Sci-comm "behind the scenes": Gendered narratives of scientific outreach activities in the life sciences

Running title: Gender and sci-comm in the life sciences

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Abstract

Science communication, or *sci-comm*, is a broad term describing activities seeking to increase scientific literacy. Sci-comm has a positive impact on perceptions of science, public policy, public scientific literacy, and career choices of future scientists. Yet, sci-comm is often viewed as at odds with, or tangential, to academic achievement, as non-scientific, or as less worthy a time commitment compared to internal communication in academia. In Australia, scientific societies and organisations engage in a range of activities underpinned by communal, or so-called "behind-the-scenes", sci-comm work by individuals done almost exclusively on a voluntary basis. Given an apparent undervaluing of sci-comm work in academia, we established a pilot study to investigate who does this work, in what capacity, and why. A semi-structured online survey was administered to 88 Australian life sciences organisations for dissemination to their members, and 49 responses were received. Respondents were mostly women in early-career researcher positions at universities. Participants almost universally agreed that their sci-comm contributions to organisations were not beneficial to career progression. Some participants suggested that this perception might stem from it being perceived as feminised or categorised as "care work", potentially resulting in its undervaluation. However, most also cited a range of personal and professional benefits gained from the work, including giving back to the general public and scientific community, and developing skills relevant to translating scientific research. The majority of survey respondents indicated that they were likely to continue such work in the future. Gaining a deeper understanding of the motivations behind, and perceptions of, behind-the-scenes sci-comm work will aid in overcoming barriers that disproportionately affect women, and promote better acknowledgement and recognition of their contributions in the future.

Key words: science communication, gender, outreach, life sciences, care work, volunteer work

1 INTRODUCTION

There is broad commitment to gender equality in academia, exemplified by adherence to accreditation programs such as Athena SWAN and ADVANCE (Rosser *et al.*, 2019). However, entrenched cultural barriers remain which inhibit the career progression of women in academia (Spoon *et al.*, 2023) including an underappreciation of their work. In science, technology, engineering, and mathematics (STEM) fields, these include the "Matilda effect", referring to the systematic lack of recognition of women in science in favour of men (Knobloch-Westerwick, Glynn and Huge, 2013); backlash faced by women scientists when acting against (Wynn and Correll, 2018) or conforming to (Rudman and Glick, 2001; Johnson, Ecklund and Lincoln, 2014; Dudo, Besley and Yuan, 2021) gendered stereotypes; a lack of women role models and mentors (Fried and MacCleave, 2009); and gender-based harassment and discrimination in academia more generally (Lindquist and McKay, 2018). These barriers persist in fields perceived as feminised, such as science communication (hereafter sci-comm). Broadly, sci-comm encapsulates work seeking to increase scientific literacy, which may be aimed at colleagues (inreach) or non-scientists (outreach) and performed through a range of media (Burns, O'Connor and Stocklmayer, 2003). Here, we will specifically refer to outreach aimed at the non-scientist general public.

Sci-comm can positively influence science policy (Hajdu and Simoneau, 2020), public perceptions of science (van Stekelenburg *et al.*, 2022), scientific literacy (Lewenstein, 2015), and retention rates of university students in science (Peckham *et al.*, 2007; Wrighting *et al.*, 2021). As such, outreach is often perceived by academic scientists as an essential duty of their work (Martín-Sempere, Garzón-García and Rey-Rocha, 2008). Yet paradoxically, many scientists are reluctant to engage in communicating research outside of their respective disciplines (Martín-Sempere, Garzón-García and Rey-Rocha, 2008), perhaps because sci-comm is often viewed by academics as a hindrance to academic research and writing, which in turn slows career progression, and therefore not a worthy investment of one's time (Watermeyer, 2015; AbiGhannam, 2016; Negretti, Persson and Sjöberg-Hawke, 2022). A further barrier to participation in sci-comm work is that gendered narratives exist in the field: women tend to do the bulk of sci-comm "care work" that is communal, supportive, 'on behalf of', and not often associated with prestige (Johnson, Ecklund and Lincoln, 2014; Rasekoala, 2019). Women are often invisible in the service role of doing sci-comm on behalf of organisations, often overshadowed by the organisation's brand rather than

