A peer-reviewed version of this preprint was published in PeerJ on 21 August 2014.

View the peer-reviewed version (peerj.com/articles/542), which is the preferred citable publication unless you specifically need to cite this preprint.

Cho AH, Johnson SA, Schuman CE, Adler JM, Gonzalez O, Graves SJ, Huebner JR, Marchant DB, Rifai SW, Skinner I, Bruna EM. 2014. Women are underrepresented on the editorial boards of journals in environmental biology and natural resource management. PeerJ 2:e542 https://doi.org/10.7717/peerj.542

Women are underrepresented on the editorial boards of journals in environmental biology and natural resource management

Alyssa H. Cho[1], Shelly A. Johnson[2], Carrie E. Schuman[3], Jennifer M. Adler[3], Oscar Gonzalez[3], Sarah J. Graves[2], Jana R. Huebner[3], D. Blaine Marchant[4], Sami W. Rifai[2], Irina Skinner[5], and Emilio M. Bruna[6,5]*

[1]Agronomy Department, University of Florida, Gainesville, FL

[2]School of Forest Resources and Conservation, University of Florida, Gainesville, FL

[3]School of Natural Resources and Environment, University of Florida, Gainesville, FL

[4]Biology Department, University of Florida, Gainesville, FL

[5]Department of Wildlife Ecology & Conservation, University of Florida, Gainesville, FL

[6]Center for Latin American Studies, University of Florida, Gainesville, FL

*Corresponding author: Emilio M. Bruna, University of Florida, Center for Latin American Studies and Department of Wildlife Ecology & Conservation, PO Box 110430, Gainesville, FL, (352) 846-0634, embruna@ufl.edu

PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug

ABSTRACT

Despite women earning similar numbers of graduate degrees as men in STEM disciplines, they are underrepresented in upper level positions in both academia and industry. Editorial board memberships are an important example of such positions; membership is both a professional honor in recognition of achievement and an opportunity for professional advancement. We surveyed 10 highly regarded journals in environmental biology, natural resource management, and plant sciences to quantify the number of women on their editorial boards and in positions of editorial leadership (i.e., Associate Editors and Editors-in-Chief) from 1985-2013. We found that during this time period only 16% of editorial board members were women, with more pronounced disparities in positions of editorial leadership. Although the trend was towards improvement over time, there was surprising variation between journals, including those with similar disciplinary foci. While demographic changes in academia may reduce these disparities over time, we argue journals should proactively strive for gender parity on their editorial boards. This will both increase the number of women afforded the opportunities and benefits that accompany board membership and increase the number of role models and potential mentors for early-career scientists and students.

PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug

INTRODUCTION

Despite women in the United States and Europe earning similar numbers of graduate degrees as men do, they remain underrepresented in upper level positions in both academia and industry in these regions (European Commission 2012; National Science Foundation 2004; National Science Foundation 2012). Several mechanisms have been put forward to explain this disparity, including biases against women in hiring, promotion, and offers of compensation, the emphasis on productivity, journal placement, and citation rates as determinants of merit despite evidence of gender bias influencing all three, inflexible or even hostile work environments, and a lack of role models and mentors (reviewed in Budden et al. 2008; Lariviere et al. 2013; Leahey 2007; Long 2001; Moss-Racusin et al. 2012). In response, universities, funding agencies, and other institutions have implemented strategies to address these issues, including making opportunities for professional advancement more broadly available and actively seeking gender diversity in leadership roles (Fox 2008). While these efforts have had some positive results, much remains to be done to ensure women in Science, Technology, Engineering, and Math (STEM) disciplines are afforded the same opportunities as their male counterparts.

The editorial boards of scientific journals act as gatekeepers that help maintain the scientific integrity and standards of a journal as well as identify emerging and innovative areas of research (Addis & Villa 2003; Mauleon et al. 2013). An invitation to serve as a Subject Editor is recognition that a scholar is respected in his or her discipline; it is also the path towards leadership positions because Associate Editors and Editors-in-Chief are typically selected from the Subject Editors. Serving on a board is also a means of advancing one's scholarship, both by becoming aware of the latest advances in the field and gaining insights into the writing and publication process. Finally, editorial boards are important professional networks – in serving on

PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug

a board one is able to develop relationships with reviewers, authors, and other editors (Addis & Villa 2003; Pearson et al. 2006). Serving on a board is therefore both an honor and a means of furthering one's research and career.

