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Gender inequities in herpetology: the case of the Argentine community

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ABSTRACT

Women in scientific fields have achieved meaningful gains in terms of participation, and they even reached gender parity in Argentina. However, in spite of several documented attempts to close the gender gap, inequalities still remain in different academic areas. Considering that disciplines have developed under different historical contexts and institutional settings, it is relevant to describe gender equality indicators for them. This could also lead us to a better understanding of the mechanisms modelling global patterns of gender bias. Here we present a detailed analysis on gender proportion in different roles that researchers perform in the Argentine herpetological community. We gathered data on gender composition of the director boards and active members of the Argentine Association of Herpetology, and the organizing committees and participants of the Argentine Congress of Herpetology. We also performed a survey on gender topics to the attendants to the 20th Argentine Congress of Herpetology. Our main results pointed out a low number of women in the highest positions of the community hierarchy, such as chair positions in the AHA and conferences and symposia in congress. This leads to a lesser visibility of women in contrast to men, and is a potential reason for the low number of female herpetologists as role models. Furthermore, we detected low numbers of female herpetologists with long academic paths, depicting a major drop out of women along their careers. Gender bias in science has a strong hierarchical component and this pattern was recovered in different scientific activities within herpetology. In this sense, directed actions and targeted policies are required to guarantee the access of women to power positions and for the promotion or retention for senior female researchers. Identifying the weakest points in terms of gender equality, and the areas where gender biases are historically established is necessary to build a more egalitarian community.

Key Words: Gender Gap; Science; Female Representation; AHA; Congress Participation.

RESUMEN

Las mujeres han logrado avances significativos en cuanto a su participación en el campo científico y en Argentina incluso han alcanzado la paridad de género. Sin embargo, a pesar de varios intentos documentados de cerrar la brecha de género, las desigualdades aún persisten en varias áreas académicas. Considerando que distintas disciplinas se han desarrollado bajo diferentes contextos históricos y escenarios institucionales, resulta relevante describir los indicadores de equidad para las mismas. Esto además puede conducir a una mejor comprensión de los mecanismos que modelan los patrones globales de sesgo de género. En el presente trabajo presentamos un análisis detallado sobre la proporción de género en diferentes roles que desempeñan los/las investigadores/as en la comunidad herpetológica argentina. Recogimos datos sobre la composición por género de las comisiones y los miembros activos de la Asociación Herpetológica Argentina, y de los comités organizadores y los participantes del Congreso Argentino de Herpetología. Además, realizamos una encuesta sobre temas de género a los asistentes al XX Congreso Argentino de Herpetología. Nuestros principales resultados señalaron un bajo número de mujeres en los puestos de mayor jerarquía dentro de la comunidad, tales como presidencias en la AHA y participación en conferencias y simposios en congresos. Esto conduce a una menor visibilidad de las mujeres en comparación con los científicos varones y es una posible razón del número comparativamente bajo de herpetólogas como mentoras o modelos a seguir. Además, detectamos un bajo número de herpetólogas con trayectorias de larga duración, lo que indicaría una importante deserción a lo largo de sus carreras. El sesgo de género en ciencia presenta un fuerte componente jerárquico y este patrón se recuperó en diferentes actividades científicas dentro del campo de la herpetología. En este sentido, se requieren acciones dirigidas y políticas focalizadas para garantizar el acceso de las mujeres a puestos de toma de decisiones/mayor exposición y para la promoción o retención de investigadoras senior. Identificar los puntos más débiles en términos de igualdad de género y las áreas donde los prejuicios de género están históricamente establecidos es necesario para construir una comunidad más igualitaria.

Palabras claves: Brecha de Género; Ciencia; Representación Femenina; AHA; Participación en Congresos.

