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EDITORIAL

Implementing the Transparency and Openness Promotion Guidelines for data and code to support computational reproducibility within the *New Zealand Journal of Ecology*

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Reproducibility of scientific results is a fundamental component of the scientific method as scientists, policymakers, and the public can have greater confidence in observations and findings that can be verified by independent scientists. However, a recent survey (Baker 2016) highlighted that the majority of scientists have concerns about scientific reproducibility (Fig. 1a). While ecological fieldwork can never be truly reproducible, ecologists can strive for computational reproducibility by adopting open science practices for their raw data and computer code (Powers & Hampton 2019). Indeed, the lack of availability of raw data (Fig. 1b) and computer code that analyses that data (Fig. 1c) are major obstacles to reproducibility (Baker 2016). As a result, open access to data and code is now encouraged via top-down processes such as the New Zealand Government Open Access and Licensing (NZGOAL) framework (New Zealand Government 2021).
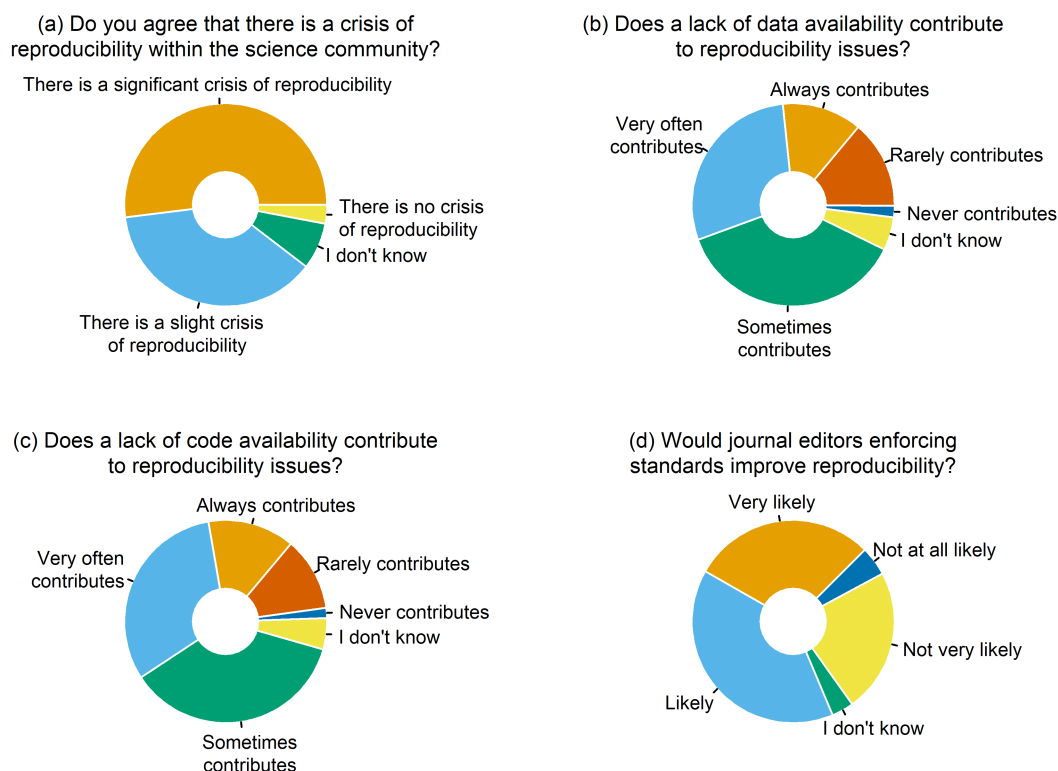
Figure 1. Summary of responses from 1576 scientists to a survey about reproducibility in science (Baker 2016) for four specific questions about (a) the problem scientific reproducibility, the importance of (b) data and (c) code availability for reproducibility, and (d) the potential for journals standards to improve reproducibility.

Further, open access to data and code is being encouraged via bottom-up processes as ecologists recognise the benefits that open science practices bring to their work (Lowndes et al. 2017).

Given these shifts towards open science practices around data and code for computational reproducibility, it is perhaps unsurprising that the *New Zealand Journal of Ecology* has recently seen an increase in the number of papers published for which the authors wish to share the data or code underpinning their work (e.g. McArthur et al. 2019; Wood et al. 2020; Gollin et al. 2021; McCarthy et al. 2021; Moloney et al. 2021). The *New Zealand Journal of Ecology* does not currently have any policies or processes around data and code associated with its articles, even though journal standards are recognised as a mechanism that could help improve reproducibility (Fig. 1d). Therefore, to meet the needs of our authors and to encourage reproducible research, the *New Zealand Journal of Ecology* has chosen to adopt the Transparency and Openness Promotion (TOP) Guidelines (Nosek et al. 2015) for journal standards.

