

Writing Tips for First-Year Biology Lab Reports

Title

The basics: usually includes main objective, species involved, and location (if relevant). The title may be derived from the x and y-axis of the main figure

Example: The distribution and effects of invasive earthworm populations in an eastern Ontario temperate forest

Do include detail so the title is not too short or too vague.

Don't exceed approximately 15 words.

Abstract

The basics: a brief description of a report that summarizes the key elements in one to three sentences each:

- the objective of the study/statement of the problem (often taken from the title), often includes wording such as this: "This study was undertaken in order to..."
- the main details of the methods
- the most important results (with statistical significance if relevant)
- the main conclusion(s) and interpretation(s) of the study (from the discussion)

Example:

The abundance and diversity of invasive earthworm species can have a dramatic and negative impact on soil chemistry, litter layer thickness, and forest understory growth in North American temperate forests. The purpose of this study was to investigate anthropogenic and abiotic factors affecting earthworm abundance and distribution, as well as the effects of these earthworms on the litter layer and forest understory. We collected earthworms at five sites at the Queen's University Biological Station (QUBS) in eastern Ontario. At each site, we counted and weighed the collected earthworms, identified them to species, and aged them as juveniles or adults. We also measured distance from roads and lakeshore, soil moisture, and soil pH at each site; collected and weighed the litter layer; and counted the number of seedlings, saplings, and mature trees in each plot. We found that earthworm abundance was negatively correlated with distance from roads, but was unrelated to distance from lakeshore, and positively correlated with soil moisture and pH. Areas with high earthworm abundance tended to have less litter layer; however, this trend was not significant. We found no relationship between earthworm abundance and numbers of seedlings, saplings, or mature trees. Although we found only minimal evidence of negative effects of earthworms at QUBS,

our study is nonetheless useful in further understanding the effects of earthworms on temperate forest ecosystems. Because the range of invasive earthworms will continue to expand as global temperatures increase, it is crucial to understand these effects in order to predict how forests will respond to climate change.

Do write in complete sentences.

Don't refer to other works, include too much detail, or give statistical details (e.g., p values).

Introduction

The basics: usually includes 3 paragraphs:

1. Introduces the relevance of the topic or question to be explored (*why we are interested*).

Example:

Human-induced invasive species are a leading cause of species declines and extinctions and currently represent one of the greatest threats to ecosystems worldwide. In the temperate forests of North America, invading species of exotic earthworms may be negatively impacting the ecosystem in multiple ways, ultimately leading to decreases in diversity and productivity. Because the range of these invasive earthworms will continue to expand as global temperatures increase, it is crucial to understand the scope and mechanism of their impacts on temperate forests.

2. Introduces overview of current, **relevant** research and usually includes at least 3 cited studies (*what we currently know*).

Example:

Earthworms may have negative impacts on the soil and litter layer of the forest, because they are detritivores that break down organic matter and change the soil's physical and chemical properties. Earthworms may change soil structure from fungally to bacterially dominated, which can have negative impacts for interactions between plant roots and symbiotic fungi (mycorrhizae, Wardle 2002; Suarez et al. 2006). They may also contribute to the mixing of the organic and mineral soil horizons and cause decreases in soil carbon storage (Bohlen et al. 2004).

3. Introduces purpose of this study*/proposes how experiment* will attempt to answer the question posed (*what we will contribute*).

Example:

In this study, we asked whether the distribution of earthworms in an eastern Ontario temperate forest was associated with abiotic and anthropogenic habitat characteristics. We also asked whether earthworm diversity and abundance was correlated with decreases in litter layer, seed germination, and sapling growth.

Do integrate source material into your writing (begin and end the second paragraph in your own words).

Don't use source material unrelated to your topic or simply summarize results of studies without integrating this information with your own study.

***Definitions:**

A hypothesis is a possible explanation for what causes something to occur (e.g., the movement of earthworms is facilitated by human activities such as fishing and driving).

A prediction is an expected result that should be observed if the hypothesis is true – a pattern in the collected data (e.g., if the above hypothesis is true, then we should expect to see more earthworms – greater numbers and more diversity of species – near boat launches and roads).

A study usually means an observational study in which researchers observe subjects and measure variables but do not assign subjects to treatments or manipulate them in any way. In an **experiment**, researchers control/manipulate the primary variables and usually assign subjects to treatments.

