Issues in scientific writing

The major issues in scientific, as opposed to other formal writing.

Scientific argumentation

Sources of information

Original data: the methods for gathering the data are described. Data are interpreted.

Introduction

Materials and methods

Results

Discussion

Conclusions

References cited

Sources of information - literature

Primary sources: Original data are presented, methods of gathering and interpreting the data are described. Articles are reviewed by other scientists, who decide whether the paper should be published (peer review). (Scientific journals, symposium proceedings, some report series)

Sources of information - literature

Secondary sources: no original data are presented; original data presented by others are reviewed, synthesized. Sources are cited. Usually undergoes peer-review. (Most books, book chapters, symposium proceedings, some journal articles)

Sources of information - literature

Tertiary sources: even further removed from the original data. Sources usually not cited, usually reviewed in some way, but variably. (Encyclopedias, some books)

Sources of information - literature

Popular accounts: highly variable in quality, scholarly content, review procedure. Do not use for scientific scholarship. (Field and Stream, Audubon, Wyoming Wildlife, Sierra, American Hunter)

Sources of information – personal communications

Discouraged by most publications, prohibited by many journals.

Apples can be of any color (E. J. Miller, Wyoming Agriculture Department, Cheyenne, WY, pers. Commun).

Citation systems

Author-date

In text:

Apples can be of any color (Johnson et al. 1992).

References cited:

Johnson, F. G., J. B. Miller, and P. F. Smith. 1992. Apples. Horticultural Digest 4:12-18.

Citation systems

Science-Nature

In text:

Apples can be of any color[1].

References cited:

1. Johnson, F. G., et al. 1992. Horticultural Digest 4:12-18.

Organizational issues – review papers or introductions to data papers

1. Chronological organization
2. Alternating concepts or positions
3. Generalizations and examples, which order?
4. Writing about ideas v. scientists

1. Chronology

Thompson-Seton (1899) recognized the importance of late-successional forests to martens. By mid-century it was recognized that martens needed these habitats for predator avoidance (de Vos 1951). Later, Buskirk et al. (1989) showed that thermoregulation was an important use of structurally complex forests. Today, we recognize a wide range of needs met by these habitat types.

2. Concepts or positions

One hypothesis for the intermediate disturbance hypothesis states that mid-seral stages contain both early and late community members (Jones 1992, Miller 1998). A conflicting view states that some species are only found in mid-seral stages, and not earlier or later (Johnson 1977, Mead 1998).

3. Generalizations & examples

(G-E) The range of ecological relationships that are considered predatory has expanded through time. Originally, only the killing of one animal by another, followed by ingestion of part of the prey, was considered predation (Johnson 1877). More recently, animals that eat seeds have been considered predators (Smith 1946), as have ectoparasites that feed on their hosts. Even herbivores are considered by some (Miller 1968) to be predators, if they cause the death of the plant eaten.

3. Generalizations & examples

(E-G) Reverse the order of the above:

Fact 1 (ref), fact 2 (ref), fact 3 (ref), generalization about the facts presented (no ref).

4. Ideas vs. scientists

The choice: make scientists or other words the subject of sentences. Both can be successful; be careful about mixing them.

HIV causes AIDS (Johnson 1984).

Johnson (1984) showed that HIV causes AIDS.

Strength of assertions

Johnson and Smith (1985) proved that HIV causes AIDS.

Strength of assertions

Authors	Data (results)
proved	proved
showed, demonstrated, concluded, found	showed, demonstrated
	were consistent with
rejected the hypothesis that	suggested
suggested, implied	
	seem to suggest
	may suggest

Strong

Weak

Referencing

The purpose of referencing is to

a. give credit to someone for a fact or idea

b. allow the reader to go to the source of the fact or idea and examine it themselves

Tightness of referencing

Tight referencing places references close to the statement supported by the reference. Loose referencing places the reference after a whole series of statements.

Loose referencing

Exceptions in southern mountains aside, the Rocky Mountains are characterized by lower species diversity and higher population densities of passerines and raptors than the Sierra Nevada (Jones 1966, Miller 1975, Smith 1992, Johnson et al. 1994).

Tight referencing

Exceptions in southern mountains aside (Johnson et al. 1994), the Rocky Mountains are characterized by lower species diversity (Miller 1975) and higher population densities of passerines (Jones 1966) and raptors (Smith 1992) than the Sierra Nevada.

How much to cite

Provide references for statements that are not common knowledge.

