University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Adv. Population Dynamics and Assessment

Number of credits

MEES 712

Course Objectives / Overview

Management of exploited populations relies on a quantitative understanding of population dynamics and the effects of exploitation on marine resources. This course will focus on developing students' quantitative and modeling skills, including understanding of population dynamics and responses of populations to exploitation and management actions. The course will cover population models of production, mortality, stock and recruitment, age and growth, and harvesting, and methods for using these models to provide management advice. Particular attention will be paid to assumptions and data requirements of models. Although examples used throughout the course will focus on fish and shellfish populations, topics covered are general and could be applied to populations of most organisms. Additionally, the course will have a focus on statistical model fitting and simulation.

Expected Learning Outcomes

In this class, students develop their ability understand and analyze population dynamics data. Specifically, students will learn

- To develop models for representing population dynamics, including models for mortality, growth, stock-recruitment, and age-structured population dynamics;
- To statistically estimate parameters and interpret results using these models in a maximum likelihood framework; and
- To develop management advice from the outputs of the models.

Course Assessment / Grading

Grades will be determined by a combination of in-class participation, assignments, and exams. Assignments will focus on MS Excel-based application and interpretation of course concepts. Two exams, a mid-term and a final, will comprise 40% of the total grade. The final is a take-home project

Participation 10%
Assignments 50%
Exams 40%

INSTRUCTOR DETAILS:
Michael Wilberg
wilberg@umces.edu
410-326-7273

CLASS MEETING DETAILS:
Dates:
Times:
Originating Site:
IVN bridge number:
(*******)
Phone call in number:
(***)
Room phone number:
CBL, Room 1120 Bernie Fowler Laboratory (teaching IVN room)

Office hours by appointment (Office in 1103 Parish House at CBL)

Course website:
https://moodle.cbl.umces.edu (make sure NOT to include "www")

CURRICULUM FULLFILMENT:
MEES 712 satisfies the PD requirement and can also serve as an elective

Prerequisites
Environmental Statistics I or permission of the instructor

Tentative Weekly Course Schedule

Topics:

Week 1: Course introduction
Assign: Introduction to modeling in Excel (or other software package)

Week 2: Terms and concepts for mathematical models Exponential/Logistic population growth, Age-based models (Leslie matrices)
Assign: Exponential and logistic population models and Leslie matrix models

Week 3: Harvest and additional mortality sources in population models, exponential mortality and deterministic theory of fishing (MSY)
Assign: Effects of fishing on populations

Week 4: Per recruit dynamic pool models (YPR and SPR)
Assign: Constructing and interpreting YPR and SPR models

Week 5: Indices of abundance and catch curves
Assign: Catch curves

Week 6: Probability, likelihood, parameter estimation, and uncertainty
Assign: Normal and lognormal distributions, estimation

Week 7: Growth
Assign: Growth model fitting

Week 7: *Mid-term Exam*

Spring Break

Week 8: Stock-recruitment and iteroparous MSY
Assign: SR model fitting

Week 9: Surplus production models (process and observation error)/Data used in models/Fitting models to a time series of data
Assign: Fitting and interpreting surplus production models

Week 10: Virtual population analysis and cohort analysis
Assign: Fitting and interpreting VPAs

Week 11-12: Statistical catch-at-age models (and age-structured production models)
Assign: Fitting and interpreting SCAA models

Week 13-14: Population dynamics in ecosystem-based management and developing and evaluating sustainable fishing policies
No assignment

May 15 *Final Exam due by noon.*

Required textbooks, reading and/or software or computer needs

Required texts - none

Optional texts for this course include

Quinn and Deriso. 1999. *Quantitative Fish Dynamics*. Oxford University Press, New York. This book is an excellent reference and the most state-of-the-art assessment book around, but the text is often dense.

Hilborn and Walters. 1992. *Quantitative Fisheries Stock Assessment: Choice, Dynamics, and Uncertainty*. Chapman Hall. This book is more readable than Quinn and Deriso, but has less coverage of advanced techniques than Quinn and Deriso, and some topics are now a bit dated.

Walters and Martell. 2004. *Fisheries Ecology and Management*. Princeton University Press. This book is very readable, but is more focused on management than either Quinn and Deriso or Hilborn and Walters.

Readings will be provided from a variety of book chapters and articles.

Course Communication

Office hours by appointment. Course materials and assignments will be distributed via Moodle. Please turn in assignments using the drop boxes provided on Moodle.

Resources

https://moodle.cbl.umces.edu (make sure NOT to include "www")

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved of various academic and research-related policies by which all students and faculty must abide.

Please visit http://www.umces.edu/consolidated-usm-and-umces-policies-and-procedures for a full list of campus-wide academic policies.