Marine Sciences

Department Information

Department of Marine Sciences website
http://www.southalabama.edu/marinesciences

Undergraduate Minor In Marine Sciences

Seventy percent of the Earth's surface is occupied by oceans. This dominance means that oceans exert a major influence on atmospheric dynamics and terrestrial ecology. The societal and economic importance of healthy ocean ecosystems cannot be overstated or ignored. The Department of Marine Sciences welcomes qualified students who wish to better focus their academic training towards oceanography and marine biology. The undergraduate minor in marine sciences is designed to complement many science and non-science majors offered at USA. Ocean-related science is relevant to many contemporary environmental issues and problems and central to understanding earth-system evolution, dynamics, climate and sustainability. The minor consists of courses and research opportunities offered primarily by faculty and researchers in the Department of Marine Sciences and the Dauphin Island Sea Lab.

Requirements for a Minor in Marine Sciences include a minimum of 18 hours in Marine Sciences related classes. The student must take MAS 134 Ocean Science, MAS 134L Ocean Science Lab, MAS 331 Marine Sciences I and MAS 332 Marine Science II. In addition to these core requirements, students must take 2-3 electives courses (MAS 371, MAS 367, MAS 430, MAS 451, MAS 471, MAS 475 or other electives approved by the Chair). Up to 6 hours required by a student's major may be applied toward the minor. The Marine Science minor places a strong emphasis on a rigorous natural science foundation; thus, several of the upper division courses related to the minor have prerequisites. Students planning the minor should check catalog course descriptions carefully and should meet with advising staff in the Marine Science Program office.

Master Of Science (M.S.) In Marine Sciences

The Master of Science (M.S.) Program in marine sciences is designed to train and prepare superior students for a career in this field. The marine sciences program offers courses and opportunities for research in four main areas: biological, chemical, physical, and geological oceanography. Each M.S. student receives formal training in at least three of these disciplines while concentrating in a specific research area. Thus, the program is structured to develop the capacity for productive and innovative research, founded on a solid background of broad scientific knowledge. The requirements and procedures that follow are specifically for the Department of Marine Sciences. However, the general rules and policies of the Graduate School also apply.

Minimum Requirements For Admission

Application before January 15 is encouraged; beginning February 1, the admission committee will make initial recommendations about applicants for the following Fall class, with formal letters sent to applicants by the end of April. Although students are normally admitted in the Fall Semester, depending on availability of space and funding, applications may be approved and students admitted throughout the year. In addition to the general admissions requirements of the Graduate School, minimal requirements for admission in full standing to the Marine Sciences M.S. Program are:

1. A baccalaureate degree in marine sciences or in a discipline related to marine sciences (e.g., biology, chemistry, geology, physics) from an accredited four year college or university
2. Applicants to graduate programs in Arts and Sciences typically have a minimum GPA of at least a 3.0 on all undergraduate work. In exceptional cases, applicants may be considered with at least a 2.5 GPA on all undergraduate work, or at least a 2.75 GPA on the last 60 hours of undergraduate work.
3. A minimum score of 300 combined on the verbal and quantitative subtests of the Graduate Record Exam (GRE)

The applicant will be required to submit:

1. A completed application including a statement indicating the student's interests and professional goals
2. Official transcripts from all undergraduate institutions attended
3. Three letters of recommendation
4. Official scores from the Graduate Record Exam (General Test)

Assessment of credentials will be supplemented by evaluation of letters of recommendation and the educational background of the student. Foreign applicants will be required to pass the TOEFL exam with a score of 71 or greater, or equivalent score on computer administered tests.

To insure compatibility between the student's research interests and the faculty expertise in the Marine Sciences Department, particular attention will be given to the statements of research interests. A faculty member will be asked to act as a "mentor" for the applicant based on the statement of interest and, if necessary, a personal interview. Through this process the student's interests will be matched to the expertise available within the faculty. Moreover, the mentor also may be able to offer the student financial support if a departmental stipend is not available. Students whose interests do not correspond to those of a faculty member and/or have not identified a faculty willing to serve as a mentor, will not be admitted into the M.S. degree program in marine sciences.

Application forms for admission can be found at http://www.southalabama.edu/departments/admissions/. Applications for fellowships (see below) are obtained by writing to: Chair, Department of Marine Sciences, University of South Alabama, Mobile, AL 36688-0002 or visit the website at http://www.southalabama.edu/marinesciences

Fellowships And Assistantships

The Department of Marine Sciences offers a variable number of research assistantships that are sponsored by externally funded grants and contracts. The current stipend for M.S. students is $17,000 per year. Additional funding for tuition fellowship may also be available through extramural grants. Information about assistantships is available from the Office of the Dean of the Graduate School, Administration Building Room 340, University of South Alabama, Mobile, AL 36688-0002.