Introduction

In recent years, a process of self-evaluation related to the gender gap has been triggered within the scientific community (de Kleijn *et al.*, 2020; Huang *et al.*, 2020). Thus, to measure gender inequities, several indicators have been defined and implemented at different scales (O'Brien *et al.*, 2019; Huang *et al.*, 2020). Various studies assessed gender gap in terms of disparities in authorship, productivity, citations, or access to funding in almost all disciplines and countries (e.g., Hill *et al.*, 2010; Larivière *et al.*, 2013; Shen, 2013; Holman *et al.*, 2018; de Kleijn *et al.*, 2020; Huang *et al.*, 2020). However, gender inequity is a multidimensional problem rooted in a historical gender imbalance that impacts the success rate of women in academia, therefore, any single indicator is often not capable of including all its relevant dimensions (Astegiano *et al.*, 2019; O'Brien *et al.*, 2019). This highlights the need of evaluating gender bias in an integrative way and considering the multiple

roles that researchers develop.

One important aspect of the scientific career is the visibility of the researchers within their discipline or respective community (Martin, 2014). Conference attendance, presentations, and plenary talks are relevant instances for researchers to achieve visibility, which lately influence their perceived quality and peer-recognition (Schroeder *et al.*, 2013; Jones *et al.*, 2014). In addition, scientific societies play a large role in visualization of their members, providing opportunities for networking both formally and informally (Potvin *et al.*, 2018). As a consequence, scientific societies and all the events or activities promoted by them may have the capacity to prompt women in their careers, as well as to promote changes throughout science to achieve gender equality.

Female participation in science has increased considerably during the last decades, and Argentina has been recently pointed out as one of the countries

that reached overall gender parity (de Kleijn *et al.*, 2020). As such, women represent 61% of the total tenure researchers, and 53% considering only Life Sciences (<https://cifras.conicet.gov.ar/publica/>) in the main research institution of the country (CONICET). In spite of this rising number of women, a recent big data analysis including the career path length of researchers across the world showed a widening gender gap for certain indicators, such as productivity and impact (Huang *et al.*, 2020). Studies like this emphasize the relevance of weighing the imbalanced access to opportunities faced by women, even from early career and varying according to geographic region or discipline (Ceci *et al.*, 2014; Maas *et al.*, 2020). In this sense, a disaggregated analysis of indicators and activities for specific scientific disciplines in Argentina is relevant since it could reveal a growing gender gap therein.

In Herpetology, particularly, gender disparities have been indicated regarding female participation in different academic roles, in authorship positions, and organizing and speaking in symposia or conferences (Parenti and Wake, 2016; Sardelis and Drew, 2016; Salerno *et al.*, 2019; Rock *et al.*, 2021). Recently, Grosso *et al.* (2021) found a pattern of male preferential connections (male homophily) in herpetological publications that marginalizes women, both at regional and global scales. In addition, a low number of women in the highest hierarchies in academia, fewer women than men publishing papers, and a lack of incentives for women were pointed out in the Brazilian herpetological community (Carnaval, 2016; Benício and Fonseca, 2019; Werneck *et al.*, 2019; Slobodian *et al.*, 2021).

The Argentine Herpetological Association (AHA) is the oldest herpetological society in South America, holding annual meetings (Argentine Congress of Herpetology) since 1983, and publishing its own journal (*Cuadernos de Herpetología*) for 36 years. Up to now, there is only one study about gender bias in the dynamics of the publication process in the Argentine herpetological community (Grosso *et al.*, 2021). Therefore, the aim of this work is to evaluate the gender proportion at complementary academic roles that researchers develop, such as participation in the AHA and the Argentine Congress of Herpetology. In addition, we tested the hypothesis that under an unbiased gender scenario, the proportion of women in top hierarchical or high exposure positions reflects the observed proportion of female members of the AHA with long career

paths. Finally, we performed a survey to characterize the general perception of the Argentine herpetological community on gender topics and to detect other barriers excluded by the quantitative data. The analyses presented herein are necessary to identify the weakest points in terms of gender equality, to establish which are the areas where gender biases are historically established, and to propose actions that may help to close the gender gap.