Previous studies have quantified the gender composition of editorial boards in the social sciences (Addis & Villa 2003; Green 1998; Stark et al. 1997), business administration and management (Metz & Harzing 2012), and STEM fields such as information systems (Cabanac 2012) and medicine (Galley & Colvin 2013; Keiser, Utzinger & Singer 2003; Wilkes & Kravitz 1995). To our knowledge, however, no such efforts have been made in ecology, natural resource management, plant sciences, or related disciplines (collectively referred to here as "environmental biology"). We therefore used ten highly regarded journals in environmental biology to address the following questions: 1) What proportion of editorial board members were women between 1985-2013? 2) How did the representation of women on editorial boards change over this time period? 3) How many women served in leadership positions, i.e., as Editors-in-Chief or Associate Editors?

METHODS

We selected for review 10 high profile environmental biology journals: *Annual Review of Ecology, Evolution, and Systematics, Biotropica, Agronomy Journal, North American Journal of Fisheries Management, American Journal of Botany, Conservation Biology, Biological Conservation, Ecology, Journal of Ecology,* and *Journal of Tropical Ecology*. We chose these journals because they are published by the primary professional organizations of which we (i.e., the authors) are members (e.g., *Biotropica*, *Conservation Biology*) or are alternative, non-society outlets for similar research (e.g., *Journal of Tropical Ecology*, *Biological Conservation*). It was

PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug

not intended to be a random sample of journals or a subset of journals with similar impact factors. Rather, they were chosen because they are the journals many graduate students in environmental biology, natural resource management, and plant sciences, including the authors, target to publish some of their thesis research.

Our analyses were based on the years 1985-2013. We chose 1985 as a starting point because it is shortly after studies began demonstrating disparities in career advancement between male and female scientists (reviewed in Long 2001; National Science Foundation 2003) but a few years prior to major initiatives by the US National Science Foundation and others to rectify these disparities (e.g., the 2001 initiation of the ADVANCE Program, National Science Foundation 2014). As such, we expect our survey period to reflect potential shifts in editorial board composition resulting from increased awareness of gender biases in STEM and the results of efforts to rectify these biases. For each journal we selected the first issue published each year and recorded the names, institutions, and editorial positions of all editorial board members. We then used Internet searches, personal knowledge, and interviews of colleagues to determine the gender of each editorial board member. Because of library licensing issues were unable to obtain data for *Journal of Tropical Ecology* for the years 1986-1989.

Journals often have different names for positions with similar editorial responsibilities, these names frequently change over time, and editorial positions are frequently created or eliminated. We therefore assigned editorial board members to the following categories based on their responsibilities: (1) Editor-in-Chief (EIC). The EIC oversees the journal and is ultimately responsible for editorial policy, standards, and practice, including appointing members of the Editorial Board. Some journals (e.g., *North American Journal of Fisheries Management*) had co-Editors-in-Chief; in such cases all were included in the total EIC count. (2) Associate Editors

PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug

(AE). The AE assists the EIC with their responsibilities and may take the lead on some aspects of journal administration; in some cases they might oversee all submissions in a particular subject area or from a geographic region. Not all journals have AEs, while those that do may vary in the length of time they have had them. (3) Subject Editors (SE). The SEs, also commonly referred to as Handling Editors, oversee the process of manuscript review. For some journals they make final decisions on manuscripts after considering reviewer feedback (e.g., *Ecology*) while for others they provide recommendations based on which EICs or AEs make final decisions (e.g., *Biotropica*). They also provide formal or informal feedback to the EICs/AEs on journal policy and administration. They are referred to collectively by a variety of titles, including Board of Editors (*Ecology, Biological Conservation*) and the Editorial Committee (*Annual Review of Ecology, Evolution, and Systematic, American Journal of Botany*). Note that two journals – the *American Journal of Botany* and *North American Journal of Fisheries Management* – used the title of "Associate Editor" for members of their Editorial Board with the responsibilities of SEs; we therefore included them in this category in our analyses. (4) Special Editors. Many journals have someone tasked with organizing special sections, reviewing data archives, soliciting reviews of recently published books of interest to the journal's readers, etc. (e.g., Biological Florida Editors for the *Journal of Ecology*; Concept Section, Data Archive, Special Features, and Invited Papers Editors for *Ecology*).

