AQUATIC ECOLOGY (Limnology)
Biology 486/ EEOB 586
Environmental Science 486/586
Biol 486XW
(Live and On-line Versions)
FALL 2014

Course description: Structure and function of aquatic ecosystems with application water quality, fishery and pollution problems. Emphasis on the comparative analysis of aquatic ecosystems, examining lakes, ponds, wetlands, streams, rivers, and estuaries. Lectures will acquaint students with the current state of knowledge in the aquatic sciences.

Important: Before you begin the course, sign on to the Blackboard Learn site (linked on the iastate.com homepage) using your computer login and password (the usual one you use for ISU e-mail), and do a "Browser Check" (see lefthand panel after Blackboard login). Follow the instructions for updating your browser then make sure you have the Real Player and Flash Player plug-ins installed. You will not be able to view all of the course content unless you do this for every computer you will use for taking this course. The Blackboard site is really sensitive to Internet speed so use a wired connection if you can. If you have problems, see the Biol 486/586 desktop in Blackboard for some tips.

Accomodation: If you have a documented disability and require accommodations, please contact the instructor early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Student Disability Resources (SDR) office, located on the main floor of the Student Services Building, Room 1076, 515-294-7220.

Intended learning outcomes

Students will:

- learn the major types of water bodies and water courses, know how they are formed and evolved, and understand their place in the hydrologic and geochemical cycles.
- learn to quantify, model and predict the physical aspects of aquatic environments (e.g. movement, heat, light).
- understand the importance, measurement, dynamics and cycling of major chemical species in aquatic environments (e.g. alkalinity, phosphorus, nitrogen, oxygen).
- learn how the functioning of aquatic ecosystems is influenced by the geologic and geographic setting of its watershed.
- know the major organisms present in aquatic ecosystems and understand the basics of their ecology.
- learn to quantify, model and predict the biological cycling of energy in aquatic environments and the relationship of biological production to management goals.
- recognize the factors responsible for the zonation of aquatic environments and organisms.
- understand the major aquatic ecosystem management methods and models.

Outcomes Assessment: Quality control will be assured by an explicit outcomes assessment procedure. A short pre-test and/or self-assessment will be givenat the beginning and end of the course. This pre-test will not count toward the final grade.

🕮 Required text

Kalff, J. 2001. Limnology: Inland Water Ecosystems. Prentice Hall, Upper Saddle River, NJ. 592 p.

Because Dr. Kalff and I are working on a revision of this book, he kindly is making it available for free on-line reading (no downloading and printing) this semester or until we get a downloadable version assembled. If you choose this option you must read it using Google Chrome and can link to it here http://limnology.eeob.iastate.edu/book_copy.aspx . If you have problems making this work, please e-mail "Satish K Kancherla, [EEOBS]" <satish@iastate.edu> and let him know that you are in my class and taking this course. A hard-copy book with revised figures will become available sometime during the semester.

Important: If I indicate **"Skip ▲ text"**, this means you may ignore the text from the "▲" to the beginning of the next section heading.

Ensure your success in this course by reading assignments prior to lecture, attending lectures, asking questions, and evaluating your learning using study questions. Online Q&A and discussions are available at any time. **If you are in the "live" course (on-campus), sometimes you will be asked to view the lecture on-line prior to attending class – in these cases you must do so or risk learning little from the discussions during class time.**

Quizzes & Tests: You must take the quizzes and tests on the schedule indicated. Students on the ISU campus must take quizzes and tests at the on-line testing center (Center for On-Line Learning, 44C Carver Hall). Students off-campus must make arrangements to have quizzes and tests proctored by a responsible party who is willing to act as a remote proctor. If you are off campus, simply send me your proctor's name, address, position or job, and e-mail address and I will make sure they receive the proper information for permitting you to take quizzes and tests.

Lecture, Reading, & Testing Schedule
(Weeks numbers refer to dates in another table below)

Week	Session	Lecture Topic	Reading Assignment in *Kalff (2001)*	Pages and special instructions	Quiz or Test (complete during week indicated)
		Please complete "pre-test" prior to beginning!			**Pre-test (not for credit)**
I (T)	**1**	**The importance of studying & managing water resources**			
I (R)	**2**	**Distinctions among aquatic ecosystems and nomenclature**	**Chapter 1: Inland Waters and Their Catchments**	**Read all (understand meaning of basic terms & concepts)**	
II (T)	**3**	**The miracles of water; a unique and important substance**	**Chapter 3 : Water : A Unique and Important Substance**	**3: Read all**	
II (R)	**4**	**Stratification: Temperature and chemical and their influence on mixing regimes**	**Chapter 11 : Temperature Cycles, Lake Stratification and Heat Budgets**	**11: Skip ▲ text**	
III (T)	**5**	**Light: Transparency, Turbidity and the Light Climate**	**Chapter 10: Light**	**Skip ▲ text except in 10.1**	**Quiz #1 (covers sessions 1-4)**