recognised under their own name. In contrast, men often present themselves as individual science communicators via blog posts or YouTube channels, resulting in their overrepresentation on social media platforms compared to within their respective scientific discipline (Amarasekara and Grant, 2019; Wilkinson *et al.*, 2022). Thus, women engaged in sci-comm work are more likely to receive informal sanctions in the workplace discouraging them from doing such work relative to their male counterparts, and may also be judged more harshly by the general public based on their attitude or appearance (Johnson, Ecklund and Lincoln, 2014; McKinnon and O'Connell, 2020). Sci-comm is characterised as being man-centric in focus, yet woman-dominated in the workforce, and therefore feminised, in practice (Pérez-Bustos, 2014; Rasekoala, 2019; Riedlinger, Barata and Schiele, 2019).

Given these mixed perceptions of scientific outreach, motivations of scientists for doing such work are not clearly understood and may differ markedly by discipline. Some academic scientists are pressured to do sci-comm by their managers or supervisors, as opposed to being motivated by a genuine desire to do outreach (Martín-Sempere, Garzón-García and Rey-Rocha, 2008), while others—particularly women—view the skills associated with scientific outreach as an asset for career progression or networking, despite the associated lack of recognition of women science communicators in academia (Daoust-Boisvert, 2022). Other motivations include a personal passion for science or desire to influence public perception or policy (Martín-Sempere, Garzón-García and Rey-Rocha, 2008; Daoust-Boisvert, 2022). Gaining a deeper understanding of the motivations behind undertaking sci-comm work will provide insights about its value, identify gender-based barriers to participation, and potentially create a more inclusive and equitable sci-comm landscape.

One type of scientific outreach mentioned previously, so-called "supportive" roles, have not been extensively examined in the literature, perhaps because they are associated with relatively new technologies such as social media platforms, for which time commitments are more difficult to measure. These service-type roles are extremely common in scientific outreach performed by organisations such as learned societies, professional associations, science-centric nonprofit organisations, or university clubs and associations, which we will hereafter refer to as scientific organisations. In Australia, the vast majority of sci-comm roles in such organisations are voluntary, usually filled by early-career researchers and performed in addition to their primary role (PGBH, pers. obs.). Tasks in these roles may include giving public talks on behalf of an organisation, managing an organisation's social media presence, creating sci-comm media (often without

individual attribution), and assisting with event planning. The Australian context therefore provides an interesting opportunity for the investigation of motivations of scientists to take on such roles.

It is the impression of several of the authors, as life sciences academics, that such "behind-the-scenes" positions in scientific organisations are overwhelmingly held by women in early-career researcher (ECR) positions. Yet, anecdotally there also appears to be little prestige or benefit to the career progression of scientists by making these contributions, leading us to ask who is performing such work and why. To address the above question, we disseminated a survey to Australian scientific societies, associations, and clubs associated with the life sciences—the study of microorganisms, plants, and animals—and asked respondents about their experiences, motivations, and perceptions of sci-comm done for these organisations. In this pilot study, we specifically sought to characterise 1) the gender, career stage, and career type of individuals who take on sci-comm roles; 2) the nature of the roles performed and respondents' reasons for doing so; 3) the perception of respondents with respect to the value of sci-comm work in career progression; and 4) the extent of internal or external acknowledgement of such work (e.g., within-organisation *vs*. in one's workplace).

This study was conducted in parallel with a forthcoming paper conducting qualitative interviews on a subset of our survey participants. In addition to the authors of this paper who have backgrounds in biology, social sciences, and law, the extended team also includes Chris Beasley at The University of Adelaide.

