Biol 470/Biol 568
Models in Ecology
Fall Semester, 2025

Lecture:	Mon, Thurs 1:00PM-2:20 PM CLE-A312
Lab:	Thurs 4:30PM-5:20PM online via Zoom (for Lab) or CLE-A329 (for Readings/Discusssion)
Sections:	Biol 470 lecture A01 CRN 10424, lab T01 CRN 10425
	Biol 568 lecture A01 CRN 14102, lab T01 CRN 14110
Instructor:	Mark A. Lewis
Office:	CUN-034C
email:	marklewis@uvic.ca, Please put BIOL 470 or BIOL 568 in subject of the email
Office Hours:	TBA
Texts:	J. Haefner. 2005. *Modeling Biological Systems*. 2nd Edition. Springer (available electronically on the University of Victoria library system).
	B.M. Bolker. 2008. *Ecological Models and Data in R*. Princeton University Press (draft pdf of this is available on BrightSpace).

Land Acknowledgment.

We acknowledge and respect the Lək^{w}əŋən (Songhees and X^{w}sepsəm/Esquimalt) Peoples on whose territory the university stands, and the Lək^{w}əŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

The Course. This course develops the methods, models and tools for quantitative ecology. Students learn to formulate, analyse, parameterize, and validate quantitative models for ecological processes and data. Applications include population dynamics, species interactions, movement, and spatial processes. Approaches involve classical hypothesis testing, computer simulation, differential equations, individual-based models, least squares, likelihood, matrix equations, Markov processes, multiple working hypotheses, and stochastic processes. A computer lab covers simulation and programming methods. Course discussion entails evaluation and appraisal of current literature. There is a term project in which students apply methods learned in the course to an ecological problem.

Learning Outcomes

- Aware of philosophical foundations for the nature of scientific evidence in ecology;
- Able to formulate quantitative models for ecological processes and data;
- Able to understand and apply dynamical and differential equation models;
- Introductory knowledge of probability and random variables;
- Familiar with statistical foundations for ecological models;

- Able to parameterize models using maximum likelihood;
- Can apply methods for model selection and assessment;
- Can fit generalized linear models, mixed effects models and related models to data;
- Able to simulate individual-based models;
- Familiar with experimental design;
- Knows how to manage ecological data;
- Can use and apply Markov and matrix models;
- Familiarity with uncertainty analysis and population viability analysis;
- Introductory knowledge of machine learning;
- Familiar with contributions of Indigenous Knowledge to ecological and evolutionary understanding;
- Able to replicate results found in the primary scientific literature by reanalysis of available datasets;
- Able to read and discuss primary scientific literature in a classroom environment;
- Able to make a project proposal and to write a scientific report;
- Able to present and discuss own research in a classroom environment;
- Introductory programming ability in R, NetLogo and Excel;
- Aware of appropriate use of generative AI in quantitative ecology.

Prerequisite. Biol 470: one of Math 110, 102, 109 or equivalent, one of Stat 255, 260 or equivalent, Biol 215 or equivalent, minimum 3rd year standing. Biol 568: permission of the instructor.

Class Structure. Most weeks will have the following structure: Monday and Thursday: 1:00 PM-2:20 PM lecture, Thursday: 4:30 PM-5:20 PM computer lab or class discussion of a reading. The last two weeks (approximately) will have group presentations.

Lectures. We will focus on mainly on chapters 1-10, 13 and 16 of the text by Haefner, and will draw information from Chapters 5-11 from the text by Bolker. Lecture notes are be posted on the BrightSpace site under BIOL 470/568.

Student-led class discussion. Each of these discussions is to be based on a reading assigned to the class. There are seven readings. There will be a group of about 4 discussion leaders for each reading. The discussion starts with the discussion leaders posting questions on the BrightSpace discussion page for the class the week before the in-class discussion. Other class members respond to the questions on the web. The in-class discussion is 40 minutes long. You are responsible for presenting the main ideas of the reading and a summary of the online discussion in a short presentation (powerpoint or pdf), and for moderating additional in-class discussion of the reading. You will also need to create a one-page summary handout

that is available to students on BrightSpace prior to class discussion. There is a section in BrightSpace for posting your presentation. Each student will be assigned to one discussion and should should participate in all four components (i) posting and responding to questions on the web (ii) creating the one-page summary handout (iii) presenting some ideas from the paper in class (iv) moderating class discussion.

Lab assignments. There will be five labs assignments. They will be posted on the BrightSpace page. These will use the computer but will also require some writing and analysis. You will be assigned a different partner each lab to work with on each lab assignments. You are asked to complete the assignment with your partner and hand it in before the next assignment starts. Biol 568 will have some extra work and questions included in the lab assignments.