Materials and methods

We built a gender-database for director boards of the AHA, its active members, the organizing committees of the Argentine Congress of Herpetology, and the congress participants. The gender of the researchers (assigned as male/female) was identified using their first names and following the free database of Gender Checker (<https://genderchecker.com>). Alternatively, gender was determined by visual inspection of ResearchGate profiles or images found in Google when the author's name was ambiguous. The gender approach used here was binary, and those individuals that could not be categorized as male or female were excluded from the analyses. Considering that these were just a few cases, this removal did not affect the overall sample-size nor the relevance of the conclusions. We are aware that the author's self-perceived gender could mismatch with the gender assigned here, and that the binary approach excludes other identities that may be present in the community. However, we were unable to consider additional identities due to analytical and operational limitations.

We gathered information about the gender composition of the director boards of the AHA by hierarchies (*i.e.*, chair and board members) during the 1982–2021 period. We also recorded the gender of the active members of the association during the 2019–2021 period, and calculated the length of their academic paths as years from her/his first published paper up to 2021. The list of members was collected from <http://aha.org.ar/socios-activos/> and the year of the publication of their papers was collected from CONICET webpage, ResearchGate or Google Scholar (full datasets are available in Supplementary Table S1).

The gender composition of the Argentine herpetological community through time was estimated using the gender proportion of attendants to the congress spanning the 1999–2019 period. We also

evaluated gender participation in the Argentine Congress of Herpetology from 1999 to 2019. We compiled data of organizing committees and of authors in the different types of presentations (dataset available in Supplementary Table S2). The authors were grouped into two main categories: regular exhibitors and invited speakers. Regular exhibitors are those presenting short oral communications and posters. Invited speakers are peer-selected, commonly funded by the congress organizers, and their presentations comprise main conferences, conferences of young herpetologists and symposia. These are usually long-lasting lectures, carried out at the prime-time slot of the congresses. The total time of exposition for main conferences was calculated for male and female speakers (considering 45 minutes each talk). Data of the attendants/authors gender and the composition of the organizing committees were obtained from the books of abstracts of each congress.

We aimed to evaluate if the observed number of women in hierarchical/high exposure positions through years was the expected by chance, or if, on the contrary, existed an underlying process shaping the gender distribution. In order to do this, we performed 1.000.000 simulations of random gender assignment to chair members in the AHA and to speakers in main conferences, calculated the proportion of women in these positions under this neutral gender scenario, and then compared them with the observed values. These simulations were performed in R (version 3.6.3, R Core Team 2020), and using as baseline the observed number of active members of the AHA with long academic paths (*i.e.*, ≥ 15 years). Finally, we performed a survey among the attendants to the 20th Argentine Congress of Herpetology in 2019 (dataset available in Supplementary Table S3). We asked them to respond to a six-point questionnaire about self-gender biases, caregiving tasks, and career challenges. The questions were: A) K. Smith recently published a paper. Which do you suppose is the first name of this author, Kevin or Karen?, B) Give the full name of three authors that have influenced your career, C) Do you have/had to take care of other people? e.g. children, elder parents, D) If you do, how does/did affect/ed your professional life?, E) Do you agree that maternity/paternity leave in Argentina is enough?, and F) Write a short paragraph that summarizes the biggest obstacles in your career.

All supplementary files were shared as datasets uploaded to figshare repository (<https://doi.org/10.6084/m9.figshare.16530618>).

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Results

The analyzed data showed only one woman as chair member of the AHA, throughout 38 years (1982–2020 period). After the election of authorities in 2020 a change was observed and both chair positions were occupied by women (raising up the percentage of women to 7.5% for the whole period; Fig. 1A). Until 1990, female participation on the director boards was lower than 40% but since 1991 the female proportion has increased, resulting in more than half of the board occupied by women at the present (54%; Fig. 1A).

During the 2019–2021 period, women represented 52% of the active members of the AHA. When analyzing the length of members' academic paths, women were the majority of the researchers with short careers paths (*i.e.*, 0 to 14 years), but men were more represented among long career paths (*i.e.*, ≥ 15 years; Fig. 1B).

