



BIOL*4610 Arctic Ecology

Fall 2018
Section(s): C01

Department of Integrative Biology
Credit Weight: 0.75
Version 1.00 - August 30, 2018

1 Course Details

1.1 Calendar Description

This three-week field course provides an opportunity to study the flora and fauna of marine, freshwater and terrestrial environments of the high Arctic. Based in the high Arctic, the course includes lectures, field exercises and student projects. An information session is held in January; students are required to register before March. Signature of course coordinator is required for course selection. Students are responsible for cost of food and transportation. This course must be recorded as part of your Fall course selection and tuition and compulsory fees will be calculated accordingly. Students taking this course DO NOT use course numbers reserved for Ontario Universities Program in Field Biology. Detailed information is available from the Department of Integrative Biology.

Pre-Requisite(s): BIOL*2060
Restriction(s): Instructor consent required.

1.2 Course Description

Churchill is a diverse region for ecological study, being located at the junction of the boreal, Arctic, and Hudson Bay biomes. The first week of the course includes exploration of terrestrial, freshwater, and near-shore marine Arctic environments as well as an overview of methods used to survey invertebrate and plant biodiversity in these environments. Group projects are performed. Evening discussions, tutorials, and student-led presentations provide background on Arctic ecology and the use of statistical techniques for studying biodiversity and ecology. Weather permitting, excursions will include viewing estuary organisms including belugas. During the second week, students conduct independent research projects. A major research paper is due in September. This course provides excellent opportunities to visit a spectacular sub-Arctic locality, to learn about Arctic ecology and Arctic biodiversity, and to conduct an independent research project in ecology with instructor guidance.

1.3 Timetable

Dates: Sunday July 8th – Sunday August 22nd, 2018

Location: Churchill Northern Studies Centre (<https://churchillscience.ca/>), Churchill, Manitoba

Cost: \$1500 (includes meals and accommodation, transport around Churchill region, research materials; does not include transportation to and from Churchill)

Enrollment: 20 students (5 for OUPFB; 15 for University of Guelph)

1.4 Final Exam

There is no final exam. The final research paper and field notebook is due Fri. Sept. 28th, 2018. 4:00 PM.

2 Instructional Support

2.1 Instructor(s)

Sarah Adamowicz

Email:	sadamowi@uoguelph.ca
Telephone:	+1-519-824-4120 x53055
Office:	CBG 113
Office Hours:	September 2018. Fridays 1-2 PM.

3 Learning Resources

3.1 MODES OF TRAVEL

The rail line remained closed in 2018, and there is no road to Churchill. Therefore, modes of travel include:

1. Flying Ontario-Winnipeg return (e.g. on Air Canada, WestJet, or Flair), and flying Winnipeg-Churchill return (on Calm Air or First Air). Please arrange for a lay-over of at least a few hours in Winnipeg as you must change airlines. Flights out of Churchill are frequently delayed due to fog or wind. I suggest not to get a fully non-changeable ticket.
2. Traveling to Thompson, Manitoba by train, bus, or carpool and then flying Thompson-Churchill (Calm Air or First Air).

3.1 THINGS TO BRING

CLOTHING

1. Fall coat
2. Sun/camping hat and winter hat
3. Raincoat and rain pants

4. Heavy sweater or polar fleece sweatshirt
5. Long-sleeved shirts
6. T-shirts
7. Pants (at least one pair of quick-dry field pants recommended)
8. Underwear
9. Mitts/gloves (waterproof)
10. Hiking boots (optional, as many people wear rubber boots the whole time outside)
11. Rubber boots (calf) – essential!
12. Running shoes (it is recommended to keep these dry for wear around the CNSC)
13. Socks (bring lots; thick/thin; bring long ones that your pants will tuck into for wearing rubber boots)
14. Bug jacket – essential! We really mean it!

