MAINTAIN BIOLOGY AND FISHERIES
- Dept Code: MBF

Degree Programs

Students admitted to the program in the Division of Marine Biology and Fisheries are required to have a strong undergraduate preparation in the life sciences, with additional coursework in mathematics (calculus), physics, and chemistry (through organic). The program offers a series of study-options leading to the M.P.S., M.S. or Ph.D. degrees. These are intended to guide the student in a comprehensive study of marine organisms and the marine environment, and to develop areas of specialization within the marine biological sciences. Students are strongly encouraged to contact the faculty member whose area of research is of interest to them.

Areas of faculty interest include biological oceanography, biochemistry and molecular biology, ecology, fisheries, microbiology, physiology, toxicology, systematics, behavior and ecosystem and fisheries management. Students are not restricted to studies in any one study-option, and may (in consultation with their faculty advisor and/or committee) tailor their academic programs to suit individual interests in more than one area of faculty expertise.

M.S. / Ph.D.

Within the Division of Marine Biology and Fisheries there are four major academic tracks for the M.S. and Ph.D. degrees, each of which has one or more sub-specializations. These are:

1. Biological Oceanography, which has an emphasis on near shore and pelagic marine life;
2. Fisheries Sciences, which focuses on fisheries stock assessment, population modeling, and fisheries management;
3. Marine Biomedical Sciences, which has subspecialties in Marine Molecular Biology and Genetics, Marine Diseases, and Marine Physiology and Biochemistry/Toxicology; and

Individual curricula may blend coursework from one or more tracks depending on the specific interests of the student.

M.P.S.

There are four Marine Biology and Fisheries tracks (http://mps.rsmas.miami.edu/requirements) for the Master of Professional Science (http://mps.rsmas.miami.edu) degree (M.P.S.).

These are:

1. Fisheries Management and Conservation (http://mps.rsmas.miami.edu/degree-program/fisheries-conservation-management): this track allows students to develop the professional skills required to be a fisheries scientist with curriculum options in various relevant areas of interest, such as fisheries management, fisheries surveys, and quantitative fisheries.
2. Marine Mammal Science (http://mps.rsmas.miami.edu/degree-program/marine-mammal-sciences): students in this degree track will prepare for employment in marine mammal management (including associated ecosystems), population assessments, acoustics, and care.
3. Oceans and Human Health (http://mps.rsmas.miami.edu/degree-program/oceans-human-health): With greater use of marine resources, there is a growing concern over the impact of the oceans on human health via water and vector-borne infectious diseases. In this track, students learn to effectively assess these impacts and develop management tactics for future remediation.
4. Tropical Marine Ecosystem Science (http://mps.rsmas.miami.edu/degree-program/tropical-marine-ecosystem): this track provides students with advanced training in the theoretical aspects of tropical marine ecology, as well as the practical aspects needed to begin a career in this field.

Courses

MBF 604. Biology of Marine Mammals. 3 Credit Hours.
The purpose of this class is to introduce students to the biology, evolution, taxonomy, physiology, natural history, behavior, conservation, and management of marine mammals.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 605. Marine Mammal Disease and Medicine. 3 Credit Hours.
This course will cover the basics (theory and application) of marine mammal disease and medicine. Applications will focus on the medical management of managed care and wild populations.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 607. Marine Mammal Applied Behavior Analysis and Managed Care. 3 Credit Hours.
This course involves a thorough examination of specific aspects of marine mammal managed care and conservation programs, with an emphasis on behavior management, analysis, and modification as a basis for adaptive response to changing environments both in-situ and ex-situ. Coursework will also focus on health management and assessment, emergency handling and transportation, government regulations, and wildlife conservation.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 608. Biometrics in Marine Science. 3 Credit Hours.
Applied statistical analysis in marine biology and biological oceanography. Descriptive statistics, probability distributions, and hypothesis testing are discussed. Concepts of analysis of variance, simple linear regression, and computer statistical distribution-free methods are also included as well as principles and procedures with computer statistical packages for data analysis. Lecture and laboratory.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.
MBF 614. Tropical Marine Biology: A Field Course. 3 Credit Hours.
General survey of marine flora and fauna of tropical marine ecosystems. Inhabitants and communities of the sandy shore, rocky shore, seagrass meadows, mangrove shoreline, coral and artificial reefs are collected, identified, maintained. Life histories of representatives are presented. Concepts of island biology and geology such as shore zonation local reef formation and the geological history of the lagoon are also discussed. The 10 day course involves 90 contact hours and approximately 40 hours of formal lectures. Grades are based on a laboratory practicum and written final exam. The course is given in its entirety at the University's field station at Bimini, Bahamas.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 615. Tropical Marine Ecology. 3 Credit Hours.
Marine ecology with emphasis on tropical ecosystems and local habitats. Physical environmental and biotic adaptations, population, and community ecology are discussed. Field exercises in mangrove, seagrass, and coral reef ecosystems are also included.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

