



# **BIOL\*4350 Limnology of Natural and Polluted Waters**

Fall 2019  
Section(s): C01

Department of Integrative Biology  
Credit Weight: 0.50  
Version 2.00 - September 04, 2019

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## **1 Course Details**

### **1.1 Calendar Description**

This course will familiarize students with the characteristics and methods of study of the limnology of natural and polluted aquatic ecosystems. The laboratory includes methods of biological, chemical and physical assessment such as field surveys of algal, macrophyte and benthic invertebrate diversity, toxicity assays, and analyses of stream flow.

**Pre-Requisites:** BIOL\*3450

### **1.2 Timetable**

**LECTURES:** 10:00 - 11:20 Tues, Thur MCKN, Room 115

**LABS:** 2:30- 5:20 Mon OR Tues, SCIE 2305

### **1.3 Final Exam**

Tuesday December 3, 2019 from 11:30AM - 01:30PM; Please see WebAdvisor for the latest information on locations etc.

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## **2 Instructional Support**

### **2.1 Instructional Support Team**

<b>Instructor:</b>	Dr. J.D Ackerman
<b>Email:</b>	ackerman@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x58268
<b>Office:</b>	SC1 2468

<b>Office Hours:</b>	Thursday & Friday 1:00 - 2:00 or by email appointment
<b>Lab Co-ordinator:</b>	Sheri Hincks
<b>Email:</b>	shincks@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x56010
<b>Office:</b>	SSC 3509

## 2.2 Teaching Assistants

<b>Teaching Assistant:</b>	Chris Farrow
<b>Email:</b>	farrow@uoguelph.ca
<b>Teaching Assistant:</b>	Trysta Bastien
<b>Email:</b>	bastient@uoguelph.ca

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## 3 Learning Resources

### 3.1 Required Resources

#### Required Textbook (Textbook)

Moss, B.R. 2018. Ecology of Fresh Waters 5th Ed. Wiley-Blackwell. 480 pp

#### Limnology of Natural and Polluted Waters (Lab Manual)

There are two lab manuals for this course. Limnology of Natural and Polluted Waters is required and must be purchased prior to lab 1. Identification keys for life along the Speed River Watershed is NOT required but is a useful resource that may be purchased (see below under Recommended Resources). Details will be made available on courselink.

- Limnology of Natural and Polluted Waters Dept. Integrative Biology, U. of Guelph

#### Lab Equipment (Equipment)

Students will be responsible for providing their own lab coats, dissection instruments, rulers, pencils, and laboratory notebooks.

Appropriate all-weather clothing for field labs is also advised.

### 3.2 Recommended Resources

#### Identification keys for life along the Speed River Watershed (Lab Manual)

This lab manual is not required but is a great identification key. If you are going to be doing any work in Southern Ontario this is a a very useful key to own.

- Identification keys for life along the Speed River Watershed. Integrative

## 4 Learning Outcomes

By the end of this course, students should be able to:

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Understand discuss the physical and chemical properties of water in freshwater streams and lakes.
  2. Recognize and discuss the environmental impacts upon ecologically diverse systems: headwater streams; floodplain rivers; shallow waters including wetlands; profundal zones; lakes; and dispersion in rivers.
  3. Describe and discuss the environmental impact of nutrient additions; acid rain; hypoxia and invasive species.
  4. Explain the environmental impacts of fisheries.
  5. Apply approaches and tools to analyze/mediate issues related to water pollution in freshwater.
  6. Develop skills in physical and chemical measurement techniques for various freshwater aquatic habitats including lentic, lotic habitats and toxicity testing.
  7. Formulate research questions by practicing the process of biological inquiry using the scientific method including testing predictions of falsifiable hypotheses.
  8. Prepare and communicate scientific ideas, including scientific writing and oral communication.
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## 5 Teaching and Learning Activities

### 5.1 Course Structure

The course is divided into twelve weeks, with two lectures and one lab period per week.

