel L., Assistant Professor of Wildlife and Fisheries Sciences-TAMU
Faculty member since 1998
Ph.D.: 1997, Texas A&M University
Field of study: phytoplankton and estuarine ecology
Courses offered: WFSC 629 (cross listed with OCNG 629)

Rosenthal, Gil, Assistant Professor of Biology-TAMU
Faculty member since 2006
Ph.D.: 2000, University of Texas at Austin
Field of study: evolution/behavior of fishes
Courses offered:

Rowe, Gilbert T., Professor of Marine Biology-TAMUG
Faculty member since 1987
Field of study: Benthic ecology.
Courses offered: OCNG 620; 622; 627

Rooker, Jay R., Associate Professor of Marine Biology-TAMUG
Faculty member since 1998
Ph.D.: 1997, University of Texas at Austin.
Field of study: Ecology of estuarine, coastal, and pelagic fishes; Recruitment process, particularly factors affecting post-settlement survival; Fish life history and migration studies; Analytical approaches to fish demography.
Courses offered: MARB 606 (Current Concepts in Marine Biology and Ecology)

Santschi, Peter H., Professor of Marine Science-TAMU
Faculty member since 1988
Ph.D.: 1975, University of Berne
Field of study: marine geochemistry, radiochemistry
Courses offered: OCNG 644 Isotope Geochemistry

Shulze, Anja- Assistant Professor of Marine Biology-TAMUG
Faculty member since: 2006
Ph.D.: 2001 University of Victoria, Canada
Field of Study: phylogenetic relationships, population structure and larval dispersal of marine invertebrates. I am addressing these questions using both morphological and molecular techniques.

Schwarz, John R., Professor of Marine Biology-TAMUG
Faculty member since 1975
Field of study: Microbial ecology; seafood safety; microbial pathogens associated with shellfish with emphasis on Vibrio species.
Courses offered: OCNG 657; 629 (Aquatic Microbiology).

Shirley, Thomas, Endowed Chair for Biodiversity, Harte Research Institute-TAMU-CC
Faculty member since: 2005
Ph.D.: 1982, Lousiana State University

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Field of study: Marine invertebrate ecology & systematics, meiofauna ecology, deep-sea invertebrate communities, marine biodiversity & conservation science
Courses offered: Benthic Ecology, Marine Biodiversity & Conservation Science

Slack, Douglas R., Professor of Wildlife and Fisheries Sciences-TAMU
Faculty member since 1973
Ph.D.: 1973, The Ohio State University
Field of study: Coastal and riparian wetlands ecology with primary emphases on avian habitat use, population ecology and behavior. Of special concern is the effects of land management practices on individual behavior and populations. Approach integrates conceptual contributions from population and community ecology.
Courses offered:

Smeee, Delbert Lee Assistant Professor of Biology – TAMUCC
Faculty member since August 2006
Ph.D.: 2006, Georgia Institute of Technology, Atlanta
Field of Study: Marine Ecology, Animal Behavior, Chemical and Sensory Ecology, Fluid Mechanics and Chemical Signaling in Aquatic Environments
Courses Offered: General Biology, Ecology, Marine Chemical Ecology, Fluid Mechanics of Organisms, Sensory Biology

Stickney, Robert R., Professor of Wildlife and Fisheries Sciences and of Oceanography and Director of Sea Grant Program-TAMU
Faculty member since 1996
Ph.D.: 1971, Florida State University
Field of Study: Mariculture (Director: Sea Grant College Program)
Courses offered: Marine Fisheries Resources

Strychar, Kevin, Assistant Professor of Marine Biology-TAMU-CC
Faculty member since 2005
Ph.D.: 2002, Central Queensland University
Field of study: Tropical and Deep-water Coral Ecology, Phytoplankton histology, and benthic biology
Courses offered: Marine Ecology, Environmental Biology

Stunz, Greg, Associate Professor of Marine Biology-TAMU-CC
Faculty member since: 2002
Ph.D.: 1999, Texas A&M University
Field of study: Marine ecology, Marine Fisheries
Courses offered: Fisheries Biology, Marine Ecology

Thomas, Rebekah, Associate Professor of Physiology-TAMUCC
Faculty member since: 2004
Ph.D.: 1995, University of Texas Health Science Center San Antonio
Field of Study: Physiology
Courses offered: Physiology, Physiological Adaptations in Animals

Thornton, Dan, Assistant Professor of Oceanography-TAMU
Faculty member since 2004
Ph.D.: 1996, University of London (Queen Mary), UK
Field of study: Benthic diatoms; sediment organic chemistry
Courses offered: Biogeochemistry

Tunnel Jr., John W., Professor of Wildlife and Fisheries Sciences and Director of Center for Coastal Studies (Corpus Christi)-TAMU-CC
Faculty member since 1974
Ph.D.: 1974, Texas A&M University
Field of study: Coral reef and coastal ecology; distribution and ecology of marine mollusks; oil spill impacts
Courses offered: Coral Reef Ecology
von Zharen, Wyndylyn, Professor of Marine Biology, Maritime Administration, and Marine Sciences-TAMUG
Faculty member since 1990
Ed.D.: 1976, University of Florida
J.D.: 1987, Univ. of South Carolina Law School
L.L.M.: 1998, University of Texas
Field of study: Marine fisheries management; marine environmental policy and law; anthropogenic stressors on marine ecosystems
Courses offered: MARS 689 (Biotic Indicators of Marine Ecosystem Health)

Waldbeser, Lillian, Associate Professor of Biology-TAMU-CC
Faculty member since: 1995
Ph.D.: 1992, Oregon Health Sciences University
Field of Study: Microbiology, immunology, genetics of marine animals, effects of habitat on growth and gonadogenesis of oysters
Courses offered: Microbiology and Immunology

Wicksten, Mary Katherine, Professor of Biology-TAMU
Faculty member since 1980
Ph.D.: 1977, University of Southern California
Field of study: deep-sea crustacean taxonomy
Courses offered: Invertebrate zoology, Biology of Molluscs

Winemiller, Kirk O., Professor of Wildlife and Fisheries Sciences-TAMU
Faculty member since 1992
Ph.D.: 1987, University of Texas at Austin
Field of study: Fisheries ecology and food webs
Courses offered: WFSC 624 (Dynamics of Populations)

Withers, Kim, Associate Research Scientist-TAMU-CC
Research Scientist & Adjunct Professor since: 1995
Ph.D.: 1994, Texas A&M University
Courses offered: Biology of Estuarine Organisms, Shorebird Ecology and Management, Environmental Science, Paleoeoclogy

Wormuth, John Hazen, Professor of Oceanography-TAMU
Faculty member since 1972
Ph.D.: 1971, Scripps Institution of Oceanography
Field of study: Zooplankton
Courses offered: Oceanography 251 (Honors); OCNG 654 Plankton Ecology

Würsig, Bernd, Professor of Marine Biology-TAMUG
Faculty member since 1989
Field of study: Behavioral ecology of marine mammals, habitat use, foraging and social structure of the cetaceans, whales, dolphins and porpoises; Adaptation in social marine mammals.
Courses offered: MARB 403 Cetacean Behavior and Behavioral Ecology; MARB 410 Animal Behavior.

4. If current faculty would be teaching new courses, how would their teaching assignments change, and how would their current assignments be accommodated?

Teaching assignments are not expected to change drastically. The Corpus Christi and Galveston campus faculty would continue to teach undergraduate courses. In College Station, most of the graduate courses would be provided by faculty in participating departments as part of their routine offerings. The courses can be offered at all three locations, but might originate at one or more of the three locations, with transmission by TTVN, WebCT and other Internet technologies, interspersed with field work at the coast for specified activities. As noted earlier, faculty members have been teaching graduate courses between College Station and the Galveston campus for many years with TTVN. Adding Corpus Christi within the network will be a straightforward addition.
5. List all new positions (faculty, graduate assistant, clerical support, etc.) required during the first five years of the program and indicate whether the positions would be additions or reassignments. If reassignment, indicate the source.

Because the program involves faculty from many departments already engaged in graduate teaching related to the MB IDP, the program can be initiated initially entirely via reassignments and through distance education technology. As the program grows, there will continue to be efficiencies and savings due to the fundamental cooperative nature of this degree.

In year 3 and beyond, new faculty needs may become apparent at one or more of the entities offering the degree. The numbers of new faculty needed will depend on and be calculated from the summered "faculty workload reports" generated each semester. The teaching load will be dispersed among numerous departments and colleges and most of the courses are already being taught within the participating departments, and thus additional teaching loads will be minimal because the new program students will be just added students to existing classes. Based on the estimated enrollment (new – not transfer) in the MB IDP (see Table 2) the budget for the IDP includes an estimate of three new faculty members by year 5.

Two approaches will be used for recruiting new faculty into specific sub-disciplines of marine biology. One will be based on student demand and present critical mass. For example, MARB has one of the strongest programs in marine mammal in the world. As a result, many students are attracted to the campus to work with the faculty in that group. By adding to this critical mass of faculty in this specialty, MARB will enhance and prolong continued strength in this important field and spread the workload generated by the student demand over more faculty. The second important strategy for hiring will be to fill sub-discipline needs in teaching and research programs. MARB, for example, has hired a new phytoplankton ecologist (A. Quigg) because plankton ecologist W. Wardle has just retired. However, MARB has no zooplankton ecologist at present, and thus a good new addition would be a faculty member in this important subject area.

6. Describe qualifications that would be sought in new faculty, indicate the expected level of appointment and anticipated contributions to the program (including research grants, contract resources, etc.).

As indicated above, the specific hires will depend upon program growth, department needs (at each of the three campuses) and existing faculty expertise as well (including reprogramming associated with retirements). Future hires will be at the level of Assistant Professor. These individuals will hold the Ph.D. degree, will have a strong teaching and research background, and will mentor graduate students. As active faculty members, they will be expected to submit grant proposals, conduct research in their fields, form collaborative units with existing faculty, and publish the results of their research. At present, the faculty is evenly spread over the 3 faculty ranks. To some extent, the MB IDP will minimize duplication of expertise at the three campuses.

7. For graduate programs:

a. Describe departmental policy regarding chairing or serving on thesis/dissertation committee, number of students supervised at one time, etc.

Any faculty member with graduate faculty status through a TAMU, TAMUG, TAMUCC academic department or through the TAMUS Pathways Graduate Faculty may serve on a committee. To chair a committee the faculty member must be a member of the MB IDP graduate faculty. No limits have been set on the number of students who can be mentored, or the number of student committees on which a faculty member may serve. This is left to the discretion of the individual faculty member based on their ability to financially support students and to be able to devote adequate time to them.

