

# **BIOL 335**

## **Limnology and Aquatic Ecology**

Fall Term (2025)

On Campus

**Course Description:** Physical, chemical and biological aspects of freshwater lakes. Emphasis will be on: morphometry; light and temperature; water chemistry; ecological and physiological requirements; composition and interaction of algal and invertebrate populations; fish interactions; eutrophication; acid rain; other forms of pollution; climatic and other environmental change.

RECOMMENDATION BIOL 201/3.0 and BIOL 202/3.0 are highly recommended.

PREREQUISITE CHEM 112/6.0

Note: compulsory field trip cost estimated at \$70.00

### **Learning Objectives**

The goals of Biology 335 are to provide students with an integrated overview of lake systems, with a focus on ecological and environmental issues.

Limnology is a large subject that covers geological, physical and chemical aspects of freshwater environments, as well as their biology and development. Obviously, in a half course we cannot attempt to examine all facets of limnology in depth. Instead, we will attempt to present an overview, emphasizing fundamental interactions and processes. The objectives of this course are to provide you with a basic understanding of the physical, chemical, and biological processes in lakes, as well as an appreciation of the impact of human activities on these water bodies.

This course also will involve interactions with the Teaching Assistants (TAs) and your fellow students in the labs and on our full-day excursion to our biology station. To facilitate your learning, please be prepared for your classes, labs and field trip and ask questions. Also, please see the guidelines below.

**Lectures:** Typically 3 lectures per week. See SOLUS for a list of various lab times.

**Course Approach and Timeline:**

Course material will be presented using three approaches: formal lectures, laboratories, and a compulsory field trip to the Queen's University Biology Station (QUBS) on Lake Opinicon (one day; either Saturday, Sept. 27 or Sunday Sept. 28). Although there is some overlap in the material that will be presented using these approaches, they and the associated reports and exams serve to reinforce the important concepts related to the learning outcomes of this course.

There is a strong practical component to this course beginning with the field trip where you will receive a crash course in limnological surveys. You will also receive an introduction to physical, chemical, and biological sampling techniques, and activities involving the identification of living plankton and invertebrates. Preserved specimens will be collected for use in our labs, but experience of sampling and identifying live organisms cannot be recreated in the lab, so attending the one-day field trip is important. The material covered on the field trip will also form part of the Lab Exam.

In teaching this course, I adapt the approach used in most standard texts, starting with the importance of physical characteristics of lakes and their interaction with light, heat, and geographic location, followed by the importance of chemistry and limiting nutrients. This simplification allows insights into the complexities of the physics and chemistry that are fundamentally linked with biology and biological change over time. In the final part of the course, I will use several integrative examples to show how lakes are impacted by both natural and anthropogenic activities, and why an understanding of environmental and ecological change is important to manage the biodiversity and ecosystem services that are provided by inland waters. Lecture topics that will be included in this course are listed below.

**Lecture Topics:**

Introduction to Limnology and Aquatic Ecology

Physical Limnology (~4 lectures: Lake morphometry; Light in lakes; Heat in lakes; Water movements)

Chemical Limnology (~ 6 lectures: Oxygen; Salinity; Carbon; Nitrogen; Phosphorus; Sulfur and Silica)

Origin of Lakes (1 lecture: Geographic aspects of limnology)

Biological Limnology (~6 lectures: Phytoplankton and primary production; Zooplankton; Fish and trophic interactions)

Integrative Limnology and Applications (~13 lectures: Paleolimnology; Acidification; Shallow lakes and alternate equilibria; Lake remediation; Saline lakes; Arctic and Antarctic lakes; Tropical lakes; Surprises in limnology; Lakes on Mars?)

**Labs:** A total of 4 labs (+ a one-day compulsory field trip at QUBS). Please show up to your scheduled lab section in the second week of class – your demonstrators will go over important organizational and safety information. Always come prepared for the labs (i.e., read and understand the PDF that has been posted for the lab).

Attendance at the labs is compulsory. All labs are held in Rm. 3320 of the Biosciences Complex. Please see SOLUS for lab times.