2 METHODS

The demographic we studied consisted of 49 individuals who had been involved in life sciences organisations in Australia, either via directly contributing to sci-comm initiatives on behalf of those organisations and/or as members. We were interested in gauging the perceptions of sci-comm work in these individuals irrespective of whether they had made such contributions themselves. The study was hosted online using the SurveyMonkey platform (http://surveymonkey.com) and distributed to organisations by the authors via email, including a preamble and information stating the reasons for the survey and the aims of our study. All respondents answered the survey anonymously. Briefly, we asked respondents about their gender identity, how they would characterise their career and career stage, the nature of sci-comm contributions to life sciences

organisations (if applicable), and acknowledgements and perceptions of such work (if applicable). Because of the small sample size of the target population, no sampling strategy was used except encouraging organisations to disseminate our survey to third parties using snowball sampling (Patton, 1990) to maximise the number of respondents. Respondents were asked at the end of the survey if they would be willing to participate in a follow-up interview, the results of which are presented in a forthcoming "sister study" by Papadelos and Beasley (unpublished) and briefly summarised in our Discussion.

3 RESULTS

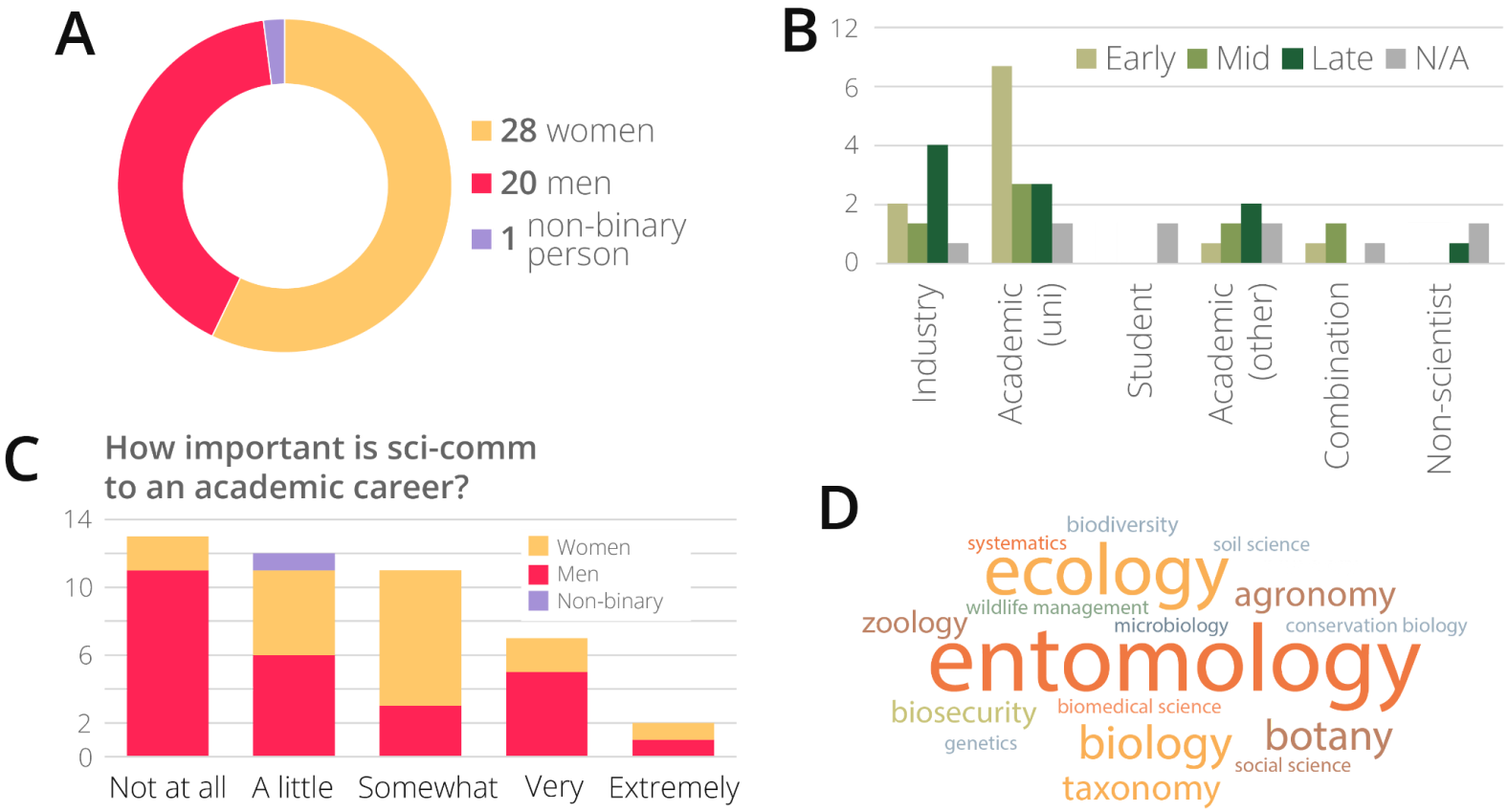

Figure 1: Breakdown of survey respondents by gender (A), career stage and type (B), sentiments surrounding science communication work in academia (C), and field(s) of respective organisations to which sci-comm contributions were made (D), shown proportionally to their incidence in responses.

3.1 Who performs sci-comm work for life sciences organisations?

Of our survey respondents, 28 identified as women (47%), 20 as men (41%), and one as a non-binary person (2%). Twenty individuals characterised their career type as university academic (40%), while non-academic scientists (e.g., in the public service) (26%), non-university academics

(e.g., employed at museums) (16%), those with non-science careers (4%), and students (4%) were also represented. The majority of respondents (25 individuals, 86%) self-identified as early or mid-career researchers (EMCRs), while a further 14 characterised themselves as late career researchers. Ten individuals stated this question did not apply to them. Taking these responses in combination, the majority of individuals answering the survey were women EMCRs working in an Australian university. Forty-three of the 49 respondents had contributed to a scientific organisation in the past in a sci-comm context.

