FW 4001 Biometry, Fall 2017[1]

Professor Dr. John Fieberg, jfieberg@umn.edu, B52 Skok
Office Hours: Thursday 1:30-3:00pm (or by appointment)

TA Spencer Rettler, rett0068@umn.edu, B52 Skok
Office Hours: Monday 2:45-3:45pm, Wednesday 10:00-11:00am

Lecture Tuesday and Thursday: 11:45-1:00 P.M., 365 Borlaug Hall
Lab Monday, 12:50-2:45 P.M, 50 Coffey Hall

Website I will make extensive use of Moodle throughout the semester (to post lecture notes, supplemental readings, and to respond to student questions outside of class). Lab and homework assignments will also be turned in electronically to Moodle.

Course Description
This course covers the basic foundations of statistical methods. In contrast to traditional methods of teaching statistics based on analytical formulas and hand-calculations, we will initially explore fundamental statistical concepts through active learning exercises on the computer. You will have opportunities to analyze real data from a variety of fields, including data you collect yourself. Lastly, you will gain experience using the R programming language, which has become the *lingua franca* for ecological statistics (and data science more generally) and may help you land your first job or a graduate research assistantship.

Learning Objectives
This course will address the following University of Minnesota Student Learning Objectives:

- *Can identify, define, and solve problems*
- *Can locate and critically evaluate information*
- *Have mastered a body of knowledge and a mode of inquiry*
- *Can communicate effectively*

How can we evaluate the effect of fishing regulations on the average size of northern pike in Minnesota lakes? How difficult is it to detect moose from helicopters, and can we quantify uncertainty in our estimates of detection probabilities? If we count polar bears in a sample of plots, how can we use that information to estimate the size of the population size in some larger area? Can we predict the age of a lion from the amount of pigmentation on its nose? These are examples of some of the questions we will explore in Biometry.

More formally, by the end of this class, my hope is that you will:

1. Understand the importance of data in ecology, conservation biology, and applied fisheries and wildlife research; gain an appreciation for how data and statistical methods are used to answer questions in a variety of other fields that impact your daily lives.
2. Be able to critically evaluate the limitations and potential uses of data that have been collected in a variety of ways (experiments, haphazard and random surveys).
3. Be able to explore categorical and continuous data using a variety of graphical and tabular displays using the R computing language.

[1] Disclaimer: This syllabus is tentative and the instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes via email or Moodle. Please remember to check your email and the course page on Moodle often.

4. Understand the foundations of frequentist statistics, including the logic behind hypothesis tests and confidence interval estimation.
5. Be able to implement common statistical methods in the R programming language, including one and two sample tests; be able to fit and interpret linear regression models with multiple predictor variables.
6. Be able to think critically about data-based conclusions in science and policy research, and communicate results of statistical analysis in both written and verbal forms.

Course Textbook
Statistics: Unlocking the Power of Data; Lock, Lock, Lock Morgan, Lock and Lock, John Wiley and Sons. A hard copy of the book can be purchased at the bookstore (new or used). Alternatively, the book is available at Amazon.com (new, used, kindle, rent). Wiley.com also offers an electronic version of the book as well as an option for interactive supplementary material online. In addition to serving as a useful future resource, the book has a wealth of examples and practice problems that can help you to further develop your statistical skills.

I will also be pulling many examples from: Analysis of Biological Data, by Whitlock and Schluter. There will be a copy of this book (and Unlocking the Power of Data) available in the Natural Resources Library.

Computing
You will gain experience analyzing real data in lab sessions and as part of weekly homework assignments. These exercises will emphasize the open-source programming language, R. We will also make use of RStudio, a free, interactive user interface to R.

Why R? R is a modern statistical computing package supported by a large network of scientists worldwide. Although the learning curve associated with R can be steep, if you invest the time to become comfortable with it now, and you will see huge dividends in the future. You will see R again if you go on to take advanced courses in FWCB (e.g., FW 5603 Habitats and Regulation of Wildlife or FW 5051 Analysis of Populations). Also, the software is free so you can take the skills you learn anywhere you go. I've even used it to make graphs for my children's elementary school science fair projects!

If you have a personal computer, you should download current versions of these programs:
1. R: http://streaming.stat.iastate.edu/CRAN/
2. RStudio: http://www.rstudio.com/

In addition, you may want to purchase a zip drive for saving all computer code that you write during the course.

Grading
Grades will be assigned in a manner consistent with the University's Grading Standards listed here: http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html

Item	Points	Percent
Homework (9 assignments drop lowest grade, 10pts each)	80	18%
Lab Exercises (10 labs, 6 pts each)	60	13%
Semester Exams (2, 80 pts each), Quizzes (as necessary)	160	36% (total)
Project	50	11%
Final Exam	100	22%
Total	450	100%

Homework
Each week, I will assign a set of graded and optional problems that will help you master key statistical concepts and also provide you with further experience analyzing real data. Answers to graded problems should be typed up and turned in to Moodle **prior to the start of class** on the due date listed on the syllabus. You should include *any R code* used to complete the assignment and *also save your document as a pdf file for ease of viewing online* (you can accomplish this in MS Word by choosing file -> save as, then select pdf for file type).

