Society for Conservation Biology

GUIDELINES FOR WRITING SCIENTIFIC PAPERS

Africa Section Communications/Mentoring Program

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WRITING AND PUBLISHING SCIENTIFIC PAPERS

Poor writing is one of the principal reasons why many scientific papers are rejected by reviewers. Writing a paper is not easy. This document provides you with some basic guidelines that will help you improve your scientific writing skills, and increase your chances of publishing in peer-reviewed journals. The following points are important to keep in mind when writing a scientific paper[1]:

A) BEFORE YOU START

- **Originality** – Generate your own educated ideas, and be as innovative as possible when conducting research. This will help to raise the quality and impact of your papers.

- **Background knowledge** – Study the literature thoroughly before you begin writing your manuscript. It is crucial that you are aware of relevant classic papers, as well as recent work. Most universities have access to extensive digital libraries, and you should familiarize yourself with using them so that you can stay updated with the latest advances in your field of research. If you don't know where to start looking for relevant literature, try finding a review paper on a topic that is relevant to your work. Reviews often provide useful overviews of all the most relevant classics and recent papers. Also see section H for some helpful resources.
- **Consolidate essential information** – Make sure that you have all the necessary data available, including figures, graphs and tables, as well as a list of the most essential references.

B) TARGETING A JOURNAL

Your manuscript should be written according to the focus and style of the targeted journal. Before determining where to submit your manuscript, it is worth examining several recent issues of relevant journals in your field of research. When deciding on a journal, keep the following points in mind:

- What are the **aims** of the journal? This information can often be found on the journal's website.
- Which **audience** does the journal target? Does the journal have a broad audience, or does it focus on a specific field of science? Which audience is important for the message in your paper?
- What is the **impact** of the journal? See Box 1 for an explanation about impact factors, and Table 1 for some examples.

BOX 1. SCIENTIFIC IMPACT FACTORS

The impact factor of a scientific journal is a measure of how frequently this journal is used (cited) by researchers. Therefore, the impact factor is often used as an indicator of the importance of a journal to its field. Impact factors are calculated on a yearly basis using citation data drawn from over 7,500 scholarly and technical journals, and published in Thomson Scientific's Journal Citation Reports.

Publishing in high impact journals can help you in your future scientific career. However, as a beginning scientific writer you need to first focus on getting your information published. Aiming too high can sometimes be a rather discouraging experience, and it is often better to publish your data in a lower impact journal than not publish at all. Furthermore, it is important to know that the impact factor is not a direct measure the scientific quality of a journal or its contents. Journal impact factors depend on the research field. High impact factors are likely in journals that cover large areas of basic research with rapidly expanding but short-lived articles that use many references. Journals with a very specific focus often have low circulation numbers, and are unlikely to obtain high impact factors – regardless of the scientific merit of the papers within it. Therefore, you should never depend solely on the impact factor in your evaluations, but also pay careful attention to other important factors, such as the aims and audience of the journal.

[1] When corresponding with editors and reviewers, your draft paper is typically referred to as a manuscript. The manuscript formally becomes a paper after it is published in a scientific journal.

TABLE 1. EXAMPLES OF SCIENTIFIC JOURNALS AND THEIR IMPACT FACTORS

Journal	ISI Abbreviated Journal Title	Impact 2006[2]
African Entomology	Afr Entomol	0.613
African Invertebrates: a Journal of Biodiversity Research	n.a.	n.a.
African Journal of Ecology	Afr J Ecol	0.416
African Journal of Hydrobiology and Fisheries	n.a.	n.a.
African Journal of Marine Sciences	Afr J Mar Sci	1.086
African Zoology (former South African Journal of Zoology)	Afr Zool	0.408
Animal Conservation	Anim Conserv	1.926
Biodiversity Conservation	Biodivers Conserv	1.423
Biological Conservation	Biol Cons	2.854
Biological Invasions	Biol Inv	2.531
Conservation Biology	Cons Biol	3.762
Conservation Genetics	Cons Genet	1.429
Diversity and Distributions	Divers Distrib	3.441
East African Agricultural and Forestry Journal	n.a.	n.a.
Environmental Conservation	Environ Conserv	0.944
Journal of East African Natural History	n.a.	n.a.
Journal of Natural History	J Nat Hist	0.631
Journal of Tropical Ecology	J Trop Ecol	1.277
Journal of Wildlife Management	J Wildlife Manage	1.538
Nature	Nature	26.681
Ostrich: Journal of African Ornithology	Ostrich	0.256
Proceedings of the National Academy of Sciences of the USA	P Natl Acad Sci USA	9.643
Proceedings of the Royal Society of London B-Biological Sciences	P Roy Soc B-Biol Sci	3.612
Public Library of Science	PLoS	14.7
Quarterly Review of Biology	Q Rev Biol	5.944
Science	Science	30.028
Scientific American	Sci Am	1.560
South African Journal of Animal Science	S Afr J Anim Sci	0.215
South African Journal of Botany	S Afr J Bot	0.648
South African Journal of Science	S Afr J Sci	0.602
South African Journal of Wildlife Research	S Afr J Wildl Res	0.488
Systematic Biology	Syst Biol	7.748
Trends in Ecology and Evolution	Trends Ecol Evol	14.125
Tropical Freshwater Biology	n.a.	n.a.
Tropical Zoology	Trop Zool	0.522
Water South Africa	Water SA	0.494
Wildlife Monographs	Wildlife Monogr	2.333
Wildlife Research	Wildlife Res	1.032
Zoological Journal of the Linnean Society	Zool J Linn Soc	2.066

