

1 **Fewer invited talks by women in evolutionary biology symposia**

2 Julia Schroeder^{1,2*}, Hannah L. Dugdale^{1,3,4*}, Reinder Radersma⁵, Martin Hinsch^{3,4},
3 Deborah M. Buehler^{6,7}, Jennifer Saul⁸, Lindsey Porter⁸, András Liker^{1,9}, Isabelle De
4 Cauwer^{1,10}, Paul J. Johnson¹¹, Anna W. Santure¹, Ashleigh S. Griffin¹², Elisabeth
5 Bolund¹, Laura Ross¹², Thomas J. Webb¹, Philine G. D. Feulner¹³, Isabel Winney¹,
6 Marta Szulkin^{12,14}, Jan Komdeur³, Maaïke A. Versteegh¹⁵, Charlotte K. Hemelrijk³,
7 Erik I. Svensson¹⁶, Hannah Edwards¹, Maria Karlsson¹⁷, Stuart A. West¹², Emma L. B.
8 Barrett¹⁸, David S. Richardson¹⁸, Valentijn van den Brink¹⁹, Joanna H. Wimpenny¹,
9 Stephen A. Ellwood¹¹, Mark Rees¹, Kevin D. Matson¹⁵, Anne Charmantier¹⁴, Natalie
10 dos Remedios^{1,20}, Nicole A. Schneider²¹, Celine Teplitsky²², William F. Laurance²³,
11 Roger K. Butlin¹, Nicholas P. C. Horrocks^{15,24}

12 * equal authorship

13 ¹Department of Animal and Plant Sciences, University of Sheffield, Sheffield, UK.

14 ²Evolutionary Biology, Max Planck Institute for Ornithology, Seewiesen, Germany.

15 ³Behavioural Ecology and Self-Organization, University of Groningen, Groningen,
16 Netherlands

17 ⁴Theoretical Biology, University of Groningen, Groningen, Netherlands

18 ⁵Edward Grey Institute, Department of Zoology, University of Oxford, Oxford, UK.

19 ⁶Department of Ecology and Evolutionary Biology, University of Toronto, Toronto,
20 Ontario, Canada.

21 ⁷Department of Natural History, Royal Ontario Museum, Toronto, Ontario.

22 ⁸Department of Philosophy, University of Sheffield, Sheffield, UK.

23 ⁹Department of Limnology, University of Pannonia, Veszprém, Hungary

24 ¹⁰ Laboratoire de Génétique et Evolution des Populations Végétales, UMR CNRS

25 8198, Lille, France

26 ¹¹ Wildlife Conservation Research Unit, Department of Zoology, University of

27 Oxford, Oxford, UK.

28 ¹² Department of Zoology, University of Oxford, Oxford, UK.

29 ¹³ Evolutionary Ecology, Max-Planck Institute for Evolutionary Biology, Ploen,

30 Germany

31 ¹⁴ Centre d'Ecologie Fonctionnelle et Evolutive, UMR 5175 Campus CNRS,

32 Montpellier, France

33 ¹⁵ Animal Ecology, University of Groningen, Groningen, Netherlands

34 ¹⁶ Evolutionary Ecology Unit, Department of Biology, Lund University, Lund,

35 Sweden

36 ¹⁷ MEMEG, Department of Biology, Lund University, Lund, Sweden

37 ¹⁸ School of Biological Sciences, University of East Anglia, Norwich, UK

38 ¹⁹ Department of Ecology and Evolution, University of Lausanne

39 ²⁰ Department of Biology and Biochemistry, University of Bath, Bath, UK

40 ²¹ Department of Ecology, Swedish University of Agricultural Sciences, Uppsala,

41 Sweden

42 ²² CERSP, UMR 7204 CNRS / MNHN / UPMC, Paris, France

43 ²³ School of Marine and Tropical Biology, James Cook University, Cairns, QLD

44 4878, Australia

45 ²⁴ Department of Zoology, University of Cambridge, Cambridge, UK

46

47 This document contains Supplementary Methods S1.

48

49

49 **(S1) Supplementary Methods:**

50 **Sex ratios of presenters and symposia organisers**

51 The number of invited speakers differed slightly between the website totals
52 (www.eseb2011.de, accessed November 2011) and the printed congress guide. Here,
53 we used the printed copy of the congress guide that was issued at registration. We
54 determined the gender of the first author through meeting them in person, or by their
55 first name given in the list of participants in the congress guide. If the gender of the
56 name was ambiguous, and/or we did not meet or know the scientist in question, we
57 used the first author's name and email address to look them up on their departmental
58 website. We were able to unambiguously determine the gender of all speakers, but not
59 of 45 of the poster presenters (19 essence posters and 26 regular posters). These
60 presenters of unknown gender were excluded from all following analyses.