Master Of Science (M.S.) In Marine Conservation And Resource Management

The M.S. in Marine Conservation and Resource Management is designed to provide a formal course of training and professional development in the marine sciences that will enable students to contribute to the sustainable management of marine resources.

The program does not require thesis research, but instead offers professional development through group projects and professional internships with government agencies, NGOs, and environmental consulting firms. The curriculum and other requirements can accommodate students currently in the workforce.

Minimum Requirements For Admission

Applications for Fall admission are due by April 15 of each year. Enrollment normally begins in the fall semester; however spring admissions will be considered on a case by case situation. In addition to the general admissions requirements of the Graduate School, minimal requirements for admission in full standing to the M.S. Program in Marine Conservation and Resource Management are:

1. A baccalaureate degree in a discipline related to marine sciences (e.g., biology, chemistry, geology, physics, and engineering) or conservation biology (economics, sociology) from an accredited four year college or university
2. Applicants to graduate programs in Arts and Sciences typically have a minimum GPA of at least a 3.0 on all undergraduate work. In exceptional cases, applicants may be considered with at least a 2.5 GPA on all undergraduate work, or at least a 2.75 GPA on the last 60 hours of undergraduate work.
3. A minimum score of 300 combined on the verbal and quantitative subtests of the Graduate Record Exam (GRE)

The applicant will be required to submit:

1. A completed application including a statement indicating the student's interests and professional goals
2. Official transcripts from all undergraduate institutions attended
3. Official scores from the Graduate Record Exam (General Test)

Doctor Of Philosophy (Ph.D.) Program

The Doctor of Philosophy (Ph.D.) Program in marine sciences is designed to provide formal course work and advanced research in marine sciences that produces significant, original contributions to knowledge. The Ph.D. degree is awarded to students who have reached and formally demonstrated a level of competence and accomplishment that enables them to pursue careers as marine science professionals. The Ph.D. degree confers eligibility for many positions in academia, industry, and government.

The marine sciences program offers courses and opportunities for research in multiple sub-disciplines: biological, chemical, physical, and geological oceanography as well as marine ecology and fisheries. Each student receives formal training in each of these disciplines while concentrating in a specific research area. The requirements and procedures that follow are specifically for the Department of Marine Sciences. However, the general rules and policies of the Graduate School also apply.

Minimum Requirements For Admission

Students are normally admitted in the Fall Semester. Although applications for admission and fellowships are accepted throughout the year, application before February 1 is encouraged; beginning February 15 the admissions committee will make initial recommendations about applicants for the following Fall class, with formal letters sent to applicants by the end of April. Depending on availability of space and funding, applications may be approved and students admitted throughout the year. In addition to the general admissions requirements of the Graduate School, requirements for admission to the Marine Sciences Ph.D. program are:

1. A narrative statement indicating the student's research interests, professional goals and commitment to full-time study for completion of degree requirements
2. Three letters of recommendation
3. For students with baccalaureate degrees:
    a. Official scores from the Graduate Record Examination General Test with a minimum score of 300 combined on the verbal and quantitative subtests
    b. A baccalaureate degree in a discipline related to marine sciences (e.g., biology, chemistry, geology, physics) from an accredited four-year college or university
    c. Applicants to graduate programs in Arts and Sciences typically have a minimum GPA of at least a 3.0 on all undergraduate work. In exceptional cases, applicants may be considered with at least a 2.5 GPA on all undergraduate work, or at least a 2.75 GPA on the last 60 hours of undergraduate work.
4. For students with M.S. degrees:
    a. An M.S. degree in a discipline related to marine sciences (e.g., biology, chemistry, geology, physics) from an accredited college or university
    b. A graduate minimum grade-point average of 3.00 overall (A=4)
5. International students must submit an official score of at least 71 on the Test of English as a Foreign Language (TOEFL), or equivalent score on computer administered tests

To ensure research compatibility between the student and the faculty in the marine sciences program, attention will be given to the statement of research interests. A faculty member will be asked to act as a mentor for the applicant based on the statement of interests and, if necessary, a personal interview. Through this process, the student's interests will be matched to the expertise available within the faculty. Moreover, the mentor may also be able to offer the student financial support if a stipend is not available. Students whose interests do not correspond to those of a particular faculty mentor, and have not identified a faculty member willing to serve as a mentor, will not be admitted into the Ph.D. degree program in marine sciences.

Application forms for admission to the program and for fellowships (see below) are obtained by writing to: Chair, Department of Marine Sciences, University of South Alabama, Mobile, AL 36688-0002.

