Received: 30 November 2021 | Revised: 3 August 2022 | Accepted: 20 August 2022

DOI: 10.1002/wat2.1616

FOCUS ARTICLE

WIREs WATER WILEY

Women in limnology: From a historical perspective to a present-day evaluation

Núria Catalán[1] | Maria Anton-Pardo[2,3] | Anna Freixa[4] | Pablo Rodríguez-Lozano[5] | Mireia Bartrons[6] | Susana Bernal[7] | Ana Genua-Olmedo[8] | Clara Mendoza-Lera[9] | Gabriela Onandía[10,11] | Xavier Benito[12] | María Mar Sánchez-Montoya[13] | Miguel Cañedo-Argüelles Iglesias[14] | Ada Pastor[15] | Anna Lupon[7]

[1]Laboratoire des Sciences du Climat et de l'Environnement (LSCE), CEA, CNRS, UVSQ, Gif-Sur-Yvette, France

[2]GRECO, Institute of Aquatic Ecology, University of Girona, Campus Montilivi, Faculty of Sciences, Girona, Spain

[3]Department of Biology and Geology, Physics and Inorganic Chemistry, University King Juan Carlos, Madrid, Spain

[4]Catalan Institute for Water Research (ICRA), Girona, Spain

[5]Department of Geography, University of the Balearic Islands, Palma, Spain

[6]Aquatic Ecology Group, University of Vic-Central University of Catalonia, Vic, Spain

[7]Integrative Freshwater Ecology Group, Center for Advanced Studies of Blanes (CEAB-CSIC), Blanes, Spain

[8]CESAM—Centre for Environmental and Marine Studies, Department of Biology, University of Aveiro, Aveiro, Portugal

[9]iES, University of Koblenz-Landau, Landau, Germany

[10]Research Platform Data Analysis and Simulation, Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany

[11]Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), Berlin, Germany

[12]Marine and Continental Waters Programme, Institute of Agrifood and Technology Research (IRTA), Sant Carles de la Rapita, Spain

[13]Department of Biodiversity, Ecology, and Evolution, Faculty of Biological Sciences, Complutense University of Madrid, Madrid, Spain

[14]Freshwater Ecology, Hydrology and Management Group (FEHM), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Institut de Recerca de l'Aigua (IdRA), Universitat de Barcelona, Barcelona, Spain

[15]Department of Biology, Aarhus University, Aarhus, Denmark

Correspondence
Núria Catalán, Laboratoire des Sciences du Climat et de l'Environnement (LSCE), CEA, CNRS, UVSQ, Gif-Sur-Yvette, France.
Email: ncatalangarcia@gmail.com

Abstract

Research in limnology is nurtured by the work of many fascinating and passionate women, who have contributed enormously to our understanding of inland waters. Female limnologists have promoted and established the bases of our knowledge about inland waters and fostered the need of protecting the values of those ecosystems. However, on numerous occasions, their contribution to the advancement of limnology has not been duly recognized. Here, we review the presence of women in limnology through the history of the discipline: from the pioneers who contributed to the origins to present day' developments. We aim at visibilizing those scientists and establish them as role models. We also analyze in a simple and illustrative way the current situation of women in limnology, the scientific barriers

Funding information
European Union Horizon 2020. Marie Sklodowska Curie actions, Grant/Award Number: 839709; German Federal Ministry of Education and Research, Grant/Award Number: 01LC1501A-H; Government of Catalonia, Grant/Award Number: BP-2018-00082; Juan de la Cierva Incorporacion, Grant/Award Number: IJC2019-041601-I; MCIN/AEI Juan de la Cierva program, Grant/Award Number: IJC2019-039181-I

Edited by: Jan Seibert, Co-Editor-in-Chief

they must deal with, and their future prospects. Multiple aspects fostering the visibility of a scientist, such as their presence in conferences, awards, or representation in societal or editorial boards show a significant gap, with none of those aspects showing a similar visibility of women and men in limnology. This article raises awareness of the obstacles that women in limnology faced and still face, and encourages to embrace models of leadership, scientific management, and assessment of research performance far from those commonly established.