We received responses from individuals from a range of disciplines (Figure 1), the most common being entomology, ecology, and biology, with several respondents reporting multiple disciplines as their primary field. The majority of respondents said that the organisation to which they contributed sci-comm work was associated with more than one scientific discipline.

3.2 The nature of sci-comm contributions

Media production, such as the production of newsletters or posters, was the most common type of contribution made to life sciences organisations (54.5% of all respondents, of which over half were women). Public speaking and contributing to social media accounts were the second and third-most common contributions, followed respectively by administration, advertising, event organising, and journal editing. By gender breakdown, women were the most highly represented in social media management (72.8%) followed by public speaking (61.5%) and media production (58%). Administrative tasks were evenly split between men and women, while the sole respondent who had contributed as a journal editor was a man.

Almost all roles performed by respondents were unpaid (81.8%), and those who had made contributions in paid roles were largely men (62.5%). All respondents who had been in paid roles reported that their contributions had been recognised via authorship in scientific publications. The majority (70.45%) of respondents reported that they made these contributions both within and outside of their day-to-day working hours. A further eight respondents completed this work entirely outside of their working hours, whereas five did so entirely within their working hours. Over two-thirds of respondents (67.4%) did not receive mentorship when performing sci-comm work for life sciences organisations.

3.2 Perceptions and motivations surrounding supportive sci-comm work

The extent of acknowledgement and perceived value of sci-comm work were markedly different within and outside of the scientific organisations concerned. Of the 46 respondents who had performed sci-comm work for organisations, 37 (80.4%) respondents reported that their contributions were acknowledged in some way by the societies for which they had done work, including via journal articles, newsletters, annual reports, or websites. Several participants stated that instead of formal recognition they were verbally acknowledged or received gifts for their contributions. In contrast, just over half (24, 52.2%) of respondents stated that their contributions to life sciences organisations had not been acknowledged in an academic context. The minority of respondents who did receive academic recognition reported that this ranged from their contributions being discussed during promotion interviews to being awarded research prizes.