Fellowships And Assistantships

The Department of Marine Sciences offers at-large fellowships to Ph.D. students annually on a competitive basis. In addition, there are a variable number of doctoral assistantships that are sponsored by externally funded grants and contracts to faculty. The current stipend for Ph.D. fellowships is $20,000 per year plus a tuition fellowship and waiver of out-of-state fees. Prospective students must submit applications by February 1 to receive consideration for at-large fellowships. Information about assistantships is available from the Office of the Dean of the Graduate School, Administration Building Room 340, University of South Alabama, Mobile, AL 36688-0002.

Areas Of Study

Marine Science (MS) - Marine Conservation
Marine Science (MS) - Non-Thesis Option
Marine Science (MS) – Thesis Option
Marine Science (Ph.D.)
Minor in Marine Sciences

Courses

Marine Sciences (MAS) (MAS)

MAS 134L Ocean Science Laboratory 1 cr
Laboratory experiences associated with BLY 134.
Co-requisite: MAS 134

MAS 134 Ocean Science 3 cr
An introduction to physical, chemical, geological and biological oceanography. Equivalent to BLY 134.
Co-requisite: MAS 134L

MAS 331 Marine Science I 3 cr
This course will present the basic principles of geological and physical oceanography. Marine science is an interdisciplinary science field in which geology, physics, chemistry and biology interact in complex ways that are fundamental to the oceanic environment. This course will examine the characteristics of oceanic and coastal geomorphology and the associated marine sediments as well as the circulation of water masses that reside in these different regions of the world's oceans. Geological oceanography topics that will be covered include: Structure and evolution of ocean basins, types and properties of marine sediments, sediment transport processes and characterizing coastal regions. Physical oceanography topics that will be covered include: basic physical laws, properties of the water and the ocean, air-sea interactions, general circulation and coastal processes.

MAS 332 Marine Science II 3 cr
Oceanography ("ocean"= the marine environment, and "graphy"= the study of) is literally the study of the marine environment. In practice, oceanography is an interdisciplinary science at the intersection of geology, chemistry, physics and biology. Marine Science II focuses on fundamental concepts in chemical and biological oceanography. The study of chemical oceanography will encompass dissolved components, stratification, chemical tracers, marine pollution, ocean acidification and global warming. This will lead to an introduction to biological oceanography, which will include organismal biology, marine adaptation and fisheries. In-class lectures will provide the students with the foundation to understand the principles discussed and will be supplemented with discussion of the modern ways in which these disciplines are pursued.

MAS 367 Marine Biology 4 cr
The relationship of marine organisms to their environment. (Usually taught in the summer semester.) Equivalent to BLY 367. Requires permission of Department Chair.
Pre-requisite: ((BLY 121 Minimum Grade of D or BLY 141 Minimum Grade of D) and (BLY 122 Minimum Grade of D or BLY 142 Minimum Grade of D)) and (BLY 301 Minimum Grade of C or BLY 341 Minimum Grade of C) and (BLY 302 Minimum Grade of C or BLY 311 Minimum Grade of C) and (BLY 303 Minimum Grade of C or BLY 325 Minimum Grade of C) and (CH 115 Minimum Grade of D or CH 131 Minimum Grade of D) and (CH 116 Minimum Grade of D or CH 132 Minimum Grade of D).

MAS 371 Shark and Ray Biology 2 cr
This course will provide an introduction to biology of sharks and rays, with special emphasis on regional shark fauna and field techniques. Topics to be covered include chondrichthyan origin, systematics, sensory biology, trophic ecology, reproductive biology, life history, ecology, fisheries and conservation. Lectures will be supplemented with discussions of papers from the primary literature to familiarize students with current research. In addition, longline, trawl and gillnet sampling will provide students with firsthand knowledge of field techniques and local shark identification. Equivalent to BLY 371. Requires permission of Department Chair.
Pre-requisite: ((BLY 121 Minimum Grade of D or BLY 141 Minimum Grade of D) and (BLY 122 Minimum Grade of C or BLY 142 Minimum Grade of C) and (BLY 301 Minimum Grade of C or BLY 341 Minimum Grade of C) and (BLY 302 Minimum Grade of C or BLY 311 Minimum Grade of C) and (BLY 303 Minimum Grade of C or BLY 325 Minimum Grade of C)).

