

Experimental Design and Analysis

Fall 2011 Course Description and Syllabus

Instructor: Catherine M. Matassa (matassa.c@husky.neu.edu)

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Required Text and Software:

Gotelli, N.J. and A.M. Ellison. 2004. *A Primer of Ecological Statistics*. Sinauer Assoc. Inc., Sunderland, MA, USA (Available at NU Bookstore or online booksellers)
JMP by SAS Institute, Cary, NC. (Available at NU Bookstore, or select a 6- or 12-month student license at <http://www.onthehub.com/jmp>)

Course Description:

Experimental Design is not your typical statistics class! You will not receive comprehensive training in biological statistics in this course. Rather, the goal is to provide you with practical, powerful and accessible tools that will allow you to design, execute, analyze, and interpret ecological experiments, while giving you the mathematical and conceptual background to pursue more complex designs and analyses in the future.

You will be introduced to a variety of statistical methods based on Analysis of Variance (ANOVA), as well as the interpretation of statistical and graphic results. Homework exercises will be assigned with each new topic for you to review the techniques on your own and to practice using statistical software. Three exams, given throughout the semester, will be used to assess your progress.

Together as a class, we will conduct a novel ecological experiment, the results of which you will independently analyze, interpret, and present in a manuscript. This aspect of the course is both challenging and rewarding in equal measure, as it provides a rare opportunity for you to experience the scientific process in a guided, hands-on environment, all the way through to the final stages of the peer review/publishing process. I cannot emphasize enough that you should start working on your manuscript as early as possible—this means finding/reading journal articles and developing your ideas/hypotheses long before you sit down and start to write.

Expectations and Grades:

Due to the applied, hands-on nature of this course, we have to be flexible regarding designated class times, especially when we need to utilize the low tides. Consequently, please come to class each week prepared for field and computer work, and always have a calculator. I will do my best to let you know ahead of time, but our time together will be used most efficiently if we're all prepared.

Course communications will be sent to your @husky.neu.edu e-mail address, so please set your preferences to forward messages to your personal address if you do not wish to use NU e-mail.

Class attendance is mandatory. Assignments are due on the dates/times specified in the syllabus unless otherwise noted. You may submit assignments early (in person to Catherine or Stephanie), but late assignments will not be accepted. Weekly readings may be completed at your own pace unless there is a scheduled discussion. However, all assigned readings and material covered in lectures/labs are subject to examination, so it behooves you to stay on schedule. You are expected to adhere to Northeastern University's Academic Integrity Policy: northeastern.edu/osccr/academichonesty.html.

- Assignments: 30% (~6 @ 5% each)
- Exams: 35% (Exam I 10%, Exam II 10%, Exam III 15%)
- Manuscript: 30% (Outline 5%, First Submission 15%, Revisions/Response 10%)
- Participation: 5%

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Fall 2011 Class Schedule

Class is scheduled for Mondays, 09:00-16:00, in the MSC classroom, with plenty of breaks for refreshments, coffee and lunch. Please be aware that we will sometimes have to change our start/end times to be able to work low tides, and we may reach some topics sooner or later than on the schedule depending on how things are going. The most up-to-date syllabus will be posted on blackboard.

Week 1:	September 7th (Wednesday, 10:05-11:45)
<i>Readings:</i>	*Hurlbert S.H. 1984. Pseudoreplication and the design of ecological field experiments. <i>Ecological Monographs</i> 54(2):187-211. *Please read for discussion on 9/12/11 Gotelli & Ellison: Chpt. 6
<i>Lecture(s):</i>	Introduction to Experimental Design / Course Overview
Week 2:	September 12th (LTs: 05:43, +0.4', 17:59, +0.4')
<i>Readings:</i>	G&E Chpt. 3 and Chpt. 4 (pp. 90-106)
<i>Lecture(s):</i>	Review of Descriptive Statistics Introduction to Hypothesis Testing Discussion of Hurlbert 1984: issues in experimental design
<i>Lab(s):</i>	Discuss and Design Class Experiment
<i>Assignment:</i>	Collect organisms and prepare materials/equipment for class experiment
Week 3:	September 19th (LT: 10:19, +1.8')
<i>Readings:</i>	Chpt. 7 (pp. 163-175), Chpt. 8 (pp. 229-236), Chpt. 10 (pp. 289-300)
<i>Lecture(s):</i>	Single Factor Analysis of Variance (ANOVA) Fmax Tests
<i>Lab(s):</i>	Start Class Experiment
<i>Assignment:</i>	HW1 (due 9/26 @ the start of class)
Week 4:	September 26th (LTs: 04:21, -0.7', 16:45, -0.9') (Quoddy Head Field Trip 9/27-9/30)
<i>Readings:</i>	Review Readings from Last Week re: ANOVA
<i>Lecture(s):</i>	Single-Factor ANOVA on JMP Statistical Software: "Fit Y by X" and "Fit Model" approaches Testing and Meeting the Assumptions of ANOVA Introduction to Manuscript Preparation
<i>Lab(s):</i>	Prep for trip to Lubec, ME
<i>Assignment:</i>	HW2 (due 10/3 @ the start of class)
Week 5:	October 3rd (LT: 10:20, +0.5')
<i>Readings:</i>	Chpt. 9, Journal Articles relevant to your manuscript (MS)
<i>Lecture(s):</i>	Fitting Linear Models to Raw Data Linear Regression and its Assumptions using JMP
<i>Assignment:</i>	HW3 (due Friday, 10/7 by 3pm to Catherine's office or mailbox)
Week 6:	October 10th (Columbus Day- no class on Monday, 10/10)
<i>Readings:</i>	Journal Articles for MS, review assigned readings
<i>Assignment:</i>	Prepare for Exam I and work on your Manuscript Outlines / Introductions

