

## **BIO 341: Limnology**

**Fall 2017**

**Lecture (Cowley 156):** TH 11:00 - 11:55 pm  
**Lab (Cowley 316):** T or H 2:15 - 5:20 pm or F 12:05-3:10

### **Instructor:**

Dr. Eric A. Strauss

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### **Texts:**

Dodds, W.K. and M.R. Whiles. 2010. Freshwater Ecology: Concepts & Environmental Applications of Limnology. 2<sup>nd</sup> ed. Academic Press, Burlington, MA.

### **Course Description:**

Limnology is the interdisciplinary study of inland waters including lakes, wetlands, ground water, and streams. This lecture portion of this course will serve as an introduction to the geological, physical, chemical, and biological processes that form and maintain these aquatic systems. Environmental threats to these systems will also be covered. Students will gain hands-on field and laboratory experience sampling aquatic systems, measuring and interpreting important limnological variables, and identifying aquatic organisms during the laboratory portion of the course.

### **Course Objectives:**

Specific objectives/goals for this course include:

- Learn the basic terminology used by limnologists and other aquatic scientists.
- Learn and integrate multidisciplinary concepts to understand how aquatic systems function.
- Develop an understanding of how living organisms survive and interact in aquatic environments.
- Learn to identify common aquatic organisms, particularly algae, zooplankton, and macroinvertebrates.
- Learn how to collect, analyze, interpret, and report limnological data.

### **Website:**

The website (on Desire2Learn [D2L]) is where you will find class notes, reading assignments, the most up to date copy of this syllabus, your current grade, and other important information and documents. It is vital you check the website regularly. I highly recommend you print the notes, put them in a binder, and bring them to class. You should consider the class notes as an outline for lecture, in other words, you should still take notes during lecture.

### **Attendance:**

Official attendance will not be taken during class; however I will have a pretty good idea of attendance by looking at the clicker data. During lecture cell phones must be silenced and listening to music devices is not allowed. An important aspect of student performance is being

attentive during class. Anything presented in lecture is fair game on the exams. We will not cover everything in the text and there will be much in lecture that is not in the text (or in the downloadable notes). If you do miss class, be sure to ask someone who was there about what you missed.

### Grading:

Grades will be assigned based on performance on in-class exams, an in-class case study, readings, a laboratory notebook, lab reports, and a laboratory exam. Below is a current list of items that will be graded. Note that more than 60% of the points are earned on exams and lab practicals. I reserve the right to make modifications to this list. The grading scale used in this class is also listed below.

Item	Points	Grade	%
Mid-terms (3)	300	A	92-100
Final	150	AB	88-91
Reading Questions	60	B	81-87
Lab Quiz	20	BC	77-80
Lab Notebook	120	C	67-76
Lab Reports	130	D	55-66
Group Lake Report	50	F	<54
Lab Practical	100		
<b>Total</b>	<b>930</b>		

### Exams:

There will be three 100-point midterm exams and one 150-point final exam. The first three midterm exams will correspond with the Unit number associated with the class notes, e.g., Exam 1 will be over Unit I notes. What we cover of Unit IV will be on the final exam. The final exam will also be comprehensive over information from the entire semester. All exams will be multi-format (multiple choice, T/F, matching, short answer, short essay, diagrams, etc). Exams will be handed out as you walk in the classroom and will be collected at the end of the class period.

### Missing Exams:

My policy on being absent for exams is that you may schedule (with me) to take an exam prior to scheduled exam time without penalty. If you miss an exam without notifying me prior to scheduled exam time you may take the exam late with a 20% per day penalty, as long as you take the exam before I return graded exams to the class (usually the next class period). After I return the graded exams to the class there will be no makeup. Missing an exam because of illness or family emergency can be taken late with proper written documentation. Exceptions to this policy will be very rare and dealt with on a case-by-case basis.