Members of the Galveston Laboratory, National Marine Fisheries Service, have expressed interest in adjunct appointments in the new MB IDP graduate program. All of these individuals hold the Ph.D., and, if acceptable to the MB IDP faculty and to the OGS, initially must be admitted to the graduate faculty as an associate or adjunct member. They then will be authorized to serve as co-chairs of graduate student committees. A member of the TAMU MB IDP PGF at any of the three participating campuses must be the other committee co-chair.

b. Identify faculty who would supervise theses, dissertations, and internships, etc.: provide examples of their ongoing research projects and scholarly publications.
The faculty members listed in section 6 are the same ones who will supervise the graduate students in the proposed program, including supervision of internships. The courses they have taught, their research interests, the number of graduate students they have mentored, and selected publications are included in Appendix B.

B. Library.

The following section was written by Natalie Wiest, Library Director, Jack K. Williams Library, Texas A&M University at Galveston:

1. **List any library holdings added in the past three years in anticipation of the program.**

Marine biology has always been a major emphasis in building the collection at TAMUG. The holdings of the library have increased dramatically with the addition of electronic-only serial titles in the 2001-2002 fiscal year. Titles available in full text include ALL of the titles of Elsevier Science; Kluwer; BioOne; JSTOR and many others. For a complete listing of 20,000 journals now available, please visit the home page of the Library (www.tamug.edu/library) and click on “Full Text Journal Articles.” Previous paper copy subscriptions included 400 titles in all. The library adds approximately 250 book titles a year in the marine biology subject area.

2. **Evaluate library holdings relevant to the proposal, noting strengths and weaknesses. Describe actions that will be taken to maintain strengths and remedy weaknesses.**

Library holdings specific to Marine Biology are the strongest part of the Williams Library collection at TAMUG. Of the 446 journals subscribed to in 1997, 97 are directly related to marine biology, 96 are of broad scientific application, 60 in marine sciences, and 21 in general marine or maritime topics for a total of 274 titles of 446. There are approximately 80,000 volumes in the Library, including both books and bound journals.

In the continuum of libraries that serve this discipline, those of Scripps Institution of Oceanography and Woods Hole Marine Biological Laboratory unofficially set the standard. Both libraries have a long tradition. They are fairly equivalent in size, with a book collection of approximately 200,000 titles and current journal subscriptions of 2000 titles. The Williams Library is more on the scale of Miller Library (Hopkins Marine Station, Stanford University; 45,000 volumes; 352 subscriptions), Fisheries/Oceanography Library, University of Washington (67,000 volumes), and University of Miami/ Rosenstiel School of Marine and Environmental Science (70,000 volumes; 785 subscriptions). These figures represent physical print collections. With the advent of major journal and book collections being available electronically, Williams Library has expanded its collection substantially in the last two years. Twenty thousand electronic serial titles are available in major collections such as Web of Knowledge (ISI); Science Direct (Elsevier); JSTOR; Aquatic Sciences and Fisheries Index (Cambridge). These are full text/full image collections as well as indexes. Forty thousand eBooks are available to student and faculty members' desktops.

Texas A&M University – Corpus Christi, Bell Library holdings are Books, Serial, Backfiles & Other Paper Materials (including government documents): 469,195; E-Books: 0; Microforms: 663,856; Audiovisual Materials: 8,185; Current Serial Subscriptions: 1,706


3. **Describe cooperative library arrangements available to students in this program.**

Texas A&M University at Galveston's branch campus status with Texas A&M University leverages electronic resources that the Galveston library by itself would not be able to afford. These databases include: BIOSIS (biological indexing and abstracting), INSPEC (engineering, physical oceanography), GeoRef (geology and geophysics), Web of Science (science citation index), Zoological Record (ecology, taxonomy, zoogeography), Science Direct (full text of 1000+ journals from Elsevier Science), entire suite of databases from Cambridge Scientific Abstracts (includes Aquatic Sciences and Fisheries Abstracts), Oceanic Abstracts, JSTOR (full image, complete backfiles of historical titles), CAB (Commonwealth Agricultural Bureau, which includes fisheries) and many others.
The General Libraries at TAMU provide a wealth of support to the disciplines supporting marine biology, and the University of Texas Medical Branch in Galveston has an excellent biological sciences collection as well. Both of these libraries give preferential treatment to interlibrary lending with TAMUG's Williams Library. The statewide cooperative program called TexShare facilitates interlibrary lending services to students, staff, and faculty. TAMUG Library uses the cooperative resources of OCLC through our regional vendor AMIGOS Library Services as infrastructure to interlibrary lending.

4. Assessment of library resources necessary for proposed program.

The Williams Library has a very good collection in the marine biology field and an excellent collection when electronic resources are factored in. No current limiting factor that would preclude strong support to this new graduate program is known. On the contrary, the library facilities at the three participating campuses are a strength.

C. Equipment

1. List any equipment acquired in the past three years for the program.

Galveston recently purchased a new coastal research vessel, the R/V SAMMY RAY. As with library acquisitions, equipment has been purchased on a more or less continuous basis. Laboratory equipment in numerous research programs has been purchased and will be used by graduate students in the program. A partial list includes a fluorescence microscope, a GC Mass Spectrometer, and a real-time PCR. The Harte Research Institute for Gulf of Mexico Studies in Corpus Christi has completed this year a $18 million research building including a wide variety of equipment that will support this program as well (see below).

2. Itemize expenditures for major additional specialized equipment and supplies needed for the program for each of the next five years.

No specialized equipment or supplies are needed at this time for the program. Participating faculty members at the three campus facilities have extramurally-funded research projects which fund equipment used extensively by graduate students registered in related departments. Other equipment purchases have been made to support the large undergraduate teaching program that emphasizes hands-on learning in both labs and field work, and some of this equipment has already been used and will continue to be available for graduate student use. Faculty members collaborate extensively with other departments and have access to specialized equipment in those departments. However, funds in the amount of $1.8 million have been allocated in the Costs section to cover start-up needs as new faculty members are hired.

D. Facilities

1. Describe facilities added or modified in the past three years in anticipation of the program.

TAMUG acquired the former Edison Chouest (Western Geophysical) facilities located just east of the Mitchell Campus on Pelican Island. The facility has been renamed the Sea Aggie Center. After considerable renovation, the TAMUG RGSO has been relocated to the Sea Aggie Center. Part of the renovation costs is listed under reallocated funds in the budget. Several new carrels have been constructed for graduate student use in this facility. The carrels are equipped with desks, chairs, bookshelves and computer jacks.

It should be noted that a new TAMUG science building is in the planning stages. When constructed, this building will house faculty members and their laboratories in both the Department of MARB and the Department of MARS, and this facility will provide space for investigators and students from any of the campuses involved in this program.

The Harte Research Institute for Gulf of Mexico Studies in Corpus, while not specifically constructed in response to the MB IDP, is nevertheless an important component of the proposed program and will house some graduate students and faculty in Corpus.

2. Describe availability and adequacy of existing facilities that will be used to support the proposed program.
Fort Crockett, a 77,413 sq. ft building housing 101 faculty and graduate students, is the primary research facility in Galveston. In addition, one faculty member and 10 graduate students are housed in space leased from the adjacent NOAA building complex.

The Mitchell Campus houses the undergraduate student body and teaching facilities. Most, if not all, graduate classes will be taught at the Mitchell Campus where distance-learning facilities are available. A 39-acre wetlands center is being developed on the Mitchell Campus. A 600 sq. ft., state-of-the-art, mariculture center was constructed on site in 2003-2004.

Several small research vessels housed at Mitchell Campus are available to faculty and graduate students, including the recently christened R/V “Sammy Ray.”

A new $50 million science building in Galveston has received authorization from the legislature for 2007 (tuition revenue bond funding + A&M System funding).

A 165-acre undeveloped wetlands site on west Galveston Island, donated by the Kempner Foundation, is available for research and teaching.

The Department of OCNG is housed in 7 floors of the 13-floor O&M Building on the College Station campus, of which a total of 1.5 floors is utilized by faculty participating in this program. State-of-the-art marine biological laboratories are available there because the OCNG Department has a long history of graduate student training and research. The WFSC Department is housed in Nagel Hall in College Station. In addition, they manage an aquaculture facility. WFSC participating faculty manage state-of-the-art research laboratories at each of these locations.

The facilities at TAMU-CC include the Center for the Sciences, the Carlos Truan Natural Resource Center, the Harte Research Center and the Conrad Blucher Institute.

3. Describe any planned renovation or alteration of existing facilities needed for the program. Estimate the date of availability. Display estimated cost in item VII.

None required (but see new facilities available above).

4. Describe any new facilities needed for the program. Estimate the date of availability. Display estimated cost in item VII.

No new facilities are needed for this program. As noted above, new facilities on Pelican Island to house its current science programs are being planned. The new facility of approximately 150,000 sq. ft. has an estimated cost of $50 million. An estimated date of completion would be 2009. This building will replace the current research building at the Fort Crockett campus.
VII. COSTS

On the attached form, provide estimates of new costs to the institution related to the proposed program(s) and provide information regarding sources of the funding that would defray those costs.

Program costs are approximately $10.7 million for the first 5 years. Funds during the first five years will be used for hiring three new faculty members and providing administrative support for the program. These costs are relatively low because there is already a well-established infrastructure for research and education in the MARB Department. It is estimated that the program will generate approximately $11.3 million in the first 5 years, principally from formula income derived from student credit hours, from research grants providing assistantships, and from reallocation of existing resources.
A PROPOSAL

to the
TEXAS HIGHER EDUCATION COORDINATING BOARD
to authorize

MASTER OF SCIENCE and
DOCTOR OF PHILOSOPHY

GRADUATE DEGREE PROGRAMS
in
MARINE BIOLOGY

prepared by:
The Texas A&M University System Components
Texas A&M University at Galveston, Texas A&M University College of Geosciences, Texas A&M University College of Agriculture and Life Sciences, Texas A&M University College of Science, and Texas A&M University - Corpus Christi

An Interdisciplinary Degree Program (IDP) of
TEXAS A&M UNIVERSITY
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Letter of Support from Joe Newton, Dean of the College of Science
Letter of Support from Flavius Killebrew, President of Texas A&M - Corpus Christi
Letter of Support from Frank Pecold, Dean, College of Science and Technology, Texas A&M - Corpus Christi
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Appendix A Framework for “Interdisciplinary Degree Programs” (IDP) at Texas A&M University

Appendix B Participating Graduate Faculty (PGF) Members list from each institution, with abbreviated resume and a list of courses to be offered from the three campuses

Appendix C Partial List of State, Federal, Local and Private Entities which are Potential Employers of MARB Graduate Students.

