MARINE ECOSYSTEMS AND SOCIETY (MES)

GRADUATE HANDBOOK 2019-2020

August 2019

MES Ph.D./M.S./M.P.S. Degree Programs

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PREFACE

This handbook is a summary of the guidelines, expectations, and rules of the Department of Marine Ecosystems and Society (MES) graduate program, including the Doctor of Philosophy (Ph.D.), the Master of Science (M.S.), and the Master of Professional Science (M.P.S.) degree.

The MES Department fosters innovative, collaborative, and multidisciplinary research and education centered on the conservation and sustainability of marine ecosystems and the services they provide to society. Through our courses, networking, practical training, and research experiences, our students learn how to foster and develop solutions to the challenges of climate change, overfishing, resource allocation, habitat degradation, and ecosystem and species conservation. In the MES program, we help students acquire the ecological, socio-economic, and political knowledge that will ultimately elevate their ability to integrate science, humanity, and sustainability in meaningful ways.

The following tracks, or areas of concentration, currently represent our dynamic faculty and relevant academic programming:

Aquaculture and Fisheries Science
Coastal Zone Management
Ecosystem Modeling and Sustainability
Exploration Science
Fisheries Management Science
Marine Mammal Science
Marine Population Dynamics
Marine Resource Economics
Ocean Law and Policy
Shark Ecology and Conservation
Underwater Archaeology

Central to graduate student education and professional development is the relationship between students and the Committee Chair. The Chair is responsible for advising, mentoring, and guiding students, particularly during the research phase of their degree. MES graduate students are expected to uphold high ethical and academic standards, pursue and maintain communication with their Chair and committee members, and achieve both research excellence and professional independence.

The MES Program and RSMAS policies are clearly stated in this handbook and are further defined by specific degree requirements. It is the responsibility of MES students and their Chairs to comply with all policies and procedures, in addition to those outlined in the M.P.S., RSMAS, and UM Graduate Handbooks. All academic handbooks evolve over time; so, students should refer to the version relevant to the academic year they matriculated.

The dissertation/thesis/internship Committee is critically important to each student's academic journey and

professional development, as well as to the goals of our academic institution. The primary role of Committee members is to support the pursuit of academic excellence, scholarship, and research. The Committee must be formed during the first year in residence, with the goal of establishing specific research objectives and a strategic academic plan. Committee members are approved by the Chair, following the criteria defined below, and are typically selected on the basis of relevant research expertise and the ability to act as an effective mentor. Ph.D. and M.S. Committees are required to meet annually to review student progress and provide research guidance. Dissertation/Thesis/Internship Chairs and Committee members are also responsible for overseeing the proposal defense (M.S. and Ph.D.) and qualifying exam (Ph.D.), as well as approving the research proposal and the final dissertation/thesis/report.

All MES students and their Chairs must draft a succinct annual progress report (template supplied), which is evaluated by the Program faculty during an annual review. This report is sent to the Program Director and the RSMAS Graduate Studies Office (GSO) to be retained in each student's file.

SUMMARY OF RULES & REQUIREMENTS

Comprehensive Exam

All MES Ph.D. students must take a comprehensive exam at the end of their second semester in residence. The exam format and content is defined by the Committee Chair and members. M.S. students in MES are not required to take a comprehensive exam. M.P.S. students should refer to the M.P.S. Handbook regarding comprehensive exam requirements and format.

The comprehensive exam is graded as pass/fail (P/F). If a student fails the exam, the option to pursue remediation occurs at the sole discretion of the Committee and the Program faculty. A failed Comprehensive Exam with no endorsement to retake the exam will result in immediate dismissal from the MES graduate program.

Proposal Defense

All M.S. and Ph.D. students are expected to compose a full proposal, including a thorough literature review, clearly outlined objectives, a summary of the significance of their proposed project (including broader impacts, if relevant), a detailed research plan, and a budget.

Following the written proposal vetting process by the committee, students are required to formally defend their proposal. The purpose of the proposal defense is to certify the readiness of the student to conduct thesis/dissertation research.

Research Ethics & Educational Training

All RSMAS students must enroll in the Research ethics course (RSM 700 - 0 credits). All students assigned as a Teaching Assistant (TA) or Instructional Student Support (ISS) must take Educational Training 1 (RSM 771 – 0 credits). Ph.D. students must also enroll in Educational Training 2 (RSM 772 – 0 credits) and Educational Training 3 (RSM 773 – 0 credits) during their first and second TA assignments, respectively. Additionally, all RSMAS students are required to complete the "Sexual Assault Prevention for Graduate Students" online modules.

Thesis/Dissertation Defense & Internship Presentation

MES requires a public oral presentation of the Ph.D. dissertation, the M.S. thesis, and the M.P.S. internship report. M.S. and Ph.D. students are required to submit the complete written thesis/dissertation to the Committee 4 weeks prior to the oral defense. The Announcement of Defense form, signed by all Committee members, must be submitted to the GSO 2 weeks before the intended defense. The final dissertation/thesis must be evaluated by the Electronic Thesis and Dissertations office at the Gables Campus and signed by all Committee members in accordance with the deadlines established by the UM Graduate School and posted on the UM Academic Calendar (http://www.miami.edu/index.php/registrar/calendar/). M.P.S. students should refer to the M.P.S. Program Handbook for details regarding the final presentation.

Leave of Absence

When a student is not registered at the University for a period of one or more semesters, this constitutes a leave of absence, which must be documented with a "Petition for Leave of Absence" form. All leaves must be approved in advance by the MES Academic Committee (AC) via memorandum from the Committee Chair. Following the termination of leave, students must be readmitted to the program, including a readmission form approved by the MES AC. The recency of credit hour rules, set by the Graduate School, continue during a leave of absence.