[2] Source: Thomson ISI Web of Knowledge. N.a. = Not available. Some journals are currently not indexed by the Thomson Scientific Journal Citation Reports.

C) OUTLINE

When you start writing the first draft of your manuscript, it may help to prepare a very rough outline covering only the most important points that you want to convey to your audience. Do not waste time on editing your draft and trying to make it perfect at this point. In the initial stages of writing it does not matter if your sentences are complete, just as long as you get your main points and ideas on paper.

Some people prefer beginning with the introduction and subsequently continue in logical order through each section of the paper. Others prefer to start with the easiest parts, which are usually the methods and results followed by the discussion and introduction. The abstract is typically written after the rest of the paper is completed.

1. TITLE

- The title should convey the **essence** of the article and draw the **attention** of the reader.
- Try to keep your title as clear and short as possible.
- Do not use abbreviations in the title and avoid jargon.

2. ABSTRACT

- The abstract should **summarize the objectives, methods, results and main conclusions** of the paper.
- The abstract is the advertisement for the paper, and it is often the only part many people read. Ideally, the abstract should be written in a way that gives away the clue of your paper but still makes people curious to read the whole story.
- Keep your abstract as concise as possible. Many journals have a maximum number of words that can be used for the abstract. Most abstracts consist of approximately 100-200 words.

3. INTRODUCTION

- The purpose of the introduction is to **provide essential background information**, and to generate interest in your paper. Do not assume that people will automatically be curious to read your paper. It is up to you to spark the interest of the reader by writing a good introduction.
- Keep the use of jargon to a minimum. If you cannot avoid it, then explain jargon to readers who are unfamiliar with the specifics. Also avoid abbreviations as much as possible, because they deter comprehension of your introduction.
- Briefly introduce the taxon or the system that you focus on in the paper so that the reader gains an appreciation for them. If you focus on taxa that are unfamiliar to most people, you should provide a brief account of pertinent information such as their natural history.
- The introduction should make clear why the topic of your paper is important, and provide the necessary information for the reader to evaluate and understand the relevance of your work. For instance, you could indicate why your approach is innovative or how your paper adds to previous work in the field.
- Always state the objective (main question, hypothesis) of your research *explicitly* in the introduction. Keep this objective clearly in mind when you write your manuscript.

- Make sure that the order in which you present information is logical. Most people start with providing information that places the paper in a wider framework, then zoom in on a particular problem, and finally mention the specific aims of their study.
- There must be a 1:1:1 correspondence between objectives stated in the introduction, methods and results. Do not make any promises in your introduction that cannot be kept based on your data.

4. METHODS

- The methods section must include **sufficient information to enable others to repeat your work**. It should also list the analytical methods used.
- Methods must be clearly related to your research question and objectives. Explain how you collected the data and how it relates to a research question that you stated in the introduction.
- Most scientific projects start off with a plan that changes during the course of research. Report what you actually did – not what you planned to do.

5. RESULTS

- This section should **summarize all the relevant data** collected and present the results of any analyses that were conducted.
- Figures and tables should be clear and relevant. Legends should be accurate and provide sufficient information for correct interpretation of the figures.
- Often (but not always) figures are used to convey ideas, whereas tables are used to convey data. Keep your figures and tables simple.
- When describing your data, it is generally better to report standard deviation (SD) instead of standard error (SE). Do not report the coefficient of variation (CV), since it adds no new information to the SD.
- Do *not* discuss your data here. Discussion and interpretation of results should take place in the next section of your paper.
- If you are certain that you used the appropriate statistical treatment for your data, but your analyses do not show the significant differences that you were hoping to find – be frank about this and do not manipulate your data to get a "better" result.
- Your results need not necessarily always agree with what other people have found. Unexpected results are often the most interesting. The most important thing is to always be honest about your data.