The TOP Guidelines, in particular those around data and code, align well with ecological research (Parker et al. 2016) and have been widely adopted by ecological journals, such as those of the British Ecological Society and the Ecological Society of America (Center for Open Science 2021). The TOP data and code guidelines have a series of expectations representing increasing levels of support for reproducibility (Table 1).

In choosing a TOP Guideline level for data and code the *New Zealand Journal of Ecology* seeks to adhere to the principle of "situated openness" from the Open and Collaborative Science Manifesto (Albornoz et al. 2019); that is, "A concept that assumes knowledge is situated within particular historical, political, and socio-cultural relations. It addresses inequalities and hierarchies of knowledge production and its inherent conflicts." As the *New Zealand Journal of Ecology* introduces these guidelines, editors need to be aware that many factors affect an individual's willingness or ability to share data and code. So, for the journal to provide an inclusive venue for knowledge sharing it must allow authors to engage with openness in a way that is acceptable to them. Hopefully, adopting this approach will minimise the risk of amplifying existing disparities in knowledge production that could be caused by mandating universal and compulsory data and code sharing practices. For example, while early career researchers tend to engage more with open science practices, given the current incentive structures they may prefer to invest their time in producing more traditional scientific outputs to maximise the likelihood of securing their next position (Allen & Mehler 2019; Toribio-Flórez et al. 2021). Likewise, failing to adapt open science practices to recognise indigenous data sovereignty principles (Carroll et al. 2021) could exacerbate the very low proportion of mātauranga Māori published within the *New Zealand Journal of Ecology* (Wehi et al. 2019).

Given these considerations around situated openness, the *New Zealand Journal of Ecology* has chosen to implement Level 1 of the data and code TOP Guidelines as of January 2022; 46(1). The Level 1 requirements are that while there are no expectations to share data or code, authors will be required to be clear about the situation. Simply stating if data or code are openly available or not can be extremely helpful, as attempting to ascertain this fact directly from the authors can be difficult and time-consuming, given the rate at which corresponding author emails cease to function (Vines

Table 1. Transparency and Openness Promotion (TOP) Guidelines for data and analytic methods (code) transparency (Nosek et al. 2015).

	Not Implemented	Level 1	Level 2	Level 3
Data Transparency	Journal encourages data sharing—or says nothing.	Article states whether data are available and, if so, where to access them.	Data must be posted to a trusted repository. Exceptions must be identified at article submission.	Data must be posted to a trusted repository, and reported analyses will be reproduced independently before publication.
Analytic methods (code) transparency	Journal encourages code sharing—or says nothing.	Article states whether code is available and, if so, where to access them.	Code must be posted to a trusted repository. Exceptions must be identified at article submission.	Code must be posted to a trusted repository, and reported analyses will be reproduced independently before publication.

Table 2. Example data and code availability statements.

Data statements	Code statements
There are no data associated with this article.	There is no code associated with this article.
There are no publicly available data associated with this article.	There is no publicly available code associated with this article.
We cannot provide our raw data publicly as we do not consider it ethical to do so.	The code from this article is openly available at [*insert link to location*]
We cannot provide our raw data publicly due to privacy, but an anonymised version of the data that can be used to replicate our analysis can be accessed at [*insert link to location*]	
Licensing conditions of the data used in this paper do not allow redistribution, but the data can be accessed at [*insert link to location*]	
The data from this article are openly available at [*insert link to location*]	

et al. 2014). Beginning at Level 1 also means that there are no expectations about where authors choose to make their data and code openly available. The ideal would be to use a trusted and stable repository that generates a digital object identifier (DOI) for the archived code and data; again, using a stable and persistent DOI facilitates retrieving data (and most likely also code) from authors in the long term (Vines et al. 2014). In our experience, many organisations provide their staff access to DOI generating institutional repositories, and for those without institutional access there are freely available services that can be used. In any case, at Level 1 the *New Zealand Journal of Ecology* will continue to accept data and code as supplementary material. The *New Zealand Journal of Ecology* website has now been updated to allow publication of additional file types, including .zip, to allow for the inclusion of a folder containing multiple data or code files. So for the present, *New Zealand Journal of Ecology* will only require authors to include a specific data and code availability statement (for example statements see Table 2).

By implementing this policy, the *New Zealand Journal of Ecology* aligns itself not only with other major journals in the field, but also the expectations of our community of authors who are already making their data and code openly available. While this new policy does not expect or require any data or code sharing, we wish to encourage the sharing of data and code, so that the *New Zealand Journal of Ecology* will be supporting scientific reproducibility and benefitting our authors. Open science practices often benefit the individual researcher with increases in citations, media attention, potential collaborators, job opportunities, and funding opportunities (McKiernan et al. 2016). We would therefore hope that authors will see data and code sharing as much as an opportunity as an administrative burden. For potential authors wanting to know more about sharing data and code, the British Ecological Society has produced a series of guides to better science (https://www.britishecologicalsociety.org/publications/guides-to/) that provide succinct and accessible overviews and advice on best practices for both data management and reproducible code.

