Course Number: FRSHWTR-502
Aquatic Ecosystem Dynamics

Instructor: Dr. Harvey Bootsma
Office: School of Freshwater Sciences, Room 2087
Contact Information: Tel: (414) 382-1717
Email: hbootsma@uwm.edu
Office Hours: I am available in my office or lab at any time during the week, except for days when I am traveling or doing field work. I suggest you call or email before visiting.
Course Meeting: Wednesday, 1:00 p.m. – 3:40 p.m.
Location: School of Freshwater Sciences, Great Lakes WATER Institute, Room 365 (note: this is not on the main campus. The address is 600 E. Greenfield Ave.)
Preproposals: Due October 1.
Midterm Exam 1: October 22, regular class time.
Poster / Proposal Presentations: Dec. 3 and Dec. 10, in class.
Poster / Proposal Hand-In: December 5, 2013.
Final Exam: Saturday, December 13, 12:30 p.m. – 2:30 p.m.

Course Description

This course is designed to give graduate students and advanced undergraduate students an interdisciplinary perspective on dynamic processes in inland waters – how various lake properties interact and change in space and time. The focus is on large lakes – their geology, physics, chemistry, biology, and interaction with human populations. The course will consider how scientists from diverse disciplines approach the study of large aquatic systems. Learning is achieved through three mechanisms:

1. Field excursions and laboratory experiments.
2. Lectures.
3. Literature review, including preparation of a poster or research proposal.

The emphasis will be on the Laurentian Great Lakes, but other large lakes of the world will also be discussed. Undergraduate students must prepare a poster on a contemporary topic for a course symposium. Graduate students will prepare a NSF-style research proposal addressing a specific problem related to any aquatic system.
Course content is coordinated to some degree with that of course FRSHWTR-504, Quantitative Freshwater Analysis. There are advantages to taking both courses simultaneously, but this is not a requirement.

Because this course focuses on dynamic processes, it is expected that students have basic quantitative (mathematical) skills, including algebra and calculus. Students are also expected to be familiar with the basics of biology, chemistry and physics, with a minimum proficiency equivalent to an introductory college course. The limnology course offered in the Biological Sciences Department (Bio Sci 512) is complementary to this course. Students who have not taken an undergraduate limnology or aquatic ecology course may find it helpful to take that course prior to or simultaneously with this course.

Learning Outcomes

The course is designed such that students will:

- Be familiar with the basic principles of hydrodynamics, biology and biogeochemistry as they relate to the science and management of large lakes.
- Develop an understanding of how scientists from diverse disciplines approach the study of freshwater inland seas in the context of classical as well as contemporary research.
- Be introduced to the basic tools used for the study of large lakes.
- Demonstrate an ability to devise strategies for the study of a contemporary problem in large lake research. This is in the form of a poster (undergraduate) and research proposal (graduate).

On completion of the course, students should be able to:

- Operate analytical equipment / instruments commonly used for large lake research, and analyze the data produced by these.
- Explain how physics, biology, geology and nutrient cycles interact in large lakes.
- Develop strategies to address specific scientific questions related to large lake dynamics.
- Communicate effectively with the community of aquatic scientists, managers and policy makers.
- Identify the skills required to understand and address large lake management challenges.

Workload

This is a 3 credit-hour course. As such, students are expected to devote 8 to 9 hours per week to this course over a full semester. This time commitment will include:

- In-class time, which includes field excursions and lab work (2.5 hours per week)
- Reading of literature assignments (see below)
- Completion of assignments (take-home and in-lab)
- Preparation of a proposal or poster (see below)
- Preparation for exams

Resources

Class Website. The course will use a Desire 2 Learn (D2L)-based website in order to coordinate the class, communicate information, deliver assignments and solicit feedback. Details are provided at the end of the syllabus. Please check the website and your email frequently because you are responsible for all announcements and changes to the syllabus posted there. If you need assistance with D2L, you can:
  • send an email to help@uwm.edu
  • pick up a phone and call 229-4040 (or 4040 on a campus phone)
  • go to Bolton 225 (this lab is not open all day -- check for specific hours)
  • if you are calling from outside the 414 or 262 area codes, call 1-877-381-3459

The Library. Library work is an important part of the course and essential to complete the poster / proposal assignments. In particular, the course will make use of the primary scientific literature (i.e. journal articles). Note: the internet is useful, but it is not a substitution for the library.

Class Notes: Lecture outlines and summaries of lectures will be available on the D2L site, usually within one week following the lecture. These are not meant to replace your own note-taking: taking notes is an essential part of the learning process.