MAS 430 Marine Botany 4 cr
A general survey of marine algae and vascular and non-vascular plants associated with the marine environment. Distribution, identification, structure, ecology, and reproduction will be considered. Course offered only through Marine Environmental Science Consortium, (usually taught in the summer semester). Equivalent to BLY 430. Requires permission of Department Chair.
Pre-requisite: ((BLY 121 Minimum Grade of D or BLY 141 Minimum Grade of D) and (BLY 122 Minimum Grade of D or BLY 142 Minimum Grade of D) and (CH 115 Minimum Grade of D or CH 131 Minimum Grade of D) and (CH 116 Minimum Grade of D or CH 132 Minimum Grade of D)).

MAS 451 Marine Vertebrate Zoology 4 cr
A study of marine vertebrates, with emphasis on fishes; their systematics, zoogeography, and ecology, (usually taught in the summer semester). Equivalent to BLY 451. Requires permission of Department Chair.
Pre-requisite: ((BLY 121 Minimum Grade of C or BLY 142 Minimum Grade of C) and (BLY 122 Minimum Grade of C or BLY 142 Minimum Grade of C) and (BLY 301 Minimum Grade of C or BLY 341 Minimum Grade of C) and (BLY 302 Minimum Grade of C or BLY 311 Minimum Grade of C) and (BLY 303 Minimum Grade of C or BLY 325 Minimum Grade of C)).

MAS 471 Marine Invertebrate Zoology 4 cr
A study of natural history, systematics, and morphology or marine invertebrates, (usually taught in the summer semester). Equivalent to BLY 471. Requires permission of Department Chair.
Pre-requisite: ((BLY 121 Minimum Grade of C or BLY 141 Minimum Grade of C) and (BLY 122 Minimum Grade of C or BLY 142 Minimum Grade of C) and (BLY 301 Minimum Grade of C or BLY 341 Minimum Grade of C) and (BLY 302 Minimum Grade of C or BLY 311 Minimum Grade of C) and (BLY 303 Minimum Grade of C or BLY 325 Minimum Grade of C)).

MAS 474 Intro to Oceanography 4 cr
A general introduction to the oceans, with emphasis on chemical, physical, and geological processes and their relation to biological systems. Course offered only through Marine Environmental Science Consortium (DISL). Offered during the summer term.
Pre-requisite: (BLY 121 Minimum Grade of C or BLY 141 Minimum Grade of C) and (BLY 122 Minimum Grade of C or BLY 142 Minimum Grade of C) and (BLY 301 Minimum Grade of C or BLY 341 Minimum Grade of C) and (BLY 302 Minimum Grade of C or BLY 311 Minimum Grade of C) and (BLY 303 Minimum Grade of C or BLY 325 Minimum Grade of C).

MAS 475 Marine Ecology 4 cr
The relationship of marine organisms to their environment, (usually taught in the summer semester). Equivalent to BLY 475. Requires permission of Department Chair.
Pre-requisite: ((BLY 121 Minimum Grade of C or BLY 141 Minimum Grade of C) and (BLY 122 Minimum Grade of C or BLY 142 Minimum Grade of C) and (BLY 301 Minimum Grade of C or BLY 341 Minimum Grade of C) and (BLY 302 Minimum Grade of C or BLY 311 Minimum Grade of C) and (BLY 303 Minimum Grade of C or BLY 325 Minimum Grade of C)).

MAS 490 Special Topics 1 TO 4 cr
An in-depth tutorial exposure to specific areas in the marine sciences. Credit and title will be arranged to examine the subject matter in the area of current interest to one group of students. Specialized topics not currently listed in catalog course offerings.

MAS 510 Oceanography and Marine Bio 3 cr
Oceanography is an interdisciplinary science at the intersection of geology, chemistry, physics and biology. This course is designed to be a survey course of these four disciplines with special emphasis on the biological aspects of ocean sciences. In-class lectures will provide the students with the foundation to understand the principles discussed, and will be supplemented with discussion of the modern ways in which these disciplines are pursued.

MAS 511 Marine Analytical Methods 3 cr
This course will provide an introduction to the analytical methods most commonly used in marine science: spectrometry, fluorometry, colorimetry, gas and liquid chromatography and the use of radio-isotopes. The course will consist of lectures covering the theory of each method and laboratory exercises in their use. Throughout, there will be a focus on the quality of the data being collected, as derived from quantitative assessments of accuracy, precision and repeatability; and propagation of errors. Students will be assessed on problem-sets based on data collected in the labs and on a research project using the instruments and techniques of their choice.

MAS 512 Chlorophyll Fluorescence Tech 2 cr
This course will provide an introduction to the scope and application of fluorescence techniques based on excitation of and emission from the ubiquitous plant pigment chlorophyll a. These include fluorometric determination of chlorophyll concentration in vitro; the use of active, single-wavelength fluorometry to assess temporal and spatial variability of chlorophyll a and microalgal biomass in natural assemblages; the use of multiple-wavelength excitation and/or hyperspectral emission to determine taxonomic distributions in vivo; and the use of modulated (pulse-amplitude modulated and fast repetition rate) fluorometry to investigate photosynthetic efficiency and model productivity.

