BIOS 3010: ECOLOGY
Dr Stephen Malcolm
Laboratory sessions

<table>
<thead>
<tr>
<th>Teaching Assistants:</th>
<th>Justina Bartling</th>
<th>Nicholas Martin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab section</td>
<td>Thursday, p.m.</td>
<td>Friday, a.m., Friday, p.m.</td>
</tr>
<tr>
<td>Office hours:</td>
<td>MW, 9:00-10:00 a.m.</td>
<td>MW, 9:00-10:00 a.m.</td>
</tr>
<tr>
<td>Location:</td>
<td>1106 Wood Hall</td>
<td>1106 Wood Hall</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:justina.r.bartling@wmich.edu">justina.r.bartling@wmich.edu</a></td>
<td><a href="mailto:nicholas.w.martin@wmich.edu">nicholas.w.martin@wmich.edu</a></td>
</tr>
</tbody>
</table>

**General Approach to Lab:** The laboratory session is a setting in which you will be encouraged to develop and test your own hypotheses to explain the observations you make. Each week the exercises will be used to test your ideas. We will also encourage you to observe ecological interactions and learn methods to test your hypotheses. You should come prepared to participate, question, reason and perhaps be ready to feel wet, cold, and muddy on one or two occasions.

**Attendance:** Attendance in lab is required. It is important that you come to class on time. Many of the labs will involve work outside and off campus. If you are late or absent it will be difficult to make up the work. Therefore, missing a lab period will result in zero credit for the exercise of that day.

**Field Work:** Since many of the labs will involve field trips, these exercises will require us to be outside for the majority of the lab period. Please dress appropriately for the weather conditions because we will be outside unless there is lightning, tornados or a blizzard.

**Lab Grades:** The lab will contribute 42% of your total course grade. Homework and weekly quizzes will determine your lab grade as indicated below.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab reports (10 at 40 points each)</td>
<td>400</td>
</tr>
<tr>
<td>Quizzes (10 at 10 points each)</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
</tr>
</tbody>
</table>

**Quizzes:** A quiz will be given at the beginning of each lab period covering the previous weeks exercise or material covered in lecture. Therefore it is crucial for you to keep up on all material covered in the lab. Quiz questions will be in a variety of
formats including: short answer, multiple choice, and statistical applications. Remember to bring a calculator to every lab. Quizzes account for 20% of your lab grade.

**Lab Reports:** The purpose of lab reports is to ask you to think critically and insightfully about the concepts covered in lab. Many of the labs will require you to apply statistics to evaluate hypotheses successfully. For this reason, the lab reports account for 75% of your lab grade. Because of the broad range of topics covered in this course, assignments may vary widely in format, but will usually be in the form of a lab report. Please ask us if you are unsure about what you need to complete for credit. Assignments must be typed and stapled. Lab reports will be collected at the beginning of the lab period.

**Structure of Lab Reports:** Scientific results must be communicated to be of value and so a large part of the process of doing “science” involves written communication. Such communication shares ideas, experimental results, analyses and interpretations within the framework of established, published knowledge and understanding.

Clarity is essential in scientific writing and in the last 100 years this has been formalized into a widely accepted system known as “IMRAD” which stands for *Introduction, Materials and Methods, Results, and Discussion*. These are the major elements of a scientific paper and this is usually the order in which they are presented. The IMRAD system provides a standardized way to present the results of scientific investigation. While this system serves as a general pattern for research articles published in many journals, each journal may have a unique set of rules. These rules, or “Instructions for Authors” specify how papers submitted for publication are to be written. Often these rules specify such things as margin settings, line spacing, font size, or even accepted abbreviations. A paper submitted for publication that does not follow these rules will usually be rejected.

For your lab reports you will use the IMRAD system and the simple rules described below and summarized in “*How to Write and Publish a Scientific Paper*” 4th edition, by Robert A. Day (© 1994 Oryx Press). Let’s further explore the IMRAD system and how to write each section of your report.

1. **Title** – the title is probably the most important element of your paper because this is what is used to index and reference the paper and conveys content to the reader. Short titles that accurately convey the content of the paper are best and should adhere to these rules:
   a. The title should be informative and short.
   b. Always include scientific names and higher taxonomic categories of the organism being studied (For example, a study of bullfrogs should include, “Rana catesbeiana (Amphibia: Anura)” in the title).
   c. “Cute” titles are not acceptable.

2. **Introduction** – This section should be written in the present tense and should bring the reader up-to-date on any background information relevant to the
present study. There is also a strong new movement in the scientific community to write in the first person – this helps to claim ownership of your work. The introduction should explain concepts and terms important to the study and last, but not least, it should state your research hypothesis. Thus the introduction should include:

a. A statement of the hypothesis you will be testing by conducting the experiment. Present the nature and scope of the problem being investigated. Do this in a reasonable and understandable way so readers will remain interested.

b. Normally, the introduction will include a review of the related literature to orient the reader and justify the research. You will not be required to do a literature review for lab reports, but you should include an explanation of the concepts and ideas related to the experiment being performed. This is also the place where you should define terms that may not be familiar to the reader. Use your textbook and lecture notes if necessary.

In summary, the introduction should allow any non-ecologist to understand the concepts behind the experiment and what you hope to find by doing the experiment.

