



## IS *OECOLOGIA AUSTRALIS* PROMOTING GENDER EQUALITY IN ITS REVIEW PROCESS?

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**Abstract:** Following recent evidence on gender bias at the publishing process in sciences, we present here a view on *Oecologia Australis* section editors, reviewers, and authors gender ratios to understand the patterns in this journal, improving the data assessment and discussions on this topic. We found that women section editors tended to accept more women than men first-authored manuscripts. There was also a slight tendency of men editors to invite proportionally more men as reviewers. There was no difference in the gender of the first author on the submitted manuscripts, although there is a tendency of male co-authorship in men first-authored papers. Despite gender bias in the scientific academy being a global tendency, our data as a medium impact journal represents an important counter point and provides more information to support gender balance studies to foment better equalitarian policies.

**Keywords:** gender bias; sex bias; minority representation; ecology journals

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In the first half of this 21st century, several scientific publications, newspaper articles and blogs have opened up gender and group disparities in the scientific academy. Some biases can have direct causes based on an explicitly pre-judgment, or indirect causes based on unconscious judgments (*i.e.* implicit bias), leading to favorable or unfavorable decisions founded on particular traits, such as sex, age, ethnicity, or skin color, even from people who consciously believe in equality principals (Staats *et al.* 2015, Calaza *et al.* 2021). Furthermore, some cumulative events in the life of people from certain groups can lead to an underrepresentation of this group in their

careers. For example, weakened self-confidence in women, as since early school days they go through overvaluation of men intelligence (Bian *et al.* 2017), or less opportunity given during career construction because of such overvaluation of men competence (Moss-Racusin *et al.* 2012, Reuben *et al.* 2014). Thus, to start a reversal in any bias is essential to understand the actual scenario and its possible causes.

Implicit bias causes a noticeable negative effect on the number of women as first authors and as reviewers in scientific publications, and in higher academic positions (Calaza *et al.* 2021). For example, less than 30 % of editors in international

conservation science journals are women (Loyola 2020). Women are less invited than men to act as reviewers in journals (*e.g.* Lerback & Hanson 2017) and men are more nominated for evaluation committees (Astegiano *et al.* 2019). Disparities or gender bias in the scientific academy are a global tendency, not restricted to a few countries or only to national or international scientific journals (Calaza *et al.* 2021).

Following these recent discussions on gender balance in scientific publishing, we decided to evaluate possible gender biases in the scientific journal *Oecologia Australis* (OA). OA is a Brazilian journal that has published studies discussing ecology and environmental sciences from the southern hemisphere since 1995. Most manuscripts submitted to OA are from Brazil, but about 10 % are submitted from other countries like Colombia and Uruguay (Barros & Guerra 2021). The journal uses the double-blind peer review system to reduce review bias (including gender bias) in the evaluation processes. However, many studies about the effectiveness of double-blind peer review in eliminating gender biases are still highly inconsistent in their outcomes (Fox *et al.* 2019), as biases could be caused not only by reviewers but also by editors in inviting reviewers and in their final decision. This way, we first questioned if the manuscript acceptance rate differs depending not only on the gender of the first author but also on the gender of the section editor. Following global trends in gender bias, we expect that women would have a smaller acceptance rate than men and that men section editors would tend to reject more women first author papers. Second, we questioned if there was any bias by the section editors to invite more women or men reviewers. We expect that men section editors would tend to select more men reviewers. Additionally, we assessed gender balance in co-authorship of the manuscripts submitted in OA testing if men first authors tend to have more men coauthors.

We assumed a binary gender system (*i.e.* man and woman) by following the name of the authors and section editors. We checked on the internet for more information on the researchers anytime we had doubts of the gender only checking the names. We are aware that gender diversity is strongly underrepresented by the binary system, anyway implicit bias of the editors on the final decision

can be led through the apparent gender assumed by the name itself. Although this could narrow the discussion in terms of the co-authorship, we believe it would not change results in terms of bias in the section editor's decisions for inviting reviewers, as we are using the same information that the section editors receive.