Materials and Methods

The basics: describes the materials and equipment used, the experimental design, and a step-by-step process of the experiment

Do

- include enough detail so the experiment can be repeated.
- use the past tense and complete but concise sentences.
- include information related to statistical methods, if used.

Results

The basics: presents the findings of the experiment in text and in figures and/or tables

1. Starts with a summary statement of main results

Example: Earthworm diversity decreased as distance from road increased but was not related to distance from lakeshore (Fig 1).

2. Includes statements of statistical significance

Example: While there was a trend for more worms to be collected from sites closer to the lakeshore (Fig 3), this relationship was not significant (t-test, $t=2.21$, $df=35$, $p=0.08$).

3. Provides a figure – the most important data (especially patterns or trends) presented in figures or tables

Do

- be sure to include a caption at the bottom of figures and at the top of tables and axis labels for graphs.
- avoid redundancy between text and graphs (graphs present results more specifically).
- use the past tense and complete but concise sentences.

Don't

- interpret or discuss results.
- include any references or raw data in the text.
- provide the same information in a figure and a table – use one or the other.
- use vague, imprecise modifiers such as “very” and “much.”

Discussion

The basics: generally includes five paragraphs that explain the results of the study, suggest possible sources of error/how the study could be improved, and provide support from sources.

1. Introduction – a very brief paragraph that simply recaps the results.

2. Analysis paragraphs – Each paragraph starts by introducing a key result or an aspect of a result with respect to the hypothesis and predictions (for example, “as we predicted”). It then interprets that result based on the data combined with background scientific knowledge and information from sources. It ends by making connections: does your result/interpretation agree with the literature? Does it open up new questions?

Example:

The abundance and diversity of earthworms was related to distance from roads, but not to distance from lakeshore. As we predicted, we found that as distance from the nearest road increased, earthworm abundance and diversity decreased. This pattern is similar to that found by Holdsworth et al. (2007) and Cameron et al. (2008), and supports the hypothesis that earthworm distribution is mediated by human activities. For example, earthworm eggs and cocoons might be accidentally transported along roads on the wheels and undersides of vehicles (Hale 2008). However, contrary to our predictions, there was no relationship between earthworm abundance or diversity and distance to lakeshore. A possible explanation for the discrepancy between our predictions and results might lie in the unique nature of the lakeshore at QUBS. Earthworm abundance is predicted to be higher near lakeshores largely due to the inadvertent release of fishing bait at boat launches. However, because QUBS is a research station, there are very few boat launches along the lakeshore, and only minimal recreational fishing. It seems unlikely that accidental release of fishing bait drives the distribution of earthworms at the station, and therefore we would not expect distance from the lakeshore to be related to earthworm abundance at QUBS.

5. Summary – summarizes conclusions drawn from the study and discusses possible implications or suggests future work.

Do

- discuss all of the main results, even/especially if they were unexpected, appear not to agree with your other results, or appear not to agree with the literature.
- begin each paragraph with a sentence that introduces a particular result, not that gives facts from another study.
- use your textbook and other sources (such as review papers) to **learn about your topic** so you can present an informed discussion.
- **emphasize your own thinking** – you should devise your own reasons to explain your results.
- be sure your reasoning relates to biological processes rather than offering only logical or “common sense” explanations.

Don't

- use source material that is not relevant to your study.
- **over-cite – don't cite general knowledge** such as material from your textbook or from review papers; cite only specific results from studies (secondary sources such as review papers present an overview of research while primary sources are studies that present the results of experimentation).

- Place too much emphasis on experimental error as the most significant reason for the results.

Referencing

The basics: refer to 3-5 sources per lab assignment – references should be primary literature, not reviews, general websites, textbooks, or encyclopedia. **Use the referencing style in the articles from the journal *Ecology*.**

Example:

Hargrave, C. W., K.D. Hambright, and J. W. Weider. 2011. Variation in resource consumption across a gradient of increasing intra- and interspecific richness. *Ecology* 92: 1226-1235.

Do

- cite in your text all specific information derived from a source.
- check to ensure all references cited in the text are listed in the Literature Cited section and vice versa.
- check references very carefully so that the style in *Ecology* is followed exactly: take note of capitalization, punctuation, the order of authors' names, the use of "and" vs. "&," etc.

Don't

- over-cite – cite only specific findings from particular studies, not general knowledge.
- quote sources directly.
- paraphrase a source too closely – use your own words.