PRACTICAL 10: RESULTS & DISCUSSION WRITING ACTIVITIES

Scientific Writing

Writing is an essential form of scientific communication. You may see research findings popularized on YouTube, TikTok, or Instagram or summarized in a popular science like National Geographic or TED Talks or podcasts like Ologies and Quirks and Quarks. **Before any research makes it to social media and popular science, it was written and communicated as a scientific research article. Such articles are structured and organized in a standard format: Introduction, Methods, Results and Discussion. This practical will focus on the Results and Discussion.**

Results

The Results section **presents the results from the study or experiment using a combination of text, figures, and tables**. The text should describe the main differences and trends, with numbers and statistics reported to help illustrate these patterns. Figures should complement the text and clearly illustrate the data. Tables are not as common as they were 5-10 years ago, but they can be useful for summarizing statistics.

The Results section is only concerned with describing patterns in the data. It **does not include any ecological interpretation** for *why* the results may have occurred. **Statistical interpretation (e.g., higher versus lower, positive versus negative) is accepted and expected.**

Discussion

This is the section where it all comes together: the context you laid out in the Introduction, the data you analyzed in the Results, and your background research and general knowledge of ecology. In this section, you connect your question/hypothesis with your results and suggest explanations for what you found, link your work with comparable research, and suggest future work stemming from your project.

You can think of the Discussion as a triangle, this time pointing upwards: **you go from the specific to the more general**. In a way, this is the most challenging section since it requires you not only to make sense of your observations but also think beyond your work. How do your results and interpretations compare with other research? What does it mean in the bigger context of ecology that you obtained these results? **To do this you will have to refer extensively to the literature.**

When writing the Discussion, consider the following:
1. Briefly summarize your results in the context of your research question or hypothesis/predictions (without repeating any of the details from the Results section). What was supported? What was not supported? Where the predictions met or not?
2. Refer to other studies that investigated the same or similar questions or contexts, and compare your results with those from those studies. Did they find similar results? If not, what might be the reasons that your results differ from those in other papers? Provide explanations for your results not following the predicted outcome or supporting your hypothesis.
3. Were there any limitations to your study? What could be improved about the study design? What factors or variables were not considered but could affect the results?
4. What (related) future studies would you like to do?
5. What is the broader, scientific importance of your main findings?
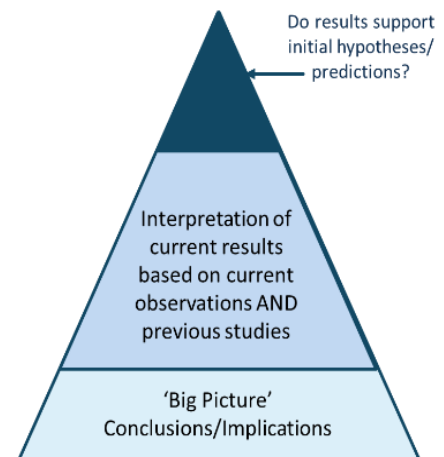
Glossary

1. **Topic Sentence** – Conveys the main idea of the paragraph.

2. **Supporting Sentence** – Provides information to support the main idea/concept of the paragraph. This is where you will most often be bringing in peer-reviewed references to provide support for your ideas in the Introduction and Discussion.

3. **Transition Sentence** – Helps to link the current paragraph to the next paragraph.

4. **Summary Sentence** – Concisely summarize the content of a paragraph into a single sentence with a main point.

Group Worksheet (Due: 1 Hour After Practical) (14 Total Points)

You will complete Parts A-C as a group and submit the Group Worksheet within 1 hour after your practical has ended (link on Quercus). In Part A, you interpret a figure and use provided statistics to describe the results. In Part B, you will take example topic sentences and organize them in the triangle structure of a Discussion section. In Part C, you will compare the hypothetical results to the results from 2 other studies. Your TA will be marking one example from each Part.

Each component of the group activity works on a specific skill to practice and develop for writing your Lab Report:

Part A = (1) Correctly interpreting results and (2) using a combination of text, statistics, and figures to describe the results.

Part B = (1) Identifying and understand the triangle structure of a Discussion section and (2) start thinking about how you can organize your Discussion section in the triangle structure.

Part C = (1) Summarizing your results and putting them into the context of other studies and (2) practice citing information from other sources.

Follow the instructions below, and place your answers on the Group Worksheet, which is a fillable PDF linked on Quercus. Submit one (1) Group Worksheet per group by the end of your practical using the link found on Quercus.