We conducted our analyses using only EICs, AEs, and SEs, and throughout our manuscript and analyses we use the term 'Editorial Board' to refer to the group collectively made up of these three categories. Special Editors were not included in our analyses unless they were also identified as EICs, AEs, or SEs because very few journals had these positions and they rarely existed for the entire survey period. We also excluded from our analyses production staff

PeerJ PrePrints

(e.g., production editors, managing editors, editorial assistants) and the *American Journal of Botany*'s "Section Representatives", which were only present in our survey in 1985 and whose primary function was to help identify journal priorities and suggest reviewers if asked – they did not make editorial decisions on individual manuscripts (Dr. Judith E. Skog, pers. comm., 2014).

RESULTS & DISCUSSION

We found that from 1985-2013 only 16% of editorial board members were women (N = 332 of 2065, Fig. 1A). The disparity also extends to leadership positions: since 1985 only 14% of Associate Editors (N = 18 of 125, Fig. 1B) and 12% of the Editors-in-Chief of our focal journals were women (N = 7 of 59, Fig. 1C). Not surprisingly, the proportions of male and female editors were significantly different for all of groups of Editors (proportion tests with continuity corrections, null probability = 0.5, SE: $\chi^2 = 946.44$, df = 1, $p < 0.0001$; AE: $\chi^2 = 61.952$, df = 1, $p < 0.0001$; EIC: $\chi^2 = 32.81$, df = 1, $p < 0.0001$).

While there was a general increase in the representation of women on editorial boards over time, for most journals the percentage of women on the board rarely exceeded 20% (Fig. 2). Nevertheless, there was notable variation among journals in the representation of gender on their editorial boards during the time period surveyed. For several journals, the proportion of women editors increased from zero in the mid-1980's to ~40% by 2013 (e.g., *Biotropica, American Journal of Botany, Conservation Biology*). Others, however, had consistently few women on their boards throughout the period surveyed (e.g., *Agronomy Journal, North American Journal of Fisheries Management, Biological Conservation*). A similar pattern of underrepresentation was observed for Associate Editors and Editors-in-Chief. While most journals had female Associate Editors at some point during the period surveyed, only 5 of the 10 journals we reviewed had ever

PeerJ PrePrints

had a woman as Editor-in-Chief (Fig. 3). Of these, only one – the *North American Journal of Fisheries Management* – had multiple women serve as EICs.

We recognize that determining the extent of gender bias in the composition of editorial boards in environmental biology will require evaluating many more journals from multiple subfields. However, the results of similar surveys in fields ranging from economics to anthropology have found disparities comparable to those we document (Addis & Villa 2003; Cabanac 2012; Galley & Colvin 2013; Green 1998; Keiser, Utzinger & Singer 2003; Metz & Harzing 2012). Assuming the results for the journals we reviewed are representative of others in environmental biology, our observations suggest two questions to be addressed by this scientific community. First, why are women underrepresented on editorial boards and in positions of editorial leadership? Second, for what gender composition on editorial boards should journals strive?

While our study was not designed to elucidate why women are underrepresented on editorial boards, potential mechanisms include many of the same ones invoked to explain why women are lacking in leadership positions in other spheres of academia (Fox 2008; Long 2001). It may also be that men continue to be more visible and hence more likely to be identified as potential board members because they have greater productivity, have more first- or last-authors of papers (West et al. 2013), and tend to be "citation elites" (sensu Parker, Allesina & Lortie 2013; Parker, Lortie & Allesina 2010). It may be that using these metrics to screen for editors might eventually – albeit slowly – result in increased numbers of women on editorial boards. This is because gender-based disparities in rates of publication (West et al. 2013) and citation (Borsuk et al. 2009) are diminishing (but see Lariviere et al. 2013), although this does not appear to be the case for all disciplines (West et al. 2013). More difficult to overcome might be the

PeerJ PrePrints

reliance on using the social and research networks of (mostly male) editorial board members to identify potential new editors (Addis & Villa 2003), since women scientists are frequently excluded from such networks or on their periphery (Fox 2008). This is where proactive measures, including the promotion of women to positions of editorial leadership, may have the greatest impact (Galley & Colvin 2013). Indeed, at least one study has found that having a female Editor-in-Chief is correlated with a greater proportion of women on editorial boards (Mauleon et al. 2013).