Appendix D Recent Marine Biology Positions Advertised Via e-mail

Appendix E External Letters of Support for the Proposed Graduate Program
TEXAS A&M UNIVERSITY AT GALVESTON

Dr. Gil Rowe
Department of Marine Biology
P.O. Box 1675
Galveston, TX 77553
roweg@tamu.edu
(409) 740-4527

May 25, 2006

MEMORANDUM

Subject: Establishment of an Interdisciplinary Degree Program (IDP) in Marine Biology

To: Dr. David Prior, Executive Vice President and Provost, TAMU
Through: Dr. Richard Ewing, Vice President for Research, TAMU
Through: Dr. Rick Giardino, Dean of Graduate Studies, TAMU
Through: Sponsoring Deans
Dr. Bowen Loftin, Vice President and CEO, TAMUG
Dr. Elsa Murano, Vice Chancellor and Dean of Agriculture, TAMU
Dr. Björn Kjerfve, Dean, College of Geosciences, TAMU
Dr. H. Joseph Newton, Dean, College of Science, TAMU
Through: Sponsoring Department Heads
Dr. Gil Rowe, Head, Marine Biology, TAMUG
Dr. William Seitz, Head, Marine Sciences, TAMUG
Dr. Del Gatlin, Interim Head, Wildlife and Fisheries Sciences, TAMU
Dr. John Morse, Interim Head, Oceanography, TAMU
Dr. Vincent Cassone, Head, Biology, TAMU

From: Dr. Gil Rowe, Head, Marine Biology, TAMU (for the participating faculty)

We request your approval of an Interdisciplinary Degree Program in Marine Biology (MB IDP) (to be submitted through the Board of Regents to the Texas Higher Education Coordinating Board).

Various faculty members in the colleges of Agriculture, Science, Geosciences and at Texas A&M University at Galveston have proposed an interdisciplinary degree program in Marine Biology. They have developed bylaws and material as specified in the Administrative Framework for Interdisciplinary Programs at Texas A&M University. As required in the framework, the attached materials include the rationale for the creation of the IDP, the bylaws, a description of the Council of Participating Deans, a budget, and the list of Participating Department Heads. As noted in the proposal, it is anticipated that faculty at Texas A&M University - Corpus Christi (TAMUCC) with interest and expertise in Marine Biology will become members of the Participating Faculty of the MB IDP upon approval of an MOU establishing that participation and TAMUCC will be represented on the Council of Participating Deans upon their inclusion.

Thank you for your consideration of this request.
TEXAS A&M UNIVERSITY AT GALVESTON

Dr. Gil Rowe
Department of Marine Biology
P.O. Box 1675
Galveston, TX 77553
trowe@tamug.edu
(409) 740-4527

April 5, 2006

MEMORANDUM

Subject: Establishment of an Interdisciplinary Degree Program (IDP) in Marine Biology

To: Dr. David Prior, Executive Vice President and Provost, TAMU
Through: Dr. Richard Ewing, Vice President for Research, TAMU
Through: Dr. Rick Giardino, Dean of Graduate Studies, TAMU
Through: Sponsoring Deans
  Dr. Bowen Loftin, Vice President and CEO, TAMUG
  Dr. Elsa Murano, Vice Chancellor and Dean of Agriculture, TAMU
  Dr. Bjorn Kjerfve, Dean, College of Geosciences, TAMU
  Dr. H. Joseph Newton, Dean, College of Science, TAMU
Through: Sponsoring Department Heads
  Dr. Gil Rowe, Head, Marine Biology, TAMUG
  Dr. William Seitz, Head, Marine Sciences, TAMUG
  Dr. Del Gatlin, Interim Head, Wildlife and Fisheries Sciences, TAMU
  Dr. John Morse, Interim Head, Oceanography, TAMU
  Dr. Vincent Cassone, Head, Biology, TAMU

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Thank you for your consideration of this request.
March 22, 2006

MEMORANDUM

Subject: Establishment of an Interdisciplinary Degree Program (IDP) in Marine Biology

To: Dr. David Prior, Executive Vice President and Provost, TAMU
Through: Dr. Richard Ewing, Vice President for Research, TAMU
Through: Dr. Rick Giardino, Dean of Graduate Studies, TAMU
Through: Sponsoring Deans
  Dr. Bowen Loftin, Vice President and CEO, TAMUG
  Dr. Dr. Elsa Murano, Vice Chancellor and Dean of Agriculture, TAMU
  Dr. Björn Kjerfve, Dean, College of Geosciences, TAMU
  Dr. H. Joseph Newton, Dean, College of Science, TAMU

Through: Sponsoring Department Heads
  Dr. Gil Rowe, Head, Marine Biology, TAMUG
  Dr. William Seitz, Head, Marine Sciences, TAMUG
  Dr. Del Gatlin, Interim Head, Wildlife and Fisheries Sciences, TAMU
  Dr. John Morse, Interim Head, Oceanography, TAMU
  Dr. Vincent Cassone, Head, Biology, TAMU

From: Dr. Gil Rowe, Head, Marine Biology, TAMU (for the participating faculty)

We request your approval of an Interdisciplinary Degree Program in Marine Biology (MB IDP) (to be submitted through the Board of Regents to the Texas Higher Education Coordinating Board).

Various faculty members in the colleges of Agriculture, Science, Geosciences and at Texas A&M University at Galveston have proposed an interdisciplinary degree program in Marine Biology. They have developed bylaws and material as specified in the Administrative Framework for Interdisciplinary Programs at Texas A&M University. As required in the framework, the attached materials include the rationale for the creation of the IDP, the bylaws, a description of the Council of Participating Deans, a budget, and the list of Participating Department Heads. As noted in the proposal, it is anticipated that faculty at Texas A&M University – Corpus Christi (TAMUCC) with interest and expertise in Marine Biology will become members of the Participating Faculty of the MB IDP upon approval of an MOU establishing that participation and TAMUCC will be represented on the Council of Participating Deans upon their inclusion.

Thank you for your consideration of this request.
TEXAS A&M UNIVERSITY AT GALVESTON

Dr. Gil Rowe
Department of Marine Biology
P.O. Box 1675
Galveston, TX 77553
roweg@tamug.edu
(409) 740-4527

April 4, 2006

MEMORANDUM

Subject: Establishment of an Interdisciplinary Degree Program (IDP) in Marine Biology

To: Dr. David Prior, Executive Vice President and Provost, TAMU
Through: Dr. Richard Ewing, Vice President for Research, TAMU
Through: Dr. Rick Giardino, Dean of Graduate Studies, TAMU
Through: Sponsoring Deans
   Dr. Bowen Loftin, Vice President and CEO, TAMUG
   Dr. Dr. Elsa Murano, Vice Chancellor and Dean of Agriculture, TAMU
   Dr. Björn Kjerfve, Dean, College of Geosciences, TAMU
   Dr. H. Joseph Newton, Dean, College of Science, TAMU
Through: Sponsoring Department Heads
   Dr. Gil Rowe, Head, Marine Biology, TAMUG
   Dr. William Seitz, Head, Marine Sciences, TAMUG
   Dr. Del Gatlin, Interim Head, Wildlife and Fisheries Sciences, TAMU
   Dr. John Morse, Interim Head, Oceanography, TAMU
   Dr. Vincent Cassone, Head, Biology, TAMU

From: Dr. Gil Rowe, Head, Marine Biology, TAMU (for the participating faculty)

We request your approval of an Interdisciplinary Degree Program in Marine Biology (MB IDP) (to be submitted through the Board of Regents to the Texas Higher Education Coordinating Board).

Various faculty members in the colleges of Agriculture, Science, Geosciences and at Texas A&M University at Galveston have proposed an interdisciplinary degree program in Marine Biology. They have developed bylaws and material as specified in the Administrative Framework for Interdisciplinary Programs at Texas A&M University. As required in the framework, the attached materials include the rationale for the creation of the IDP, the bylaws, a description of the Council of Participating Deans, a budget, and the list of Participating Department Heads. As noted in the proposal, it is anticipated that faculty at Texas A&M University - Corpus Christi (TAMUCC) with interest and expertise in Marine Biology will become members of the Participating Faculty of the MB IDP upon approval of an MOU establishing that participation and TAMUCC will be represented on the Council of Participating Deans upon their inclusion.

Thank you for your consideration of this request.
MEMORANDUM OF UNDERSTANDING
AMONG
TEXAS A&M UNIVERSITY AT GALVESTON (TAMUG),
TEXAS A&M UNIVERSITY-CORPUS CHRISTI (TAMU-CC), AND
TEXAS A&M UNIVERSITY, COLLEGE STATION (TAMU)
FOR THE FORMATION OF A
MARINE BIOLOGY
INTERDISCIPLINARY DEGREE PROGRAM (MB IDP)

Through this Memorandum of Understanding, Texas A&M University at Galveston, Texas A&M University–Corpus Christi, and Texas A&M University, College Station agree to create an interdisciplinary Ph.D. program in Marine Biology (MB IDP). The MB IDP will follow the framework established by Texas A&M for the creation of interdisciplinary degree programs and interdisciplinary research programs.

The MB IDP coordinates the resources of the comprehensive graduate program in Marine Biology in Galveston with other graduate programs and research groups in related, complementary disciplines housed in several colleges and research centers at TAMU-CC and TAMU. This alliance of faculty enhances the graduate education opportunities of participating students across a spectrum of disciplines on participating campuses. The MB IDP significantly enlarges the total course and research offerings, facilities, and faculties to form one of the largest and most diverse graduate programs in Marine Biology in the United States and internationally. As such, it is expected to contribute to an overall increase in graduate enrollment and student and faculty quality at TAMUG, TAMU-CC, and TAMU.

Initially, the Participating Graduate Faculty (PGF) will be derived from the departments of Marine Biology (TAMUG), Marine Sciences (TAMUG), Oceanography (TAMU), Wildlife and Fisheries Sciences (TAMU), and Physical and Life Sciences (TAMU-CC). Faculty, departments, colleges and universities within the System can be added via the MOU process with approval by the Council of Participating Deans (COPD), following the guidelines of the established framework for establishing IDPs and the MB IDP by-laws.

Robert Gates, President
Texas A&M University

Flavius Killebrew, President
Texas A&M University-Corpus Christi
David Prior, Provost
TAMU

Robert Kirby, Interim Provost
Texas A&M University-Corpus Christi

Harvey Knull,
Graduate Dean and Associate Vice President for Research,
Texas A&M University-Corpus Christi

Richard Ewing, Vice President for Research
TAMU

John R. Giardino, Dean of Graduate Studies
TAMU

R. Bowen Loftin, Vice President
TAMUG
Substantive Degree Program Request - Title Page

NAME OF INSTITUTION Texas A&M University, Texas A&M University at Galveston, Texas A&M University - Corpus Christi

NAME OF PROPOSED PROGRAM Marine Biology

Display how proposed program(s) would appear on the Coordinating Board program inventory, include Texas CIP designation(s)

Marine Biology
Texas CIP code: 26.1302
How would the name(s) of program(s) appear on student diplomas?