PART A: RESULTS IN FIGURES AND TEXT (4 POINTS)

Below are 3 examples of results for you to interpret and translate from figures and tables to text. Each example has a question to answer, and you will write your response as if you were writing for a lab report.

Example 1: Biodiversity by Habitats on the UTM Campus (BIO205 Summer 2023 Data)
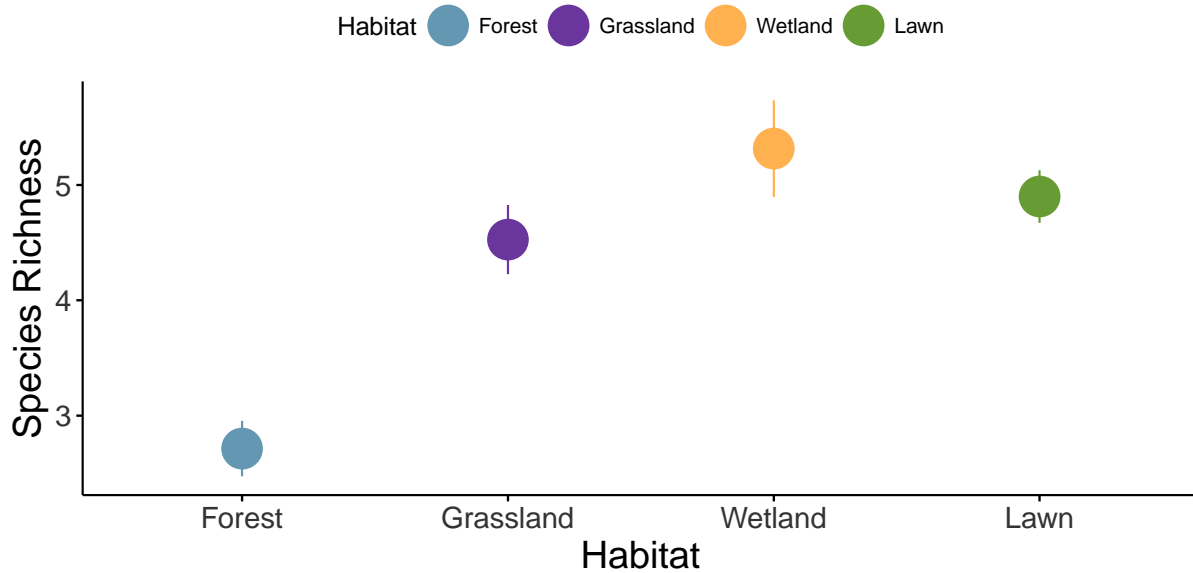
Habitat	Mean	Standard Error
Forest	2.71	0.24
Grassland	4.53	0.30
Wetland	5.32	0.42
Lawn	4.90	0.23

Question: What are the patterns in species richness among habitats? Make sure to report the mean and standard error in the text (mean ± standard error).

Example 2: Species Evenness by Soil Salinity (BIO205 Summer 2023 Data)
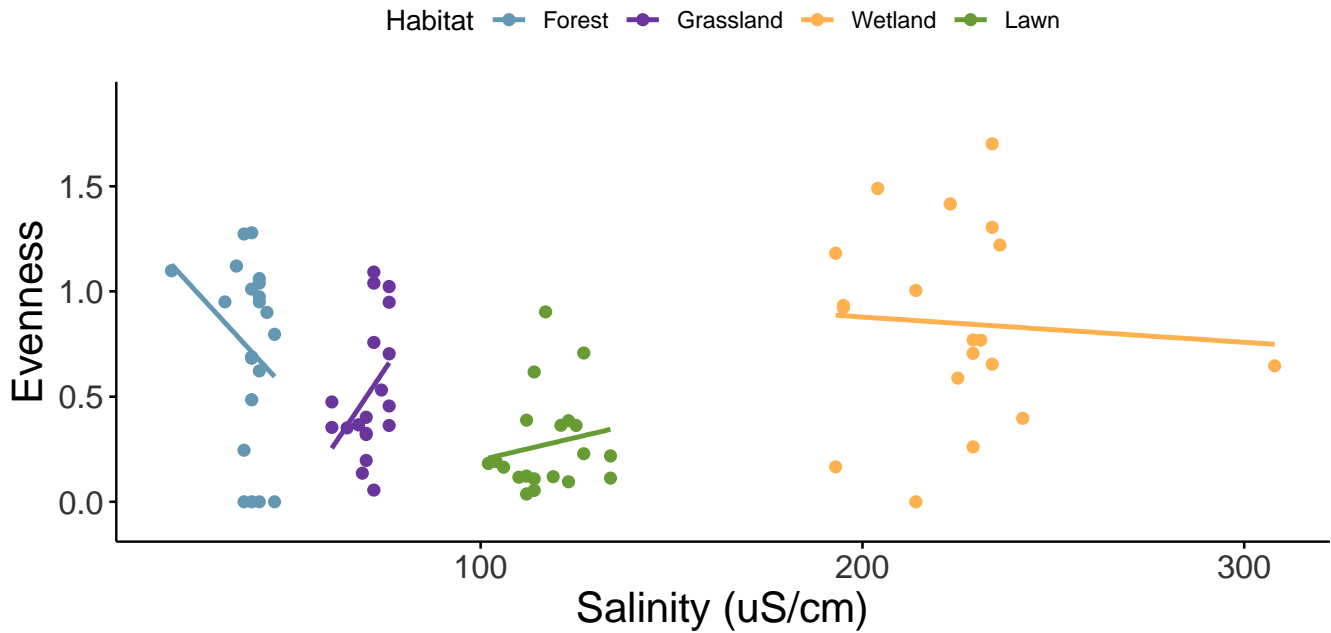
Habitat	Slope Estimate (β)	Standard Error
Forest	−0.020	0.015
Grassland	0.027	0.019
Wetland	−0.001	0.003
Lawn	0.004	0.009

