



Where are the women in ecology?

Peer-reviewed letter

Gender inequality is pervasive across the sciences. In ecology, women constitute 55% of graduate students, 41% of postdocs, and an even lesser percentage of tenured faculty (no data are available on tenured women in ecology, but only 36% of tenured US biology faculty are women [NSF 2011a]). Ecological Society of America (ESA) membership reflects these numbers: although 53% of ESA members between 21 and 35 years old are women, only 37% and 27% of members aged 36–50 and aged 51+ are women, respectively (ESA 2006a).

This discrepancy is also detectable in disciplinary journals. I analyzed the gender, when discernible, of all authors published in *Ecology* in 2011 ($n = 258$ articles), excluding book reviews. I also categorized the discernible gender of those named in the acknowledgements section of each article ($n = 92$ articles). When possible, I confirmed authors' genders with pronouns used on professional websites. I likewise analyzed the 20 most-cited ecology and environmental science articles from 1998 to 2008 (ScienceWatch 2008).

The majority (72%) of the 922 authors to publish in *Ecology* in 2011 were men. Articles with one or more female authors had an average of three male authors, whereas articles with one or more male authors had an average of one female author. Gender disparity was also evident in author position: women represented 33% of first authors (often denoting the project lead) but only 21% of last authors (often denoting the head of the lab). Meanwhile, of 297 people acknowledged by first name for their assistance with fieldwork and data collection, 44% were women (Figure 1a). Most strikingly, while 88 articles were authored exclusively by men, only five were authored exclusively by women (Figure 1b). The 20 most-cited arti-

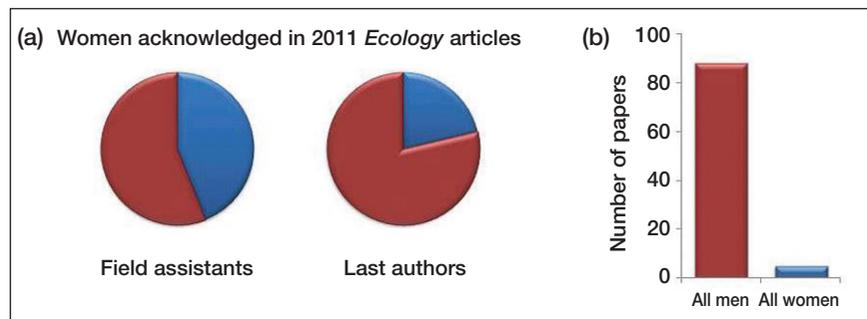


Figure 1. In articles published in *Ecology* in 2011 ($n = 258$), (a) only slightly fewer women (blue) were acknowledged than men (red) for assistance with fieldwork and data collection. Meanwhile, only 21% of last authors were women. (b) Many more articles were authored exclusively by men than exclusively by women.

cles from 1998 to 2008 showed similar trends: 24 of 114 authors (21%) were women, and only one of 20 first authors and two of 20 last authors were women.

This limited review suggests that while women outnumber men in graduate ecology programs and participate equally in data collection, women do not publish as many articles in *Ecology* as do men. There are four potential and non-exclusive explanations for this pattern: (1) an equal percentage of men and women publish but there are more men in the discipline; (2) individual women submit fewer articles than individual men; (3) women are rejected from journals at a higher rate than men; and (4) men are granted authorship by their collaborators more often than are women.

The known imbalance of male-to-female tenured faculty lends credence to explanation (1). But jour-

nal submission is not limited to tenured faculty. I know of no anecdotal or published evidence for explanation (2), while the validity of explanation (3) remains highly contested (Cici and Williams 2011). The disparities between the percentage of female graduate students (55%), acknowledged field assistants (44%), first authors (33%), and last authors (21%) are perhaps attributable to some combination of explanations (1) and (4).

Authorship is not the only realm in which gender inequality matters. I also calculated the percentage and total dollars of National Science Foundation (NSF) grants awarded to women in 2011 in the NSF Population & Community Ecology Program (NSF 2011b). A total of 45 of 105 grants (43%) were awarded to female principal investigators – a percentage that exceeds the proportion of female tenured faculty.