Tips – Get comfortable rubber boots that fit you well. We will be spending a lot of time in rubber boots. Also, we recommended avoiding the mesh-only insect jackets. Those leave too many vulnerable spots for this environment. We'd recommend the type of bug jacket that is mainly closed material, with mesh only in the face area and under the arms. A camping hat is helpful for keeping the bug netting of the jacket off your face. (Hopefully we will also have some very windy

days to enjoy the lovely Hudson Bay views without a bug jacket, but you want to be prepared.)

LINENS

1. Face cloth
2. Towel, if desired (small ones are provided)

Sheets and blankets are provided.

OTHER

1. Day pack
2. Sunglasses
3. Water bottle
4. Insect repellent
5. Spare glasses, if needed
6. Field notebook (hard cover strongly recommended)
7. Pencils (or write-in-the rain pen) and pencil sharpener

8. Binoculars*
9. GPS (or GPS app on a smartphone)*
10. Laptop**
11. Digital camera or smart phone with camera**

* Highly recommended to have your own.

** It would be best to have your own camera device, but you could share with another person if you don't have your own. It is also preferable to have your own laptop. If you don't have a laptop, please contact the course instructor in advance. It may be possible to borrow one.

PERSONAL

1. Hair brush
2. Shampoo, conditioner
3. Shaving kit
4. Soap
5. Toothbrush, paste, floss

6. Sunscreen, moisturizer, lip balm
7. After-bite or other insect bite treatment
8. Antihistamines, aspirin or Tylenol
9. Band-aids and polysporin (or other antibiotic cream) in case of minor scratches
10. Ample supply of any other medications you require

You will have access to a washing machine/ dryer at the CNSC (\$6/load in loonies)

3.1 THINGS NOT TO BRING

1. You will not need a sleeping bag as sheets, pillowcases, blankets, etc. are provided by the CNSC.
1. You can't use a tent because of bears.
1. Pack everything you need, but try to stick to one large pack plus your day pack, as the rooms are shared and cozy. Also, be sure to check on luggage restrictions on flights, as Calm Air limits are lower than for some other airlines.

3.1 BACKGROUND READING

It is critical that you do some background reading to broaden your understanding of Arctic environments before the course. The following book provides an excellent low-cost introduction to the Arctic. It can be ordered from any bookseller (e.g. www.amazon.ca) for about \$27.00 (or less used).

E.C. Pielou. 1994. A Naturalists Guide to the Arctic. University of Chicago Press, Chicago.

I would also highly recommend the following book, which contains a wealth of information about the Churchill region specifically.

As of December, 2016, this excellent work was available for a very affordable price (\$23) through:

<http://www.mcnallyrobinson.com/9780986937101/lorraine-brandson/churchill-hudson-bay>

L.E. Brandson. 2011. Churchill Hudson Bay: A Guide to Natural and Cultural Heritage. Churchill Eskimo Museum, Churchill, Manitoba.

You may also wish to purchase regional-specific guidebooks for taxonomic groups that are especially of interest to you. Several resources (such as plant identification books) will be available to be shared during the course. When in Churchill, you may also wish to purchase your own copy of guidebooks. For example, we will be extensively using the “Wildflowers of Churchill” book by Karen Johnson, and that can be purchased in Churchill (approximately \$20 last year).

Other Information

1. There is a large amount of information on Arctic life and environments at the following website:

www.polarlife.ca

2. You can learn more about DNA barcoding at the following websites. We will draw upon prior DNA barcoding and biodiversity research conducted at Churchill during our course.

www.barcodinglife.org; <http://www.ccdb.ca/>; <https://biodiversity.uoguelph.ca/>

3. Student research. You can read about a previous group project conducted by the instructors and students of the Arctic Ecology 2012 course that has been published.