Master of Science in Marine Biology
Doctor of Philosophy in Marine Biology

Administrative unit(s) responsible for the program(s):

Faculty of Marine Biology, Texas A&M University System, under the Council of Participating Deans (which includes Texas A&M at Galveston, Texas A&M University College of Geosciences, Texas A&M University College of Agriculture and Life Sciences, Texas A&M University College of Science, and College of Science and Technology Texas A&M - Corpus Christi

Proposed date for implementation of program: September 2007

Persons to be contacted for further information about proposed program(s)

Name: Dr. Gilbert T. Rowe Title: Head, Department of Marine Biology, Texas A&M University at Galveston
Phone: 409/740-4527; Fax: 409/740-5001; e-mail: roweg@tamug.edu [Provisional Chair of the Participating Graduate Faculty]

Name: Dr. Delbert Gatlin Title: Interim Head, Department of Wildlife and Fisheries Science, College of Agriculture and Life Sciences, Phone: 979/845-5777; Fax: 979/845-3786; e-mail: dgaatlin@tamu.edu [Provisional Co-chair of Participating Graduate Faculty]

Name: Dr. R. Bowen Loftin Title: Vice President and CEO, Texas A&M University at Galveston, Phone: 409/740-4403; Fax: 409/740-4407; e-mail: loftin@tamug.edu [Chair of the Council of Participating Deans]

Name: Dr. John R. Giardino Title: Dean of Graduate Studies, Texas A&M University
Phone: 979/845-3631; Fax: 979/862-1692; e-mail: rickg@tamu.edu

Name: Dr. Harvey Knull Title: Associate Vice President for Research and Scholarly Activity and Dean of Graduate Studies, Texas A&M University-Corpus Christi, Phone: 361/825-2177; Fax: 361/825-2755; e-mail: Harvey.Knull@tamucc.edu

Name: Dr. Frank Pezold Title: Dean of College of Science and Technology, Texas A&M University-Corpus Christi
Phone: 361/825-3655; Fax: 361/825-5789; e-mail: Frank.Pezold@tamucc.edu
EXECUTIVE SUMMARY

Texas A&M University System

Campuses in Galveston, College Station, and Corpus Christi

Proposal to create the degrees of

Master of Science in Marine Biology
Doctor of Philosophy in Marine Biology

Marine biologists within the Texas A&M University System (TAMUS), including the Departments of Marine Biology (MARB), Marine Sciences (MARS), Wildlife and Fisheries Sciences (WFSC), Oceanography (OCGN) and Biology (BIOL), Life Sciences (LSCI) at Texas A&M - Corpus Christi (TAMUCC), are proposing to initiate a graduate program offering both the M.S. and Ph.D. degrees in marine biology among three entities of the TAMUS. The need for this program is based on the expansion of the field of marine biology since the beginning of the environmental movement and the popularization of marine biology in the media. The demand for these degrees is high, based on the estimated 300+ inquiries from prospective graduate students in the past five years; the MARB Department at Texas A&M University at Galveston (TAMUG), for example, has received 160 inquiries (not counting inquiries received by individual faculty members) since late June 2002, an average of about 5 per month.

In 1998, the Department of Marine Biology at the Galveston campus produced a 5-year strategic plan (entitled “A Five-Year Strategic Plan for Entering the 21st Century”) in which one of the recommendations was to develop a graduate program in MARB. In 1999, the Texas Legislature granted TAMUG permission to begin the process of planning to offer graduate degree programs (HB 188, passed by the House on 8 April 1999 and by the Senate on 10 May 1999). Planning authority was granted by the Texas Higher Education Coordinating Board (THECB) in January 2001. The THECB Table of Programs states that the M.S. and Ph.D. degrees will be “in cooperation with Texas A&M University (TAMU) only.” These two proposed graduate degrees will be TAMU degrees, managed according to the existing framework at TAMU for “Interdisciplinary Degree Programs” (IDP, Appendix A). The IDP is a cooperative program involving the Departments of MARB, MARS, BIOL, OCGN, and WFSC at TAMU, and the Department of Life Sciences at Texas A&M - Corpus Christi (TAMUCC), with the MARB Department as the host department in this endeavor. All proposed faculty for the new program are already members of the graduate faculty within their home university. Once the program is approved, all the present graduate faculty will also become the Participating Graduate Faculty (PGF) of the TAMU Marine Biology Interdisciplinary Degree Program (MB IDP). There are numerous graduate degree programs in Texas with some marine biology related coursework, but there is no specific “marine biology” degree.

The principal strengths of the proposed MB IDP lie in the international recognition, scholarly productivity and extramural funding of its diverse faculty, as well as the strategic location of two campuses on the Gulf of Mexico. Students have access to a variety of marine habitats on the upper Texas coast at the Galveston facility, including the Galveston Bay system, with its open bay, oyster reefs and wetlands, and the open Gulf with its barrier islands, beaches and offshore habitats. The Corpus campus on the other hand accesses the distinctly different habitats of the South Texas coast, including Padre Island, a barrier island enclosing the hypersaline but fertile Laguna Madre. The popular undergraduate program in Galveston has been designed to complement a typical contemporary biology department by placing emphasis on the level of the organism and ecosystem. The Galveston researchers assembled to study marine mammals are, as a group, arguably the best in the world, participating in numerous international research projects in diverse and distant locations. The participating graduate faculty also includes a sizeable group of invertebrate ecologists who contribute to on-going, highly-funded studies of coastal ecosystems, the deep sea, the hypoxic zones of the continental shelf, oyster reefs, offshore rigs and natural coral banks, and the saline caves of the Bahamas and Yucatan, as well as mariculture and regional fisheries. The fisheries faculty use the latest in molecular and geochemical approaches to explore the recruitment and production of economically important species of both coastal and pelagic open-ocean populations. Plant biologists focus on the plankton, harmful algal blooms and wetlands restoration. Two new degree programs that complement the proposed initiative include the non-thesis professional degree in Galveston (Masters of Marine Resources Management in the Department of Marine Sciences, a participating department member) and the interdisciplinary program at Corpus Christi (PhD in Coastal and Marine System Science). The generic name “marine biology” applies to elements of all of the proposed programs listed and is important for marketing prospective students and their eventual employers.

A number of associated institutions outside of the TAMUS universities academic departments listed will also add to the IDP’s diversity. Research projects and undergraduate teaching are already supplemented by University of Texas
Medical Branch (UTMB) and National Marine Fisheries Service (NOAA/NMFS) professionals in Galveston and by cooperating research centers in College Station, and these organizations will contribute to graduate student supervision and financial support when the new program is initiated. The Texas Institute of Oceanography (TIO) supplements graduate student research support directly and through additional facilities provided through the Institute of Marine Life Sciences (IMLS) and the Laboratory for Ocean and Environmental Research (LOER), both in Galveston. The Corpus campus houses the Center for Coastal Studies, The Conrad Blucher Institute and Harte Research Institute for the Gulf of Mexico Studies. In College Station, the Geochemoical and Environmental Research Group (GERG), the Sustainable Coastal Margins Program (SCMP) and the Integrated Ocean Drilling Project (IODP) provide opportunities for graduate students to work with prestigious research scientists within interdisciplinary programs with international scope. Research professionals with the US Geological Survey and Texas Parks and Wildlife are co-located on the Corpus campus and participate in graduate education and research. Total expenditures in “Environmental Sciences” (for definition see Research Expenditures, THECB, July 2006, page A-8) for all three campuses for FY2005 was $76,800,000.00, which includes oceanography and life in the oceans. Of this, $17,500,000.00 in expenditures was attributed to TAMU-CC and TAMUG, reflecting an average increase at the two coastal sites of 24.4% over the past 4 years. (Research Expenditures, THECB, July 2006). Among the outstanding projects within the TAMU System, research projects have discovered methane seep communities in the deep northern Gulf of Mexico, documented life 100’s of meters deep in ocean sediments millions of years in age, documented a field of asphalt-like sea floor in the Gulf of Campeche, discovered population of whales not thought to exist in the Gulf of Mexico, described more than 300 new species in deep caves, and have generated new approaches to managing Louisiana “dead sea” (low oxygen).

The goal of the proposed graduate program is to attract high-quality students interested in one or a combination of the sub-disciplines of marine biology who wish to pursue careers in higher education, government, or private industry. The structure of the education provided by the program will ensure that highly qualified individuals will be sent into the job market or on to further education. Employment of graduates will be related to environmental and living resource regulation and management within all levels of government; industries related to or affected by resource utilization and management; and within all levels of academia, to teach and conduct basic and applied research. For the M.S. degree, this will be accomplished by providing a very strong curriculum, hands-on research experience in most courses and either a rigorous program of field and/or laboratory research for thesis option students. Non-thesis option students have a larger course load than thesis option students. Both thesis and non-thesis students will be supervised by graduate advisory committees responsible for development of the final degree plan. For the Ph.D. degree, in addition to coursework, a dissertation based on rigorous scholarly research will be required.

The Participating Graduate Faculty (PGF) from the combination of departments working together is an ideal organization for the proposed graduate program for the following reasons:

- there is a large undergraduate marine biology program (ca. 500 MARB majors in the Fall Semester of 2005) in Galveston, as well as traditional undergraduate biology degrees in College Station, Corpus Christi and other Texas universities, which are all training numerous students with potential interest in the proposed graduate program;

- there is an established, qualified marine biology faculty (> 30) at the three locations, in a wide range of specialties, with extensive experience in state-of-the-art marine research and graduate student advising;

- the PGF has a record of substantial extramural research funding;

- the PGF already have extensive experience in mentoring graduate students in each of their home departments on the three respective campuses;

- student financial support is available at all three facilities through more than 30 graduate teaching assistantships (GAT) and at least 20-30 research assistantships (GAR) per semester, along with various fellowships;

- there are state-of-the-art physical facilities for conducting graduate student education and research at all three campuses;

- participating departments are located in a geographic triangle that encompasses a high concentration of federal, state and local governmental agencies that manage living resources and the environmental quality of the Texas coast and Gulf of Mexico;
• two of the three participating campuses are located on the Gulf of Mexico, where coastal tourism, economically-important living resources, and petrochemical facilities are clustered;

• Aside from programs at Nova Southeastern University, Florida Institute of Technology and the University of Miami, there are no other graduate programs in marine biology in a state adjacent to the Gulf of Mexico.

The degree program will focus on independent supervised research complemented by formal coursework. Essential components of the program include the following:

• a highly diverse curriculum available on all three campuses;

• original, supervised scholarly research, to be written up and formally defended as a paper, thesis or dissertation;

• efficiencies obtained by sharing the diversity of courses already offered at the three participating entities facilitated by distance learning technologies;

• students in the M.S. non-thesis option will be able to pursue a majority of degree requirements “by distance;” M.S. thesis-option and Ph.D. students also will benefit from distance technologies in being able to avail themselves of courses offered at the alternative campuses and while they are doing research away from any campus, and in interactions with members of their committees and others from whom they are separated by distance.

Students will earn one of the following degrees:

• Master of Science, non-thesis option, with 36 total semester credit hours;

• Master of Science, thesis option, with 32 total semester credit hours including thesis; or,

• Doctor of Philosophy, with a minimum of 64 total semester hours beyond the M.S. degree or a minimum of 96 total semester hours beyond the B.S. degree, including dissertation.

