# Guide to the Major Project

The written, major project is **due Friday, April 3, 2026 (by 11pm)**. Please email me your final projects (pm45@queensu.ca).

The goal of the major project is to:

(1) Enable students to conduct science, from the development of questions through study design, data collection, analysis, summary, interpretation, and write-up. Students will conduct their own field research similar to an MSc research project, but condensed into less than one week.

(2) Discover something new and interesting about the winter ecology of birds in the eastern Ontario region.

The final project should be a written paper in the format of the journal *American Naturalist*, 10-15 pages in length (not including the literature cited or figures, double spaced), including an Abstract, Introduction, Materials and Methods, Results, and Discussion sections. The major projects are usually group projects - the final written project will be written and submitted by the group.

Introduction: Provide a broad (but succinct) introduction to the important biological issue(s) relevant to your project to put your study in context. By broad, I really mean broad (e.g., all organisms require a source of energy, or many organisms, including birds, maintain body temperatures above the temperature of their environment, etc.). Start broad and gradually focus your introduction to your specific question, hypotheses and predictions. Clearly lay out hypotheses and predictions of your study.

Methods: Should be detailed and clear enough that someone could replicate your study exactly using only your written methods.

Results: I will help you with statistics during the course. Keep results focused - use figures to illustrate your major points.

Discussion: Highlight your major results, interpret them in the context of alternative hypotheses and previous research on the topic. Describe any limitations of your study that might influence your interpretations. Place your study in the context of broader issues outlined in your introduction - what do you results mean for the broad, relevant issues?

I've added some helpful hints for writing below. Please write in the first person, past tense (e.g., "We studied the roost sites of ...."). The rubric for the major projects also follows.

# Tips for Effective Writing

As biologists, we want to avoid weak thinking, weak science, and weak writing – one often leads to the other.

1. Use the active voice. E.g., NO: "The wings of warblers were measured ..." YES: "We measured the wings of warblers ..."

2. Make sure sections of your paper correspond. (e.g., clearly list predictions in a particular order in the introduction, and keep the same order throughout).

3. Avoid tangents. Stay focused!

4. Make the paragraph the unit of composition. The opening sentence indicates by its subject the direction the paragraph is to take.

5. Map out your paragraphs BEFORE you start writing. E.g., start with an outline of topic sentences, possibly with point form ideas to include in each paragraph.

6. Make sure that every sentence within the paragraph pertains to your topic sentence of the paragraph.

7. Put statements in positive form. E.g., NO: "He was not very often on time." YES: "He usually came late." Make definite assertions. Avoid tame, colourless, hesitating, noncommittal language.

8. Use definite, specific, concrete language. E.g., NO: "A period of unfavourable weather set in." YES: "It rained every day for a week."

9. Omit needless words. E.g., NO: "The reason why robin's eggs are blue is that ..." YES: "Robin's eggs are blue because ..." NO: "Tree Swallows are known to migrate." YES: "Tree Swallows migrate."

10. Use direct sentence structure. NO: “Because larger annual percent changes might be more common in species with smaller populations, we included population size in our analyses.” YES: “We included population size in our analyses because larger annual percent changes might be more common in species with smaller populations.” (Note - in some contexts, an inverted sentence structure, like the one used in the NO example, can be more effective, but a direct structure is generally more clear.)

11. Avoid jargon and unnecessary abbreviations and acronyms. For e.g., NO: "The trophic niche of the Short-eared Owl." YES: "Food of the Short-eared Owl" or "What Short-eared Owls eat." NO: “We utilized a secure containment system to transport organisms.” YES: “We used a plastic shoebox to transport the beetles.” (OR even better: “We moved beetles in a plastic shoebox.”) NO: “CORT links ELA to poor growth via its role in responses to MS and CMS.” YES: “Cortisol links early life adversity to poor growth via its role in responses to maternal separation and chronic mild stress.”

12. Express coordinate ideas in similar form. E.g., NO: "Formerly, science was taught by the textbook method, while now the laboratory method is employed." YES: "Formerly, science was taught by the textbook method; now it is taught by the laboratory method."

13. Avoid pronouns as subjects. E.g., NO: "It is known that Tree Swallows migrate." YES: "Tree Swallows migrate." NO: "Tree Swallows migrate to warmer climates in winter. This is important because ..." YES: "Tree Swallows migrate to warmer climates in winter. Migrating south is important because ..."

14. Do not use nouns as adjectives. E.g., NO: “Reproduction success is a direct fitness proxy.” YES: “Reproductive success is…”

15. Do not use the words “since” or “as” to mean “because”. NO: “Kelp forests are essential to sea otters, since they provide protection from shark predation.” YES: “Kelp forests are essential to sea otters, because they provide protection from shark predation.”

16. Make the biology the subject of your sentences, not the biologists. NO: "Smith et al. (1999) showed evidence for beetles burying carcasses. In another study, Johnson et al. (2012) found evidence for beetles feeding on eggs." YES: "Beetles bury carcasses (Smith et al. 1999) and feed on eggs (Johnson et al. 2012)."

17. Make the biology the subject of your sentences, not the statistics. NO: “The GLM revealed a significant relationship between hormones and reproductive success.” YES: “Birds with higher hormone concentrations fledged more offspring (statistics).”

18. Do not use language that indicates causation when your findings can only reveal correlation. NO: “High cortisol causes lower offspring growth” YES: “High cortisol predicted lower offspring growth.” OR: “Offspring with higher cortisol grew less.” [note: speculations about causation can be included in the introduction and discussion, and statements indicating causation are appropriate if you conducted an experiment and found the manipulation caused a change in the dependent variable]

19. End papers, reports, chapters, proposals with a broad conclusion, not suggestions for future work.

## Final Project Rubric - 40%

**Abstract.** Do you provide a succinct yet complete overview of your study? (2%)

**Introduction.** Do you adequately present the broader context of your study? Do you justify why your study is important? Do you gradually narrow your introduction to focus on the goals, hypotheses, and predictions of your study? Is your introduction accurate? (5%)

**Methods.** Do you provide a clear and detailed review of what you did in your study such that someone could easily replicate your work? Did you write in the first person? (5%)

**Results.** Do you provide a focused, succinct report of what you found? Do you avoid discussing your results in this section? (3%)

**Figures & Tables.** Are your figures and tables clear and effective? Are your figures and tables easily understood? (5%)

**Discussion.** Do you discuss your results with respect to other relevant work? Do you discuss the strengths and weaknesses of your study? Do you provide a broader context for your study? Is your Discussion accurate? (5%)

**Grammar, Spelling.** Was your final project well written? Was your overall presentation effective? Was your paper professional (e.g., free of typos, incorrect words)? (5%) See Tips for Effective Writing above. I will expect you to follow these tips.

**Referencing.** Is your review of the literature appropriate and adequate? (5%)

**Overall Project.** Was your project exciting and successful? Does your work stimulate interest? (5%)