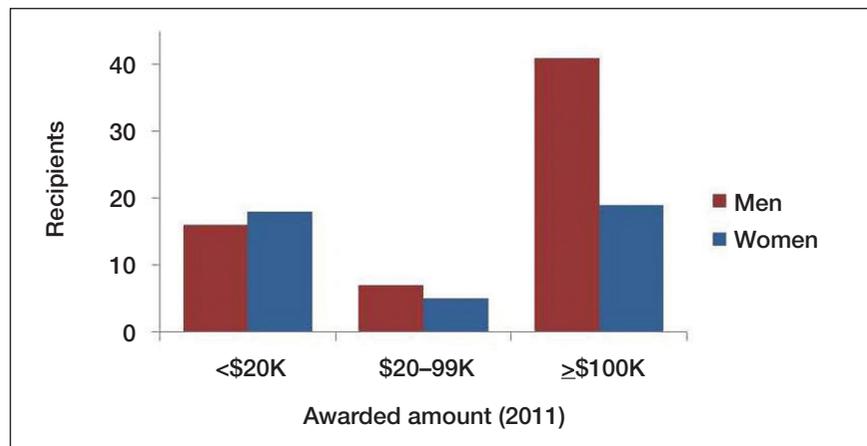


Figure 2. Proportion of recipients (principal investigators) of grants awarded in 2011 by the NSF Population & Community Ecology Program by gender and amount awarded.

However, only \$4.8 million of the awarded \$15.8 million (or 30%) went to female principal investigators. On average, women were awarded 35% less than men (\$114 000 versus \$175 000); the median award to women was 57% lower than that to men (\$59 000 versus \$137 000) (Figure 2; NSF 2011b). This disparity in research funding is consistent with the fact that, across all ages, the median salary of doctorate-holding women scientists is roughly 80% of that of men (NSF 2006).

Authorship and funding establish prestige and professional opportunity. It is important that ecologists acknowledge both the gender disparities in these realms and the experiences of women who have faced reduced professional mobility, increased teaching loads, limited access to role models and mentors, sexist peers, and disproportionate allocation of funds, lab space, and students (Sax 1994; Sonnert and Holton 1995; Damschen *et al.* 2005; Armstrong *et al.* 2007). With nearly 20 years of equal participation in graduate training, ecology publications should look radically different than they currently do.

The 2006 ESA Women and Minorities in Ecology Committee set the goal of reducing or removing barriers to entry and advancement in the profession (ESA 2006b). It is my hope that this letter will advance those goals by sparking difficult but fruitful conversations within ecology departments and the ESA.

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Rigs-to-reefs is more than rigs and reefs

Peer-reviewed letter

In their recent scientific review of rigs-to-reefs (RTR) programs, the conversion of obsolete offshore petroleum structures into artificial reefs, Macreadie *et al.* concluded that RTR may be a valid option for deep-sea benthos conservation (*Front Ecol Environ* 2011; 9[8]: 455–61). Previous scientific publications on RTR in the North Sea (eg Picken and McIntyre 1989) likewise concluded that conversions would be beneficial, but no such conversions have taken place in the North Sea. The reason for this has almost nothing to do with science and everything to do

with politics. Because the history of RTR policy remains in the shadows, a path forward that integrates current scientific thought into policy is unlikely to be followed.

Rigs-to-reefs in the North Sea was first proposed in March 1995 by the oil company Esso Norge. The proposal – based on a commissioned scientific study – recommended creating an in-place pilot artificial reef from the steel understructure of the *Odin* oil-rig platform, while taking all deck and module material to shore; Esso offered to pay approximately US\$2.5 million toward a 5-year pilot study project conducted by the Institute of Marine Research (Esso Norge 1995).

The timing of Esso's plan for *Odin* could not have been worse. Only a month after Esso submitted their plan, Greenpeace protestors boarded the *Brent Spar* buoy – also in the North Sea – to protest the planned disposal of the facility in deepwater by another oil company, Shell. The protest captured substantial media attention, and Shell gas stations were boycotted and even physically attacked during the standoff (Rice and Owen 1999).

Thereafter, a new political climate against deepwater disposal took shape. At the 4th International Conference on the Protection of the North Sea on 7 June 1995, Denmark's delegation asked for an international prohibition on the disposal of oil-rig platforms at sea, termed “dumping”. The Conference issued the Esbjerg Declaration, which stated that land-based disposal was preferred for offshore installations. The Oslo-Paris Commission (OSPAR), an international treaty-making body for North Sea issues, followed suit with OSCOM Decision 95/1, ordering a moratorium on all platform disposal at sea until formal rules could be established. Norway and the UK refused to sign both documents.

Within this politically charged atmosphere, Greenpeace threatened protests if Norway decided to “dump” platforms. The *Odin* plan