Questions: How is species evenness (Shannon-Weiner index) related to soil salinity across habitats? Make sure to report the slope estimate in the text. For example (slope = −0.020).

Hint: look at the direction (positive or negative) of the slope estimate. You do not need to include the standard error of the slope.

PART B: IDENTIFY THE TRIANGLE STRUCTURE (4 POINTS)

Below are 2 'deconstructed' discussion outlines, where you will match the topic sentence to the stated purpose or objective of the paragraph. The column "Purpose/Objective of the Paragraph" is ordered in the triangle structure (P1 = first paragraph, P2 = second paragraph, etc.), so you just need to match the appropriate topic sentence from the second column. After matching the sentences, you will discuss and reflect on what you like about each example, what could be improved, and how you could apply this to your Lab Report.

Note: The purpose or objective of the paragraph was written in the outline, but you can use the stated purposed or objective as a subheading in a scientific paper as well. The first paragraph of a Discussion section should not have a subheading.

Example 1

Purpose/Objective of the Paragraph	Topic Sentence
P1: Overview of results; relate back to hypothesis	A: We observed differences in nodule density that were linked to urbanization.
P2: Discussion of how the mutualism varies along the urbanization gradient	B: There are some limitations that we should explicitly state and concisely describe.
P3: Why was soil N not affected by urbanization?	C: Our results show that urbanization alters the ecology of the white clover-rhizobia mutualism, with support for this conclusion from three key results.
P4: Limitations	D: Our study represents a robust evaluation of the effects of urbanization on an ecologically-important mutualism.
P5: Concluding paragraph with future directions	E: Despite evidence of urbanization affecting the white clover-rhizobia mutualism, we did not identify a direct link from urbanization to soil N and effects on the mutualism.

Example 2

Purpose/Objective of the Paragraph	Topic Sentence
P1: Summary of results related to QHP	A: Detritivore biomass was expected to consistently be the primary driver of leaf decomposition, given the relationship between biomass and metabolism and resource uptake (Brown et al. 2004) and results from previous studies (Hieber and Gessner 2002, Sanpera-Calbet et al. 2009, Frainer et al. 2014).
P2: Explain why there might not be local adaptation	B: Our results suggest that decomposition of terrestrial resource subsidies in detritus-based streams is complex, with effects on this critical ecosystem process mediated through direct and indirect pathways.
P3: Compare results to other studies	C: Other biotic and abiotic variables that were not included in our analyses could have affected leaf decomposition.
P4: Limitations	D: Evaluating how detrital resource subsidies and biodiversity affect decomposition is critical given the importance of decomposition in the carbon and nutrient cycling (Cebrian 1999, Gessner et al. 2010) and the role detritus serves in community stability and diversity and how diversity, in turn, affects decomposition (Moore et al. 2004, Frainer et al. 2014).
P5: Conclusions and broader impacts	E: Despite plausible mechanisms and evidence for adaptation to dominant local resources in streams (Kominoski et al. 2011, Jackrel and Wootton 2014, 2015b), our evidence suggests decomposition is not due to local adaptation by stream consumers (Fig. 1); however, there are potential explanations for this result.