For what gender composition on editorial boards should journals in environmental biology strive? We propose they should proactively seek gender parity, rather than simply mirror the proportion of women earning doctoral degrees in a specialization, conducting research in particular disciplines, or who are members of academic societies – numbers which, in contrast to other fields (e.g., Morton & Sonnad 2007), we were surprised to find are extremely difficult to ascertain for environmental biology. Some might argue that the relatively lower number of female senior scholars in certain fields (e.g., agronomy) might make parity a challenge. However, it is important to emphasize that the issue in not whether there is parity in the number of women earning PhDs, but whether there are sufficient qualified women worldwide to comprise half an editorial board, which is a much smaller number (mean number of board members in 2012 = 56 ± 41.3 SD, range = 9-127). It is difficult to argue that there are not, given the global reach of academic societies (Carroll 2014), the internationalization of research programs (Stocks et al. 2008), increases in research productivity in developing countries (Holmgren & Schnitzer 2004), and the time elapsed since issues of gender & STEM came to the fore (though we concede that for highly specialized or national journals parity may be a greater challenge). We argue that Editors must work harder to proactively identify these potential board

PeerJ PrePrints

members – the fact that journals with similar disciplinary foci can have very different representation (e.g., *Biological Conservation* and *Conservation Biology, Biotropica* and *Journal of Tropical Ecology*) suggests increasing the proportion of women on editorial boards can be matter of policy and not pool size.

Attempts by journals to strive for gender parity would greatly increase the number of women afforded the opportunities and benefits that accompany board membership, as well as increase the number of female role models and mentors for early-career scientists and students seeking guidance on scientific publishing. When coupled with initiatives such as double-blind reviewing (Budden et al. 2008) and efforts to explore factors that influence our perceptions of 'merit' (Lortie et al. 2007), editorial board parity could ultimately help reduce the pervasive and insidious "gender productivity puzzle" first identified over thirty years ago (Cole & Zuckerman 1984). Finally, a more inclusive editorial board might bring unanticipated benefits to the journal itself, including attracting a broader diversity of research topics, contributors, and approaches (Stegmaier, Palmer & van Assendelft 2011). All of this could greatly increase a journal's impact via shaping both the discipline and the scientific workforce advancing it.

ACKNOWLEDGEMENTS

We thank R. Primack, R. Eades, C. Lortie, J. Parker, and F. Piper for helpful discussions or feedback on the manuscript and M. Duryea, D. Archer (Interim Deans for Research and Directors of Florida Agricultural Experiment Station), and R. E. Turner (Dean of the College of Agricultural and Life Sciences) for funds to publish in an open-access journal. Data and code used in this paper are available at the Dryad Digital Repository (accession number ---- ----).

PeerJ PrePrints

FIGURE LEGENDS

Fig. 1. The proportion of men and women who served as (A) Subject Editors, (B) Associate Editors, and (C) Editors-in-Chief of 10 environmental biology journals from 1985-2013.

Fig. 2. Change in the percentage of women on 10 Editorial Boards from 1985-2013. Editorial boards comprise Editors-in-Chief, Associate Editors, and Subject Editors.

Fig. 3. Total number of men and women who served as (A) Editors-in-Chief (B) Associate Editors or (C) Subject Editors of 10 environmental biology journals from 1985-2013. Note that we categorized the Associate Editors of the *American Journal of Botany* and *North American Journal of Fisheries Management* as Subject Editors given their responsibilities, and hence are depicted with that category.

PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug

REFERENCES

Addis E, and Villa P. 2003. The editorial boards of Italian economics journals: women, gender, and social networking. *Feminist Economics* 9:75-91.

Borsuk R, Budden A, Leimu R, Aarssen L, and Lortie C. 2009. The influence of author gender, national language and number of authors on citation rate in ecology. *Open Ecology Journal* 2:25-28.

Budden AE, Tregenza T, Aarssen LW, Koricheva J, Leimu R, and Lortie CJ. 2008. Double-blind review favours increased representation of female authors. *Trends in Ecology & Evolution* 23:4-6.