The well-established rules and guidelines of the Office of Graduate Studies (OGS), TAMU, regarding admission, advising, course requirements, examinations, and thesis and dissertation research, production, and defense will be followed. Students admitted to the MB IDP through the TAMUCC campus will follow the well-established rules and guidelines for graduate education at TAMUCC.

Program costs are approximately $10.7 million for the first 5 years. Funds during the first five years will be used for hiring an estimated three new faculty members and providing administrative support for the program at the three campuses. These costs are relatively low because there is already a well-established infrastructure for research and education in the participating departments. It is estimated that the program will generate approximately $11.3 million in the first 5 years, principally from formula income derived from student credit hours, from research grants providing assistantships, and from reallocation of existing resources.
I. PROGRAM ADMINISTRATION

A. Describe how the program would be administered.

The program will be interdisciplinary, involving courses and linking faculty from the TAMUS – TAMU Colleges of Science (SCI), Agriculture and Life Sciences (COALS), Geosciences (GEOS), TAMU at Galveston (TAMUG) and TAMUCC. The program will be administered and governed under the Administrative Framework for Interdisciplinary Programs as outlined in Appendix A. Based on this framework, oversight will be conducted by an Administrative Council composed of a Council of Participating Deans (COPD), plus the Dean of Graduate Studies (DGS) and the Vice President for Research (VPR). The Administrative Council will meet annually to ensure that adequate personnel and resources are available to the program.

An internal advisory board will be composed of Participating Department Heads (PDH), consisting of department heads or their designees, from each participating department. The PDH will meet annually, or as needed, to provide departmental input to the Administrative Council, the IDP Chair and Co-Chairs and participating graduate faculty. The PDH will include the following departments: MARB (TAMUG), Marine Sciences (TAMUG), Biology (SCI), Wildlife and Fisheries Sciences (COALS), Oceanography (GEOS), Life Sciences (TAMUCC).

The Participating Interdisciplinary Marine Biology graduate faculty (PGF) will form a Faculty Executive Committee (EC) composed of one member of the PGF from each of the participating departments. These representatives will be chosen by vote within their respective departments or by appointment by the respective Department Head. The whole of the PGF will elect a Chair from one of the three campuses and two Co-Chairs, representing the other two campuses, with approval by the COPD. The Chair and the Co-Chairs will be responsible for managing the program on a day-to-day basis, but will be responsible to the COPD.

![Diagram of administrative council structure]

Figure 1

1. Indicate the name and title of person(s) who would be responsible for curriculum development and ongoing review.

The MB IDP will be administered by the Faculty EC and its elected Chair from TAMU, TAMUG, or TAMUCC. They will report annually on all program activities, including budgetary requests, to the Administrative Council. Curriculum development is the responsibility of the curriculum committee of the MB IDP under the bylaws required by the framework for interdisciplinary degree programs. The IDP elected chair has overall signature authority. All degree plans, theses and dissertations must be approved by the IDP elected chair.

2. Describe the responsibilities for student advisement and supervision.
The MB IDP Chair, assisted by a staff graduate advisor (SGA), will have overall supervisory authority for advising all graduate students in the program with respect to assisting in registration, thesis or dissertation deadlines, etc. These two will work closely with the Co-Chairs at the other campuses to handle student needs. The staff graduate advisor, to be hired within the MARB department at TAMUG, will be responsible for student recruitment, record-keeping, advising and registration, under the supervision of the Chair. In addition, before the completion of the first eighteen credit hours for the MS degree and the first 27 credit hours for the PhD degree, each student will select a graduate committee consisting of no less than three (for the M.S. degree) or four (for the Ph.D. degree) members of the graduate faculty, and file a degree plan. The Chair of the student’s committee must have a graduate faculty appointment in the “MB IDP” and will have direct responsibility for supervising and advising the student with regard to academic and research topics.

The SGA will work closely with the Chair and Co-Chairs on issues related to recruiting, registration, foreign national guidelines, travel and leave, adherence to TAMU OGS rules and procedures, benefits, fellowships and the assignment of teaching (GAT) and non-teaching assistantships (GANT).

3. If the program would be administered by more than one administrative unit, what factors would make this desirable?

The proposed graduate program will be administered under the Administrative Framework for Interdisciplinary Programs at Texas A&M (Appendix A) because it is a cooperative venture between two universities (TAMU and TAMUCC) and five colleges (TAMUG, COALS, SCI and GEOS, and the College of Sciences and Technology at TAMU-CC). The University has adopted this structure for providing coordination between colleges and departments. The deans or vice-presidents of the multiple administrative units form the Council of Participating Deans (COPD). The COPD, along with the Dean of the Office of Graduate Studies and the Vice President for Research, form the Administrative Council, who oversee and thus ensure the implementation and success of the program. The Faculty Executive Committee, who represent the faculty from each of the participating departments, and their elected Chair and Co-Chairs in residence at each of the three campuses, along with the Staff Graduate Advisor, will oversee daily operations.

Putting these different units together in this curriculum is desirable because it brings a diverse spectrum of resources and faculty together under one umbrella for the benefit of the students. Each participating unit brings a different set of human resources and facilities to the program. For example, WFSC and OCNNG have traditionally studied the high end and the low end of the marine food web, respectively. Separating them is an artificial distinction because they are interdependent in natural ecosystems. Bringing them together in a graduate curriculum unifies those interests with the organismal capabilities in the Department of MARB, which covers them both at the undergraduate level. The College Station campus departments have an extensive history in graduate education – this is complemented by the strong undergraduate marine-related programs at TAMUG and TAMUCC and strong MS-level graduate programs at TAMUCC. TAMUG trains maritime officers; OCNNG (along with ocean drilling and the Geochemical and Environmental Research Group) utilizes ocean-going research vessels. The College Station units have graduate students who need financial support and teaching experience, whereas Galveston has an extensive field- and laboratory-based undergraduate curriculum in which GAT’s are in demand. TAMUCC also has graduate students seeking financial support and a need for GAT’s. TAMUCC has developed a strong presence in the marine sciences with its PhD in Coastal and Marine System Science and the formation of the Harte Research Institute for Gulf of Mexico Studies.

A significant advantage of this administrative structure for the State of Texas is that components from both the upper and lower Texas coast are working cooperatively to educate Marine Biologists familiar with both geographic regions.

B. If a non-academic administrative unit, e.g. "institute" or "center" would be involved in administering the program, describe the relationships.

No non-academic units will be involved in administering this program.

C. If a new organizational unit would be created, or an existing organizational entity modified as a result of this program, identify and describe the anticipated result.

An Interdisciplinary Degree Program (IDP) will be created within institutions of the TAMUS. Oversight will be by an administrative council from colleges within universities of the TAMU System. This council is referred to as the
COPD (the Dean from each participating college, COPD), along with the VPR and the DGS. The COPD will oversee a group of Participating Graduate Faculty (PGF) from each of the participating departments, who will elect a Chair, along with two Co-Chairs. The Chair, along with the two Co-Chairs, will supervise the day-to-day operation of the IDP. A PGF Executive Committee (EC) will be selected from the participating departments, with one representative from each department. The responsibilities of the Chairs and the EC will include oversight of subcommittees to deal with student recruiting, initial student advising, assignment of teaching assistantships, and course offerings. The Chair and Co-Chairs will be responsible for teaching assignments, class room space and teaching assistantships, in view of the recommendations of the EC, and in cooperation with the heads of the home department of each PGF member. See Figure 1 for the administrative structure.
II. PROGRAM DESCRIPTION

A. Program Objectives

1. Describe the educational objectives of this program. (Include reference to preparation of students for licensure or certification, if appropriate and any special outcomes or competencies which the program would provide that are not available from existing degree programs.)

The goal of the program is to educate high-quality students who wish to pursue careers in research, higher education, government, not-for-profit non-governmental organizations (NGO’s) or industry. The program will ensure that highly qualified individuals will be sent into the job market or on to further education by providing a strong curriculum with hands-on research experience, a rigorous program of field and/or laboratory research for thesis option students or extensive, in-depth course work for non-thesis option students, and rigorous field and laboratory research for Ph.D. students.

The M.S. degree is intended to attract three principal types of individuals:

a. students who recently received an undergraduate degree in a biology program;

b. teachers interested in broadening their knowledge and strengthening their credentials in marine biology;

c. governmental and industrial personnel seeking to broaden their knowledge and enhance their credentials.

The need for teachers and regulators to be informed on environmental science issues is paramount if the nation’s coastal and offshore resources are to be properly managed and maintained. The proposed M.S. degree program will serve that need, as well as provide students with the research experience necessary to proceed to a Ph.D. degree program.

The Ph.D. degree is intended to attract students who are interested in teaching and conducting independent research in academia, government or industry, or overseeing such research. Students may enter the Ph.D. program directly if they have sufficient preparation, or may enter with a M.S. in biology or a related discipline.

No license or certification is associated with this program.

2. If the program design includes multiple curricula (concentrations, emphases, options, specializations, tracks, etc.), describe the educational objectives of each (Each of these curricula must be identified on the title page, including the Texas CIP code).

a. M.S. Program

Two options are requested. The thesis option will require a written thesis based on original research, and passing a final oral exam covering the thesis subject and general biological topics. This option is intended for students planning to continue with their graduate education at the doctoral level and subsequently enter university-level teaching and research programs, or those seeking governmental service in a resource management capacity.

The non-thesis option is intended for an ever-increasing number of public and private school teachers and resource managers in government or industry seeking additional skills. The non-thesis option will require completing in-depth coursework and passing a final oral exam covering general biological topics. Students pursuing a non-thesis option must complete four credit hours in addition to the number required for the thesis option.

Offering courses by distance technologies will enable many employed individuals, such as teachers, to have access to MB IDP courses at any of the participating campuses or even remote from the Galveston, College Station or Corpus Christi campuses. Laboratory work will be planned, and scheduled, to enable this group of students to participate successfully in this program. It also maximizes the efficiency of resource utilization by drawing on the expertise in three geographic regions.
b. Ph.D. Program

No options are requested.

B. Admission Standards

1. State admission requirements for the program (if there are different categories for admission, e.g. unconditional, probationary, etc., describe each).

The requirements for admission to the MB IDP will be the same as for admission to graduate studies at TAMU; that is, a student must:

a. Hold a four-year baccalaureate degree or higher from a college or university of recognized standing (i.e., a degree recognized as equivalent to a baccalaureate degree from an accredited institution in the U.S.), have a satisfactory overall transcript, and the student’s grade point ratio in the last 60 hours of coursework must be acceptable;

b. Show promise of intellectual and academic ability to pursue advanced study and research satisfactorily, through both scholastic evidence and a minimum of three letters of recommendation from persons capable of judging the applicant's capabilities, and an evaluation of the Statement of Purpose essay;

c. Have had adequate preparation to enter graduate study in the chosen field;

d. Provide evidence of professional and/or academic experience if seeking a non-thesis option M.S. degree;

e. Have acceptable GRE or GMAT scores (evaluated in a manner that complies with House Bill 1641).

f. International students must achieve the status of English Proficiency Verified. This may be accomplished by scoring at least 550 on the paper-based, or 213 on the computer-based, TOEFL exam, at least 400 on the GRE verbal exam, or at least 22 on the GMAT. Before international students will be allowed to teach, they must be English Proficiency Certified. This may be accomplished by scoring at least 80 on each section of the English Language Proficiency Examination, earning grades of A or B in English Language Institute courses (300 or higher level courses). Students who have graduated from an accredited U.S., New Zealand, Australian, UK or Canadian institution of higher learning will be granted automatic certification.

