

Course Number: MAR 536
Course Title: Biological Statistics II
Instructors:
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Class Location: SMAST II Room 157
Class Time: Tuesday/Thursday 10:30-11:45
Wednesday 10:30-12:30 (January 27 to March 9)
Office Hours: Tuesday/Thursday afternoon by appointment

Course Description: Student-led learning in statistical analysis of ecological data. This course provides guided learning in advanced statistical analysis, as applied to ecological research and other fields of marine science. Advanced concepts in probability, hypothesis testing, and estimation will be presented by students, including analyses of example data sets and problems. Students will be required to learn selected methods independently, present topics to the class that are relevant to their graduate research and complete a class project. A computer lab, focused on introductory and intermediate programming and analysis using R, will be held for the first half of the semester.

Course Objectives:

1. Self-learning in advanced quantitative concepts and methods
2. Familiarity with advanced statistical methods
3. Experience communicating advanced quantitative topics
4. Experience in statistical programming

Credits: 4

Prerequisites: Students should have taken an introductory graduate statistics course (e.g. MAR 535 Biological Statistics I or equivalent), or seek permission from the instructors.

Evaluation procedures:

1. An advanced statistical analysis of data relevant to the student's graduate research topic, including a detailed report and oral presentation (55% of course grade).
 - a. Brief description of the topic including a statement of the problem, proposed statistical method, and supplemental reference(s) is due February 25 (5% of course grade).
 - b. Oral presentation on the project at the end of the semester (25% of course grade).
 - c. Project report (due May 3rd 2016). A written description of the methods and results of the project in the form of a draft scientific manuscript (Introduction, Methods, Results, Discussion). (25% of course grade).

2. Student Lecture (30% of course grade) - Chapter assignment or supplemental reading on a statistical topic relevant to the student's graduate research. A one-hour lecture on assigned reading, including introduction of the method, demonstration of the method using example datasets and leading class discussion. Lectures will be graded based on the instructors' evaluation of accuracy, clarity, and comprehensiveness. Feedback from other students will also be considered in evaluation of presentations.
3. Participation in class discussions (5% of course grade). Attendance at all lectures and labs is the best way to understand topics and assignments, but is not required for evaluation.
4. Computer lab exercises (10% of course grade). Completion of short laboratory exercises using R during the first half of the semester.
5. Failure to complete any of these requirements for evaluation will result in a score of zero for missing components. A final grade of 'incomplete' may be recorded at the request of the student and the discretion of the professor.
6. No academic dishonesty, including plagiarism, will be tolerated and the University Academic Integrity policy applies:
<http://www.umassd.edu/studentaffairs/studenthandbook/academicregulationsandprocedures/>

Required Hardware: laptop computer

Required Software:

1. R (free download at <http://r-project.org>, students may also wish to install Rstudio, an integrated development environment for R, free download at <http://www.rstudio.com>)

Principal Text:

Zuur, A.F., Ieno, E.N. and Smith, G.M. (2007). *Analysing Ecological Data*. Springer. 700p.
Series: *Statistics for Biology and Health*. (available as ebook through the UMass Amherst library system, or hard copy ~\$100 online).
Support website for book (www.highstat.com/book1.htm)

The form for students to request access to UMass Amherst ebook collection is available at:
<http://www.umassmarine.net/wp-content/uploads/2014/04/NENS-Form-for-UMass-Amherst.pdf>

Supplementary Text (others as needed):

Bolker, B.M. 2008. *Ecological Models and Data in R*. Princeton University Press.
(<http://press.princeton.edu/titles/8709.html>)

James, G., Wittem, D., Hastie, T., and Tibshirani, R. (2014). *An Introduction to Statistical Learning With Applications in R*. Springer. (ebook available online)
Support website for book (<http://www-bcf.usc.edu/~gareth/ISL/>)

Course outline and tentative schedule of lectures/labs (the schedule of advanced topics later in the semester is expected to change based on student needs):