Smith MA, Boyd A, Bringloe T, Britton-Foster C, Cahill H, Desnoyers K, Duitshaever N, Gibson D, James S, Jeong Y, Kelly D, Levene E, Lyttle H, Masse T, Pare K, Paris K, Russell C, Scott E, Silva D, Sparkes M, Valkova K, Adamowicz SJ. 2016. The northward distribution of ants forty years later: re-visiting Gregg's 1972 collections in Churchill, Manitoba, Canada. *The Canadian Entomologist*. 148: 307-315. (doi:10.4039/tce.2015.53)

<http://esc-sec.ca/2015/09/29/from-inquiring-students-to-published-authors-an-adventure-in-the-arctic/>

3.1 Campus Resources

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: <http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

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

- make an appointment with a program counsellor in your degree program.
<http://www.bsc.uoguelph.ca/index.shtml> or
<https://www.uoguelph.ca/uaic/programcounsellors>

If you are struggling to succeed academically:

- 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/>

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.uoguelph.ca/~ksomers/>

If you have a documented disability or think you may have a disability:

- The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability. For more information, including how to register with the centre please see: <https://www.uoguelph.ca/csd/>
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4 Learning Outcomes

The overall learning outcomes for the Ontario Universities Program in Field Biology (<http://www.oupfb.ca/>) apply to this course as well, with a focus on a northern Canadian ecosystem.

4.1 Course Learning Outcomes

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

1. appreciate a novel natural ecosystem and express key factors that regulate the distribution, abundance, and diversity of local organisms.
2. develop a research program using your current understanding of ecological processes (from your prior course work such as BIOL*2060, BIOL*3110, or Biol*3060) in order to answer a question about ecological processes in a natural system local to the field site.
3. conduct process-oriented research (why is it there? mechanistic/ process/causal understanding) as distinct from descriptive research (who/what is there?) by applying the scientific method, which develops hypotheses and testable predictions, and gain facility with making observations through sampling techniques. *(In this course, we will also explore the interplay between discovery and hypothesis-driven research. Descriptive or exploratory projects that include a quantitative, statistical component will also be welcome. Please discuss this with the instructor while you are designing your independent research project. An expectation would be to use a portion of your Discussion section to discuss new hypotheses that could be tested, arising from your findings.)*
4. evaluate the quality of evidence for statistically-based conclusions using your understanding of applied statistics (from your prior course work, such as STAT*2040 or STAT*2230, as well as this course), and independently apply standard statistical methods to effectively summarize, compare, and communicate patterns in collected data that are used to test predictions and infer ecological process.
5. exhibit critical thinking and make judgments and conclusions based on logic and evidence rather than opinion during all stages of your research, including: identifying research goals; expressing your thinking and judgement in oral and written form; evaluating information in the face of uncertainty; identifying and using relevant scientific literature to motivate and contextualize your research.
6. collaborate effectively in your research group and with course instructors to solve problems related to performing your research, constructively critique the work of others, and manage timely completion of group projects.
7. communicate effectively in oral and written formats, as evidenced through writing up field notes, delivering oral presentations of research proposals, and writing about your original research contribution.

5 Teaching and Learning Activities

Arctic Ecology aims to provide students with an introduction to Arctic ecosystems through both group studies and individual projects carried out in the vicinity of Churchill, Manitoba. The first

week of the course will focus on an exploration of biological diversity and ecological processes in terrestrial, freshwater, and near-shore marine environments of this area. These studies set the stage for individual research projects, which ordinarily involve an experimental or analytical study of some organism, biological community, or problem identified earlier in the course.

5.1 Description

Churchill is a diverse region for ecological study, being located at the junction of the boreal, Arctic, and Hudson Bay biomes. The first week of the course includes exploration of terrestrial, freshwater, and near-shore marine Arctic environments as well as an overview of methods used to survey invertebrate and plant biodiversity in these environments. Group projects are performed. Evening discussions, tutorials, and student-led presentations provide background on Arctic ecology and the use of statistical techniques for studying biodiversity and ecology. Weather permitting, excursions will include viewing estuary organisms including belugas. During the second week, students conduct independent research projects. A major research paper is due in September. This course provides excellent opportunities to visit a spectacular sub-Arctic locality, to learn about Arctic ecology and Arctic biodiversity, and to conduct an independent research project in ecology with instructor guidance.