Cabanac G. 2012. Shaping the landscape of research in information systems from the perspective of editorial boards: A scientometric study of 77 leading journals. *Journal of the American Society for Information Science and Technology* 63:977-996.

Carroll C. 2014. Can a conservation-oriented scientific society remain relevant in the 21st century? *Conservation Biology* 10.1111/cobi.12371.

Cole JR, and Zuckerman H. 1984. The productivity puzzle: Persistence and change in patterns of publication of men and women scientists. *Advances in Motivation and Achievement* 2:217-258.

European Commission. 2012. She Figures 2012: statistics and indicators on gender equality in science. Brussels, Belgium: European Commission, Directorate-General for Research and Innovation.

PeerJ PrePrints

Fox MF. 2008. Institutional transformation and the advancement of women faculty: the case of academic science and engineering. In: Smart JC, ed. *Higher education: handbook of theory and research*. Amsterdam, The Netherlands: Springer, 73-103.

Galley HF, and Colvin LA. 2013. Next on the agenda: gender. *British Journal of Anaesthesia* 111:139-142.

Green K. 1998. The gender composition of editorial boards in economics. Royal Economic Society Women's Committee. Available at http://www.res.org.uk/SpringboardWebApp/userfiles/res/file/Womens Committee/Publications/editorialcomposition_Jan1999.pdf (accessed 15 April 2014).

Holmgren M, and Schnitzer SA. 2004. Science on the rise in developing countries. *Plos Biology* 2:10-13.

Keiser J, Utzinger J, and Singer BH. 2003. Gender composition of editorial boards of general medical journals. *Lancet* 362:1336-1336.

Lariviere V, Ni CQ, Gingras Y, Cronin B, and Sugimoto CR. 2013. Global gender disparities in science. *Nature* 504:211-213.

Leahey E. 2007. Not by productivity alone: How visibility and specialization contribute to academic earnings. *American Sociological Review* 72:533-561.

Long JS. 2001. From scarcity to visibility: gender differences in the careers of doctoral scientists and engineers. Washington DC, USA: National Academies Press. p 337.

PeerJ PrePrints

Lortie CJ, Aarssen LW, Budden AE, Koricheva JK, Leimu R, and Tregenza T. 2007. Publication bias and merit in ecology. *Oikos* 116:1247-1253.

Mauleon E, Hillan L, Moreno L, Gomez I, and Bordons M. 2013. Assessing gender balance among journal authors and editorial board members. *Scientometrics* 95:87-114.

Metz I, and Harzing A-W. 2012. An update of gender diversity in editorial boards: a longitudinal study of management journals. *Personnel Review* 41:283-300.

Morton MJ, and Sonnad SS. 2007. Women on professional society and journal editorial boards. *Journal of the National Medical Association* 99:764-771.

Moss-Racusin CA, Dovidio JF, Brescoll VL, Graham MJ, and Handelsman J. 2012. Science faculty's subtle gender biases favor male students. *Proceedings of the National Academy of Sciences of the United States of America* 109:16474-16479.

National Science Foundation. 2003. Gender Differences in the Careers of Academic Scientists and Engineers: A Literature Review (NSF 03-322). Arlington, USA: National Science Foundation, Division of Science Resources Statistics.

National Science Foundation. 2004. Gender differences in the careers of academic scientists and engineers (NSF Report 04-323). Arlington, USA: National Science Foundation, Division of Science Resources Statistics.

PeerJ PrePrints

National Science Foundation. 2012. Doctorate recipients from U.S. universities: 2012 (NSF Report 14-305). Arlington, USA: National Science Foundation, National Center for Science and Engineering Statistics.

National Science Foundation. 2014. ADVANCE Program. *Available at* http://www.nsf.gov/crssprgm/advance/ (accessed 30 July 2014 2014).

Parker JN, Allesina S, and Lortie CJ. 2013. Characterizing a scientific elite (B): publication and citation patterns of the most highly cited scientists in environmental science and ecology. *Scientometrics* 94:469-480.

Parker JN, Lortie C, and Allesina S. 2010. Characterizing a scientific elite: the social characteristics of the most highly cited scientists in environmental science and ecology. *Scientometrics* 85:129-143.