MBF 618. Coral Reef Biology, Ecology, And Conservation. 3 Credit Hours.
Coral reefs as integrated systems are examined from geological, ecological, and biological perspectives. The roles of global and local environmental fluctuations, physical disturbance, and biotic interactions in controlling reef formation and community structure are emphasized. The physiology of scleractinian corals and their algal symbionts is described and the prevalence of algal-invertebrate symbiosis on coral reefs related to nutrient cycling, productivity, and food webs on coral reefs.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

MBF 621. Field Techniques and Instrumentation in Tropical Marine Ecology. 3 Credit Hours.
This course covers the instrumentation and field techniques commonly used to characterize the structure and function of the three dominant ecosystems in the tropics and subtropics, i.e. coral reefs, seagrass beds and mangroves.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 639. Oceanic Productivity. 3 Credit Hours.
History, methods, and current topics relevant to studies of marine primary production. Magnitude and fate of primary production in the sea is essential to understanding secondary production, the success of fisheries recruitment, and global climate.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 642. Oceans and Human Health. 3 Credit Hours.
The objective of this interdisciplinary course is to provide students with introductory knowledge of the broad and relatively young field of Oceans and Human Health. The focus is the present, future, and potential effects of oceanic processes and aquatic organisms on human health, and vice versa. These diverse factors reflect the physical, chemical, biotic and social processes which require an integration of information and knowledge from the medical, marine and social sciences. The course covers harmful algal blooms, marine microbes, and global climate change as well as an overview of coastal impacts and remedies (e.g. dugs from the sea and marine models) through a series of coordinated lectures and case studies on human health, physical environment, and oceanographic processes. Prerequisite: Permission of instructor.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 645. Marine Population Assessment Surveys And Analysis. 3 Credit Hours.
In spite of global conservation efforts, marine animal populations show increasingly critical low levels of abundance. Marine population assessment techniques are mostly based on fishery-dependent data for those species that are commercially exploited. Population assessment techniques based on these types of data usually lack spatial resolution and they do not provide spatial-temporal patterns of species diversity and community structure. Conversely, direct resource surveys aim to provide representative estimates of the relative abundance and population structure of the species (and community) of interest. These surveys can generate multi-species population databases that are fundamental for the modeling and understanding of important ecosystem-wide mechanisms of resource conservation. Multi-species indices of relative abundance are also important in the “tuning” of modern stock assessment and conservation methods. In this course students will learn about experimental sampling concepts and designs, instrumentation, survey implementation and statistical methods to directly assess size-structured population abundance (i.e., density estimates scaled to survey area), and of exploited and non-target species (e.g. sea turtles, marine mammals, etc.) in the ecosystem. Students will analyze real data from various surveys carried out in the past using statistical techniques to estimate valid population parameters and variances. Comparative analyses of survey designs are discussed based on an ample literature on the subject matter, which will be made available to the students.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.
MBF 646. Marine Population Biology Processes And Modeling. 3 Credit Hours.
Marine and freshwater animal populations undergo many changes in response to exploitation of core predator and prey species in their ecosystem while subjected to environmental and anthropogenic perturbations in their habitats. Understanding these changes is a major objective of marine population scientists and paramount to marine conservation science. Marine Population Biology Processes and Modeling considers some of the fundamental properties of wild aquatic populations with the aim of knowing and understanding their interactive dynamics. For this purpose mathematical models are used under assumptions that they will provide an adequate description of the biological processes of interest. In this course students will learn conceptual aspects and estimation methods for the main population processes such as growth, survival, reproduction and feeding. Such concepts are framed by mathematical modeling to facilitate interpretation of dynamic population-level processes. Emphasis is also on data requirements and statistical validation of the data and model fitting such that students will develop an ability to integrate and summarize complex biological knowledge under a set of well defined protocols.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Spring.

MBF 650. Analytical Techniques in Marine Biology. 2 Credit Hours.
Theory and applications of selected analytical techniques necessary to conduct quantitative research in marine biology (e.g., electrophoresis, metabolite assays, enzyme assays, radioisotope methodology). One hour lecture followed by three hour laboratory per week.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Offered by Announcement Only.

MBF 655. Graduate Physiology. 3 Credit Hours.
Broad overview of concepts important for physiology. Topics include discussions of genomes, molecular evolution and functional genetics (metabolism), cell biology and cell communication, and organismal-environmental interactions. Readings from the primary literature are included with an emphasis on seminal papers.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Spring.