Academic Standing & Student Progress

All graduate students must maintain a cumulative 3.0 GPA or higher. This is a requirement of the Graduate School and is evaluated each semester by the GSO. A student whose GPA falls below a 3.0 is automatically placed on Academic Probation. If the GPA is not increased to a 3.0 in the subsequent semester, the student may be dismissed from the Program.

All M.S. and Ph.D. students will be evaluated annually by their Committee Chair. Students who fail to meet the expectations set forth by their committee will receive a formal Progress Warning. This document will include realistic expectations regarding specific deliverables and relevant deadlines. If the student does not meet the expectations detailed in the written warning, they will be placed on Departmental Probation and may be dismissed from the Program.

Appeals & Policy Amendment

All students should be aware that there is no right to a degree. The M.P.S., M.S., and Ph.D. degrees are conferred only with the approval of the Committee and upon completion of all degree requirements, as defined by the Department, the School, and the University.

Students may appeal any decision made by the MES AC to the RSMAS Graduate AC, and, if necessary, the Associate Dean of Graduate Studies at RSMAS.

The University, School, and Department reserves the right to amend policies at any point in time. Students and faculty will be notified of policy changes, with all amendments published in subsequent versions of the handbook.

DOCTOR OF PHILOSOPHY (PH.D.) DEGREE

Timeline

Ph.D. students are expected to complete the degree in 5 years. This excludes students who enter the Program with a Master's degree, whom are expected to complete the Ph.D. in 4 years.

Year 1: Enroll in courses; Form dissertation Committee and coordinate first Committee meeting; Pass comprehensive exam before the end of summer semester

Year 2: Enroll in and complete coursework; Compose and defend proposal; Pass qualifying exam; Coordinate second Committee meeting

Years 2 - 4: Coordinate annual meetings with Committee; Conduct research and begin writing dissertation chapters

Year 5: Complete dissertation and host defense

Students are required to meet with their Committee annually and provide a succinct, 1-page progress report (template provided). The Committee Chair is expected to add a statement summarizing their view of student progress, and the report is then evaluated by MES faculty during the annual student review. The progress report should then be distributed to the Program Director and the GSO for filing.

Dissertation Committee

The dissertation Committee will consist of no fewer than five members, as follows:

a. The Chair, who must be a member of the MES/UM Graduate Faculty (see Appendix 1)
b. Three, additional UM Graduate Faculty members, including at least one additional member from MES
c. One faculty member from outside RSMAS (i.e., outside MES or UM)

Students must submit their Appointment to Committee form to the GSO and notify both the GSO and Program Director of any changes in membership.

Credits

Ph.D. students must complete 60 credits beyond the baccalaureate degree, including at least 27 course credits (completed in residence at UM), 6 of which must be at the 700-level, and a minimum of 12 dissertation research credits. For students who enter the Ph.D. program with a Master's degree from another school, careful consideration should be given regarding the transfer of credits. Transferred credits should be relevant to the MES Ph.D. program and each student's track, as defined by the Chair.

Course Requirements

Course enrollment and scheduling is defined by the student and their Chair. MES students are affiliated with one or more of the MES tracks (see PREFACE) and will be expected to adhere to all, relevant academic requirements. At minimum, all Ph.D. students in MES are required to enroll in the following courses, unless proficiency is clearly established:

Biometrics in Marine Science (MES 608)
Advanced Biometrics in Marine Science (MES 715)

Full-time status is achieved by either a total of 9 course credits or 1 dissertation research credit (MES 830) (i.e.,

800-level courses are full time status indicators) per semester.

Additionally, students must attend all MES student seminars and host one seminar during their fourth semester at RSMAS and every year thereafter, with the exception of the semester in which they defend their dissertation.

Course Waivers

A student who has successfully completed one or more graduate level courses at an accredited institution with an MES equivalent may petition the MES AC to provide a waiver. Students should discuss these courses with their Committee Chair and obtain an approval memorandum from each instructor of the equivalent graduate course at RSMAS. The memorandum is reviewed by the MES AC and, upon approval, submitted to the GSO for official notice.

Dissertation Proposal

The dissertation proposal is the foundation for the qualifying exam, and both must be completed no later than the end of the second year in residence.

The first step in designing a research project is to formulate clearly stated hypotheses, and the purpose of the proposal is to certify the readiness of the student to conduct dissertation research. Though there is no dissertation proposal template available at this time, the following components are strongly recommended:

PROJECT SUMMARY (1 page or less): Describe the specific goals and significance of the research.
PROJECT DESCRIPTION (12-15 pages):

1. Project Description (12 – 15 page):
    a. Briefly sketch **the background information** relevant to specific hypotheses, using the published literature to provide a context and comparison to the proposed project.
    b. Convey a clear message regarding the **significance of the proposed project** in terms of existing gaps in research/knowledge and how filling the gap(s) will advance the field. Concisely state the importance of the research by related the specific objectives to longer-term goals and outcomes.
    c. Provide a concise overview of **pilot/preliminary studies** pertinent to the proposed research.
    d. Detail a **technical research plan**, specific to each objective, including but not limited to: experimental and sampling design, procedures and techniques, and planned analyses.
    e. **Define the delimiations and limitation**s of the project, incluidng a brief list of alternative approaches.
    f. Provide a **tentative sequence and timeline of deliverables** for the investigation.
    g. Draft a **budget** summarizing the costs associated with the research project, including but not limited to: travel, software, instruments/tools, reagents, and/or training opportunities.
    h. Include **references cited**.

The Chair of the Committee should work with the student to ensure a sound document is distributed to the dissertation Committee, thereby avoiding numerous edits by the Committee members. The Committee is responsible for reviewing and approving the proposal.

Dissertation Proposal Defense

Ph.D. students are required to formally defend their proposal. The purpose of the proposal defense is to certify the readiness of the student to conduct dissertation research, as well as facilitate an open discussion regarding the objectives of the dissertation and the relevant experimental approach.

Since the qualifying examination is based on subjects relevant to the proposed research, this meeting is an excellent time to define topics and identify pertinent readings.