MAS 515 Environmental Toxicology 4 cr
Introduction to the scientific and technical principles of toxicological processes in the context of the ecosystem. Students will understand the types of major environmental toxicants and how to properly evaluate their toxicity and factors that influence toxicity. Students will recognize and coherently formulate risk assessment and by using the tools and techniques acquired, develop and communicate proposals for remediation.
Pre-requisite: (BLY 301 Minimum Grade of C and BLY 302 Minimum Grade of C) and (CH 201 Minimum Grade of C and CH 202 Minimum Grade of C) and (CH 540 Minimum Grade of B and CH 541 Minimum Grade of B).

MAS 520 Marine Resource Management 3 cr
Designed to acquaint graduate students concerned with management of marine resources; development of legislation, evolution of policy, legal processes, impacts on human resources. The emphases will be placed on living resources.

MAS 521 Marine Conservation Biology 3 cr
This course will develop student's understanding of conservation biology in marine habitats. Lectures and assigned or student-selected readings will cover the widest possible range of current topics in marine conservation biology. Regular field trips will supplement and exemplify lecture topics. Each class will include an introductory lecture that presents an overview of basic ecological concepts and historical perspective for the assigned readings, followed by discussion. Students will lead discussion of student selected papers and write a topical term paper.

MAS 522 Horseshoe Crabs- Resource Mgmt 2 cr
The course will travel to Delaware Bay, home of the largest population of horseshoe crabs in the world. Students will gain and apply information on recent conflicts in horseshoe crab research and fishery management to explore political, ecological, and economic values of marine resources, options for management, conservation, and outreach, conflict resolution and applied ecology.

MAS 523 Anthropogenic Impacts on Coast 3 cr
This course will offer a state-of-the-art review of the nature and extent of anthropogenic impacts on marine coastal ecosystems, including climate change, destruction of wetlands, overfishing and nutrient pollution.

MAS 524 Scientific Communication 3 cr
Instruction on the principles of scientific communication and opportunities to practice different forms of written and oral communication common to marine and other sciences. Topics include: 1) the rationale for scientists to communicate effectively, 2) how to identify and share information to different audiences, 3) successful scientific date presentations, 4) writing, editing, publishing, and reviewing abstracts, scientific papers, and proposals, and 5) biases in scientific communication.

MAS 525 Chemical Ecology 3 cr
Chemical Ecology focuses on chemically medicated interactions within organisms in both aquatic and terrestrial environments. The topics covered include: chemoreception, chemical defense, chemical attraction, and the impact of chemical ecology on humans.

MAS 530 Marine Microbial Ecology 3 cr
A general survey of the types of microorganisms found in the marine environment. Emphasis will be on the interaction of microorganisms with each other and with their environment. In particular, the role of microorganisms in carbon cycling and biogeochemical processes will be stressed. Readings from current literature will expose students to the latest techniques and research.

MAS 531 Physiol Eco Marine Microalgae 3 cr
This course will cover the acclimative responses of marine microalgae to variability in light, nutrients, temperature and other environmental factors. Stress responses that are engendered when variability in these environmental factors exceeds the organisms' acclimative capacity will also be covered. The course will emphasize the commonality of these processes across taxa as well as considering taxon-specific responses that allow different groups to exploit their niches. Methods such as molecular biology, active fluorescence and remote sensing that can be used to investigate population dynamics and growth over a range of spatial and temporal scales will be covered.

MAS 532 Marine Trophic Processes 3 cr
This course will examine the nature and controls of the trophic routes followed by primary production and resulting carbon budgets in coastal ecosystems. Trophic processes in marine ecosystems such as herbivory, consumption by secondary consumers, decomposition, export/import and burial will be studied. The course will also offer a review of anthropogenic impacts, such as eutrophication and climate change, on the trophic rate of primary production and carbon budgets in coastal ecosystems. Students are expected to contribute with personal experimental projects and critical reading and discussion of seminal papers.

MAS 533 Marine Molecular Ecology 3 cr
The use of molecular biology in ecological studies has been increasing rapidly with the development of new techniques. These techniques can supplement the laboratory and field studies traditionally part of ecology. This course seeks to introduce the use of molecular techniques in marine ecology through lectures accompanied by computer exercises using data from public databases. Lectures will pull data from the primary literature, with emphasis on examples of applications in marine science. Computer exercises will introduce students to how data is analyzed as well as to some of the programs available to carry out this analysis.