5.2 Schedule of Activities

Our schedule of activities will be dependent on the elements (rain, fog, snow, wind)! We will meet each day after breakfast to discuss the day's activities and objectives, before heading into the field. Whenever possible, field activities will occur between 9:00 a.m. and 5:00 p.m., with a break for lunch and returning to the centre in time for supper. When there is heavy fog and poor visibility, we will not be in the field due to concerns over polar bear safety. Churchill is known as the "Polar Bear Capital of the World". If we are fogged out for certain time periods, we will use those times for discussions, software tutorials, individual project planning, and data entry or specimen identification and sorting. We may also visit the very interesting Itsanitaq Museum in the town centre of Churchill, which features Inuit Art as well as exhibits on the cultural and natural history of Churchill. Evenings during the initial phase of the course will be devoted to presentations and structured discussions. Evening activities typically run between approximately 7-9:00 PM.

There will be flexibility in schedules once the transition to individual project mode has occurred. Days and evenings during the second week are generally spent working on individual projects. For safety reasons, field work will take place in groups. Therefore, there will be some logistical constraints upon the design of individual projects. In prior years, we had freshwater and terrestrial research teams visiting a shared set of sites. This approach led to interesting synergies. We may have 1-2 social evenings out in the town of Churchill.

5.3 Discussion Topics

The following themes will be considered in our discussions and tutorials. Although the instructors will take the lead on some evenings, active student participation is expected, in the form of questions and discussion. As well, there will be two student-led evenings of presentations and discussions the first week (see further below).

Topics for discussion and tutorials the first week:

- Introduction to Churchill and CNSC facilities, brief review of course goals, code of conduct
- Introduction to Churchill environments
- Measuring and comparing diversity, research design
- Statistical analysis in R
- Specimen collection and identification techniques

5.4 ITINERARY

July 8 Arrive in Churchill. Orientation to CNSC and course objectives. Code of conduct.

July 9-14 Survey of biological diversity and ecological processes in terrestrial, freshwater, and near-shore marine habitats near Churchill. There will also be small group research projects. Weather permitting, this week will include:

- Half-day tours of all major biological zones of the Churchill region (tundra, boreal forest, fen, bog, freshwaters, marine).
- Half-day tour of the estuary for beluga viewing.

July 15-20 Individual research projects

July 21 Wrapping up

July 22 Depart Churchill

Notes

You can stay at the station for an extra day or two before or after the course if you can't get flights on the exact needed dates. However, note that the course fee only includes exactly 14

nights at the station. Additional nights are \$60/day and require a reservation. Inform the course instructor of your travel plans.

5.5 THINGS TO DO (Soon!)

1. Fill out your application form for the course. Please return application form, deposit, and course waiver form to Connie Davison, Room 2484, Science Complex, no later than the last Friday in January. You will be informed about acceptance by the end of the semester. A waiting list position may be created if demand exceeds positions.

1. Upon acceptance, make your travel plans and commence background reading. Be sure to remember to prepare your first presentation in advance of arriving in Churchill.

1. Once you make your travel plans, notify course instructor by email (sadamowi@uoguelph.ca) of your expected mode of travel, anticipated time of arrival, and flight numbers (if applicable).

6 Assessments

6.1 Evaluation

This course has an explicit focus on applying tools and concepts, analyzing and interpreting data, and creating knowledge – not only memorizing facts.

6.2 Course Evaluation

Assignment	Value	Learning Outcome Assessed	Due Date
Presentation #1	5%	1, 7	week 1 in course
Presentation #2	5%	2, 3, 7	week 2 in course
Group Project	10%	4, 5, 6	in course
Quality of Participation	10%	6	in course
Field Notebook	20%	1, 7	Fri. Sept. 28 4 PM

6.3 PRESENTATION #1 (5%)

Presentation #1. 4-5-min presentation, prepared in advance and delivered during week 1. Example topics are given below. This assignment encourages reading and preparation before arriving in the field as well as collaborative learning for the whole group. It is encouraged to use Powerpoint slides. You would prepare ~5 slides total, including the title slide, for presentation that is to be a maximum of 5 minutes. Please do stick closely to the time limit. Please practise and time your presentation at least twice in advance. You are welcome to practice with peers and provide one another with feedback. You should arrive in Churchill with your slides already prepared. Note that internet access is extremely limited at the CNSC, and so researching literature will not be possible most of the time while we are in Churchill.

