

# Open Code in Ecology and Evolutionary Biology: An Evidence-Based Appraisal by SORTEE

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## Summary

1. Open Code is the practice of publicly archiving analysis or software code in a manner that follows FAIR (Findable, Accessible, Interoperable, and Reusable) guiding principles. This allows for increased transparency of data processing and analysis, and facilitates computational reproducibility of research results.
2. The empirical evidence for the general benefits of Open Code mostly focuses on the increase in computational reproducibility and citation count. Without code, the ability to computationally reproduce results is limited. However, even when present, low-quality code can still hamper reproducibility. The evidence for increased citation counts is mixed. There is no empirical evidence of any cost to Open Code.
3. Research in Ecology and Evolution focuses predominantly on the availability of Open Code alongside published articles, which remains low.

## What is Open Code, and why is it important

Open Code refers to the practice of providing analysis or software code in a manner that follows FAIR guiding principles (Findable, Accessible, Interoperable, and Reusable; see [Wilkinson et al. 2016](#); see [Barker et al. 2022](#) for a code-oriented version of the FAIR guiding principles) and is suggested to be one of the key components of the ongoing ‘Credibility Revolution 2.0’ ([Marcus, 2025](#)). Open Code promotes transparency (the act of making research visible), allows for the repurposing of existing code and material, and importantly, when provided along with data, can allow for computational reproducibility of results (defined here as “the ability to produce consistent results using the same input data and analysis code”; [National Academies of Sciences, Engineering, and Medicine 2019](#), p46); all together, this builds trust and credibility in the published results ([Cadwalader & Hrynaszkiewicz, 2022](#); [Marcus, 2025](#)). Furthermore, making code open and available during the peer review process provides reviewers with deeper insight into the methods and allows authors to double-check their code for errors ([Fernández-Junicio, 2021](#)).

## General research on the costs and benefits of Open Code

There is little research on the costs and benefits of Open Code. The majority of research focuses on the impact of Open Code on computational reproducibility. Rather unsurprisingly, access to analytical code was found to be the strongest predictor of successful

computational reproducibility in the Journal of Memory and Language ([Laurinavichyute et al., 2022](#)). However, the provision of code alone does not guarantee computational reproducibility; functionality (i.e., whether code executes and runs) is another vital component. For instance, in articles from the journals Copernicus and Journal of Statistical Software, [Konkol et al. \(2019\)](#) found that even when software code was available, 39/41 articles encountered errors that caused the code to not run. In addition, when assessing 2000 replication datasets and 9000 R files from the Harvard Dataverse, [Trisovic et al. \(2022\)](#) found that only 26% ran without error in the first execution, which increased to 44% after code cleaning. Furthermore, even when code is available and functional, reproducibility is not always successful (i.e., the attempt to reproduce the results of a study yields different results). For instance, depending on strictness of criterion, the results of between 34% ( $n = 20$ ) and 56% ( $n = 33$ ) of 59 articles could be reproduced in the Journal of Memory and Language in 2019 ([Laurinavichyute et al., 2022](#)).

Apart from increasing transparency and computational reproducibility, it has also been suggested that Open Code may lead to an increased number of citations ( ([Vandewalle, 2012](#); [Colavizza et al., 2020](#); [Maitner et al., 2024](#); [Kang et al., 2023](#)). However, recent work using the Open Science Indicators dataset (produced by Public Library of Science (PLoS) and DataSeer) found no evidence of increased citation advantage when code is made open ([Colavizza et al. 2024](#)). There is little research into the drawbacks of code-sharing (however for perceived barriers, see [Gomes et al. 2022](#)). Although there might be a time cost in preparing code for sharing (see [Cadwallader & Hrynaskiewicz 2022](#)) there is no evidence of any other costs to Open Code.

## General research on Open Code in Ecology and Evolutionary Biology

The majority of Open Code research in Ecology and Evolutionary Biology (EcoEvo) has focussed on computational reproducibility, and in particular the prevalence of code archived alongside published articles, which is an initial requirement for computational reproducibility ([Campbell et al., 2023](#); [Kambouris et al., 2024](#); [Kellner et al., 2025](#)). Generally, studies have shown that computational reproducibility is low, largely due to the low proportion of articles that share analytical code (Table 1) or the low functionality of code. For instance, [Kellner et al. \(2025\)](#) abandoned their reproducibility assessment due to the low number of articles sharing code that ran without error or excessive runtime (7% of 497 studies had code that ran; [Kellner et al., 2025](#)). [Kambouris et al. \(2024\)](#) assessed full computational reproducibility in 177 meta-analyses and demonstrated that, even when code was

available and functional ( $n = 26$ ), the success rate for reproducing an article's results ranged from 26.9 to 73.1%, depending on the precise definition of reproducibility used. Beyond these studies, there has been little research conducted on the costs and benefits of Open Code in EcoEvo, although it has been suggested that Open Code leads to a greater number of per-year citations (Maitner *et al.*, 2024). This research has some limitations as it focuses solely on the use of the R coding language, when other languages are also regularly used (e.g., Python and MATLAB; Lai *et al.*, 2019; Gao *et al.*, 2025) and, as code-sharing is generally not mandatory, articles that choose to share code could be a non-random subset of the published literature.

Table 1: Studies assessing code availability in published EcoEvo articles.

Article	Proportion	Period	Articles	Sample
Sánchez-Tójar <i>et al.</i> 2025	4.8%	2015-19	314	12 ecological journals without code-sharing policies
Maitner <i>et al.</i> 2024	5.5%	2010-22	1001	Agriculture and biological science journals
Kambouris <i>et al.</i> 2024	16%	2015-17	177	Meta-analyses in EcoEvo
Kimmel <i>et al.</i> 2023	27%	2018-22	354	5 ecology journals
Culina <i>et al.</i> 2020	27%	2015-19	346	14 ecological journals with code-sharing policies
Kellner <i>et al.</i> 2025	33%	2018-22	497	9 ecology-related journals
Cooper <i>et al.</i> 2026	35%	2017-24	1670	7 British Ecological Society journals

## Prevalence of Open Code within Ecology and Evolutionary Biology

The proportion of publications sharing code remains low in EcoEvo. Recent studies found that between 4.8 and 35% of research articles shared code (see Table 1). The low adoption of Open Code practices may be the result of relatively few EcoEvo journals mandating code sharing (26.9% of 275 EcoEvo journals in 2025; Ivimey-Cook *et al.*, 2025). Several journals (American Naturalist, Proceedings of the Royal Society B, Ecology Letters, Peer Community In, Ethology, Journal of Evolutionary Biology, and Behavioural Ecology, ESA Journals) have recently adopted data editors that check the availability of code. Broader adoption of this practice across EcoEvo journals should increase the prevalence of Open Code (Pick *et al.*, 2026).

## Diversity, Equity, and Inclusion Concerns with Open Code

Researchers often have differing levels of coding experience and access to training opportunities, as not all institutions prioritize or support the time needed to develop coding skills. This disparity can even occur between different research groups in the same department, where the value placed on dedicating time to Open Science practices can vary significantly. All of these factors will ultimately influence the confidence of researchers to share code. In addition, if not anonymized temporarily for peer review, the provision of Open Code could prevent double-blind reviewing, where the author's identity is hidden from the reviewer. However, a multitude of different repositories can enable blinding (see <https://methodsblog.com/2023/08/23/double-anonymous-peer-review-frequently-asked-questions/>).

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