Pearson CH, Mullen RW, Thomason WE, and Phillips SB. 2006. Associate editor's role in helping authors and upholding journal standards. *Agronomy Journal* 98:417-422.

Stark BL, Spielmann KA, Shears B, and Ohnersorgen M. 1997. The gender effect on editorial boards and in academia. Bulletin of the Society for American Archeology 15(4). Available at http://www.saa.org/Portals/0/SAA/publications/saabulletin/15-4/SAA6.html (accessed 15 April 2014).

Stegmaier M, Palmer B, and van Assendelft L. 2011. Getting on the Board: the presence of women in political science journal editorial positions. *Political Science & Politics* 44:799-804.

PeerJ PrePrints

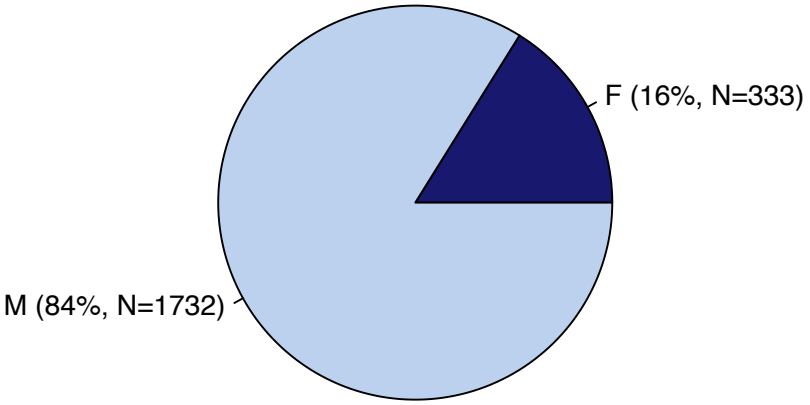
Stocks G, Seales L, Paniagua F, Maehr E, and Bruna EM. 2008. The geographical and institutional distribution of ecological research in the tropics. *Biotropica* 40:397-404.

West JD, Jacquet J, King MM, Correll SJ, and Bergstrom CT. 2013. The role of gender in scholarly authorship. *Plos One* 8:e66212.

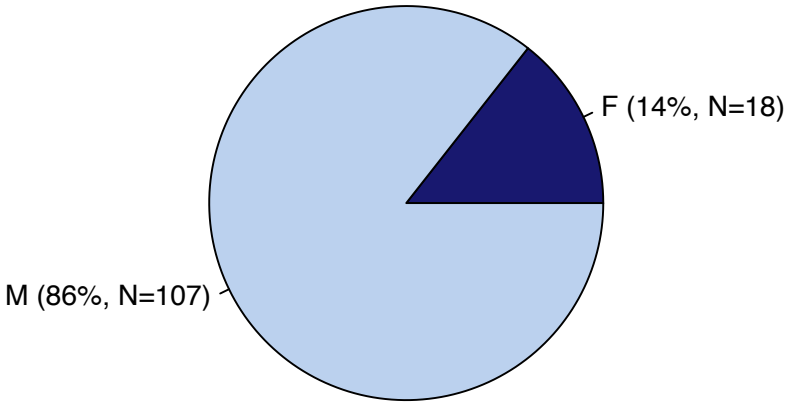
Wilkes MS, and Kravitz RL. 1995. Policies, practices, and attitudes of North American medical journal editors. *Journal of General Internal Medicine* 10:443-450.

