SCIENTIFIC WRITING

Dr. Craig 5/5/12

Skillful scientific writing involves using precise, concise language. Use primarily the first person and active voice (e.g. "I conducted the trials", not "the trials were conducted") when writing, and *always avoid* use of the second person. Papers should be cast in the format of this document- single spaced, 12-point type and Times New Roman font.

Use the following outline *exactly* as shown (including capitalization, boldface, centering, and other formatting shown) to prepare a laboratory report in the format of a scientific paper. All scientific journals use a specific format in presenting their articles, and this is the format that we will use for our scientific journal "article." Do not insert extra spaces in an attempt to make the report appear longer. In scientific writing, concise format is a virtue.

TITLE

Author name
Author address (school address)

Abstract.- In this section, provide a brief summary. It consists of a hypothesis statement and a brief review of methods, results and conclusions. It should not be more that a paragraph long, and can usually be completed in four or five sentences.

INTRODUCTION

Begin with a clear statement of purpose and hypothesis to be tested and give readers some background into the topic.

Objective.- State what the purpose of performing the investigation was. Name the goals of the study. Never use the phrase "*in this lab*" anywhere in the report. These are extraneous words that add nothing to understanding the investigation.
Hypothesis.- Restate the objective as an *if – then* statement; e.g. If we measure the output of CO_2 by a resting animal, then we can compute the animal's basal metabolic rate.
Background research.- Provide an 1) overview of what is known about the topic to be investigated, 2) show readers how this information relates to the present investigation and 3) show how this study extends knowledge of the topic.

METHODS

Describe in paragraph form how the investigation was conducted. Because the work has been completed, use the *past tense* to report methods.

Materials.- Make a bulleted list or table that reports all materials used in the investigation.
Procedures.- Provide a step-by-step review of the procedures used. Include sufficient detail so that another individual can duplicate the investigation. Lab and field procedures should be separated into individual paragraphs.

RESULTS

Describe observations made, but *do not* yet try to explain what they mean. All data collected should be reported in this section. Depending on the nature of the data, tables or graphs are inserted into the Results.

Observation review.- Describe what was observed while performing the investigation; e.g. if collecting aquatic insects, what did the streams look like in which the collecting was done, what were the weather conditions? In the lab, what did these organisms look like, how did they behave and how could they be distinguished from other materials in the sample?

Tables, Figures.-

Use the following examples of tables and graphs. Note that tables and graphs have titles, numbers and explanatory materials that permit understanding of them without having to reference the text.

TABLE 17. Observations of habitat use by individual Yellow-throated Vireos showed that they inhabited forests moister and with more mixed hardwoods than would be predicted by habitat availability. F = forest type, M= moisture regime, D = dbh, C = canopy cover, U = understory density, O= oak, MH = mixed hardwoods, CN = conifer-northern hardwoods, PO = pine-oak, CO = conifer, MI = mixed sites.

	Mean Habitat Characteristics				
	F	M	D	C	U
Availability	2.3	1.4	2.3	2.0	2.7
Use	1.2	2.1	2.0	2.6	2.2

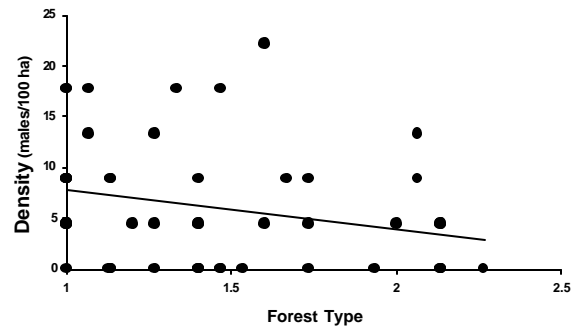|	Percent Vegetation					
	OD	MH	CN	PO	CO	MI
Availability	51.0	13.7	13.1	13.1	8.5	0.7
Use	52.3	31.8	11.4	4.5	0.0	0.0

FIG. 50. Population density showed a variable but significant increase with increasing deciduous forest cover.

Analysis.-

Summary statistics.- Examine tables and graphs for the major patterns that they show. Report these here in several sentences. *Do not* yet explain what they mean.

Data review.- Report the details of what the data show. *Do not* be redundant by repeating numbers already reported in tables and graphs. Instead, go through each data set and explain what *patterns* they show.

DISCUSSION AND CONCLUSIONS

Describe here what the data *mean* in paragraph form.

Hypothesis evaluation.- Do the data support or reject the hypothesis? We use inductive (conclusions are based on accumulation of evidence) rather than deductive logic (one fact leads irrefutably to the next) in scientific investigation, so we do not generally prove the hypothesis. Hence, our data only lend support to our hypothesis. Make a statement like this: "I support my hypothesis because…"

Supporting statement.- Discuss in detail how the data lend support to or tend to reject the hypothesis. Examine all the data here in paragraph form.