This article is categorized under:
Science of Water > Methods
Water and Life > Methods

KEYWORDS
bias, equity, freshwaters, gender, herstory

1 | INTRODUCTION

From the beginning of the 20th century, women have achieved huge advances in academia as well as in the socio-economic and political spheres (Lake, 1999). However, there are still many barriers for women, particularly in traditionally male-dominated STEM fields (Science, Technology, Engineering, and Mathematics). The proportion of women in top positions of STEM is still low and numbers have barely improved since the 1960s (Bell et al., 2009; Downes & Lancaster, 2020). Even if there is a positive trend towards gender balance, at the current rate it will take decades to close the gender gap (European Commission, 2019; Holman et al., 2018). This pattern is often explained, among other factors, by the high rates of career abandonment ("leaky pipeline"; Makarova et al., 2016) and the low promotion of women compared to their male counterparts (European Commission, 2019). In turn, these factors are related to gender-specific barriers that women experience during their STEM career, such as biases in research evaluation metrics (Andersson et al., 2021), lower visibility in meetings and conferences (Ford et al., 2018) or cultural barriers to leadership (Blackburn, 2017; Makarova et al., 2016; McCullough, 2020). Additionally, these barriers affecting women in STEM cascade into future generations because they limit the number of same-gender role models (Drury et al., 2011), which ultimately results in a vicious circle. Unless these barriers are identified, women will remain as prominent casualties.

The trajectory of women in limnology, the ecology of inland waters, is not an exception. Since this discipline emerged in the 19th century (Talling, 2008), numerous inspiring women have contributed substantially to push forward the frontiers of limnology. However, their contributions have been often been overlooked and very few have been awarded and acknowledged by their discoveries and life-time work (Waterton et al., 2019). For example, Downes and Lancaster (2020) reviewed the contributions of four pioneering women in limnology and the effect of publication bias in the career of freshwater ecologists. Nowadays, there are many women leading top research in limnology, and yet they, as well as the younger generations, keep facing gender-specific barriers and biases (Lester & Rosten, 2020). Awareness and understanding of the history of limnology from a female perspective (from hereafter, "Herstory") is crucial for identifying fruitful ways forward and away from gender bias.

In this article, we aim to bring into the spotlight the past and current situation of female limnologists. To achieve this objective, we conducted a comprehensive study including three main spheres. First, we illustrate the historical contribution of women to limnology because we acknowledge that only by learning from the past context and legacies, we can better understand the present situation and identify fruitful ways forward. We recover dozens of hidden figures across the limnological discipline. Second, we analyze the current situation of female limnologists, focusing on the gender bias and barriers that persist such as research evaluation metrics, visibility in conferences, and leadership and governance of academic institutions, societies, and journals. Finally, we

acknowledge some of the ongoing initiatives and provide some future prospects to achieve gender equity and justice in limnology.

2 | HERSTORY IN LIMNOLOGY

The history of limnology is full of outstanding researchers that have contributed to advance our knowledge on the structure and functioning of freshwaters. In this section, we take a retrospective look at the three phases of the "Herstory" of limnology (sensu Talling, 2008) from a gender perspective.

2.1 | The grounds (of limnology)

The grounds of limnology were settled in the 19th century, when lakes and ponds attracted the attention of numerous naturalists. At that time, limnology was essentially descriptive and focused mainly on the hydrology, morphology, and geology of the European and North American lakes, with little emphasis on their biota. However, later in the 1880s, two publications changed this traditional view: *The Lake as a Microcosm* (Forbes, 1887) and *Le Léman* (Forel, 1982). By analyzing how seasonal changes in environmental variables affect the biotic community of lakes, these two publications became the first attempt to establish connections between abiotic and biotic processes, setting the grounds for modern limnology. These seminal works were followed by important taxonomic monographs and textbooks, including the world-recognized book *Life in Inland Waters*, with special references to animals, written by Kathleen Carpenter (1928) or the *Field Book of Ponds and Streams: an Introduction to the Life of Fresh Water* (1930) by Ann H. Morgan.

