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Last and corresponding authorship practices in ecology

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Running head: Authorship practices in ecology

Abstract

Authorship is intended to convey information regarding credit and responsibility for manuscripts. However, while there is general agreement within ecology that the first author is the person who contributed the most to a particular project, there is less agreement regarding whether being last author is a position of significance and regarding what is indicated by someone being the corresponding author on a manuscript. Using an analysis of papers published in *American*

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30 *Naturalist, Ecology, Evolution, and Oikos*, I found that: 1) the number of authors on papers is
31 increasing over time; 2) the proportion of first authors as corresponding author has increased
32 over time, as has the proportion of last authors as corresponding author; 3) 84% of papers
33 published in 2016 had the first author as corresponding author; and 4) geographic regions
34 differed in the likelihood of having the first (or last) author as corresponding author. I also
35 carried out an online survey to better understand views on last and corresponding authorship.
36 This survey revealed that most ecologists view the last author as the “senior” author on a paper
37 (that is, the person who runs the research group in which most of the work was carried out), and
38 most ecologists view the corresponding author as the person taking full responsibility for a
39 paper. However, there was substantial variation in views on authorship, especially corresponding
40 authorship. Given these results, I suggest that discussions of authorship have as their starting
41 point that the first author will be corresponding author and the senior author will be last author. I
42 also suggest ways of deciding author order in cases where two senior authors contributed
43 equally.

44

45 Keywords: corresponding author; last author; authorship; contribution statements

46

47 **Introduction**

48 Who is the last author on a paper? Depending on authorship conventions in a field, the
49 last author might be the person whose surname comes last alphabetically, the person who runs
50 the research group where the research was done, or simply the person who did the least work on
51 the project (Tscharntke et al. 2007). In math, for example, authorship tends to be determined
52 alphabetically (Waltman 2012), whereas in biomedical fields, the last author position is one that
53 tends to carry extra weight (Moulopoulos et al. 1983, Wren et al. 2007, Venkatraman 2010). In
54 ecology, alphabetical author lists are not the norm, but standard authorship practices have
55 received relatively little study. Thus, we are in a similar situation to the one described in 1997 by
56 Rennie et al. when they discussed order of authorship and what it conveys: “Everyone is equally
57 sure about their own system; the point is that none of these schemes is actually disclosed, so the
58 readers, to whom this should be addressed, are not let in on the secret: they have not been told
59 which code book to use and how it works.” The goals of this study are to see if the number of
60 authors and the position of the corresponding author have changed over time, to describe the

61 current systems in use by ecologists regarding last and corresponding authorship, and to see
62 whether certain factors (e.g., research area, career stage) are associated with views on authorship.

63 As noted in an earlier publication on this topic (Tschardt et al. 2007), the first author of
64 an ecology paper is generally the person who made the greatest overall contribution to the work,
65 but there is no consensus on how to determine the order of the remaining authors. In a survey of
66 57 ecologists at the 2004 meeting of the Ecological Society of America, respondents gave ten
67 unique authorship order combinations for a scenario involving only three potential coauthors,
68 with respondents disagreeing about both who should be included as an author and the order of
69 authorship (Weltzin et al. 2006). There is also confusion over what is signified by corresponding
70 authorship (Laurance 2006).

71 This is problematic for two reasons. First, people are assessed based on their publication
72 records, meaning that unclear authorship criteria make it difficult to determine how much credit
73 an author should get for a publication (Tschardt et al. 2007, Wren et al. 2007, Eggert 2011).
74 Job applications, grant proposals, and tenure and promotion decisions are all impacted by
75 publication records. If people evaluating these applications, proposals, and dossiers have
76 different views on what it means to be last or corresponding author, then authorship order does
77 not provide a reliable signal. This can be problematic if, for example, an assistant professor puts
78 herself as last author as an indicator of having led the work, but a tenure letter writer thinks she is
79 last because she did the least work. Second, authorship on a publication entails not just credit for
80 the work, but responsibility for it as well (Rennie et al. 2000, Venkatraman 2010, Eggert 2011).
81 In cases where concerns about research are raised, it is important to know, for example, if
82 corresponding authorship indicates that someone is taking full responsibility for the publication.

83 In this study, I first present data on the number of authors over time as well as the
84 position of the corresponding author over time in four journals (*American Naturalist*, *Ecology*,
85 *Evolution*, and *Oikos*). For papers published in these four journals in 2016, I also asked whether
86 geographic region or number of authors influenced the likelihood of having the first (or last)
87 author as corresponding author. I also present results of a survey of scientists (80% of whom
88 identified ecology as their primary research area) that asked about views on last and
89 corresponding authorship. In addition to giving information on overall views of ecologists, the
90 survey allowed me to explore whether factors such as research subfield, time since PhD,
91 geographic location, and amount of interdisciplinary work were associated with views on last

92 and corresponding authorship. I end by suggesting that, since most readers expect authors to use
93 a first-last author emphasis (FLAE, sensu Tschardt et al. 2007) and since the vast majority of
94 papers in *American Naturalist*, *Ecology*, *Evolution*, and *Oikos* have the first author as the
95 corresponding author, those are good starting places for discussions regarding author order and
96 corresponding authorship (while recognizing that there will be situations where it is desirable or
97 necessary to deviate from this). I also give suggestions for how to determine authorship order in
98 cases where two “senior” authors have made equal contributions to a study.

99

100 **Methods**

101 *Literature survey*

102 The literature survey involved a combination of approaches. First, I began by reviewing
103 the first issue of the journal *Ecology* every ten years from 1956-1986. In 1996, I reviewed the
104 second issue of the journal, since the first contained a special feature and I wished to avoid any
105 potential confounding effects of analyzing a special feature. I used this data set to look at
106 corresponding authorship practices in *Ecology* from 1956-1996, tracking whether there was a
107 note indicating to whom correspondence (or reprint requests) should be sent. Second, I collected
108 data from Web of Science on the number of authors of papers published in all issues of *Ecology*
109 every ten years from 1956-1996 and every five years from 2001-2016, as well as from the
110 journals *American Naturalist*, *Evolution*, and *Oikos* every five years from 2001-2016. Third, for
111 2001, 2006, 2011, and 2016, I also extracted data on corresponding authorship from Web of
112 Science. I considered authors who had their email addresses in the Web of Science record as
113 corresponding authors (but see note below about exceptions, especially in 2001 & 2006).
114 Corresponding authorship was then grouped into six categories: 1) “first” (the email address
115 given was for the first or only author in the author string), 2) “middle” (the email address given
116 was for someone other than the first or last author), 3) “last” (the email address given was for the
117 last author), 4) “ND” (not designated; when an email address was not given for any author), 5)
118 “all” (when both – for papers with only two authors – or all of the authors on a paper had email
119 addresses given), and 6) “other” (when email addresses were given for some other combination
120 of authors, such as the first and last). For one paper in *Oikos*, an email address was given but it
121 was not possible to determine which author the email address corresponded to; this paper was
122 omitted from the analysis. For all four journals in 2001 and for *American Naturalist* in 2006, the

123 email addresses given (or not given) by Web of Science did not match what appeared on the first
124 page of the article in the print journal. In most cases in 2001, the issue was the omission of email
125 addresses; for *American Naturalist* in 2006, the issue was that Web of Science had email
126 addresses for all authors in most cases, whereas the print copy indicated one author for
127 correspondence. Thus, for all four journals in 2001 and for *American Naturalist* in 2006, I did
128 not use Web of Science data regarding corresponding authorship. Instead, I manually reviewed
129 the papers in the first 900 pages of each journal in that year to determine corresponding
130 authorship, using the same criteria given above. (This was done by visiting the stacks in the
131 University of Michigan library; Figure 1.) In some cases, email addresses were given for
132 multiple authors but one author was indicated as the one to whom correspondence should be
133 addressed; in these cases, only the author designated for correspondence was considered the
134 corresponding author. Editorial material, book reviews, retractions, and corrections were
135 excluded from analyses.

