From Policy to Practice: Progress towards Data- and Code-Sharing in Ecology and Evolution

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Abstract

High quality research data and analytical code are essential for ensuring the credibility of scientific results, are key research outputs, and are crucial elements to facilitate reproducibility. However, in ecology and evolution (E&E) in particular, it is currently unknown how many journals have policies on data- and code-sharing for peer review purposes, or upon manuscript acceptance. Furthermore, the clarity of such policies may impact authors' compliance. Thus, we assessed the clarity, strictness, and timing of data- and code-sharing policies across 275 journals in E&E. We also analysed initial policy compliance using submission data from two journals: *Proceedings of the Royal Society B* and *Ecology Letters*. Across all 275 journals, 22.5% encouraged and 38.2% mandated data-sharing, whereas 26.6% encouraged and 26.9% mandated code-sharing. Most journals that mandated data- or code-sharing required these to be provided “during peer review” (59.0% and 77.0%). This number was reduced for journals that encouraged data- and code-sharing (40.3% and 24.7%). More journals mandated or encouraged data- (+5.7%) and code-sharing (+12.6%) since the last assessments of these percentages in 2021 and 2020. Mandatory policies were associated with higher rates of data- and code-sharing upon submission (16.9% pre-mandate to 42.6% post-mandate), even when not fully adhered to. When enforced by editorial staff, mandated policies led to very high compliance rates (e.g., 96.5%). Our results also suggest that low initial compliance may in part be explained by vague wording used in sharing policies. We provide seven specific recommendations to help journals improve policy compliance and boost data- and code-sharing in E&E.

Keywords

open science, journal policy, reproducibility, replicability, transparency, peer review

Introduction

In the last two decades, there has been a fundamental shift in the scientific community towards transparency; providing both data and code is now considered by many to be a minimum requirement for publication (Stodden *et al.*, 2013, 2018; Powers & Hampton, 2019). To address this, journals have gradually moved towards implementing data- and code-sharing policies (Roche *et al.*, 2015; Culina *et al.*, 2020), with the number of journals that explicitly mandate data- and/or code-sharing greatly increasing in the last decade (Stodden *et al.*, 2013; Abdill *et al.*, 2024), including in ecology and evolution (Mislan *et al.*, 2016; Sholler *et al.*, 2019; Culina *et al.*, 2020; Berberi & Roche, 2022; Roche *et al.*, 2022). However, despite an increase in policy implementation in journals in recent years, compliance with these data– and code-sharing policies appears to be lagging (Roche *et al.*, 2015, 2022; Stodden *et al.*, 2018; Culina *et al.*, 2020; Kambouris *et al.*, 2023; Kimmel *et al.*, 2023). As a result, the replicability and reproducibility of scientific findings remains low across numerous fields of research (Archmiller *et al.*, 2020; Minocher *et al.*, 2021; Kambouris *et al.*, 2023; Kimmel *et al.*, 2023; Lear *et al.*, 2023; Nguyen & Benjamin-Chung, 2023). In part, such low compliance may be driven by vague language and non-definitive policy requirements (Christian et al., 2000), which can impede both author and editor understanding. This highlights the need to assess journal policies and their clarity of language to examine a potentially important cause of low compliance, and strengthen reproducibility and reuse via greater data- and code-sharing in ecology and evolution.

Whereas much of the research thus far has focussed on the amount of data- and code-sharing post-publication (i.e., after acceptance), much less is known about the proportion of journals that require data and code upon manuscript submission (*during* peer review). Providing data and code for peer review not only allows for deeper insight into the manuscript for reviewers and editors (Powers & Hampton, 2019; Archmiller *et al.*, 2020; Fernández-Juricic, 2021), but can also promote reproducibility earlier in the publication process, as well as reduce the probability of errors in published papers (Casadevall *et al.*, 2014; Sanchez *et al.*, 2021; Heyard & Held, 2022; Chen *et al.*, 2023; Ivimey-Cook *et al.*, 2023; but see Berberi & Roche, 2022, 2023). Indeed, Heyard & Held (2022) suggest that although preparing data and code for submission during peer review may increase workload, it could also promote the uptake of reproducible workflows in research groups, and ultimately, reduce sources of error and improve the quality of the data and code shared. However, despite some journals adopting mandatory data- and code-sharing during peer review for some years (e.g., *The American Naturalist* (in 2022), *Ecology Letters* (in 2023), and *Proceedings of the Royal Society B: Biological Sciences* (in 2017)), little is known about the overall percentage of journals in ecology and evolution that have implemented any form of policy on data- and code-sharing for peer review and their compliance rates, when in place.

To this end, we first reviewed the current state of data- and code-sharing policies across 275 journals that publish studies in ecology and evolution. For each policy, we considered three main features: (1) the clarity of the policy (i.e., how easy it was to understand); (2) the strictness of the policy (i.e., from mandatory to optional sharing); and (3) the 'timing' of the policy (i.e., at which point in the publication process data- and/or code-sharing was required or expected by the journal: during peer review or after acceptance). We aimed to test: (1) whether the number of journals encouraging or mandating data- and code-sharing "during peer review" differed from the number encouraging or mandating sharing "after acceptance"; (2) whether there are associations between data- and code-sharing timing and strictness, between a policy's strictness and timing, and between a policy's clarity and strictness; (3) whether the number of journals mandating or encouraging data- and code-sharing (either "during peer review" or "after acceptance") has increased since the assessments by Berberi & Roche (2022; data) and Culina *et al*. (2020; code).

Second, using data obtained directly from the editorial team at two journals that publish ecology and evolution studies (*Ecology Letters* and *Proceedings of the Royal Society B: Biological Sciences*), we examined (1) whether the number of submissions sharing data and code differed from those that didn't share; (2) whether sharing of data was greater than code; and (3) whether the introduction of a mandatory data- and code-sharing policy was associated with an increase in data- and code-sharing upon manuscript submission.

Methods

The pre-registration for this study is available at: https://osf.io/zxurh (Ivimey-Cook *et al.*, 2024) and was written after data collection of journal policies but prior to receiving data from *Ecology Letters and Proceedings of the Royal Society B: Biological Sciences* (hereafter, *Proceedings B)* and prior to data analysis. In addition, where appropriate, we provide author initials as per MeRIT to identify authors roles in the methodology and elsewhere (Nakagawa *et al.*, 2023).

Data and code accessibility

All analyses were conducted in R (v4.4.1; R Core Team, 2024). All data and code used for processing, analysis, and visualisation are available at Open Science Framework (https://osf.io/cqn3f/, DOI:10.17605/OSF.IO/CQN3F; Ivimey-Cook *et al.*, 2024).

Data- and code-sharing policies

A list of journals that publish ecology and evolution studies was created by combining a series of lists previously generated as described below, producing a preliminary list of 284 journals after duplicates were removed. 241 journals came from a search for "ecology" and "evolutionary biology" journals in the Clarivate Journal Citation Report (https://jcr.clarivate.com/jcr/browsecategories) on the 30th of September, 2022 (searched performed by Patrice Pottier). 118 journals were compiled by AC as part of a pre-conference event on Registered Reports for the Society for Open, Reliable, and Transparent Ecology and Evolutionary Biology (SORTEE; (O'Dea *et al.*, 2021) in 2023 by merging a list of ecology journals (https://listofjournals.com/field.php?q=Ecology) with a list of ecology and evolution journals compiled for a hackathon organised as part of the SORTEE conference in 2021 (https://freeourknowledge.org/2021-07-01-registered-reports-now_ecol-evol-biol/). The remaining 96 journals were surveyed by both Mislan *et al*. (2016) and Culina *et al*. (2020). The resulting list of 284 journals was then used in the hackathon "Open code and data practices during peer review", for policy extraction, which EIC, AST, and NPM organised at the SORTEE conference on October 17th, 2023. We removed nine titles from the list post-hackathon, which were either duplicated or no longer appeared to be in operation (n_{final} = 275 journals; see Table S1; note an additional four journals were removed post-preregistration as they were found to no longer be operating).