MAS 540 Sediment Biogeochemistry 3 cr
Detailed examination of sediment biogeochemical processes and the implications thereof on nutrient cycles, plant production, and animal distribution, including discussion of early diagenesis in coastal sub-tidal and wetland sediment systems. permission of instructor.

MAS 548 Marine Biogeochem Processes 2 cr
The course will examine the interaction between biological, chemical and geological processes in the marine environment. This will be done by first reviewing the cycling of several of the major elements (e.g. carbon, nitrogen, phosphorus, sulfur, and iron) in the sea, and then examining how these cycles differ between various marine ecosystems (e.g. open ocean surface waters, estuaries, coral reefs, seagrass systems and tidal marshes). The focus will be on developing an understanding of how biogeochemical processes serve to regulate ecosystem function in these various habitats. Prerequisites: Organic chemistry, geology, marine ecology.

MAS 550 Fisheries Techniques 3 cr
Students are exposed to a detailed, semi-quantitative introduction to current biological and technological methodologies for studying fishes and aquatic habitats, with emphasis on study design and integration across sub-disciplines.

MAS 551 Quant Methods Fish and Ecology 3 cr
Ecological and fisheries research has progressed beyond qualitative inference and is continuing to adopt more quantitative methods. A diversity of modeling and experimental approaches exists for ecologists and fisheries scientists. This course is designed to familiarize the students with the most commonly used quantitative approaches. Requires permission of instructor.

MAS 555 Fisheries Oceanography 2 cr
Students examine the relationships between fish life history, recruitment dynamics and harvest potential, and local-, meso- and global scale oceanographic processes. Students are exposed to the evolution in thinking on the role of interaction between biology and physics relative to fish and fisheries.

MAS 560 Mar Exp Ecol 4 cr
Advances in marine ecology and oceanography are dependent on the ability of researchers to design effective and robust experiments to test hypothesis. Understanding the power, limitations and potential biological and statistical artifacts are critical to achieving this goal. The course focuses on fundamental concepts in the design and analysis of experiments in marine sciences, ecology and fisheries. Primary emphasis will be placed on design and interpretation and secondarily on techniques for analyses. 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. In-class demonstrations and take-home problems will provide students with experience in performing many of these analyses.
Pre-requisite: BLY 520 Minimum Grade of C or ST 540 Minimum Grade of C and ST 545 Minimum Grade of C. ST 545 can be taken concurrently with this course.

MAS 570 Ocean Var and Global Change 2 cr
This course will examine large scale, spatial and temporal variability in the Earth/ocean system as evidenced by present-day and paleo records. Variability such as the El Nino Southern Oscillation will be covered. It will critically evaluate the evidence for and the consequences of modern global change as it pertains to the marine environment. Emphasis will be placed on potential changes in climate, biogeochemical cycles, hydrologic cycles, eutrophication/ species diversity, and UV light fluxes. Prerequisites: Permission of instructor.

MAS 571 Marine Hydrodynam-Biomechanics 4 cr
To present an introduction to the importance of small scale fluid dynamics, thermodynamics, and solid mechanics to marine science and to present techniques for measurement of important parameters.

MAS 572 Estuarine Hydrodynamics 3 cr
This course will address physical processes in estuarine environments. With physical processes in estuaries occurring in various time scales, discussion will proceed in terms of three different time scales: turbulent, tidal, and residual time scales. Emphasis will be placed on mass transport by physical transport processes (water movement).
Pre-requisite: MAS 601 Minimum Grade of B.

MAS 573 Oceanology of Gulf of Mexico 3 cr
This course provides a survey of the physics, chemistry, biology, geology and meteorology of the continental margins and deep ocean regions in the Gulf of Mexico and adjacent waters. Requires permission of instructor.

MAS 574 Marine Ecosystem Modelling 3 cr
An introduction to the principles, tools, and applications of marine ecosystem modelling. Emphasis will be placed on biological and physical coupling and numerical representations of these processes. Students will develop facility with numerical tools and learn how to apply coupled models to their ecosystems of interest.

MAS 575 Marine Ecology 4 cr
The course covers general ecological principles and how they apply to marine ecosystems. Both open ocean and nearshore waters are considered. Specific topics covered include: adaptations of marine organisms for life in the intertidal vs. subtitle zones; different modes of feeding and reproduction in marine organisms; and the importance of predation, competition, adult/larval interactions and dispersal mechanisms. The second half of the course is devoted to discussion of specific habitats including: coral reefs, mangrove swamps, kelp forests, and hydrothermal vents.