Students with Special Needs: Students with special needs should arrange to speak with me during the first week of classes so we can best accommodate your learning style. Note University Policies: Students with disabilities. Verification of disability, class standards, the policy on the use of alternate materials and test accommodations can be found at the following: http://www.uwm.edu/Dept/DSAD/SAC/SACltr.pdf

The Writing Center welcomes writers at all skill levels, inexperienced through advanced, freshmen through graduate students. FY1--over 1/3 of the students who visited in the past 4 yrs were juniors, seniors or grad students. Whether still exploring a reading, brainstorming, drafting or revising, writers can benefit from talking one with one of the well-qualified and well-trained tutors. Make appointments online 24/7: http://www.writingcenter.uwm.edu

Required Readings
Learning in this course will rely in part on the reading of scientific literature (see below). There is no assigned textbook. However, students may find any of the following textbooks useful as background reading either before or during the course:


Other journal articles and books that are relevant to the topics covered in this class are listed below. I will let you know which of these are required readings. You may also find some of these useful when designing and composing your poster / proposal.


Cherkauer and Ansari, 2005. Estimating ground water recharge from topography, geology and land cover. Ground Water 43 (1)
Chrzastowski & Thompson. 1994. Surface elevation and shoreline changes over 14,000 years of Southern Lake Michigan. J. Great Lakes Res. 20: 9-26
Lehman, J. 2002. Mixing patterns and plankton biomass of the St. Lawrence Great Lakes under climate change scenarios. J. Great Lakes Res. 28: 583-596

**Course Requirements and Grading**

<table>
<thead>
<tr>
<th></th>
<th>Undergraduate</th>
<th>Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class quizzes and assignments</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Field / Lab Reports</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Inter-student teaching assessment</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Midterm Exam 1</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Final exam</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Poster</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Proposal</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

**Field Excursions:** This course places an emphasis on learning through practice. This is facilitated through several major field excursions, during which a variety of sampling and measurements are conducted on a local water body. These excursions are followed by analyses and experiments in the laboratory. For each excursion, students will form small groups (3-4 students per group). Each group will select a different research module. Following the field excursion and lab work, each group will prepare a research report (1 report per group). Group composition will not necessarily be the same for all three of the excursions. Each report is worth 10% of the final grade, for a total of 30%.

**Poster Presentation:** Undergraduate students are required to develop a poster presentation (48”x 42”) that integrates knowledge from at least two of the thematic areas discussed in the course to address a contemporary problem in large lakes research and/or management. A poster pre-proposal (1 page maximum) is due October 1. Posters will be presented in class December 3 and December 10, and are to be handed in by December 5. The poster is worth 20% of the final grade.

**Graduate Students:** Graduate students will be required to write and present a research proposal that addresses a current basic and/or applied science question related to aquatic
science. Proposals are to be developed in the format of a National Science Foundation rapid response proposal (abbreviated format). A pre-proposal (1 page maximum) is due October 1. Proposals will be presented in class December 3 and December 10, and are to be handed in by December 5. The proposal is worth 20% of the final grade.

Class Schedule

(note: this schedule is flexible, and may change according to student needs and progress on field / lab work.)

Week 1  Course introduction. Form working groups. Introductory quiz.

Week 2  Training in field and lab methods. Meet in room 1080.

Week 3  Field excursion 1.

Week 4  Quiz on field and lab methods. Lecture. Hydrology and hydrodynamics. Light and heat.

Week 5  Group presentations of results from field excursion 1. Field excursion 1 reports due (1 per group). Pre-proposals due.

Week 6  Lecture. Dissolved gases. Major ions. Inter-student training for field excursion 2.

Week 7  Field excursion 2.

Week 8  Midterm exam (1 hour). Lecture. Inorganic carbon system.

Week 9  Lecture: Nutrients Field excursion 2 reports due. Inter-student training for field excursion 3.

Week 10  Field excursion 3.

Week 11  Lecture. Nutrients, plankton, photosynthesis.

Week 12  Field excursion 3 reports due. Lecture. Aquatic food webs.

Week 13  Thanksgiving break
Week 14  Presentations of posters / proposals (hard copies due Dec. 5).

Week 15  Presentations of poster / proposals.

FINAL EXAM. Saturday, December 14, 2013. 12:30 p.m. – 2:30 p.m.

Course Policies

Attendance: Some of the material for this course will be made accessible through the D2L website. This material is meant to help the student prepare for class, but it does not replace the material presented in class.

Late assignments will be downgraded by 5% for each day past the due date.

Missed Exam Policy: There are no make-up exams except for extreme emergencies which require official documentation. In such an event, contact me as soon as possible to discuss the problem. An un-excused absence will result in lost points for that exam. Policies regarding final examinations can be found at the following: http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm.

Academic Misconduct: In this course, you are expected to perform to the best of your ability in an honest manner. Cheating, plagiarism, or other acts of misconduct will result in a severe penalty to you, as per University of Wisconsin System Chapter 1. http://www.uwm.edu/Dept/OSL/DOS/conduct.html. Plagiarism is a particular concern: many students seem unclear about what it involves. I recommend that you read: http://www.plagiarism.org/learning_center/what_is_plagiarism.html because ignorance is not acceptable as an excuse.

Other University Policies: Various policies related to this course can be found on the Secretary of the University’s website at http://www4.uwm.edu/secu/SyllabusLinks.pdf