MBF 665. Fisheries Ecology and Oceanography. 3 Credit Hours.
Course content is intended to introduce fisheries oriented students to key biological, ecological, oceanographic and climatic processes of direct relevance to fishery species. with a view toward development of an ecosystem perspective. The view that marine ecosystems may operate as complex adaptive systems will be presented as a potential key element of effective long-term ecosystem-based marine resources management.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Fall.

MBF 670. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Marine Biology and Fisheries.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Offered by Announcement Only.

MBF 671. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Marine Biology and Fisheries.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Offered by Announcement Only.

MBF 672. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Marine Biology and Fisheries.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Offered by Announcement Only.

MBF 673. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Marine Biology and Fisheries.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Offered by Announcement Only.

MBF 674. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Marine Biology and Fisheries.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Offered by Announcement Only.

MBF 676. Diseases of Marine Organisms. 3 Credit Hours.
Infectious, genetic, and environmentally induced diseases of marine fishes and invertebrates as well as diagnostic methods, cellular, and molecular pathology. Lecture, 3 hours.

**Components:** LEC.
**Grading:** GRD.

MBF 677. Management And Conservation Of Marine Ecosystems. 3 Credit Hours.
In this course students will learn how fisheries management works to achieve these objectives. The primary focus will be on how fisheries interact with marine ecosystems, including how particular fisheries management measures influence fishing mortality rates. Nevertheless, the ecosystem-based approach to fisheries management requires seeing fisheries as integrated systems, so it will also be necessary to discuss social, economic and legal aspects of fisheries management.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Spring.
MBF 678. Evolutionary Genetics. 3 Credit Hours.
A Graduate course that presents an overview from "New Evolutionary Synthesis" (1900) to Evolutionary Genomics. The critical points to emphasize is the importance of standing genetic variation, the role of neutral evolutionary process versus evolution by natural selection and how a evolution perspective provides meaning insights into the biology.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 686. Environmental Biology of Fishes. 3 Credit Hours.
Ecology, dispersal, and modes of life of fishes. Adaptations by larvae and adults to various habitats are covered as well as the effects of man on fish faunas and the importance of fishes to various ecological systems. Lecture, 3 hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

MBF 690. Acoustic Measurement of Nekton, Plankton and Underwater Habitat. 3 Credit Hours.
MBF 590 is an introductory course on the theory, history and applications of acoustics to measure nekton, plankton and structure underwater. It was designed for those students who wish to learn how to make quantitative measures of organisms and structure underwater. It is a prerequisite for MBF 690, Advance Measurement of Nekton, Plankton and Underwater Habitat, which focuses on data acquisition in the field and laboratory signal processing. This course is essential for students who need to make precise and accurate underwater measurements for their research.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 702. Biological Oceanography Seminar. 1 Credit Hour.
Participation is required of all students in Marine Biology and Fisheries department every semester they are in residence whether or not they are registered for the course. Students past their second semester must give one 20-minute presentation per year, on their research or other acceptable topic. Dates are be assigned by lottery. Course may be taken for credit only once.
Components: SEM.
Grading: GRD.
Typically Offered: Fall & Spring.

MBF 704. Biological Oceanography. 3 Credit Hours.
A comprehensive course in Biological Oceanography, including energy flow, biogeochemical cycles, planktonic and benthic ecosystem structure, evolutionary ecology, adaptations of marine organisms, and paleoceanography. Course is required of all MBF students and should be taken in sequence with Oceanography I (MPO 501), Oceanography II (MAC 502), and Oceanography IV (MGG 504).
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 707. Biochemical Toxicology. 3 Credit Hours.
Biochemical mechanisms of absorption, distribution, metabolism, and excretion of natural and synthetic environmental toxicants. Methods for evaluation of acute and chronic toxicity, carcinogenesis, mutagenesis, and teratogenesis including in vivo, isolated organ, tissue culture, and subcellular approaches to toxicity testing are included.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

MBF 710. The Physical Environment of Marine Organisms. 3 Credit Hours.
The fluid environment of the sea influences the growth, distribution, and survival of marine organisms. The physical processes that affect organisms occur in space and time, ranging from the molecular properties of water to basin-wide linkages between oceanic regime and climate shifts are discussed. Course emphasis is placed on how physical processes affect the life of plankton to nekton. Students are required to present reviews based on the literature.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 713. Marine Population Dynamics. 3 Credit Hours.
The concepts of stocks, sub-populations, and populations as biological systems in the marine environment. Quantitative studies of growth, mortality, recruitment, and abundance of marine populations are discussed. Data requirements, experimental design, sampling, and mathematical procedures for estimating population parameters are included. Lecture and laboratory.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 714. Population Modeling and Management. 3 Credit Hours.
Mathematical and computer-intensive models of exploited populations fish, shellfish, marine mammals, and sea turtles. Stock production (surplus production), structured analytical yield (yield-per-recruit and age-size structured assessments), stock and recruitment, simulation modeling, adaptive control theory, risk assessments, and decision theoretic analyses are discussed. Techniques of management, concepts of resource allocation, and fishery management institutions with case studies are also included. Lecture and computer-based laboratory.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