**One-Day Field trip:** In this course we have a compulsory one-day field trip to the Queen's University Biology Station (QUBS) (class is split in two: one half on Saturday, September 27 and one half on Sunday, September 28). The bus will arrive on Barrie St. at the north end of the Biosciences Complex by 7:20 am. We will leave at 7:30 sharp and will return by approximately 6 pm the same day. The estimated cost of the field trip will be \$70. This cost will cover the cost of transportation to and from the Biology Field Station, user fees, and lunch. During this field day, you will participate in four hands-on modules, that alternate between on-lake and off-lake activities. I will post the field manual on the BIOL335 OnQ website as you will need to read this manual prior to coming on the field trip.

### **Course Learning Outcomes:**

Limnology, the study of inland waters, is an inherently interdisciplinary subject. The overall goal of this course is to provide you with a basic understanding of the physical, chemical, and biological processes in lakes, as well as an appreciation of the impact of human activities on these waterbodies, and solutions to pressing problems in aquatic ecology.

More specifically the Learning Outcomes of this course include being able to:

- A) Explain and effectively communicate how basic principles and concepts associated with the physical, chemical, and biological aspects of limnology can be applied to understand lake ecosystems.
- B) Understand, recognize, and describe contributions from the disciplines of physics, chemistry, biology, geography, environmental studies and engineering to the understanding of limnological systems;
- C) Use limnological techniques to collect, analyse, and interpret chemical and biological data;
- D) Conduct, analyse, and interpret the laboratory exercises to gain understanding of limnological concepts, and gain experience in the writing of clear, concise and integrated reports;
- E) Apply limnological concepts and critical thinking to demonstrate an integrated understanding of the roles of physical, chemical, and biological characteristics in the structure and function of aquatic communities (at all trophic levels from microbes to fish), in lakes and ponds from the Arctic to the tropics; and
- F) Describe, understand, logically predict, and clearly communicate the impact of a variety of human activities (e.g., watershed disturbances, mining, industrial activities) on aquatic ecosystems and environmental health, and formulate appropriate remediation techniques.

### **Course Materials (Textbooks/Reading):**

The only material you will be responsible for is material covered in lectures, labs, and the field trip. However, detailed background material and many of the figures etc. used in lectures will be coming from the new textbook:

**Jones, I.D. and Smol, J.P. [Editors]. 2024. *Wetzel's Limnology: Lake and River Ecosystems. 4th Edition.* Elsevier, Oxford. 1088 pp.**

<https://shop.elsevier.com/books/wetzels-limnology/jones/978-0-12-822701-5>

This textbook is freely available as an e-book from the Queen's Library ([Wetzel's Limnology | ScienceDirect \(queensu.ca\)](https://www.queensu.ca/science-direct)). This is an updated version of the classic limnology text by Robert Wetzel (2001, who died a few years after publication) - *Limnology: Lake and River Ecosystems* (3<sup>rd</sup> edition). This is a comprehensive (over 1000 page) account of limnology. Please note that there are summaries of the important points of each chapter at the end of each chapter. I will also post several other relevant materials via the BIOL335 OnQ website.

### **Approximate Learning Hours**

<i>Teaching method</i>		<i>Average hours per week</i>	<i>Number of weeks</i>	<i>Total hours</i>
In-class hours	Lecture	~3	12	~36
	Seminar			
	Laboratory	3	4 labs (see onQ page) and lab exam	~13 + field trip below
	Tutorial			
	Practicum			
	Group learning			
	Individual instruction			
Other	Online activity			
	Off-campus activity	Day trip to Queen's University Biology Station		Leave by 7:30am and return by ~6pm ~11
	Private study			~60
Total hours on task				~120

## **Weighting and Alignment with Course Learning Outcomes (CLOs) -- Grading Scheme**

<b>Component</b>	<b>Weight (%)</b>
Assignment 1 (Lab 1): Lake Models and thermal stratification; your assignment is due 10 days following your lab.	10%
Midterm exam - covers lecture material up to the end of the physical and chemical limnology sections of this course, held in class. This exam has been tentatively scheduled on the Monday prior to your fall break.	20%
Assignment 2 (Lab 3): Assessment of long-term change in aquatic systems; your assignment is due 10 days following your lab.	15%
Lab Exam (covers material covered in lab and the fieldtrip)	15%
Final Exam (written in the exam period. The goal of the exam is to give you the opportunity to show that you can integrate and apply the information learned in this course).	40%