136 For the journal *Ecology*, changes in the number of authors over time (1956-2016) were
137 analyzed using a glm with Poisson error. For 2001-2016, I used the dataset on number of authors
138 from all four journals and a glm (again, with Poisson error) with year, journal, and their
139 interaction as fixed effects. Changes (over 2001-2016) in whether the first author was
140 corresponding author were analyzed using a glm with binomial error with year, journal, and their
141 interaction as fixed effects. This analysis was also carried out for whether the last author was
142 corresponding author.

143 For the 2016 publications, I also extracted information on where the reprint author lived,
144 and used that to compare corresponding authorship by region using a glm with binomial error
145 and logit link function. In most cases, there was only one reprint author indicated; however, in
146 cases where there were multiple addresses, I used the country indicated in the last address. The
147 regions used in this analysis were Africa, Asia, Europe, North America (which included Canada,
148 Jamaica, Mexico, Panama, and the United States), Oceania (which included Australia and New
149 Zealand), and South America. I did this analysis once with a response variable indicating
150 whether the first author was the corresponding author, and once with a response variable
151 indicating whether the last author was the corresponding author. For the statistical analysis, I
152 only included regions with at least 50 publications (that is, Asia, Europe, North America, and
153 Oceania).

154 I also looked at whether the number of authors influenced whether the first or last author
155 was the corresponding author; because of the small sample sizes for papers with 10 or more
156 authors, I combined papers with 10 or more authors and treated the number of authors as an
157 ordinal predictor. This analysis used data from all geographic regions, but omitted papers with
158 only one author (as those could not have a last author as corresponding author, based on the
159 authorship definitions I used).

160 All analyses were carried out in R (v 3.4.1). Figures were also made in R using the ggplot
161 (Wickham 2009) and cowplot (Wilke 2017) packages. Data and code for the analyses and figures
162 are available at: <https://doi.org/10.5281/zenodo.883464>

163

164 *Poll*

165 I carried out a poll of readers of the *Dynamic Ecology* blog. In addition to appearing on the blog,
166 the poll was advertised via social media and thus likely reached a wider readership than a typical
167 blog post. The poll first appeared on 6 April 2016 and ran for two weeks. After removing four
168 blank responses, there were 1122 responses to the poll.

169 The poll had four main questions: 1) For ecology papers, do you consider the last author
170 to be the senior author? 2) Which of the following statements most closely matches the current
171 norms in ecology in terms of who is corresponding author? 3) Which of the following statements
172 would be best practice in terms of who is corresponding author? and 4) If someone includes a
173 statement on his/her CV indicating they have used a first/last author emphasis, do you pay
174 attention to that? The poll also asked about the respondent's primary research area, whether their
175 research is primarily basic or applied, how frequently they conduct interdisciplinary research,
176 how many years post-PhD they are, where they live (options: Africa, Asia, Australia, Europe,
177 North America, and South America), and what their current department is (divided by discipline:
178 EEB, biology, natural resources, or other). The full survey, including the questions and all the
179 answer options, is given in the Supplement.

180 In addition to presenting the overall responses to the four main questions, I used the
181 additional information on research area, geographic location, years since degree, and department
182 type to look for factors associated with views on last and corresponding authorship. Prior to
183 doing those analyses, I decided that a difference between two groups in their views on authorship
184 had to be at least 10% in order to be considered notable. While this threshold is somewhat

185 arbitrary, it helped ensure that small differences weren't overinterpreted. Data were analyzed in
186 R (v 3.4.1) and plotted using the ggplot (Wickham 2009), cowplot (Wilke 2017), and likert
187 (Bryer and Speerschneider 2016) packages. For the analysis of views on last authorship,
188 responses were turned into a binary response based on whether they viewed the last author as
189 likely to be the senior author (with "Yes", "It depends, but probably yes", and "Not sure, but
190 probably yes" all being coded as 1 and the other three responses as 0). For the analysis of views
191 on current corresponding authorship practices, I created a binary variable based on whether
192 someone chose the "full responsibility" option (that is, whether or not they chose the option
193 saying that the corresponding author "uploaded the files, managed the revisions and wrote the
194 response to reviewers, and took responsibility for the paper after publication").

195 For the analysis of differences across career stages, I excluded data from the 19
196 respondents who did not have PhDs and were not in graduate school, then treated the other
197 categories as ordinal variables and looked a linear effect of career stage (years since PhD) on
198 views on last or corresponding authorship. For analyses related to geography, I compared views
199 of people currently living in Europe with those of people currently living in North America. For
200 analyses related to research area, I compared responses of people who identified primarily as
201 ecologists with those of people who identified primarily as evolutionary biologists. For analyses
202 of department type, I compared responses of people who are in EEB departments with those of
203 respondents in Biology and Natural Resources departments. Finally, for the analysis of views on
204 last authorship, I also tested for effects of whether someone primarily does basic or applied
205 research, and of the frequency with which they do interdisciplinary research (modeled as an
206 ordinal variable). Neither basic vs. applied research nor the amount of interdisciplinary research
207 significantly influenced views on last authorship; therefore, in the interest of space, those results
208 are not presented below. All analyses were done using glms in R with binomial error and a logit
209 link function.

210 One important caveat for this study, as discussed further in the discussion section, is that
211 there are surely biases related to this being a voluntary, online poll of blog readers. Among other
212 things, the poll respondents are likely to be younger, on average, than ecologists as a whole. One
213 conclusion of this study is that this area would benefit greatly from additional study by social
214 scientists with formal training in survey design and qualitative analysis.

215 Aside from expecting the number of authors on papers to increase over time (as has been
216 found by others: Johnson 2006, Weltzin et al. 2006, Fox et al. 2016, Logan 2016), I did not have
217 strong *a priori* hypotheses about how corresponding authorship patterns would change, or about
218 whether or how research area, geographic location, years since degree, and department type
219 might influence patterns of corresponding authorship or views on last and corresponding
220 authorship.

221

222 **Results**

223 *Authorship over time*

224 The number of authors on *Ecology* papers is increasing over time ($Z = 24.46, p < 0.0001$), with a
225 particularly notable uptick after 1996 (Figure 2A). In 1956, the median number of authors on a
226 paper was 1 (mean = 1.4), whereas in 2016 the median was 4 (mean = 4.6). Between 1956 and
227 1996, the corresponding author on a paper was not usually indicated and mailing addresses for
228 all authors were given. Of the 129 papers analyzed during that window, only two indicated the
229 author to whom correspondence should be addressed; in other words: it was very rare for a
230 corresponding author to be indicated during this time window. Interestingly, in one of the cases
231 (Kalisz and Teeri 1986) the first author was indicated, whereas in the other (Murcia and
232 Feinsinger 1996) the second author was indicated.