Each journal was assigned to three separate data extractors (DEs, n = 36). Each DE was assigned an initial subset of 15 journals, with the option to extract additional subsets. Mean and median number of subsets of 15 journals assigned per person were 1.3 and 1 respectively, with a range = 1 to 3. For each journal, DEs extracted information regarding the timing of data- and code-sharing (Categorical: Not Expected At All; During Peer Review; After Acceptance (Post-Publication); Unclear; Other), policy strictness (Ordinal: Not Mentioned; Encouraged; Optional for Authors; On Reviewer Request; Mandated), and clarity (Quantitative: 1 (Totally Unclear) - 5 (Totally Clear) [5 levels]) into a Google Form (full details on variables in Table S2). As mentioned above, this extraction was done prior to pre-registration. Between-DE agreement was tested using Fleiss Kappa intraclass correlation scores for the categorical variables of strictness and timing, and Kendall's W for the ordinal variable of clarity (via package {irr} v0.84.1; Gamer *et al.*, 2012).

Deviation from preregistration

Prior to analysis, we made one change to the DE's responses. The category "Other", which was originally among the responses for data- and code timing, was subsequently re-categorised as either "During Peer Review", "After Acceptance, or "Not Expected At All" by EIC, AST and NPM based on the text entries provided by the DEs. In addition, clarity ratings were excluded from the analyses for journals that did not have any data or code policy (i.e., policy strictness = "Not Mentioned"). When DEs left scores for clarity blank because they were unable to locate a policy despite the journal having a policy, we assigned the lowest clarity score (i.e., 1) to those entries, based on the rationale that not being able to locate or identify a data- or code-sharing policy is consistent with the policy being extremely unclear. Note that, the dataset generated after response re-categorisation and data exclusion was used to assess the agreement between DEs in their data extraction across all journals and to assess journal clarity ratings.

Due to the high number of "Unclear" responses from DEs and to obtain up-to-date data- and code-sharing policies across the entire dataset for each journal, EIC and AST reviewed and re-assessed (using the same timing and strictness ratings as the DEs above; clarity was not re-assessed) all of the 275 journal policies in 9th-15th September 2024 along with any policy text copied by the DEs into the Google Form during extraction (regardless of the level of agreement between DE's). At this stage an additional step was also conducted. If a journal specifically referenced adhering to a publisher-level policy, this higher-level policy was also checked to ensure that the timing and strictness was similar between both policy levels. However, if either the journal or publisher required data- and or code-sharing at an earlier time or with increased strictness, this was taken as the final rating (for instance, if a journal mentions encouraging data- and code-sharing after acceptance, but the publisher mentions that editors and reviewers can request data and code during peer review, then the overall rating became: during peer review on reviewer request for both data and code). This re-assessment was conducted due to the length of time between the hackathon (October 2023) and the final data analysis (September 2024). We list a number of important methodological clarifications below. Note that this dataset, which incorporated up-to-date and potential publisher-level policies, was used for all future analyses.

Methodological clarifications

In addition, we applied several different rules for rating strictness and timing in order to maintain consistency across journals (some of which are mentioned in the pre-registration above but are reiterated here for clarity).

1. As the use of verbs differed markedly across journals, a consistent rating was applied. When a journal uses wording such as "expect", "must", or "require" this represents mandated. If a journal instead uses words such as "should", "recommends" or "requests" this is taken as encouraged. Lastly, if a journal uses wording such as "if data are present" or "we invite authors to archive data" then this is taken as optional. The authors of this paper realise this is not ideal and opinions may differ as to precise terminology.
2. For journals with data and/or code as "Mandated" or "Encouraged", if the journal does not explicitly mention that data or code should be available during peer review or at submission, timing should be assigned as "After Acceptance". In addition, this applies when a journal mentions "prior to publication" or discusses "data- or code-sharing".

3. For journals that “require” code but only for "papers that describe new simulations or analytical methods", strictness should be assigned as “Encouraged”. This also fits when some but not all forms of data and/or code have a mandated policy.
4. If a journal mentions data- and/or code-sharing but does not say anything about whether data and/or code should or must be submitted at any point, strictness should be assigned as “Optional to Authors” and timing, unless stated otherwise, as “After Acceptance”. This also includes when journals say that data or code can be uploaded as supplementary material.
5. If a journal does not want any new data, strictness should be assigned as “Optional for Authors” and timing as “Not Expected At All”. This refers to particular cases where previously published data must be made available if novel analyses have been conducted. This also includes when journals simply require authors to state the availability of data or code with no requirement for sharing.
6. If a journal mandates data and/or code-sharing as a condition of publication but then also mentions that data and/or code should be available upon request from editors and reviewers, strictness should be assigned as “On Reviewer Request“ and timing as “During Peer Review”. This also applies for higher-level publisher policies if the journal directly refers to them in text.
7. Lastly, for most ScienceDirect journals, there is consistent use of the same text (with minor edits) for their data- and code-sharing, since they explicitly write “Research data refers to the results of observations or experimentation that validate research findings, which may also include software, code, models, algorithms, protocols, methods and other useful materials related to the project.”, we decided to treat their sharing policies as concerning both data and code. In addition, though the policies do not explicitly mention that the sharing should be done during peer review, we have deemed that they do so implicitly and categorise the timing as “During Peer Review” based on the policies

including the following two statements: “To foster transparency, we require you to state the availability of your data in your submission if your data is unavailable to access or unsuitable to post.” and “You are [required or encouraged (depending on the journal)] to: Deposit your research data in a relevant data repository. Cite and link to this dataset in your article. If this is not possible, make a statement explaining why research data cannot be shared.”, which we interpret as having to be “during peer review” given that the policies ask you to add the data to the reference list and very clearly ask you to explain upon submission why you might not be able to share the data (e.g., due to ethical reasons).

This updated dataset was then used for the remaining analyses, including calculating several descriptive statistics (exploratory analyses listed in the pre-registration) and assessing the difference between journals in terms of code- and data-sharing strictness, timing, and clarity. Specifically, NPM calculated Cramer’s V non-parametric correlations (i.e., between journal code- and data-sharing policy strictness; between journal code- and data-sharing timing; and, between strictness and clarity for both code and data separately; via package {confintr} v1.0.2 (Mayer, 2022) as well as performed chi-squared tests ($\chi 2$) to assess if journals differ in whether code or data is expected “during peer review” or “after acceptance”. Lastly, to assess changes in the number and percentage of journals mandating or encouraging data- or code-sharing, NPM compared our results with those of Berberi and Roche (2022) and Culina et al. (2020) using $\chi 2$ tests. To do this, we used the subset of overlapping journals between these studies and ours (Culina et al. 2020: 95 out of 96 journals overlapped with our list; Berberi and Roche 2022: 194 out of 199 overlap).

Journal-specific submission data

We received data related to the data and code submission for peer review on the 28th of February 2024 from *Proceedings B*, and the 2nd of April 2024 from *Ecology Letters*.