Potential topics for presentation #1

You will find below a selection of topics from which to choose. However, the topics listed below are not to be considered an exhaustive; other topics will be considered, but please touch base with me in advance. Contact the instructor with your first and second preferred topics at least 2 weeks prior to departure for the course. There will be a limit of 1 student per topic. Some topics are amendable to splitting (e.g. multiple presentations could focus on different endangered species), and so I will make suggestions on splitting if there are topics with more than one very strongly interested student. If you wish to propose a different topic, please feel free to contact me.

- Geological History and Rock Formations of the Churchill Region
- Glacial History of the Churchill Region and Impacts on Biological Community
- Growth Forms of Arctic Lichens and their Role in Arctic Ecosystems
- Tree/Shrub Species of the Churchill Region and their Adaptations to Sub-Arctic Life
- What is "The Tree Line" and How is it Changing?
- Genetic and Species Diversity of Willows in the Arctic
- Diversity of Flowering Plants in the Churchill Region
- Insect-Plant Interactions in the North
- Northern Arthropod Temperature Adaptations
- Bird Diversity of Churchill
- Bird Migration and Impacts of Migratory Birds on Arctic Ecology

- Ecology of Polar Bears and Impacts of Climate Change
- Endangered Species in the North (other than polar bear)
- Patterns of Recent Sea Ice Change and Impacts upon Other Marine Wildlife
- Invasive Species in the North
- Climate Change and Canada's North: Terrestrial or Freshwater Systems
- Life Cycle and Social Structure of Beluga Whales and Their Usage of the Churchill River
- Feeding Ecology of Beluga Whales
- Marine Life of Hudson Bay (other than belugas)
- Biodiversity of the Hudson Bay Lowlands Biome
- Hydrology of the Hudson Bay Watershed and the Churchill River
- History of Human Habitation of the Churchill Region and Uses of Wildlife
- Early Biological Exploration of Canada's North
- Actual and Potential Impacts of Shipping Industry on Churchill and other Arctic Ecosystems
- History of Rail Line in Churchill and Impact of Rail Line Closure on Northern Communities

Please find below an example outline for a 5-minute presentation, by slide. The general rule of thumb for staying on time is one slide per minute, typically excluding the title slide. You might have slightly more slides than that if you have a few slides that are photos only. You should practice with a timer!

i. Title slide. Include your presentation title, your name, date. It is suggested to include a compelling photo.

ii. Introductory slide. What is the main topic/problem/question you are investigating? And, why is it important? Why should the audience care? (For a short presentation such as this, you would need to narrow in on a particular aspect of the above general topics. For example, for a talk on belugas, you might choose to focus on the social structure of belugas. For a talk about polar bears, you might focus specifically on the impact of declining sea ice cover, for example.)

iii-iv. The next two slides would include the main evidence you are presenting. Even though this presentation is short, you should consult at least 2 articles from the primary literature. You are also welcome also to consult major governmental websites (e.g. Government of Canada websites for information on: demographics, economic metrics, sea ice coverage metrics, long-term temperature data, etc.). If you cite any sources from the regular news media, be sure to indicate so clearly. Such sources can be used to discuss contemporary ethical, social, and economic considerations associated with development in the North. Consult the original scientific article, if one is cited. However, this does not replace the need to consult at least 2 articles from the primary literature. Opinion vs. fact must be clearly distinguished. Include your information sources (e.g. as a footnote on the slide).

v. Next steps. What remains unknown relating to your topic? What are the most important next research steps to address this question?

vi. Conclusion. Briefly reiterate your main point. What is the take-home message of your talk?

The following webpage of the Department of Integrative Biology includes helpful links that can assist you in creating an effective presentation. There is also information there about scientific writing that will assist you in being successful with other course assignments.