### Readings:

There are seven articles listed on the schedule as non-text readings. The articles are posted on D2L and you are responsible for reading all of the papers but you need to answer the questions for only six of the articles. The questions are also posted on D2L. You may discuss the papers

with each other, but answer the questions on your own. Your answers must be written in complete sentences and deposited into the D2L dropbox before the due date/time. The due date and time are firm. Late answers will not be accepted. Each reading is worth 10 points. If you do all seven articles the lowest grade will be dropped. The readings (in alphabetical order) are:

- Adrian, R. and others 2009. Lakes as sentinels of climate change. *Limnology and Oceanography*. 54: 2283-2297.
- Baron, J. S. and others 2003. Sustaining healthy freshwater ecosystems. *Issues in Ecology*. Issue 10. 18 pp.
- Clarke, T. 2001. Taming Africa's killer lake. *Nature* 409: 554-555.
- Ellis, B. K. and others 2011. Long-term effects of a trophic cascade in a large lake ecosystem. *Proceedings of the National Academy of Sciences* 108: 1070-1075.
- Meyer, J. L. and others 2003. Where rivers are born: The scientific imperative for defending small streams and wetlands, p. 23 pp. *Sierra Club and American Rivers*.
- Rogers, P. 2008. Facing the freshwater crisis. *Scientific American* 299: 46-53.
- Steffen, M. M. and others. 2014. Status, causes and controls of cyanobacterial blooms in Lake Erie. *Journal of Great Lakes Research* 40: 215-225.

**How to do well in this class:**

1. Attend class
2. Read through the notes prior to class and after class
3. Take written notes – you remember better what you write down
4. Ask questions
5. Don't just memorize – strive to understand
6. Be sure to get the easy points (readings and lab notebook)
7. Study for the exams (and not just for an hour or two)
8. Don't just coast through lab – spend some time on your lab notebooks and really make a point of understanding what you are doing
9. Don't procrastinate – plan ahead. Note when assignments are due. Also, try to get your organism drawings done early

### **My Legal Obligations to You**

Please refer to the following UWL website (<https://www.uwlax.edu/info/syllabus/>) regarding the legal statements regarding:

- Sexual Misconduct
- Religious Accommodation
- Students with Disabilities
- Veterans and Active Military Personnel.

Please know that these are not just here because I have to put them there – I fully support and agree with these positions.

### **Return of Graded Work**

Generally, I return work that requires individual feedback within 14 days from the date the work was due (usually much faster). I will notify you if I am unable to grade the work within the 14-day timeframe, and will identify a revised return date. If you submit work after the due date, it may not be returned within 14 days. Your graded coursework will be returned in compliance with FERPA regulations, such as in class, during my office hours, or via the course management system through which only you will have access to your grades. Final exams will not be returned, but you may come to my office to see your graded exam after the final exam scores are posted.

### **Student Evaluation of Instruction (SEI)**

UWL conducts student evaluations electronically. Approximately 2 weeks prior to the conclusion of a course, you will receive an email at your EagleApps address directing you to complete an evaluation for each of your courses. In-class time will be provided for students to complete the evaluation in class. Electronic reminders will be sent if you do not complete the evaluation. The evaluation will include numerical ratings and, depending on the department, may provide options for comments. The university takes student feedback very seriously and the information gathered from student evaluations is more valuable when a larger percentage of students complete the evaluation. Please be especially mindful to complete the surveys.

### **Academic Dishonesty**

Strict adherence to UWL policies will be maintained, consult the Eagle Eye (student handbook) (<https://www.uwlax.edu/student-life/student-resources/student-handbook/>) for full details. What is academic dishonesty? Here is the official UWL definition:

Academic misconduct is an act in which a student:

- a. Seeks to claim credit for the work or efforts of another without authorization or citation;
- b. Uses unauthorized materials or fabricated data in any academic exercise;
- c. Forges or falsifies academic documents or records;
- d. Intentionally impedes or damages the academic work of others;
- e. Engages in conduct aimed at making false representation of a student's academic performance; or
- f. Assists other students in any of these acts.