Ecology Letters

For *Ecology Letters*, we received initial submission data for original research articles (i.e., “Letters”) from two 3-month periods, Jun - Aug 2021 (i.e., the pre-mandate period, 280 submissions) and Sep - Nov 2023 (i.e., the post-mandate period, 291 submissions). Note that for *Ecology Letters,* the mandated enforcement of data- and code-sharing for peer review had been in place in August 2023. 79 out of the 280 submissions from the pre-mandate period were rejected before peer review, and no information on compliance could be extracted for these. Therefore, we only used data on the 201 remaining submissions during this period. During the pre-mandate period, authors were required to provide a data availability statement with their initial submission, either providing a link to the study’s data (e.g., DOI, GitHub repository, or website) or stating that such a link would be provided upon acceptance (note that in the pre-mandate period, the requirement did not include any reference to code-sharing). The policy requiring a data availability statement had been in place since *ca.* 2018 (*Ecology Letters* Editorial Team *pers. comms.*). Data from the pre-mandate period included whether a compliant data availability statement was provided, and if so, whether it included a link. During the post-mandate period, authors were required to submit a link (e.g., DOI, GitHub repository, or website) to the study’s data and code upon submission. This policy was implemented in early 2023 and has been systematically enforced by the managing editors since Aug 2023 (i.e., prior to review and any formal data editor or peer review, the managing editor was responsible for checking and enforcing the mandated policy). Data from the post-mandate period include whether a compliant link was provided upon first submission (but without verifying that all necessary data and code and associated metadata was provided). Note that “Letters” submissions do not distinguish between research articles that may not rely on data or code (e.g., some theoretical papers); therefore, the percentage of non-compliant submissions may include a small number of submissions that did not use data or code.

With the data received from *Ecology Letters*, NPM assessed whether the frequency of policy-compliant submissions was higher than the frequency of non-policy-compliant submissions both within and between the pre- and post-mandate periods using $\chi 2$ tests. In addition, since compliance did not require the provision of a data-sharing link in the pre-mandate period, NPM also compared the frequency of submissions that did or did not provide a data-sharing link within the pre-mandate period, and between the pre- and post-mandate periods.

Proceedings of the Royal Society B: Biological Sciences

For *Proceedings B*, we received submission data for all article types from a single post-mandate period (i.e., Mar 2023–Feb 2024, 2340 submissions), where authors were required to provide data and/or code via sharing a link or uploading them as supplementary materials. This mandate has been in place since *ca.* 2017 (*Proceedings B* Editorial Team *pers. comms.*). Data received include the manuscript type (e.g., Research, Evidence Synthesis, Comment, etc.) and the authors’ responses to the following submission questions: (1) “*Does your paper present new data, or use data/models published elsewhere*?”, and (2) “*If yes, provide a link to your data if it is in a repository. If depositing your data with Dryad, ensure that you give the private reviewer a 'sharing' link. If your data is uploaded as supplementary material, please state this. Your paper will be unsubmitted without this information*.”. Note, that although the *Proceedings B* policy requires data- and code-sharing, the questions included during the submission procedure only referred to data.

In contrast to *Ecology Letters*, we did not have access to pre-mandate data and therefore could not assess policy compliance and percentage of submissions providing a data- and/or code-sharing link for *Proceedings B* before the mandate. In addition, we were not able to assess initial policy compliance in this post-mandate period with the data we obtained because submissions determined to be non-compliant by the managing editors were unsubmitted and authors were required to add the missing information before resubmitting. Therefore, we first used question (1) above to explore the proportion of papers from each manuscript type that had data associated with them. In addition, using the authors' response to question (2) above for the subset of research manuscripts with associated data (i.e., 2000 submissions), NPM first compared the percentage of submissions that appear to have provided a data- and/or code-sharing link to those that provided data and/or code as supplementary materials. NPM then estimated the percentage of submissions that appeared to have provided data, code, or both data and code, by categorising them based on the text provided by the authors in question (2), and compared the proportion appearing to share data to the proportion appearing to share code using $\chi2$ tests.

Results

Code- and data-sharing policies

Overall, fewer than a quarter of all 275 investigated journals implemented "mandated data sharing during peer review" (22.6%; Table 1, Fig. 1), however, this was still the most common data-sharing policy. The second and third most common policies were data-sharing on 'reviewer request during peer review' (17.1%) and 'mandating data sharing post-publication' (15.6%). Lastly, 10.6% of all journals did not have any form of data-sharing policy (Table 1, Fig. 1). For code, the most common finding was for journals to have no code-sharing policy (23.3%; Table 1, Fig. 1). For journals that did have a code-sharing policy, the percentages were similar to those of data sharing, where the most common policy was mandated code-sharing during peer review (20.7%) closely followed by encouraged code-sharing post-publication (20.0%) and code-sharing on reviewer request during peer review (18.6%; Table 1, Fig. 1). In total, 167 journals mandated or encouraged data sharing (60.7% of all journals). Of these, about half required some kind of data sharing during peer review (87, 52.1%) and during post-publication (80, 47.9%; $\chi2 = 0.293$; $P = 0.588$). The results were similar for code-sharing: of the 147 journals that mandated or encouraged code-sharing (53.5% of all journals), a similar percentage required it during peer review (75, 51.0%) and during post-publication (72, 49.0%; $\chi2 = 0.061$; $P = 0.805$).

We also found a significant non-zero correlation between the strictness of data- sharing policies and the strictness of code-sharing policies (V = 0.546, 95% Confidence Interval (hereafter 95CI): [0.489, 0.605]), consistent with journals with stricter data policies tending to have stricter code policies. Similarly, the timing of both data- and code-sharing requirements were also significantly correlated (V = 0.733, 95CI: [0.651, 0.817]). We also found that the strictness and clarity rating of a policy were significantly correlated both for data (V = 0.295, 95CI: [0.230 0.366]) and code (V = 0.217, 95CI: [0.163 0.281]). Summary statistics show that that highest mean clarity rating was for journals with mandated data sharing (3.77, SD = 0.99; median = 4) compared to the overall average (3.49, SD = 1.16; median = 4) and for journals with mandated code-sharing (3.08, SD = 1.25; median = 3) compared to the overall average (2.56, SD = 1.33; median = 2), although the difference between mandated journals and the overall means were relatively small.

The number of journals that mandate data- and code-sharing was found to increase. In 2021, Berberi & Roche (2022) found that 35.6% of journals (n = 69 out of 194) mandated data sharing, compared to 41.2 of those journals that mandate data sharing as of 2024 (n = 80). Berberi &

Roche (2022) also found that 41.8% of journals (n = 81) had a weak data-sharing policy and 22.7% (n = 44) appeared to have no data-sharing policy at all. In comparison, we found that 49% of journals (n = 95) had a non-mandated or weak data-sharing policy (i.e., encouraged, on reviewer request, optional), and only 9.8% of journals (n = 19) appeared to have no data-sharing policy at all. While the results do not represent a statistically significant increase in the percentage of journals that mandate data-sharing between 2021 and 2024 ($\chi 2 = 1.090$; $P = 0.297$), there was a statistically significant increase in the percentage of journals with some form of data-sharing policy during this period ($\chi 2 = 10.915$; $P < 0.001$). Culina *et al*. (2020) found that 72 out of 95 journals (75.8%) encouraged or mandated code-sharing in 2020. Here, we found that 84 out of those 95 journals (88.4%) now have implemented some code-sharing policy. This includes journals that we classified as “On Reviewer Request” (n = 21). This difference corresponds to a statistically significant increase in the percentage of journals implementing some form of code-sharing policy between 2020 and 2024 ($\chi 2 = 4.334$; $P = 0.037$). Incorporating three additional journals that we had categorised as “Optional for Authors” increases this percentage to 91.6%, which would represent an even greater increase since 2020 ($\chi 2 = 7.555$; $P = 0.006$). However, the observed increase may be partially influenced by subtle differences in the categorisations used in Culina *et al.* (2020) and here.

