

# BIOLOGY 334/634: LIMNOLOGY

Fall 2005, CRN 11049/11628

## TIME AND PLACE

Lecture: 9-9:50 AM M, W, F; Room 001 Rooke Chemistry Building

Lab: 2-4:50 PM Th; Room 322 Biology Building

## INSTRUCTOR

Dr. M. E. McTammany, 311 Biology Building, x73975, mmctamma@bucknell.edu

Office hours by appointment or luck (until 5:30 PM)

## PREREQUISITES

BIOL 208 (Population and community biology); junior, senior, or graduate standing

## TEXTBOOK (required)

Introduction to limnology. S. I. Dodson, 2005, McGraw-Hill.

Other reading and course materials will be available on Blackboard throughout the semester.

## GRADE

Assignments	30%
Lab practical	10%
Midterm exams	25%
Final exam	15%
Course project	20%
<b>Total</b>	<b>100%</b>

## ASSIGNMENTS

Throughout the semester, you will be asked to analyze, interpret, and graph using data from books and field trips. These assignments will be spaced out according to relevant lecture material. Data from each field trip (see lab section) will be made available to the entire class before the assignments are due. Assignments must be completed *independently*. Each assignment will be worth 20 points, and I will drop your lowest 2 scores. Assignments are due **before lecture** on assigned dates and can be turned in electronically using the dropbox feature in Blackboard or the dropbox in my public space. You will lose 1 point for each day late.

## EXAMS

**Midterm exams** will be given in the regularly scheduled lecture period on **September 26 and November 2**. These exams will cover all material to that point but will focus on material since the previous exam. In addition, all reading assignments are considered course material and are thus fair game for exams. Your **final exam** will include new material since the Nov. 2 exam and cumulative questions. The final exam time and place will be announced later.

## OTHER ITEMS

ATTENDANCE: All students are expected to attend scheduled lectures and labs and to participate in discussions, field trips, and group projects. Please see me in the beginning of the semester if you will miss something due to an extracurricular activity to make arrangements for missed work.

HONOR CODE: We will adhere strictly to the Bucknell Student Handbook policy on collaboration and taking exams. Any suspected violations of this policy will be discussed between us and reported to the Associate Dean.

ACCOMMODATIONS: If you require accommodations for a learning disability, please see me in the beginning of the semester to make arrangements for notes, assignments, and exams. You will need to have documentation in order to receive accommodations in this course.

ENVIRONMENTAL LAB: Throughout this course, you will be using the Environmental Lab (300 Breakiron) for analysis of samples from field trips and group projects. Dr. Elaine Keithan administers this facility and is very giving of her time and expertise for our class. Please contact her **ahead of time** if you would like to use the Lab (ekeithan@bucknell.edu, x71593). Be respectful and follow her instructions when you are using the Environmental Lab.

FIELD EQUIPMENT: In this course, you will be borrowing research equipment from the instructor or the Environmental Lab. This equipment is expensive and is used for research purposes in addition to this class. Be careful when using the equipment, follow directions, and always return equipment promptly in clean, good condition after using. Problems with any piece of equipment should be reported to the instructor immediately.

## EXPECTATIONS OF STUDENTS

1. Demonstrate a basic understanding of the physical, chemical, and biological characteristics of lakes and streams
2. Understand and properly use limnological terminology
3. Demonstrate the ability to interpret limnological data
4. Demonstrate the ability to communicate limnological data
5. Know where to find information about freshwater ecosystems
6. Demonstrate a basic understanding of how to design and conduct freshwater research
7. Gain a familiarity with the basic tools of freshwater research
8. Work effectively with a group
9. Demonstrate a professional attitude

## EXPECTATIONS OF INSTRUCTOR

1. Exciting, stimulating, and organized lectures
2. Field trips and laboratory experiences
3. Independent group research projects
4. Oral and written reports with instructor feedback
5. Homework and exams with instructor feedback

## SCHEDULE (complete, but tentative)

Date	Topic	Lecture Reading	Assignment Due
Aug 24	Syllabus, introduction, history	3-27	Interest (in class)
Aug 26	Properties of water, solutions	29-39	
Aug 29	Origins of lakes	277-287	
Aug 31	Physical structure of lakes	265-267, 274-275, 164	
Sep 2	Light in lakes	46-47	Bathymetry
Sep 5	Heat in lakes	40-44	Light
Sep 7	Waves in lakes	53-56	
Sep 9	Dissolved gasses	44-45, 48-50, 237-238	Temperature
Sep 12	Dissolved gasses, African lakes	232-237, Tanganyika, killer lakes	
Sep 14	Hydrologic cycle, stream origins	272-274	Oxygen
Sep 16	Water flow and work	276, 287	
Sep 19	Physical structure of streams	267-271	pH profile
Sep 21	Physical structure of streams	50-53	
Sep 23	Chemical sources in streams		<i>Prospectus</i>
Sep 26	<b>EXAM 1</b>		
Sep 28	Introduction to organisms	163-165, 65-73, 75, 79-80	
Sep 30	Algae	73-79	Q, substrate
Oct 3	Phytoplankton	47-48, 193-194	
Oct 5	Plants	131, 133-138, 199-200	
Oct 7	Intro. to animals, zooplankton	85-92	
Oct 10	FALL BREAK		
Oct 12	Zooplankton	92-108	
Oct 14	Macroinvertebrates	161-165, 121-124, 197-199	Algae
Oct 17	Invertebrates, aquatic insects	107-109, 154-156	Zooplankton
Oct 19	Aquatic insects	109-115	
Oct 21	Fish	124-130	
Oct 24	Fish, other vertebrates	130-135, 197	Invertebrates
Oct 26	Invertebrate adaptations	172-176, 190-193, 238-239	
Oct 28	Community interactions	165-172, 176-178, 209-211	
Oct 31	Trophic cascades	202-203, Spencer et al. 1991	
Nov 2	<b>EXAM 2</b>		
Nov 4	Energy flow in lakes	212-217	
Nov 7	Energy flow in streams, RCC	271-272	Lake PP
Nov 9	Redox, micronutrients	35-36, 250	<i>Lab practical (Nov 10)</i>
Nov 11	N in lakes	245-250	Insects FFG
Nov 14	P in lakes, stoichiometry	239-245, 250-251	
Nov 16	Nutrients in streams		Lake N, P profile
Nov 18	Succession in lakes	201-202, 244-245	
Nov 21	Cultural eutrophication	Edmondson 1970; Schindler 1974	<i>Rough draft (Nov 22)</i>
Nov 23	THANKSGIVING BREAK		
Nov 25	THANKSGIVING BREAK		
Nov 28	Paleolimnology	290-291	
Nov 30	Human impact, management	299-311	<i>Presentations (Dec 1)</i>
Dec 2	Human impact, management	252-258	Stream N, P
Dec 5	Management, evaluations		<i>Final paper (6 PM)</i>