### **Assignment Submission Policy**

One of the skills you are expected to master during your university education is to communicate clearly and logically the knowledge that you have gained. Two written assignments are part of this course (Lab 1 and Lab 3). As 25% of your final mark will be dependent on them, you should spend considerable time in preparing concise, clear, and correct reports. These reports should be written as papers. The format of the papers will be detailed in your lab. Your reports will be due 10 days following your lab. Each assignment will have an automatic three-day grace period (after the 10-day deadline). As such, short-term academic considerations are built into the assignments. Submission of assignments after the grace period will be reduced by 10%/day.

### **Grading Method:**

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale:

#### ***Queen's Official Grade Conversion Scale***

<b>Grade</b>	<b>Numerical Course Average (Range)</b>
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69

C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

**Important University Dates** Please visit the [Faculty of Arts and Sciences Sessional Dates website](#) for all academic deadlines.

### **Proctored Exams**

#### Timing of Final Examinations

Once the exam schedule has been finalized, the final exam date will be posted on your SOLUS account. The exam dates for each term are listed on the Faculty of Arts and Science webpage under "[Important Dates](#)." Student exam schedules for the Fall Term are posted on SOLUS immediately prior to Thanksgiving and on the Friday before Reading Week for the Winter Term. Students should **delay finalizing any travel plans until after the examination schedule has been posted**. Exams will **not be moved or deferred** to accommodate employment, travel/holiday plans or flight reservations. For information regarding what is considered extenuating circumstances and qualifications for Academic Consideration, please visit the [Faculty of Arts and Science's Academic Consideration webpage](#).

### **Questions About the Course and Contacting the Teaching Team:**

Questions about your labs (and the associated assignments) should be directed first to your Teaching Assistant. Normally, your TA will be available in your regularly scheduled lab slot. Any reoccurring questions or concerns that we learn of will be addressed on the OnQ page for this course, either as a course announcement, or in the discussion form.

For any questions on the lecture components of this course, please feel free to contact me before/after lecture, or during a scheduled office visit. If this is not possible, please e-mail me and we can set up a time to discuss your questions.

### **Queen's Email**

The university communicates with students via Queen's email. Please check your email regularly to ensure you do not miss important information related to your course.

### **Course Feedback**

At various points during the course, you may be asked to take part in a variety of feedback activities, such as surveys and questionnaires. This feedback enables the teaching team to improve the course. All surveys are anonymous and are directly related to activities, assessments, and other course material.

## **Notice of Recording**

Synchronous (live) classes may be delivered in this course through Zoom and/or Teams, video conferencing platforms supported by the University. Steps have been taken by the University to configure these platforms in a secure manner. Classes will be recorded with video and audio (and, in some cases, transcription) and will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen's University, please see the [Notice of Collection, Use and Disclosure of Personal Information](#).

## **Copyright of Course Material**

Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's express consent. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

## **Policies**

### **Class Attendance**

Your presence and participation in class contributes to the knowledge and skills that you will develop throughout this course. I expect that you attend class regularly, participate in class conversations and learning activities. These types of activities provide active engagement, promote a deeper understanding of the course content, and contribute to your success in this course.

### **Academic Support**

All undergraduate students face new learning and writing challenges as they progress through university: essays and reports become more complex; effectively incorporating research into writing becomes more important; the types of assignments become more diverse; managing your time and developing the skills you need to read and think critically gets more challenging. I encourage students to contact Student Academic Success Services (SASS). SASS offers many different ways to receive support:

- Free online or in-person [appointments](#) to get personalized support on writing and academic skills from expert staff and trained peers.
- [Workshops](#) and [drop-in programs](#). SASS' [Events Calendar lists events coming soon](#).
- [Online resources](#) that provide strategies for academic skills and writing development at university.
- If English is not your first language, SASS has specific resources for [English as Additional Language students](#), including weekly programs and EAL academic skills appointments. You can meet on an ongoing basis with an EAL consultant to work on your academic writing, speaking, listening, and reading skills.