In addition, quantitatively (with numbers) compare findings with those from other lab groups. This is analogous to comparing research results with those of other researchers working on the same topic. Determine whether data from other groups refute or help to verify findings.

Sources of error.- Discuss what factors might have led to erroneous conclusions. Discuss also the amount of variability that may be present in the data (i.e. discuss data accuracy and precision).

ASSESSMENT

Evaluation is based on the kinds of criteria that editors use when deciding to accept or reject submitted manuscripts:

1. Is the writing clear and concise?
2. Does grammatical usage conform to acceptable usage?
3. Is the proper format followed?
4. Is the methodology as presented valid?
5. Are results presented coherently?
6. Are the results portrayed succinctly with tables and graphics, with no repetitive or unnecessary material?
7. Are the data correctly analyzed and appropriate conclusions drawn?
8. Does the author examine how the conclusions fit with the larger body of knowledge about this topic?

The details of grading are contained in a separate scoring guide.

Lab report rubric: scientific paper format

Name _____

Scientific quality (reports use the heading format in this scientific quality section <u>exactly</u>)

Major headings	Subheads	Assessment	Evaluation Student	Teacher
	Abstract.-	**2 pts.** Does not link hypothesis to conclusions.		
		4 pts. Clearly links hypothesis, data and conclusions.		
INTRODUCTION	*Objective.-*	**2 pts.** Weak		
		4 pts. Well stated		
	Hypothesis.-	**2 pts.** Weak		
		4 pts. Well-stated and in if-then format.		
	Background research.-	**2 pts.** Weak and incomplete statement of background into the study.		
		4 pts. General statement of background into the study.		
		6 pts. Strong and specific background statement that ties the study to existing knowledge and cites pertinent literature.		
METHODS	*Materials.-*	**1 pt.** Incomplete list		
		2 pts. Complete list		
	Procedures.-	**2 pts.** Weak and incomplete description of procedures.		
		4 pts. General description of procedures.		
		6 pts. Complete and detailed description that lists all steps of procedures.		
RESULTS	*Observation review.-*	**2 pts.** Weak and incomplete review of observations made in the lab and field.		
		4 pts. Complete review that identifies all key observations made in the lab and field.		
	Tables.-	**1 pt.** Presented in a table.		
		1 pt. Appropriately titled with a table number designation.		
		2 pts. Uses correct numerical units.		
		6 pts. All necessary tables are included.		
	Figures.-	**1 pts.** Correct graph type		
		2 pts. Axes correctly labeled		
		2 pts. Legend correctly labeled		

		1 pt. Appropriately titled with a figure number.			
		6 pts. All necessary figures are included.			
	Analysis.-	*Summary statistics.-*	**1 pts.** Averages and statistical tests largely missing.		
			2 pts. Averages or statistical tests incompletely reported.		
			4 pts. Averages or tests complete.		
		Data review.-	**2 pts.** Minimal review of the findings illustrated in graphs, tables and statistical tests.		
			4 pts. General review of principal findings.		
			6 pts. Thorough review of the principal findings.		
DISCUSSION AND CONCLUSIONS	*Hypothesis evaluation.-*	**1 pts.** Incomplete or incorrect interpretation of findings.			
		2 pts. Correct but vague statement of acceptance or rejection of the hypothesis.			
		4 pts. Thorough, lucid acceptance or rejection of hypothesis.			
	Supporting statement.-	**2 pts.** Evidence supporting conclusion is not explicitly reviewed.			
		4 pts. Evidence supporting conclusion is reviewed generally.			
		6 pts. Evidence connected to hypothesis evaluation is thoroughly reviewed.			
	Sources of error.-	**1 pts.** Principal error sources are weakly or incorrectly stated.			
		2 pts. Principal error sources are stated generally.			
		4 pts. Error sources are thoroughly reviewed.			
Writing Quality					
	Organization	**2 pts.** Ideas leading to conclusions are weakly stated.			

		4 pts. Ideas are strongly stated, with a clear relationship between data, analyses and hypothesis evaluation.		
		6 pts. Ideas thoroughly and compellingly relate data and analyses to hypothesis evaluation.		
	Content	**2 pts.** Conclusions are supported by weak evidence.		
		4 pts. Correct but general evidence is cited in support of conclusions.		
		6 pts. Strong evidence is cited in support of conclusions.		
	Mechanics	**2 pts.** Grammar and usage significantly interferes with comprehension of the topic.		
		4 pts. Grammar and usage permits a general understanding of the topic.		
		6 pts. Grammar and usage are clear, concise and lucid.		
Format				
		2 pts. Format shows major departures from scientific paper requirements.		
		4 pts. Format shows minor departures from scientific paper requirements.		
		6 pts. Format follows requirements of scientific paper in detail.		