

The aim of *Modelling Biological Data* is to move beyond traditional statistical models that assume normally distributed observations and to introduce models better suited to the types of data commonly encountered in the biological sciences. The course is applied in nature with a significant practical component. You will learn to use the R statistical software to fit modern statistical models and to interpret and present results from your data analyses.

## Instructor

Dr. Mark Vanderwel (LB 248; mark.vanderwel@uregina.ca; office hours: by appointment)

## Prerequisites

STAT 200 (if taken as a 400 level course)

Prior programming experience (e.g., CS 110) is recommended.

## Lectures & Labs

*Lectures:* Tues., Thur. 08:30 – 09:45, CL 418. See table below for lecture dates.

*Computer-based lab classes:* Thur. 2:30 – 5:15, ED 561.

## Recommended texts

There is no required textbook for the course. If you are interested in using a textbook to reinforce your understanding of the course material, I recommend the following:

**Zuur A.F., Ieno, E.N., Walker, N.J., Saveliev, A.A., and Smith, G.M. (2009) *Mixed Effects Models and Extensions in Ecology with R*. Springer.** The book and individual chapters are available for free through the U of R library's online subscription.

**Bolker, B. (2008) *Ecological Models and Data in R*. Princeton University Press.** Chapter PDFs freely available from <http://ms.mcmaster.ca/~bolker/emdbook/>.

**Zuur A.F., Ieno, E.N., and Smith, G.M. (2007) *Analysing Ecological Data*. Springer.** The book and individual chapters are available for free through the U of R library's online subscription.

**McElreath R. (2016) *Statistical Rethinking: A Bayesian course with examples in R and Stan.* CRC Press.** The book and individual chapters are available for free through the U of R library's online subscription.

## Grade Allocation

	BIOL 440	BIOL 810
Lab assignments	50%	30%
Participation	10%	10%
Data analysis project		30%
Presentation		10%
Final exam	40%	20%

## Lab Assignments

Weekly assignments based on the lab material will be given out. These assignments will require you to demonstrate an understanding of the data analysis skills developed in the labs and the statistical knowledge covered in lecture. Lab assignments will be set during the Thur. lab and are due at start of the following week's lab (Thur. at 2:30). I am happy for you to collaborate in groups, but the work you submit (answers to questions, R scripts) must be your own. Solutions to assignment questions will be presented in the subsequent lab.

There is a forum set up on URCourses for students to ask and answer questions about the lab assignments. You may use this forum to ask questions for help. I also encourage you to answer other students' questions on the forum. Contributions to this forum will be used in evaluating your participation grade for the course. Please use the forum responsibly; teaching is undermined if users simply post entire answers to questions.

## Data Analysis Project (BIOL 810 only)

Students enrolled in BIOL 810 will use the approaches presented in the course to perform a complete independent analysis of a data set. Students are encouraged to use suitable data from their own research, with the prior approval of the instructor. If such data are not available, a data set will be assigned by the instructor. Further details will be provided during the course.

Students will give a 10-15 min. presentation and submit a written report on their data analysis project near the end of the course.

## Exam

Apr. 21, 09:00-12:00 (Subject to change. Please consult the final exam schedule to confirm exam date and time.)

Students are required to write the final exam to pass the course. "Deferred" final exams are granted only by the Assistant Dean, Undergraduate (for Faculty of Science students), or by the

Deans and/or Assistant Deans of other Faculties of Federated Colleges of the University Regina. There are no exceptions.

## Schedule of Topics

Wk	Tuesday (AM lecture)		Thursday (AM lecture, PM lab)		
1	Jan 7	Introduction	Jan 9	Simple regression	Intro to R lab
2	Jan 14	Transformations	Jan 16	Linear models	Simple reg. lab
3	Jan 21	Interactions	Jan 23	Interactions	Linear mod. lab
4	Jan 28	PDFs	Jan 30	PDFs	PDFs lab
5	Feb 4	GLM	Feb 6	Overdispersion	GLM lab
6	Feb 11	Likelihood	Feb 13	Likelihood	Likelihood lab
	Feb 18	Winter break	Feb 20	Winter break	Winter break
7	Feb 25	Optimization	Feb 27	Likelihood functions	Non-linear lab
8	Mar 3	Model evaluation	Mar 5	Model selection	Cross-valid. lab
9	Mar 10	Bayesian models	Mar 12	Simple Bayes	Bayesian lab
10	Mar 17	MCMC	Mar 19	Writing a sampler	MCMC lab
11	Mar 24	Mixed models	Mar 26	Mixed models	Mixed mod. lab
12	Mar 31	Hierarchical Bayes	Apr 2	Hierarchical Bayes	Hier. Bayes lab
13	Apr 7	Autocorrelation	Apr 9	Presentations	Presentations

## Attendance Policy

Students are expected to be on time for class. Students that are chronically absent without a valid reason will receive a zero for the participation portion of their grade. One written warning will be provided to the student before such action is taken.

## Student Conduct

Students of the University of Regina are expected to conduct themselves responsibly and with propriety both in their studies and in their general behaviour, and are expected to abide by all policies and regulations of the University of Regina. Misconduct, which may be academic (that is, in academic studies) or non-academic (in general behaviour), is subject to disciplinary action.

## Other Information

Information on emergency preparedness can be found on the course web page on URCourses.