The agreement between data extractors (DEs) was statistically significant for all six extracted variables. There was general agreement on the timing, strictness, and clarity of the data and code policies for journals (Table 2). The percentage of full disagreement (i.e. no agreement between the three DEs) ranged from 7% for Data Strictness to 30% for both Data and Code Clarity (median = 14.5%, mean = 18.1%; Table 2).

Table 1.: Summary of policy requirements for data- and code-sharing for 275 ecological and evolutionary journals.

Note that Not Mentioned - Not Expected At All = no policy and Optional for Authors - Not Expected At All = there is no requirement for new sharing of “new” data or code or a journal simply wants an availability statement (see “Methodological clarifications” above).

Policy strictness	Policy timing	Data policy	Code policy
Mandated	- During Peer Review	62 (22.55%)	57 (20.73%)
	- After Acceptance (Post-Publication)	43 (15.64%)	17 (6.18%)
Encouraged	- During Peer Review	25 (9.09%)	18 (6.55%)
	- After Acceptance (Post-Publication)	37 (13.45%)	55 (20.00%)
On Reviewer Request	- During Peer Review	47 (17.09%)	51 (18.55%)
Optional for Authors	- During Peer Review	15 (5.45%)	2 (0.73%)
	- After Acceptance (Post-Publication)	9 (3.27%)	11 (4.00%)
	- Not Expected At All	8 (2.91%)	0 (0.00%)
Not Mentioned	- Not Expected At All	29 (10.55%)	64 (23.27%)

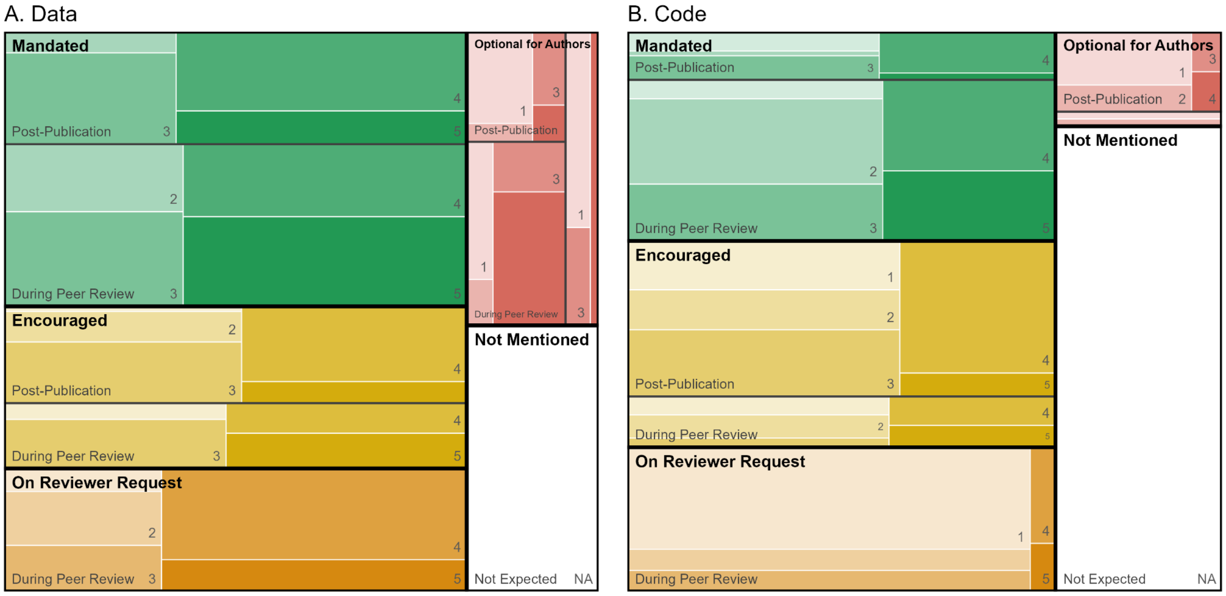

Figure 1. Treemap showing the proportions of (A) data, and (B) code policies by timing ("during peer review", "after acceptance", "not expected at all", ""unclear"), strictness ("encouraged", "optional", "not mentioned", "on reviewer request", or "mandated"), and clarity (from 1-5) ratings. Subgroup areas are proportional to the number of journals determined to be within each grouping (total n=246 and 211 for data and code policies, respectively; for summary data for timing and strictness groupings see Table 2). Thick black links distinguish strictness groupings (i.e., Mandated = green, Encouraged = yellow, On Reviewer Request = orange, Optional for Authors = red, Not Expected At All = white), and grey lines distinguish timing subgroupings. Numbers displayed show the clarity score for each subgroup (1 - 5, or NA for journals without a policy), which are shaded relative to their clarity score (1 = lightest, 5 = darkest). Timing labels of smaller subgroups are not displayed, including for A, Optional for Authors/ Not Expected at All (4 journals), and in (B), Optional for Authors/ During Peer Review (2 journals). Figure produced via package {treemapify} v2.5.6 (Wilkins, 2021). Figure by NPM and RZ.

Table 2: Summary agreement data between data extractors (DEs) for policy timing, strictness, and clarity for data- and code-sharing submission policies across journals that publish ecology and evolution studies. The analysis of timing ("during peer review", "after acceptance", "not expected at all", ""unclear") and strictness ("encouraged",

“optional”, “not mentioned”, “on reviewer request”, or “mandated”) includes all 275 journals, whereas that of clarity (from 1-5) includes 246 journals for data and 211 journals for code, which corresponds to the subset of journals mentioning data- and/or code-sharing in their policies.

Response		**Full agreement (3/3)**	**Partial agreement (2/3)**	**No agreement (0/3)**	**Between-DE agreement coefficients**
Data	- Timing	71 (25.82%)	167 (60.73%)	37 (13.45%)	Fleiss' κ: 0.261 (P < 0.001)
	- Strictness	156 (56.73%)	100 (36.36%)	19 (6.91%)	Fleiss' κ: 0.555 (P < 0.001)
	- Clarity	29 (11.79%)	142 (57.72%)	75 (30.49%)	Kendall's W: 0.505 (P < 0.001)
Code	- Timing	90 (32.73%)	142 (51.64%)	43 (15.64%)	Fleiss' κ: 0.259 (P < 0.001)
	- Strictness	118 (42.91%)	123 (44.73%)	34 (12.36%)	Fleiss' κ: 0.389 (P < 0.001)
	- Clarity	34 (16.11%)	114 (54.03%)	63 (29.86%)	Kendall's W: 0.535 (P < 0.001)

Journal-specific submission data

Ecology Letters

The *Ecology Letters* manuscript submission data showed that in the pre-mandate period (i.e., where the authors were required to simply provide a data availability statement in their initial submission) the number of submissions complying with the policy was statistically higher than the number of non-compliant submissions (Table 3 & 4). In contrast, in the post-mandate period (i.e., where the authors were required to provide a link to the study’s data and/or code in their initial submission) policy compliance was statistically lower than non-compliance (Table 3 & 4). Nonetheless, despite lower policy compliance during the post-mandate period, the percentage of submissions including a link to the study’s data and/or code increased significantly after the introduction of the mandate (Table 3 & 4; however, we note that we could neither assess compliance for data- and code-sharing separately nor confirm whether all data and code were provided). Fewer submissions appear to include data and/or code with their submission (i.e., provided a link) than those that did not, in both the pre-mandate and post-mandate period (Table 3 & 4).