6. DISCUSSION

- The discussion is in many ways the most important section of your paper. The discussion should present an interpretation of your results, as well as a comparison with those of others. Just presenting a list of results is not enough for a scientific publication. You need to be able to **interpret your data, and draw conclusions**.
- Ensure that all your arguments and assumptions are scientifically formulated, clearly stated, and well-supported, either by your own results or by citing other people's work. All your statements must be accurate (true or falsifiable) and logical.
- A good paper can be read and evaluated on its own. Ensure that you have provided all the necessary information for your reader to make an independent judgment.

- Refer to the original objective (main question, hypothesis) of your research. Explain whether or not you have succeeded in reaching your objective.
- Make sure to explain why your results are of importance in a wider context.
- Some journals require you to formulate your conclusion in a separate section. If not, you should end the discussion with a concluding paragraph. If your data do not allow you to draw any firm conclusions, you can make generalized inferences. You may also end your paper with a section that discusses the relevance of your study system or with a general statement about the implications for future research.

7. REFERENCES

- It is important to stay updated with the latest literature. Always cite the most recent papers that are relevant to your work. It looks very unprofessional if you refer to a book from 1975 but neglect to cite a paper from 2002 providing new data and insights that are pertinent to your topic.
- Make sure that you **cite your sources properly**. Journals always provide guidelines on how to cite references, including scientific papers, book chapters, and even Internet sites. It is important that you *strictly* follow the format used by the journal to which you intend to submit your work.
- When citing a work by three or more authors, refer to them as "et al." in your paper. For instance: (Cohen, Bills, Cocquyt, and Caljon 1993) should be cited as: (Cohen et al., 1993). In the references section, you should list every author.
- Focus on **peer-reviewed scientific sources** of information to support the statements that you make in your paper. Peer-reviewed means that the editor of the journal and at least two peers (persons with expertise in the field) read and commented on the paper after it was submitted. Peer-reviewed papers are only accepted and published by the journal after the author has successfully addressed the concerns of the reviewers. The journals of all the major professional scientific societies are peer-reviewed. See section G for more information about the reviewing process.
- Manuscripts that are accepted for publication or in press can be cited as peer-reviewed papers (instead of noting the publication issue and page numbers, you add *in press*). Manuscripts that are in preparation or under review should be cited as personal communications within the text and NOT listed in the reference section.
- Try to avoid citing so-called 'grey' or 'gray' literature as much as possible. **Grey literature** includes all literature that is not peer-reviewed, such as unpublished reports, newsletters, working papers, theses, government documents, environmental impact reports, bulletins, fact sheets, book chapters and conference proceedings. Grey literature is not subject to the same degree of rigorous evaluation as peer-reviewed papers are. If you cannot avoid using grey literature you should be cautious about the risk that the authors may have used poor methods or jumped to unjustified conclusions.
- The same problems that exist with grey literature also count for the **Internet**. Therefore, you have to be extremely cautious when using the Internet as a source of data. Avoid referring to Internet sites, unless you can ascertain that they represent a reliable source, recognized authority or database (e.g. IUCN Red List database, UNEP WCMC Global Biodiversity Atlases, or FAO Fishbase).
- When citing **personal communications** with other experts, it is your responsibility to cite only reliable sources and recognized authorities. Do not list personal communications in the references section
- **Do NOT plagiarize other people's work**. Plagiarism means literarily copying or using someone else's words, ideas or results without any attribution. Plagiarism is highly unethical and qualifies as a

form of scientific misconduct. If you use someone else's words, ideas or results, you should always acknowledge this and refer to the original source.

- Avoid literally copying text, unless it is functional (e.g., if you want to emphasize its original meaning or phrasing). When using original text, *always* use quotation marks.
- Before submitting your manuscript, always make sure to check if your reference list is complete!

D) FORM & STYLE

- Your writing style is important because it determines the way your reader perceives your paper. Writing is an art in itself, but you can learn a lot from other people's work. Spend a few hours reading papers to see how they are structured. Carefully pay attention to how material is allocated to the introduction, methods, results, and discussion.
- Brevity and clarity are very important in scientific papers. Endless sentences discourage most readers, so it is best to avoid them. The best papers are those that convey a strong message using few words. Maximum readability is achieved by keeping your sentences concise and straightforward. Avoid using unnecessary words. Exclude all information that is not relevant to your hypothesis and/or that cannot be verified.
- The text always becomes clearer and shorter with verbs in the active voice. Avoid writing in the passive voice where possible. For instance, you should write "We conducted a pilot survey" instead of "A pilot survey was conducted".
- As a rule, the majority of your sentences should contain about 15-20 words, and paragraphs should contain approximately 150-200 words.
- If necessary, use prepositional phrases to minimize long strings of nouns. This helps to maintain the flow of your paper.
- Always ensure that there is a clear and logical continuation from the introduction through the methods and results to the discussion section.
- Divide blocks of text different paragraphs. The first line of a new paragraph should be indented (using a default left tab stop of 0.63 cm or less).
- Always keep the text left-justified (i.e., with a ragged right margin). In tables only the first column is usually left-justified, and the rest centered.
- Do not include figures and tables within the text, but place them at the end of the paper (after the references).
- Every journal follows different standards with respect to formatting of their papers. This includes the maximum number of words that can be used, the order in which information is presented, the way references are completed, etc. Failure to comply with formatting rules can result in immediate rejection, so make sure that you follow the journal's instructions carefully.
- The journal is responsible for the final layout of your paper.