We evaluated all accepted and rejected manuscripts submitted to OA from 2018 to 2020. This period was chosen considering the regular periodicity of the journal and the detailed and accurate information available. We excluded special issues from our analyses, as the review process of those can be sometimes different from the issues with spontaneous submissions (*e.g.*, invited authors in special issues). We also excluded all manuscripts rejected before the review process for not fitting in the journal scope, as those do not even have a designed section editor. We assume that the first author is the lead author of the manuscripts, and we do not infer any bias caused by a senior or junior academic position. All analyses were run in the R environment (version 4.0.2, R Core Team 2020). For our questions, we ran generalized linear models with binomial distribution, using likelihood ratio tests to compare our expectations with the null model of no effect of section editor's or first author's gender on our response variables. Because in our third question the proportion of women as first author presented a lot of zeros, we used a zero inflated model in glmmTMB package (Brooks *et al.* 2017). We used the DHARMA package for model's diagnosis (Hartig 2020). All the data and the R script of the analyses are available in the Supplementary Material.

From 2018 to 2020, OA processed 266 manuscripts (131 published and 135 rejected). In those, there were 134 manuscripts edited by men and 132 by women. A total of 153 manuscripts were submitted by a man as a first author and 113 by a woman. We see no difference from the expected 50/50 pattern for the gender of the section editors ( $\chi^2 = 0.28$ ,  $df = 1$ ,  $p = 0.60$ ) and for the gender of the first author ( $\chi^2 = 2.73$ ,  $df = 1$ ,  $p = 0.10$ ).

Overall acceptance rate during all this period for reviewed manuscripts in OA was 0.49 (95 % CI: 0.43-0.55), and, contrary to our expectations, when section editors were men there was no difference in acceptance rates for both men and women first authored papers (Figure 1A). However, when

section editors were women there was a tendency to accept more manuscripts first authored by women (0.66, CI: 0.53-0.79) than men (0.41, CI: 0.30-0.52) ( $p = 0.032$ , Figure 1A). Considering the review process, when the section editor was a man, the proportion of women invited as reviewers was on average 8 % smaller (0.40; 95 % CI: 0.35-0.45) in comparison to when the section editor was a woman (0.48; 95 % CI: 0.42-0.53;  $p = 0.052$ ; Figure 1B).

When we evaluated the co-authorship, we found that the number of authors in reviewed manuscripts varied between 1 and 10, and the mean number of authors per manuscript was similar among men and women first authored manuscripts: 3.8 (SD = 1.7) and 4.0 (SD = 1.6), respectively. The proportion of women as co-authors was on average 7 % higher for manuscripts first authored by women (0.49; 95 % CI: 0.42 - 0.55) than by men (0.42; 95 % CI: 0.36 - 0.47) (Figure 1C), indicating that men tended to have more men as co-authors. However, this difference was only marginally significant ( $p = 0.085$ ).

