Conservation Biology

Editorial

Promoting transparency in conservation science

Transparency is a hallmark of effective science. If results are not shared openly or one cannot determine how results were derived, the progress of science is impeded. Most scientists understand this core principle, but its benefits are not always considered during design and publication of studies. Benefits of transparency include accurate interpretation of results, a reduction in bias, a greater capacity to include results in data syntheses, and facilitation of the updating and replication of studies. Without institutional support, however, practices that promote transparency are not nearly as common as they should be, despite the commitment of many in the scientific community. For instance, authors often fail to report basic information such as sample sizes, directions of effects, and measures of variation for all or a subset of the results they report (e.g., Fidler et al. 2006; Parker 2013; Ferreira et al. 2015). Underreporting of results is more likely in cases where the statistical relationships reported are weak or not significant (Cassey et al. 2004; Parker 2013). This bias in data reporting can alter the interpretation of conclusions and undermine the validity of reviews and future research syntheses. Similarly, there is evidence that weak effects are likely to go entirely unreported (Csada et al. 1996; Møller & Jennions 2002; Fanelli 2010), again resulting in a misleading picture of scientific outcomes in the literature. Important details regarding experimental design, study location, and statistical models are also often missing (Mislan et al. 2016), further hindering interpretation, evaluation, and replication.

Journals are well poised to play a pivotal role in promoting transparency because articles specifically include methods and results sections and authors are held to strict reporting standards as conditions for publication. In the digital era, there are relatively few intrinsic barriers to including the additional information required for transparency either as supplementary information or in data repositories. Recognition of the role of journals in promoting transparency has led to widespread adoption of data-sharing policies by journals in ecology and evolutionary biology in recent years (Whitlock et al. 2010).

In November 2015, representatives of nearly 30 journals in conservation, ecology, and evolution joined researchers and representatives of funding agencies to identify ways to improve transparency in these disciplines. This workshop (funded by the U.S. National Science Foundation and by the Laura and John Arnold Foundation and hosted by the Center for Open Science) identified general principles and specific tools that journals can adopt to encourage greater transparency of the science they publish. Most of the ideas that emerged from the workshop fit well within the recently developed Transparency and Openness Promotion (TOP) framework (https://cos.io/top/) (Nosek et al. 2015). The TOP framework contains suggested guidelines for journals and funders designed to be useful across the breadth of empirical disciplines. These TOP guidelines are suggested standards for archiving of data, code, and other potentially useful content; citation of archived content; reporting details of study methods and results; preregistration of study analysis plans; and study replication. The guidelines and discipline-specific explanations of these guidelines for ecology, evolution, and conservation developed at the November 2015 workshop are available from https://osf.io/g65cb/; this document is referred to as Tools for Transparency in Ecology and Evolution (TTEE). Both the general TOP guidelines and the discipline-specific interpretations, including examples of checklists, will be updated through formal review processes.

As part of its strategy to encourage greater transparency, *Conservation Biology* has implemented a transparency checklist for authors to complete when they submit a paper. The checklist is devised to encourage authors to think about the level of transparency in their manuscripts, and the questions are related to hypotheses, description of methods and statistical analyses, reported results, and provision of information needed for the study to be reproduced. What qualifies as thorough design and analysis transparency varies among disciplines, so *Conservation Biology*'s checklist was composed to accommodate the wide variety of disciplines represented in the journal.

Science stands to derive major benefits as journals move to adopt transparency standards. A deliberate approach from *Conservation Biology* and other journals to promote transparency will facilitate consistent outcomes, clear interpretation of published methods and results, reduced bias in the results available to the scientific community, more effective meta-analytical synthesis, and improved opportunities to update and replicate studies. These outcomes will be an important legacy for the future of conservation science.

Conservation Biology, Volume 30, No. 6, 1149–1150

DOI: 10.1111/cobi.12760

Acknowledgments

The participants in the workshop on Improving Inference in Evolutionary Biology and Ecology (IIEE) made possible both this editorial and the Tools for Transparency in Ecology and Evolution (TTEE). The list of workshop participants is available from https://osf.io/dhp3t/. The IIEE workshop was funded by the Laura and John Arnold Foundation and the U.S. National Science Foundation (DEB: 1548207). The Center for Open Science hosted the meeting and provided valuable logistical support.

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Literature Cited

Cassey P, Ewen JG, Blackburn TM, Møller AP. 2004. A survey of publication bias within evolutionary ecology. Proceedings of the Royal Society of London B: Biological Sciences **271:**S451–S454.

Csada RD, James PC, Richard HME. 1996. The "file drawer problem" of non-significant results: Does it apply to biological research? Oikos **76:**591–593.

Fanelli D. 2010. "Positive" results increase down the hierarchy of the sciences. PLOS ONE **5** (e10068) DOI: 10.1371/journal.pone.0010068.

Ferreira V, Castagneyrol B, Koricheva J, Gulis V, Chauvet E, Graça MAS. 2015. A meta-analysis of the effects of nutrient enrichment on litter decomposition in streams. Biological Reviews **90:**669–688.

Fidler F, Burgman MA, Cumming G, Buttrose R, Thomason N. 2006. Impact of criticism of null-hypothesis significance testing on statistical reporting practices in conservation biology. Conservation Biology **20:**1539–1544.

Mislan KAS, Heer JM, White EP. 2016. Elevating the status of code in ecology. Trends in Ecology & Evolution **31:**4–7.

Møller AP, Jennions MD. 2002. How much variance can be explained by ecologists and evolutionary biologists? Oecologia **132:**492–500.

Nosek BA, et al. 2015. Promoting an open research culture. Science **348:**1422–1425.

Parker TH. 2013. What do we really know about the signalling role of plumage colour in blue tits? A case study of impediments to progress in evolutionary biology. Biological Reviews **88:**511–536.

Whitlock MC, McPeek MA, Rausher MD, Rieseberg L, Moore AJ. 2010. Data archiving. The American Naturalist **175:**E45–E146.