Qualifying Examination

At the end of the second year in residence, all Ph.D. students must take a written qualifying exam, which emphasizes subject matter critical to the execution of the proposed dissertation research. As such, the purpose of the qualifying examination is to demonstrate that MES doctoral students possesses the requisite knowledge and expertise to be successful. The topic areas are established and agreed upon by the student, Chair, and the dissertation Committee at the proposal defense. The Committee is encouraged to provide direction and readings for study, as well as establish a clear format for the exam. It is the Chair's responsibility to host the exam and organize and distribute grades (pass/fail) in a timely manner. Students must pass the qualifying exam in order to be admitted to candidacy.

In the event of a failure, a student may be re-examined once upon the recommendation of the Committee, in consultation with the MES AC. If approved, the reexamination must occur before the end of the subsequent semester. A supplemental oral qualifying examination may be required by the student's Committee but cannot serve as a substitute for the written examination, which is a Graduate School requirement.

Advancement to Candidacy

In order to advance to candidacy, a student must complete all coursework and pass the qualifying exam. Students should advance to candidacy at the end of their second year and no later than one semester prior to their defense.

Dissertation Defense

MES requires a public oral presentation of the Ph.D. dissertation, and students are required to submit the complete written dissertation to the Committee 4 weeks prior to the oral defense. The Announcement of Defense form, signed by all Committee members, must be submitted to the GSO 2 weeks before the intended defense. The final dissertation must be evaluated by the Electronic Thesis and Dissertations office at the Gables Campus and signed by all Committee members in accordance with the deadlines established by the UM Graduate School and posted on the UM Academic Calendar (http://www.miami.edu/index.php/registrar/calendar/).

Time in Residence & Recency of Credit

As designated by the UM Graduate School, Ph.D. students must complete all degree requirements within 8 years, including leaves of absence. After 7 years of dormancy, credits must be revalidated. As a rule, credits are reinstated for 4 years following the completion of the Qualifying Examination.

Admission to the Ph.D. Program

Students interested in the Ph.D. program must submit an application online and are strongly encouraged to communicate with prospective Chairs at least 3 months in advance of the proposed enrollment date. Upon acceptance, the Chair commits to funding the student for 5 years of the doctoral degree (4 for students with a

Master's degree).

Completion of the M.S. degree in MES does not guarantee acceptance in the Ph.D. program. Interested students must obtain a written recommendation from the M.S. Thesis Committee at the time of the M.S. defense and submit the recommendation to the GSO and the MES AC. If accepted, the student must complete a readmission form, and the proposed Committee Chair must confirm financial support as described above. In most cases, students are able to transfer 24 course credits from their M.S. at RSMAS, leaving 3 course credits + a balance of 33 credits to complete the Ph.D. Of the 33 credits, the student and Committee Chair define the ideal distribution of course versus research credits.

Funding

Most Ph.D. students are supported by fellowships, research assistantships, and teaching assistantships, which include tuition, stipend, and research funds. Research Assistants and Teaching Assistants are awarded tuition scholarships under the terms of current RSMAS policy. There are a limited number of competitive School or University Fellowships available that provide support of varying duration and nature, and all MES Ph.D. students are strongly encouraged to apply. In addition to the financial support, many of these awards carry incomparable professional prestige. A list of scholarship funds, internal and external, can be found in the RSMAS handbook.

MASTER OF SCIENCE (M.S.) DEGREE

Timeline

M.S. students are expected to complete the degree in 2 years, with a thesis equivalent to a single published scientific paper. A short extension of the time in residence may be requested in writing by the Committee Chair and submitted to the MES AC.

> Year 1: Enroll in courses; Form dissertation Committee and coordinate first Committee meeting; Define research plan and draft proposal; Defend proposal before the end of summer semester
>
> Year 2: Conduct research and begin writing thesis chapters; Complete thesis and host defense

Students are required to meet with their Committee **a minimum** of once per year and provide a succinct, 1-page progress report (template provided). The Committee Chair is expected to add a statement summarizing their view of student progress, and the report is then evaluated by MES faculty during the annual student review. The progress report should be distributed annually to the Program Director and the GSO for filing.

Thesis Committee

The thesis Committee consists of no fewer than three members, as follows:

a. The Chair, who must be a member of the MES/UM Graduate Faculty (see Appendix 1)
b. One, additional MES Graduate Faculty member
c. One faculty member from outside RSMAS (i.e., outside MES or UM)

Students must submit their Appointment to Committee form to the GSO and notify both the GSO and Program

Director of any changes in membership.

Credits

Students enrolled in the M.S. program must complete 30 credits, including 24 course credits (18 of which must be completed in residence at UM) and 6 research credits. A maximum of 6 credits of graduate coursework from another school that did not result in the conferral of a degree may be transferred at the sole discretion of the Committee Chair. Transferred credits should be relevant to the MES Ph.D. program and each student's track. Students should discuss these courses with their Committee Chair and obtain an approval memorandum from each instructor of the equivalent graduate course at RSMAS. The memorandum is reviewed by the MES AC and, upon approval, submitted to the GSO for official notice.

The distribution of credits in the M.S. program should follow one of the options below:

> Option 1: Students enroll in 18 course credits over 2 semesters, with the remaining 6 course credits completed in the 3rd semester. One (1) research credit is added to any semester in which enrollment is <9 credits in order to achieve full-time status. Students balance their time between coursework and research in the 3rd semester. The 4th semester is devoted to completing thesis research and will include the balance of research credits required to reach 6 total.
>
> Option 2: Students enroll in 24 course credits over 2 semesters. The remaining research credits are distributed across the 3rd and 4th semesters, and this time is devoted entirely to thesis research.
>
> Option 3: Students enroll in any number of credits across the 1st, 2nd, and 3rd semesters. One (1) research credit is added to any semester in which enrollment is <9 credits in order to achieve full-time status. Students balance their time between coursework and research in the 3rd semester. The 4th semester is devoted to completing thesis research and includes the balance of research credits required to reach 6 total.