61 ESEB funded the conference fees, but not travel costs, of two invited speakers
62 per symposium; however, symposium organisers could invite additional speakers if
63 they secured outside funding. Twenty-five symposia had two invited speakers, two
64 had four, two had three, and one had one. One symposium, with three invited
65 speakers, was a merger of three symposium proposals. This symposium had not
66 documented all changes to their invited speakers due to the mergers, and we excluded
67 this from our analyses of declined talks.

68 The deadline for calls for ESEB symposia are generally at least a year in
69 advance, at which time potential organisers must have contacted their invited speakers
70 to confirm their availability. Successful symposium proposals are then selected by a
71 committee. Most ESEB 2011 symposia had two organisers (one had one organiser, 26
72 had two, two had three, and one had six since it was a merger of three symposium
73 proposals).

74

75 **Baseline populations - faculty**

76 We compared the sex ratio of invited speakers with the faculty sex ratios from the
77 Evolutionary Biology departments at the world top-10 universities for the Life
78 Sciences (Times Higher Education University Ranking 2010–2011,
79 [http://www.timeshighereducation.co.uk/world-university-rankings/2010-2011/life-](http://www.timeshighereducation.co.uk/world-university-rankings/2010-2011/life-sciences.html)
80 [sciences.html](http://www.timeshighereducation.co.uk/world-university-rankings/2010-2011/life-sciences.html); accessed May 2012) to the most accurate level that each institutional
81 website allowed. We excluded the John Hopkins University (Rank 8), as their Biology
82 Department did not have a distinct Evolutionary Biology group; instead we added
83 Imperial College London (Rank 11) to complete the top-10 Evolutionary Biology
84 departments. We used the following departments and universities: MIT, Biology;
85 Harvard University, Human Evolutionary Biology and Molecular Cellular Biology;
86 Stanford, Department of Biology; University of Oxford, Zoology; University of Yale,
87 Ecology and Evolutionary Biology; University of Cambridge, Zoology; Imperial
88 College London, Division of Ecology and Evolution; Princeton University, Ecology
89 and Evolutionary Biology; and, University College London, Research Department of
90 Genetics, Evolution and Environment.

91 Our decision to choose only the top-10 universities was somewhat arbitrary.
92 We therefore also assembled data of Evolutionary Biology faculty in the widest sense
93 for European Universities only (the top 10 in the same ranking, Cambridge, Oxford,
94 Imperial, UCL, ETH Zürich, Edinburgh, LMU Munich, Utrecht University, Uppsala
95 University and Ghent University, accessed May 2013). The numbers are similar:
96 Professors 24% (SE = 2%), Lecturers 29% (SE = 5%), and Fellows 40% (SE = 4%).
97

98 **Baseline populations – authors in top-tier journals**

99 In Evolutionary Biology, the first author is usually the one who wrote the text and did
100 most of the work, while the last author is usually the primary investigator who
101 secured funding and supervised the work. We used the journal-specific search engines
102 to select relevant papers. We used the search engine of the journal *Science* to search
103 for original research contributions between January 2010 and January 2012 with the
104 keywords ‘evolution’, ‘evolved’ or ‘evolution*’ in the title. A similar search was not
105 possible directly on the site of the journal *Nature*. We therefore used their search
106 mechanism by subject and selected all articles and letters published in *Nature* under
107 the subject category ‘Evolution’ between January 2010 and January 2012. We
108 disregarded any results from the Earth Sciences. Then, we determined the sex ratio of
109 the first and last authors of these articles, excluding articles authored by consortia.