Week	Session	Lecture Topic	Reading Assignment in *Kalff (2001)*	Pages and special instructions	Quiz or Test (complete during week indicated)
III (R)	6	Ecosystem succession and zonation	Chapter 4 : Water Resources, Water Pollution and Lakes	Read all	
IV (T)	7	The origin and evolution of streams			
IV (R)	8	Stream hydrology and channel structure	Chapter 5: Hydrology and Climate	5: Skip ▲ text	
V (T)	9	Where do lakes come from? The Diverse Origins of Lakes, Ponds & Wetlands	Chapter 6: Origin and Age of Lakes	Skip ▲ text	Quiz #2 (covers sessions 5-8)
V (R)	10	Lake and Pond Shape and Form	Chapter 7: Lake and Catchment Morphometry	Skip ▲ text	
VI (T)	11	Water Physics: Waves, Currents, Seiches, Tides, Beach Erosion and Sedimentation	Chapter 12: Water Movements	Skip ▲ text.	
VI (R)	12	Microbial Limnology and aquatic epidemiology	Chapter 22: The Bacteria	Skip ▲ text	
VII (T) (Mid-term week)	13	Primary Producers and Primary Production: measurement, indices, and factors influencing it.	Chapter 21: The Phytoplankton	Skip ▲ text (extra time for reading!)	Mid-term (covers sessions 1-12)
VII (R)	14	Zooplankton	Chapter 23 : Zooplankton	Skip ▲ text	
VIII (T)	15	Lentic benthos	Chapter 25 : Zoobenthos	Skip ▲ text	
VIII (R)	16	Lotic Ecology	Chapter 8: Rivers	8: Skip ▲ text	
IX (T)	17	Secondary Production	Chapter 8: Rivers		Quiz #3 (covers sessions 13-16)
IX (R)	18	Origin and Diversity of Aquatic Plants	Chapter 24: Benthic Plants	Skip ▲ text	
X (T)	19	Macrophyte and littoral zone ecology			
X (R)	20	North American Wetland plant communities and classification			
XI (T)	21	Oxygen; anoxia and hypoxia	Chapter 15 : Dissolved Oxygen Chapter 16: Redox potential	Read all	

Week	Session	Lecture Topic	Reading Assignment in *Kalff (2001)*	Pages and special instructions	Quiz or Test (complete during week indicated)
XI (R)	**22**	**Carbon, Carbon Dioxide, and Alkalinity**	**Chapter 14 : Inorganic Carbon and pH**	**Skip ▲ text except in 14.2**	
XII (T)	**23**	**Phosphorus & Nitrogen; the concept of nutrient limitation**	**Chapter 17: Phosphorus Concentrations Chapter 18: Nitrogen Cycling**	**17 : Skip ▲ text 18: Skip ▲ text**	**Quiz #4 (covers sessions 16-22)**
XII (R)	**24**	**Lake, Pond and Reservoir Management Strategies**	**Chapter 9 : Aquatic Systems and Their Catchments Chapter 29: Reservoirs**	**Skip ▲ text**	
XIII (T)	**25**	**Control of Aquatic Plants**			
XIII (R)	**26**	**Fish, Fish Habitats, & Eutrophication**	**Chapter 26 : Fish and Water Birds**	**Skip ▲ text**	
XIV (T)	**27**	**Water Quality and Agriculture**			
XV (T)	**28**	**Sediment, sedimentation & paleolimnology**	**Chapter 20: Particle Sedimentation and Sediments**		
	Finals week	***Final Exam*** **(Final Exam must be completed by Wednesday of Finals Week)**			**Final covers sessions 12-28**
		Please complete "post-test" (not for credit) and course evaluation (confidential) after the final exam!			

Laptop use in class is encouraged. Anyone discovered using laptops for e-mail, chats, or anything else not directly connected with note-taking in class will receive an automatic failing grade on the next exam. Similar penalties also apply to the use of other communication devices in class. Please shut down any equipment that is likely to distract you or other class members.

!Assessments and exams will cover lecture materials and assigned readings. Lectures accentuate the material I consider most critical.