Provide references for direct attributions.

Provide adequate, but not excessive, references to support the statement.

Direction attribution (quotation)

As Miller (1994:345) stated, ". . . the consequence of this interaction is that young men have higher rates of myelodysplasia."

Excessive direction quotation

Do not use extended direct attributions (quotations) unless paraphrasing will fail to capture some nuance of meaning.

Unneeded extended quotation

As Johnson (1998) stated, "The black-footed ferret was believed to be extinct in 1980, but was rediscovered in northwestern Wyoming in 1981. The population was monitored until 1986, when 17 ferrets were taken into captivity. These formed the basis of the captive breeding effort."

Citation overkill

The mule deer is an ungulate native to North America (Clark 1806, Miller 1892, Johnson 1912, Mead 1946, Smith 1973).

Scientific argumentation

1. Describing something
2. Setting up and resolving a paradox
   a. contradicting the results of previous work
   b. demonstrating, then resolving apparently contradictory statements
3. Testing hypotheses or predictions
4. Building a case for a point of view

Some conventions for most scientific writing

1. Identify abbreviations at first use, if the abbreviation will be used alone. Then, use the abbreviations.

The black-tailed prairie dog (BTPD) was present throughout the study area. The BTPD has not been studied in Nebraska.

Some conventions for most scientific writing

2a. Identify organisms by scientific name at first use of the common name, then use the common name.

The black-tailed prairie dog (*Cynomys ludovicianus*, BTPD*)* was present throughout the study area. BTPD were most common . . .

Some conventions for most scientific writing

2b. If no common name is available, identify organisms by scientific name throughout.

***Cynomys ludovicianus* was present throughout the study area. *C. ludovicianus* was most common . . .**

Writing for journals

What do journals look for in scientific writing?

Advice to authors, *Evolutionary Ecology Research*

Use English. Make it simple.

- **Avoid long, complex sentences.**
- **Use 'I' and 'me' if accurate.**
- **People from many subareas of biology read our journal. So keep jargon to the minimum that you absolutely need. And define all terms that might befuddle someone outside your narrow area.**
- **Use the active voice when you can. A good rule: Minimize the proportion of your sentences using the verb 'to be'. For example, write 'depends on' instead of 'is dependent on'.**
- **Treat abstract sentences like a disease. Cure them. For example, write 'species diversity declines at increasing latitude', not 'species diversity is related to latitude'. Make your sentences convey information.**

Advice to authors, *Nature* family of publications

***Nature* is read by scientists from diverse backgrounds. In addition, many are not native English speakers. Although a shared basic knowledge of biology may be assumed, please bear in mind that the language and concepts that are standard in one subfield may be unfamiliar to nonspecialists. Thus, technical jargon should be avoided as far as possible and clearly explained where its use is unavoidable. Abbreviations, particularly those that are not standard, should also be kept to a minimum. The background, rationale and main conclusions of the study should be clearly explained. Titles and abstracts in particular should be written in language that will be readily intelligible to any scientist. We strongly recommend that authors ask a colleague with different expertise to review the manuscript.**

Advice to authors, *Journal of Biology*

- **Check that your message is clear. It should be contained in the last sentence of the last paragraph of the Discussion.**
- **Check the structure of your article. Use paragraphs as your basic building blocks. The most important sentence of each paragraph should appear at the beginning of that paragraph, and these key sentences should lead on from one to another in a logical way.**
- **Check your facts. Make sure that everything is still reported accurately and that errors have not crept in.**
- **Check your references - Try to use them only to support the statements you are making, and not to show off your knowledge or plug your previous publications. Write them in the required style. Reread them to ensure that you are still quoting them correctly.**

Advice to authors, *Journal of Biology*

- **Get the basics of language right. Obey the basic rules of English grammar and spelling, and if you are not good in these area get help from someone who is. This is particularly important if English is not your first language.**
- **Keep your style as simple as possible Don't be afraid to use short words and short sentences - it will make your work accessible to a larger number of people internationally. Do not be afraid to say 'In this study we…' rather than the old fashioned and pompous 'It was discovered in this study that…'**

Writing backwards

1) Conclusions (what are your punchlines?)

2) Include only those results that contribute substantially to your conclusions

3) Include only those methods necessary to understand your results

4) The discussion should place your conclusions in context and refer to conflicting or corroborating studies

5) The introduction should set up the questions for which your results and conclusions are the answers