MBF 715. Advanced Biometrics in Marine Science. 3 Credit Hours.
An introduction to advanced statistical analysis of multivariate empirical observations with primary emphasis on applications in the assessment and interpretation of the dynamics of marine populations and communities in marine biology, biomedical sciences, fisheries, and biological oceanography. Advanced methods in linear, multiple and nonlinear regression analysis, probability and estimation theory, multiple partial correlation, ANCOVA, GLIM, general additive models, nonlinear optimization, multivariate statistics (classification and ordination), and sampling techniques. Exploratory data analysis and modeling are emphasized using the software SAS, S-PLUS, and MATLAB.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.
MBF 716. Bayesian Statistics For Marine Scientists. 3 Credit Hours.
Bayesian methods are increasingly used in ecology, fisheries science and marine biology, as a statistically rigorous means to incorporate information from diverse sources into a single analysis, deal with missing or incomplete data, and directly estimate the probabilities of hypotheses or outcomes. This course will cover Bayesian methods from the theory to the practical use of the statistics package OpenBUGS for Bayesian analysis. Topics will include development of prior probability density functions, numerical methods for integrating posterior probability density functions, diagnostics of convergence, and methods for model selection and model averaging. Examples will be taken from ecology and marine science and will include Bayesian meta-analysis of life history parameters, fisheries stock assessment models, tag-recapture models, molecular biology, decision analysis and estimation of animal abundance from surveys. Students will be encouraged to read the peer reviewed literature critically, and evaluate whether the Bayesian methods that are commonly applied are being used and interpreted appropriately. After doing several assigned homework problems, students will have an opportunity to develop a Bayesian analysis on their own data set.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 710. Marine and Estuarine Fishes. 3 Credit Hours.
Lectures and laboratories on comparative evolution, morphology, physiology, and ecology of fishes. Laboratory emphasis is placed on family level taxonomy and systematics of marine and estuarine fishes.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

MBF 790. Advance Measurement on Nekton, Plankton, and Underwater habitat.. 3 Credit Hours.
MBF 690 is the second course in a series on the acoustic measurement of nekton, plankton and underwater habitat. It follows in the introductory course MBF 590. In this course, we will focus more on the acquisition and processing of plankton, nekton and marine habitat data using sonar hydrophones. We will also spend time reviewing and discussing the classic papers that have been published on this topic. This class was designed for those students who wish to learn how to make quantitative measures of organisms and underwater habitat structure for their research.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

MBF 805. MPS Internship. 1-6 Credit Hours.
Supervised project for students pursuing the Master of Arts degree in Marine Studies. Consists of a paper, researched, and written on a topic approved by the student’s advisory committee, and presented as a seminar to the student’s division. Six credits are required for graduation.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

MBF 810. Master's Thesis. 1-6 Credit Hours.
The student working on his/her master’s thesis enrolls for credit, in most departments not to exceed six, as determined by his/her advisor. Credit is not awarded until the thesis has been accepted.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

MBF 815. Masters Thesis-Post Candidacy. 1-6 Credit Hours.
Used to establish student has been admitted to candidacy for the MS Degree. The student working on his/her Master’s Thesis enrolls for credit not to exceed 0 6 combined with 710. Credit is not awarded until the Thesis has been accepted.
Components: LEC.
Grading: GRD.

MBF 820. Research in Residence. 1 Credit Hour.
Used to establish research in residence for the thesis for the master’s degree after the student has enrolled for the permissible cumulative total in MBF 710 (usually six credits). Credit not granted. May be regarded as full time residence.
Components: THI.
Grading: GRD.

MBF 830. Doctoral Dissertation. 1-12 Credit Hours.
Required of all candidates for the Ph.D. The student will enroll for credit as determined by his/her advisor but not for less than a total of 12. Not more than 12 hours of MBF 730 may be taken in a regular semester, nor more than six in a summer session. Where a student has passed his/her a qualifying examinations, and (b) is engaged in an assistantship, he/she may still take the maximum allowable credit stated above.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.
MBF 850. Research in Residence. 1 Credit Hour.
Used to establish research in residence for the Ph.D., after the student
has been enrolled for the permissible cumulative total in appropriate
doctoral research. Credit not granted. May be regarded as full-time
residence as determined by the Dean of the Graduate School.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.