### **Accommodations for Disabilities**

Queen's University is committed to working with students with disabilities to remove barriers to their academic goals. Queen's Student Accessibility Services (QSAS), students with disabilities, instructors, and faculty staff work together to provide and implement academic accommodations designed to allow students with disabilities equitable access to all course material (including in-class as well as exams). If you are a student currently experiencing barriers to your academics due to disability related reasons, and you would like to understand whether academic accommodations could support the removal of those barriers, please visit the [QSAS website](#) to learn more about academic accommodations or start the registration process with QSAS by clicking **Access Ventus** button at [Ventus | Accessibility Services | Queen's \(queensu.ca\)](#)

VENTUS is an online portal that connects students, instructors, Queen's Student Accessibility Services, the Exam's Office and other support services in the process to request, assess, and implement academic accommodations.

To learn more go to: <https://www.queensu.ca/ventus-support/students/visual-guide-ventus-students>

### **Academic Consideration for Students in Extenuating Circumstances**

Academic Consideration is a process for the University community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to,

- Short term Physical or Mental Illness or Injury (stomach flu, anxiety/depression, mononucleosis, concussion, broken bones, surgery, medical treatments, etc.)
- Traumatic Event/Confidential (Bereavement, serious injury, illness or required treatment for a significant other/family member or a traumatic event such as divorce, sexual assault, social injustice, etc.)
- Requirements by Law or Public Health Authorities (court dates, jury duty, requirements to isolate, etc.)
- Significant Event (varsity athletic event, distinguished event, serving in the Reserve Forces, etc.)



Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances. For more information, please see the [Senate Policy on Academic Consideration for Students in Extenuating Circumstances](#).

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. For more information, undergraduate students in the Faculty of Arts and Sciences should consult the Faculty's webpage on [Academic Consideration in Extenuating Circumstances](#) and submit a request via the [Academic Consideration Request Portal](#). Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their instructor and/or course coordinator as soon as possible once academic consideration has been granted. Any delay in contact may limit the options available for academic consideration.

For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see the Faculty of Arts and Science's [Academic Consideration website](#). ASO courses include links to information on **Academic Consideration** on your **Course Homepage** in onQ.

Please see the Teaching Team page for contact information for your instructor and TA(s), where relevant.

## **Inclusion**

### **Equity, Diversity, and Inclusion Statement:**

I am committed and continue to promote and develop an inclusive climate that recognizes and respects equal dignity and worth of all persons. This climate is created and maintained by a university-wide commitment to and understanding of educational equity, supported by policies, programs, curricula, practices that promote safe and full participation of all members. Our department has embraced these initiatives and we continue to develop and integrate principles of EDI and ways of knowing throughout our department. I am happy to discuss our ongoing initiatives and I welcome constructive feedback.

As many of you are aware, our previous Chancellor at Queen's was the late Honorable Murray Sinclair, an Anishinaabe and member of the Peguis First Nation, a legal scholar, judge, a Commissioner of the Truth and Reconciliation Commission (TRC), a former Senator, and the General Counsel of an Indigenous law firm. At a recent convocation, he spoke elegantly about the TRC, and the steps to promote reconciliation between Canada and the Indigenous peoples. One of the 94 recommendations of the TRC was the importance of land acknowledgements. As part of this syllabus, I am happy to provide a land acknowledgement as part of this syllabus: *Queen's University is situated on the traditional Anishinaabe and Haudenosaunee territory. I am grateful to be able to live, learn, teach, and play on these lands, forming respectful relationships with ancestors of the original occupants of these lands.*

### **Building a Classroom Community**

University is a place to share, question, and challenge ideas. Each student brings a different set of lived experiences. You can help to create a safer, more respectful classroom community for learners by following these guidelines:

- Make a personal commitment to learn about, understand, and support your peers.
- Assume the best of others and expect the best of them.
- Recognize and value the experiences, abilities, and knowledge each person brings to the course.
- Acknowledge the impact of oppression on other people's lives and make sure your words and tone are respectful and inclusive.
- Encourage others to develop and share their ideas.
- Pay close attention to what your peers say/write before you respond. Think through and re-read what you have written before you post online or send your comments to others.
- Be open to having your ideas challenged and challenge others with the intent of facilitating growth.
- Look for opportunities to agree with one another, building on and intentionally referencing peers' thoughts and ideas; disagree with ideas without making personal attacks, demeaning, or embarrassing others.