Proceedings of the Royal Society B: Biological Sciences

Proceedings B submission data showed that the manuscript types 'Research' and 'Evidence Synthesis' had the highest percentage of submissions with associated data (90.3% and 81.3%, respectively; Table 5), however this does not infer whether the associated data and/or code was actually shared with the manuscript. Based on the authors' responses to the two submission questions, the percentage of submissions that appear to have included a link to and/or uploaded the data and/or code as supplementary material was very high across all manuscript types (96.5%; Table 6). Many of the submissions that did not provide data or code via a link or supplementary material were genetic studies that included only accession numbers to public sequence repositories (e.g., Genbank), which are currently treated as policy-compliant during the submission screening process. More authors chose to share their data and/or code via a link rather than as supplementary material (Table 6). Lastly, a considerable percentage of submissions appear to share only data (45.1%), followed by submissions sharing both data and code (29.5%), or only code (3.3%). As a result, the number of papers appearing to share data compared to code was significantly higher ($\chi 2 = 675.79$; $P < 0.001$; Table 6). Submissions mentioning code only were often simulation- or computation-based studies.

Table 3: *Ecology Letters* submission data summary. There are 201 submissions with data from the pre-mandate period and 291 submissions with data from the post-mandate period. Pre-mandate compliance requires submissions to include a data availability statement, which may or may not include a link to the study's data, while post-mandate compliance requires submissions to include an active link to a data/code repository of the study.

Was the submission apparently compliant with the period-specific policy at the time?	**Pre-mandate ('21)** *(policy: data-sharing statement)*	**Post-mandate ('23)** *(policy: data/code-sharing link)*
- Yes	134 (66.67%)	124 (42.61%)
- No	67 (33.33%)	167 (57.39%)
Did the submission include a link to the study's data and/or code?		
- Yes	34 (16.92%)	124 (42.61%)
- No	167 (83.08%)	167 (57.39%)

Table 4: Comparisons of compliance and link sharing within and between pre- and post-mandate periods for *Ecology Letters* submissions.

Pre-mandate period (‘21)	**χ2 (P-value)**
- Compliance is higher than non-compliance.	22.333 (P < 0.001)
- Fewer submissions included DOI/ links than those that did not.	88.005 (P < 0.001)
Post-mandate period (‘23)	
- Non-compliance is higher than compliance, and fewer submissions included DOI/ links than those that did not.	6.354 (P = 0.012)
Pre- versus post-mandate period (‘21 vs ‘23)	
- Compliance was lower in the post-mandate period.	26.626 (P < 0.001)
- Link sharing was higher in the post-mandate period.	34.838 (P < 0.001)

Table 5: Summary data for the submission question (i): “*Does your paper present new data, or use data/models published elsewhere?*” by manuscript type for submissions to *Proceedings B*. Note that the column “My paper contains data” has been adjusted from the original question (it was simply “Yes”). Values in parenthesis relate to percentage.

Manuscript Type	**“*My paper has no data*”**	**“My paper contains data”**
Research	216 (9.75%)	2000 (90.25%)
Review	47 (73.44%)	17 (26.56%)
Biological Science Practices	7 (36.84%)	12 (63.16%)

Evidence Synthesis	3 (18.75%)	13 (81.25%)
Commentary	10 (90.91%)	1 (9.09%)
Special Feature Reviews	7 (87.50%)	1 (12.50%)
Invited Reply	2 (66.67%)	1 (33.33%)
Comment	2 (100.00%)	0 (0.00%)

Table 6: Summary data for how data and or code is provided for original Research type manuscripts (total submissions = 2000), and the apparent levels of data, code or data- and code-sharing based on the statement provided by authors in response to the submission question (ii): "*If yes, provide a link to your data if it is in a repository. If depositing your data with Dryad, ensure that you give the private reviewer a 'sharing' link. If your data is uploaded as supplementary material, please state this. Your paper will be unsubmitted without this information*." for submissions to *Proceedings B*.

Is a link and/or supplementary materials apparently provided?	
- Yes	1929 (96.45%)
- No	64 (3.20%)
- Unclear	7 (0.35%)
If it is provided, how?	
- Link	1094 (56.71%)
- Supplementary materials	713 (36.96%)
- Both	121 (6.27%)

Based on the author's response, does data, code or both appear to be provided?	
- Data only	869 (45.05%)
- Code only	63 (3.27%)
- Data and code	568 (29.45%)
- Unclear	428 (22.19%)

Discussion

We had two overall aims for this study: (1) to assess the current state of data- and code-sharing policies in journals that publish ecology and evolution studies; (2) to assess the influence of journal policy mandates on data- and code-sharing compliance using initial manuscript submission data obtained directly from the editorial offices of two journals. Our results show that uptake of data- and code-sharing policies in ecology and evolution is slow; less than half of all journals possess some form of mandated data- and code-sharing policy. Of these, an even smaller number of journals facilitate data and code review by requiring authors to share data and code during peer review. Once such a mandate is in place, it appears to be followed by higher rates of data- and code-sharing, despite low initial compliance. We argue that some reasons for low compliance stem from a lack of journal enforcement of mandated policies (see Fidler *et al.*, 2004) in addition to the wide variety of data- and code-sharing policies that are often unclear and difficult-to-interpret.

Across all 275 journals that publish ecology and evolution studies, we found that, in 2024, only 38.2% mandated data-sharing either during peer review or after acceptance, and 10.6% did not even mention data in their policies. The remaining 51.2% either encouraged data-sharing (22.5% of all journals), only required it upon explicit reviewer request (17.1%), or made it optional for authors (11.6%). Mandating code-sharing was substantially lower compared to data-sharing (26.9%) with about a quarter of the journals (23.3%) not mentioning code in their policies. The remaining half (49.5%) either encouraged code-sharing (26.6%), only required it upon reviewer request (18.6%), or made it optional for authors (4.7%). These results are in agreement with previous findings showing that code-sharing policies are far less common than data-sharing policies (Stodden *et al.*, 2013; Mislan *et al.*, 2016; Culina *et al.*, 2020; Abdill *et al.*, 2024). It should be noted that the number of journals encouraging or mandating data and code during peer review in our study may likely be an overestimation due to the large proportion of policies originating from a single publisher, where we had decided to be particularly lenient in our policy timing categorisation (ScienceDirect by Elsevier; mandated: 31 journals, encouraged: 7 journals). In this specific case, we had taken the policy to refer to data- and code-sharing "during peer review", despite no specific reference in text (see details in Supplementary Material "Methodological Clarifications"). As such, our percentages likely reflect ceiling values (i.e., a best-case scenario). If we replace these "during peer review" policy timings with "after acceptance", the percentage of journals mandating data- and code-sharing during peer review would be halved (i.e., 11.2%, and 9.5%, respectively) and, if we considered encouraging data- and code-sharing during peer review, they would be reduced by a third (i.e., 6.5% and 4.0%, respectively). These all present worrying statistics.

We found evidence that data- and code-sharing policies are typically aligned with one another in terms of both timing and strictness. Journals with stricter data-sharing policies tend to have stricter code-sharing policies and require data- and code-sharing at similar stages. These results are in line with previous surveys in ecology and evolution that have found that articles that shared data were up to 12 times more likely to share code than articles that did not share data (Maitner *et al.*, 2024). Importantly, we also found evidence that the average clarity of policy was related to strictness, with journals that mandated data- and code-sharing having policies that were clearer to understand and to locate when compared to the average policy clarity among journals. These results are particularly important when considering previous findings, suggesting that policy wording is a significant factor in aiding authors (and even editors) interpretation (Christian *et al.*, 2020). These findings underscore the imperative for journals to make their data- and code-sharing policy wording as clear and easy-to-find as possible, so as to increase author and editor understanding and, thus, aid policy compliance.