Please note: Regardless of enrollment option, students are expected to submit their proposal and begin their thesis research no later than their first summer in residence. The subsequent pace will depend upon whether or not students elect to enroll in courses during their 3rd semester.

Course Requirements

Course enrollment and scheduling is defined by the student and their Chair. MES students are affiliated with one or more of the MES tracks (see PREFACE) and will be expected to adhere to all, relevant academic requirements. At minimum, all M.S. students in MES are required to enroll in either of the following courses, unless proficiency is clearly established:

> Biometrics in Marine Science (MES 608)
> OR
> Statistics for Environmental Management (RSM 612)

All M.S. students are required to complete at least 12 course credits in MES. A formal request for an exception to this rule can be submitted in writing to the Committee Chair, and any/all exceptions will be made at the discretion of the MES AC.

Full-time status is achieved by either a total of 9 course credits or 1 dissertation research credit (MES 810) (i.e.,

800-level courses are full time status indicators) per semester.

Additionally, students are expected to attend MES student seminars.

Thesis Proposal & Proposal Defense

The first step in designing a research project is to formulate clearly stated hypotheses, and the purpose of the proposal is to certify the readiness of the student to conduct thesis research. A proposal template will be provided, and all M.S. students are required to attend a proposal writing seminar during their second semester in residence. Students must submit and defend their proposal before the start of their fourth semester in residence.

The purpose of the proposal defense is to ensure that each student possesses the requisite knowledge and expertise to successfully execute the proposed research project, as well as facilitate an open discussion regarding the stated objectives and experimental approach.

Thesis

The full thesis should be equivalent to a single, peer-reviewed publication.

Thesis Defense

MES requires a public oral presentation of the M.S. thesis, and students are required to submit the complete written thesis to the Committee 4 weeks prior to the oral defense. The Announcement of Defense form, signed by all Committee members, must be submitted to the GSO 2 weeks before the intended defense. The final thesis must be evaluated by the Electronic Thesis and Dissertations office at the Gables Campus and signed by all Committee members in accordance with the deadlines established by the UM Graduate School and posted on the UM Academic Calendar (http://www.miami.edu/index.php/registrar/calendar/).

Transfer from M.S. to Ph.D.

Students may request to be considered for transfer from the M.S. program to the Ph.D. program in MES. These requests, accompanied by a written recommendation from the student's Committee, must be submitted to the MES AC prior to the start of the fourth semester in residence and/or before the completion of 24 graduate course credits. Requests made after this time will not be considered. If approved, students must fulfill the requirements of the Ph.D. degree, including the commitment of a faculty member to fund the student. Transfers are not guaranteed, and if successful, the Ph.D. clock will be considered started upon entry to the M.S. program, with 5 years to complete the Ph.D.

Funding

Two funding models currently exist:

A) MS-1: a self-funded MS. The Chair covers the research costs of the thesis. Tuition and insurance are paid by the student or granted to the student by fellowships.

B) MS-2: a fully-funded MS. The Chair covers the stipend, tuition, insurance, and thesis research costs (similar to that of a Ph.D. student).

MASTER OF PROFESSIONAL SCIENCE (M.P.S.) DEGREE

Please refer to the 2019-2020 MPS Handbook:
http://mps.rsmas.miami.edu/wp-content/uploads/sites/2/2019/08/MPS-Handbook-2019-2020-FINAL.pdf

Appendix 1. MES GRADUATE FACULTY 2017-2018

Jerald S. Ault, Professor and MES Department Chair — 305.421.4884
Theoretical population dynamics, risk assessment, fishery management systems

Andrew Bakun, Professor — RETIRED
Climate and fisheries, ocean processes regulating marine population dynamics

Daniel Benetti, Professor — 305.421.4889
Aquaculture science, technology, R&D, management, project development, environmental monitoring, site and project feasibility studies, business and production planning

Kenny Broad, Professor — 305.421.4851
Environmental anthropology, climate and society interaction, environmental policy

David Die, Research Associate Professor — 305.421.4607
Fisheries management, fish stock assessment, bio-economics

Nelson Ehrhardt, Professor — RETIRED
Fishery research and management, marine population dynamics analysis and modelling, fisheries oceanography

Maria L. Estevanez, Senior Lecturer — 305.421.4012
Management of recreational and commercial fishing, industry economic impact studies, marine resource allocation policy, marine geographic information systems

Neil Hammerschlag, Assistant Professor — 305.421.4356
Behavioral ecology of sharks, predator-prey interactions, biomagnification of toxins; marine conservation and outreach programs

Frederick "Fritz" Hanselmann, Lecturer — 305.421.4347
Underwater and maritime archaeology, underwater cultural heritage management, 16th – 18th century colonial shipwrecks, submerged prehistoric sites, capacity building in Latin America and the Caribbean

Keene Haywood, Senior Lecturer – 305.284.1781
Citizen science, applications of technology to exploration, video production and multimedia in science communication, geospatial technologies

David Letson, Professor and MES Graduate Program Director — 305.421.4083
Economics of severe weather and climate change adaptation

Sarah K. Meltzoff, Associate Professor — 305.421.4087
Marine resource management and sustainable development policy, social analyses of fisheries and aquaculture

Jill Richardson, Senior Lecturer— 305.421.4346
Marine mammal behavior, acoustics, welfare, cognition, and health; marine science education/outreach

Daniel O. Suman, Professor — 305.421.4685
Environmental law, coastal law, coastal management, environmental planning, marine policy

Gary Thomas, Professor — RETIRED
Fishery ecology, coastal marine ecosystems, hydroacoustics

Appendix 2. MES COURSES

Political Ecology of Marine Management (MES 501/601) – 3 credits, SPRING/ANNUAL
Course provides a grounding in political ecology as an important theoretical approach to resource policy and management. The social analysis of resource use, social change, and development are discussed. Models of development and concepts of nature relate to resource use and policy formation are also included. Within this framework, ethnicity, class, and the politics of conservation are explored.