Week 7:	October 17th (LT: 09:02, +1.6')
<i>Readings:</i>	Chpt. 10 (pp. 314-317), Chpt. 7 (pp. 175-180), Journal Articles for MS
<i>Lecture(s):</i>	Introduction to ANCOVA
<i>Exam:</i>	Exam I (morning)
<i>Manuscript:</i>	Manuscript Outlines and Preliminary Citations (due 10/24 @ the start of class)
Week 8:	October 24th (LT: 15:30, -0.6')
<i>Readings:</i>	Chpt. 10 (pp. 314-317, 333-335), Journal Articles for MS
<i>Lecture(s):</i>	Analysis of Covariance: Methods and Interpretations
<i>Lab(s):</i>	Take Down Experiment
<i>Assignment:</i>	HW4 (due by 9am on 11/01)
Week 9:	October 31st (LT: 09:01, +0.2')
<i>Readings:</i>	Chpt. 10 (pp. 302-308), Chpt. 7 (pp. 171-188), Journal Articles for MS
<i>Lecture(s):</i>	Multi-way ANOVA and ANCOVA; Introduction to Simple Nested Designs
<i>Lab(s):</i>	Finish Mussel Measurements, Preliminary Analysis of Experiment Data
<i>Assignment:</i>	HW5 (due by 9am on 11/4)
Week 10:	November 7th (LT: 14:46, +0.8')
<i>Readings:</i>	Journal Articles for MS
<i>Lecture(s):</i>	Writing your Manuscripts
<i>Lab(s):</i>	Review of Class Data/Analyses/Figure-Making
<i>Assignment:</i>	Prepare for Exam II
Week 11:	November 14th (LT: 06:54, +1.3')
<i>Readings:</i>	Journal Articles for MS, Review Previous Readings for Exam II
<i>Lecture(s):</i>	Trip to Campus for Colloquium Seminar: Jonathan Losos; 2pm Peer Reviews
<i>Manuscript:</i>	First Submission due next week (11/21 @ 9am)
<i>Exam:</i>	Exam II (8:30am – 10:30am)
Week 12:	November 21st (LT: 13:30, -0.1') (Thanksgiving Holiday, no classes 11/23-11/25)
<i>Readings:</i>	Chpt. 7 (pp. 180-182, 188-194), Chpt. 10 (pp. 300-314), Chapter 12 (383-406)
<i>Lecture(s):</i>	No Class
<i>Manuscript:</i>	First Submission due today at 9am. Receive Peer Review Assignments by 3pm
<i>Assignment:</i>	Peer Review, due 11/28 @ the start of class
Week 13:	November 28th (LT: 06:47, -0.2', 19:26, -1.2')
<i>Readings:</i>	Chpt. 7 (pp. 175-182, 188-194), Chpt. 10 (pp. 300-314), Chapter 12 (383-406)* You must complete these readings before 11/28.
<i>Lecture(s):</i>	Nested Designs, Randomized Blocks (and Intro to MANOVA)
<i>Assignment:</i>	HW 6 (due by 9am on 12/2)
<i>Manuscript:</i>	Complete your revisions, due next week (12/5 @ the start of class)
Week 14:	December 5th (Last week of classes)
<i>Lecture(s):</i>	Course Review for Final Exam
<i>Assignment:</i>	Prepare for Final Exam
Week 15:	December 12th (Final Exam Week)