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Course Materials:

Canvas

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Introduction:

Welcome to Biology 314 (Ecology and Population Biology). In broad terms, population biology is the study of ecological and evolutionary processes and their impact on the abundance and distribution of species. The primary goals of this course are to introduce you to the conceptual and theoretical underpinnings of this exciting field and to familiarize you with the statistical methods used to draw inferences about population level processes. An additional goal will be to illustrate the applied importance of population biology, ranging from the evolution of antibiotic resistance in bacteria to current debates over the role hatcheries should play in conserving shrinking populations of Pacific Salmon. Theoretical underpinnings and applied issues will be presented during lectures and reinforced by exams that focus on critical thinking and problem solving. Statistical methods used to draw inferences about ecological and evolutionary processes will be introduced during lab sections, practiced using simple problem sets, and reinforced through application to real-world data.

Course structure:

Course lecture periods will present conceptual material and provide opportunities to ask questions and work through practice problems likely to appear on exams. All lectures will be posted on Canvas prior to the scheduled class period. Laboratories will focus on developing the basic statistical skills needed to analyze ecological and evolutionary data and on the writing skills that allow results to be clearly communicated. The laboratory portion of the course will begin with an introduction to basic techniques used to organize, describe, and visualize data, and include a problem set designed to reinforce the efficient use of these techniques. The remainder of the laboratory portion of the course will be divided into three discrete modules, each of which focuses on the analysis of a particular type of data. Modules will begin with an introductory lecture by your TA where the statistical tools needed to analyze the data are presented. Working on a simple problem set

due in the following lab period will develop familiarity with these tools. The next phase of each module will introduce a real data set, and challenge you to evaluate support for a particular hypothesis using the new statistical tools you have learned. You will be given two weeks to analyze this data set and prepare a two-page written report of your findings. Details on the required format and content of reports can be found below, and a grading rubric is available online. During weeks reserved for data analysis, your TA will be available during lab periods to assist you. Because science in the real world is a collaborative enterprise, working in groups to share ideas and approaches to data analysis is encouraged. However, each student must prepare and submit an independently written report. Directly copying other's reports, or even sections of other's reports, is not acceptable.

Exams:

There will be four take-home exams given during the semester. Each exam will be made available on Canvas at the start of the lecture period indicated in the syllabus. These exams will be due 36 hours later, giving you most of two days to work through the problems and submit your answers online. You may use any resources you wish to answer the questions, but you must show all your work and the logical and/or mathematical steps used to arrive at your conclusions. All answers must be written in your own words, prepared using a word processor, and submitted as a MS Word file or as a PDF. Photos of hand-written work will not be accepted. All previously covered material is fair game on each exam, so **each exam is cumulative**, and the contribution each exam makes to your final grade reflects the increasing amount of material covered by each. Thus, early exams contribute less to your final grade than do later exams. Exam questions will build from practice problems worked in lectures and laboratories. A make-up exam will be given only for legitimate and **officially documented** university approved reasons. If you feel an error has been made in the grading of your exam, you must bring this to the attention of your TA or instructor within 5 working days; **no re-grades will be performed after this time**.

Lecture Practice Problems:

Each lecture will end with the presentation of one or two practice problems based on the day's material. It is your responsibility to work through and solve these practice problems before the next lecture period. **Your solutions to the practice problems must be submitted online before the start of the next lecture period**. These must be prepared using a word processor and submitted as a MS Word file or as a PDF. Photos of hand-written work will not be accepted. The solution to each practice problem will be worth two points, with one point assigned for showing your work and another for the correct solution. At the beginning of the lecture, we will work through the practice problems together before moving on to the day's new topic. Exam questions will be very similar to these practice problems. Late work will not be accepted.

Laboratory reports:

The goal of laboratory reports is to clearly and concisely communicate scientific results. Laboratory reports must be prepared using a word processor and e-mailed to your TA by the appropriate due date using a standard digital format (i.e., Word or PDF). **Reports may not exceed two pages and must be prepared using a font of size 10 or greater**. Each report must contain the following sections:

- Summary – Begin your report with a concise summary of your findings. Clearly state the hypothesis being tested, methods used, results found, and an evaluation of support for the hypothesis. The summary should be in bold face type and ***must not exceed 200 words***.

- Introduction – A single paragraph describing the data set and the hypothesis to be tested.

- Methods – One to two paragraphs describing the approach you took to analyze the data. Include details of all statistical tests used and any assumptions made during your analysis.

