UMES Professional Science Master's Program

Course Descriptions

(*New courses)

MEES 699: Special Problems: Internship Experience/Non-thesis project 3 credits
Students will be required to complete an internship at any of the state or federal agencies or at an approved environmental or natural resources consulting firm. Interns will be required to spend up to 250 hours in order to earn 3 non-thesis project credits. Alternatively, students may complete fewer hours per week over an entire semester for a total equivalent of 3 months. A minimum of 150 hours of experience at an internship site is required. Students will work with potential supervisors at the internship site to develop a project based on mutual interest. Students will be required to write a proposal describing their internship duties that will be presented to faculty and students. Students will work with the internship supervisor to determine and complete a form that will list the tasks to be accomplished on a weekly basis. Deliverables will be sent to the internship supervisory committee on a monthly basis. Interns will be required to prepare and submit reports on their projects at the end of their internships. A special symposium will be organized during which students will make oral presentations to fellow students and professors on their experiences and knowledge gained at the internship site.

MEES 642: Fish Population Dynamics and Stock Assessment 4 credits
In this course, the effects of alternative management actions and environmental factors on the abundance and biomass of fish populations will be discussed. The course will begin with an overview of population modeling by reviewing essential mathematical concepts and biostatistics in the areas of algebra, beginning calculus, differential equation and descriptive statistics. Then, students will be taught the basic fish population characteristics and life histories including growth, mortality, fecundity, recruitment, biomass, and age structure. Finally, students will learn how to use various mathematical models to estimate population parameters and predict yield under different management scenarios. Topics to be covered include: estimation of fish abundance, population growth and mortality rates, stock identification and dynamics and stock recruitment relationships. Other topics to be covered are fish production models, catch at age analysis, and the problems in fisheries management.

***MEES 643: Risk and Decision Analysis in Natural Resources Management 3 credits**
This course will enable students to develop skills for managing natural resources with relevant decision frameworks reflecting uncertainty and risk about future events. The decision frameworks involve making tradeoffs across options and time using quantitative methods of risk assessment and decision analysis taking uncertainty into account. The course also considers the types of variability and risks faced by resource managers for several natural resources including forests, waters, wild life, and fisheries.

MEES 688A: Scientific Communications 4 credits
This course is intended for graduate students in basic and applied sciences, and other technical disciplines such as engineering and technology. The course will address important writing concepts, content, organization, format, and style applied to professional scientific communications such as peer-reviewed manuscripts, science articles and reports for magazines,

posters, proposals for funding agencies, theses, and dissertations. Topics such as oral presentations, ethics and research and publications, writing critiques of scientific articles and reports, and preparing cover letters, curriculum vitae, teaching and research statements for positions in academia and industries will also be covered.

MEES 688P: Personnel Development, Management, and Evaluation 3 credits
This course covers leadership strategies required in recruitment, development, and in-service effective use of personnel. It focuses on the evaluation techniques that promote a highly motivated personnel with a subsequent professional delivery system.

MEES 688: Business and Fish Management Ethics 3 credits
The purpose of this course is to assist students in understanding ethical implications in the decision-making process and to assume their role as managers with a sense of a broader purpose impacted by moral consciousness. Concepts and principles are discussed in light of problem situations with ethical implications with a focus on the development of critical and analytical thinking. Prerequisite: Sophomore Standing.

MEES 688/MBF 613: Marine Population Dynamics (UM-RSMAS) 3 credits
The objectives of the course are: 1) to introduce students to the theory and practice of the quantitative characterization of the processes that regulate, control and affect populations of harvested marine animals, and 2) to train students to use population dynamic models to answer resource management questions. Students will be expected to familiarize themselves with basic theories of marine population dynamics, including mathematical derivations of basic population models. They will understand the relative importance of different biological processes in explaining the dynamics of essential ―population level‖ characteristics, and develop an understanding of the impact of fishing and the ecosystem on the dynamics of marine populations. Furthermore, students will learn to use statistical and modeling tools to develop hypotheses, estimate parameters, and make predictions about the dynamics of fished systems. They will acquire knowledge of the basic concepts required to support single species management, and the basic models that support current population assessment models. Finally, they will be able to explain the link between single species management and ecosystem management. The course objectives will be met by a combination of theoretical lectures, weekly assignments, and interactive computer sessions.

MEES 688: Fish Ecology 3 credits
This course will examine the patterns of fish diversity. There will also be an analysis of the effects of environmental factors (abiotic and biotic) on the survival, growth, and reproduction of fish, as well as the evolution of life history patterns in fish. To be covered also will be aspects of population dynamics of fish including quantitative methods for estimating abundance, growth, mortality and production, and stock-recruitment relationships. There will also be discussions on the impacts of anthropogenic factors on essential fish habitat and fish.

***MEES 644: Multivariate Statistics 3 credits**
Students will learn various types of multivariate statistical methods including, factor analysis, multidimensional scaling, and cluster analysis. Knowledge from this course will enable students to summarize data and reduce the number of variables necessary to describe the data. The use of

Multivariate Statistics will allow students to analyze complex sets of data from their disciplines, determine if multiple independent variables exist in the data set; and, if the data set contains dependent variables that are correlated with one another.

***MEES 641: Fisheries Survey Sampling 3 credits**
This course will train students in methods of estimating abundance, mean size, proportions, and other parameters of fish and wildlife populations. Students will learn theory and techniques for different sampling strategies including random, stratified, systematic, cluster, adaptive, regression and ratio estimators, as well as procedures for estimating variance, confidence intervals, relative error, and sample sizes for each method. Problems and examples will be based on real-world data sets drawn from marine fisheries research, with emphasis on trawls, dredges, traps, or video surveys, and will be analyzed using Microsoft Excel.