Week	Date (week of)	Lecture Topic*	Text Chapter	Lab Topic
	Sept. 2	L1 – An Introduction to Natural and Polluted Waters	1	NO LAB
1	Sept. 9	L2 – Hydrology and Light  L3 – Physical-Chemical Properties of Water	2, 5  3, 4	Lab 1: Introduction
2	Sept. 16	L4 – Sinks and Sources of Oxygen  L5 – Evolution and Diversity of Freshwater Organisms	3  6	** Lab 2: Lake Assessment – Field trip I
3	Sept. 23	L6 – Environmental Impact Assessment  L7 – Headwater Streams	N/A  7	Lab 3: Lake Assessment - Laboratory Analyses
4	Sept. 30	L8 – Headwater Streams – Environmental Impacts  L9 – Statistical Analysis I – Univariate Statistics	8  N/A	** Lab 4: Stream Assessment - Field trip I Lotic environment study.
5	Oct. 7	L 10 – Floodplain Rivers	9	** Lab 4: Stream Assessment - Field trip I Lotic environment

Week	Date (week of)	Lecture Topic*	Text Chapter	Lab Topic
				study.  <b>Guelph Lake Report due at 11:59 PM Friday, Oct. 11th</b>
6	Oct. 14	<b>Thanksgiving Study Break</b>  L11 – Floodplain Rivers – Environmental Impacts  <b>Midterm Lecture Exam Oct. 17</b>	10	NO LABS THIS WEEK
7	Oct. 21	L12 – Statistical Analysis II – Spatial and Temporal Analysis  L13 – Lakes – Shallow Waters (wetlands)	10  11, 12	Lab 6: Acute Lethal Toxicity Conduct experiments on Daphnia. Experiments run Monday to Friday  <b>Chemical / Physical Data Group Data due at 11:59: Friday October 11</b>
8	Oct. 28	L14 – Lakes – Pelagic Zones  L15 – Lakes – Profundal Zones	13  14	Lab 7: Macroinvertebrate ID - upstream site
9	Nov. 4	L16 – Hypothesis Formulation and Testing  L17 – Environmental Impacts of Fisheries	11  15	Lab 8: Macroinvertebrate ID - downstream site  <b>Toxicity Report due at 11:59 PM: Friday, Nov. 8th</b>

Week	Date (week of)	Lecture Topic*	Text Chapter	Lab Topic
10	Nov. 11	L18 – Environmental Impacts of Nutrients Additions  L19 – Intermittent Stratification in the Western Lake Erie	15  N/A	Lab 9: Water Quality Techniques / Complete Lab Analyses  <b>Biological Metrics Analyses due at 11:59 PM: Friday Nov. 15 th</b>
11	Nov. 18	L20 – Aquatic invasive species  L21 – Conservation & Management of Freshwater Species at Risk	N/A  N/A	** Lab 10: Tour of Guelph Water Pollution Control Plant  <b>Stream Assessment Report due at 11:59 PM: Friday, Nov. 22th (Group); Monday Nov 25 (Individual)</b>
12	Nov. 25	L22 – Nutrient Management  L23 - Replaces Fall Study Break (Tuesday Oct. 9th)	N/A  N/A	NO LAB

\* Subject to change

\*\* We will be in the field the weeks of Sept. 16, Sept. 30, October 8 and November 18. These labs will take place outside of the Science Complex at various aquatic sampling locations and the Guelph Sewage treatment plant. Students must dress appropriately and must review the field safety protocols outlined in the lab manual before engaging in these activities. Always bring lab manual, pencils and a notebook (If you have waders please bring them when we are sampling the streams)!

Other details will be provided on courselink.

## 5.2 Important Dates

<b>Date</b>	<b>Event</b>	<b>Time / Location</b>
Sep 5	First lecture	MCKN 115 (lecture)
Sep 9/10	First labs	SSC 2305 (lab)
Sep 13	Add period ends	Friday
Sep 16/17	Field Trip- Guelph Lake	Meet in lab
Sep 30/ Oct 1	Field Trip - Stream	Meet in lab
Oct 7/8	Field Trip- Stream	Meet in Lab
	<b>Lake Assessment Report Due (GROUP AND INDIVIDUAL)</b>  <b>Chemical / Physical Data Group Data</b>	ONLINE by 11:59 PM
Oct 14	Thanksgiving	NO LABS THIS WEEK
Oct 15	Fall study break	NO CLASSES
Oct 17	<b>Midterm lecture exam</b>	in class
Nov 8	<b>Toxicity Report Due</b>	ONLINE by 11:59 PM
Nov 15	<b>Biological Metrics Analysis due</b>	ONLINE by 11:59 AM
Nov 18/19	Field Trip- Sewage treatment Plant	Meet in lab
Nov 22	<b>Stream Assessment Report Due -</b>	ONLINE by 11:59 PM