Our analysis reinforces positive trends found in previous meta-research studies, which demonstrate slow but steady improvement in the state of data- and code-sharing in ecology and evolution. The number of journals mandating or encouraging data-sharing for the subset of 194 journals surveyed by Berberi & Roche (2022) has increased from 36 to 41% and 42 to 49%, respectively, since 2021. Importantly, whilst still non-zero, the number of journals with no data-sharing policy in the same subset has decreased substantially from 23 to 10% (i.e., a 57% decrease since 2021). For code, the number of journals mandating or encouraging code-sharing for the smaller subset of 95 journals investigated by Culina *et al.* (2020) also increased from 76% in 2020 to 89% in 2024. However, this increase is seemingly slowing. Mislan *et al.* (2016) found that only 15% of those 95 journals had a code-sharing policy in 2015, thus, from an average increase in 12 journals/year adding a code-sharing policy from 2015 to 2020, the increase has slowed down to 3 journals/year from 2020 to 2024. Although data-, and particularly code-, sharing remains generally low in ecology and evolution, with recent meta-research studies suggesting rates between 12 and 79% for data-sharing, and 3 and 27% for code-sharing (e.g., Magee *et al.* 2014: 2001-2013; Culina *et al.* 2020: 2015-2019; O'Dea *et al.* 2021: 2010-2019; Roche *et al.* 2022: Kambouris *et al.* 2024: 2015-2017; Maitner *et al.* 2024: 2010-2022; Sánchez-Tójar *et al.* 2024: 2015-2019), both are nonetheless increasing (Culina *et al.*, 2020;

Roche *et al.*, 2022; Maitner *et al.*, 2024; Sánchez-Tójar *et al.,* 2024). This study builds on previous findings and illustrates that more still needs to be done to highlight the importance of data- and code-sharing within the field of ecology and evolution, particularly in relation to the enhancing long-term reproducibility by increasing data and code availability (Magee *et al.*, 2014; Kambouris *et al.*, 2023).

Our results also indicate that journals have significant power to contribute to increased data- and code-sharing. In *Ecology Letters*, the number of submissions providing a link to data and/or code increased in the post-mandate period, despite the number of submissions adhering to the policy decreasing between the pre- and post-mandate period. Though perhaps counterintuitive at first, this pattern makes logical sense and is unsurprising if the barrier to compliance upon initial submission is higher (i.e., data and code were required upon first submission in 2023 compared to simply requiring a data availability statement in 2021) and authors fail to provide the required files upon initial submission. The increase in the number of submissions providing links to data and/or code in the post-mandate period is suggestive of an overall increase and a positive effect of the policy implementation (in addition to editorial policing) by *Ecology Letters*. It's important to note that using *initial* policy compliance upon submission avoids the potentially confounding influence of data editors, which have been in place in *Ecology Letters* since 2023 (Thrall *et al.*, 2023) and which actively contribute to increased policy compliance and reusable data and code, typically at a later stage in the peer review process. However, with this data, we can not account for the overall increase in rates of data- and code-sharing over time (which represents a general cultural shift towards more open and reproducible science), which may have contributed to the increased number of submissions providing data and/or code. However, it does appear that when these policies are enforced and have been established for several years, the number of submissions providing data is very high. For *Proceedings B*, we found a level of compliance close to 100% within the submission period (96.5% in Mar 2023 -

Feb 2024), but note that we did not have access to *initial* submissions that may have been previously unsubmitted by the editorial office for not adhering to the data- and code-sharing policy. Thus, we are likely overestimating the effect of the policy mandate owing to editorial enforcement (although conversely it shows the substantial positive effect of successfully enforcing a mandate). Nevertheless most submissions stated that they have provided data (74.5%), which was far greater than those providing code (32.7%). This discrepancy may be partially explained by the submission system focusing on data sharing without explicitly asking authors to share their code. Therefore, although data-sharing compliance appears high in *Proceedings B*, code-sharing still lags behind, as observed in previous surveys (e.g., Kimmel *et al.*, 2023). We note, however, that we were unable to answer two of the pre-registered hypotheses related to the journal-specific submission data due to the type of submission data finally obtained from both journals. Specifically, for *Ecology Letters*, we were not able to separate whether rates of data- and code-sharing differed. For *Proceedings B*, we only obtained data from a post-mandate period so we were unable to test the effects of the introduction of a data- and code-sharing policy on rates of submission compliance, and the data we obtained did not include manuscripts unsubmitted for not initial adhering to the policies. Nonetheless, our analyses clearly show the great potential that submission data provided by journals have for understanding research practices, the efficacy of journal policies, and how to improve them. Ensuring the recording and transparency of a journal's submission data, and treating this as scientific data in its own right, should be of high priority as it provides an invaluable resource for the science of science (i.e., meta-research).

One thing is clear though, if journals implement data- and code-sharing policies, the overall availability of data and code increases, even when policy compliance is far from ideal (Peng, 2011; Vines *et al.*, 2013; Caetano & Aisenberg, 2014; Magee *et al.*, 2014; Evans, 2016; Hardwicke *et al.*, 2018; Cadwallader *et al.*, 2022; Kambouris *et al.*, 2023). Our results highlight that there is much room for improvement by journals to ensure the long-term reproducibility of scientific findings. In particular, the high percentage of journals failing to mention data- or code-sharing in their policies is concerning given that both data and code are key research products that not only increase the reproducibility and reliability of results but also their credibility (e.g., Soderberg *et al.*, 2020; Viglione, 2020) and impact (measured here as a citation advantage for data-sharing: (Piwowar *et al.*, 2007; Henneken & Accomazzi, 2011; Piwowar & Vision, 2013; Maitner *et al.*, 2024); and code-sharing: (Vandewalle, 2012; Bonneel *et al.*, 2020; Kang *et al.*, 2023; but see Colavizza *et al.*, 2024).