Economics of Natural Resources (MES 502/602) – 3 credits, FALL/ANNUAL
Course brings together the approaches of natural resource and environmental economics to provide a comprehensive overview of the economics of national, international, and global environmental problems. A unifying theme throughout the course is the concept of sustainable development, defined as maximizing the net benefit to economic development while maintaining the services and quality of natural resources over time. Economic reasoning is used to examine the causes and consequences of environmental and resource problems and measures for dealing with them.

Fieldwork in Coastal Management (MES 504/604) – 3 credits, SPRING/ANNUAL
This course will select a coastal research site and explore its physical geography, culture, legal framework and institutions, and tourist development/conservation conflicts. In addition, we will examine different methodologies for diagnosing the site's socioeconomic, governance, and environmental characteristics. Participants will meet weekly throughout the semester in Miami to discuss background readings and develop a group research field project that course participants will carry out during a Spring Break trip to the research site. Upon return to the University of Miami, the class will prepare manuscripts and presentations based on the field data that course participants have collected during the trip.

Fieldwork in Coastal Cultures (MES 505/605) – 3 credits, SPRING/ANNUAL
Field course in which the student participates in a social and economic analysis of a coastal culture (i.e., stone crab fishermen in Everglades City, spiny lobster fishermen in Key West, boat builders and commercial divers in the Abacos, Bahamas). Preliminary lectures and reading introduce the theory and method which the student then practices during a week-long field trip.

Advanced Fieldwork in Coastal Cultures (MES 506/606) – 3 credits, SPRING/ANNUAL
This ethnographic fieldwork course lets you experience coastal cultures first-hand in Miami and the Keys. Learning the political ecology approach in the field, you keep an in-depth field journal, complimenting entries with photography as visual anthropology. We will be interacting with some of Miami's wealth of ethnic communities, both Latino and Haitian. Tourism has become a mainstay of the Miami and Keys economy. We will examine real estate development and social conservation in relation to commercial and recreational fisheries. We will examine the rivalries and alliances among different interest groups involved in tourism from conservation to development. We will observe human/environmental interactions, as well as interview various interest groups such as tour operators, real estate developers, visitors, store and restaurant owners, and park manager requirements and procedures at the federal level are examined. Judicial opinions are studied that reflect environmental disputes and controversies. The course also considers some of the substantive requirements of environmental impact analyses such as the assessment of physical and biological environment and socioeconomic impacts.

Aquaculture I (MES 512/612) – 3 credits, FALL/ANNUAL
This course examines the various strategies of resource exploitation and utilization related to aquaculture development. It focuses on environmental, technological, management, social and economic aspects of sustainable aquaculture. Advanced, emerging technologies and management strategies are examined, both at the hatchery and growout levels. The course also covers systems and all stages of planning and development, from site and species selection to feasibility studies, evaluation and sustainable use of natural resources, advanced hatchery and growout technologies. Emphasis is given on environmental sustainability as well as technical and economic feasibility of aquaculture projects.

Aquaculture II – Lab (MES 513/613) – 3 credits, SPRING/ANNUAL
This course covers basic science and advanced aquaculture technologies, with emphasis on production. It encompasses reproduction, spawning, larval husbandry, nursery and growout techniques of commercially important species of fish, crustaceans, mollusks, algae, non-traditional species and the production of live feeds such as microalgae, rotifers, *Artemia* spp. and other zooplanktonic organisms. The course also covers ontogeny, nutrition, physiology, bioenergetics and growth, environmental monitoring, disease prevention and control (prophylaxis, probiotics and vaccines), water quality management and growout

technologies such as recirculating aquaculture systems (RAS), bioflocs and offshore surface and submerged cages. The course addresses advanced technology and proper management practices for sustainable aquaculture development. Aquaculture II is primarily a lab course, with a great deal of hands-on experience at the experimental hatchery and are required to conduct experimental trials and assist with ongoing projects. Course requires a background in either aquaculture and biological sciences or business. Prerequisite: MES 512/612 or permission of instructor.

Underwater Archaeology Field Techniques (MES 514/614)
This course is designed to provide students the practical and scientific tools necessary to conduct archaeological investigations in underwater contexts. Critical skills such as baseline mapping, trilateration, artifact illustration, photography, and others are discussed, practiced, and ultimately applied during summer fieldwork. Site visits to nearby shipwrecks are also a possible component of the course. Please note that there is a significant amount of diving to complete this this course.

Marine Archaeological Survey and Technology (MES 515/615)
This course is designed to provide students with an introduction to current technologies and marine remote sensing tools utilized in archaeological survey. Instruction in the use of technology such as the magnetometer, sidescan sonar, sector scan sonar, scanning lasers, and other tools are covered. The use of data acquisition software and the post processing of data are also key elements of this course. There is a significant component of this course utilizing boats and also a smaller diving component.

Ocean Policy and Development and Analysis (MES 516/616) – 3 credits, FALL/ANNUAL
Ocean policy development and analysis of issues such as: offshore oil drilling, fisheries resource conflicts, marine mammal protection, ocean dumping and incineration, multiple use conflicts in marine protected areas, pollution from land based sources, and oil spill contingency planning.

Legal, Environment and Business Planning in Aquaculture (MES 517/617) – 3 credits, FALL/ANNUAL
This course covers business concepts and production planning related to aquaculture ventures. It focuses on environmental and legal issues related to aquaculture development, including Federal and State laws, policies, and regulatory agencies governing commercial and research aquaculture facilities. It examines aspects related to ownership and boundaries in the coastal zone, legal and regulatory constraints, international consideration, private and public rights, risks and incentives. It also covers fish and shellfish as personal property and conservation laws affecting the fish farmer.