Grading:

Evaluation	Points
(1) 4 in-class or Web-CT assessments	80
(2) Mid-term Exam	80
(3) Final Exam	90
(4) Homework Assignments	80
(5) Participation	20
Total Points	350

Schedule of Course Weeks

Course Week	Dates	
I	**August 25-29**	
II	**September 2-5**	**Assignment 1 due at noon on Friday**
III	**September 8-12**	**Take Quiz #1**
IV	**September 15-19**	**Assignment 2 due at noon on Friday**
V	**September 22-26**	**Take Quiz #2**
VI	**Sept 29 – Oct 3**	
VII	**October 6-10 (Mid-term)**	**Take Mid-term exam**
VIII	**October 13-17**	**Assignment 3 due at noon on Friday**
IX	**October 20-24**	**Take Quiz #3**
X	**October 27 – Hallowe'en**	
XI	**November 3-7**	**Assignment 4 due at noon on Friday**
XII	**November 10-14**	**Take Quiz #4**
XIII	**November 17-21**	
	Break	
XIV	**December 1-5**	
XV	**December 8-12**	
Finals	**December 15-19**	**Take final exam by the end of Wednesday of this week**

(1) Quizzes will cover recent lecture material and recent reading assignments (i.e., since the previous assessment). Quizzes will be composed of multiple choice and short answer questions.

(2) The Mid-term exam will consist of multiple choice, short-answer, and other questions administered on Blackboard Learn. We use concept- and problem-solving-based methods of objective testing. Objective questions are created to evaluate students' abilities to reason and solve problems. Unprepared students perform poorly on exams and quizzes. Cheating will be dealt with following ISU's general policies, without exception. There is no time-limit on taking quizzes and exams.

(3) The final exam will be much like the mid-term although somewhat longer and part will be given in class. Exams covering lecture material and reading assignments will be mixtures of question types including multiple choice, problem solving, short development, short answer.

(4) Homework

1. **<u>Assignment 1</u>: Create 2 stratified liquid systems (in a glass, bottle, jar, aquarium, etc.) using any materials you need to use. Take images of the systems and include them in your write-up. Submit an electronic document indicating for each image, (1) how you decided to make the stratified system, (2) what principles you used to design it, and (3) the way you made it happen. [Rubric: picture of each (2); explanation of the composition of the system (2); explanation of the principles**

involved (2); explanations of the techniques you used to assemble it (2); creativity (4) (total 20 points)].

2. **Assignment 2: Locate a stream or river near you. Take photos of pool, riffle, and run habitats. In your write-up, indicate for each how they are created and what their ecological characteristics might be. [Rubric: picture of each (2); explanation of creation (2); ecological characteristics of each (2); map showing location of the stream segment (2); total (20)].**
3. **Assignment 3: Find a lentic system near you. Figure out how big it is and how it is oriented with the wind. Find a way to measure wave height. Measure it for a while. Is this a lot of waves for the given amount of wind exposure? In your write-up show images of the system, provide your reasoning and calculations, and explain why you are seeing a lot or a little wave action at this site. [Rubric: aerial image of lentic system studied (2); measurement of size and wind orientation (4); measurement of wave height and explanation of the principles of it(4); estimation of wind speed when you made measurements (2); reasoning and calculations (2); discussion of "lot" vs "little" wave action for wind and exposure (6); total (20)].**
4. **Assignment 4: Find as many species of aquatic plants in some aquatic ecosystem as you can (minimum 6). Take pictures of them and for each explain why they are found in the particular ecosystem where you found them. In your discussion, explain why this ecological relationship exists.[Rubric: photos of each (1 point each up to 6); names of each plant (1 point each up to 6); explanation of why they are found in the system where you found them (1 point each up to 6); map or maps showing where your plants were found (2); total (20)].**
5. **General notes on assignments: Assignments are due on the day and time indicated. Each day or part of a day after that will cost 20% of the assignment grade. All assignments will be check automatically for plagiarism. Please submit these as .doc files with embedded images. See https://help.blackboard.com/en-us/Learn/9.1_SP_10_and_SP_11/Student/060_Tests_and_Assignments/Submitting_Assignments for assistance with uploading procedures**

Students are expected to participate in course discussions. Please prepare for the course by performing assigned readings and assigned on-line lectures. Participation is assessed by contributions to in-class and/or on-line class discussions, Q&A sessions, and daily preparation assessed via short quizzes that are not counted in the quiz total.

Supplemental credit

I am offering supplemental means of increasing students' performance in this class. Although students must take all quizzes, the grade on a supplemental credit project may be substituted for the lowest grade on a quiz. Supplemental credit projects will be at-home field or lab exercises. A list of possible projects will be available by the end of the second week of class. They are worth a potential maximum of 30 point instead of the total 20 points for each quiz.

Graduate students

Graduate students enrolled in EEOB 586 must complete one of the above supplemental credit assignments as part of their normal contribution to the course.

Final Grades:

Percentage	*Grade*
90-100%	= A
80-89%	= B
70-79%	= C
60-69%	= D
Below 60 %	= F

- Instructor may curve grades if appropriate.
- Plus/minus grades will be used.