Project. The class project is to be done by triplets of students. The goal is to apply methods and techniques learned in class to a specific research problem. A project proposal, report and class presentation are needed. Each member of the group needs to contribute equally to the project. This is one way to learn from one another. The project proposal is due **Oct 2** and the project report is due on **Dec 12**. Biol 470 students are asked to choose from a list of projects. Biol 568 students are asked to come up with their own project.

Grading.

A percentage will be calculated based on leading class discussion: 15%, lab assignments: 40%, project: 40% and other discussion (both on the web forum and in-class): 5%. The percentage will then be translated to a course grade according to UVic regulations. A percentage below 50% gives a course grade of F. The project is a required component of the course. An incomplete project gives a course grade of N, no matter what the overall percentage for the course. Late assignments, project proposals or project reports will be penalized at 10% per day.

Supplemental Texts.

1. R. Hilborn and M. Mangel. 1997. *The Ecological Detective*. Princeton University Press.
2. K.P. Burnham and D.R. Anderson. 2002. *Model Selection and Multi-modal Inference*. 2nd Edition. Springer

Class Recording: Be aware that sessions in this course may be recorded to allow students who are not able to attend to watch later. Any recordings will be posted in Brightspace. Students who have privacy concerns can contact me and will have the option to limit their personal information shared in the recording. If you have other questions or concerns regarding class recording and privacy please contact privacyinfo@uvic.ca.

Statement of Inclusion: The University of Victoria is committed to creating a learning experience that is as accessible as possible. If you are registered with the Centre for Accessible Learning (CAL) and anticipate or experience any barriers to learning in this course, please

feel welcome to discuss your concerns with the instructor. If you are a student with a disability or chronic health condition you can meet with an advisor at CAL to discuss access and accommodations: CAL Services.

Academic Policies and Regulations: Undergraduate policies and academic regulations are described in the UVic Undergraduate Calendar. Please read very carefully the Policy on Academic Integrity, the Academic Concession Regulation/Guidelines, and Academic Important dates.

- Academic Integrity: Students are required to abide by all academic regulations set as set out in the University calendar, including standards of academic integrity. Violations of academic integrity (e.g. cheating and plagiarism) are considered serious and may result in significant penalties. Policy on Academic Integrity
- Academic Concession Regulation/Guidelines: Please refer to the links below when determining what is a valid reason to request an Academic Concession and the process for requesting a concession. Academic Concessions and Accommodations. If there are any elements of the course that you cannot complete due to concessions or accommodations (eg, class presentations), please contact the instructor as soon as possible to make alternative arrangements.
- Academic Important Dates: Check here. It is the students responsibility to attend to Add/Drop dates published in the Calendar (last day to add courses: Sept 19, last day to drop without failure: Oct 31). Students must not assume they will be dropped automatically from any course they do not attend. It is also the students responsibility to check their records and registration status.

UVic Services:

- **Student Supports for Online Technology** - Learn Anywhere
- **New Student Mental Health Supports** - In addition to providing both face to face and online mental health resources through our new Student Wellness Centre, a 24x7 phone and online student mental health resource and support program is available for all UVic students, no matter where they are located, at any time. Student Wellness
- **Counselling Services** - Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students. Student Counselling
- **Sexualized Violence Prevention and Response** - UVic takes sexualized violence seriously. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting the Sexualized Violence webpage. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). If you want to take part in the important prevention work

taking place on campus, you can also contact the sexualized violence resource office in EQHR. Sexualized Violence Resource webpage

- **Health Services** -Wellness supports for students provides a full service, primary health clinic for students, and coordinates healthy student and campus initiatives.
- **Centre for Accessible Learning** - The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. CAL

Indigenous Academic and Community Engagement: Indigenous Academic and Community Engagement - University of Victoria (uvic.ca) Elders' Voices - The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students and others in Indigenous ways of knowing and being. IACE

Use of Generative AI Tools This course does not include detailed instruction on the use of generative AI. *Please note that you can opt for not using generative AI at all to successfully complete all the courses requirements.* However, in this course, you are limitedly authorized to make the use of generative AI such as ChatGPT.

These are the assignments and activities you can work together with generative AI:

- Student-led class discussion (handout, presentation)
- Project (proposal, analysis, report, presentation)

Please familiarize yourself with the UVic online material on scholarly use of generative AI tools. In order to not violate academic integrity, you must cite ChatGPT or any other tool properly using one of the following styles: APA style or Chicago. Additionally, you must add as an appendix all the prompts and questions used within the generative AI to create content as an appendix. For all the other activities in this course, please refrain from using any generative AI.