MAS 576 Benthic Ecology 2 cr
This course covers the evolutionary history and the ecology of marine benthic communities from the earliest fossils to present. The importance of scale and of proper design will considered. Other topics include: predation, competition, adult/larval interactions and dispersal mechanisms. There will be discussion of productivity and materials cycling in benthic systems. Special topics of students' suggestions conclude the course.

MAS 577 Coastal Processes 3 cr
The coastal ocean has a physical regime that is distinct from that of the open ocean. This physical regime contributes to disproportionally high levels of ecological productivity associated with these areas. Because of the often close coupling of physical and biogeochemical processes in the costal ocean, the solutions to the problem facing these ecosystems typically require interdisciplinary perspectives. The objective of the course is to introduce the main physical processes and fisheries in the coastal ocean. The course will provide an overview of the physics operating in the coastal ocean and link the physical forcings to biogeochemical processes and ecosystem function. The course will cover topics from shelf break-open ocean interactions to the fundamental processes operation in estuarine environments. The end goal is for graduate students to acquire a fundamental understanding of the physical mechanisms driving the circulation and the associated hydrographic properties in the coastal ocean and how those physical phenomena link to biogeochemical processes.
Pre-requisite: MAS 601 Minimum Grade of C. MAS 601 can be taken concurrently with this course.

MAS 579 Coastal Ecosystem Dynamics 2 cr
Coastal Ecosystem Dynamics will allow students to investigate the basic principles of ecosystem structure and function. The course is divided into 2 parts: an instructional phase for learning basics of ecosystem modeling, and a student-led investigation of the structure and function of a variety of coastal ecosystems. This approach will give the student a set of quantitative tools for modeling ecosystems. Also, students will learn to evaluate differences and similarities of energy and nutrient processing in disparate ecosystems. There will be one 2 hr class meeting each week during which students will learn to use the ecological modeling software packages 'Ecopath' and 'Ecoism'. During the initial period, students will 'dissect' published models (obtained from the Internet) as a mechanism to understand the utility of ecosystem modeling as well as the basics of this particular software. The second half of the course will be devoted to student-constructed ecosystem models. The models will be constructed from data and pathway descriptions in Alongi's 'Coastal Ecosystem Processes' (CRC Press). A synthesis of these models will be constructed and placed on the WWW.

MAS 580 Marine Biogeo and Paleoecology 3 cr
This graduate level course will give students a broad overview of the time course of evolutionary changes in the structure and function of marine ecosystems, and will consider the interacting roles of both historical and current factors as they influence the distribution and abundance of marine organisms. Lectures will be mixed with discussions of assigned readings from the primary literature to stimulate critical thinking about the various topics.

MAS 581 Advanced Marine Ecology 2 cr
This course will build on the foundations provided by introductory ecology courses to enhance understanding of the mechanisms that control the distribution and abundance of marine plants and animals. The class periods will be dominated by discussions of assigned readings from the primary literature, which will be complemented by summary lecture material.

MAS 582 Marine Larval Ecology 2 cr
An in depth treatment of the taxonomy, nutrition, dispersal, bio-energetics, behavior, and bio-physical coupling of larval forms of marine species.

MAS 583 Field Marine Science I 2 cr
The Field Marine Science course will consist of an 11 day field exercise in representative coastal sites in Maine with emphasis on rocky intertidal, kelp bed and eelgrass habitats. Two faculty members will accompany the students, participate in the pre-trip readings and evaluate the product developed by each student.

MAS 584 Oceanographic Experience 1 TO 3 cr
This course provides students with practical skills involved in oceanographic research. Skills may include hydrographic, hydroacoustic, and organismic sampling, gear deployment and use of analytical instrumentation at sea. Students participate in one or more oceanographic cruises during a semester and carry out a defined project using research tools available on the ship. A final report on the project forms the major part of the course grade. Cruises are available only on an ad hoc basis so permission of the instructor is required.

MAS 585 Marine Zooplankton 3 cr
This course familiarizes the student with the taxonomic breadth of estuarine and marine zooplankton ranging from protistans through all major phyla of metazoa. Though the focus of the course is on taxonomic familiarization, basic biology (including reproduction and feeding) of all major taxa represented in the plankton will be covered. Students will also learn basic and advanced field collection, laboratory and statistical techniques. Although not a prerequisite, it is useful for students to have a background in invertebrate zoology.

MAS 586 Marine Restoration Ecology 3 cr
The course examines factors in the evolution current U.S. and International marine and coastal policy related to the management of natural resources. Course includes policy components, policy information implementation, change processes and economic criteria for evaluating policy effectiveness. The course also surveys the basic approaches to economic valuation of marine resources.