The EC, under the direction and guidance of the Chair and the Co-Chairs, will establish a Graduate Recruiting and Advising Committee (GRAC) consisting of members of the participating graduate faculty, with at least one member from each participating department. These committee members will review applications, make recommendations for admission, financial support or rejection, and determine, in conjunction with prospective committee chairs, if leveling courses are needed.
C. Degree Requirements

1. In tabular form, indicate the semester credit hours (SCH) requirements in each of the following categories applicable to the proposed degree programs; include the total SCH requirements for the degree:

<table>
<thead>
<tr>
<th>Credit Hours Required for Master of Science Degree</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thesis</td>
<td>Non-thesis</td>
</tr>
<tr>
<td>Courses</td>
<td>22</td>
<td>34</td>
</tr>
<tr>
<td>Seminar</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Research hours</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Credit Hours Required for Doctor of Philosophy Degree</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>With M.S.</td>
<td>64</td>
<td>96</td>
</tr>
<tr>
<td>Without M.S.</td>
<td>39-55</td>
<td>29-55</td>
</tr>
</tbody>
</table>

   a. Foundation (Leveling) Courses (0 credit hours to as many hours as needed).

Students entering the program will be expected to have a strong background in the biological sciences, as well as a good foundation in chemistry, physics, earth sciences, and mathematics. Students lacking preparation in a particular subject area, but who are otherwise well-qualified to enter the graduate program, will be required to take appropriate leveling course work in addition to that specified for the M.S. or Ph.D. degrees. These courses will not be credited as part of the degree plan. A full complement of undergraduate leveling courses is already available on each of the three campus units participating (TAMU, TAMUCC, and TAMUG). The need for leveling courses will be decided upon by the MB IDP GRAC in consultation with the prospective committee chair.

   b. Additional courses available to all students in the proposed program.

As with all graduate degrees at Texas A&M University, the academic program is tailored to the background and educational goals of each degree candidate in consultation with his or her Graduate Advisory Committee, utilizing courses provided by the faculty (a list of courses currently available to the MB-IDP is given below). As with all A&M degrees, final degree plan approval resides in the Office of Graduate Studies, but with recommendation from the department. In the case of an interdisciplinary degree program the elected faculty chair also approves all degree plans to maintain consistency with the curriculum goals of the IDP as developed by the curriculum committee.

The curriculum of the MD-IDP, while not specifying individual courses, nevertheless requires that all students will be required to demonstrate competence in, and understanding of, general principles of marine biology and ecology, including biological processes at the level of the cell up to the functioning of whole ecosystems; broad knowledge of marine biodiversity, including fundamentals of genetics, and relationships of biodiversity to biological and ecological processes; broad knowledge of the characteristics of the marine environment; accompanied by understanding of, and skills in, the analysis of biological and environmental data (experimental design and statistics: systems modeling). Assessment of this body of knowledge on an individual-student basis will be through course work completed, the thesis and dissertation proposal, the Preliminary Examination for the PhD student, the written thesis and dissertation on the student’s original research, and the thesis and dissertation defense. For the student
enrolled in the 36-hour non-thesis option, competency in the above mentioned principles will be
demonstrated through an oral final examination. Degree plans will be reviewed individually by the
departments and the chair of the participating faculty to ensure that the foundations discussed above are
met by the coursework.

The courses available at each of the three participating campuses, in each of the different departments and
colleges, are listed below. Other courses may be substituted for one or more of the courses in the lists, if
the student has previously completed upper division or graduate-level courses with content deemed
adequate by the student’s GAC. If a student advances from the M.S. in MB directly to the Ph.D., and has
already taken these courses, the student will still need to demonstrate competence in the subject areas on
the Preliminary Examination. The courses in each student’s degree plan will be determined by the
student, the student’s thesis or dissertation advisory committee, and the student’s Chair. The total number
of hours for the degree sought must still be met.

c. Courses elected by the student.
   1. For the M.S. degree

   Courses totaling 24 hours for the thesis option, or 36 hours for the non-thesis option, will be chosen
   by students in consultation with their chairs and committee members. These courses may be drawn
   from any set, within or outside the participating departments, deemed appropriate and necessary by
   the student and committee. Thesis option students will take 8 hours of research courses.

   2. For the Ph.D. degree

   The students in consultation with their chairs and committee members will choose all elective
courses, except as prescribed below.

d. Prescribed courses
   1. For the M.S. degree

   MARB/OCNG/WFSC/BIOL/CVM 681, Seminar, 2 credit hours total (thesis and non-thesis options).

   2. For the Ph.D. degree

   MARB/OCNG/WFSC/BIOL/CVM 681, Seminar, 2 credit hours total.

e. Other required courses
   1. For the M.S. degree – thesis

   MARB/OCNG/WFSC/BIOL/CVM 691, Research, 8 credit hours maximum (thesis only).

   2. For the Ph.D. degree

   No specific requirements.

f. Residence
   1. For the M.S. degree

   M.S. students, both thesis and non-thesis option, are expected to devote most of their time and energy
to graduate studies under the direction of the students’ major professors and the advisory committees.
Although there is no specific requirement that the student be in residence on any of the three
campuses, a student’s chair and committee will be the ultimate arbiter of the time in residence at any
one of the participating facilities. In addition, students enrolled through the TAMU or TAMUG
campuses will have to meet the degree residency requirements as stated in the TAMU Graduate
Catalog and students enrolled through the TAMUCC campus will have to meet the graduate degree
residency requirements as stated in the TAMUCC Graduate Catalog.
The MB IDP seeks approval to offer the M.S. degree (non-thesis) as both a residential and as a distance degree. Many courses will be offered by distance to meet the needs of students who want to pursue the M.S. non-thesis option, or M.S. thesis option, but who are employed and are unable to be on a particular campus.

2. For the Ph.D. degree

Students entering the program with a baccalaureate degree must spend two academic years in residence at one or a combination of the three campus facilities. Students entering with a M.S. degree must spend at least 1 year in residence. The residency requirement may be met at any of the three participating locations, or any combination of months on all campuses, totaling either one or two years, as required. Registration on-campus for 9 credit hours per long-term or registration in 700 or 799 (distance) sections of courses offered by distance along with 691 totaling 9 credit hours in aggregate per long term shall satisfy the technical requirement for residency. The student’s committee chair, along with the committee, will be the ultimate arbiter of the amount of time to be spent working in the mentor’s facility or otherwise working closely with the mentor.

g. Student's Advisory Committee (SAC)

1. For the M.S. degree

The Committee will consist of at least three members, each of whom must have a graduate faculty appointment at TAMUCC or TAMU or TAMUS Participating Graduate Faculty. The Chair of the Committee must be a faculty member in one of the participating departments and be a formal member of the MB IDPs PGF. At least one member must be from a different academic department.

2. For the Ph.D. degree

The Committee will consist of at least four members, each of whom must have a graduate faculty appointment at TAMUCC or TAMU. The Chair (or co-Chair) of the Committee must be a faculty member of one of the participating departments and be a formal member of the MB IDPs PGF. At least one member must be from a different academic.

3. External Committee Members

Committee members outside the University, e.g., qualified scientists at other academic institutions, governmental agencies, or industries, will be authorized as Associate Graduate Faculty, for both M.S. and Ph.D. committee service, if they have expertise beneficial to the guidance and/or completion of the student's research. The external member may not constitute one of the three (M.S.) or four (Ph.D.) required committee members. The OGS, TAMU, must approve all external committee members before they may serve on a committee. Categories and requirements of graduate faculty members are described in the TAMU Graduate Catalog.

h. The Degree Plan

Students, in conjunction with their committee chairs and committee members, will choose courses in the degree plan. The limitations on certain courses are described in the TAMU or TAMUCC Graduate Catalogs. A list of suggested courses is included below.

Guidelines for the use of transfer and certain other courses in the Ph.D. program can be found in TAMU Graduate Catalog.

i. Time Limit

All degree requirements for the M.S. and Ph.D. must be completed within 7 and 10 years, respectively, of entering the degree program, in accordance with provisions contained in the TAMU Graduate Catalogue.

j. Applications and Deadlines
All applications and deadlines will be in accordance with provisions of the OGS, TAMU and the TAMUCC OGS.

k. Examinations

1. For the M.S. degree

A final examination will be required of both thesis option and non-thesis option students. However, a thesis option student may be exempt from taking the final examination with a GPR of 3.5 or higher. The examination will cover all fields of general biology, as well as the specific research topic in the case of thesis option students. Thesis option students may schedule the final examination after completion of all course work or if they are currently registered in final required course work and after the thesis, in substantially final form, has been submitted to their committee for review. Non-thesis option students may schedule the final examination after completion of all course work. Both thesis option and non-thesis option students must have a GPR of 3.0 or higher for courses on the degree plan completed within the participating colleges, and there must be no unresolved grades of D, F or U for any course listed on the degree plan.

2. For the Ph.D. degree

A preliminary examination, written and oral, is required, and shall be administered in accordance with the rules outlined in the Graduate Catalogues of the respective institution. It will be given no earlier than a date at which the student is within approximately 6 credit hours of completion of the formal course work on the degree plan, or no later than the end of the semester following completion of the formal course work on the degree plan. The written portion of the exam shall cover all fields of study included in the student’s degree plan. The written examinations must be completed and reported as satisfactory before the oral portion of the examination may be held. On successful completion of the preliminary examination (written and oral portions), all graded coursework on the degree plan with the exception of any remaining 681, 684, 690 and 691, residency requirements met, and submission of an approved dissertation proposal, the student will be admitted to candidacy.

Students enrolled through TAMU or TAMUG must pass the final examination/dissertation defense by deadline dates published in the TAMU OGS calendar and students enrolled through TAMUCC must pass the final examination/dissertation defense by deadline dates published in the TAMUCC OGS calendar. No student may be given a final examination unless their GPR is 3.0 or above, they have been admitted to candidacy, and there are no grades of D, F or U for any course listed on the degree plan.

2. Identify and describe special requirements for the program, e.g. clinicals, field experience, internships, practicum, thesis, etc.

1. For the M.S. degree

The M.S. student will be encouraged to teach undergraduate laboratory courses for at least one semester, especially if the student has not already had teaching experience as a graduate student or teaching professional. All teaching assistants will comply with Southern Association of Colleges and Schools (SACS) requirements that they have either 18 graduate credit hours in the subject matter or will be under the direct supervision of a faculty member.