	<b>GROUP</b>	
Nov 25	<b>Stream Assessment Report Due - INDIVIDUAL</b>	ONLINE by 11:59 PM
Nov 28	Last lecture (replaces fall study break days)	MCKN 115
Dec 3	<b>Final exam</b>	Dec. 3 (11:30AM - 01:30PM)

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## 6 Assessments

In all cases, students will be expected to write using complete sentences and proper grammar. **All students are expected to complete and submit work individually unless otherwise stated.** Students will be held responsible for all materials given in lectures, laboratory classes, and as specific reading assignments unless otherwise stated. No unofficial deferments of any scheduled evaluation will be given. Students who miss the midterm or other assessment components for documented medical or other legitimate reasons will have their final marks pro-rated on the basis of completed evaluations. No make-up evaluations will be conducted and all other reports and the final exam must be completed in order to pass the course.

Assessment standards for this course follow the definitions given in the 2019-2020 Undergraduate Calendar

### 6.1 Marking Schemes & Distributions

Assessments	Weight	Learning Outcomes Addressed
Lake Assessment Report	10 %	5,6,7,8
Midterm Exam	25 %	1,2,3,4,5



Toxicity Report	<b>10 %</b>	5,6,7,8
Stream Assessment Report	<b>25 %</b>	5,6,7,8
Final Exam	<b>30 %</b>	1,2,3,4,5
<b>Total Marks</b>	<b>100%</b>	

Lab attendance is mandatory.

Assessment standards for this course follow the definitions given in the 2019-2020 Undergraduate Calendar

## LAB NOTEBOOKS

Each of you should maintain your own Lab Notebook. It will serve as a written record of everything you do in the lab and in the field and will include observations, data sheets, drawings, questions, insights, ponderings, and aha moments. It will serve as an invaluable study tool while you are writing your reports and studying for exams. Your lab notebook will NOT be graded.

## LAB REPORTS

The lab reports will consist of a formal write-up of various activities. For all reports, follow the instructions in the laboratory manual. The reports will be graded very strictly for format according to that used by Limnology and Oceanography (L&O). All lab reports will be submitted to the Dropbox on Courselink. See the lab manual and CourseLink for details. More details about these assignments will be provided in lecture and in lab.

## 6.2 Assessment Details

### Guelph Lake Report (10%)

**Due:** Fri, Oct 11 - , 11:59 PM, Dropbox  
**(10 % = 5% group + 5% individual)**

This assignment will be submitted in two parts- a GROUP report as well as an INDIVIDUAL

report. Each TEAM (3 per group) will prepare a scientific report following standards of L&O on the results of field sampling and lab analyses of lake data. Each TEAM will submit an abstract, Methods and Materials and Results. The Introduction and Discussion of the report will be submitted **as an individual contribution**, which is due on the date listed above. More details will be provided in lab.

You **MUST** submit an individual contribution in order to receive a group contribution. If you do NOT submit an individual portion, you will receive a grade of 0 for the assignment.

**Group Data: Chemical/ Physical (1%)**

**Due:** Fri, Oct 11 - , 11:59 PM, Google Doc

Group Data for Chemical / Physical parameters

**Midterm exam (25%)**

**Date:** Wed, Oct 17, 10:00 AM - , 11:20 AM, In Class

This exam will cover lecture content only and will take place during the lecture period. The test will include all the material presented in class up to the preceding lecture period. The exam may consist of multiple choice, short answer type or long answer questions. Synthesis of concepts, rather than straight regurgitation of facts will be emphasized. **No make-up midterm exam will be given.** If a student fails to write the midterm exam, a request for academic consideration with supporting documentation must be submitted to the instructor. If approved, final marks will be pro-rated on the basis of completed evaluations

**Toxicity Report (10%)**

**Due:** Fri, Nov 8 - , 11:59 AM, Dropbox

Acute Lethal Toxicity report following standards of L&O on the results of the toxicity study is required from each TEAM (3 per group) of students. More details will be provided in lab.