<https://www.uoguelph.ca/ib/academic-resources-UG>

6.4 PRESENTATION #2 (5%)

Presentation #2. 3-4-min presentation during week 2 about your individual research project proposal. You would prepare this presentation after the course has started and while you are in the early stages of your individual research project. I recognize that internet access is an issue in Churchill, and so reference to the literature is not required at this stage. However, you are welcome to make reference to the literature if you have done prior relevant readings. You are

also welcome to reference concepts and findings from the literature that were previously presented in the course. This presentation should be 5 slides long:

i) Title slide. Throughout your presentation, you are encouraged to include photos, particularly your own field photos.

ii) Research question. When you are on this slide, it is also helpful to indicate what background knowledge or observation led you to become interested in this question. Why is this an interesting question?

iii) Hypothesis and predictions. Your hypothesis is a statement about a proposed biological mechanism that you plan to test. Your prediction(s) is a statement of what you will observe if your hypothesis is true.

iv) Your study design. I suggest to consider using shapes in Powerpoint to depict your study design. Be sure to indicate at what scale your study is replicated and how many replicates you plan to collect.

v) Potential results. You may consider using Powerpoint shapes to prepare a cartoon graph (e.g. bar chart, scatterplot with hypothetical regression line, etc.). Also indicate what statistical test you plan to perform to test your hypothesis. End your presentation with a sentence or two restating your overall goal and indicating why this study is interesting/relevant/important.

6.5 GROUP PROJECT (10%)

Two group projects will be completed during week 1 of the course for the purpose of demonstrating and practising principles of field research: asking a question, designing a study, collecting data, analyzing and visualizing the data, and interpreting the results. For the second group project, each group will perform an analysis and write up a short (2-4 pages) outline of a paper.

6.6 PARTICIPATION (10%)

Participation and intellectual engagement during the course (10%)

- Active involvement! Examples include: being on time for morning meetings, participating in

discussions, arriving prepared, being an active audience member for your colleagues' talks (listening, asking questions afterwards, offering insights and comparisons), actively participating during field collecting, persevering through logistical challenges, interacting respectfully and collaboratively with others, seeking advice and working with your peers and instructors to solve problems, and taking care with collecting high-quality data throughout the course.

6.7 FIELD NOTEBOOK (20%)

Field Notebook and Natural History Journal (20%)

- Your field journal is a time machine. It is meant to take you back to a specific SPACE and a specific TIME and enable you to recreate the specific conditions and observations that you made on that day in that space. You will keep a field journal describing your activities and observations each day. You will record specific field information at every site, including the date, location names, GPS co-ordinates, weather, site attributes, and species observed. You will also record your own activities and observations. Employ a colloquial style and include sketches, diagrams, and maps when relevant. In your notebook overall, you should include a minimum of three detailed drawings of plant specimens (including labeling of parts) and a minimum of three detailed drawings of animal specimens (including labeling of parts). This encourages really looking at the organisms inhabiting this environment and also careful observation of the features you are using for identification. Also, include your observations about species interactions (e.g. which insects are visiting which flowers?), other animal behaviours, and the growth habits of plants in different environments. Throughout the course, I also suggest to jot down questions that you have ("I wonder why...?"), as this will help you to become inspired for your individual project and later reading. You can also write in your notebook in the lab, such as your observations about plant and invertebrate specimens brought back from the field for more detailed examination. You will use this notebook throughout the course, including during your own individual research project during week 2. Try to write legibly (for your future self as much as for the instructor!).
- Your field journal must be submitted on or before **4:00 pm Friday, September 28, 2018**. This is your **original, hard copy, hand-written field journal** into which you made observations throughout the course. Using a different colour ink (you may wish to leave a space after each day's journal entry in the field), you may add annotations if you wish after the end of the field course period, such as adding further interpretations regarding your observations after consulting references. You are also welcome to add retroactive observations, but any such notes that are added later rather than on the day of the field work should be dated. (An example might be to go back and note that a particular day was anomalously cold in relationship to subsequent days or to add a Linnaean name for a taxon you observed.) Your field journal will be returned to you after grading. For any students based far from Guelph, you may submit a PDF containing a scan of your journal.