Research experience and writing a thesis are considered normal requirements for thesis option programs leading to M.S. degrees in the marine biological field.

2. For the Ph.D. degree

The Ph.D. student will be encouraged to teach undergraduate laboratory courses for at least two semesters, especially if the student has not already had teaching experience as a graduate student or teaching professional. All GATs will comply with SACS requirements that they have either 18 graduate credit hours in the subject matter or will be under the direct supervision of a faculty member.
The Ph.D. dissertation is required and shall demonstrate the ability to perform independent research. The dissertation must be the original work of the candidate.

No specific internships are required, although individual faculty mentors may recommend an internship as a means of expanding the student's knowledge and understanding of his or her chosen field.

3. If transfer students would be admitted to the program, list articulation agreements completed, in negotiation, or planned.

In accordance with limitations stated in the TAMU Graduate Catalogue, students who transfer into the program may apply up to 12 graduate credit hours toward the degree plan. No special articulation agreements have been completed, are in progress, or are planned. Transfer hours are not limited for the Ph.D.

D. Curriculum

1. Identify by prefix, number, title, and description (including prerequisites) courses to be required or elected in the proposed program. Identify with an asterisk (*) courses added during the last three academic years, and with two asterisks (**) courses to be added if the program is authorized.

**Marine Biology**
(MARB)

606. Advanced Concepts in Marine Population Biology* (3-0). Credit 3 Survey of recent scientific papers, methods, and concepts in the fields of marine biology and ecology with lecture and discussion materials based on recent (published within the last few years) texts and articles from leading journals such as Nature, Science, Ecology, Marine Ecology Progress Series, etc. Prerequisite: approval of instructor.

613. Molecular Techniques in Marine Biology** (1-3). Credit 2. Laboratory techniques in molecular biology that can be applied to the study and understanding of life in the sea. Prerequisites: graduate standing or approval of instructors.

616. Introduction to Methods in Scientific Diving* (2-3). Credit 3. Prepare and qualify divers for entry into the TAMUG Scientific Diving Program. Students must pass medical, swimming, skin diving and scuba diving tests. Lectures include diving equipment, physics, physiology, medicine, regulations, environment, emergency and decompression procedures. Prerequisites: advanced scuba certification or approval of instructor.

617. Research Diving Methods* (0-6). Credit 2. Survey of research methods and techniques using diving. Designed to train students in safe, efficient use of diving to collect and record data underwater for studies primarily in biology, geology, and archaeology. Students will be expected to develop and execute a research project in an appropriate subject area. Prerequisites: MARB 616 or approval of instructor.

620. Marine Biological Resources* (3-0). Credit 3. Introduction to management and conservation of biological resources for food, recreation and employment. Emphasis on resource conservation and management of marine fisheries and mariculture. Prerequisites: BIOL 114, CHEM 102, GEOL 104, or OCNG 251.

651. Shore and Estuarine Fishes of the Gulf of Mexico* (2-6). Credit 4. Taxonomy, ecology and zoogeography of fishes inhabiting estuaries and marine ecosystems of the northwestern Gulf of Mexico. Emphasis on community structure and factors affecting spatial and temporal abundance of fishes found along the Texas coast. Prerequisites: MARB 311 or equivalent; approval of instructor.

653. Life in Extreme Environments** (2-0). Credit 2. Comparison of community structure and function in extreme environments, including hypoxia and anoxia, methane seeps, deep sea, hydrothermal vents, caves, hypersalinity, and polar habitats with extraterrestrial extrapolations. Prerequisite: approval of instructor.

654. Coastal Plant Ecology* (3-3). Credit 4. Study of the identification, distribution, production, ecological importance, evaluation and management techniques, and abiotic and biotic environments of estuarine, coastal, and dune vascular plants. Prerequisite: approval of instructor.

655. Wetlands Ecology, Monitoring and Delineation* (2-6). Credit 4. Study of the characteristics and importance of wetlands, and methods of delineating, monitoring, and evaluating of wetlands. Students will learn wetland plants, soils, hydrology, ecology of wetlands, animals inhabiting wetlands, delineation techniques, laws pertaining to wetlands, permits required for impacts, mitigation and management techniques for wetlands. Prerequisite: approval of instructor.

656. Tropical Marine Ecology* (2-3). Credit 3. Field-oriented experience in coral reef, mangrove, sea grass, and other tropical marine ecosystems. Biodiversity, ecology, and conservation issues of the Yucatan Peninsula emphasized. Student must develop independent research project. One week of lecture in Galveston is followed by two weeks of fieldwork in the Yucatan Peninsula. Field trips required. Prerequisites: advanced scuba certification and 20 dives, or approval of instructor.
662. Biology of Marine Mollusca* (3-3). Credit 4. Survey of marine mollusks including their morphology, ecology, physiology and reproduction. Emphasis on species of ecological and commercial importance. Prerequisites: MARB 435 or MARB 665, or equivalent.

665. Marine Invertebrate Zoology* (3-3). Credit 4. Taxonomy, morphology, biology and phylogeny of invertebrates. In depth discussions about major taxa. Detailed dissections of representative organisms, with written and oral presentations of the dissections. Prerequisites: MARB 435 or equivalent; approval of instructor. Cross listed with ZOOL 665.


681. Seminar* Credit 1 each semester. Important current developments in marine biology with special reference to the literature. May be repeated once for credit.

684. Professional Internship* Credit 1 to 9 each semester. On-the-job training in the field of marine biology. Prerequisite: graduate standing in Marine Biology.

685. Problems* Credit 1 to 6 each semester. Limited investigations in fields other than those chosen for the thesis or dissertation.

689. Special Topics in ....* Credit 1 to 4. Special topics in marine biology. May be repeated for credit.

691. Research* Credit 1 or more each semester. Original research on selected marine biology problem to be used in thesis or dissertation.

### Biology (BIOL)

601. Biological Clocks. (3-0). Credit 3. Introduction to the formal properties of biological rhythms; cellular and molecular bases for rhythmicity; temporal adaptations of organisms using clocks. Prerequisite: Graduate classification or approval of instructor.

602. Transmission Electron Microscopy. (3-6). Credit 5. Methods of studying biological material with the transmission electron microscope, fixation, ultra-microtomy, cytochemistry, replica and shadowing, and other biological related procedures. Prerequisite: Approval of instructor received one month prior to registration.

611. Molecular Biology of Differentiation and Development. (3-0) Credit 3. Major paradigms of eukaryotic gene regulation in terms of the role of gene expression during ontogeny and the effect of dysfunction in these processes on the neoplastic state.

617. Cell Biology. Credit 1 to 5. Structure and function of eukaryotic cells discussed on a comparative basis to seek out basic organization of complex cells and their parts. Prerequisite: BIOL 413 or approval of instructor. Cross-listed with VAPH 617.

650. Genomics. (2-0) Credit 2. Modern genomics as a tool for understanding biological systems; review of gene structure and organization and the history of sequencing technologies; focus on transcriptional, translational and functional genomics. Prerequisite: Graduate classification or approval of instructor.

670. The Cell Cycle. (1-0) Credit 1. Discussion of current cell cycle research, a universal principle of molecular, cellular and developmental biology, and the causation of cancer and aging. Prerequisite: BIOL 413 or approval of instructor.

672. Molecular Biology of Photosynthesis. (5-0). Credit 1. Structure, function, and regulation of the photosynthetic apparatus of a variety of photosynthetic systems, including plant chloroplasts, cyanobacteria, and purple and green photosynthetic bacteria; emphasis on regulation of expression of genes that encode photosynthetic membrane components. Prerequisite: BICH 631.

673. Cellular and Molecular Aspects of Development. (3-0) Credit 3. Mechanisms of development at the cellular and molecular levels; gene regulation during embryogenesis; tissue interactions in relation to morphogenesis and differentiation, and pattern formation; emphasis on eukaryotic systems. Prerequisite: BIOL 413 or 414 or equivalent.

### Botany (BOTN)

620. Field Systematic Botany. (2-6) Credit 4. Basic principles and concepts of seed plant systematics; procedures of identification, family recognition, terminology, nomenclature, herbarium techniques, systems of classification and the taxonomic literature. Prerequisite: BOTN 301 or equivalent or approval of instructor.

635. Plant Molecular Biology. (3-0) Credit 3. Molecular aspects of plant growth, development, reproduction and evolution, emphasizing the structure, function, regulation, interaction and manipulation of plant genes; practical applications of plant molecular biology. Prerequisite: GENE 431

636. Plant Cell Biology. (3-0) Credit 3. Biogenesis, structure, function and interactions of plant cells during development, with emphasis on current literature and experimental approaches. Prerequisite: BIOL 430 or 617 or approval of instructor.

### Microbiology (MICR)
606. Microbial Genetics. (3-0) Credit 3. Basic understanding of microbial genetic systems and how genetic analyses can be used to investigate fundamental biological processes in microbes. Prerequisite: Approval of instructor.

Zoology
(ZOOL)

605. Principles and Methods of Systematic Biology. (3-3) Credit 4. Evolutionary theory, sub-specific variation, speciation and phylogeny; evolutionary, cladistical and numerical taxonomy, methods and rules used in viral, bacteriological, botanical and zoological classification. Prerequisite: Graduate classification.

634. Comparative Neurobiology. (3-0). Credit 3. Cellular, molecular, and systems neurobiology, together with neuroethology. A comparative approach to subject matter is stressed. Topics such as evolution of nervous systems and their diverse structure and complex functions are dealt with.

649. Comparative Endocrinology. (3-3) Credit 4. Function of endocrine glands and hormonal regulatory systems in different animal groups, vertebrates and invertebrates; mechanism of action of hormones at the cellular and molecular level; recent experimental advances in endocrinological research; isolation; purification and assay of certain hormones. Prerequisite: Course in physiology, BICh 410 or equivalent, or approval of instructor.

653. Zoogeography. (3-0). Credit 3. Evolutionary, geological and ecological interpretations of the present and past distributions of terrestrial, freshwater and marine organisms.

654. Field Zoogeography. (0-3). Credit 1. An optional laboratory designed to accompany ZOOL 653, Zoogeography; field studies of ecological, geological and systematic processes which govern the geographical distribution of animals and the formation of biogeographical provinces. Prerequisite: Graduate classification.

663. Biology of the Crustacea. (3-3) Credit 4. Classification, life history, morphology, physiology, ecology, diseases, parasites and predators of crustaceans; economic aspects of crustaceans; original literature emphasized. Prerequisite: ZOOL 335 or equivalent, or approval of instructor.

664. Biology of Invertebrates. (3-3) Credits 4. Morphology, biology and phylogeny of invertebrates. Topics may be either detailed discussions of specific organisms or comparative information on a process. Prerequisite: ZOOL 335 or equivalent.