**Tentative Limnology Class Schedule:**

<b>Date</b>	<b>Day</b>	<b>Topic</b>	<b>Dodds</b>	<b>Reading</b>
Sept 5	T	Introduction	Ch. 1	
7	H	Properties of Water	Ch. 2	
12	T	Light	52-61	Rogers Due
14	H	Lake Classification	Ch. 4 & 5	
19	T	Lake Classification	139-151	Baron Due
21	H	Lakes and Reservoirs	151-160	
26	T	Lakes and Reservoirs		
28	H	Water Movement in Lakes	162-165	Adrian Due
Oct 3	T	Streams and Rivers	Ch. 6	
<b>5</b>	<b>H</b>	<b>Unit I Exam</b>		
10	T	Streams and Rivers	Ch. 8	
12	H	Organism Classification	Ch. 9	Meyer Due
17	T	Microbes		
19	H	Algae	Ch. 10	
24	T	Fungi, Plants, Animals		
26	H	Animals		
Oct. 26/27 Dr. Stephen Carpenter, renowned Limnologist from UW-Madison, will present a different public seminar on each afternoon – time/titles/locations TBA				
<b>31</b>	<b>T</b>	<b>Unit II Exam</b>		
Nov 2	H	Food Webs and Invasives	Ch. 12	
7	T	Chemistry		Ellis Due
9	H	Oxygen and Redox		
14	T	Production, Respiration	Ch. 13	
16	H	Carbon and Phosphorus Cycles	Ch. 14	
21	T	Phosphorus	Ch. 17	
23	H	Thanksgiving Break – No Class		
28	T	Nitrogen, Sulfur, Iron and Silica Cycles		
<b>30</b>	<b>H</b>	<b>Unit III Exam</b>		
Dec 5	T	Nutrient Use and Remineralization		Clarke Due
7	H	Trophic State and Eutrophication	Ch. 18	Steffen Due
12	T	Eutrophication		
<b>15</b>	<b>F</b>	<b>Unit IV/Final Exam (4:45-6:45pm)</b>		

**This schedule is tentative and subject to change.**

## Limnology Lab Information

### Limnology Laboratory Schedule:

Date	Lab Activity	Reports Due
Sept 5/7/8	Lab Introduction and Macroinvertebrate ID	
12/14/15	Hydrodynamics (Setup Marsh Food Web Microcosms) <sup>#</sup>	
15-17	UNDERC Field Trip (21 students)	
19/21/22	Light and Limnological Graphing	Hydrodynamics and Light/graphing <sup>δ</sup>
22-24	UNDERC Field Trip (21 students)	
26/28/19	Lake Models	
Oct 3/5/6	Field Trip – Mississippi River*	Lake Models
10/12/13	Organisms – Zooplankton ID (Collect Marsh Food Web Microcosms) <sup>#</sup>	
17/19/20	Field Trip – Stream Sampling*	
<b>24/26/27</b>	<b>Lab Quiz</b> Diatom Clearing & Chlorophyll analysis	Stream Lab
Nov 31/2/3	Diatom Mounting, Algal ID	
7/9/10	Marsh Food Web Lab	
14/16/17	Nutrient Analysis	Marsh Food Web
21/23/24	Thanksgiving Break - No Lab	
Dec 28/30/1	Case Study: Lake Nyos	Nutrient Analysis and Case Study
5/7/8	Summary of collected data	
<b>12 (all)</b>	<b>Lab Practical – Lab Notebooks Due</b>	Final Lab Report

\*We will be outside regardless of weather (except significant ice or thunderstorms)

<sup>#</sup>Marsh food web microcosm setup and collection will be done by instructors

<sup>δ</sup>The Light/Graphing Lab is an individual in-class lab with a report due the same day

### General Laboratory Requirements:

Limnology Lab is designed to complement the material presented in lecture portion of the course. A significant portion of the points in the course will be generated in Lab, therefore Lab attendance is highly recommended. Many of the labs simply cannot be “made up” if you miss the activity. If you do miss a lab, see the instructor as soon as possible. If the lab is something you cannot make up, you will probably have to take a zero on that lab.

Arrive to lab on time. If you are late, you may miss the class leaving for the field or you will miss important information regarding the laboratory exercise.

Read through the lab handout prior to coming to lab. You will have a much better idea of what to expect and how to do the lab exercise for the day.