233 Looking across all four journals for the period 2001-2016, the number of authors
234 increased over time ($\chi^2_1 = 384.3, p < 0.0001$; Figure 2B) and journals differed in the number of
235 authors per paper ($\chi^2_3 = 39.0, p < 0.0001$), but there was not a significant difference between
236 journals in the increase in the number of authors over time (that is, there was not a significant
237 journal*year interaction: $\chi^2_3 = -6.3, p = 0.097$).

238 The proportion of first authors as corresponding author increased over time ($\chi^2_1 = 48.0, p$
239 < 0.0001 ; Figure 3) and differed between journals ($\chi^2_3 = 258.9, p < 0.0001$); moreover, the
240 change in first author as corresponding author over time differed between journals (interaction:
241 $\chi^2_3 = -19.3, p = 0.0002$). *American Naturalist* and *Evolution* showed high proportions of papers
242 with all authors having email addresses in 2001 and 2006, whereas this was rare in all journals in
243 2016 (Figure 3). The proportion of last authors as corresponding author also increased over
244 2001-2016 ($\chi^2_1 = 21.9, p < 0.0001$; Figure 3); the proportion of last authors as corresponding
245 author did not differ significantly between journals ($\chi^2_3 = 3.6, p = 0.31$), nor did journals differ

246 significantly in the increase over time (interaction: $\chi^2_3 = -4.8$, $p = 0.19$). In 2016, the
247 corresponding author was usually the first author (range across the four journals: 77-90% of
248 papers); less commonly, it was the last author (range across the four journals: 9-18% of papers).

249 250 *Analysis of corresponding authorship in 2016*

251 Geographic regions differed in the likelihood of having the first (or last) author as corresponding
252 author. Focusing on the regions with at least 50 publications in the dataset, papers where the
253 reprint author lived in Asia were much less likely to have the first author as corresponding author
254 (Figure 4A; pairwise comparisons to Europe, North America, and Oceania: all $Z > 3.1$, all $p <$
255 0.002) and more likely to have the last author as corresponding author (all $Z < -2.7$, all $p <$
256 0.006). Papers where the reprint author lived in Europe were less likely to have the first author as
257 corresponding author than ones where the reprint author lived in North America ($Z = -1.99$, $p =$
258 0.047), but this effect was more modest (83% vs. 88%).

259 There was no clear relationship between the number of authors on a paper and the
260 likelihood of the corresponding author being first (linear regression term for model with 10 or
261 more authors binned together: $Z = 0.032$, $p = 0.975$) or last (linear regression term: $Z = -0.031$, $p =$
262 0.975) author (Figure 4B). If papers with 7 or more authors were binned together, there was
263 still not a significant effect of number of authors on last authorship (linear regression term: $Z =$
264 1.59 , $p = 0.11$), but there was a significant effect on first authorship (linear regression term: $Z = -$
265 2.53 , $p = 0.012$).

266 267 *Demographics of poll respondents*

268 80% of respondents indicated that ecology was their primary research field (Table 1). Most poll
269 respondents were current students (28%) or had received their PhD within the past 1-5 years
270 (31%), but respondents included people in all categories, including those who received their PhD
271 over 20 years ago (Table 2). The vast majority of the poll respondents live in North America
272 (64%) or Europe (26%; Table 3).

273 274 *Views on last authorship*

275 For ecology papers, most respondents viewed the last author as the senior author (that is, the lab
276 head or principal investigator; Figure 5A). However, this view is not unanimous: the three “no”-

277 related answers garnered 14% of the responses. Confusion about whether the last author is the
278 senior author could be reduced if ecologists included a note on their CV indicating that the last
279 author position is one of emphasis. However, the poll results suggest this is likely to only be
280 partially effective – 29% of respondents said they do not or would not pay attention to these
281 statements (Figure 5B).

282 Year of degree (as a proxy for career stage) influenced views on last authorship (Figure
283 6A), with people who are within 10 years of their PhD (or currently in graduate school) more
284 likely to view the last author as senior author (as evidenced by a significant linear term in the
285 regression: $Z = -2.2, 0.028$). Respondents living in Europe were more likely to say the last author
286 is the senior author, as compared to those in North America (95% “yes” responses vs. 82%,
287 respectively; $Z = 5.3, p < 0.0001$; Figure 6B). Looking at primary research area, the two
288 evolution categories had the highest proportion of positive responses to the question about
289 whether the last author was the senior author, with ecologists being somewhat less likely to give
290 one of the “yes” responses (as compared to evolutionary biologists; Figure 6C; contrast of
291 ecology vs. evolution: $Z = 2.4, p = 0.02$). People in Biology and EEB departments were more
292 likely to view the last author as the senior author, compared to those in Natural Resources
293 departments or other types of departments (Figure 6D; contrasts of EEB departments to Biology
294 ($Z = 0.23, p = 0.82$), Natural Resources ($Z = 3.03, p = 0.002$), and other departments ($Z = 3.22, p$
295 $= 0.001$)).

296

297 *Views on corresponding authorship*

298 There was substantial variation in respondents’ views on current and best practices for
299 corresponding authorship (Figure 7). Most respondents (54%) said that the corresponding author
300 “uploaded the files, managed the revisions and wrote the response to reviewers, and took
301 responsibility for the paper after publication”. The next most common response (19% of
302 respondents) was that the current practice is that the corresponding author is the person who
303 simply uploaded the files – though only 8% viewed this as best practice. Only 7% said that the
304 current practice is that the corresponding author is the senior author.

305 Looking at the effects of career stage (that is, years since PhD), research area, department
306 type, and geographic region on views on corresponding authorship practices, the only factor that
307 was statistically significant and reached the 10% effect size threshold was department type

308 (Figure 8): people in EEB departments were more likely to choose the “full responsibility”
309 option (that is, to say the corresponding author “uploaded the files, managed the revisions and
310 wrote the response to reviewers, and took responsibility for the paper after publication”) than
311 those in Biology departments (60% vs. 50%, respectively; $Z = 2.4$, $p = 0.016$). There was no
312 significant impact of career stage (linear regression term: $Z = -1.3$, $p = 0.20$), nor were there
313 significant differences in ecologists vs. evolutionary biologists ($Z = 1.12$, $p = 0.26$) or those
314 living in Europe vs. North America ($Z = 1.6$, $p = 0.10$).

315

316 **Discussion**

317 The number of authors on papers in ecology has increased over time; in 1956, most
318 *Ecology* papers had only a single author, whereas in 2016 the median number of authors was 4.
319 Prior to the late 1990s, it was rare for the corresponding author of a paper to be designated; now,
320 the first author is usually the corresponding author, with the last author being the corresponding
321 author in a minority of cases. Most ecologists view the last author as a position of emphasis in a
322 paper, though this view is not universal. Most ecologists view the corresponding author as the
323 person taking full responsibility for a paper, but, again, the survey revealed variation in views
324 regarding current and best practices for corresponding authorship. Overall, there is variation in
325 views on corresponding and last authorship in ecology, and the field would benefit from greater
326 consensus on what is signified by corresponding and last authorship, as well as additional studies
327 into the factors that influence decisions regarding corresponding and last authorship.

328 To state the obvious, decisions about who should be last and/or corresponding author are
329 only necessary if there is more than one author. Thus, the trend in ecology towards having more
330 authors on papers (Figure 2), as also seen by others (Johnson 2006, Weltzin et al. 2006, Fox et al.
331 2016, Logan 2016), means that there are more decisions to be made regarding authorship,
332 including last and corresponding authorship.