6.8 INDIVIDUAL RESEARCH PROJECT (50%)

Your individual project should be written up as a scientific paper (i.e. include abstract,

introduction, materials and methods, results, discussion, and references). Your paper should include figures, and likely also tables, depending upon the nature of your study. Your reference section should follow the format employed by the scientific journal *Molecular Ecology*.

Four criteria will impact the evaluation of your report:

1. Identifying an interesting question where there is an opportunity to contribute new knowledge.
2. Quality of study design, data collection, analysis, and interpretation.
3. Clarity of presentation, adherence to grammatical rules, and logical flow of ideas.
4. Placement of results in a broader scientific context.

Your individual major research report must be submitted on or before **4:00 pm Friday, September 28, 2018**. This must be typed. Use 12-point font and double spacing. You may use colour figures. For students based in Guelph, this should be submitted in hard copy to CBG 113. Also submit an electronic copy in either Word (preferred) or PDF format by email to: sadamowi@uoguelph.ca. (For students not based in Guelph, the electronic version alone is sufficient.)

TIPS: You should not still be writing new content on September 26th! We'd recommend commencing work on your paper immediately after your return from the field. Proofreading and revising your work is essential to submitting a high-quality paper. In addition to being scientifically well done, you should aim for your submission to be clearly written, grammatically correct, and free from punctuation and spelling errors. Such problems distract from conveying your meaning. Your reference list should be complete. All references cited in the text should be listed in the reference list; conversely, the reference list should include all articles cited and only articles cited. The reference list should be formatted correctly and ordered correctly. See author instructions for the reference list for *Molecular Ecology*. Tables and figures should be numbered in the order in which they are first cited in the text. For example, Table 1 would be the first table that is cited in the text, Table 2 would be the second table mentioned in the text, etc. You can cite your tables and figures multiple times, in any order following the first mention. Check that you reference the correct table and figure numbers in the prose. Each table and figure should have a clear description that is understandable separate from the main prose. This can be placed on the same page as the table or figure (above the table for tables and below the figure for figures). Place all tables and figures at the end of your document. Also, include your commented R code as an Appendix (right after your main paper, as part of the same file). If you have large tables of raw data, you should include these as supplementary materials. It is fine for such tables to be in electronic format only (such as a CSV or Excel file).

7 Course Statements

7.1 Field Station

We will be based at the beautiful Churchill Northern Studies Centre (CNSC – see <http://www.churchillscience.ca/>) for the duration of the course. These facilities are located about 15 km out of the town of Churchill at the former Rocket Launch Facility of the National Research Council. Staff members at the Centre will prepare our meals, provide an orientation session, aid in resolving issues, and will provide additional instruction and interaction during our stay. Meals are eaten together in a common dining hall. Vegetarian and other diets can be accommodated; be sure to indicate any dietary restrictions on your application form. All who stay at the centre help out with some duties (e.g. dish duty) on a rotating basis. Accommodation is in shared rooms with bunk beds (4/room). There are showers and washer/dryer for clothes (\$6/load, bring loonies). The course fee includes 14 days/nights of accommodation, 3 meals a day, snacks, and access to designated CNSC classroom and laboratory facilities. If your travel schedule requires you to arrive early or stay beyond the last day of the course, additional days at the CNSC can be booked at a cost of \$60/night. Please contact the instructor with information on your specific travel schedule, once you have your tickets booked.

7.2 Instructors

In 2018, the course will be instructed by Dr. Sarah Adamowicz, Associate Professor in the Department of Integrative Biology at the University of Guelph, together with Mr. Peter Smith, Lab Supervisor and Course Instructor, and with the assistance of Mr. Kamil Chatila-Amos, who will serve as the course TA. I have previously taught the course several times, and some of my group's research focuses on the biota of Churchill. We have investigated questions in biogeography, biodiversity, evolution, and the community ecology of invertebrates using the Churchill system. The course will also benefit from the long history of research in the Churchill region, as there are data sets and literature upon which we can build for the group and individual projects. You will likely also profit from encounters with other scientists and graduate students working at the CNSC as well as the experienced scientific staff of the CNSC.