110

111 **Statistical analyses**

112 All statistical analyses were performed in R.2.15.1 (R Development Core Team,
113 2011). We compared the sex ratios (presented as percentage women) of poster
114 presenters (regular posters and essence posters) and oral presenters (plenary speakers,
115 invited speakers, regular speakers). Plenary speakers, as defined in the ESEB 2011
116 congress guide, include the presidential address and the invited presentation by the
117 John Maynard Smith prize winner, but the statistical results did not change
118 qualitatively when we excluded these. We tested the sex ratio differences using a χ^2
119 test, with Yate’s correction for continuity (Mantel & Greenhouse, 1968).

120 We then compared the sex ratio of invited speakers with the sex ratio of all
121 other presenters, and the sex ratio of plenary speakers with that of all other presenters.
122 Since the χ^2 test is prone to type II errors for small sample-sizes (Crawley, 2007),

123 when expected counts were less than 5 we applied Fisher's exact test to test for a
124 deviation from an odds ratio of 1 between female and male speakers in the tested
125 categories. One could argue that oral presenters represent a different group of
126 scientists compared with poster presenters (Isbell *et al.*, 2012) because peer-review
127 deemed their abstracts of higher quality and/or to reflect topics of higher interest than
128 those of the poster presenters. Hence, they may represent more experienced scientists,
129 meaning that comparisons between both groups (oral and poster presenters) might not
130 be valid. Additionally, gender differences in self-promotion (Moss-Racusin & Rudman,
131 2010) may result in fewer women applying for oral presentations. While we do not
132 test for a difference in scientific quality or self-selection between posters and oral
133 presentations, we acknowledge that these could bias our analyses. We therefore tested
134 for differences in the sex ratio of invited versus regular oral presenters, and of plenary
135 versus regular oral speakers, assuming that peer review facilitates an equally high
136 quality of all oral presentations.

137 Some invited speakers declined invitations to speak. We therefore tested for a
138 difference in the sex ratios of invited speakers that declined or accepted an invitation
139 to speak (hereafter termed: 'initially invited' [i.e. including declines] and 'realised
140 invited' [i.e. excluding declines] speakers) using the χ^2 test. 20 women were invited
141 initially; 10 accepted and 10 declined. Whereas 68 men were initially invited; 50
142 accepted and 18 declined.

143 The sex ratio of speakers at a symposium can depend on the gender of the
144 symposium organiser (Isbell *et al.*, 2012). We first tested whether the sex ratio of the
145 symposium organisers differed from that of all presenters and of regular presenters.
146 We then tested for an association between the presence and absence of women among
147 the organisers of a symposium and the sex ratio of their invited speakers (listed in the

148 congress guide), using a generalised linear model with binomial error structure and
149 logit link.

150 If bias occurs when selecting invited speakers, we would expect the sex ratio
151 of invited speakers to differ from the baseline populations of scientists who could
152 qualify as invited speakers at ESEB. We used the `rbinom` function in R to compare the
153 sex ratio of both the realised and initially invited speakers from all 30 symposia, to
154 those from 10,000 randomisations. The randomisations facilitated comparison of the
155 sex ratios of our baseline populations with that of the invited speakers, accounting for
156 the fact that each symposium was limited to two ESEB-funded invited speakers. In
157 each randomisation, two invited speakers were randomly selected 30 times, using the
158 sex ratios of the three career stages (Professors, Lecturers and Fellows) of faculty
159 members of Evolutionary Biology departments (from the world top-10 rankings in
160 Life Sciences) and authors of current high-impact journals (i.e. first and last authors
161 of primary research articles in *Nature* and *Science*). We also tested the sex ratios of
162 the symposium organisers against the baseline sex ratios of different career stages of
163 faculty members.

164

165 **References**

- 166 Crawley, M.J. 2007. *The R Book*. Wiley & Sons, Chichester.
- 167 Isbell, L., Young, P.T. & Harcourt, A.H. 2012. Stag parties linger: Continued gender
168 bias in a female-rich scientific discipline. *PLoS ONE* 7: e49682.
- 169 Mantel, N. & Greenhouse, S.W. 1968. What is the continuity correction? *Am. Stat.*
170 22: 27–30.
- 171 Moss-Racusin, C.A. & Rudman, L.A. 2010. Disruptions in women’s self-promotion:
172 The backlash avoidance model. *Psychol. Women Q.* 34: 186–202

173 R Development Core Team 2011. *R: A language and environment for statistical*
174 *computing*. R Foundation for Statistical Computing, Vienna, Austria.