These guidelines outline the fundamental components of a strong scientific research project. The goal of the research is to advance scientific knowledge using standard procedures for gaining and communicating knowledge. It is this framework that reviewers (supervisors, committee members, journal editors, and readers) will use to evaluate your work and to learn from it.

Over the term, we will practice articulating, developing and integrating each of these components. You will have assignments throughout the term that focus on one or several components of these, and the final assessment of your scientific report will focus both on the strength of each part as well as on the strength of them together, and how well they produce new ecological understanding.

Your report is not about what plankton species are found in Alta Lake! It will instead explore a general question, such as what is the primary control on diversity in montane lakes.

Project Elements:

1. Main Objective: What is the single main objective of the research? This needs to relate to some kind of general ecological question or problem, and be articulated in a single concise statement.

2. Testable hypothesis: Generating hypotheses is a challenge, and requires careful thought and familiarity with the discipline and literature. Make sure there are not logical gaps between the hypotheses, objective and methods used to test them, or if gaps exist, address them. A hypothesis or set of hypotheses must:

- clearly contribute to achieving the main objective
- be able to be definitively tested and rejected
- ideally, the set of hypotheses should together support some inference about the main objective.

3. Methods: How will hypotheses be tested?
- Indicate the type of evidence that will be used and how it will be collected. Examples include: field sampling and comparison among sites; experimental tests; synthesis from the literature.
- How will data be collected and analyzed? What statistical tests will you use?
- What is the timeline for this process (when do you expect to have your data?)

4. Results: Consider, in advance, the 2-3 key figures or tables you will produce for your final paper. Sketch them, including axes, and even the data that would reject or fail your hypotheses or support your predictions.

5. Inference and Next Steps: What logical steps will you use to achieve your main objectives, and draw conclusions? How exactly will your figures (sketched above) answer your original questions? Consider different possible versions of the results, and how you might interpret them. Then revisit your questions – are you happy with how your hypotheses are stated, given the possible results?

Milestones and timeline:

Each of these milestones is a draft, providing an opportunity for you to identify challenges and to get feedback. We will peer-review some of these (#1, #7, and others). They don't have to be perfect, but they do need to be <u>concise</u>, and <u>they will be marked as indicated below</u>.

In some cases, it may feel too early to do one of these, but we will do it anyway! See how far you get, and identify the places you get stuck. Don't leave something blank. You will get marks for addressing the point of the exercise clearly; there is not usually a 'right' answer.

1) *First draft of two-pager (DUE 9/26)*. Articulate what you think you need to do or know to get to the next step.
   a. all headings in the guidelines are addressed (1 pt)
   b. the links between each section are identified (not necessarily fulfilled, but identified clearly and specifically) (1 pt)
2) *Draft of main objective, testable hypotheses and results (due 10/10)* (fig/table template)
   a. the main objective clearly references a fundamental ecological question and references are used to provide background and justification of the problem (0.5 pt),
   b. hypotheses are testable (0.5 pt),
   c. results templates test hypotheses (1 pt)
3) *Draft of methods (DUE 10/24)*
   a. field, lab and statistical methods are drafted (1 pt),
   b. each method clearly and specifically references the hypothesis it is testing (1 pt)
4) *Draft of results (DUE 11/7)*
   a. draft figures with data (1 pt)
   b. clear and specific reference to research questions / hypotheses are provided (1 pt)
5) *Inference draft (DUE 11/14)*
   a. the main objective is revisited in light of the results, specifically (1 pt),
   b. an attempt to answer/address the main objective is made (1 pt),
   c. limitations to the inference are articulated (1 pt),
   d. the inference is placed in context of the literature (1 pt).
6) *Draft of appendix (DUE 11/19)*
   a. Data is clearly presented, with meta-data (1 pt)
   b. R code for figures is included and annotated (1 pt)
7) *Rough draft of full report (DUE 11/26)*
   a. All sections of the guidelines are addressed clearly and concisely. (1 pt)
   b. We will peer review these in class (with partners).
8) *Final report (30 points)*
   a. Presentation is clear, concise and in scientific style (3 points),
   b. Report is complete and accurate (20 points) (methods are described correctly, data is correct and consistent with other reports, analyses are done correctly, figures have proper units, legends, etc; data and analyses are interpreted fully and in line with the original objectives and not in excess, sufficient supporting information is provided, scientific literature and references are included)
   c. Overall synthesis of the parts to clearly articulate what was learned, in the context of what was known before (e.g., literature references and writing) (7 points)