333 Over the past several decades, various systems for attempting to indicate how much
334 different authors contributed to multi-author papers have been proposed (e.g., Davis and
335 Greggerman 1969, Mouloupoulos et al. 1983, Rennie et al. 1997, Weltzin et al. 2006). A common
336 suggestion is to use author contribution statements (e.g., Mouloupoulos et al. 1983, Rennie et al.
337 1997, Cozzarelli 2004). While author contribution statements do have the potential to remove
338 ambiguity about whether the last author is a position of emphasis, they have several problems

339 themselves. First, unless the full author contribution statements are put on a CV for every
340 publication, people reviewing job, grant, or award applications are unlikely to see them
341 (especially at earlier stages of screening). Second, and more problematically, people do not
342 necessarily trust author contribution statements (Venkatraman 2010, Fox 2016): in a different
343 poll done on the Dynamic Ecology blog, only 41% of respondents indicated that author
344 contribution statements are always or usually accurate in their experience (Fox 2016). One
345 possible modification would be to make the author contribution statements less fine-grained:
346 rather than indicating which authors carried out which specific tasks, contribution statements
347 could indicate which research groups led different aspects of the project (e.g., “the X Lab led the
348 empirical components of this work, and the Y Group led the development of the mathematical
349 model”).

350 Thus, for the foreseeable future, people will continue to attempt to infer the contributions
351 of different authors based on the order of authorship. The results of this survey demonstrate that,
352 at present, most ecologists tend to view the last author as the senior author (Figure 5). Therefore,
353 when discussing authorship, ecologists should assume that most people will interpret authorship
354 order assuming a first-last author emphasis (FLAE), viewing the last author as the senior author.
355 As a result, I recommend that discussions regarding authorship should have as their starting point
356 that the senior author will be the last author. However, a problem arises when multiple groups
357 collaborate, making it so that there is not one “senior” author. In cases where two “senior”
358 authors made equal contributions, I recommend indicating that with a footnote (e.g., “these two
359 authors contributed equally”). However, even with a footnote, a decision still needs to be made
360 about order. I recommend that, if one person would benefit more from the last author position
361 (say, because they are pre-tenure), that person should be listed last. If the two people are at
362 similar career stages (or if there’s another reason why the recommendation in the previous
363 sentence doesn’t make sense), they should flip a coin (or use some other random method) and
364 indicate in the footnote that that’s how the decision was made. If the collaboration results in
365 more than one contribution with equal last authorship, the authors could alternate in an ABBA
366 sequence as a means of balancing out equal contributions over time. (These same general
367 guidelines could be applied in cases of shared first authorship as well.) Given the continued
368 potential for confusion regarding what is conveyed by authorship order – especially in more
369 complicated situations arising from collaborations between multiple research groups – and given

370 the high stakes of tenure and promotion decisions, it might be advisable to include a short
371 paragraph in the dossier that describes the authorship system that was used (e.g., a first-last
372 author emphasis system) and noting exceptions (e.g., for a high profile paper based on work done
373 in several different research groups).

374 When making decisions related to authorship, it is also important to keep in mind that
375 individuals likely have biases that might influence who is viewed as “senior” and that this might
376 impact views on who should be last author on a manuscript. A recent study found that only
377 ~25% of last authors in the journal *Functional Ecology* were women (Fox et al. 2016). It is likely
378 that at least some of this pattern can be attributed to women being more likely to leave science,
379 leading to fewer women as senior authors (Fox et al. 2016). At the same time, the same biases
380 that contribute to women disproportionately leaving science (e.g., Moss-Racusin et al. 2012)
381 might also influence decisions regarding which author is viewed as “senior” (and, therefore, in
382 the emphasized last author position). Thus, in addition to recommending that authorship
383 discussions begin with the default of having the senior author as last author, I also recommend
384 that, when thinking about who is the senior author, people should be aware of potential biases
385 (such as those related to gender or race/ethnicity) that might influence who they view as
386 “senior”.

387 Of the papers published in 2016 that were examined for this study, 84% had the first
388 author as the corresponding author. Based on the survey results, most people will assume that
389 this person “uploaded the files, managed the revisions and wrote the response to reviewers, and
390 took responsibility for the paper after publication”, but 19% will think it simply means that that
391 is the person who uploaded the files. Thus, there is substantial variation in how people view
392 corresponding authorship, including whether it is viewed as something that indicates something
393 larger about responsibility for the work reported in the manuscript. Further work on this topic –
394 especially studies that collect qualitative data on the topic – would be useful for understanding
395 current views on corresponding authorship. One potential focus for such studies is whether
396 corresponding authorship is perceived differently depending on whether the corresponding
397 author is the first or last author, as was found in a survey of medical school department chairs
398 (Bhandari et al. 2014). Based on the combination of poll results and current corresponding
399 authorship practices, a reasonable starting point for discussions of authorship on ecology articles

400 would be to have the lead author be the corresponding author on a paper noting that, in doing so,
401 many readers will assume that means that person is taking full responsibility for the paper.

402 One important conclusion from this study is that there is much more work to be done on
403 this topic. This study has several limitations – most notably relying heavily on an online survey
404 of blog readers to understand current views on last and corresponding authorship. One problem
405 arising from this approach is that it almost certainly skewed the age distribution of respondents
406 (as compared to the age distribution of ecologists as a whole). In addition, the survey design
407 (multiple choice questions) doesn't allow insight into what factors people were weighing as they
408 decided between different options, nor into what caveats they may have wished to add as they
409 chose a response. Moreover, people likely varied in terms of how they interpreted some of the
410 options (e.g., does full responsibility simply mean that is the person who handles all the requests
411 for more information, or does it mean that, if a major problem was found with the paper, that
412 person would take full responsibility for it?) This topic would benefit greatly from study by
413 someone with training in social science methods, including survey design and qualitative
414 research methods. Such work could provide further insights into the factors that influence
415 individual author's decisions regarding last and corresponding authorship, as well as the ways in
416 which search committees, tenure and promotion committees, and others view authorship.

417 Authorship carries with it both credit and responsibility, and the order of authorship can
418 convey information about how much credit and responsibility an author of a multi-authored
419 paper deserves. However, because of variation across fields and over time, what is indicated by
420 last authorship and corresponding authorship is not necessarily clear. My analyses indicate that
421 most ecologists view the last author as the “senior” author on a paper (that is, the head of the
422 group where the majority of the work was carried out), that the first author tends to be the
423 corresponding author on ecology papers, and that most ecologists interpret corresponding
424 authorship as taking full responsibility for a paper. Thus, in addition to agreeing with earlier calls
425 to discuss authorship early and often (Weltzin et al. 2006), I suggest that those discussions have
426 as their starting point that the last author is the senior author and the first author is the
427 corresponding author. Collaborations between multiple groups have the potential to be trickier,
428 but the general guidelines given above can help resolve ties that arise from equal contributions.

429

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436 data on authorship could be downloaded from Web of Science, and to Stephen Heard and an
437 anonymous reviewer for helpful comments on an earlier draft of the manuscript.

438

439 **Author contribution**

440 M.A.D. carried out the literature survey and poll, analyzed the data, and wrote the manuscript.
441 Conveniently, by having only one author, there were no decisions to make regarding author order
442 or corresponding authorship.