Perhaps as a result of the aforementioned lack of formal recognition, the majority of respondents did not view their contributions to be important in advancing their academic careers. Responses varied when asked to gauge the value of such work, ranging from “not at all” (28.9%), “a little” (26.7%) or “somewhat” (24.4%) “very” (15.5%), or “extremely” (4.4%) valuable in an academic context. Almost all respondents who considered the work “not at all” valuable were women (84.6%), while most who answered “a little” or “somewhat” were men. Several respondents elaborated on their feelings regarding a lack of acknowledgement in an academic context:

> *Early career people might go into these opportunities for their career advancement. You soon realise that, whilst extremely valuable experience, it is not acknowledged enough by those who pay your salary.*

> *Industry, including government, value these skills highly - but they were not valued in academia.* [...] *It's almost a self fulfilling prophecy - do this 'extra' work to make yourself more employable outside of academia just in case, but by doing so you are likely to make yourself less competitive in academia.*

Despite academic attitudes towards sci-comm work expressed by our participants, almost all respondents stated they would continue to make these contributions if given the opportunity (87.2%). Respondents articulated clear drivers for doing sci-comm work beyond direct career benefits, such as skill development, gaining experience and confidence in public speaking, and making new social connections for future collaborations:

The value I receive is in my own education. I have no formal training in this field so every article I add to the society's newsletter is a learning opportunity.

It's helped me to make connections outside of my immediate network and in different fields.

Others were motivated by personal satisfaction derived from communicating research, promoting the importance of science and evidence-based decision-making, and educating the general public. Some respondents noted that it was fulfilling to them regardless of (limited) career benefits, and it provided them satisfaction to contribute to the broader image of science in society:

I receive personal satisfaction. I strongly believe that being a scientist is a tremendous privilege, and part of our responsibility is to ensure our work is communicated back to our communities. I also believe I have a responsibility to be visible as a role model for women and minority communities.

I find it fulfilling to see how this work impacts others. The exposure to these topics and the people that study them can be limited, yet it is important to make it available to others. You have no idea what positive impact it may have.

Finally, some respondents saw clear professional benefits in performing sci-comm work, such as being recognised in promotions, awards, or grant applications:

Because of the research work and the publication I was able to obtain a full scholarship to follow my research passion.

As an academic, there was some professional value in that it could be used for promotion, award and grant applications and yearly work plans.

Ultimately, skill development and personal satisfaction were the most common motivators for doing sci-comm work, followed by networking opportunities (mentioned in 20% of responses), a desire to communicate and promote science to the general public (20%), career progression (11%), and giving back to the broader scientific community (4%). One respondent who had made sci-comm contributions to a scientific organisation felt it had no value and was simply part of a "busy period on top of usual responsibilities".

4 DISCUSSION

Our results shed light on the motivations driving "behind-the-scenes" sci-comm work for Australian life sciences organisations and the demographics undertaking this work. The majority of respondents to our survey were female early-career researchers working at a university, corroborating previous studies that found science communication is a feminised field composed of younger researchers (Abi Ghannam, 2015; Rasekoala, 2019; Wilkinson *et al.*, 2022). Though we did not undertake formal statistical analysis to examine the survey results presented here, a greater number of female participants were involved in supportive tasks such as social media management, whereas male participants were predominantly in paid roles, including the single journal editor surveyed. This supports the notion that, broadly speaking, science communication can be separated into two narratives: work undertaken by women in service or communal roles, as seen here, and work undertaken by men representing themselves as individuals in public speaking contexts (Johnson, Ecklund and Lincoln, 2014; Wilkinson *et al.*, 2022).