Advice for journals

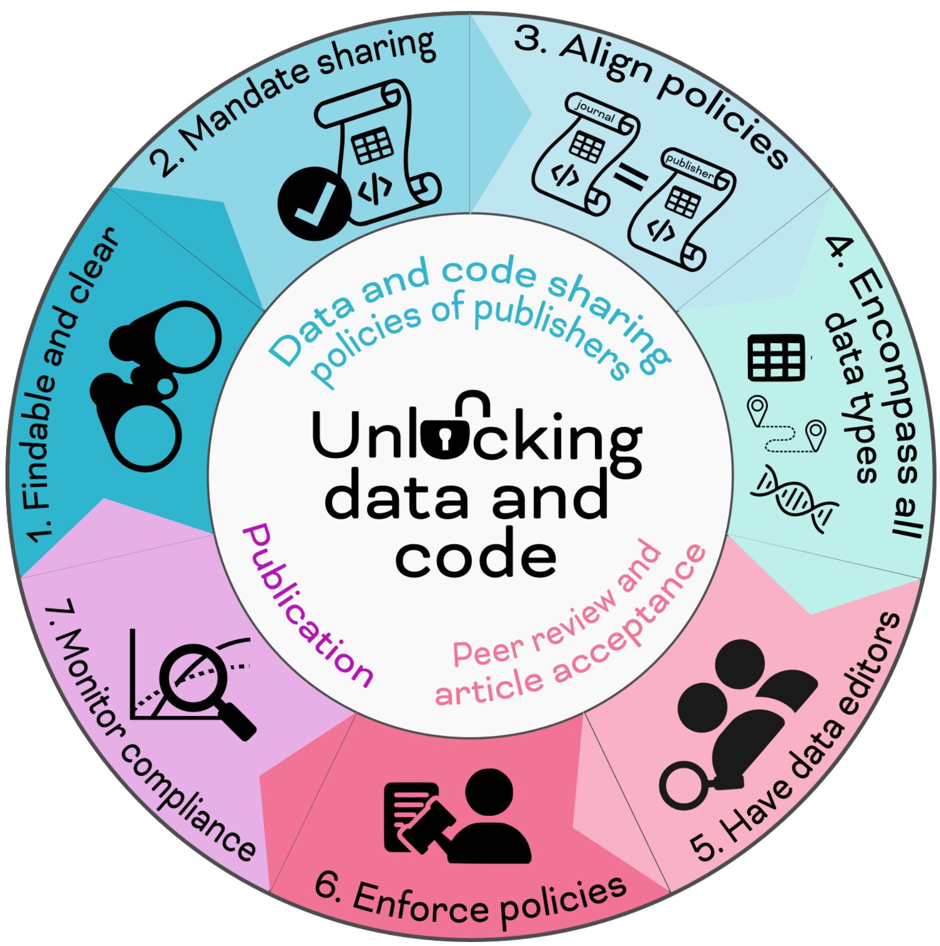

Figure 2. Visual depiction of the 7 points of advice for journals integrated in the publication process. Suggestions 1-4 involve the journal and/or publisher, suggestions 5-6 occur during peer review and article acceptance, and 7 occurs after publication to monitor the success of the process. Icons modified from Flaticon: Table-grid by Dave Gandy, Coding by Major Icons, regulation by IwitoStudio, people by Muhazdinata, copy by torskaya, magnifier by Creative Stall Premium, . Figure by RZ and KRBN.

Our assessment of sharing policies across journals that publish ecology and evolution studies has given us insight into potential areas of improvement for data- and code-sharing policies. We list seven points of advice below.

1. **Develop explicit, unambiguous and easy-to-find policies.** Ambiguity in journal requirements can lead to confusion and poor compliance (see Christian et al., 2000). Terms used in the policy should be clearly defined with clear guidance on the timing and specific requirements for data- and code-sharing. For instance, what constitutes "*complying with field standards"* ("All authors are requested to make sure that all data and materials as well as software application or custom code support their published claims and comply with field standards"), *"novel code"* or "*new simulations or analytical methods*" ("Novel code must be supplied as private-for-peer review in an external repository during the review process"; "Where a paper describes new simulations or analytical methods, we require authors to make any relevant software publicly available, wherever possible"), *"some types of data"* ("We require some types of data to be provided in manuscripts or deposited in public, community-supported repositories, prior to publication") or *"when- or wherever possible"* ("We suggest that data be presented in the main manuscript or additional supporting files, or deposited in a public repository whenever possible)". Note, the text has been adjusted to maintain the anonymity of journals.

2. **Mandate sharing of both data and code during peer review.** There are numerous benefits to providing both data and code during peer review including early error detection, increased understanding of experimental and statistical methods, and the ability to assess the computational reproducibility and general reliability of results during peer review. Sharing during peer review may also encourage authors to prepare their data and code in a way that is both understandable and reusable. Furthermore, data and code are often promised "upon request", but this promise is rarely fulfilled (Krawczyk & Reuben, 2012; Hussey, 2023). Journals should move away from "request-based" policies and instead require direct and mandated deposition of materials. This shift would eliminate ambiguity and make it easier to track and enforce compliance.
3. **Align journal- and publisher-level policies.** In several cases, there was variability between when the journal expected data- and code-sharing and when the publisher expected data- and code-sharing (for instance between Springer Nature journal and publisher policies). A similar mismatch was found with policies on preprint sharing (Purgar *et al., In Prep*). These should remain consistent in terminology (in strictness and timing) and, if possible, be specifically referenced in the journal's author guidelines to reduce confusion.
4. **Ensure that policy applies to all types of data and code.** Journals should mandate data- and code-sharing for all types of data and code rather than only certain types (e.g., all data should be mandated rather than simply DNA or protein sequences. Similarly, requiring sharing of all computer code, rather than simply "custom code" which may lead to confusion due to ambiguity). This would make the policy less ambiguous, and improve the general reproducibility of all the results, rather than just some. Although we note that there may be exceptions to this rule in rare circumstances (e.g., sensitive personal information or data involving endangered species; see Jenkins *et al.*, 2023). Journals

should ensure that this is clearly mentioned and specified under their data- and/or code-sharing policy section.

5. **Have data and code editors.** To assess the adherence of data and code to FAIR principles (Findable, Accessible, Interoperable, and Reusable; see Wilkinson *et al.*, 2016; Lamprecht *et al.*, 2020), some journals use the expertise and knowledge of dedicated data editors or reviewers (for example STAR checks in Psychological Science see Hardwicke & Vazire, 2024). While this might require additional resources and would not affect policy compliance upon *initial* submission, it can significantly enhance the rigour of the review process and the reproducibility of the final published study. As a result we encourage all journals to consider data editors as part of their formal review process.
6. **Enforce the policy.** Journals should enforce their mandated policies by first checking author compliance (Roche, 2016). This can be done at a basic level by checking if data or code links are provided, higher level checks may require dedicated staff or software (e.g., DataSeer.ai https://dataseer.ai/) at journals (see below). Journals should clearly state the consequences of not adhering to initial data- and code-sharing requirements. These consequences could range from simply having to resubmit the manuscript with accompanying data/code during initial submission, to rejection of the manuscript, or to publication of a note highlighting the lack of data and/or code availability. A clear articulation of consequences would motivate authors to comply.
7. **Continuous monitoring and evaluation of policy compliance rates.** Journals should carefully curate their submission data and regularly monitor and openly report on compliance rates to their data- and code-sharing policies. This data can be used to identify areas where policies need to be improved or enforcement needs to be strengthened. It also allows funding agencies and institutions to track good scientific practice and institutional data policies, which nowadays more often include mandatory

and open data and code-sharing (such an initiative is already being conducted at PLOS, Open Science Indicators (PLOS, 2024).

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Supplementary materials for "*From Unclear Policy to Practice: Progress towards Data- and Code-Sharing is Slow in Ecology and Evolution*"

Table S1. Final list of journals that publish ecology and evolution studies (n = 275).

