

FISHERIES AND WILDLIFE SCIENCES 6004

Advanced quantitative methods in fisheries and conservation biology

CATALOG DESCRIPTION

This course is designed to introduce advanced quantitative methods in fisheries population dynamics and conservation biology. Students will learn how to use appropriate quantitative methods in fitting models to data, to estimate vital parameters for fisheries with uncertainty, to compare different models (hypotheses), to evaluate current status of a fishery and risk of applying alternative management strategies through formal stock assessment processes, and to understand and interpret uncertainties associated with assessment in a probabilistic way in managing fisheries resources.

Prerequisites are firm. I expect students to have had at least a year of calculus, some classical statistics, some of the classical ecological models and basic knowledge of computation languages, such as MATLAB and R. Models and basic probability and statistics theory taught in FiW 5514 – Fish Population Dynamics and Modeling, are directly used in this course. Applied quantitative methods covered in this course include: Monte Carlo, bootstrap, maximum likelihood estimation and likelihood inference, and Bayesian statistics.

A combination of the teaching styles of lecture, question-based, class computing practice, discussion and case study is used for this course.

Pre: FiW 5514 and Stat 5616 or equivalent courses
(2H).

I. Fall semester of years that of enough students.

MEETING TIMES AND CLASSROOM

Monday and Wednesday 4:00-5:15PM, Cheatham XXX

INSTRUCTORS

Yan Jiao, 110 Cheatham Hall, 231-5749, yjiao@vt.edu
Office hours: Friday 10:00-12:00AM or contact me for an appointment.

RECOMMENDED BOOK

Hilborn R. and Mangel M. 1997. The ecological detective, confronting models with data. Princeton University Press, Princeton, New Jersey.

OTHER RECOMMENDED READINGS (distribute separately on scholar website)

GOALS AND EXPECTATIONS

- 1) Students will be able to develop mathematical models that simulate population dynamics in a realistic fashion based on existing data and knowledge of organisms.
 - a) Write computer spreadsheets, or Matlab codes or other software that the students know
 - b) Predict outcomes from mathematical models and develop general expectations based on different input parameter values.
- 2) Student will be able to estimate model parameter uncertainty and the probabilities of achieving management objectives via different actions (e.g., harvest regulations)
 - a) Estimate model parameter uncertainty using appropriate inference methods.
 - b) Apply probabilities and Monte Carlo type simulations to estimate outcome probabilities.
 - b) Evaluate the model uncertainties to decide which parameters or processes are most critical to results and decisions.
- 3) Students will become more familiar by journal articles that contain unfamiliar equations and/or symbols.
 - a) Read and discuss contemporary articles recommended by the instructor and selected by the students themselves.
 - b) Evaluate potential contributions and possible improvement in these journal articles.

LECTURE TOPICS

Topics	Readings
A general review of tools of the ecological detective beyond the null hypothesis (confronting models to data)	Preface, Ch1
Probability and practice of random data generation	Ch 3
Monte Carlo and its application in risk assessment in conservation biology	Case study 1
Confrontation 1: least square Model selection based on least square	Ch 5 and 11
Uncertainty estimation using Bootstrap and its application in fisheries and biology	Case study 2
Confrontation 2: Likelihood and Maximum Likelihood	Ch 7
Uncertainty estimation and Model selection using likelihood	Case study 3
Confrontation 3: uncertainty estimation using Bayesian approach	Ch9 FAO2001
Continue of Bayesian approach	Case study 4
Comparison of the 3 inference methods	Ch 1 and 2, Punt 1997; Wade 1999

EVALUATION

Final grades will be based on:

- Assignment 1 - 4 (80%, 20% each) (students are free to pick up the computing languages to do the assignments)
- In-class discussion leadership and summary (20%)

Grading

Grading will be assigned as described in the graduate Catalog. We feel that a “C” indicates adequate performance and that a “B” or an “A” indicate “good” and “superior” work. Your grades are determined independently and you will not be competing against other students for the “curve.” Grades will be assigned according to a curve no stricter than the following schedule:

Letter Grade	% of total points	
A	90-100	Your grade will be determined by your performance on the assessments described in the above section.
B	80-89.99	
C	70-79.99	
D	60-69.99	
F	<60	

ABSENCE POLICY:

Students are expected to attend each class. No make-up lectures will be given.

CHANGES TO SYLLABUS:

The instructor reserves the right to make changes to the syllabus during the course. Any necessary changes will be announced in class and posted on the course website.

HONOR CODE STATEMENT:

“The Virginia Tech Honor Code embodies a spirit of mutual trust and intellectual honesty that is central to the very nature of the university, and represents the highest possible expression of shared values among the members of the university community.

The Honor Code is the University policy which expressly forbids the following academic violations:

1. Cheating -- Cheating includes the actual giving or receiving of any unauthorized aid or assistance or the actual giving or receiving of any unfair advantage on any form of academic work, or attempts thereof.
2. Plagiarism -- Plagiarism includes the copying of the language, structure, ideas and/or thoughts of another and passing off same as one's own, original work, or attempts thereof.
3. Falsification -- Falsification includes the statement of any untruth, either verbally or in writing, with respect to any circumstances relevant to one's academic work, or attempts thereof.

Therefore, the student body at Virginia Tech will not tolerate any violation of the Honor Code. All students, upon admission to this University, have pledged to abide by the Honor Code. Any student found by the appropriate forum within the Honor System to have violated the Honor Code shall be deemed guilty as charged.”

I encourage students to work together when studying for class and in reviewing drafts of assignments. The work that you hand in for a grade should be your own. I will report any suspected honor code violations to the Honor System Office. If you have any questions about what is or is not appropriate behavior, please contact me immediately. Cheating, plagiarism, and falsification are completely at odds with the educational process.

SPECIAL NEEDS:

"Any student with special needs or circumstances should feel free to meet with me during office hours".