



Summer Session 2022

**BIOE 453 Lake Ecology
Syllabus**

3 credits; Lectures, Labs, Field Work

Course dates: August 1 – 12, 2022

Instructor: Dr. Shawn Devlin

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<https://flbs.umt.edu/urls/peo>

Prerequisites: One year of college-level biology, chemistry, and mathematics, and an ecology course (can be met via BIOE 342 Field Ecology at FLBS) or equivalents; or consent of instructor.

Level: U/G offered for undergraduate and graduate credit (see graduate increment page 3)

Course Description:

An examination of the physical, chemical and biological characteristics of lake ecosystems with an emphasis on how the physical processes of lake circulation and stratification, nutrient loading and cycling, primary and secondary production and food web interactions, and the role of atmospheric and land use/watershed affect water quality. This course focuses on the functional relationships and productivity of plant and animal assemblages in lakes as regulated by physical, chemical and biotic processes. Fundamental concepts of ecology as they relate to the aquatic environment are emphasized. Limnological principles are presented within the context of regional and landscape spatial scales. Students will learn basic and contemporary methods of study in field settings potentially including Flathead Lake, glacial lakes of Glacier National Park and Swan Valley, and nutrient rich lakes. Because this is a field course offered through the Flathead Lake Biological Station, emphasis is directed toward experiential learning and obtaining hands-on examination and characterization of lakes that will serve the student well throughout their career.

Student Learning Outcomes:

After taking this course students will be able to:

- Define common aquatic ecological terms and discuss these terms in an ecological context.
- Classify different organismal groups based on their functional roles within an aquatic ecosystem.
- Appraise the role of physical components of lakes and connect how physical factors interact with the biology.
- Assemble and arrange multiple concepts from several disciplines i.e. biology, chemistry, physics to interpret ecological concepts such as productivity or respiration.
- Criticize, evaluate, interpret, and summarize existing and new published literature.

Required Text: Checkout copies of the required texts are available in the classroom for each student. Students are responsible for replacement cost of lost or heavily damaged checkout copies.

Vincent, W. F. 201. Lakes: A Very Short Introduction. Oxford University Press. (Paperback).

Dodds, Walter K. and Whiles, Matt R. 2010. Freshwater Ecology: Concepts and Environmental Applications of Limnology. 2nd Edition. Academic Press. Dodds, W. K. and M. R. Whiles. 2010. Freshwater Ecology: Concepts and Environmental Application of Limnology. Academic Press. (Hardback).

Reference Texts: Reference books and field guides will be available in the classroom.

Course and Field Supplies/Equipment: (*available for purchase at the FLBS Bookstore)

Students should bring the following supplies:

- Rite in the Rain 8.5" by 11" field notebook* or other waterproof field notebook
- Lab notebook*
- Fine-tipped forceps-one straight and one soft touch*
- Binder or clipboard (optional)
- Pencils*
- Lunch pack-up resealable container(s)*
- Water bottles to hold 2 liters of drinking water*
- Personal mess kit – plate, cup, silverware
- Wading shoes and/or waders
- Clothes that can get muddy
- Flashlight and batteries
- Mask, fins, snorkel, wetsuit (all optional, but if you already have these, bring them!)
- Laptop computer

REQUIRED Overnight Field Gear and Other Items to Bring Checklists: <http://flbs.umt.edu/urls/lists>

Evaluation and Grading:

Evaluation of your performance in this course will be based on an exam, evaluation of your field note book, presentation, project summary and overall participation. A breakdown of overall importance and a description of each component are below. Many objectives will be group oriented and cooperation and involvement is required however all assessment criteria are ultimately are based on the individual. Details regarding how each task will be graded will be presented early in the course.

Exam 20%—An exam consisting of true/false, multiple choice, short answer and short essay sections will be given the second half of the second week of the course. Section 1 will be a sit down, closed book exam and section 2 (consisting of short essays) will be a take home, open book format. Section 1 will one be graded on depth of knowledge and section 2 will be assessed based on depth of knowledge, clarity and professionalism (spelling, grammar, etc.).

Presentation 30%—A ten minute public presentation describing your assigned project, detailing the methods used and the major findings and a short discussion in the context of Lake Ecology will be required. A Lake Ecology Seminar will be Friday August 3 in the Lecture Hall of the Elrod Building. An overview regarding the presentation will be discussed. Note that this is the largest component of your grade. A professional and sophisticated approach will be needed.

Project Summary 15%—A two-page summary of Field projects will be required. An introduction, a description of methods uses, overview of the results, and a discussion of the ecological context. The length is purposefully short- you will need to be concise! References are required and will use a numbered format to reduce text. An in-class discussion of this summary will provide more detail.

Field Notebook 20%—Detailed notes are essential to field ecology. You will be required to keep a detailed field notebook throughout the course. We will go on several excursions and each should be documented and any information that may be of interest to your future self will be documented. Things like weather, timing of sampling, and notes on potential issues that occurred during sampling are all topics that should be in your notebook. These are your scientific journals by which you will recreate your experience in your presentation. The format is your choice; however, you will be graded on your ability to document your work in such a way that I can read and understand any and all issues, good or bad, which may have occurred while in the field. We will discuss field note books early in the course.

