

Course Title:	Environmental change in Lake Ecosystems
Instructor(s):	Dr. Shelley E Arnott, arnotts@queensu.ca
Dates:	Sunday Aug 23 to Sat Sept 5, 2020
Location:	Queen's University Biology Station
Cost:	\$1200 (includes \$350 deposit). Balance due Aug. 1. This cost includes room and board, local transportation, and supplies.
Prerequisites:	University course in general biology. Additional course(s) in ecology and biostatistics are an asset.
Enrolment:	Max 12 students
Description:	<p>In this two-week course, students will become proficient at limnological sampling, conducting surveys in a heterogeneous landscape, and experimental design. Students will be based at the Queen's University Biology Station and will collect data on lakes along the Rideau Canal, in Frontenac Provincial Park, and on QUBS property. We will survey and compare lakes with different physical and chemical characteristics and with different levels of human impact, including invasive species. Emphasis will be on examining physical, chemical, and biological factors that determine the abundance and distribution of organisms within and among lakes.</p> <p>Students will learn limnological techniques commonly used to characterize lake ecosystems. In addition, we will use high-resolution data from lake monitoring rafts to model lake physical properties.</p> <p>During the first 5-6 days of the course, students will work in teams to collect data on ~ 20 lakes in the Frontenac Arch landscape. In the second half of the course, students will conduct independent research experiments inspired by their observations and interests that developed while visiting lakes in "The Land Between", a region with rich biodiversity and unparalleled beauty.</p> <p>Students will be required to canoe/boat, hike, and carry limnological equipment to the lakes. A moderate level of physical fitness and a positive attitude are essential. Previous canoeing/boating experience is NOT necessary. Students will receive basic instruction in paddling techniques and boating safety at the beginning of the course.</p>
Evaluation:	<ol style="list-style-type: none"> 1) Seminar: 30-minute seminar, prepared in advance, based on scientific literature 20% 2) Group project to showcase data and analyses on lakes 20% 3) Written report (10-15 pages) based on data obtained individual projects (due~ 4 weeks after end of field course) 40% 4) Participation: 20%

An Average Day – What to Expect

(a) Daily timeline	A typical work day for the first 5-6 days— 7:00 breakfast, 8:00-12:00 gather gear and sample bottles for field work, canoe/hike/drive to field site, sample lake; 12:00-1:00 lunch break in the field or at QUBS, 1:00 travel to and sample second lake, 5:30-6:30 dinner, 7:00-8:00 student seminars, 8:00-10:00 lab work and preparation for next day. The final six days are for independent projects. Daily timeline will depend on projects and individual schedules.
(b) Work habitat & Physical exertion	We will be outdoors every day for the first half of the course, canoeing or rowing to the middle of the lake, hiking to lakes, portaging canoes (0.2 to 1 km). The property is wooded and hilly but there are clear paths. Students will be expected to carry limnological sampling equipment and sample bottles (~10-15kg). Limnological sampling is not physically demanding, but students will be hauling zooplankton nets from lake bottom to surface (10 to 40 m) several times. We will be sitting in boats for ~2 hours while sampling.
(c) Common activities	<ul style="list-style-type: none"> • common activities: walking in woods and fields, paddling or rowing boats, taking limnological samples • associated risks: the main risk at QUBS is Lyme disease that is tick borne. This is entirely preventable, though, and we will train all students in methods for preventing tick bites, inspecting for ticks, and treating bites. For walking in woods and fields, sturdy footwear is essential, and waterproof boots and rain gear may be needed on some days. A second important risk is drowning if boats capsize. Everyone must wear a personal floatation device that will be provided and will receive training in canoe rescue. All field work will be done in pairs or groups.
(d) Weather, dehydration, & biting insects	The weather at QUBS at the end of August tends to be pleasant with daily highs in the mid-20s and nighttime lows in the teens. We occasionally have rain so bring rain gear and waterproof boots. Warm layers are also advisable. At this time of year there are few biting insects, but sometimes deer flies can be bothersome. Students should bring water bottles to ensure adequate hydration while in the field.
(e) Toxic/poisonous, wildlife/ plants	Ticks are now common at QUBS, especially in tall grass/fields. While Lyme disease is serious, it is preventable and we will teach you how to prevent tick bites, and how to deal with them effectively if you are bitten.
(f) Sleeping, washroom & laundry facilities	<ul style="list-style-type: none"> • sleeping accommodations: shared dorm-like rooms or small cabins; you will need to bring your own sleeping bag and pillow, towel and toiletries • washroom facilities: flush toilets in the larger cabins, otherwise nearby in the lodge • washing/laundry facilities: available for a fee; it is advisable to bring enough clothing for two weeks
(g) Meal plans & food allergies	All meals are prepared and eaten in a large central modern operations building at QUBS. Food is served cafeteria-style. Allergies and most dietary restrictions can be readily accommodated.
(h) Non-academic responsibilities	You are required only to keep the lab and your own living area reasonably clean and free from leftover food, and to bus your own tables after meals. You will also be responsible for the care and maintenance of limnological equipment.
(i) Degree of isolation	<p>At QUBS the main operations centre is wired, so you should have no trouble (at least in that building)</p> <ul style="list-style-type: none"> • recharging cameras, laptops, devices (also in all of the accommodations) • accessing wi-fi <p>Cell service is patchy and not reliable at all locations.</p> <p>Food is cooked in a central facility on a predetermined schedule so it is not possible to make last-minute requests to satisfy dietary requirements and there is no food (except fruit) available between meals</p> <p>QUBS is well equipped with first aid supplies</p> <ul style="list-style-type: none"> • you should bring your own medications, and even first aid supplies if you have favourites • is not close to a doctor or hospital. This is a relatively remote location so it takes 30 min or more to get professional medical attention

(j) Alcohol & drugs	Alcohol is not permitted in work buildings, but small quantities (associated with responsible behaviour) is permitted in the residences; smoking and vaping are not permitted in buildings at QUBS.
(k) Vaccinations/ Insurances	No special vaccinations are needed. Insurance is not needed for Ontario residents. Students should bring their health cards in the unlikely event that medical care is needed.
(l) Social Situations	<p>There will likely be other researchers or visitors at QUBS while you are there for the course. The main times you will be interacting with people outside the course will be at meal times. You will be working and living with the same group of about 14 people for the entire two-week period. We try our best to make this a fun and rewarding educational experience, and that works best if everyone is fully engaged in the course. This is a unique opportunity to completely immerse yourself in field research.</p> <p>Everyone must follow Queen's Code of Conduct, which is based on the simple premise of mutual respect. There is a zero-tolerance policy for harassment or violence towards any student or staff at QUBS. Any violations of this policy should be immediately reported to the course instructor or QUBS staff.</p>
(m) Final comments	<p>This is a fun but intensive course where we try to visit different lake types and participate in independent studies, immersing ourselves in both field work and data analysis for the full 12 days. We generally have planned activities for entire days so you will not have a lot of free time for other activities. People who fully engage, find the course rewarding and interesting. Most of your learning will be through hands-on experiences and practical applications of concepts and ideas.</p> <p>Please also see the QUBS website https://qubs.ca for more detailed information about many of the above topics and especially https://qubs.ca/sites/default/files/2016-05/QUBS_Guidelines_for_fieldcourse_users_2014.pdf</p>