Data availability

The data from this article are openly available at https://doi.org/10.6084/m9.figshare.3394951.v1

Code availability

The code from this article is openly available at https://doi.org/10.7931/tqw7-2g75

Author contributions

TRE conceived the idea and conducted the data analysis. TRE, JMRB, GLWP and SVW developed the idea and wrote the manuscript.

References

Albornoz D, Hillyer B, Posada A, Okune A, Chan L 2019. Principles for an inclusive open science: the OCSDNet Manifesto. In: Chan L, Okune A, Hillyer R, Albornoz D, Posada A eds. Contextualizing openness: situating open science. Ottawa, University of Ottawa Press. Pp. 23–50.

Allen C, Mehler DMA 2019. Open science challenges, benefits and tips in early career and beyond. PLoS Biology 17: e3000246.

Baker M 2016. 1,500 scientists lift the lid on reproducibility. Nature 533: 452–454.

Carroll SR, Herczog E, Hudson M, Russell K, Stall S 2021. Operationalizing the CARE and FAIR Principles for Indigenous data futures. Scientific Data 8: 108.

Center for Open Science 2021. Transparency and Openness Promotion Guidelines. https://www.cos.io/initiatives/top-guidelines (Accessed 9 July 2021).

Gollin JF, Gorman N, Armstrong DP 2021. Twenty years on: changes in lizard encounter rates following eradication of rats from Kāpiti Island. New Zealand Journal of Ecology 45: 3423.

Lowndes JSS, Best BD, Scarborough C, Afflerbach JC, Frazier MR, O'Hara CC, Jiang N, Halpern BS 2017. Our path to better science in less time using open data science tools. Nature Ecology & Evolution 1: 0160.

McArthur N, Boulton RL, Richard Y, Armstrong DP 2019. The role of pine plantations in source-sink dynamics of North Island robins. New Zealand Journal of Ecology 43: 3362.

McCarthy JK, Leathwick JR, Roudier P, Barringer JRF, Etherington TR, Morgan FJ, Odgers NP, Price RH, Wiser SK, Richardson SJ 2021. New Zealand Environmental Data Stack (NZEnvDS): A standardised collection of spatial layers for environmental modelling and site characterisation. New Zealand Journal of Ecology 45: 3440.

McKiernan EC, Bourne PE, Brown CT, Buck S, Kenall A, Lin J, McDougall D, Nosek BA, Ram K, Soderberg CK, Spies JR, Thaney K, Updegrove A, Woo KH, Yarkoni T 2016. How open science helps researchers succeed. eLife 5: e16800.

Moloney PD, Forsyth DM, Ramsay DSL, Perry M, McKay M, Gormley AM, Kappers B, Wright EF 2021. Occupancy and relative abundances of introduced ungulates on New Zealand's public conservation land 2012–2018. New Zealand Journal of Ecology 45: 3437.

New Zealand Government 2021. NZGOAL (New Zealand Government Open Access and Licensing) framework. https://www.data.govt.nz/toolkit/policies/nzgoal/ (Accessed 9 July 2021).

Nosek BA, Alter G, Banks GC, Borsboom D, Bowman SD, Breckler SJ, Buck S, Chambers CD, Chin G, Christensen G, Contestabile M, Dafoe A, Eich E, Freese J, Glennerster R, Goroff D, Green DP, Hesse B, Humphreys M, Ishiyama J, Karlan D, Kraut A, Lupia A, Mabry P, Madon T, Malhotra N, Mayo-Wilson E, McNutt M, Miguel E, Levy Paluck E, Simonsohn U, Soderberg C, Spellman BA, Turitto J, VandenBos G, Vazire S, Wagenmakers EJ, Wilson R, Yarkoni T 2015. Promoting an open research culture. Science 348: 1422–1425.

Parker TH, Nakagawa S, Gurevitch J, IIEE (Improving Inference in Evolutionary Biology and Ecology) workshop participants 2016. Promoting transparency in evolutionary biology and ecology. Ecology Letters 19: 726–728.

Powers SM, Hampton SE 2019. Open science, reproducibility, and transparency in ecology. Ecological Applications 29: e01822.

Toribio-Flórez D, Anneser L, deOliveira-Lopes FN, Pallandt M,

Tunn I, Windel H 2021. Where do early career researchers stand on open science practices? A survey within the Max Planck Society. Frontiers in Research Metrics and Analytics 5: 586992.

Vines TH, Albert AYK, Andrew RL, Débarre F, Bock DG, Franklin MT, Gilbert KJ, Moore J-S, Renaut S, Rennison DJ 2014. The availability of research data declines rapidly with article age. Current Biology 24: 94–97.

Wehi PM, Beggs JR, Anderson BJ 2019. Leadership and diversity in the New Zealand Ecological Society. New Zealand Journal of Ecology 43: 3368.

Wood JR, Richardson SJ, McGlone MS, Wilmshurst JM 2020. The diets of moa (Aves: Dinornithiformes). New Zealand Journal of Ecology 44: 3397.