

Aquatic science and management (ENSC/GEOG 3106)
Course outline – Fall 2020

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TEACHING ASSISTANT: Madelaine Bourdages
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OFFICE HOURS: By appointment (just email)

PREREQUISITES: Third year standing or permission of the program director.

SCHEDULE: Monday & Wednesday 2:35 – 3:55 am
Online

STRUCTURE OF THE COURSE: This course has been designed to be delivered using an **Asymmetrical delivery mode**. This means that you should be able to access most of the course material during the week at a time that is convenient for you. I will be uploading video lectures, lecture slides, readings, and assignments onto cuLearn and all assignments will be handed in by the student through cuLearn. A few of the assignments, such as the midterm, will need to be completed over a designated timeslot during a single day (more details will be provided in class) but for most assignments you will have multiple days to complete them. To give students the chance to ask questions about the material covered the Teaching Assistant and the Instructor will host live Zoom sessions where we will answer questions that have been emailed to us ahead of time, or asked directly by the students during the Zoom session. Students will be welcomed to attend these Zoom sessions but attendance is not mandatory. These Zoom sessions will be recorded and uploaded to cuLearn so all students in the course will have access to the questions and the answers discussed.

REQUIRED TEXTBOOK: None! The instructor will email links to readings through CULearn. This will require accessing materials from the library. If you want to do extra reading some excellent relevant texts are:

Kalff, J. 2002. Limnology: inland water ecosystems. Prentice-Hall, Inc.

Wetzel, RG. 2001. Limnology: lake and river ecosystems, 3rd ed. Academic Press.

Smol, JP. 2008. Pollution of lakes and rivers: a paleoenvironmental perspective, 2nd ed. Blackwell Publishing.

Scheffer, M. 2004. Ecology of shallow lakes. Kluwer Academic Publishers.

Allan, JD and Castillo, MM. 2008. Stream ecology: structure and function of running waters, 2nd ed. Springer.

EVALUATION:

Assignment 1 (September 23 rd)	10%
Assignment 2 (October 7 th)	10%
Mid-term (October 21 st)	20%
Assignment 3 (November 9 th)	10%
Assignment 4 (November 30 th)	10%
Take Home final exam	35%
Participation*	5%
<i>(*carrying out assigned readings and submitting very short write-ups based on readings)</i>	
Total	100%

Requests for Academic Accommodations

Carleton provides [academic accommodation to students](#) for reasons of disability, religious observance, pregnancy and/or parental leave, sexual violence, and student activities.

Providing accommodations simply means providing alternatives to students who cannot perform the essential requirements of their academic programs due to the reasons mentioned above. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the university.

This section provides only a brief overview of the accommodations policy and process. Please contact [Equity and Inclusive Communities](#) for a full explanation.

Religious Observation

A request should be made in the first two weeks of the academic term, or as soon as possible where the scheduling of an event or activity conflicting with a religious obligation does not appear in the course outline or calendar. A list of multi-faith holy days is accessible through the [Equity Services website](#). Instructors can also contact Equity Services to confirm the eligibility of a religious event or practice.

Pregnancy and/or Parental Leave

Requests for parental leave must be made in writing to the Registrar's Office, or in the case of graduate students, to the Office of the Dean of Graduate and Postdoctoral Affairs. A student who is pregnant may request a temporary modification to her program (e.g., laboratory or field work). The student should meet with the instructor(s). The department chair/director and the faculty dean can assist in the discussion. An Equity Services advisor can also be consulted if a student has questions about pregnancy and/or parental leave.

Students with Disabilities

Carleton is strongly committed to providing access and accommodation for all individuals with identified and duly assessed disabilities. The university has a [Senate-approved policy on academic accommodation](#) that forms part of its human rights policy. The policy promotes efforts to accommodate students with disabilities so that they will have the opportunity to meet learning outcomes and be fairly evaluated in their performance. In

no case, however, does academic accommodation negotiate away, lower, or remove the academic standards and learning outcomes of any course or program, rule, regulation, or policy at the university. Some students with disabilities may require special accommodations for tests and exams. In these cases, students must present you with a signed accommodation form from the Paul Menton Centre detailing their accommodation needs well in advance of the date of an exam. A copy of the [Paul Menton Centre accommodations policy can be found here](#).

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit carleton.ca/sexual-violence-support.

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see [the policy](#).

Contacts

<p>Equity Services 503 Robertson Hall 613-520-5622 equity@carleton.ca carleton.ca/equity</p>	<p>Paul Menton Centre 501 University Centre 613-520-6608 pmc@carleton.ca carleton.ca/pmc</p>
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COURSE OVERVIEW: This course will cover the fundamentals of aquatic science bringing together the physical, chemical, and biotic aspects of lake, river, and estuary systems including how humans are changing aquatic ecosystems and management techniques for the use and conservation of these resources. Topics covered during the class will include the structures and function of aquatic systems; the dynamics of the pelagic and littoral zones, human impacts and environmental change, and monitoring and management of aquatic ecosystems.

