BIOL 633: Term Project

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Fall 2023

Preamble

At this point in the term, we have learned about some common statistical approaches to different problems in ecology and evolution, and will now turn our efforts to putting this into practice. In this section we will gain experience in:

- Creating *research proposals* or *IMRaD-style manuscripts*

- Providing critical, useful feedback in the form of a mock peer-review

- Responding to feedback and further refining your manuscripts or proposals

- Presenting your research to an audience of peers in a conference-style presentation

Doing statistics and data analysis as a working scientist is not simply a matter of fitting the "correct" model or set of analyses and then pasting your ensuing results into a document. Like most academic disciplines, it is a matter of convincing your audience using a combination of word-smithing, modeling framework or mathematics (where needed), and graphic design. Even the most brilliant data collection and analysis is worth little if nobody can read or understand it! However, a lucid writing style and attractive figures are (hopefully) not everything: you must also convince your audience that the data you collected is *a*) appropriate to answer your particular question and that *b*) your methods of analysis were appropriate.

Depending on the timing of your particular degree program, you may choose to write either a *proposal* or a *manuscript*. If you've recently submitted your proposal, you may choose to do a more analytical version of it, but I would encourage you to be as forward-looking as possible, as the goal of this assignment is ultimately to produce material that can be used to further your scientific career.

The tasks that are before you:

1. Submit a manuscript or proposal, along with a cover letter to the "editor" (SR)

2. Provide two anonymous[1] peer reviews for drafts from your colleagues

3. Write a formal response to the comments from your reviewers and editor, and re-submit the updated draft

4. Create a 15 minute conference presentation detailing either your proposal, or your submitted manuscript (13 minute presentation, 2 minutes for questions)

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[1]This will be semi-anonymous, given that the class is small. However, this is similar to "real" peer review: the pool of peer-reviewers in your field tends to be fairly small, so it's common to have reviewers that you partially know.

Types of submissions

Research proposal

In general, a **proposal** must:

- Explain and justify your research topic

  - Introduce the reader to your research topic, and place it within the overall scope of your discipline
  - Reveal the current problems or gaps in understanding. What is not known? What questions have other authors posed that are unanswered (or partly answered)?
  - Explain why this problem matters. Is the answer to this problem theoretically or practically important?
  - Introduce your research goals to the reader in relation to the research gaps you've identified. Often this can be framed as your *hypothesis*, or put in another way, "how you think the world works". What are the causal agents you identify?
  - Make *predictions* about what you're likely to find. If you find a certain results (positive, negative, neutral), will this support your original hypothesis, or lend support to an alternative one? Simple figures are often useful for this.

- Methods: data collection

  - Types of experimental controls/treatments that you plan to use
  - Possible field work or laboratory setups
  - Other sources of data (e.g. a literature review in the case of a meta-analysis)
  - Identify what permissions or ethics approvals are required

- Methods: data analysis

  - What types of models or analysis will you use to answer your questions?
  - Of the data that you collect, what are the *dependent* and *independent* variables?
    * If you're dealing primarily with observational data, defend your causal assumptions (i.e. why does X cause Y, rather than Y causing X?)
  - How are your models structured? R model formulas or mathematical structures can be helpful
  - What parameters or other output will you use to idenfity support for your hypotheses? What types of tests will you use to identify strong ("significant") effects or negligible ones?
  - How might these results look in a figure? This can be related to your earlier "predictions" figures

- Identify an action plan, potential collaborators, timeline, and budget (*not required for this assignment*)

Manuscript

An IMRaD (Introduction, Methods, Results, and Discussion) manuscript will be similar to the proposal in many respects, in particular with reference to introducing and justifying your research topic and approach, but in this case will be referring to things that you've already done. These manuscripts follow this general form:

- Introduction

  - See "Explain and justify your research topic" above

- Methods

  - See "Create a data collection plan" and "Create a data analysis plan" above

- Results

  - Describe the data you collected, results of your analysis, and how it relates to your original hypothesis and predictions
  - Use figures or tables for supporting these results

- Discussion

  - Relate your research findings back to the broader field. What new things has your research revealed?
  - Briefly: future research or practical implications

- Supplemental

  - Figures or Tables that are not central to the overall message of your paper (but still may be of interest to an interested reader) can go into a Supplemental.
  - Small case-studies or pilot studies that were not large enough to warrent being included in the text, but that still influenced your research methods or conclusions, can also be included.
  - R code (or other languages) is sometimes included here, if a specific program/algorithm was written for your analysis

Style

- Jargon and acronyms should be kept to a minimum. Both of these can help to quickly convey information, but only if the reader is also familiar with them. Some (e.g. p-values, ANOVA) will be common to all fields and won't require explanation, but this is somewhat flexible

- Make sure your submission uses standard English grammar. Spelling styles can be American or British, as long as they are consistent

- The document should be structured and well-organized, using section headings, subsections, and paragraphs with proper topic sentences. Ideas should flow between sections, paragraphs, and sentences in a logical way.

- Avoid passive voice, overly-complicated sentence structures, or wordiness. Include statistics (e.g. p-values) where needed, but not at the expense of the text. Aim for maximum readibility and clarity

- Use figures and tables to back up your writing (and reduce the amount of text needed). Figure and table captions should stand alone, and not require other parts of the text in order to make sense.

- Decide which figures and tables are important to include in your text, and put the rest into a Supplemental/Appendix. A rule of thumb for an "average" manuscript is about two figures and three tables

- Citation styles are up to the author, as long as the style is consistent

Initial submission

Introduction:

- Research topic is clearly introduced, and knowledge gaps are identified

- Theoretically or practically relevance is justified

- Research questions, hypotheses, and predictions are identified

Methods:

- Data collection, including field work protocols or lab setups are clearly explained

- Sample size (or *proposed* sample size) is stated, along with the sampling structure (e.g. how many samples per day, site, etcetera?)

- What types of models or analysis will you use to answer your questions?

- Of the data that you collect, what are the *dependent* and *independent* variables?

  - If you're dealing primarily with observational data, defend your causal assumptions (i.e. why does X cause Y, rather than Y causing X?)

- How are your models structured? R model formulas or mathematical structures can be helpful

- What parameters or other output will you use to idenfity support for your hypotheses? What types of tests will you use to identify strong ("significant") effects or negligible ones?

Peer review

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Response to peer review

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Presentations

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