## GROUP RESEARCH PROJECTS

You will be conducting semester-long group research projects to explore a topic relevant to the course through experimentation and data collection. Projects will be done in groups of 3 students and will require periodic meetings with instructor. Topics may be selected from the list below or designed by the group (with instructor approval). All projects will be done in ponds or streams at Bucknell Natural Area so that we can create a snapshot of aquatic ecosystems at this site. Assignments include a written project proposal, progress presentation to the class, an oral presentation to the class, and a final research paper. Your literature review, rough draft, and final paper must be **properly referenced** with in-text citations and a complete Literature Cited section containing all external sources (articles, books) used for information. We will use a good deal of lab time throughout the semester for group projects, but you will need to conduct projects outside of class time as much as necessary. Participation will be determined through meetings with the instructor and self- and peer-evaluations of your group members.

### PROJECT GRADES AND SCHEDULE

Date due	Item	% of grade
Aug 25, in lab	Group project introduction	
Aug 29-31	Discuss topic with instructor (outside of class)	
Sep 8, in lab	Library session – literature database searching	
Sep 23, in class	Literature review and prospectus	10%
Sep 30-Oct 5	Discuss progress with instructor (outside of class)	
Oct 27, in lab	Progress presentation	
Nov 22, 5PM	Rough draft of final paper	10%
Nov 28-30	Discuss draft with instructor (outside of class)	
Dec 1, in lab	Oral presentation of project	20%
Dec 5, in class	Project participation	10%
Dec 5, 6PM	Final paper	50%

### GENERAL PROJECT IDEAS

1. How do light, temperature, and oxygen change in lakes during autumn?
2. What effect do storms have on lakes or streams?
3. What effects do lakes have on streams (or vice versa)?
4. How do physical properties of streams affect macroinvertebrates or algae?
5. How abundant and diverse are lake plankton communities?
6. What is the spatial or temporal pattern of organisms living on lake bottoms?
7. How do stream communities change with the surrounding landscape?
8. How does water velocity affect drift of aquatic insects?
9. What role do benthic algae play in lakes?
10. How productive are algae and macrophytes in lakes or streams?
11. How do grazers affect algae production?
12. What happens to leaves that fall into lakes or streams?
13. Which nutrients limit primary production in lakes?
14. How rapidly are nutrients taken up in lakes?
15. How far do nutrients travel in streams before being taken up?
16. What effect does woody debris have in streams?

## LIMNOLOGY LABORATORY

### FIELD TRIPS

In the beginning of the semester, we will take several field trips. These field trips are rain or shine, unless the weather is severe or dangerous. Please *dress appropriately* for the weather and for mucking around in streams and ponds. There will be 6 field trips during the semester, five on Thursday and one on Saturday. For Thursday field trips, we will leave at **1 PM sharp** from the Biology Building to allow time for travel and field work. We may be returning after 5 PM, but every effort will be made to get back to campus on time. For the Saturday field trip, we will leave the Biology Building at **8 AM sharp**. Please do not be late (you will be left behind)!

### LAB PROTOCOLS

There is not a lab manual for this course, but I will provide you with several protocols to perform common field and lab measurements. Please keep these protocols and use them as a valuable reference for your group projects. Follow these directions carefully to ensure high quality data and your safety.

### LAB PRACTICAL

There will be a lab practical to reinforce methods used in field and lab, identification of aquatic organisms, and data processing. The practical will be given Nov. 10 during regular lab time.

### SCHEDULE

Date	Location: Topic/Destination
<b>Aug 25</b>	<b>Field trip: Group project intro., field equipment</b>
<b>Sep 1</b>	<b>Lake field trip: F. J. Sayers Reservoir</b>
Sep 8	Library session, statistics and graphing
<b>Sep 10 (Sat.)</b>	<b>Lake field trip: Harveys Lake</b>
Sep 15	Lab: lake sample analysis
<b>Sep 22</b>	<b>Stream field trip: Stony Run</b>
<b>Sep 29</b>	<b>Stream field trip: Buffalo Creek</b>
Oct 6	Lab: Stream samples
Oct 13	Lab: Plankton
Oct 20	Lab: Invertebrates and insects
<b>Oct 27</b>	<b>Field trip: Group project progress</b>
Nov 3	Free time to work on group projects
<b>Nov 10</b>	<b>Lab practical</b>
Nov 17	Free time to work on group projects
Nov 24	Thanksgiving
Dec 1	Project oral presentations