**Group Data: Biological Metrics (1%)**

**Due:** Wed, Nov 14 - , 11:59 AM, Google Doc

Group data: Biological Metrics Analyses

**Stream Assessment Report: GROUP (10%)**

**Due:** Wed, Nov 21 - , 11:59 AM, Dropbox

**(10% = 2% group data [see below] + 8% group work)**

A Rapid Bioassessment Protocol evaluation of a stream. Teams are required to submit ongoing data collection to the Dropbox by the dates listed above. A final scientific report following standards of L&O on the results of the RBP bioassessment protocol evaluation is required from each TEAM (3 per group) of students. More details will be provided in lab. The report (minus the Introduction and Discussion components) is due on the date listed above. The Introduction and Discussion of the report will be submitted **as an individual contribution**, which is due on the date listed below.

You **MUST** submit an individual contribution in order to receive a group contribution. If you do NOT submit an individual portion, you will receive a grade of 0 for the assignment.

**Stream Assessment Report - INDIVIDUAL (15%)****Due:** Mon, Nov 25 - , 11:59 AM, Dropbox**(15% Individual= 12.5 Individual, 2.5 participation )**

A Rapid Bioassessment Protocol evaluation of a stream. Teams are required to submit ongoing data collection to the Dropbox by the dates listed above. A final scientific report following standards of L&O on the results of the RBP bioassessment protocol evaluation is required from each TEAM (3 per group) of students. More details will be provided in lab. The report (minus the Introduction and Discussion components) is due on the date listed above. The Introduction and Discussion of the report will be submitted **as an individual contribution**, which is due on the date listed above. The Individual portion of your report will include a participation grade (2.5%) assigned by members of your group.

You **MUST** submit an individual contribution in order to receive a group contribution. If you do NOT submit an individual portion, you will receive a grade of 0 for the assignment.

**Final Exam (30%)****Date:** Tue, Dec 3, 11:30 AM - 1:30 PM, TBD

This exam will be written during the final exam period and will cover all of the content covered in the course. The exam may consist of multiple choice questions, short answer, and longer essay questions. You will be assessed on your ability to evaluate the information and interpret it in light of the studies you have examined in the lecture. If a student misses the final exam, a request for academic consideration including documentation must be submitted to the Program Counsellor within 5 working days of the missed exam.

## 7 Course Statements

### 7.1 Late Policy

Late lab assignments are not accepted without prior arrangement with Dr. Ackerman or Sheri Hincks. Work that is handed in late will be penalized 10% **each day** that it is late.

It is incumbent on the student to inform the instructors of the course within the first two weeks of class if there is a conflict between a student's religious observations (Holy Days) and a scheduled lab component, or lecture / lab evaluations.

### 7.2 Appropriate Use of Conferences

This course has been designed to foster interaction between students, student teams and

with the instructors. The conferences (Discussions in Courselink) provide a means for team members to share ideas, opinions, and resources. The use of these computer conferences is a privilege, not a right, which may be revoked at any time for abusive conduct. Please show respect for the opinions of others at all times, even if you do not agree with their ideas. We encourage you to disagree, critique and add new insights, but this must be done in a positive manner. Discussions in the online conferences must be treated the same as face-to-face discussions. In the conferences others cannot see such things as facial expression and body language, both of which we normally take into account when talking face-to-face with someone. Therefore, be very careful in the phrasing of your contributions and responses, as they may be interpreted differently than what you had intended. Please respect your fellow students. You MUST NOT post racist, sexist, homophobic, or other similar remarks that are likely to cause offence. Please keep in mind that the conferences are public places. Anyone with access to the course website has the capability of seeing conference postings.

### 7.3 Use of Animals

The University is committed to principles of conducting research and teaching in accord with the highest ethical standards. Given that the use of animals, in research and teaching, is a critical aspect of the work of the University of Guelph, the Department of Integrative Biology is committed to minimizing the use, pain, and suffering of animals used for teaching and to ensuring that animals which are used will receive care and treatment that meets or exceeds the standards outlined by provincial guidelines and statutes, and by the Guidelines of the Canadian Council on Animal Care. For more information [http://www.uoguelph.ca/research/assets/acs/docs/university\\_animal\\_care\\_policy\\_and\\_procedures.pdf](http://www.uoguelph.ca/research/assets/acs/docs/university_animal_care_policy_and_procedures.pdf)

## 8 Department of Integrative Biology Statements

### 8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

### 8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides

support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

## 8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.selfregulationskills.ca/>

## 9 University Statements

### 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

### 9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester.

This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

## 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

More information can be found on the SAS website

<https://www.uoguelph.ca/sas>

## 9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

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