Analysis of Biological Data Syllabus

Department of Biology

BIOL4062 Fall 2023

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral, current and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

In BIOL4062 all students are welcome regardless of race/ethnicity, gender identity or expression, sexual orientation, socio-economic status, age, or any other diverse aspect or identity.

Course Instructor(s)

Name	Email	Office Hours
Derek Tittensor (he/him)	derek.tittensor@dal.ca	Tue/Thu 11:35-12:00 (LSC 7060), or via email.
Ana Eguiguren (she/her)	ana.eguiguren@dal.ca	Email for appointment

Course Description

Biologists are increasingly using quantitative techniques to analyze larger and larger data sets. A command of the available analytical techniques is an important part of the set of skills which are expected of a trained biologist, especially those working in the broad area of ecology. The class will introduce techniques available for the analysis of biological data, including correlation, regression, multivariate, Bayesian and hierarchical methods. Emphasis will be on the practical use and abuse of these techniques rather than derivations or mathematical formulae; the idea being that students will learn a suite of approaches that will enable them to select suitable techniques for multiple data types. Students will explore real and realistic data sets, as well as simulated data, and learn good practices for hands-on application of approaches.

Course Prerequisites

Prerequisites: STAT 2080.03 or ECON 2280.03 or MATH 2080.03, AND BIOL 3872.03. Students should have familiarity with R (strongly preferred), or some other statistical, command-line, programming language (e.g. Python, MATLAB; but support is only in place for R).

Course Exclusions

None.

Course Structure

Course Delivery

Course delivery is hybrid. Around 2/3 of the lectures will be in-person with about 1/3 pre-recorded and available on the class Brightspace on the day of the lecture. In-class test on 5 Dec will be in person. Students are expected to attend in-person lectures as these will not be recorded for subsequent viewing. Students connecting to online resources from outside Canada are responsible for ensuring awareness and compliance with any applicable laws in the country from which they are connecting.

Lectures

Tue & Thu 10:05-11:35am, LSC202.

Course Materials

Course Brightspace page contains relevant materials and will be used for pre-recorded lectures. No textbook necessary.

Assessment

Assessment	Weight (% of final grade)	Date
Assignments		
Report of analysis of data set 1a	***10%***	***5 Oct***
Report of analysis of data set 1b	***10%***	***12 Oct***
Report of analysis of data set 1c	***10%***	***19 Oct***

Report of analysis of data set 1d	***10%***	***26 Oct***
Report of analysis of data set 1e	***10%***	***9 Nov***
Description of data set 2 and proposed analysis	***5%***	***17 Oct***
Report of analysis of data set 2	***30%***	***1 Dec***

Tests/quizzes

In class test (80 min)	***15%***	***5 Dec***

Final exam

No final exam; in-class test on Tuesday 5th Dec.

Other course requirements

None.

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Assignments must be sent in through Brightspace by 16:30 on due date.

10% off for each weekday late without medical or other legitimate explanation (use the *Student Declaration of Absence* form; up to 3 times in course)

Course Policies related to Academic Integrity

This course is tailored towards individual learning, so there is to be no working in groups on assignments. Plagiarism detection software may be used on assignments.

Generative AI and LLM policy: Writing for assignments should not use ChatGPT or other generative AI. You are welcome to explore ChatGPT to help you code your statistical analyses, though the final code should be yours; be aware that AI-generated code may not be accurate or may have unanticipated issues, and also be aware that uncritically using AI-generated code will impact your learning.

Learning Objectives

Developing knowledge of methods for analyzing biological data.

Course Content

Lecture	Date	In-person / pre-recorded
Introduction to 4062/5062	Tue 5 Sep	In-person
Inference in Biology	Thu 7 Sep	In-person
R (a refresher)	Tue 12 Sep	In-person (led by TA)
Correlation and linear regression	Thu 14 Sep	Pre-recorded
Introduction to multivariate analysis and multivariate distances, association measures	Tue 19 Sep	In-person
Principal component analysis	Thu 21 Sep	In-person
Multivariate analysis with grouped units or grouped variables	Tue 26 Sep	TBD
Multivariate analysis of association matrices; Cluster analysis	Thu 28 Sep	TBD
Categorical Data: Contingency Tables and Log-Linear Models	Tue 3 Oct	In-person
Introduction to likelihood	Thu 5 Oct	In-person

Multiple linear regression and path analysis	Tue 10 Oct	TBD
Generalized linear models	Thu 12 Oct	TBD
Logistic regression	Tue 17 Oct	In-person
Bayesian data analysis using STAN	Thu 19 Oct	In-person
Hierarchical models	Tue 24 Oct	In-person
Simulating data to check your models and cross-validation	Thu 26 Oct	In-person
Diversity analysis, sampling effort, and bootstrapping	Tue 31 Oct	In-person
Analyzing temporal data	Thu 2 Nov	In-person
Analyzing spatial data	Tue 7 Nov	In-person
Good modelling practice and tips	Thu 9 Nov	In-person
Fall study break	Tue 14 Nov	*No class*
Fall study break	Thu 16 Nov	*No class*
Graduate presentations 1 (undergrads to attend)	Tue 21 Nov	In-person*
Graduate presentations 2 (undergrads to attend)	Thu 23 Nov	In-person*
Graduate presentations 3 (undergrads to attend)	Tue 28 Nov	In-person
Graduate presentations 4 (undergrads to attend)	Thu 30 Nov	In-person
In-class test	Tue 5 Dec	In-person

Student Resources

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html

Dalhousie COVID-19 information and updates: https://www.dal.ca/covid-19-information-and-updates.html

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: http://www.dal.ca/cultureofrespect.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:
https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.