Learning Outcomes:

1. Integrate foundational knowledge in limnology with aquatic ecosystem management.
2. Define established and emerging environmental stressors of aquatic ecosystems.
3. Identify relevant environmental policy related to aquatic ecosystems in Canada
4. Understand the design, implementation, and strengths/weakness of aquatic monitoring programs
5. Evaluate, synthesize, and communicate data on aquatic ecosystems to inform evidence-based management

Assignment 1: Mini-review (topic) (10%)

The goal of this assignment is for you to summarize a research topic in aquatic sciences that you find interesting and to get you writing early in the term.

Assignment:

Find and read at least two peer-reviewed publication related to a topic you find interesting in the aquatic sciences. Use these publications to help you write your summary and cite them in the text and in a references section.

This assignment should be kept brief and to the point (absolute max 500 words) but should accurately summarize the content of the articles and explain why you find the topic/research interesting and how the research has contributed to our understanding of aquatic science.

For your references, base the formatting on the style of the journal article you selected.

Assignment 1 marking scheme:

Explains and properly summarizes content /4
Clearly summarized, concise, accurate

Contribution to our understanding and why you find the article interesting /4
Clearly explained Accurate
Linked to broader body of work

Proper formatting /2
Proper sentence structure Referencing style Spelling & Grammar

Comments:

Assignment 2: Graphing and interpretation (10%)

The purpose of this assignment is to graph and interpret a temperature and oxygen profile versus water depth in a lake. Students will be given data to produce a graph and interpret the results in the context of aquatic ecosystems. Both the graph and a written document interpreting the graph will be handed in (<200 words). More details for the interpretation of the results will be included in the assignment handout.

Assignment 2 marking Scheme: /10

Graph /4
Are the values graphed correctly
Proper axes labels
Title and legend for the graph

Written interpretation /6
Is the interpretation correct
Clearly written

Assignment 3: Mini-review (Limnologist) (10%)

The goal of this assignment is for you to learn about and summarize the main research contributions of a scientist working in the field of limnology or aquatic ecology.

Assignment:

Select a scientist working in the fields of limnology or aquatic ecology and use an academic search engine or citation index (e.g. google scholar, Web of Science, Scopus) to learn about their work. Think about the following questions to help you frame your mini-review: 1) In what years was the scientist actively publishing?, 2) what institution were they affiliated with?, 3) Where did their research take place (e.g. in the lab or in the field? If in the field what was the geographical location of most of their studies)?, 4) What was (were) their major contribution(s) to the study of limnology? 5) What are some of their most highly cited work? 6) Why did you select this scientist, what was it about their work that interested you? Read at least two peer-reviewed publication from the scientist you selected and use these publications to help you write your summary and cite them in the text and in a references section.

This assignment should be kept brief and to the point (absolute max 500 words) but should accurately summarize the questions posed in the paragraph above.

For your references, base the formatting on the style of one of the journal article you selected.

Assignment 3 marking scheme: /10

Explains and properly summarizes content /4
Clearly summarized, concise, accurate

Contribution to our understanding and why you find the article interesting /4
Clearly explained accurate
Linked to broader body of work

Proper formatting /2
Proper sentence structure Referencing style Spelling & Grammar

Assignment 4: Calculating and Evaluating Ecological Indices (10%)

The goal of this assignment is to familiarize students with the calculation of ecological indices that are often used in environmental monitoring programs to summarize large quantities of complex data. For this assignments students will calculate the Family Biotic Index (FBI) often used in stream monitoring programs to relate macroinvertebrate data to stream ecological health or pollution. Students will calculate the FBI score based on data that will be given to them, interpret the results, and discuss some strengths and weaknesses of ecological indices. Students will hand in both their calculations and a written document (<200 word) interpreting the results and the strengths and weaknesses of ecological indices in monitoring programs.

Assignment 4 marking Scheme: /10

Calculations /4
Work easy to follow and clearly laid out
Are the values correct

Written interpretation /6
Is the interpretation correct
Were strengths and weakness of ecological indices discussed and accurate
Clearly written

TENTATIVE SCHEDULE (subject to change):

Week	Date	Content
1	Sept 9	Course introduction, general introduction to aquatic systems
2	Sept 14,16	Distribution and forms of inland waters, physical structure, watersheds as management units
3	Sept 21,23	Chemical cycles of key elements in aquatic systems
4	Sept 28,30	Algae and aquatic plants, primary production, and spatial food-web subsidies
5	Oct 5,7	Zooplankton, food-webs, and trophic cascades
6	Oct 12	Thanksgiving (no class)
	Oct 14	Rivers and Estuaries
7	Oct 19	Mid-term review
	Oct 21	Mid-term exam
8	Oct 26, 28	Fall break – No class
9	Nov 2,4	Human modification of watersheds lakes, rivers and estuaries
10	Nov 9,11	Pollution of lakes, rivers, and estuaries
11	Nov 16,18	Invasive species, Climate change, and multiple stressors
12	Nov 23,25	Watershed monitoring, reference conditions, and paleolimnology
13	Nov 30, Dec 1	Governance of aquatic resources, successes in management, and emerging stressors
14	Dec 7,9	Freshwater resources in the Anthropocene
		Review for Final Exam (last class!!!)