

**University of Guelph  
College of Biological Sciences  
Department of Integrative Biology**

## **COURSE OUTLINE**

**IBIO\*6000 ADVANCES IN ECOLOGY AND BEHAVIOUR**

*Specific topic: Graduate Statistics in Integrative Biology*

### **General course description**

This is a modular course in which several faculty lecture and/or lead discussion groups in tutorials about advances in their broad areas, or related areas, of ecology and behaviour. Topics may include animal communication, optimal foraging, life-history evolution, mating systems, population dynamics, niche theory and food-web dynamics. The course includes lectures and seminars in which the students participate. Offered annually.

### **Course description specific to topic**

The objective of this course is to provide students with a practical introduction to ecological data analysis using R. The course will be based on a series of teaching modules that will cover a variety of topics relevant to graduate statistics. Each module will begin with a brief synopsis or introductory lecture. Students will then be expected to independently work outside of class through a series of exercises that will allow them to learn relevant concepts through hands-on applications. The independent module exercises will finish with the completion of an assignment, which will include the analysis of a provided dataset as well as the student's own dataset. Students are, therefore, encouraged to enter the course with an analyzable dataset in hand, but if one is not available the instructor can provide a dataset to be analyzed during the course. The course will finish with a final project in which the students will have completed an entire analysis of their own data and written up their methods and results from this analysis.

This course will use R for all data analysis. An introduction to the use of R and R code for performing analyses will be provided. This course will, therefore, be a good opportunity for students to increase their familiarity with R. The goals of the course, however, are conceptual and will focus on statistical principles that are relevant to graduate students in Integrative Biology.

### **Instructor**

Andrew McAdam  
Office: 2457 SSC  
e-mail: amcadam@uoguelph.ca  
Office hours: TBD

### **Learning outcomes**

1. Reinforcement of basic principles of statistics
2. Functional use of R and RStudio to perform statistical analyses.
3. Familiarity with ethics of data analysis and presentation.

4. Familiarity with contemporary approaches for analyzing real (i.e. messy) data.
5. Practice effective communication of statistical results in text, tables and figures.

### **Course resources**

We will be using R (<https://www.r-project.org>) and RStudio (<https://www.rstudio.com>) in the course. These are freeware. Students will be required to download the most recent versions of these software packages at the start of the course.

### **Course schedule**

Topics:

1. Quantitative approaches
2. Power, replication, control and independence
3. Introduction to R
4. Presentation of data and results
5. Review of general linear models (regression, ANOVA)
  - a. Assumptions, diagnostics, interactions, SS types
  - b. Nonlinearities, collinearity, problems with ratio variables, ANCOVA
6. Maximum likelihood and model selection
  - a. Stepwise procedures, AIC
7. Non-normality, transformation and generalized linear models
8. Mixed-effects models

### **Class format**

One two-hour meeting per week. Specific meeting time and location will be determined by the end of the first week of classes.

### **Methods of assessment**

#### *Assignments (60%)*

There will be five assignments, only 4 of which will be graded. Each assignment will expect students to apply the principles discussed during class to a real situation. Students will be required to implement a technique discussed in class to a provided dataset and their own independent dataset using R. The results of this work will be written up as an assignment complete with annotated R code, text and perhaps tables or figures.

Learning outcomes: 1, 2, 3, 4, 5

#### *Final Project (40%)*

The final project for the course will involve each student completing a thorough analysis of some of their own data. The dataset and biological question to be addressed will be determined by each student individually. The project will describe statistical methodology used and provide results along with associated tables and figures. This project should be similar in scope to what might be included in a scientific paper on the topic. Each of the assignments in the course will help students progress toward completion of the final project.

Learning outcomes: 1, 2, 3, 4, 5

Grading will follow the Graduate Calendar criteria (see below).

## Course and University Policies

### When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact, and be prepared to provide supporting documentation. See the graduate calendar for information on regulations and procedures for Academic Consideration:

<https://www.uoguelph.ca/registrar/calendars/graduate/current/index.shtml>

Assignments that are submitted after the deadlines indicated on the assignment **will not be accepted** and the distribution of course marks **will not be altered** for any student unless Academic Consideration for illness or other compassionate grounds has been approved by the course instructor.

### Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

For more information, contact CSD at 519-824-4120 ext. 56208 or email [csd@uoguelph.ca](mailto:csd@uoguelph.ca) or see the website: <http://www.csd.uoguelph.ca/csd/>

### Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Graduate Calendar:

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

### E-mail Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

### Drop Date

The last date to drop one-semester courses, without academic penalty, is the 40<sup>th</sup> class day. To confirm the actual date please see the schedule of dates in the Undergraduate Calendar. For regulations and procedures for Dropping Courses, see the Graduate Calendar:

<https://www.uoguelph.ca/registrar/calendars/graduate/current/index.shtml>

### Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### Grading

Grading will follow the criteria outlined by the Graduate Calendar and as follows.

<b>Percentage Grade</b>	<b>Letter Grade</b>	<b>Description</b>
90-100	A+	<b>Outstanding.</b> The student demonstrated a mastery of the course material at a level of performance exceeding that of most scholarship students and warranting consideration for a graduation award.
80-89	A- to A	<b>Very Good to Excellent.</b> The student demonstrated a very good understanding of the material at a level of performance warranting scholarship consideration.
70-79	B	<b>Acceptable to Good.</b> The student demonstrated an adequate to good understanding of the course material at a level of performance sufficient to complete the program of study.
65-69	C	<b>Minimally Acceptable.</b> The student demonstrated an understanding of the material sufficient to pass the course but at a level of performance lower than expected from continuing graduate students.
0-64	F	An inadequate performance.

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-as-gradeint.shtml>

## **Campus Resources**

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

If you are concerned about any aspect of your academic program:

- make an appointment with a program counsellor in your degree program.

If you are struggling to succeed academically:

- There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.  
<http://www.learningcommons.uoguelph.ca/>

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.  
<https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations.  
<http://www.uoguelph.ca/~ksomers/>

If you have a documented disability or think you may have a disability:

- The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability. For more information, including how to register with the centre please see: <https://www.uoguelph.ca/csd/>