7.3 CODE OF CONDUCT

All participants are required to adhere to field and laboratory safety protocols. Training will be provided at the beginning of the course. Key components of the field safety training include staying in the group (don't wander away from the group!) and alerting others and retreating to the vehicle when a polar bear is spotted. No food or drink is permitted in laboratory spaces. Students are encouraged to ask questions and raise any safety concerns they may have.

Participants in this course agree to treat all others with respect, including other course participants, other guests of the CNSC, CNSC staff, Churchill town citizens, etc. Harassment will not be permitted. The course welcomes all individuals with a suitable academic background.

Some elements of the course involve providing feedback to one another and peer review. The purpose of this is to help one another to improve understanding of concepts and to improve the research products produced (e.g. oral presentations, formulation of hypotheses, research design, etc.). Also, providing feedback to others facilitates concentration and one's own learning. Critiques should be delivered respectfully. Focus your comments on the arguments and the materials presented, not the person. As well, unexpected challenges commonly arise during field work. It is important to work through such challenges in a mutually respectful fashion, even if expressing frustration at a situation.

The CNSC hosts many different groups for educational and research purposes, ranging from school groups to senior citizen science groups. Please be considerate of others and do not make excessive noise at any time, and be especially quiet at night. Socializing in the CNSC is encouraged, and there are designated spaces for this. Please note that the walls are thin in the dormitory area, and so please do your socializing in the designated areas and not in the sleeping quarters. It is strongly advised to avoid drinking games and excessive alcohol consumption. This can be dangerous. Also, while the field course is great fun, it is best to remember that this is an academic/professional setting. Also, it is forbidden to provide alcoholic beverages to underage people. The legal age for alcohol consumption in Manitoba is 18. Nevertheless, do not provide alcohol to any high school students regardless of their age.

Before posting photos or videos to social media, ask permission from any other individuals that appear in your images. Please do feel free to share your own stories about your field experiences as well as photos of the landscapes, organisms you are studying, and photos of yourself in the field.

7.4 Grading

As a fourth-year course, expectations are high for performance in Arctic Ecology. There is no bell curve used, and all students have the opportunity to perform well. Grades follow the standard definitions at the University of Guelph:

- **80 - 100 (A) Excellent.** An outstanding performance in which the student demonstrates a superior grasp of the subject matter, and an ability to go beyond the given material in a critical and constructive manner. The student demonstrates a high degree of creative and/or logical thinking, a superior ability to organize, to analyze, and to integrate ideas, and a thorough familiarity with the appropriate literature and techniques.
- **70 - 79 (B) Good.** A more than adequate performance in which the student demonstrates a thorough grasp of the subject matter, and an ability to organize and examine the material in a critical and constructive manner. The student demonstrates a good understanding of the relevant issues and a familiarity with the appropriate literature and techniques.
- **60 - 69 (C) Acceptable.** An adequate performance in which the student demonstrates a generally adequate grasp of the subject matter and a moderate ability to examine the material in a critical and constructive manner. The student displays an adequate understanding of the relevant issues, and a general familiarity with the appropriate literature and techniques.
- **50 - 59 (D) Minimally Acceptable.** A barely adequate performance in which the student demonstrates a familiarity with the subject matter, but whose attempts to examine the material in a critical and constructive manner are only partially successful. The student displays some understanding of the relevant issues, and some familiarity with the appropriate literature and techniques.
- **0 - 49 (F) Fail.** An inadequate performance.

For further information on grading, please see:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/2015-2016/c08/c08-grds-proc.shtml>

Late assignments are issued a penalty of 10% per each additional 24 hr period starting after the due date/time, including weekends.

7.5 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

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.
- 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: [Chemistry & Physics Help](#) and [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.
 - [Student Health Services](#) is located on campus and is available to provide medical attention.
 - 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](#).
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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 regulations and procedures for [Academic Consideration](#) are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

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: www.uoguelph.ca/sas

9.6 Academic Misconduct

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 discourages misconduct. 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.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate 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 which apply to undergraduate, graduate and diploma programs.