443

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493
494

495 **Figure Legends**

496

497 **Figure 1.** Stacks containing bound volumes of journals (Shapiro Library, University of
498 Michigan)

499

500 **Figure 2.** Number of authors on papers in *American Naturalist*, *Ecology*, *Evolution*, and *Oikos*
501 over time. See methods for more information on which journal issues were analyzed. A) Data for
502 *Ecology* for 1956-2016. B) Data for *American Naturalist*, *Ecology*, *Evolution*, and *Oikos* for
503 2001-2016.

504

505 **Figure 3.** Corresponding author position for articles in *American Naturalist*, *Ecology*, *Evolution*,
506 and *Oikos*. “ND” means that a corresponding author was not designated.

507

508 **Figure 4.** Influence of geographic region and number of authors on corresponding authorship. A)
509 Percentage of corresponding authors from different geographic regions who are first author (gray
510 bars) or last author (blue bars). The statistical analysis of this dataset only included regions with
511 at least 50 publications. B) Relationship between the number of authors on a paper and whether
512 the corresponding author is the first author (gray bars) or last author (blue bars). Numbers over
513 the bars indicate the number of papers in that category. The gray and blue bars do not always
514 sum to 100% because, rarely, the corresponding author was a middle author or a combination of
515 authors (see Figure 3 for general patterns).

516

517 **Figure 5.** Views of poll respondents on A) whether the last author of a paper is the senior author
518 and B) whether they would pay attention to a statement on the CV indicating that the last author
519 position was one of emphasis.

520

521 **Figure 6.** Variation in views on last authorship by career stage, geographic location, research
 522 area, and department type. The bars shaded in greens are positive responses to the question “For
 523 ecology papers, do you consider the last author to be the senior author”, whereas gold responses
 524 are negative responses (as described in the figure legend). The percentage on the right gives the
 525 total percentage of positive responses, while the percentage on the left gives the total percentage
 526 of negative responses for a group. The number on the right hand side shows the number of
 527 respondents in a given category (e.g., 29 respondents indicated that they live in South America).

528
 529 **Figure 7.** Views of poll respondents on current (light blue) and best (gray) practices for
 530 corresponding authorship.

531
 532 **Figure 8.** Influence of career stage, research area, department type, and geographic location on
 533 views on current corresponding authorship practices.

534
 535
 536 **Table 1.** Primary research area of respondents to poll on last and corresponding authorship,
 537 sorted in decreasing order of commonness.

Primary Research Area	%
ecology (primarily field-based)	50
ecology (primarily computational-based)	19
evolutionary biology (primarily organismal)	12
ecology (primarily wet-lab based, including molecular ecology)	11
evolutionary biology (primarily molecular)	5
biology other than EEB	2
outside biology	2

538
 539 **Table 2.** Number of years since receiving PhD for poll respondents.

Years since PhD	%
0 (current students should choose this)	28

1-5	31
6-10	18
11-15	12
16-20	5
>20	5
no PhD and not a current student	2

540

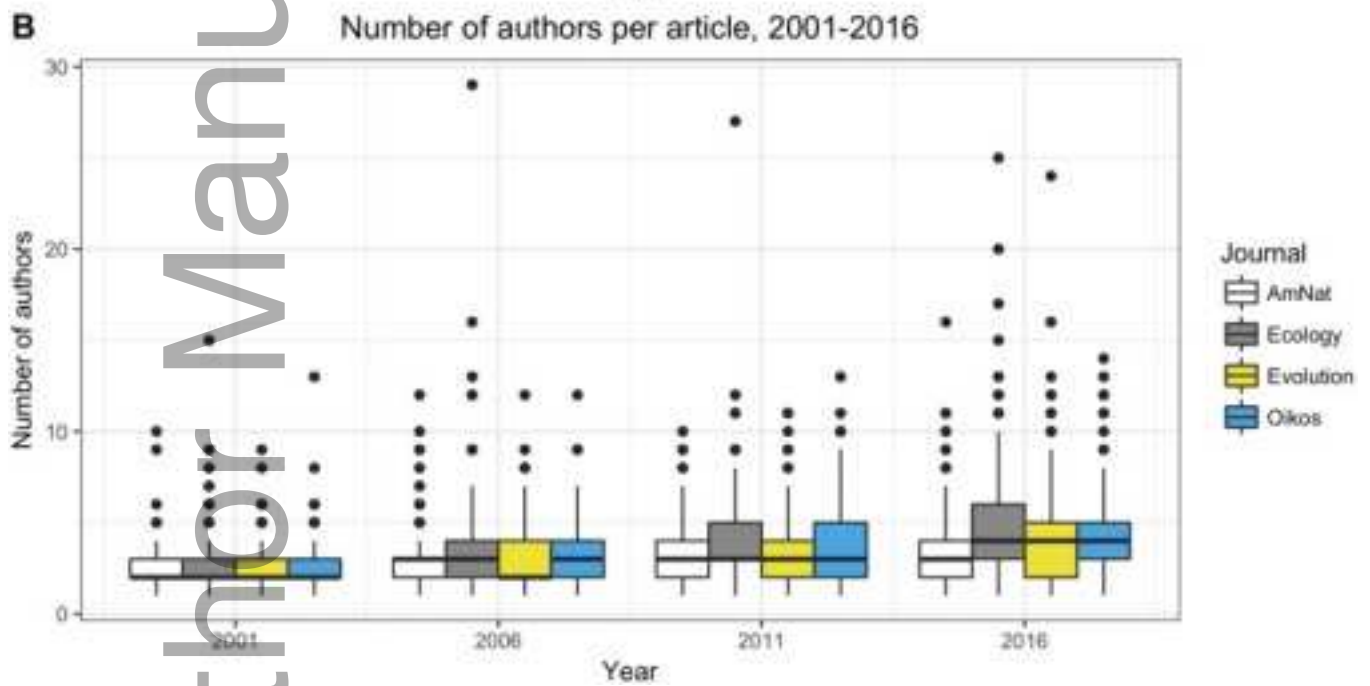
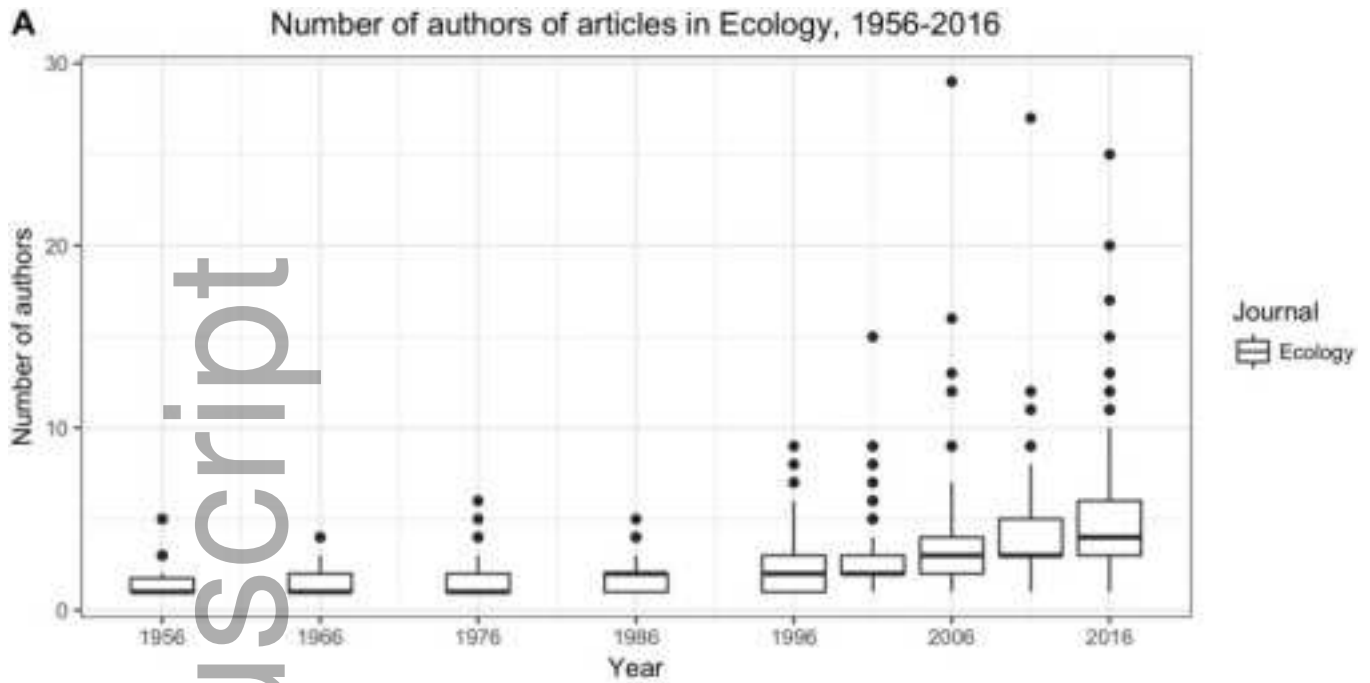
541 **Table 3.** Geographic location of poll respondents, sorted alphabetically.

