

Aquatic science and management (ENSC/GEOG 3106)
Course outline – Fall 2024

INSTRUCTOR: Dr. Jesse Vermaire
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OFFICE HOURS: By appointment (just email)

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

SCHEDULE: Tuesday & Thursday 8:35 – 9:55 am

STRUCTURE OF THE COURSE: This course has been designed to be delivered in person.

REQUIRED TEXTBOOK: None! The instructor will email links to readings through Brightspace. This will require accessing materials from the library.

We will primarily be following material in the text book below:
 Jones, I.D. and Smol, J.P. 2024. Wetzel's Limnology: lake and river ecosystems, 4th ed. Academic Press.

If you want to do extra reading some excellent relevant texts are:

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

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 19 th)	10%
Assignment 2 (October 3 rd)	10%
Mid-term (October 17 th)	20%
Assignment 3 (December 7 th)	25%
Take Home final exam	30%
Participation*	<u>5%</u>
<i>(*carrying out assigned readings and submitting very short write-ups based on readings)</i>	
Total	100%

MISSED COURSE WORK: If you will be late with an assignment or miss the mid-term please reach out to me to make arrangements to submit the work. With valid reasons a make-up mid-term examine will be administered in a date that works for both of us.

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 climate 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 (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 (250 - 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 1 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 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: Case study on the Peace-Athabasca Delta (25%)

For this assignment I would like you to produce a 7-10 page document (including a cover page and references) outlining the challenges faced by the Peace-Athabasca Delta (PAD) and recommendations on what Canada should do to prevent Wood Buffalo National Park from being listed as a World Heritage in Danger.

Specifically, I would like you to:

- 1) Describe the physical and human geography of the PAD. What is the PAD and where is it located, what is special or unique about the PAD, what is special about the biology of the PAD, and what Nations of people call this place home.
- 2) Describe what environmental changes are occurring in the PAD and how this is affecting the landscape and the biology of the PAD.
- 3) Describe how the environmental changes are impacting the people and way of life in the PAD.
- 4) Describe what is driving the environmental changes occurring in the PAD. What do we know to date and can you think of any important question that remain unanswered about what is driving environmental changes in the PAD?
- 5) Finally, provide some recommendations to the Government of Canada about what can be done to conserve the PAD and reduce the likelihood that Wood Buffalo National

Park will be listed as a UNESCO World Heritage in Danger Site. Note that I do not expect you to have all the answers here, this is a complex issue and if it was easy to solve it would already be solved.

Include figures, pictures, and maps in your report as you see fit to support your statements, just cite them in the figure caption and reference list.

Assignment 3 marking Scheme: /25

Background material on the PAD. Physical description of the environmental conditions of the PAD and how they are changing /8

Discussion of the people and communities that live in the PAD and how their traditional way of life depends on the environment of the PAD and how environmental changes are altering their way of life. Discussion of how other organizations depend on the PAD and their roles and responsibilities. /8

Scientific analysis of how the PAD is changing and a summary and interpretation of the scientific evidence describing why these ecological changes are occurring. What, if anything, can be done to conserve the environment of the PAD? /7

Proper formatting /2

Proper sentence structure Referencing style Spelling & Grammar

Comments:

TENTATIVE SCHEDULE (subject to change):

Week	Date	Content
1	Sept 5	Course introduction, general introduction to aquatic systems
2	Sept 10,12	Distribution and forms of inland waters, physical structure, watersheds as management units
3	Sept 17,19	Chemical cycles of key elements in aquatic systems
4	Sept 24,26	Algae and aquatic plants, primary production, and spatial food-web subsidies
5	Oct 1,3	Zooplankton, food-webs, and trophic cascades
6	Oct 8,10	Rivers and Estuaries
7	Oct 15 Oct 17	Mid-term review Mid-term exam (in class)
8	Oct 22, 24	Fall break – No class
9	Oct 29, 31	Human modification of watersheds lakes, rivers and estuaries
10	Nov 5,7	Pollution of lakes, rivers, and estuaries
11	Nov 12,14	Invasive species, Climate change, and multiple stressors
12	Nov 19, 21	Independent study and project report on the Peace-Athabasca Delta. Dedicate class time to research and some online resources will be provided.
13	Nov 26, 28	Watershed monitoring, reference conditions, and paleolimnology
14	Dec 3 Dec 5	Freshwater resources in the Anthropocene Review for Final Exam (last class)

Statement on Academic Integrity:

- a. Permissibility of submitting **substantially the same piece of work** more than once for academic credit.
 - It is expected that assignments for this course are original pieces of work designed to meet the requirements of the assignment.
- b. Permissibility of **group or collaborative work**.
 - There is no group or collaborative work in this course.
- c. Permissibility of the use of **generative artificial intelligence tools (e.g. ChatGPT)**.
 - Unless explicitly permitted, either generally or for a specific assignment, any use of generative AI tools to produce assessed content is considered a violation of academic integrity standards.
- d. Plagiarism:

The University Academic Integrity Policy defines plagiarism as *“presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.”* This includes reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, artworks, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment
- using another’s data or research findings without appropriate acknowledgement
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own
- failing to acknowledge sources with proper citations when using another’s work and/or failing to use quotations marks.”

Plagiarism is a serious offence that cannot be resolved directly by the course’s instructor.

The Associate Dean of the Faculty follows a rigorous [process for academic integrity allegations](#), including reviewing documents

and interviewing the student, when an instructor suspects a violation has been committed. Penalties for violations may include a final grade of “F” for the course.

Statement on Mental Health:

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult <https://wellness.carleton.ca/>”

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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