PeerJ PrePrints

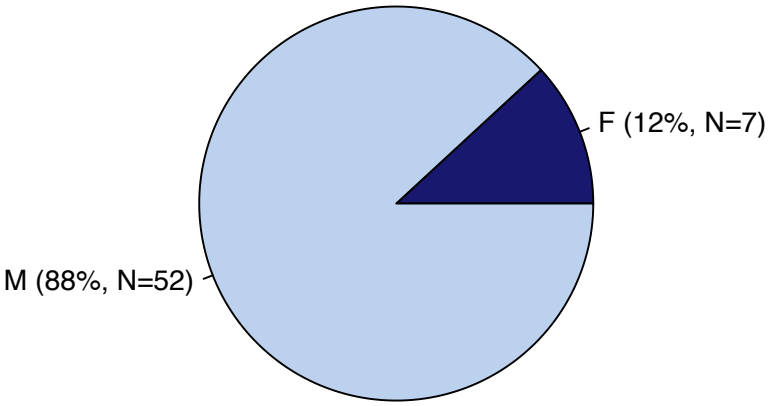
(A) Subject Editors



(B) Associate Editors

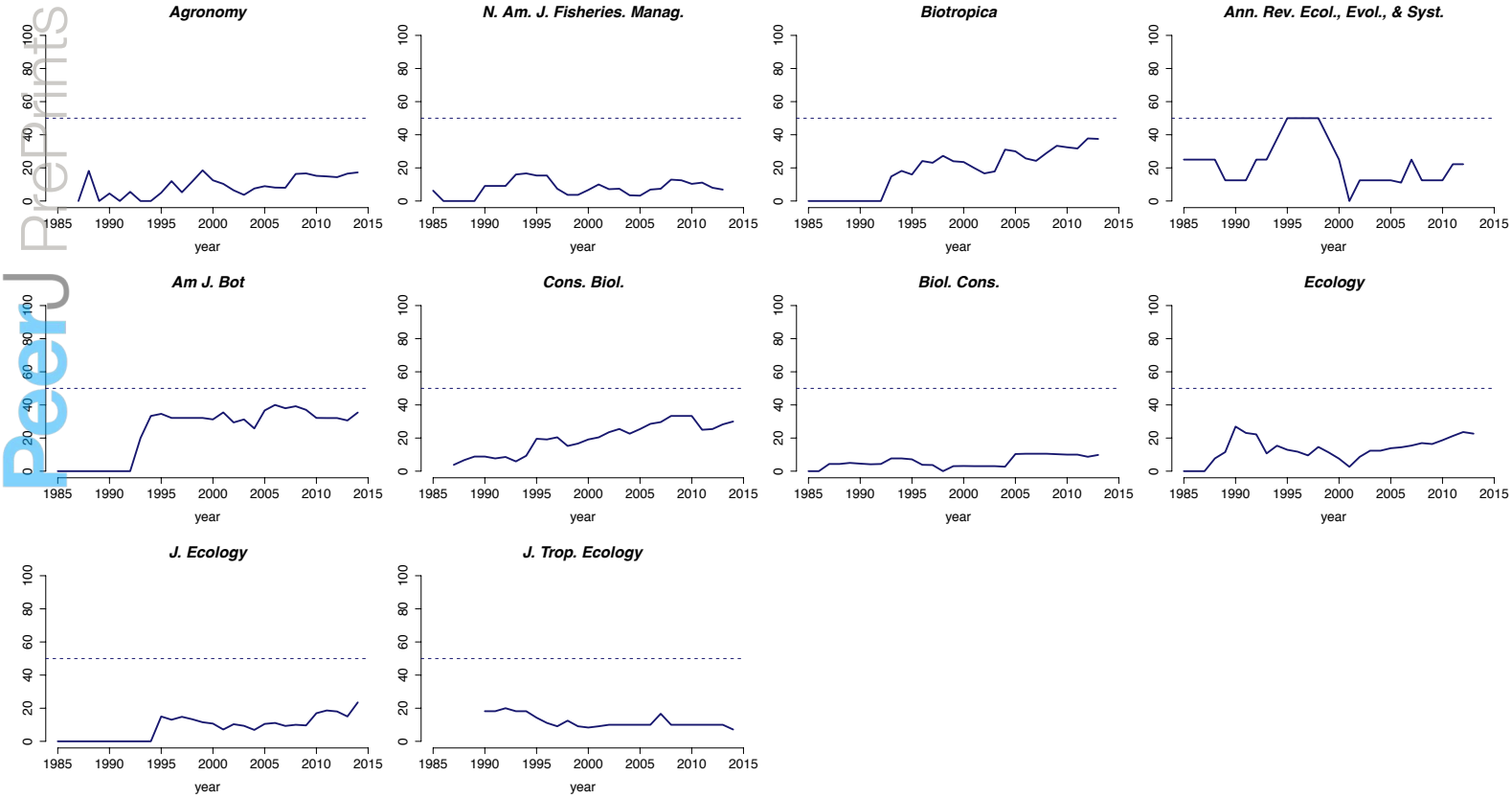


(C) Editors–in–Chief



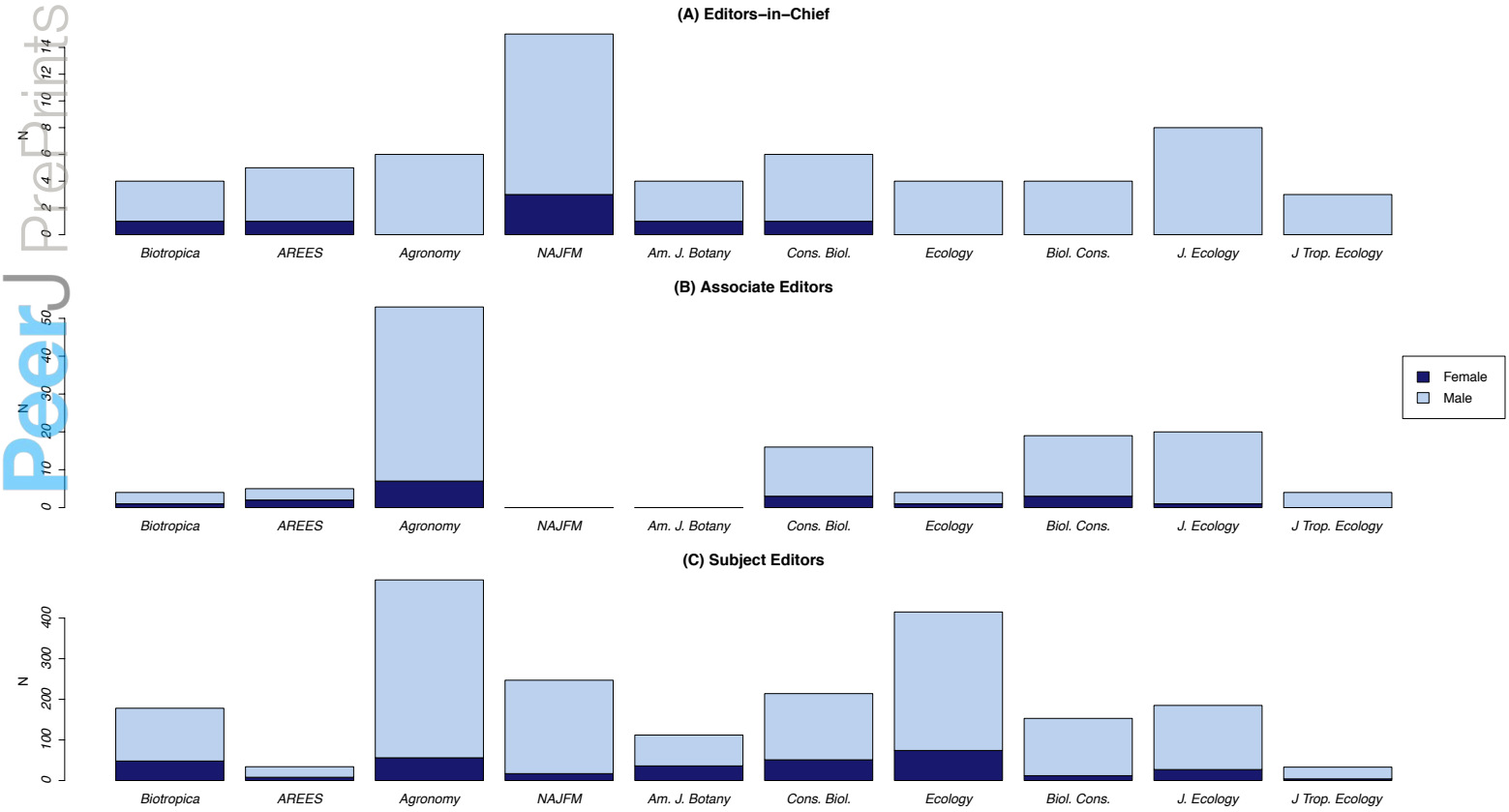
PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug



PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug



PeerJ PrePrints

PeerJ PrePrints | http://dx.doi.org/10.7287/peerj.preprints.369v3 | CC-BY 4.0 Open Access | received: 5 Aug 2014, published: 5 Aug