Our results showed that in the last 20 years of the Argentine Congress of Herpetology women constituted on average 52% of the organizing committees and 45% of the authors attending the event (Fig. 1C–E). Although the overall gender participation of authors was balanced over the years, differences were noticeable when comparing the gender proportion of invited speakers and regular exhibitors (Fig. 1F–G). Of the 724 invited speakers, 38% were women (Fig. 1F). For main conferences, 35 women and 86 men were invited, summing up 26.25 h and 64.50 h of exposition, respectively. For young herpetologists' conferences, 13 women and 9 men participated during the nine years in which this event was held. For symposia, 581 authors participated, 38% of them were women, and female participation was higher than male only in two years (Fig. 1F). Opposite to what occurred in the category of invited speakers, in regular presentations female participation climbed to 46%, and they even were majority in some years (Fig. 1G).

The baseline of researchers used to perform the simulations was composed by 40% of female herpetologists. The simulations found that the probability to obtain the observed number of women as chair members of the AHA (observed proportion: 1 woman out of 46) was 0.001%, while the probability of being invited as a speaker in main conferences (observed proportion: 35 women out of 121) was

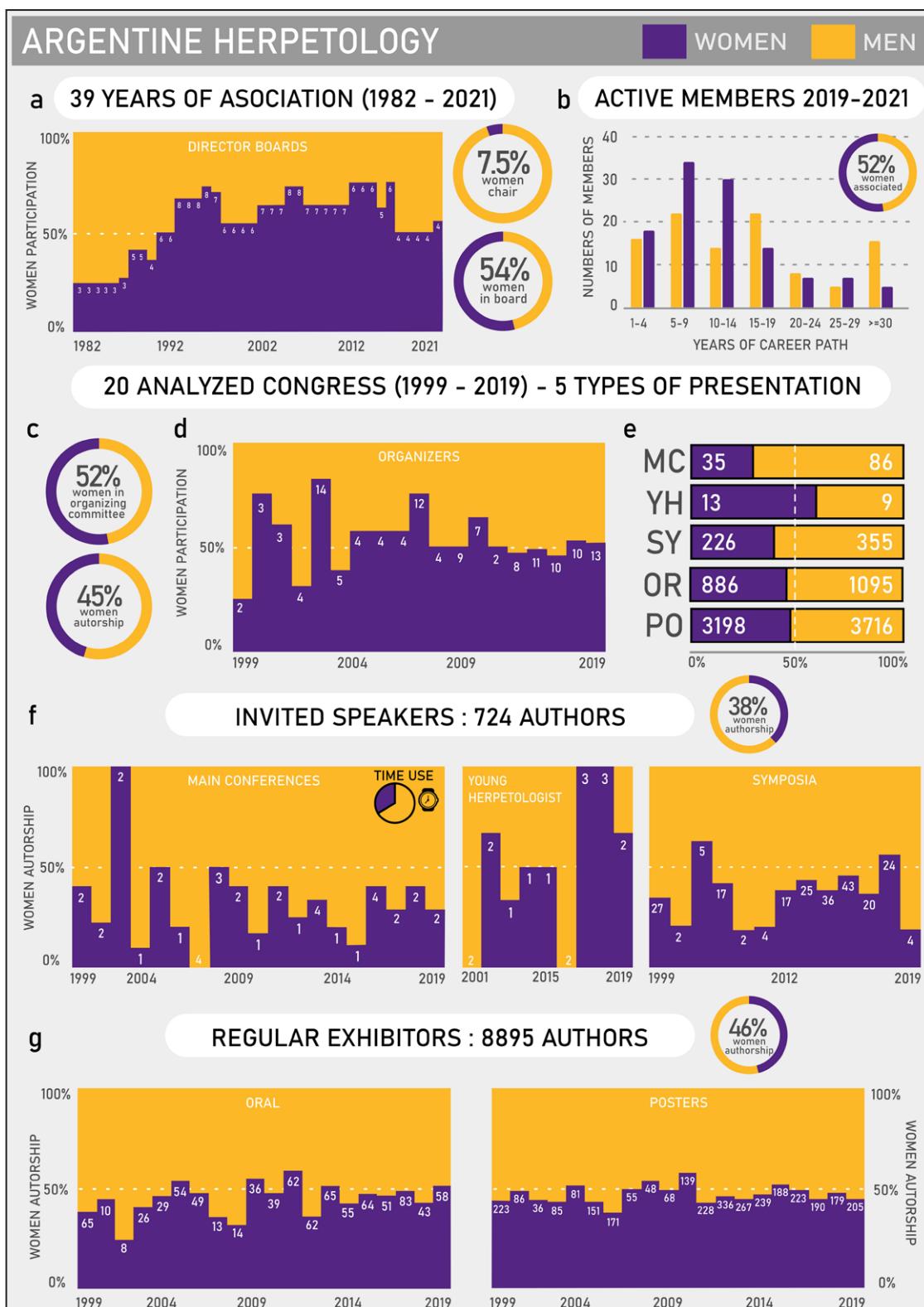


Figure 1. Gender distribution in Argentine Herpetology. (a) Director boards during the 39 years of the Argentine Herpetological Association (AHA). (b) Career path lengths of active members of the AHA during 2019–2021 period. (c–g) Gender participation in the Argentine Congress of Herpetology from 1999 to 2019. (c–e) Organizing committees of the congresses and overall participation among the five different types of presentations. (f) Percentages of participation of invited speakers. (g) Percentages of participation of regular exhibitors. White numbers on the histograms represent absolute values of women. Abbreviations: MC = main conferences; YH = young herpetologists conference; SY = symposia; OR = oral presentations; PO = posters.

0.007% (see Supplementary Information Fig. S1).

The survey was answered by 84 congress attendees of different academic status, from which 68% were women (Fig. 2). When asked to complete the first name of an author given the initial letter of the name, most of the surveyed thought in a man (87.5%; Fig. 2A). The same occurred when the surveyed attendants were asked to mention the three most influential researchers in their careers, the majority named a man as a reference (68%; Fig. 2 B). The survey also revealed that 47% of women researchers were involved in caregiving tasks and that most of them felt overwhelmed when balancing work and life