Coastal Zone Management (MES 518/618) – 3 credits, SPRING/ANNUAL
Development of a framework for formulation and assessment of coastal zone policy. Analysis of issues and conflicts in coastal zone management (CZM), such as: zoning and planning, coastal and beach protection, ecosystem protection, the federal flood insurance program, adaptations to sea level rise, coastal pollution from land-based sources, and tourism impacts.

Aquaculture III Fieldwork (MES 519/619) – 3 credits, SUMMER/ANNUAL
Aquaculture III will complement Aquaculture I and II-Lab. It is a field course conducted simultaneously with an annual UM-IATTC Tuna Workshop at the world renowned Achotines Laboratory in Panama, Central America. Students will be able to apply most of the topics taught in MES 512/612 and MES 513/613. It covers reproduction and larval development of commercially and ecologically important marine fish species, focusing on tuna. Topics include physiology, biology, ecology, genetics, nutrition and environmental issues related to marine fish aquaculture. The course covers and requires participating in capture, handling, transportation, maturation, spawning, larval husbandry, nursery and growout techniques. Participants will learn about the research projects being conducted by the IATTC with yellowfin tuna, *Thunnus albacares*, and will visit and spend time at Open Blue Offshore farm in the Atlantic Ocean side of Panama.

Environmental Law (MES 520/620) – 3 credits, FALL/ANNUAL
An introductory course focusing on environmental problems. The study of Regulatory legislation, common law, and administrative law. Topics include toxic substances, air and water pollution, and habitat and species protection.

Water Resources in China and Vietnam: Science and Policy (MES 521/621) – 3 credits, SUMMER/ANNUAL
The course examines Water Resources from broad perspectives (water quality and quantity, ground water, international river management, watershed management, coastal issues). Additionally, it compares management strategies and problems in three countries: China, Vietnam, and the USA. The course is also highly interdisciplinary - combining natural science, policy, and the social sciences. We spend half of the time in Vietnam and the other half in China, and both countries have long-term established cooperation with three universities: Hanoi University of Mining and Geology (HUMG), Hanoi University of Natural Resources

and the Environment (HUNRE) and Yunnan University, Asian International Rivers Centre (AIRC). In both countries, we arrange lectures and discussions with local students at these universities for one week. The other week is dedicated to fieldwork and travel.

Principles and Practices of Marine Social Science Research (MES 522/622) – 3 credits, FALL/ANNUAL
This course will introduce students to the theory of marine social science methods, focusing on how the methods relate to the design, planning, implementation, analysis, and reporting of marine social science research. The course will be divided into three sections: theory, design, and planning; statistical analysis; and spatial data construction and analysis.

Fisheries Socioeconomics and Management (MES 525/625) – 3 credits, FALL/ANNUAL
The course covers both conceptual and practical aspects dealing with the management of commercial and recreational fisheries. The first part of the course offers an introduction to micro-economic principles, focusing on efficient resource allocation. Building on these principles, we develop bio-economic models to illustrate the interactions between the resource, harvesting sector and environment. We also review the theory and practice of unregulated open access, limited entry and rights-based management. Last, we study the economics of the recreational sector and explore a number of contemporary fishery management challenges.

Submerged Cultural Resource Management (MES 526/626)
This course discusses various aspects and details of managing underwater cultural heritage/submerged cultural resources. Topics will include ethics, policies and procedures, marine protected areas, and federal, state, and international laws governing management of submerged archaeological sites. Specific focus is placed on examining the variety of management concepts and frameworks utilized both in the U.S. and internationally. Finally, the role and value of public archaeology in management is also presented and discussed.

Exploration Science Field Studies (MES 527/627) – 3 credits, SPRING/ANNUAL
This course provides students with an opportunity to gain field experience by being part of an expedition team that is tasked with observing, documenting, and communicating discovery, which are the hallmarks of exploration. Students will be tasked with systematically collecting data and media while learning to travel and work as a group in various environments on the island of Eleuthera over the week of spring break. The trip explores the island from the northern tip to the southern tip in a very intensive, hands-on way. We will be based out of the Cape Eleuthera Institute, which provides room, board, and other services. We spend several days camping in the field. In addition to the week, students meet several times before and during the semester to work on logistics, background research, and presentations.

Seafood Market and Marketing (MES 528/628) – 3 credits, SPRING/ANNUAL
This course aims at educating the next generation of professionals in the seafood business and present future managers of an aquaculture business with the necessary knowledge in the packaging, pricing, placement, promotion and distribution of their finished product to give them the best return on their investment. The course covers basic theories but it is primarily a practical approach to the production, marketing and distribution of seafood products in the U.S. and the world market.

Biology, Ecology, and Management of Mangrove Ecosystems (MES 529/629) – 3 credits, SPRING/ANNUAL
This course is intended to introduce students to mangrove ecosystems, one of the most productive, and biologically diverse, ecosystems in the world, and one of South Florida's key coastal ecosystems. The principal objective is to explain how our scientific understanding of mangrove ecosystems has been unfolding and how today they are considered paramount not only for their organic carbon contributions to coastal areas, but as protectors of the coast, mitigators of global climate change, reservoirs of biodiversity, and supporters of the livelihoods of millions of inhabitants throughout the world. The course will consist of lectures, class discussions, and presentations of student assignments. The lectures will follow an open seminar format in which all students are expected to actively participate in the discussion of the presented material. Two lectures will take place during field trips to local mangrove areas.

Port Operations and Policy (MES 530/630) - 3 credits, TBD
The course will include: Introduction to ports, ports geography; port operations, port administration, Federal port policy; free ports/free zones, port investment/tariffs, port marketing, Coastal Zone Management and ports, case studies, CZM; fostering economic development.