667. Biology of the Marine Annelida. (3-3). Credit 4. Survey of marine annelids including their physiology, reproduction; emphasis on morphology and taxonomy of polychaetous annelids to enable students to more rapidly and accurately analyze benthic assemblage data. Prerequisites: ZOOL 335 or equivalent; approval of instructor.

Oceanography
(OCNG)

608. Physical Oceanography. (3-2) Credit 4. Observations, instruments; physical properties of seawater; property distributions; characteristics of water masses; heat budget; kinematics; gravity, pressure, hydrostatics, stability; horizontal flow; Coriolis force, geostrophy; friction, wind drift; general circulation; wave motions; tides. Prerequisite: MATH 172 or equivalent; PHYS 219.

610. Mathematical Modeling of Marine Ecosystems. (3-2). Credit 3. Theory and technique of model development for marine ecosystems; mathematical representation of interactions among nutrients, phytoplankton, zooplankton, fish and the physical environment; scrutiny of biological concepts and mathematical structure of existing models; laboratory segment to focus on computational techniques applicable to classroom problems. Prerequisites: OCNG 608 and 620, calculus or approval of instructor.

620. Biological Oceanography. (3-0) Credit 3. Critical analysis of contribution of biological science to our understanding of sea; discernible interrelationships between organisms and physiochemical parameters. Prerequisites: General prerequisites for oceanography.

622. Analysis of Benthic Communities. (2-3) Credit 3. Comprehensive study of marine benthos with principal emphasis upon Gulf of Mexico and Caribbean Sea. Prerequisite: OCNG 620 or equivalent.

625. Current Topics in Biological Oceanography. (1-0) Credit 1. Areas of current research; plankton processes; microbial food web; benthic communities; fisheries; global change. May be taken up to three times. Prerequisite: OCNG 620 or approval of instructor.

627. Ecology of the Continental Shelf. (3-0). Credit 3. Environments, populations and communities of the continental shelf. Interactions of the shelf with the estuaries and the deep sea; man’s impact on the shelf ecosystems. Prerequisites: Approval of instructor.

629. Lower Food-web Dynamics of Aquatic Ecosystems. (2-3). Credit 3. Dynamics of the lower food web in estuaries, rivers and lakes, detailing the role and interactions between biota and how they are influenced by abiotic processes; effect of man’s activities on natural succession patterns and ecosystem productivity, elucidating the potential for new management practices. Prerequisite: Graduate classification. Cross listed with WFSC 629.


642. Marine Biochemistry Lab. (0-2) Credit 1. Laboratory exercises including analyses of salinity, oxygen, nutrients, carbon dioxide system, organics; focus on both dissolved and solid phases; measurements of phytoplankton biomass, productivity, growth and mortality; determination of water column and benthic biomass and respiration; microbial biomarkers; overview of field instrumentation. Prerequisites: General prerequisites for oceanography; graduate classification.

644. Isotope Geochemistry. (3-0). Credits 3. Stable and radioactive isotope variations in natural materials; applications to geochronometric, geothermometric and paleoclimatologic studies of the marine environment. Prerequisite: Approval of instructor.

645. Marine Organic Geochemistry. (3-0). Credit 3. Origins, fates and distribution of organic compounds in contemporary marine environments and in recent and ancient sediments. Specific analytical techniques. Prerequisite: Approval of instructor.

647. Chemical Contamination of the Marine Environment. (3-0). Credit 3. Assessment of the inputs, transfers, effects and fates of heavy metals, radio-nucleides, petroleum hydrocarbons, chlorinated hydrocarbons and other chemicals in the ocean; models developed to predict the future viability of the ocean with particular emphasis on the Gulf of Mexico. Prerequisite: Approval of instructor.

649. Estuarine Biogeochemistry. (3-0) Credit 3. Geomorphology; physical oceanography and sedimentation dynamics of estuaries; chemistry of nutrients; trace metals and organic matter; major controls in estuarine productivity and interactions among estuaries, marshes and coastal waters. Prerequisites: OCNG 620 and 640.

650. Aquatic Microbial Ecology. (3-0). Credit 3. microbes in natural environments, including both water and sediment habitats in marine, fresh and ground water systems; process studies of microbial food webs and biogeochemical cycling; current methods and research directions. Prerequisites: OCNG 620 and WFSC 414 or approval of instructor. Cross listed with WFSC 650.

652. Sedimentary Biogeochemistry. (3-2). Credit 4. Focus on benthic processes occurring near the sediment-water interface of marine sediments; interdisciplinary approach in examining complex interrelationships among organisms, pore waters and sedimentary minerals in different marine environments; laboratory methods taught and applied to field case studies in different marine environments. Prerequisites: OCNG 620 and 640 or approval of instructor.


660. Implementing Marine Ecosystem Models. (3-0). Credit 3. Examination of examples of implementations of models of marine ecosystems in the most influential papers; students expected to code the simpler examples and analyze them; review of important nutrient-phytoplankton-zooplankton (NPZ) models as well as other approaches to studying aquatic ecosystems. Prerequisite: approval of instructor.

662. Coastal and Marine Sedimentary Processes. (3-2). Credit 4. Sedimentary processes (erosion, transport and deposition) from the coastline to the deep sea; development of estuaries, deltas, continental shelves, submarine canyons, fans; behavior of fluids and particles in boundary layers. Lab: recirculation flume, field and lab instrumentation. Prerequisite: Approval of instructor.

674. Paleooceanography. (3-0). Credit 3. History of oceans through the geologic time; marine paleontological, geochemical, sedimentological and geophysical evidence; inferred changes in seawater properties, ocean circulation and sea level; relation to climate, tectonic processes, atmospheric chemistry and evolution of life. Prerequisite: OCNG 630 or approval of instructor.

689. Environmental Management System Strategies for the Scientist. (3-0) Credit 3. Provide students with EMS strategy skills: environmental laws that may be triggered by activities; fundamental structure of an EMS; EMS alternatives; concepts in an audit; alternative dispute resolution; how effectively EMS can reduce costs and increase profits. Prerequisite: approval on instructor. Cross listed with MARS 675 at Texas A&M University at Galveston.

690. Marine Environmental Policy: A Survey. (3-0). Credit 3. Basic concepts and mechanisms of international and US federal environmental law and policy; survey of the field and focus on case studies illustrating basic types of environmental problems. Prerequisite: approval of instructor. Cross listed with MARS 675 at Texas A&M University at Galveston.

691. Oceanographic Data Collection and Analysis Methods. (3-0). Credit 3. Applications of data collection strategies, numerical methods, the actual mechanics of oceanographic data analyses, and interpretation of the results (i.e., hypothesis testing). Primary emphasis on common techniques and approaches used in collection and analysis of oceanographic data. Prerequisite: graduate standing.

Rangeland Ecology and Management (RLEM)

609. Nutrient Cycling: Global and Ecosystem Perspectives. (3-0). Credit 3. Biogeochemical cycles of carbon, nitrogen, sulfur, and phosphorous and their interaction with biotic and abiotic processes; biogeochemical processes investigated at the
global level and in several types of terrestrial ecosystems; addressing global climate change, deforestation, acid precipitation, ozone depletion. Prerequisite: RENR 205 or equivalent; graduate classification.

610. Wetland Plant Taxonomy. (1-4). Credit 3. Interpretation of plant morphologies for keying and the identification of wetland plants from prime habitats; plant communities including the plant's adaptation to variation in salinity and soils; identification of inconspicuous flowered plants species including sedges, rushes and grasses. Prerequisite: RLEM 304 or approval of instructor. Offered Fall semester of even numbered years.

Renewable Natural Resources
(RENR)

664. Coastal Zone Management. (3-0). Credit 3. Major issues of coastal management in the United States; relationships between natural environments of the coastal zone and public policies affecting the development, use and conservation of natural resources.

Statistics
(STAT)

601. Statistical Analysis. (3-2). Credit 4. For students in engineering, physical and mathematical sciences. Introduction to probability, probability distributions and statistical inference; hypothesis testing; introduction to methods of analysis such as tests of independence, regression, analysis of variance with some consideration of planned experimentation. Prerequisite: MATH 152 or 172.

602. Statistical Methods of Regression Analysis. (3-0). Credit 3. Linear, nonlinear, nonparametric and logistic regressions; methodologies and their statistical foundations for detection of collinearity, outliers and correlation in errors or independent variables. Prerequisites: STAT 601 or 641; STAT 610; MATH 423 or equivalent.

651. Statistics in Research I. (3-0). Credit 3. For graduate students in other disciplines; non-calculus exposition of concepts, methods and usage of statistical data analysis; T-tests, analysis of variance and linear regression. Prerequisite: MATH 102 or equivalent.

652. Statistics in Research II. (3-0). Credit 3. Continuation of STAT 651. Concepts of experimental design, individual treatment comparisons, randomized blocks and factorial experiments, multiple regression, x2 tests and a brief introduction to covariance, non-parametric methods and sample surveys. Prerequisite: STAT 651.

653. Statistics in Research III. (3-0). Credit 3. Advanced topics in ANOVA; analysis of covariance; and Regression Analysis including analysis of messy data; non-linear regression; logistic and weighted regression; diagnostics and model building; emphasis on concepts; computing and interpretation. Prerequisite: STAT 652.

Veterinary Anatomy and Public Health
(VAPH)

605. Chemical Hazard Assessment. (3-0). Credit 3. Chemical and biological methods for testing hazardous chemicals and complex mixtures; chemical analysis; microbial bioassays; developmental toxicity; enzyme induction; mammalian cell culture. Prerequisite: Graduate classification.

618. Food Toxicology. (3-0). Credit 3. The study of food additives, chemical and microbial contaminants, and naturally occurring toxins associated with foods. Prerequisite: Graduate classification.


670. Basic Environmental Toxicology. (3-0). Credit 3. Introduction to general principles of toxicology; test methods, target organs and risk assessment for engineers and other non-toxicologists; risk assessment methodology. Prerequisite: Graduate classification.

Veterinary Microbiology
(VTMI)


643. Pathogenic Bacteriology I. (3-4). Credit 4. Pathogenic bacteria, their culture and biological characteristics and pathogenicity. Prerequisite: Minimum of 8 hours of undergraduate microbiology.

Veterinary Physiology and Pharmacology
670. Toxicology. (3-3). Credit 4. Fundamentals of toxicology including the disease syndromes produced in humans and animals by organic and inorganic chemicals; environmental factors in intoxications. Prerequisite: Advanced standing in biochemistry and physiology; approval of instructor.

671. Toxicology Testing Concepts. (2-2). Credit 4. Approval process for compliance with federal drug and chemical laws. Prerequisites: VTPP 665 and 670 or approval of instructor.

676. Genetic and Molecular Toxicology. (3-0) Credit 3. Mechanisms of toxicant-induced target organ toxicity with emphasis on molecular control of mammalian and cell growth differentiation. Prerequisite: Graduate course in cell biology or biochemistry.