duties (Fig. 2 C-D). Most participants (94%) answered that leaves for childbirth in Argentina are too short, especially for fathers (46%; currently two days after childbirth; Fig. 2E). Men and women differed when recognizing the biggest obstacles in their careers (Fig. 3). Women's answers pointed primarily to the family burden since the words that popped out mostly were "children" and "family", while money-related issues like "resources", "economy", and "funding" were in second place (Fig. 3A). In contrast, men's most significant concerns were related to money, since the word that popped out mostly was "funding", and items non-related to academic activities like "family" or "bureaucracy" appeared in second place (Fig. 3B).

Discussion

According to our results, women in Argentine herpetology have almost equal representation as men in several academic roles—as board members of the association, members of the organizing committees, and authors in congresses. However, gender disparity is evidenced when analyzing women participation in top hierarchical/high exposure positions—as chair members of the association, and speakers at main conferences and congress symposia. Moreover, through the performed simulations we showed that about 99% of the simulated cases resulted in a better scenario for women than portrayed by the real data. In other words, this depicted a significantly lower representation of women in those positions than expected in an unbiased gender scenario.

An increasing number of women have been incorporated in scientific disciplines during the last decade (de Kleijn *et al.*, 2020; Huang *et al.*, 2020). Nevertheless, Potvin *et al.* (2018) pointed out that

women fulfilling leadership roles represent only 9% within zoological societies in South America. This gender mismatch at the hierarchical levels reveals a widespread phenomenon known as "glass ceiling", which was described as the intangible barriers—like peer-recognition, unequal family burden, gender stereotypes, among others—that prevent the promotion of highly qualified women to power positions (Akpinar-Sposito, 2013). In Argentina, the AHA has incorporated two women as chair members during the election of authorities in 2020, raising the proportion of women in this academic role. Further participation of women in decision making positions has also been reported recently for some Brazilian professional associations, since they had incorporated women as presidents, directorships and board members (Slobodian *et al.*, 2021). The increase in the representation of women in power positions is meaningful in a historical gender-unbalanced scientific landscape (Astegiano *et al.*, 2019), but considering that research is constructed in a collaborative fashion, the hierarchical structure of academia should be under debate as well.