**Lab Notebook Guidelines (120 points)**

Each student will be required to maintain a laboratory notebook.

- A. The notebook can be any kind of permanently bound notebook (not spiral bound and pages cannot have perforations).
- B. Notebooks should have a detailed table of contents – leave the first two pages blank and fill them in as the semester progresses.
- C. Every page should be numbered and dated.
- D. Don't write on the back of pages because ink can bleed through pages making the book difficult to read.
- E. Notes should be taken during every lab and field trip.
- F. For each lab indicate what is to be accomplished (i.e., objective of lab).
- G. All writing in notebook should be in pen at the time of lab or field trip, not copied over after the lab or field trip is over.
- H. Place all of your organism drawings in the back of your lab book. Start on the last page and move forward. Drawings may be in pencil.

Points for the lab notebook will be allocated with the following breakdown:

Hydrodynamics (5 pts)

Take notes on what you are doing and enter raw data into your lab book. There is an additional group lab report with this lab.

UNDERC field trip (20 pts)

Take field notes at all sites visited. Record any data that was collected at any site. Also, take notes on Hydrolab calibration and how to use all equipment including Secchi disk, Van Dorn sampler, plankton nets, etc. You have to be there to earn the points.

Light and limnological graphing (5 pts)

Take notes on calculating extinction coefficient. Write the answers to the lab report questions in your lab book in addition to typing them up for the report. There is an additional individual lab report with this lab due the day its done in lab.

Lake models (5 pts)

Take notes on what you are doing and enter raw data into your lab book. There is an additional group lab report with this lab.

Mississippi River field trip (5 pts)

Take field notes at all sites visited. Record any data that was collected at any site.

Stream sampling field trip (5 pts)

Take field notes at all sites visited. Record any data that was collected at any site. There is an additional group lab report with this lab.

Diatom and Chlorophyll (5 pts)

Take notes on theory and procedure. Record raw data from chlorophyll analysis

Marsh Food Web Experiment (5 pts)

Describe the detailed experimental design, methods, and record raw data. There is an additional group lab report with this lab.

Nutrient Analysis (5 pts)

Record raw data from nutrient analysis. There is an additional group lab report with this lab.

Organisms (60 pts)

- A. Sketches of at least 30 autotrophs (algae & cyanobacteria) and 30 invertebrate heterotrophs (zooplankton, insects, protozoa, crustaceans, etc. – but not mollusks) should be drawn in the notebook.
- B. Accompanying each sketch should be an indication of organism identification and size and a note of collection location and date (see examples).
- C. Place all of your organism drawings in the back of your lab book. Start on the last page and move forward.
- D. Completing this requirement may take time outside of the normal laboratory schedule.
- E. Sketches may be done with pencil or pen

**Group Lab Reports (130 points)**

Throughout the semester there will be seven lab reports associated with lab activities (see lab schedule). The lab groups will be determined based on lab benches and the same groups will be used for all reports. It is up to you to ensure group harmony and participation. If one or more group members simply do not participate, you can inform me through email. The reports must be computer generated. Submit the completed assignments in the appropriate drop-box folder in D2L and on time. Please, only one submission per group per report (each student does not need to submit the assignment). The light and graphing report is to be completed individually (not as a group).

Point value for the reports will be:

- Hydrodynamics (20 pts)
- Light and limnological graphing (20 pts) – \*\*\*\*Individual report\*\*\*\*
- Lake Models (20 pts)
- Stream Discharge (20 pts)
- Marsh Food Web Experiment (20 pts)
- Lake Nyos Case Study (10 pts)
- Nutrient Analysis (20 pts)

**Group Lake Report (50 points)**

You will use some of the data collected from the UNDERC field trip to generate your final lake comparison lab report. The lab report will compare and contrast at least ten variables from five lakes sampled at UNDERC. The lakes and variables you analyze are up to you. I will be looking for graphical representation of the variables and explanation on any patterns observed within and among lakes. In addition, I will be looking to see if you linked variables, e.g., a certain pattern in variable x can cause patterns in variable y and z.