Standardising Peer Review in Paleontology journals

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Introduction

Peer review is widely considered to be fundamental in maintaining the rigour and validity of scholarly research. However, the process is often opaque, which can introduce bias into reporting standards for research and impact the overall quality of the published record.

Presently, peer review is a non-standardised process, either across or within disciplines. Training and support is generally lacking, and it is often the case that reviewers, through no fault of their own, are unaware of the critical questions to be asking with respect to research design, methods, reporting, and analysis. Given that there are over 200 journals that publish palaeontology research (Tennant and Lomax, 2019), this can make the process confusing for reviewers, irrespective of their relative expertise.

The aim of this project is to formulate a clear set of guidelines explicitly for reviewers in palaeontology journals, or multi-disciplinary journals that include palaeontology submissions. Through this, peer review can be more transparent and as objective as possible, representing a form of peer review best practice. It can also help to improve the soundness and reporting standards for paleontology research as a whole.

These guidelines were inspired by Parker et al. 2018, who created a similar checklist for the fields of ecology and evolution. Some of these points are adapted from the TTEE (Tools for Transparency in Ecology and Evolution) guidelines.

Guidelines

These guidelines are presented in a way that reflects the typical structure for research articles. Specific sections are provided for articles that either involved quantitative research or the use of fossil specimens.

Some of the items in this checklist will not be applicable to different types of research paper.

General

- Have any relevant funding sources been disclosed
- Have any relevant conflicts of interest been disclosed
- Have any previous versions of this work been indicated (e.g., preprints or pre-registrations)
- Is the language used appropriate for a scientific publication
- Is the manuscript structure appropriate

Figures

- Are any figures legible, relevant, and integrated into the text

Tables

- Are any tables legible, relevant, and integrated into the text

Supplementary files

- Are all supplementary files provided in non-proprietary formats and in a sustainable manner
- Are all supplementary files referenced within the main text

Abstract

- Is the abstract concise, conveying the main research findings
- Are any key conclusions missing

Introduction

- What type of study is this (e.g., replication, exploratory, meta-review)
- What is the primary purpose for conducting this study
- Is this part of a larger study, or a one-off
- What are the specific research questions addressed
- What is the scope of the study
- Is the published literature covered sufficiently
- Are any critical published articles missing
- Are any appropriate angles or context missing
- Is the history of the research sufficiently described

Methods

- Are the methods reported in sufficient detail and clear enough to allow another researcher to gather the same data and run the identical analyses?
- When was this study started and for how long was its duration

Data collection

- Are the supporting data included in the manuscript or in a relevant repository
- Are the data presented in a way that is consistent with the FAIR principles
- When were the data collected
- Did the authors develop their analysis plan, including choices of variables, without looking at the data, for instance prior to gathering data or with a dummy data set?
- What were the conditions under which the data were collected or extracted
- Why was this study design selected
- Provide the precise details of data analysis, including information on software programs and packages, and annotated full code or set of commands.
- Are all information sources described, including accession dates
- Were data collected and vetted by all, some, or just one of the authors

- Were data obtained from previously published sources, or unpublished sources

- Is justification given for data that were ccollected but not including in the final analyses

- Were any assumptions, simplifications, or transformations to the data made

- Are any methods of weighting applied, and justifications for this given

- Are potential biases assessed and, if so, mitigated (e.g., publication bias, missing data, or selective reporting within studies)

- Complete and explicit database search terms including all logical connectors and operators sufficient to exactly duplicate search. Also, indicate all other sources of data (e.g. literature cited sections of published reviews, personal unpublished data, collaborative group project data available from cited sources or online).

- Are model selection criteria provided

Involving fossil specimens

- If relevant, possible and allowable, deposit voucher specimens of the studied taxon/taxa in an appropriate curated collection

- Are all analysed specimens available in a public and curated repository, and with accession numbers

- Were all relevant permits and permissions obtained to study specimens, and to publicise them

- Are all relevant contextual information provided, including:

  - Taxon name
  - Taxon level
  - Age of specimen, both stratigraphically and in Ma
  - Horizon of discovery, including bed, member, formation, and group
  - Lithology specimen discovered in, and environmental interpretations
  - Geographic location of specimen, including GPS co-ordinates and latitude and longitude
  - Discoverer of speciment, and date of discovery
  - Previous taxonomic diagnoses and information, including synonyms
  - Relevant type and referred specimens
  - Original, revised, or emended diagnoses
  - Taphonomy of specimen and mode of preservation
  - Methods of collection
  - Methods of preparation
  - Completeness of specimen and articulation
  - Any associated fossils

Involving quantitative analysis

- What statistical tests were formed, and why were they chosen

- What is the total sample size

Software environment

- Are all software and scripts identified, including their versions and availability

- Is the full model specification provided, including specific parameter choices and their justification

- Are all software and scripts available in a public repository and under an appropriate FOSS license

- Are code scripts appropriately annotated to faciliate easier understanding

Results

- Are the results presented in a clear and coherent manner
- Are the results reported in a way that is supported by the data
- Is sufficient justification given for the erection of new taxa

Involving quantitative analysis

- Are the full outcomes of statistical tests reported, including basic parameter estimates of central tendency (e.g., means), other basic estimates (e.g., regression and correlation coefficients), and variability (e.g., standard deviation) and associated estimates of uncertainty (e.g., confidence or credibility intervals)
- Are appropriate test statistics reported, including the degrees of freedom and p-values.
- For Bayesian analyses, this also should at a minimum include information on choice of priors and MCMC (Markov chain Monte Carlo) settings (e.g. burn-in, the number of iterations, and thinning intervals).

Involving fossil specimens

- Is the morphology described in a systematic manner
- Are enough supporting images provided to illustrate relevant morphologies
- Are sufficient measurements provided

Discussion

- Is the strength of the evidence evaluated and interpreted
- Are the sample sizes large enough to justify the authors' conclusions? If presenting significance tests, how much power would this study have to detect statistically significant weak, moderate and strong effects?
- Are potential sources of bias, and their consequences, appropriately evaluated and interpreted
- Do the results contribute to the research field, irrespective of whether they are 'negative' or a replication study
- Are the new results placed into sufficient context of the relevant literature
- Are all arguments balanced
- Are the full implications of the new results discussed in sufficient detail

Conclusions

- Are the conclusions supported by the results
- Are the conclusions consise and not over-embellished

Discussion

Here, we provide no recommendations about how researchers should subjectively assess the 'impact' or 'quality' of a study.

This checklist is not designed as a replacement for critical thinking and the application of wider forms of expertise.

It is designed to provide a baseline standard for research such that minimum standards of reporting quality are met.

Individual reviewers can find this useful. Journals can also integrate these guidelines into their reviewer policies as part of ensuring that they are faciliating peer review to a sufficient quality standard.

References

Morey et al. 2018

TOP Guidelines