We found two contrasting distribution patterns among the active members of the AHA. There are more women than men among researchers with short career paths; on the contrary, men are the majority among researchers with long career paths (Fig. 1B). This occurs in spite of the recruitment of female herpetologists has been constant and similar to that of men since 1999. Thus, low proportions of women with long academic paths do not seem to be the result of low recruitment in the past, but the consequence of the "leaky pipeline". This phenomenon describes the higher dropout rate of women compared to men's at all stages of their academic trajectory (Alper, 1993; Goulden *et al.*, 2011; Shaw and Stanton, 2012), and was documented in several scientific fields (e.g., Luckenbill-Edds, 2002; Holmes *et al.*, 2008; Martin, 2012; Valentova *et al.*, 2017; Jadidi *et al.*, 2018; Huang *et al.*, 2020).

Multiple factors may lead women to leave research in sciences, but according to the surveyed information, caregiving tasks and motherhood could be the most significant within the herpetological community. These results are reinforced by previous studies showing that women are more prone than men to resign labor activities in favor of domestic life (e.g., Holmes *et al.*, 2008; McGuire *et al.*, 2012; Cerrato and Cifre, 2018; Lione, 2018), and that motherhood seems to be a breakthrough event in

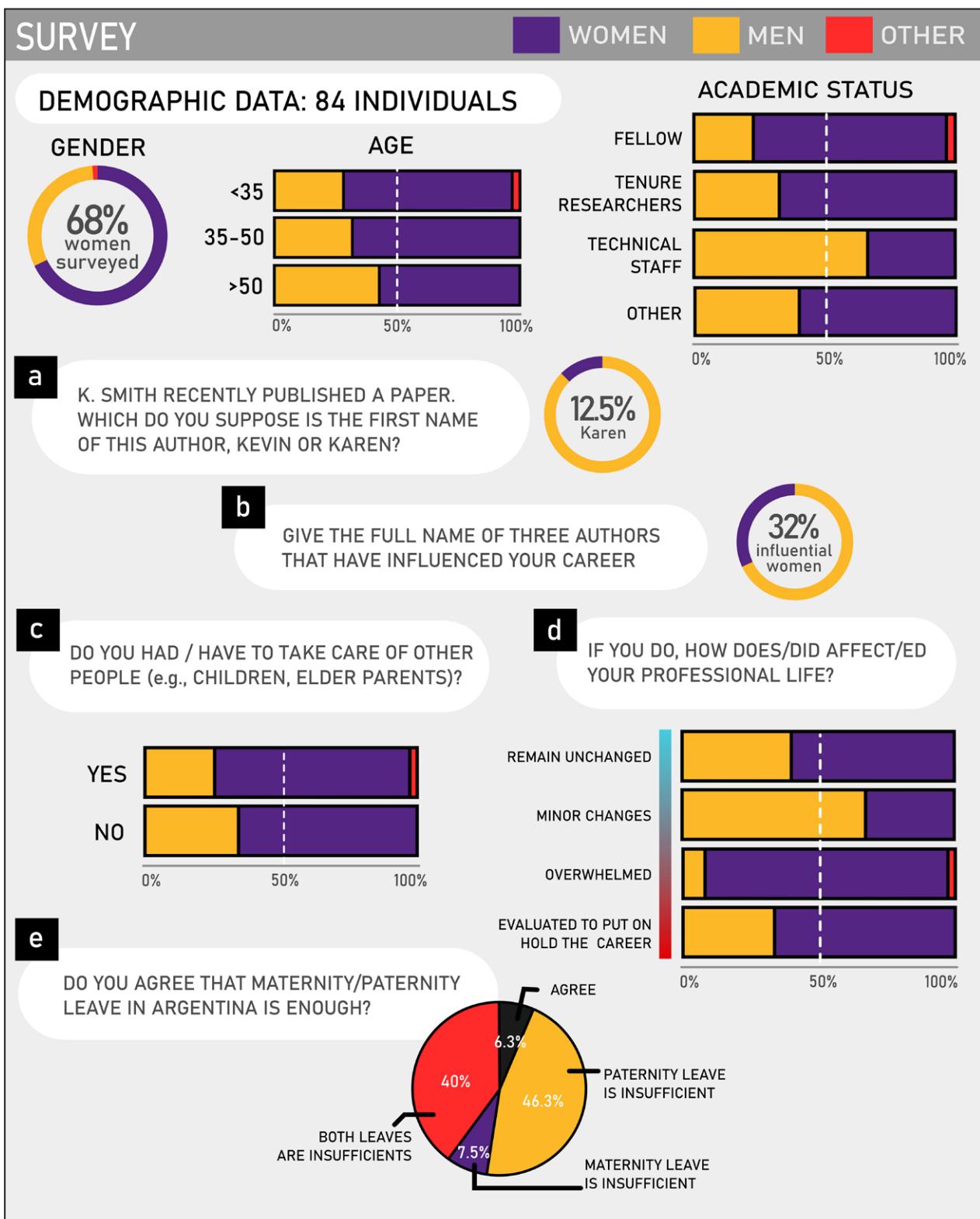


Figure 2. Summary of the survey answered by 84 attendees of the 20th Argentine Congress of Herpetology in 2019. (a–e) Questions with their summarized responses. Color codes in (a), (b) and (e) correspond to the gender referred in the answer.

women's academic careers (e.g., Kyvik and Teigen, 1996; Stack, 2004; Fox, 2005; Hunter and Leahy, 2010; Ceci and Williams, 2011; Cech and Blair-Loy,

2019). In the Argentine academic field—a population with high levels of education and a strong presence of paid work—women spend more time than