Number	**Journal Name**
1	acta amazonica
2	acta ethologica
3	acta oecologica-international journal of ecology
4	african journal of ecology
5	african journal of range & forage science
6	african journal of wildlife research
7	agriculture ecosystems & environment
8	alpine botany
9	ambient science
10	american journal of biological anthropology
11	american naturalist
12	animal behaviour
13	animal biotelemetry
14	animal conservation
15	annales zoologici fennici

16	annals of botany
17	annual review of animal biosciences
18	annual review of ecology evolution and systematics
19	annual review of entomology
20	anthropocene
21	anthropological science
22	aob plants
23	applied ecology and environmental research
24	applied soil ecology
25	applied vegetation science
26	aquatic ecology
27	aquatic invasions
28	aquatic microbial ecology
29	aquatic toxicology
30	arctic science
31	arid ecosystems
32	austral ecology
33	australian journal of botany
34	australian systematic botany

35	avian conservation and ecology
36	basic and applied ecology
37	behavior research methods
38	behavioral ecology
39	behavioral ecology and sociobiology
40	biochemical systematics and ecology
41	biodiversity and conservation
42	biogeosciences
43	biological conservation
44	biological invasions
45	biological journal of the linnean society
46	biological reviews
47	biology letters
48	biology open
49	biosystems diversity
50	biotropica
51	bird conservation international
52	bmc ecology and evolution
53	bulletin of the american museum of natural history

54	bulletin of the peabody museum of natural history
55	chemistry and ecology
56	chemoecology
57	cladistics
58	communications biology
59	community ecology
60	compost science & utilization
61	conservation biology
62	conservation letters
63	conservation physiology
64	contemporary problems of ecology
65	current biology
66	current opinion in insect science
67	development genes and evolution
68	diversity-basel
69	diversity and distributions
70	eco mont-journal on protected mountain areas research
71	ecography

72	ecohydrology
73	ecohydrology & hydrobiology
74	ecologia aplicada
75	ecological applications
76	ecological complexity
77	ecological economics
78	ecological engineering
79	ecological indicators
80	ecological informatics
81	ecological management & restoration
82	ecological modelling
83	ecological monographs
84	ecological processes
85	ecological questions
86	ecological research
87	ecological restoration
88	ecology
89	ecology and evolution
90	ecology and society
91	ecology letters

92	ecology, environment and conservation
93	ecoscience
94	ecosistemas
95	ecosphere
96	ecosystem health and sustainability
97	ecosystem services
98	ecosystems
99	ecotoxicology
100	elife
101	environmental biology of fishes
102	environmental evidence
103	environmental pollution
104	ethology
105	ethology, ecology and evolution
106	european journal of soil biology
107	european journal of wildlife research
108	evodevo
109	evolution
110	evolution & development
111	evolution letters

112	evolution medicine and public health
113	evolutionary applications
114	evolutionary bioinformatics
115	evolutionary biology
116	evolutionary ecology
117	fems microbiology ecology
118	fire-switzerland
119	fire ecology
120	fish and fisheries
121	flora
122	folia oecologica
123	food webs
124	freshwater biology
125	freshwater science
126	frontiers in ecology and evolution
127	frontiers in ecology and the environment
128	frontiers in forests and global change
129	frontiers in zoology
130	functional ecology
131	fungal diversity

132	fungal ecology
133	genome biology and evolution
134	global change biology
135	global ecology and biogeography
136	global ecology and conservation
137	global environmental change
138	heredity
139	human-wildlife interactions
140	human ecology
141	ideas in ecology and evolution
142	insect systematics & evolution
143	integrative organismal biology
144	interciencia
145	international journal for parasitology-parasites and wildlife
146	international journal of ecology & development
147	international journal of sustainable development and world ecology
148	invertebrate systematics
149	isme journal

150	israel journal of ecology & evolution
151	journal for nature conservation
152	journal of animal ecology
153	journal of applied ecology
154	journal of arid environments
155	journal of avian biology
156	journal of biogeography
157	journal of biological dynamics
158	journal of chemical ecology
159	journal of comparative physiology b: biochemical, systemic and environmental physiology
160	journal of ecology
161	journal of evolutionary biochemistry and physiology
162	journal of evolutionary biology
163	journal of experimental biology
164	journal of experimental marine biology and ecology
165	journal of experimental zoology part b-molecular and developmental evolution

166	journal of fish and wildlife management
167	journal of freshwater ecology
168	journal of heredity
169	journal of human evolution
170	journal of molecular evolution
171	journal of natural history
172	journal of plant biology
173	journal of plant ecology
174	journal of soil and water conservation
175	journal of systematic palaeontology
176	journal of thermal biology
177	journal of tropical ecology
178	journal of vegetation science
179	journal of wildlife and biodiversity
180	journal of wildlife management
181	journal of zoological systematics and evolutionary research
182	landscape and ecological engineering
183	landscape and urban planning
184	landscape ecology

185	limnology and oceanography
186	mammal review
187	marine biology
188	marine biology research
189	marine ecology progress series
190	methods in ecology and evolution
191	microbial ecology
192	molecular biology and evolution
193	molecular ecology
194	molecular ecology resources
195	molecular phylogenetics and evolution
196	movement ecology
197	natural areas journal
198	nature
199	nature climate change
200	nature communications
201	nature ecology & evolution
202	neobiota
203	new phytologist
204	new zealand journal of ecology

205	northeastern naturalist
206	northwest science
207	oecologia
208	oikos
209	organisms diversity & evolution
210	oryx
211	paleobiology
212	pedobiologia
213	people and nature
214	perspectives in plant ecology evolution and systematics
215	philosophical transactions of the royal society b: biological sciences
216	phytocoenologia
217	plankton and benthos research
218	plant biology
219	plant ecology
220	plant ecology and diversity
221	plant physiology
222	plant species biology

223	plant systematics and evolution
224	plants people planet
225	plos biology
226	polar biology
227	polar record
228	polar research
229	polar science
230	polish journal of ecology
231	polish polar research
232	population ecology
233	proceedings of the academy of natural sciences of philadelphia
234	proceedings of the linnean society of new south wales
235	proceedings of the national academy of sciences: usa
236	proceedings of the royal society b-biological sciences
237	rangeland ecology & management
238	rangeland journal
239	regional studies in marine science

240	remote sensing
241	remote sensing in ecology and conservation
242	restoration ecology
243	reviews in fish biology and fisheries
244	revista chilena de historia natural
245	russian journal of biological invasions
246	russian journal of ecology
247	science
248	science advances
249	science of the total environment
250	scientific reports
251	soil ecology letters
252	south of russia-ecology development
253	southeastern naturalist
254	southwestern naturalist
255	systematic biology
256	systematic botany
257	systematic entomology
258	taxon
259	theoretical and applied ecology

260	theoretical ecology
261	theoretical population biology
262	trends in ecology & evolution
263	tropical ecology
264	tropics
265	urban ecosystems
266	vestnik tomskogo gosudarstvennogo universiteta-biologiya
267	vie et milieu-life and environment
268	web ecology
269	western north american naturalist
270	wetlands
271	wetlands ecology and management
272	wildlife biology
273	wildlife monographs
274	wildlife research
275	zoologica scripta

Table S2. List of variables extracted by data extractors. Data entry used a standard template provided as a Google Form.

General information section	Data extractor's email address
	Name of the data extractor
	Name of journal
Data-sharing policy section	When was the earliest the journal expected data to be provided? (Categorical: Not Expected At All; During Peer Review; After Acceptance (Post-Publication); Unclear; Other.)
	How strict is this policy? (Ordinal: Not Mentioned; Encouraged; Optional for Authors; On Reviewer Request; Mandated.)
	Provide the text that mentions the above statement (if possible). (Long answer text)
	How clear do you think this statement is? (Quantitative: 1 (Totally Unclear) - 5 (Totally Clear) [5 levels])
	Where was the data policy located? (provide a URL to the specific page; if any) (Short answer text)

	Any other comments. (Long answer text, optional)
Code-sharing policy section	When was the earliest the journal expected code to be provided? (Categorical: Not Expected At All; During Peer Review; After Acceptance (Post-Publication); Unclear; Other.)
	How strict is this policy? (Ordinal: Not Mentioned; Encouraged; Optional for Authors; On Reviewer Request; Mandated.)
	Provide the text that mentions the above statement (if possible). (Long answer text)
	How clear do you think this statement is? (Quantitative: 1 (Totally Unclear) - 5 (Totally Clear) [5 levels])
	Where was the code policy located? (provide a URL to the specific page; if any) (Short answer text)
	Any other comments. (Long answer text, optional?)