- Results – One to two paragraphs describing results of your analyses. Provide statistical details (e.g., *p* values and degrees of freedom) where appropriate. Using tables and figures to summarize your results is encouraged, but these must fit within the two-page limit for your report. Be sure to explain why each result matters, and how it helps to evaluate support for the hypothesis.

Grading of laboratory reports:

Laboratory reports must be turned in by the date specified in the lab schedule (see table below). These reports will then be graded by your teaching assistant according to the rubric available online and returned to you within one week along with detailed comments. If you are unsatisfied with the grade you received, you may revise your report in light of the comments made by your teaching assistant and turn it in again for a re-grade. **Your revision will be due within one week of receiving your initial grade**. You are strongly encouraged to discuss the suggestions made by your TA prior to turning in a revision as only one revision is allowed per report.

Grade breakdown for laboratory reports:

Scientific merit	60 points
Clarity and quality of writing	40 points
Total	**100 points**

Course Grades:

Your grade will be determined based upon the following point distribution:

Exam 1	100
Exam 2	140
Exam 3	160
Exam 4	200
Lecture practice problems	60*
Lab problem sets	40
Lab reports	300
Total	**1,000**

90% of the total points or higher will be an A, 80% of the total points or higher will be a B, 70% of the total points or higher will be a C, etc. The course is not curved, these cut-offs will be strictly applied, and final grades will not be rounded up (or down). In other words, an 89.9% is still a B, not an A.

* It may be possible to earn more than sixty points through successful completion of lecture practice problems. If this is the case, any additional points accrued will count as "extra credit".

Course Evaluations:

Although not required, your feedback on course evaluations is greatly appreciated. The most helpful feedback describes things you liked about the course and did not like and includes suggestions for improving the course and my teaching. **If 90% or more of you submit course evaluations, everyone will receive 10 bonus points!**

Learning outcomes:

The primary goals of this course are to introduce you to the conceptual and theoretical underpinnings of ecology and population biology and to familiarize you with key statistical methods used to draw inferences about population level processes. Additional goals will be to illustrate the applied importance of population biology through discussion of topics such as the evolution of antibiotic resistance in bacteria and the role hatcheries should play in conserving shrinking populations of Pacific Salmon and to promote efficient scientific writing.

Lecture and Exam Schedule

Date	Lecture
January 12	What is population biology?
January 17	Properties of populations
January 19	Malthus, Darwin, and natural selection
January 24	Genetic variation
January 26	Natural selection
January 31	Genetic drift
February 2	**EXAM 1**
February 7	Gene flow
February 9	Speciation
February 14	Population growth I
February 16	Population growth II
February 21	Life histories I
February 23	**EXAM 2**
February 28	Life histories II
March 2	Niches and geographic range
March 7	Interspecific competition
March 9	Predation
March 14	**Spring Break**
March 16	**Spring Break**
March 21	Herbivory and top-down vs. bottom-up regulation
March 23	Mutualism
March 28	**No Class**
March 30	**EXAM 3**
April 4	Parasitism and infectious disease
April 6	Ecology and evolution of infectious disease
April 11	Island biogeography
April 13	Communities
April 18	Food webs
April 20	Pacific Salmon
April 25	Climate change
April 27	**EXAM 4**
May 2	TBD
May 4	**Optional: Super Bonus Quiz**

Laboratory Schedule and Important Deadlines

Week	Activity	Due
January 9- January 13	No Lab	
January 16- January 20	Getting started: Organizing, Visualizing, and Describing Data	
January 23- January 27	Module 1: Frequencies and G-tests	Problem Set 1
January 30- February 3	Introduction to Data Set 1	Problem Set 2
February 6- February 10	Open lab for help with Data Set #1 analysis and report	
February 13- February 17	No activity. Report 1 due during regularly scheduled lab	Report 1
February 20- February 24	Introduction to Module 2: Means and t-tests	
February 27- March 3	Introduction to Data Set 2	Problem Set 3
March 6- March 10	Open lab for help with Data Set 2 analysis and report	
March 13- March 17	No Labs (Spring Break)	
March 20- March 24	No activity. Report 2 due during regularly scheduled lab	Report 2
March 27- March 31	Introduction to Module 3: Relationships and linear regression	
April 3- April 7	Introduction to Data Set #3	Problem Set 4
April 10- April 14	Open lab for help with Data Set #3 analysis and report	
April 17- April 21	No activity. Report 3 due during regularly scheduled lab	Report 3
April 24- April 28	Open lab for help with revisions of Report 3	
May 1- May 5	No Labs (Dead Week)	