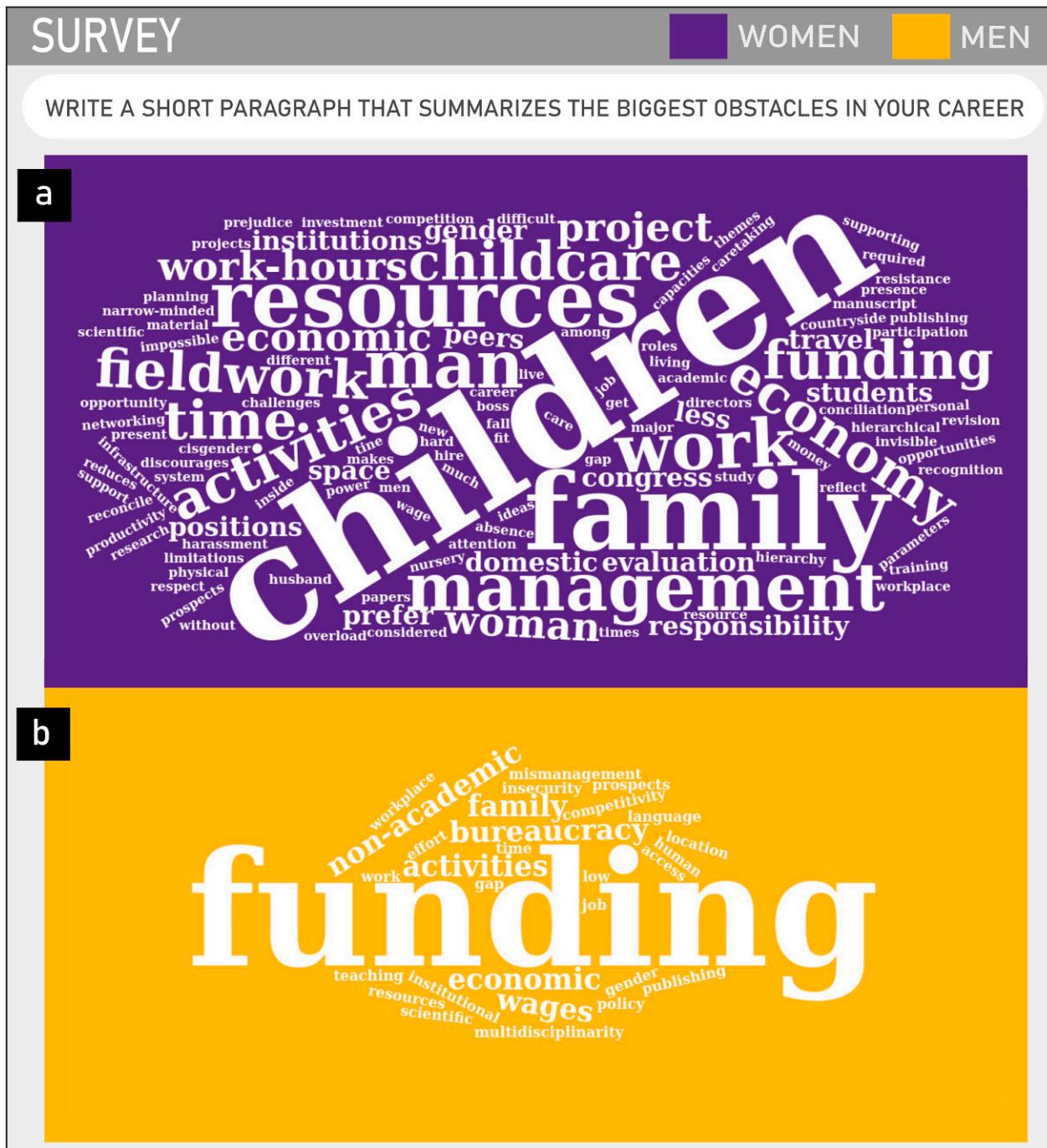


Figure 3. Word cloud constructed from gender-differentiated responses of the survey released by 84 participants of the 20th Argentine Congress of Herpetology in 2019.

men in domestic labors and caregiving tasks (Lione, 2018; Andreozzi *et al.*, 2019). However, such choices might be constrained by gender stereotypes of the society where female researchers are educated and develop their scientific careers (Ceci and Williams, 2011).

The performed survey also showed that most herpetologists thought of a man when asked to

name influencer scientists in their fields (Fig. 2), highlighting the low number of women constituting role models. This is possibly related to the homophilic dynamics and the consequent marginalization of women described for the publication process in Herpetology (Grosso *et al.*, 2021). Also, this may be an outcome of the overall low proportion of women occupying high exposure positions in this field. In

this regard, we found a significant low number of women as invited speakers in the Argentine Congress of Herpetology (Fig. 1F), which leads to a lesser visibility and may influence their peer-recognition. Our results agree with previous analyses of gender participation in congresses for other biological disciplines, where women were significantly under-represented among invited speakers (Schroeder *et al.*, 2013; Kalejta and Palmenberg, 2017) or had reduced exposure compared to men (Isbell *et al.*, 2012; Jones *et al.*, 2014). When analyzing the causes of these biases, the imbalanced gender proportion of the organizers has been pointed as responsible for the low numbers of invited women (Isbell *et al.