MAS 587 Seagrass Ecosystem Ecology 2 cr
A survey of current literature on topics related to the ecology of seagrass ecosystems. Students will read assigned papers to be analyzed in faculty lead discussion format. A final research paper will be prepared by each student.

MAS 588 Field Marine Science II 3 cr
The Field Marine Science course will consist of an 8 - 12 day field exercise in representative coastal sites. Faculty members with diverse interests will accompany the students, participate in pre-trip discussions and evaluate the product developed by each student. The course is designed to familiarize students with habitats and research conditions on the Northern Gulf Coast. Field trip locations are selected on the basis of faculty and student interest, economics, and availability of logistic support. Students pay their room and board costs for the field exercise. The course is primarily for graduate students, but advanced undergraduates may enroll with consent of instructor. Both MAS 588 and MAS 583 may be taken for credit when each is taught in a different environment.

MAS 589 Marine Plankton 3 cr
The course familiarizes the student with the taxonomic breadth of phytoplankton, bacterioplankton and zooplankton in estuaries, coastal seas and open oceans. Though the focus of the course is on taxonomic familiarization, basic biology (including reproduction and feeding) of all major taxa represented in the plankton will be covered. Student will learn fundamental, as well as "cutting-edge", field laboratory and statistical techniques. Two hours of lectures each week will be accompanied by two hours of hand-on laboratory work. Prerequisites: Graduate status in one of the physical or biological sciences.

MAS 590 Sp Top - 1 TO 4 cr
An in-depth tutorial exposure to specific areas in the marine sciences. Credit and title will be arranged to examine the subject matter in an area of current interest to one or group of students. Specialized topics not currently listed in catalog course offerings. MAS 590 is available to master students - MAS 690 is available to Ph.D. students.

MAS 592 Seminar 1 cr
Students and faculty meet weekly in an interactive discussion of current literature in marine sciences. The focus will be on "state-of-the-art" theories and methodologies as they occur in the primary marine literature. Student presentation is required to receive credit.

MAS 594 Directed Studies 1 TO 4 cr
Independent research, not related to the thesis, under the direction of a member of the graduate faculty. May be used to learn new techniques or explore research questions of special interest. A maximum of 4 hours may be earned for this course toward the MS degree.

MAS 599 Thesis 1 TO 8 cr
Independent research by the student under the sponsorship of a member of the department. Progress reports of the work accomplished are required every six months.

MAS 601 Physical Oceanography 4 cr
Physical properties and circulation of the worlds oceans. Topics to be covered include: basic physical laws; properties of heat, water, and salt budgets; waves; tides; large and small scale circulations; sea-level fluctuations; interactions of the sea with the atmosphere and land masses; light and acoustics.

MAS 602 Chemical Oceanography 4 cr
An in-depth examination of the chemistry of sea water and its relationship with biological, geological, and physical processes in the oceans. Coverage of sea water composition, buffering capacity, redox potential, and photochemistry will form the basis for an in-depth analysis of dynamic equilibria of gases, organic materials, nutrients, and trace elements in the sea. Critical evaluation of recent primary literature in chemical oceanography will be used to illustrate state-of-the art research approaches.

MAS 603 Geological Oceanography 4 cr
Geological Oceanography encompasses the historic and current consequences of both geophysical and classical geological processes. Included topics are tectonic theory and its development, sedimentary processes in coastal and oceanic provinces, stratigraphy, structural geology, micropaleontology, erosion, diagenesis and the formation of hydrocarbons.

MAS 604 Biological Oceanography 4 cr
A comprehensive survey of marine organisms and their interaction including pelagic and benthic communities of the oceans, coastal waters and estuaries. Primary formation of particulate material, feeding processes, kinetics of food webs, biogeochemical processes, patterns of distribution, ecology of biotic systems, human interactions and current concerns are topics to be covered.

MAS 690 Sp Top - 1 TO 4 cr
An in-depth tutorial exposure to specific areas in the marine sciences. Credit and title will be arranged to examine the matter in an area of current interest to one or group of students. Specialized topics not currently listed in catalog course offerings. MAS 590 is available to master students - MAS 690 is available to Ph.D. students.

MAS 692 Seminar 1 cr
Students and faculty meet weekly in an interactive discussion of current literature in marine sciences. The focus will be on "state-of-the-art" theories and methodologies as they occur in the primary marine literature. Student presentation is required to receive credit.

MAS 694 Directed Studies 1 TO 4 cr
Independent research, not related to the dissertation, under the direction of a member of the graduate faculty. May be used to learn new techniques or explore research questions of special interest. A maximum of 4 hours may be earned for this course toward a Ph.D. degree.

MAS 799 Dissertation 1 TO 8 cr
Independent research by the student under the sponsorship of a member of the department.

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