E) GENERAL POINTS

- Get in the habit of reading scientific papers on a regular basis. In addition to learning about the scientific topic, pay attention to what you can learn about scientific writing.

- Proofreading and editing your own work can be difficult sometimes. It often helps to put your manuscript aside for at least one day. This will allow you to distance yourself from it, so that you can look at your manuscript from a fresh perspective.
- When you revise your paper, try to look at it from the point of view of a critical reviewer. Ask yourself the following questions: Does every sentence make sense? Is every sentence useful? Does the text follow a logical order? Is the main message conveyed in a clear and concise manner?
- Hand in drafts to your coauthor(s) way ahead of a final deadline, if possible. This will allow you to get the critical feedback that your work may need.
- Papers often have more than one author. Co-authorships are subject to several unwritten rules. The first author is often the person who designed the research, collected most of the data, and put in most effort to write the actual paper. If someone either (i) contributes substantially to the conception of the initial ideas for your paper, or (ii) helped with the design, data collection, analysis, or interpretation of the data, or (iii) helped draft or revise the paper, then you should consider this person as a co-author.
- The last author does not necessarily have much input in the actual writing of the paper, but is typically a supervisor, or the person who runs the lab where the research was conducted.

F) SUBMITTING YOUR PAPER

There are a few important points to keep in mind before you send your drafts out for review:

- Make sure that you refer to *all* the figures and tables you include in the paper.
- Mistakes such as spelling errors, sloppy citing, mislabeled figures, inaccurate taxonomic names, and unfinished sentences are inexcusable. They can make reviewers really grumpy, so make sure that you use a spelling and grammar checker. Thoroughly check the literature cited and make sure it follows the journal's format. Scrupulously scan your manuscript for mistakes one more time before you submit it.
- Your paper should be accompanied by a cover letter (maximum 1 page). In this letter, you present your manuscript to the editorial board of the journal you aim to publish in. The cover letter should make clear that your manuscript is important and fits the requirements of the journal.

G) THE REVIEWING PROCESS

Before a paper is published, it typically undergoes several rounds of editing. You will receive comments from your co-authors as well as reviewers. Learning how to deal with criticism is something that every scientist needs to go through. Remember that critique of your paper is not personal. Never simply ignore comments. Try to see them as something positive that you can learn from, and use them to improve the quality of your scientific writing.

- When resubmitting your manuscript, it should be accompanied by a response letter. This letter should address *all* the points raised by the reviewers. The best way to do this is to repeat and number each point in your cover letter. Response letters are often several pages long.
- Either deal with questions or objections in a revised manuscript (even if they cannot be definitely answered), or justify in your response letter why you choose not to deal with them in your revision.
- If a reviewer misunderstood something in your paper, it is likely that you did not express your idea or data clearly enough.
- Always respond positively and constructively to feedback or criticism of your paper.

H) RESOURCES

The following resources may be very useful when writing a scientific paper:

- **African Journals Online** (AJOL) provides a good overview of journals that are published in Africa: http://www.ajol.info
- **Online Access to Research in the Environment** (OARE) provides students and researchers in more than 100 developing countries with the opportunity to access to one of the world's largest collections of literature in environmental science research for free. See: http://www.oaresciences.org
- **Google Scholar** is an easy way to find scientific literature on a wide variety of topics. The big advantage of Google Scholar is that it is a free and simple service, which can be used by anyone with a computer and access to the Internet. http://scholar.google.com
- **ISI Web of Science** (WoS) provides an information platform where you can search one of the most comprehensive online scientific literature databases. WoS enables you to quickly find the most recent papers on a certain topic. You can also easily find out how many times a paper is cited, and you can see who cites who. Note that your institution will need to sign up with Thomson Scientific before you can get access to WoS. See: http://isiknowledge.com and http://scientific.thomson.com
- **Personal websites** of researchers can sometimes be useful places to find papers. If you cannot access a specific paper through the digital library of your university, you might be able to find a PDF file on the personal website of one of its authors.
- **The Tropical Biology Association** (TBA) organizes annual workshops on scientific writing for African scholars. The TBA has published a Skills Series that also includes a document on scientific writing and publishing, which can be downloaded from their website. See: http://tropical-biology.org
- **Purdue Online Writing Lab** offers a variety of useful resources, ranging from suggestions for scientific writing and style guides to special worksheets for non-native English speakers. See: http://owl.english.purdue.edu/owl

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