Type	Day	Date	Reading	Topic	Presenter
Lecture	Tue	26-Jan	Zuur et al. Chap. 1-4	Introduction, data exploration	Steve
Lab	Wed	27-Jan		Introduction to R and R Studio, working with data	Gavin
Lecture	Thur	2-Jan	Bolker 2008 Chap. 4	Probability review	Gavin
Lecture	Tue	2-Feb	Zuur et al. Chapter 5	Linear regression review	Steve
Lab	Wed	3-Feb		Introduction to plotting, manipulating data	Gavin
Lecture	Thur	4-Feb	Zuur et al. Section 6.1	Extending linear model (GLM)	Steve
Lecture	Tue	9-Feb	Zuur et al. Section 6.2	Classification, Logistic regression	Steve
Lab	Wed	10-Feb		Probability, Linear modeling in R, PCA.	Gavin
Lecture	Thur	11-Feb	Zuur et al. Chapter 12	Matrix algebra review and PCA	Steve
Lecture	Tue	16-Feb	NO CLASS	Monday schedule	
Lab	Wed	17-Feb		Programming practices, conditional statements	Gavin
Lecture	Thur	18-Feb	James et al. Chapter 7	Nonlinear models, splines	Gavin
Lecture	Tue	23-Feb	Zuur et al. Chapter 14	Linear Discriminant Analysis	Steve
Lab	Wed	24-Feb		Creating functions, debugging	Gavin
Lecture	Thur	25-Feb	Zuur et al. Chapter 7	GAMs Project descriptions due	Steve
Lecture	Tue	1-Mar	James et al. Chapter 5	Resampling methods, Cross-Validation	Gavin
Lab	Wed	2-Mar		Permutation analysis	Gavin
Lecture	Thur	3-Mar	Zuur et al. Chapter 9	Tree Models	Steve
Lecture	Tue	8-Mar		Project Feedback & Discussions	Steve
Lab	Wed	9-Mar		Advanced plotting	Gavin
Lecture	Thur	10-Mar	James et al. Section 10.3	Cluster Analysis	Steve
Lecture	Tue	15-Mar	NO CLASS	spring break	
Lecture	Thur	17-Mar	NO CLASS	spring break	
Lecture	Tue	22-Mar	Zuur et al. Chap. 12	Principal components analysis	Ashley
Lecture	Thur	24-Mar	Zuur et al. Chap. 13	Correspondence analysis	Arjun
Lecture	Tue	29-Mar		Zero-Inflated GLM	Alex
Lecture	Thur	31-Mar		Presence-Only Discrimination	Tammy
Lecture	Tue	5-Apr	NO CLASS		
Lecture	Thur	7-Apr	NO CLASS		
Lecture	Tue	12-Apr		Bayesian Methods	Chris
Lecture	Thur	14-Apr	Agresti	Analysis of Categorical Data	Brooke
Lecture	Tue	19-Apr	Zuur et al. Chapter 19	Spatial statistics (Gaussian spatial processes)	Megan
Lecture	Thur	21-Apr		Presentations	Alex&Tammy
Lecture	Tue	26-Apr		Presentations	Ashley&Arjun
Lecture	Thur	27-Apr		Presentations	Chris&Brooke
Lecture	Tue	3-May		Presentations	Megan

The following statement regarding Title IX information has been reviewed by the Faculty Senate in spring 2015:

The purpose of a university is to disseminate information, as well as to explore a universe of ideas, to encourage diverse perspectives and robust expression, and to foster the development of critical and analytical thinking skills. In many classes, including this one, students and faculty examine and analyze challenging and controversial topics. If a topic covered in this class triggers post-traumatic stress or other emotional distress, please discuss the matter with the professor or seek out confidential resources available from the Counseling Center, <http://www.umassd.edu/counselling/>, 508-999-8648 or -8650, or the Victim Advocate in the Center for Women, Gender and Sexuality, <http://www.umassd.edu/sexualviolence/>, 508-910-4584. In an emergency contact the Department of Public Safety at 508-999-9191 24 hrs./day.

UMass Dartmouth, following national guidance from the Office of Civil Rights, requires that faculty follow UMass Dartmouth policy as a “mandated reporter” of any disclosure of sexual harassment, abuse, and/or violence shared with the faculty member in person and/or via email. These disclosures include but are not limited to reports of sexual assault, relational abuse, relational/domestic violence, and stalking. While faculty are often able to help students locate appropriate channels of assistance on campus, disclosure by the student to the faculty member requires that the faculty member inform the University’s Title IX Coordinator in the Office of Diversity, Equity and Inclusion at 508-999-8008 to help ensure that the student’s safety and welfare is being addressed, even if the student requests that the disclosure not be shared. For confidential counseling support and assistance, please go to <http://www.umassd.edu/sexualviolence/>