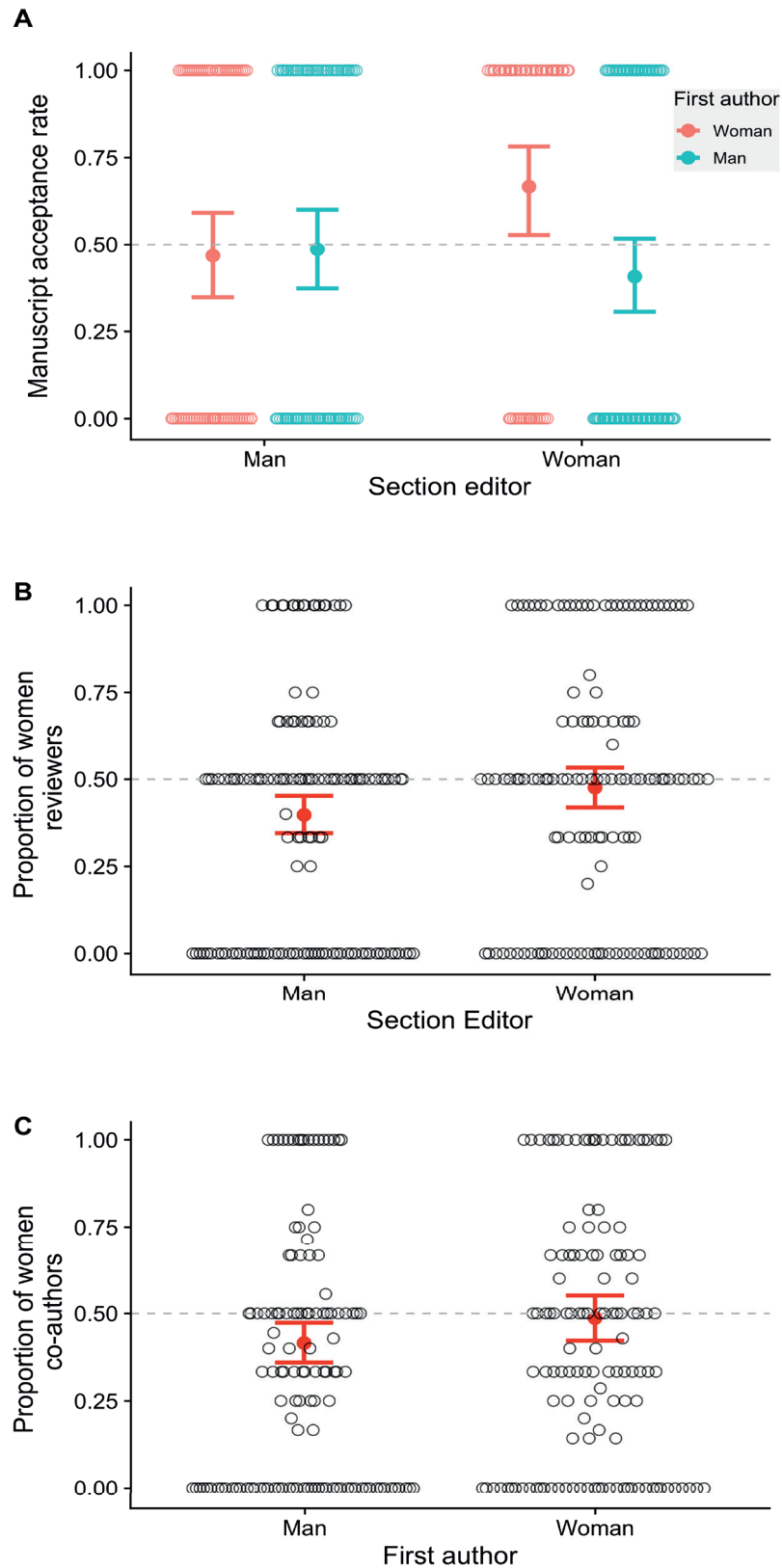
Although OA has never had an explicit gender equality policy, we found a similar number of man and woman section editors in the analyzed period. A well gender-balanced section editors group in OA could be a result of OA coordination by women chief editors since 2016. Woman presence in a leadership position could be a factor that avoids gender bias in the choice of section editors, because men in leadership positions tend to choose more men over women as their peers in the scientific academy (Lerback & Hanson 2017).