Ultimately, the gendered differences we observe here reflect a broader societal pattern of women often taking on poorly compensated work low in prestige, evident in the demographic performing service-related responsibilities in academia being largely female (Cardozo, 2017; Coin, 2018). As these internal "care" roles dominated by women are perceived as unskilled, they are often not adequately recognised or rewarded (Glenn, 2010; Cardozo, 2017). Based on documented experiences in the literature, we expected participants might have felt compelled to assume these roles either due to pressure by their supervisors, or out of a sense of duty (Pearson, Pringle and Thomas, 1997; Martín-Sempere, Garzón-García and Rey-Rocha, 2008; Johnson, Ecklund and Lincoln,

2014). To some extent, these sentiments were echoed in our survey results: participants acknowledged sci-comm was not adequately acknowledged or valued in academia, and such work was not usually associated with career benefits. However, respondents were motivated by a range of personal and professional development goals, with almost 90% stating they wished to continue communicating science on behalf of life sciences organisation(s). Our survey results revealed two common narratives motivating participants: 1) a desire to communicate science to the general public, either to contribute to the scientific community ("giving back") or to enhance public scientific literacy; or, less commonly, 2) to develop one's own skills for career advancement, such as public speaking or translating science for a nonscientific audience. Taken together with results of past studies, it is evident that while sci-comm is commonly associated with neutral to negative sentiment in academia, there is significant variation in motivations for participating in sci-comm work on behalf of organisations, and its benefits to communicators clearly extend far beyond opportunities for career progression.

A qualitative sister study to the present paper was conducted by Papadelos and Beasley (unpublished) by interviewing a subset of survey participants, further highlighting the mixed experiences associated with undertaking sci-comm work. Six participants were recruited for interviews and expressed similar sentiments to those in the survey, but provided additional insights into gendered perceptions of the field. In particular, participants strongly expressed that sci-comm was a field predominated by women, that it was often "invisible" and "thankless", and that, due to a lack of conventional measurement or set working hours, such contributions were often "constant". Papadelos and Beasley (unpublished) consider sci-comm to be devalued because it is care work, therefore feminised. The results of these interviews suggest negative sci-comm experiences tend to be more strongly associated with situations in which individuals are not directly credited and instead act under the umbrella of a broader, organisational identity. As such, participants suggested further recognition of sci-comm work may not be the way forward in encouraging gender parity in the field. Papadelos and Beasley (unpublished) therefore propose preliminary steps to enhance the crediting of individuals who perform sci-comm are necessary, including establishing formal job titles attached to sci-comm roles or standardising the inclusion of sci-comm in requirements for job applications.

While our study provides valuable insights into sci-comm work, there are several challenges and limitations that need to be acknowledged. First, our findings are specific to an Australian context in which the majority of sci-comm contributions are voluntary and unpaid; this may differ in international settings where communication is allocated as part of an academic workload. Second, we only focused on the life sciences. The life sciences—particularly biological sciences—is one of the best represented fields in science communication worldwide, with a relatively high proportion of women also working in the field (McCullagh *et al.*, 2019). However, there may be a larger gap between the proportion of women and men who undertake sci-comm work in the life sciences compared to fields such as the physical sciences (Ecklund, James and Lincoln, 2012), meaning our findings may not neatly translate to other disciplines. Finally, as our approach was mainly a quantitative one, more qualitative data is needed to deepen our understanding of what drives behind-the-scenes sci-comm work in Australia, and the potential benefits of taking on such roles.

5 CONCLUSIONS

A broad range of frameworks exist in Australian universities to encourage gender equity, yet women in academia continue to experience barriers to career progression for a variety of reasons. One such example is the undervaluing of science communication; this work is crucial to the translation of complex research, but women may be disproportionately penalised when taking on these roles due to perceptions that sci-comm lessens one's research capacity (particularly when performing in a service or "behind-the-scenes" role). Sentiments around sci-comm work remain poorly quantified, and questions remain as to who takes on these roles, and why, given their apparent negative connotations in academia.

Here, we investigated motivations associated with "behind-the-scenes" sci-comm undertaken on behalf of Australian life sciences organisations—which tends to be volunteer work done by researchers—and the perceptions attached to such work in an academic context. We disseminated a self-administered online survey and, within the constraints of the present study, our findings reveal the majority of people performing such work are early to mid-career women working in universities. Whilst sci-comm contributions were usually acknowledged by the organisation involved, participants consistently expressed that this work was undervalued or inadequately acknowledged in academia jobs and was not important in advancing their academic

career. Nonetheless, the majority of participants expressed they would continue doing such work because of a range of associated personal and professional benefits.