PART C: COMPARE AND CONTRAST RESULTS (6 POINTS)

Below are 3 examples with hypothetical results that you might find for your lab report. Compare those results to those from 2 other hypothetical studies. Each example is designed to practice comparing your results in different situations, such as your results being supported by other studies or having your hypothesis rejected but the results still supported by other studies. For each example, write 2-4 sentences which put your hypothetical results into the context of the other two studies. Make sure to include the appropriate in-text citations.

Example 1: Results Supported by Other Research

Your Hypothetical Results	Hypothetical Study 1	Hypothetical Study 2
You found highest plant biodiversity in the lawn habitat, which has the greatest human disturbance.	Lahey et al. (2015) surveyed plant and insect diversity along an urbanization gradient, and they showed that biodiversity tended to peak in residential/suburban areas, but it remained high in urban area. In contrast, the rural areas had the lowest biodiversity, possibly owing to agricultural influences at some of the sampled sites.	Chenoweth et al. (2012) sampled urban and nonurban streams in the desert of Arizona, and they found higher biodiversity of aquatic insects in urban streams compared to nonurban streams. They suggested urban streams serve as a refuge in the desert, as the flow is more permanent.

Instructions: Compare and contrast your hypothetical results to the results from the 2 hypothetical studies. Write your response as if you are writing for your Lab Report, and make sure to include the appropriate in-text citations.

Example 2: Results Partially Supported by Other Research

Your Hypothetical Results	Hypothetical Study 1	Hypothetical Study 2
You found that plant biodiversity – measured as species richness – increased with increasing soil nitrogen.	Liu et al. (2018) conducted a nitrogen addition experiment, whereby half of their experiment plots received a weekly addition of nitrogen and the other half received no nitrogen fertilizer. After 2 years of growth, they found the nitrogen addition plots had 80% more species richness and 200% more biomass compared to the control plots.	Zhang et al. (2021) conducted a factorial experiment, whereby they added (1) no nutrients, (2) nitrogen, (3) phosphorous, or (4) nitrogen and phosphorous. After 2 years of growth, they found highest species richness (120% increase) and biomass (300% increase) in the combined nitrogen and phosphorus addition treatment. In contrast, the nitrogen or phosphorus additions only had intermediate species richness and biomass, but both treatments still had higher species richness and biomass than the control (no addition).

Instructions: Compare and contrast your hypothetical results to the results from the 2 hypothetical studies. Write your response as if you are writing for your Lab Report, and make sure to include the appropriate in-text citations.

Example 3: Rejected Hypothesis but Results Supported by Other Research

Your Hypothetical Results	Hypothetical Study 1	Hypothetical Study 2
You hypothesized that species richness would be highest in the forest because it has the lowest human disturbance, but you found that the forest had the lowest species richness. You did find that the forest had the highest species evenness out of all the habitats.	Francoeur et al. (2009) surveyed plant communities along gradients of human disturbance across 30 cities. They sampled communities in parking lots, urban parks, residential areas, and forests. They found highest species richness in residential areas, intermediate species richness in urban parks, and lowest species richness in the parking lots and forests. They suggested that socioeconomic and cultural variables could influence residential plant biodiversity, as many of the residential areas had gardens that were planted and maintained by people in the neighbourhood.	Gaudin et al. (2023) surveyed forest and grassland communities across Ontario, including both plant and microbial (e.g., bacteria and fungi) communities. They found that grasslands consistently had higher plant and microbial biodiversity than forests. Additionally, they found a positive relationship between soil microbial and plant diversity, whereby plant diversity increased with increasing soil microbial diversity, and this relationship was only present in the grasslands.

Instructions: Compare and contrast your hypothetical results to the results from the 2 hypothetical studies. Write your response as if you are writing for your Lab Report, and make sure to include the appropriate in-text citations.

Individual Worksheet (Due: Next Day by 11:59PM) (5 points)

For your individual worksheet, you will (1) relate your results back to your QHP in paragraph form. In your paragraph, make sure you address the following questions:

Did the data support your hypothesis?
Did the results follow your predictions?

Remember, it is okay if your hypotheses and/or predictions were not supported!

Similar to the individual assignment for the Introduction Writing Activities (Practical 7), the assignment is designed so you can take what you learned from the above activities and apply them when you write your Lab Report.

Complete the "Individual Worksheet", a fillable PDF linked on Quercus. Your individual submission is due by 11:59PM the day following your practical. You will submit your assignment through Quercus, the Individual Worksheet will be marked for completion.