Continent	%
Africa	1
Asia	1
Australia	6
Europe	26
North America	64
South America	3

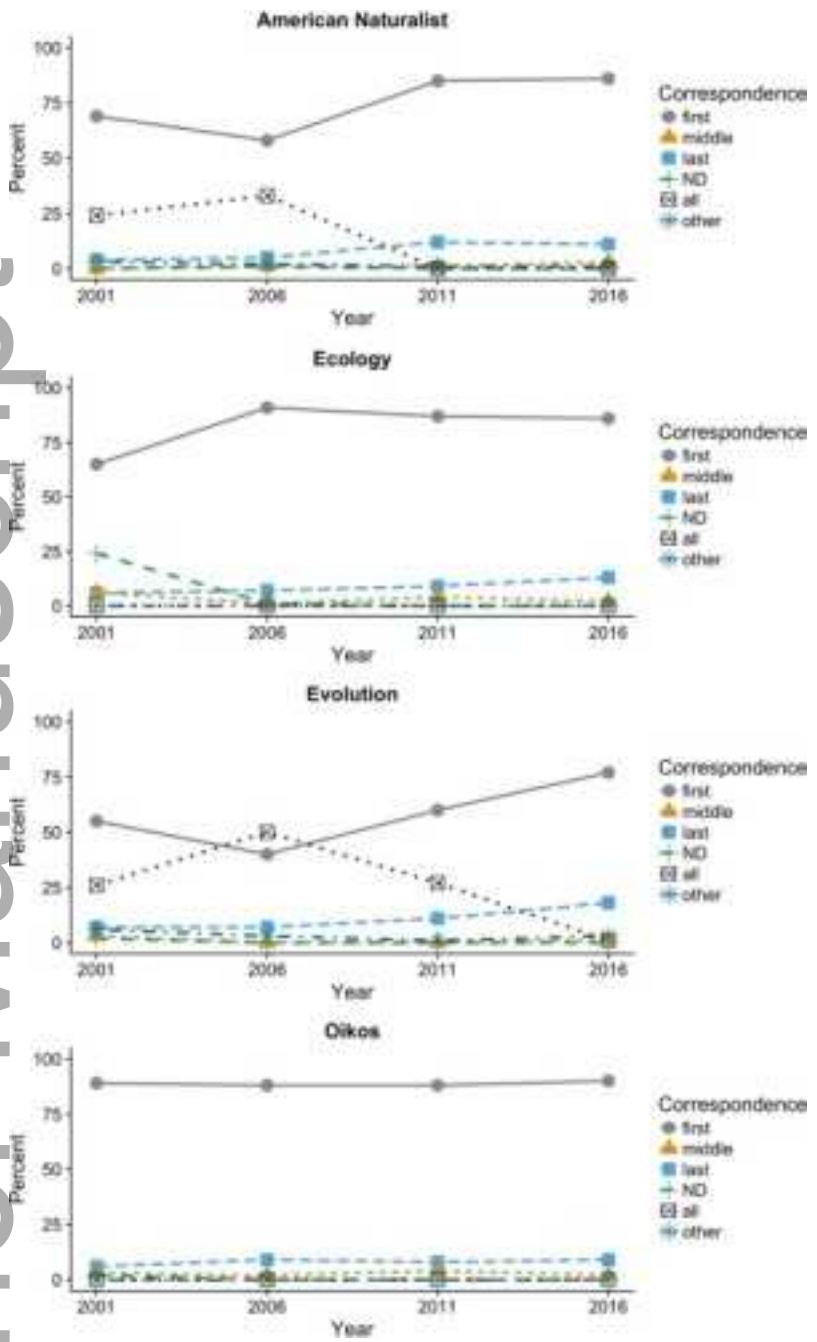
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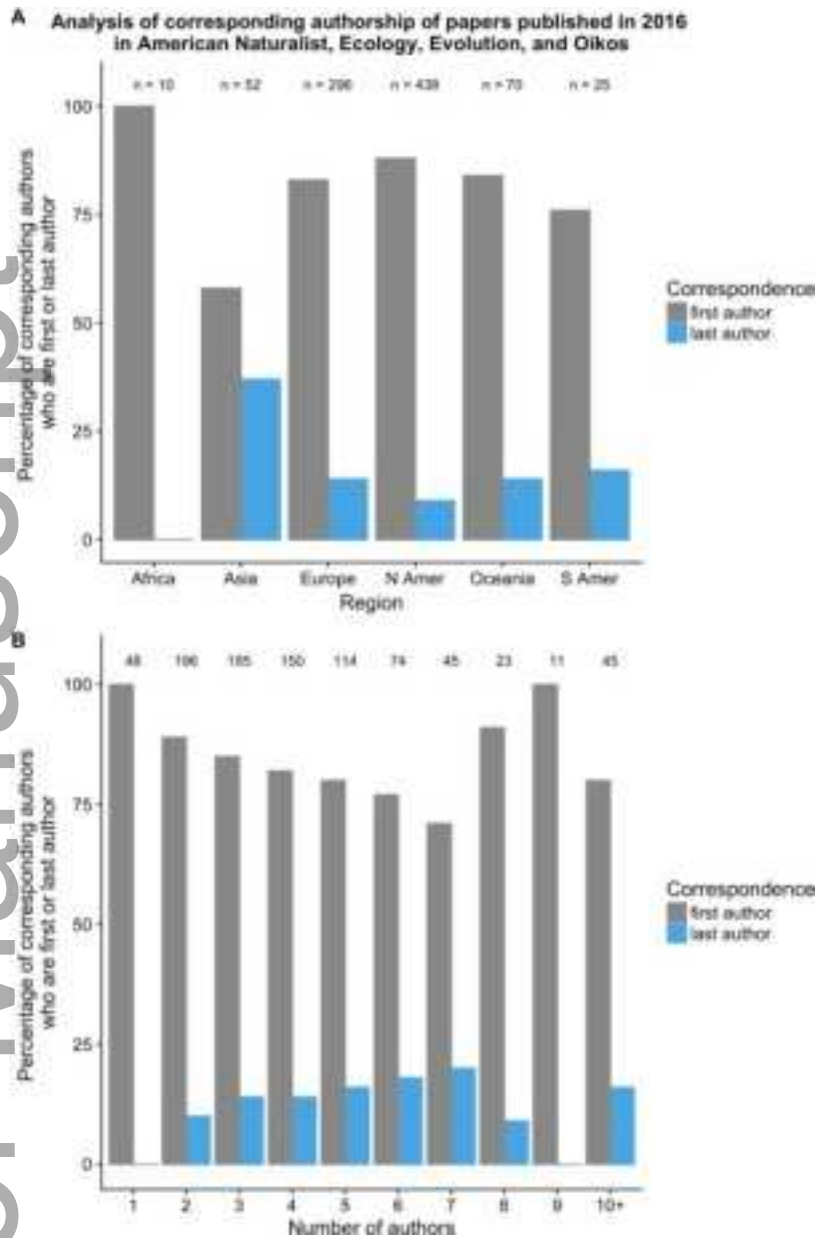
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