*, 2012; Casadevall and Handelsman, 2014; Sardelis and Drew, 2016; Débarre *et al.*, 2018). This was not the case in the organizing committees of the Argentine herpetological congresses, where women's proportions were high (Fig. 1C). Thus, further studies are needed to elucidate the factors driving gender bias in speaker selection.

Achieving gender parity within the scientific community, does not ensure that women will "break the glass ceiling" and will occupy high exposure and decision-making positions, currently occupied by their male counterparts (McGuire *et al.*, 2012; Shaw and Stanton, 2012; Holman *et al.*, 2018). Directed actions and targeted policies are needed to guarantee promotion and retention of female herpetologists, particularly of those with more than 15 years of career path length (Holman *et al.*, 2018; Huang *et al.*, 2020). Accordingly, since 2016 CONICET has given funding and institutional endorsement to those meetings reaching gender parity, in order to prompt visibility of female scientists and improve access of young women to role models and mentors. In this sense, more women in power positions not only encourages equity, but also enriches professional relationships and leads to a higher quality of science (Woolley *et al.*, 2010; Campbell *et al.*, 2013; Nielsen *et al.*, 2018).

We are aware that deep systemic and intrinsic changes are required and, in the words of Harding (1996), the transformation of the very foundations of science and of the culture that gives its value are needed. Nevertheless, questioning the practices that perpetuate gender inequities is a first step necessary to build a more egalitarian scientific system.

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