Overall Participation 15%—Students will find this course demanding. Eager, active and engaged students will make things go smoothly and lead to a great experience for all. Passive or disengaged students, or those

students with defeatist, uncooperative, or pessimistic behavior will hurt the experience for all. You must be active, engaged, and glad to be here. We will have lots of reading to do outside of class to ensure we have time to get into the field and sample. I will expect engagement and active participation outside of class as well. This should be the easiest percentage of your grade to obtain. Be Pro-Active and have Fun!

Graduate Credit

In addition to normal expectations, graduate students will present an overview of their graduate work to the class and field questions about the concepts addressed by their research. The instructor also expects a higher degree of class leadership and logistical support from graduate students.

Lake Ecology Field Projects

We will conduct several field sampling expeditions and each will be a part class projects you will be assigned for your paper and presentation. Each topic will require cooperation and a team approach to get all the data needed to complete the projects. A brief description is listed below. However, each description is purposefully vague as each topic's project will be developed by all of us in class.

Trophic status effects on physical attributes in Lakes

This project will use the natural gradient in trophic status of lakes within the Flathead Valley. We will sample several lakes to determine what lake physiochemical attributes are correlated and how this relates to other lake characteristics. Much of this project will rely on field sampling events, however, in addition to data collection, data assembly will be required.

Nutrient limitation of algal biomass

This BIOASSAY will experimentally investigate how nutrient additions alter algal biomass. Using carboys and *in situ* incubations will we test which nutrients are limiting algal growth in Flathead Lake.

Depth distribution of zooplankton in Flathead Lake

This project will investigate how abundance of zooplankton changes with depth in Flathead Lake. The scope of this project may include a comparison of depth distribution during daylight hours and at night.

Are Twin Lakes really twins?

This project will investigate two remote lakes called Twin Lakes. We will conduct an investigation to determine how similar or different the lakes really are. This project will involve a hike up into Jewel Basin.

Periphyton growth and disturbance, aspect, and substrate

This project will focus on the algae under your feet. Periphyton grows on substrates in the shallower areas of a lake- the littoral zone. This project will access the roles of disturbance, aspect and substrates on periphyton growth in Flathead Lake.

Comparison of in situ Fluorometrically derived Algal biomass to Lab Based Method

Understanding the density or abundance of phytoplankton is of critical importance to limnologists. This project will explore two methods of measuring algal biomass at specific depths in several lakes.

Role of Flowering Rush in structuring Macroinvertebrate Communities

Flowering Rush is an aquatic invasive species that has invaded Flathead Lake. This project will examine if there are differences in macroinvertebrates communities in areas invades by Flowering Rush and areas where Flowering Rush has not established.

Other projects that may be of personal interest can be proposed by students, however, instructor approval is required.

Course Policies:

Students are expected to review and adhere to the University of Montana Student Code of Conduct at this link: https://www.umt.edu/student-affairs/community-standards/um_student_code_of_conduct_2021-2020.pdf and adhere to the Flathead Lake Biological Station Code of Conduct form signed during student registration. Students must also abide by the FLBS Rules and Regulations and the Safety Orientation Checklist. Students who have not already completed the University of Montana online Prevention Education Programs: AlcoholEdu and Sexual Assault Prevention for Adult Learners must complete these programs at this link: <https://www.umt.edu/student-affairs/programs/> (NetID and password required).

Class Schedule (2022 Updates Pending): *One of the complicating factors for field work in general and especially aquatic field work is the ever changing weather. Storms, rain and wind can all bring our progress to a halt. Also constantly at play in field research- shifting priorities and Murphy’s Law. Thus, the schedule listed below is not only tentative–it is subject to change without notice.*

Note: Make sure you pack your brown bag lunch each day at breakfast!

Date	Lectures/Lab/Field Work
1-Aug-2022 (M) (Canoes at FLBS)	Introduction Course Outline PI/Project assignments Physical Attributes of Lakes (Morphology and Origins) Limnology Overview Canoe/Boat Safety Knots and the People that Tie them
2-Aug-2022 (T) (Jessie B)	Physical Profile of Flathead Lake Waves and Currents Theme From the Bottom- Nutrients, Light, and Allochthony Metabolism Experimental Design
3-Aug-2022 (W) (Jessie B)	Freshwater Research Lab tour Flathead Lake Food Web Overview PLANKTON Tows, Scope work, and ID BIOASSAY Deployment
4-Aug-2022 (Th) (Vehicles)	Flowering Rush Day East Bay Sorting/Picking Samples
5-Aug-2022 (F)	TWIN LAKES Hike PERIPHYTON PIs

Date	Lectures/Lab/Field Work
8-Aug-2022 (M) <i>(Jessie B)</i>	ZOOP Migration BIOASSAY Fish Threats to Lakes
9-Aug-2022 (T) (Canoes)	Multi-lake SAMPLING with canoes
10-Aug-2022 (W) (Canoes)	Multi-lake SAMPLING with canoes
11-Aug-2022 (Th)	Exam review Data Prep/Analysis Presentation Prep Project finish up
12-Aug-2022 (F)	Final Exam Presentation Prep Presentations Take Home Exam

Students with disabilities may request reasonable modifications by contacting the instructor. The University of Montana assures equal access to instruction for students with disabilities in collaboration with instructors and the Office for Disability Equity. The University does not permit fundamental alterations of academic standards or retroactive modifications. If you have a disability that adversely affects your academic activities, please let us know at summersession@flbs.umt.edu so we can discuss an accommodation.