MEES 688/MBF 672: Bayesian Statistics for Marine Scientists (UM-RSMAS) 3 credits
This course will cover Bayesian statistical methods from the theory to the practical use of statistics packages such as WinBUGS. 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 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.

MEES 688/MBF 614: Advanced Fisheries Modeling (UM-RSMAS) 3 credits
This is an advanced population dynamics course that presents a synthesis of mathematical and computer-intensive models to assess and manage population (i.e., fish, shellfish, marine mammal and sea turtle) responses to exploitation. It covers a rigorous quantitative development of modeling concepts and stock assessment techniques including: stock production (surplus production), structured analytical yield (yield-per-recruit and age-size structured assessments), stock and recruitment, and, dynamic structured methods. Additionally, it will examine equilibrium and non-equilibrium approaches to data assimilation and parameter estimation, simulation modeling, decision theory, adaptive control, and risk assessment. Specific population modeling and resource allocation case studies from regional, federal and international fishery management institutions will be examined. The course has lecture and computer-based laboratory components.

***MEES 648: Ecosystem modeling for fisheries 3 credits**
This course is arranged so that students learn (or review) the basics of the traditional fisheries modeling and management methods and are introduced to the ideas of ecosystem-based management and modeling in the first week. Subsequent weeks build on the basics to more complex and realistic models. The first week is focused on traditional methods. These methods are rooted in population dynamics and harvest and tend to have a top-down view of the ecosystem. In Week 2, students are introduced to extended stock assessment methods building on what they learned in the first week. Some fisheries stock assessments now are beginning to incorporate environmental factors and other explicit sources of mortality (e.g., predation mortality) besides fishing and natural mortality. These approaches are basically top-down but with some potential bottom up factors affecting a population. In week 3, students will shift gears

and focus on individual-based models that are focused on mostly bottom up effects – i.e. how physical features and habitat influence growth and reproduction of and individual fish and how that extrapolates to the whole. Finally, in week 4, students would focus on whole ecosystem models, this framework allows the incorporation of bottom-up and top-down effects on a stock and an ecosystem. The model discussed in Week 1 and 2 are more suitable for tactical management; the models discussed in Weeks 3 and 4 are more suitable for strategic management.

***MEES 640: Introduction to Environmental and Resource Economics 3 credits**
Environmental and resource economics is the study of how economic forces and institutions affect the environment and are in turn affected by them. This course provides an introduction of major topics in the field, such as pollution, climate change, biodiversity, and fisheries. Students will learn basic market theory and the significance of market failures in the environmental context, and will study policy responses to these market failures, both the theory and the practice. Economics helps understand behavior and helps guide policy by identifying trade-offs, not by picking the best trade-off. The goal of the course is to make students aware of the importance of economics arguments they may encounter in the context of environmental policy discussions.

***MEES 647: Research Methods in Envonmental & Natural Resources Economics 3 credits**
This course will cover the practice and methods of applied research in environmental and natural resources economics. Topics include philosophical foundations, research project design, reporting research results, and criticism of proposals and research papers. This course is specifically designed for students who are majoring in fisheries and resource economics, but is open to any student interested in research methods.

***MEES 649: Economics of Renewable Resources 3 credits**
This course intends to provide theoretical framework of natural resource economics. It will cover the major areas of renewable resources including the use and conservation of forest, marine and mineral resources, and the valuation of renewable resource assets. There will be several reading materials assigned for each lecture.

***MEES 650: Econometrics 4 credits**
This course is an introduction to the use of multiple regression methods for analyzing data in economics and related disciplines. It addresses the multivariate analysis of quantitative data at the intermediate level. The primary focus is to use statistical packages for calculating multivariate statistics and the utilization of the statistical output in research findings.

***MEES 652: Marine Resource Policy 3 credits**
Coastal estuarine and marine systems are some of the most biologically dynamic systems in the world serving as nursery grounds for many of the nation's important recreational and commercial fisheries. These systems are also some of the most attractive as areas for urban and suburban development as such highly sensitive to anthropogenic effects. Many of the marine fisheries whose young utilize coastal systems for development and growth are significantly impacted by environmental declines which reduce recruitment to offshore marine stocks. Add to this the demands for fish, shellfish and plant products from the sea which have also significantly impacted the fisheries and offshore ecosystems there comes a need for a concerted look at how

marine resource policy is developing and how it will be implemented. In addition the potential economic value of offshore marine areas is not confined to biological resources and is now being explored as areas for energy production (tidal and wind generators), oil exploration, military uses, reefs for attracting fish and so on. It is highly likely that like zoning practices on land our coastal aquatic areas will also be subject to development of exclusive rights and zoning for specific purposes. The intent of this course is to inform the student of the current and proposed uses for our estuarine and marine areas, the sciences that are needed to develop the information that is to be used in policy development and how marine policy is being developed and in some cases how it should be developed.

AGEC 813: Advanced Microeconomic Theory 3 credits
This is an advanced treatment of the theory of prices and markets. Discussions focus on analysis of the theory of the household and the firm, concepts of general equilibrium and welfare economics, and principles of efficient and equitable allocation of resources.

Quality of Program and Support Faculty

All graduate faculty members possess a terminal degree in an area of fisheries and/or resource or agricultural economics, and supporting areas. (*Affiliate faculty from NOAA or University of Miami-RSMAS)

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For further information on the Professional Science Master's degree please contact:
Dr. Paulinus Chigbu – 410-651-3034 or at pchigbu@umes.edu
Ms. Judith Rose – 410-651-7846 or jarose@umes.edu