Assignments will take considerable time to complete – you should plan on starting them early. Penalty-free extensions may be granted in *extremely rare cases* (e.g., **documented** illness, or emergencies with **prior notification**), but in general, I expect you to plan ahead for sanctioned events (e.g., intercollegiate athletic events, University activities, religious observances, etc.) so that you can turn in assignments on time. Despite best intentions, extenuating circumstances may cause you to occasionally miss a deadline. I will drop your lowest homework score to allow for this possibility, but please do not ask me to bend the rules when it comes to turning in late assignments.

Lab Exercises
You will work in groups to complete a weekly lab assignment. To prepare for the lab, I will ask you to complete a short set of exercises on the computer (prior to coming to lab). This will help ensure that you are able to use the time in lab efficiently and productively. After the lab, you will be expected to create a document containing a short description of the various functions you used in the lab. This document can serve as a useful reference when working on future lab and homework assignments. Past students have also found it useful when working with R in other classes. Lastly, I anticipate asking a few coding questions on the semester exams and will allow you to use your post-lab summary as a cheatsheet when completing these questions.

You are expected to attend **all labs**. Your lab grade (13% of the total course grade) will be determined by your level of participation, both in completing pre- and post-lab assignments and attending and participating in lab sessions. You will receive a 0 for any week in which miss lab without a *legitimate and verifiable excuse* (illness certified by Boynton Health Service or your family physician; emergencies caused by a death or serious illness in your immediate family; participation in intercollegiate athletic events or other University activities; or subpoenas, jury duty, military service, and religious observances). If you anticipate missing a lab for what you believe to be a valid, but unofficial reason (e.g., a course field trip, a professional conference) let me know in advance. In such cases, it may be possible to complete the lab assignment ahead of time.

Quizzes: I will consider giving short in-class or Moodle-based quizzes if classroom discussion is lacking or if it appears that extra motivation is needed to ensure you keep up with the material outside of class.

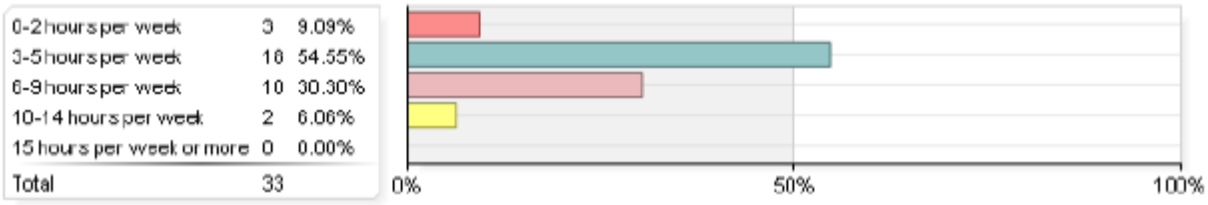
Project: You will be expected to complete a group project for this course in which you collect and analyze your own data. I will set aside 1 lecture and 1 lab period for you to work on your project. I encourage you to begin thinking about your project early on in the semester so that you can take advantage of these opportunities to meet as a group without any scheduling conflicts.

Exams: We will have two mid-semester exams on Oct. 16 and Nov. 20, and a final exam on December 16 (Saturday) from 8:00am-10:00am. **[Note: the exams on Oct. 16 and Nov. 20 will be held in Coffey 50 during the normal lab time.]** Make-up exams will be allowed only under **extreme** circumstances (e.g., illness with doctor's note, school sponsored activities with advanced notice).

How can you best succeed in this course?
The best way to succeed in FW4001 is to come to class and labs prepared, engage in classroom discussions, and complete all lab and homework assignments (starting early whenever possible). If concepts are not clear, read (or reread) sections in the book, work through additional odd numbered practice problems, and come to office hours. Mastering the statistical concepts and computing skills to be successful in this class **is definitely possible**, but it will require practice, practice, practice.

> *Practice isn't the thing you do once you're good. It's the thing you do that makes you good.* ― Malcolm Gladwell, Outliers: The Story of Success

University guidelines suggest that the **average** student should expect to spend approximately 8 hours of additional out-of-classroom work per week for a 4-credit class. You will be asked to allocate time to many different tasks for this course (pre- and post-labs, homeworks, readings, studying for exams). Yet, student responses from past years indicate that the workload is in line with university guidelines (see responses below to "Approximately how many hours per week do you spend working on homework, reading, and projects for this course" from past participants):



Scholastic Dishonesty:
Although you are encouraged to collaborate on homework assignments, each individual will be responsible for their own write up. The same goes for post-lab summaries. ***I will have a zero-tolerance policy when it comes to cheating on assignments or examinations.*** Cheating will result in a 0 for the assignment, and I will be forced to file a formal report to the Office for Student Conduct and Academic Integrity. If you ever have any questions about what might or might not be permissible, ask!

Student Conduct Code:
As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see:

http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Sexual Harassment:
"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:

http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf

Equity, Diversity, Equal Opportunity, and Affirmative Action:
The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status,

veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:

http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations:
The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please share your letter with me as soon as possible in order to secure accommodations in a timely manner.

For more information, please see the DS website, https://diversity.umn.edu/disability/.

Mental Health and Stress Management:
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

Academic Freedom and Responsibility:

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom and conduct relevant research. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.* When conducting research, pertinent institutional approvals must be obtained and the research must be consistent with University policies.

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

** Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*