Marine and Coastal Protected Area Theory, Planning, Management, and Issues (MES 531/631) – 3 credits,

SPRING/ANNUAL
This course shall present the study and analysis of marine and coastal protected areas in an interdisciplinary manner, commencing with an overview of conservation biology and protected area principles (ex. island biogeography), a survey of coastal and marine protected area (MPA) theory, ranging from MPA size, population and spillover benefits, and biodiversity protection potential, and the influence of ecological parameters on MPA design (including the maintenance of biodiversity, spillover, and connectivity). Another critical component of the course will be a historical review on MPAs and MPA management, how the concept developed and proliferated, and its present status. Included as part of this discussion will be an overview on the typology and diversity of MPAs, comparing a variety of inter-governmental organization (IUCN, UNCLOS, UNEP, etc.) and national institution (ex. US National MPA Center) frameworks, demonstrating the variety in uses and restrictions and critically evaluating the overall and regional success of MPAs. The course will next address human dimensions and socioeconomic impacts of MPAs, including the economic performance and financing mechanisms of MPAs, stakeholder engagement, participation, and conflicts, and management approaches. Finally, the course will review a series of MPA case studies, which incorporate the aforementioned topics in a 'real world' environment and demonstrate how the concept has been applied across the world.

Theory and Method in Underwater and Maritime Archaeology (MES 532/632)
This course covers archaeological theory and methodologies used to interpret underwater and maritime sites in both prehistoric and historic contexts. The interconnection of theoretical constructs with submerged archaeological remains is emphasized, providing a broad toolset that can be used to better understand and explain the archaeological assemblage and associated data sets acquired from the investigation of these sites.

Decision Analysis: Natural Hazards and Catastrophes (MES 533/633) – 3 credits, SPRING/ANNUAL
This course addresses the behavioral factors (cognitive biases, heuristics, risk perception, social influences, and past experiences) that together help explain why people tend to underprepare for potential natural and man-made disasters. Implications for science communication and public policy are emphasized.

Introduction to Ecological Modeling (MES 540/640)
An introduction to conceptual and mathematical model building methods for ecological processes at population, community, ecosystem, and landscape/seascape- level scales. Other topics include mathematical foundations, numerical modeling, holistic and structured population models, demography, density-independent and -dependent models, linear and nonlinear systems, community composition, competition, succession, and ecosystem structure and function are discussed. Gap-phase, process-based, compartmental, and coupled biological-physical ecosystem models at landscape scales are also examined.

Marine Population Assessment Surveys and Analysis (MES 545/645) – 3 credits, SPRING/ANNUAL
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 produce estimations.

Marine Population Biology Processes and Modeling (MES 546/646) – 3 credits, SPRING/ANNUAL
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.

Introduction to Marine Geographic Information Systems (MES 560/660) – 3 credits, FALL & SPRING/ANNUAL
Marine Geographic Information Systems are emerging as a distinct subset of GIS, due to fundamental differences between terrestrial and underwater spatial information (2-D vs. 3-D, multiresolution, synoptic data collection, time depth (4-D) modeling). Approximately the first half of this course is a brief review of basic GIS, and the second half concentrates on aspects of marine data acquisition and manipulation in the GIS context.

Introduction to Marine Geographic Information Systems - Laboratory (MES 561/661) – 0 credits, FALL & SPRING/ANNUAL
This laboratory introduces students the basic methods and technology in Marine Geographic Information Systems. The course is taught with hands-on laboratory exercises following the evolution of Marine Geographic Information Systems, from basic cartography to topological and network modeling to internet access and application.

Spatial Analysis: Intermediate Course in Marine GIS (MES 562/662) – 3 credits, SPRING/ANNUAL
This course provides a general survey of available quantitative methods for spatial analysis using Geographic Information Systems (GIS). Although GIS has been widely used for mapping and database management, this course is focused on the functionality of GIS as an effective tool for modeling and analyzing complex spatial relationships. Quantitative methods suitable for analyzing different features types are discussed. Applications for such methods are also presented.

Citizen & Participatory Science (MES 564/664) – 3 credits, FALL/ANNUAL
The Citizen and Participatory Science course will focus on preparing students for designing and implementing citizen and participatory science projects aimed at addressing questions and problems around specific environmental issues. As social networks grow, open data comes online and mobile technologies proliferate and advance, the opportunity to tap into eager and interested citizens to collect data for research and documentation purposes is quickly rising. This program will look at history of citizen science, which is over 100 years old, and will analyze current and past projects. Students will be exposed to how citizen science projects are designed and implemented and how they can be best leveraged to gain useful data for research. Guests lecturers will be invited for virtual and in-person presentations. A key component of the course will be for students to design a citizen science project using best practices. These projects can provide the baseline for launching real projects with organizations interested in applying citizen science to their work. The course will look at both technology driven projects as well as low-tech projects to expose students to the range of work being done in this rapidly evolving area.

Exploration Technology and Media (MES 565/665) – 3 credits, SPRING/ANNUAL
The emphasis of this course is on documentary video production as a tool for exploration using a variety of technologies and methods. As video becomes increasingly important in communication, this course will provide an overview of the production process (pre-production, production, post-production) for those with backgrounds in science, education, and outreach. A variety of films will be reviewed and the process of science storytelling will be examined. In addition, the course will touch on mobile, mapping, imaging, ROV and UAV (drone) technologies.

Conservation and Management of Marine Mammals (MES 570/670) – 3 credits, FALL/ANNUAL
This course explores current and pressing threats to large marine vertebrates, particularly mammals, and the relative legislation in place to protect them. Additionally, we will explore the methods and tools used to assess, manage, and conserve marine mammal populations, including case studies that exemplify both successes and failures. Discussions will include anthropogenic impacts, the Marine Mammal Protection Act/IWC/ESA/Florida Manatee Sanctuary Act/IUCN, a stock as a management unit, OSP/PBR, mark-recapture and other methodologies integral to wild population management, marine mammal strandings response, and the ethics of human intervention as it relates to the management of marine ecosystems as a whole. Emphasis will also be placed on the acquisition of relevant skill sets, such as communication of conservation messages using social media, advocacy with integrity, grant writing, and stranding and rehabilitation procedures and certifications.