One attempt to avoid biases adopted by OA is the double-blind peer review process, which could reduce reviewers' biases based on authors' names, but it is not necessarily effective against any editor bias. Given that, we expected that women first-authored papers would have a smaller acceptance rate for publication than men first-authored papers and that men section editors would tend to reject more women first-authored papers. However, we found that women first-authored papers have a higher acceptance rate when edited by women, while men editors do not have a clear difference between acceptance rate in relation to the gender of the first author. Other journals have achieved gender equality in recommendations and choice of reviewers through hiring more women as

editors, as Journals from American Geophysical Union (Lerback & Hanson 2017) and there was an increase in women first-authored papers when the review process is anonymous (Budden *et al.* 2008), but we are not aware of an increased women first-authored papers only when edited by a woman. This pattern at OA could reflect both that women researchers, as expecting more obstacles in the publication process, would put more effort into preparation before submission – and then increase the chance of acceptance, and/or would take fewer risks – submitting less papers and/or in lower impact journals (Lerback & Hanson 2017), as well as a higher rejection by for man section editors. We speculate that a better prepared paper would increase the chances of women in the submission process, but the acceptance rate when edited by a man could decay by implicit bias (Bendels *et al.* 2008, Lerback & Hanson 2017).

We found that there is a slight tendency of men editors to invite proportionally more men to review papers. Generally, authors suggest more men reviewers and also men receive more invitation to review by editors of both genders (*e.g.*, Lerback & Hanson 2017). However, in OA it seems that only men section editors are biased by men reviewers as women editors tended to invite men and women editors in equal proportion. We believe that gender equality could bring more diverse opinions and thus improve the quality of revisions.

We found no difference in the gender of the first author for the submitted manuscripts to OA. There is a tendency of more man author leadership in high impact journals (Bendels *et al.* 2008), thus considering the low impact of OA, our result on men and women equally being first authors was not a surprise. Women tend to underestimate their own skills (Reuben *et al.* 2014), which could explain a tendency to avoid submission to high impact factor journals as they unconsciously doubt the quality of their own paper. Considering the co-authorship, there was no significant difference in the number of men and women co-authorship considering the gender of the first author, but there is a tendency of male co-authorship in man first-authored papers that deserves attention. The tendency of men publishing with more men and women presenting an egalitarian co-authorship is consistently



**Figure 1.** A) Acceptance rate of reviewed manuscripts in *Oecologia Australis* from 2018 to 2020 according to the gender of the section editor and of the first author. B) Proportion of women reviewers of manuscripts according to section editor's gender. C) Proportion of women co-authors according to the first author's gender. For all figures: dots and lines indicate estimates and 95 % confidence intervals of the models; each circle indicates one reviewed manuscript. Dashed lines indicate 0.5 acceptance rate (A) or 50 % proportion of women as reviewers (B) or co-authors.

observed in Brazil over all fields and regardless of the total number of co-authors (Araújo *et al.* 2017). This pattern could be influenced by the career stage of the researchers, and we encourage that other studies investigate this. Our main goal with these analyses for OA is to stimulate the debate, OA is a medium impact journal, which undoubtedly can help understand implicit bias that impairs women in science, as our results act as a counter point to high impact journals patterns. Also, OA have long been coordinated by women, which may have contributed to equal numbers as we found here and comparisons with similar impact journals coordinated by men could be made to foment this discussion.

Finally, scientific journals in general should aim to make likewise numbers and analyzes available to their audience if the goal is to eliminate gender discrepancies in the short term (Hammerschmidt *et al.* 2008, Calaza *et al.* 2021). The journals should focus on obtaining more complete records on the personal information of its authors to assist in the journal's analyzes, and periodically assess the existence of bias. If any gender bias is found, it could be corrected when chief-editors do their best to use unbiased criteria for section editors and thus reviewers, however some unconscious bias in both men and women could be already implemented in their production (Langenberg 2018), requiring chief editors to implement affirmative policies to achieve better representation of women and other minorities.

## ACKNOWLEDGMENTS

ACD (PNPD-PPGEE/UERJ), project number 1631/2018), CSB (PNPD-PPGE/UFRJ) and NP (PNPD-PPGE/UFRJ) have postdoctoral scholarships from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES- Finance Code 001.

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**Supplementary material:** Data, metadata and R code for the analysis.

*Submitted: 5 July 2021*

*Accepted: 29 July 2021*

*Published on line: 06 August 2021*

*Associate Editor: Alan Braz*