(3) Materials and Methods – This section should be written in past tense and provides the reader with information about the equipment and supplies and how they were used. Do not simply prepare a list of the materials. This section must give enough detail so any intelligent person could repeat the experiment exactly. If this is not accomplished, then your experiment and the data collected are considered invalid. The key to scientific investigation is that the methods used in an experiment can be duplicated and the results verified.

The description of equipment and supplies should include technical specifications, quantities, and source of methods (if known). Do not ignore information related to any living organism used. Be sure to include genus, species, age, sex, and where you obtained the organisms (if known).

When describing the methods, you will usually do so in chronological order. The only exception to this rule is that you should describe similar methods in the same part of this section. Be sure to include exact measurements (in SI units only – no imperial measures!). It has been suggested that this section read like a recipe. While the lab handout gives an overview of your methods, your description should be much more detailed.

(4) Results – This section should be written in the past tense. Traditionally, papers were written in the passive voice, but increasingly, all sections of modern papers are written in the active voice. The passive voice was thought to reflect greater deductive reasoning and active voice was thought to imply inductive arguments. However, we now think that active voice reflects research ownership and greater accountability for published results.
The results section is where you present your data. A typical paper will usually never include all of your data (note: data are always plural!). The experiments you conduct are fairly simple, thus you will be expected to include all of the data collected, unless instructed otherwise. Only perform statistical tests if they are meaningful to your experiment. These numbers are usually presented in tables and figures (graphs), but not always. Use a table to present a large group of numbers. If you have only a few numbers incorporate them as text. A table or graph should include enough information to be fully understood without any further information. This means that you need informative legends for the tables and figures.

You will decide how to present your data, whether in a table, graph or text. Regardless of how you present your data, be sure to follow appropriate rules and standards. If you do decide to use tables and graphs, they should be referenced in chronological order in the text.

You will also be instructed as to what statistical tests are appropriate in what situations. Be sure the results are stated clearly – this is the part of the paper where you are sharing new knowledge with the rest of the scientific community and beyond. Finally, avoid repeating in the text what you have presented in tables and figures.

**Rules for Tables:**

- a. Only use a table for repetitive data that must be included.
- b. Tables should be numbered sequentially (Table 1, Table 2, etc…).
- c. A table should have a title or legend in the form of a sentence, which adequately describes the information being presented in the table.
- d. It is not always necessary to use every bit of data collected.
- e. Only include variables measured, not standard conditions.
- f. Elements of a table should read down.
- g. Only use horizontal lines separating major sections of the table. Vertical lines will rarely be used.
- h. Include a legend above the table to provide all of the information necessary to understand the data being presented.
**Rules for Figures (Graphs):**

a. Any data that would not normally be included in a table should not be included in a graph.
b. Figures, like tables, should be numbered sequentially.
c. A figure should also have a title (legend) in the form of a sentence to describe adequately the information being presented. This legend should be placed after the Figure 1, etc., and be below the figure itself.
d. If the data show a trend that would make an interesting picture, create a graph.
e. Be sure each datum point is clearly distinct (use open circles, squares, or triangles). Use a separate symbol for each data series and connect data points with a straight line.
f. Never include more than four series of data on each graph.
g. Label both axes and the origin appropriately with large letters so it is clear and readable. Be sure correct units are included.
h. Include a legend so the reader can fully understand and interpret the graph. Be sure to include a key to the symbols if appropriate.

(5) **Discussion** – The primary purpose of the discussion is to show the relationships among the observed facts. Try to keep this section short and to the point. Avoid writing a long “wordy” discussion. A good discussion will do the following:

a. Present the principles, relationships, and generalizations shown by the results.
b. Show how your observations agree with or contradict field observations (if known).
c. State your conclusions as clearly as possible. Your conclusions are your opinion and by definition are never wrong, as long as you back them up (see d).
d. Summarize your evidence for each of your conclusions. This is the part where you back up your opinion with observations made and data collected.
e. Tell whether or not the results support or reject your research hypothesis as stated in the introduction.
f. Suggest further experiments that will explore the same problem, or new questions that have been prompted by the results obtained.

(6) **Literature Cited** – Although you are not required or expected to use citations other than your ecology text and lecture notes, if you do use them, you **must** cite them appropriately. Consult a recent issue of the journal *Ecology* or other primary literature source for format and content.
Basic instructions for the preparation of reports for labs in BIOS 3010:

1. All papers must be typed, double spaced on standard 8.5 x 11 inch sheets (even though this is not an SI format – this is an issue beyond our control!!), with a 12-point font. Papers that are not word-processed will not be accepted.
2. All text pages must have margins of 1 inch on all sides.
3. Each table and/or figure should be presented on separate pages and should be sized to fit the page symmetrically.
4. Label each section of the paper (IMRAD) properly.
5. Papers must use correct English grammar and spelling (US English – but UK is OK too!).
6. All pages should be stapled together once in the upper left corner. Please do not use report binders.

The Ten Commandments of Good Writing:

(from “How to Write and Publish a Scientific Paper” Day. 1994)

1. Each pronoun should agree with their antecedent
2. Just between You and I, case is important.
3. A preposition is a poor word to end a sentence with.
4. Verbs has to agree with their subjects.
5. Don’t use no double negatives.
6. Remember to never split an infinitive.
7. Avoid clichés like the plague.
8. Join clauses good, like a conjunction should.
9. Do not use hyperbole; not one writer in a million can use it effectively.
10. About sentence fragments.

“We train ecologists in our universities and even employ them in our governmental agencies but we seldom take their advice.”

- Rachel Carson