Marine Conservation Biology (MES 571/671) – 3 credits, FALL/ANNUAL
Until now, fisheries management has used a species-specific approach to conservation, focusing attention on economically important species that people consume. There has been some research on charismatic mega-fauna, particularly whales, seabirds and sea turtles. To this day, fishery biologists are concerned mainly with assessing stocks of commercially harvested species to maintain biomass production, rather than maintaining and restoring biological integrity: species composition, habitat structure

and ecosystem function. It is only in the past few years that a new biodiversity-focused, ecosystem-based, multidisciplinary scientific approach to marine conservation has emerged. This new paradigm is known as Marine Conservation Biology.

The Archaeology of Seafaring (MES 572/672)
Ships and seafarers have had considerable influences on civilization throughout history. The ship typically represents the pinnacle of a society's understanding of many disciplines: astronomy, geography, metallurgy, physics, warfare, et cetera. No other process similarly spread the delights and devastation of the world so effectively. This course studies man's evolutionary relationship with the sea from early civilization through the 20th century. Emphasis will be on archaeological and ethnographical investigations concerning shipwrecks and maritime epicenters supporting maritime culture. This will be a lecture course supported by visual, audible, and hands-on presentations.

Marine Conservation Outreach (MES 573/673) – 3 credits, SPRING/ANNUAL
This course will explore the concepts, theories and practices of creating and evaluating effective Marine Conservation Outreach. The course will cover the project life cycle from planning to implementation to evaluating efficacy.

From Gold to Glory: History and Ethics of Exploration (MES 574/674) – 3 credits, FALL/ANNUAL
This course will address changes in motivation and approaches to exploration with a focus on risk perception, physiological limitations, and social-cultural context, including how past colonial legacy is still influencing perceptions of the current generation of scientists, explorers, and the groups they interact with. Assignments will include critical readings of source materials and case studies of particular expeditions.

Management and Conservation of Marine Ecosystems (MES 577/677) – 3 credits, SPRING/ANNUAL
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.

Acoustic Measurement of Nekton, Plankton and Underwater Habitat (MES 590/690)
This is an introductory course on the theory, history and applications of acoustics to measure nekton, plankton and underwater habitat. 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 790, Advance Measurement of Nekton, Plankton and Underwater Habitat, which focuses on data acquisition in the field and laboratory signal processing. This course is essential f or students who need to make precise and accurate underwater measurements for their research.

Maritime Archaeology Field Study (MES 591/691)
This field-based course focuses on the acquisition of data from shipwreck sites and subsequent interpretation and analysis. Topics of study will include shipwrecks from the 16th century to World War II era. Students will learn about historic maritime activity and be exposed to analyzing both the archaeological and historical record in examination of these sites. This course will be taught in collaboration with partners in the National Park Service and/or NOAA and dives will take place in Biscayne National Park, Dry Tortugas National Park, or the Florida Keys National Marine Sanctuary.

Archaeological Study of Submerged Pre-Contact Sites (MES 592/692)
This is a field-based course with a focus on submerged pre-contact or prehistoric archaeological sites within North America, Latin America, and the Caribbean. Students will learn about the past human activity, settlement patterns, and habitation of various regions and sites, while conducting fieldwork. Focus will be placed on topics such as the peopling of the Americas approximately 13,500 years ago, human adaptation to environmental change, and the location and investigation of now-inundated coastal sites and submerged caverns and caves. Techniques and methods of data acquisition for these site types will be taught and students will be responsible for writing a final report on the findings.

International Ocean Law and Governance (MES 710) – 3 credits, SPRING/ANNUAL
This course shall track the history and development of international ocean law, from a series of bi-lateral and multi-lateral treaties, the evolving customary law framework, and coastal and maritime state claims to the codification and proliferation of international legal agreements addressing the panoply of ocean use and management issues. Applying a chronological approach, the course shall identify and discuss key developments in international ocean law, leading to the drafting of the Third United Nations Law of the Sea Convention (UNCLOS III). By evaluating the multifold themes addressed under the convention, the course will analyze

the effects of convention in a post UNCLOS III world, especially in the fields of environmental protection, the management of marine fisheries and living resources, the allocation of seabed and subsoil resources, issues affecting the high seas, and polar regions.

Marine Population Dynamics (MES 713) – 3 credits, FALL/ANNUAL
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.

Population Modeling and Management (MES 714) - 3 credits, FALL/BI-ANNUAL
Mathematical and computer-intensive models of exploited populations fish, shell fish, 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.

Advanced Biometrics in Marine Science (MES 715) - 3 credits, FALL/BI-ANNUAL
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.

Coastal Law and Policy (MES 720) – 3 credits, FALL/ANNUAL
Course examines the authority of different levels and agencies of government to make decisions affecting the coastal zone. Course also explores the coastal problems of shoreline use and development, uses of water areas and the seabed, and the related questions of environmental protection.

Advanced Acoustic Measurement of Nekton, Plankton, and Underwater Habitat (MES 790) – 3 credits, FALL/ANNUAL
This 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.

Internship Project (MES 805) – 1 credit*, FALL & SPRING/ANNUAL
All MPS students must enroll in a minimum of 2 and maximum of 6 internship project credits. *These credits are full-time status indicators.

Thesis Research (MES 810) – 1 credit*, FALL & SPRING/ANNUAL
All M.S. students working on their thesis must enroll in 6 thesis research credits. *These credits are full-time status indicators.

Dissertation Research (MES 830) – 1 credit*, FALL & SPRING/ANNUAL
All Ph.D. students working on their dissertation must enroll in a minimum of 12 dissertation research credits, as determined by their Committee Chair. No more than 12 credits of MES 830 may be taken in a regular semester, and no more than 6 in a summer session. *These credits are full-time status indicators.