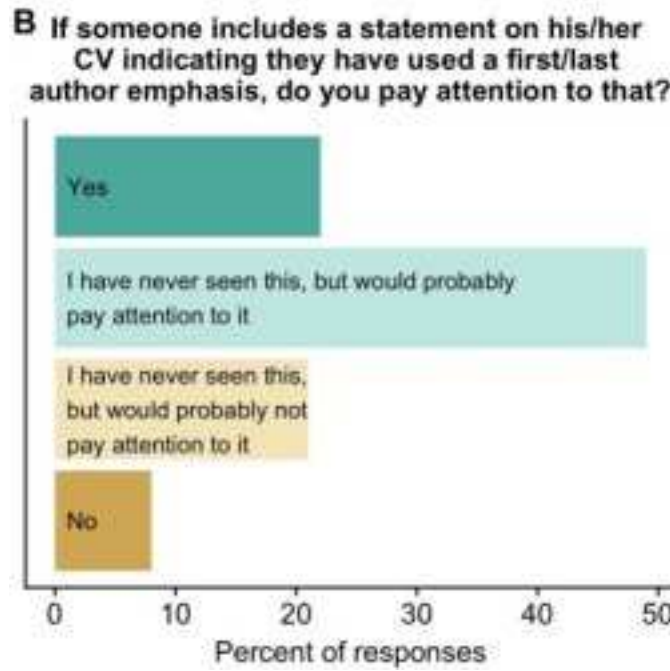
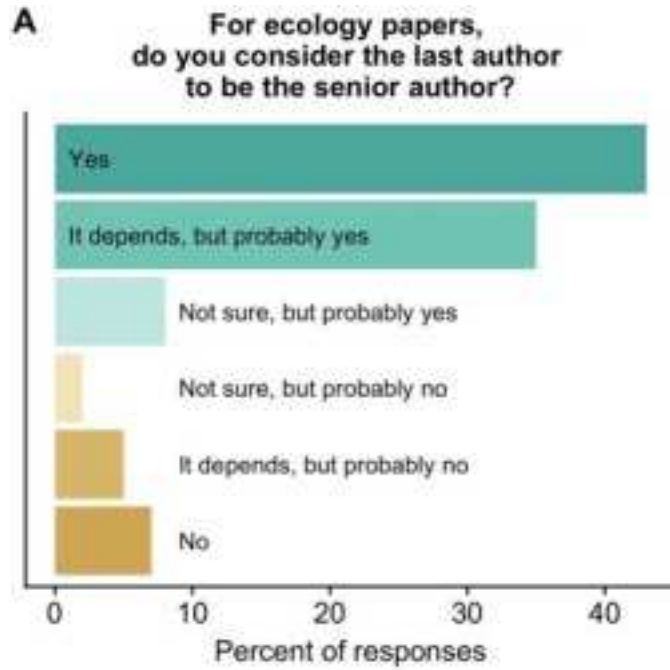
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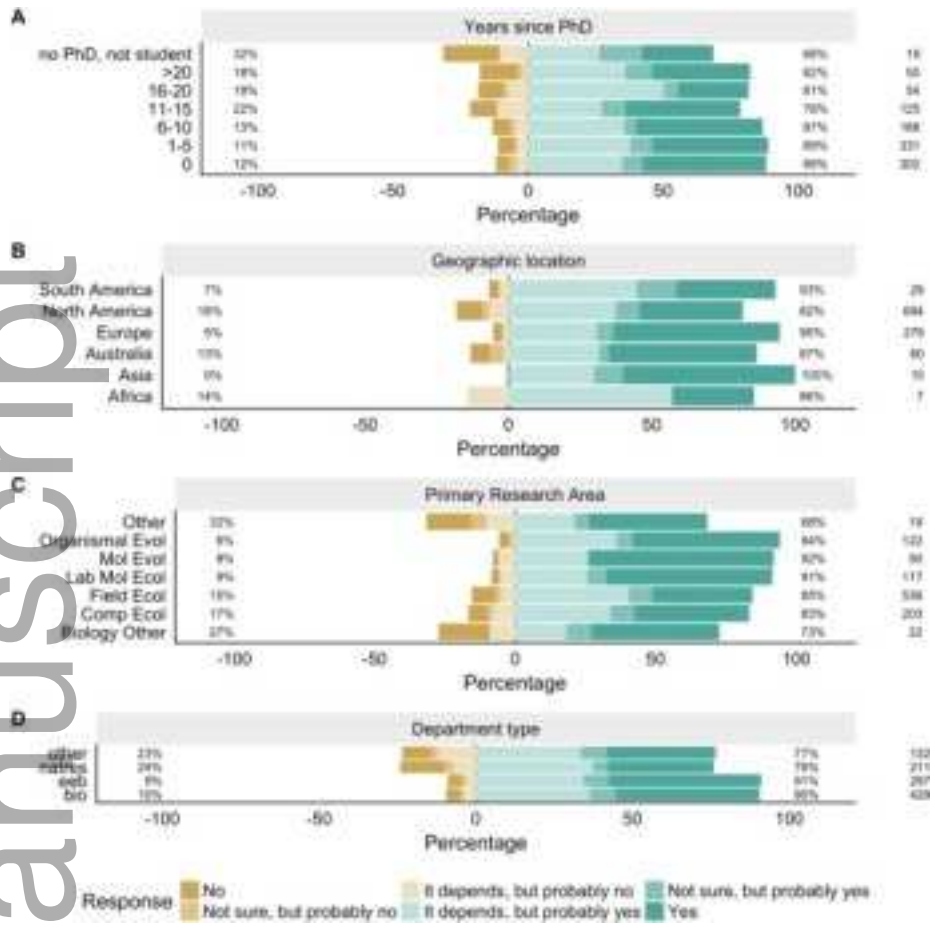
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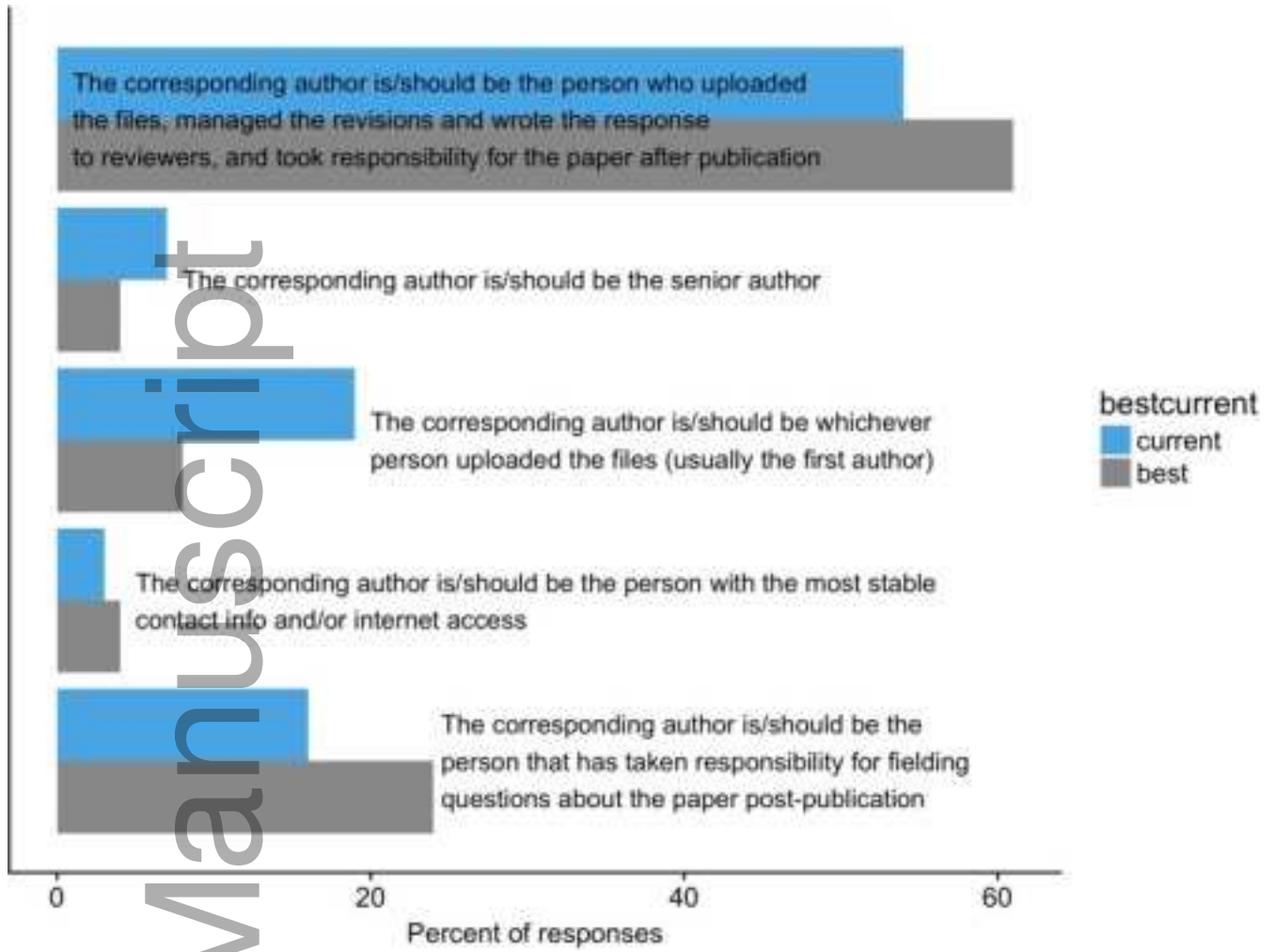