### **Fostering Accessibility**

All of us have a shared responsibility for fostering accessibility and promoting meaningful inclusion of those with disabilities. The [Accessibility Hub](#) at Queen's University's Human Rights & Equity Office offer a host of [tutorials](#) that provide us all with practical tips for:

- creating accessible documents, e.g., to submit to your teaching team or share with peers in peer feedback activities/in a presentation,
- emails, e.g., while communicating with group members or your teaching team, and
- meeting practices (e.g., in tutorials/labs/seminars or virtual meetings).

### **Name/Pronoun**

If, for whatever reason, you wish to change how your name appears in onQ and/or on class lists, please follow these steps. You may also use this process to add your pronouns to the appearance of your name.

1. Log into SOLUS.
2. Click on Personal Information tab.
3. Click on the Names tab
4. Click on the Add New Name tab
5. Choose Preferred from the Name Type drop down menu
6. Enter the name you would like to appear in onQ and/or on class lists.
7. Click Save.

Please allow 24 to 48 hours for your name to be registered within the system. If you have further questions or concerns, please contact ITS at Queen's University

## **Queen's Policy Statement on Academic Integrity**

Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge, and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Queen's students, faculty, administrators and staff therefore all have responsibilities for supporting and upholding the fundamental values of academic integrity. Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility and by the quality of courage. These values and qualities are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University.

The following statements from "The Fundamental Values of Academic Integrity" (2nd edition), developed by the International Center for Academic Integrity (ICAI), contextualize these values and qualities:

1. **Honesty** Academic communities of integrity advance the quest for truth and knowledge through intellectual and personal honesty in learning, teaching, research, and service.
2. **Trust** Academic communities of integrity both foster and rely upon climates of mutual trust. Climates of trust encourage and support the free exchange of ideas which in turn allows scholarly inquiry to reach its fullest potential.
3. **Fairness** Academic communities of integrity establish clear and transparent expectations, standards, and practices to support fairness in the interactions of students, faculty, and administrators.
4. **Respect** Academic communities of integrity value the interactive, cooperative, participatory nature of learning. They honor, value, and consider diverse opinions and ideas.
5. **Responsibility** Academic communities of integrity rest upon foundations of personal accountability coupled with the willingness of individuals and groups to lead by example, uphold mutually agreed-upon standards, and take action when they encounter wrongdoing.
6. **Courage** To develop and sustain communities of integrity, it takes more than simply believing in the fundamental values. Translating the values from talking points into action -- standing up for them in the face of pressure and adversity — requires determination, commitment, and courage.

Students are responsible for familiarizing themselves with and adhering to the Senate [regulations](#) concerning academic integrity, along with [Faculty or School](#) specific information. Departures from academic integrity include, but are not limited to, plagiarism, use of unauthorized materials, facilitation, forgery and falsification. Actions which contravene the regulation on academic integrity carry sanctions that can range from a warning, to loss of grades on an assignment, to failure of a course, to requirement to withdraw from the university.

## **Turnitin Statement**

This course makes use of Turnitin, a third-party application that helps maintain standards of excellence in academic integrity. Normally, students will be required to submit their course assignments through onQ to Turnitin. In doing so, students' work will be included as source documents in the Turnitin reference database, where they will be used solely for the purpose of detecting plagiarized text in this course. Data from submissions is also collected and analyzed by Turnitin for detecting Artificial Intelligence [\(AI\)-generated text](#). These results are not reported to your instructor at this time but could be in the future.

Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. The similarity report generated after an assignment file is submitted produces a similarity score for each assignment. A similarity score is the percentage of writing that is similar to content found on the internet or the Turnitin extensive database of content. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process.

Please read Turnitin's [Privacy Policy](#), [Acceptable Use Policy](#) and [End-User License Agreement](#), which govern users' relationship with Turnitin. Also, please note that Turnitin uses cookies and other tracking technologies; however, in its service contract with Queen's Turnitin has agreed that neither Turnitin nor its third-party partners will use data collected through cookies or other tracking technologies for marketing or advertising purposes.

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## **Copyright:**

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