This pilot study is the first to quantify sentiments around “behind-the-scenes” sci-comm work in Australia. We have highlighted that largely negative sentiments surrounding sci-comm in academia documented in the literature also occur in an Australian context—in particular, a lack of adequate recognition of volunteer work associated with science communication. Yet, our findings have also shed further light on the wide range of benefits individuals gain from performing science communication and its importance beyond simply contributing to one’s career. Science communication is an immensely important field depended on by the life sciences, and rather than encouraging individuals to be aware of the attached costs and benefits when undertaking “behind-the-scenes” roles such as these, we feel our findings instead highlight the need for cultural and organisational change in both scientific organisations and the academy. Such efforts could include balancing gender ratios or the tailoring of roles to better benefit women and/or early-career researchers to ensure individuals are not contributing more than they are benefiting on a personal or professional level.

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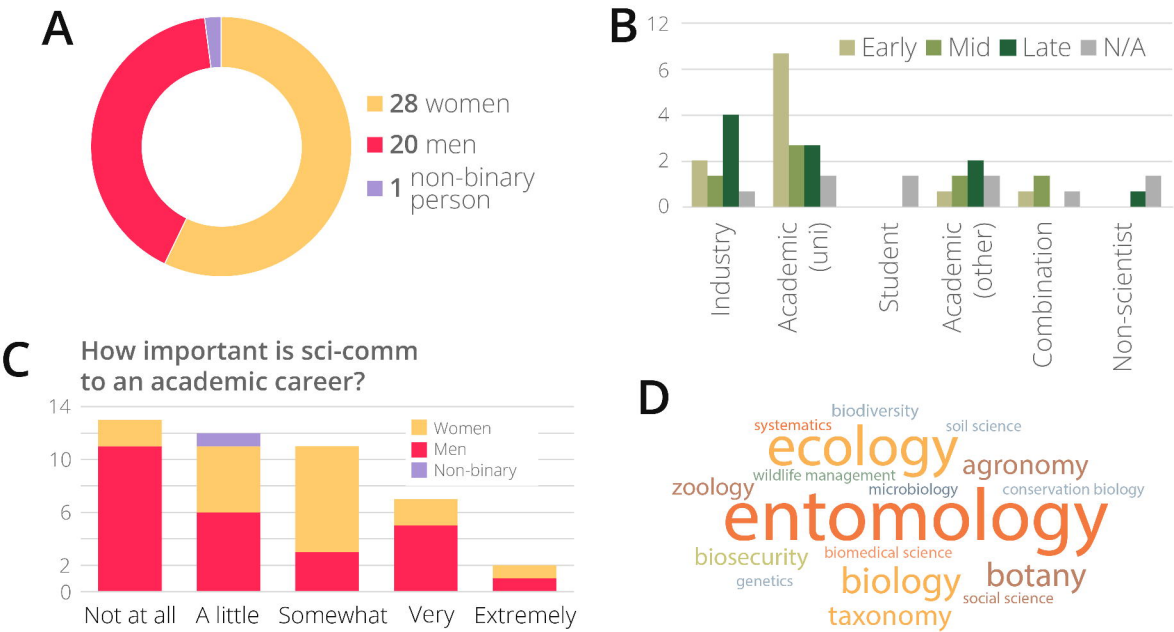
A
28 women
20 men
1 non-binary person
B
12
6
4
2
0
Early
Mid
Late
N/A
Industry
Academic (uni)
Student
Academic (other)
Combination
Non-scientist
C
How important is sci-comm to an academic career?
14
10
6
2
0
Women
Men
Non-binary
Not at all
A little
Somewhat
Very
Extremely
D
biodiversity
systematics
soil science
ecology
agronomy
wildlife management
zoology
microbiology
conservation biology
entomology
biosecurity
biomedical science
genetics
biology
botany
social science
taxonomy