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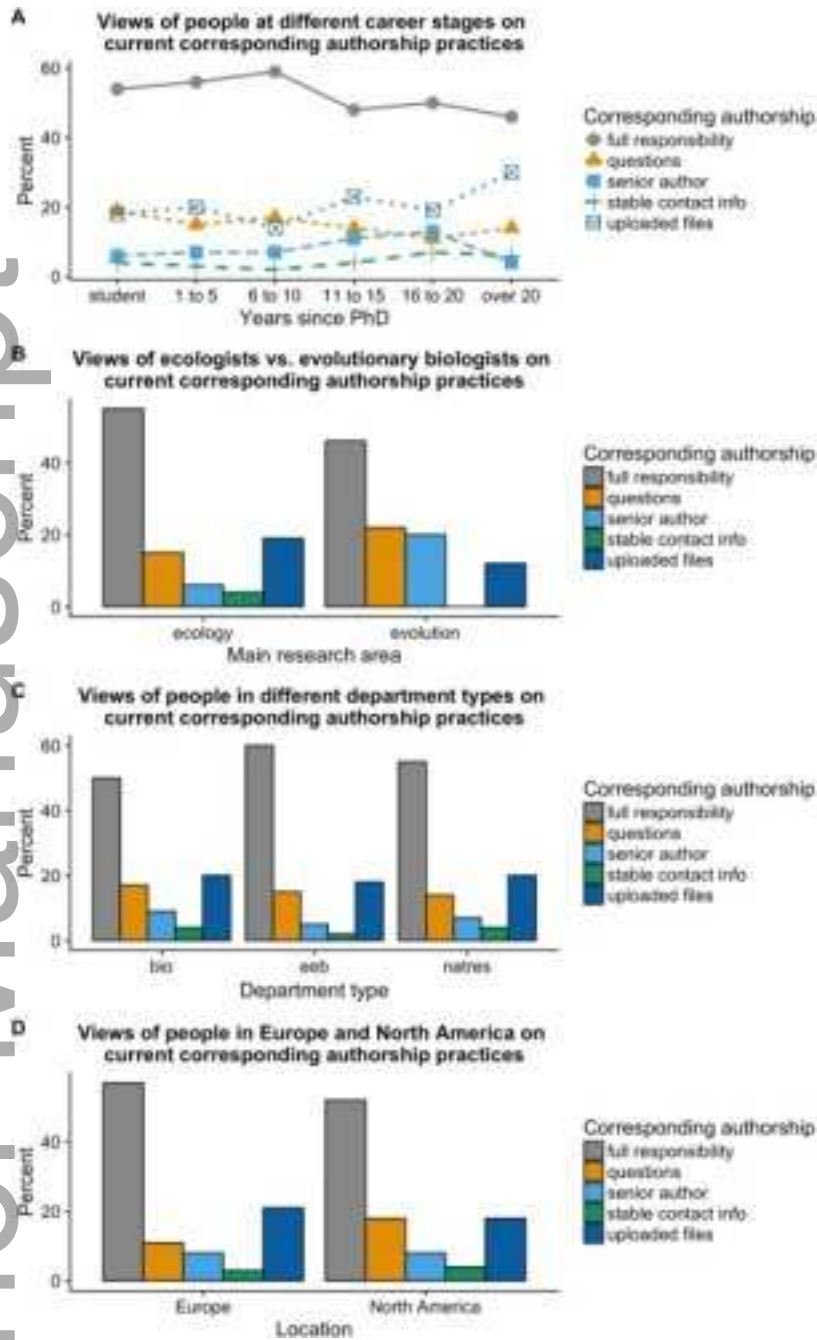


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