In those days, not too many women were limnologists, and the few ones who decided to pursue this scientific career had to face a society that considered them incapable of any intellectual work (Downes & Lancaster, 2020). Despite the obstacles, some women emerged as pioneers of limnology in Europe and the United States (Figure 1). For example, the studies of Harriet B. Merill, Ann H. Morgan, Emmeline Moore, and Rina C. Monti greatly contributed to our knowledge of the biology and ecology of freshwater organisms (Morgan, 1930), zooplankton (Merrill, 1893; Monti, 1929), and fish (Moore, 1923). Also, Emmeline Moore and other female limnologists, such as Kathleen Carpenter, were pioneers in assessing how pollutants impact aquatic biota by defining environmental quality indicators for freshwaters (Carpenter, 1924; Moore, 1926).

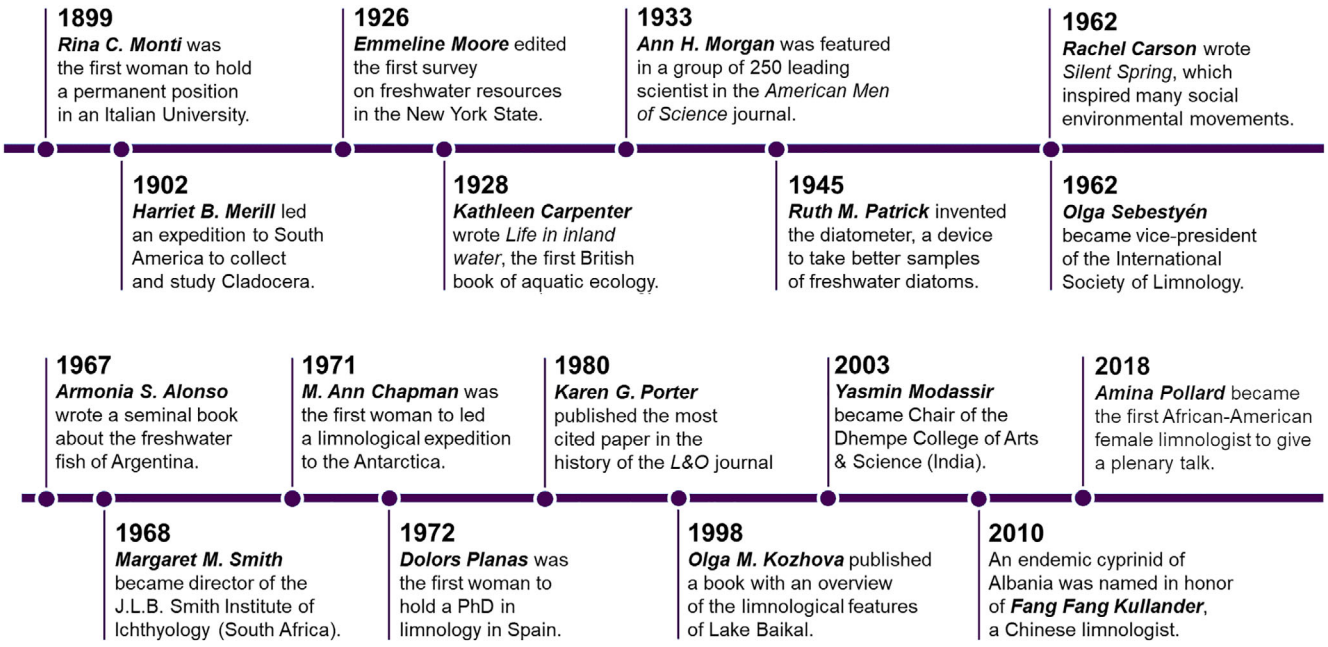

FIGURE 1 Timeline of the "Herstory" in limnology, where selected achievements of female limnologists are highlighted. The list of achievements and contributions of female limnologists is expanded in Annex 1.

Despite most of the knowledge of freshwater environments and their biota was centered on Europe and North America, the first limnological expeditions traveled to Amazonia (1902–1903 and 1907–1909), Central Africa Lakes (Percy Sladen Expedition, 1929), Siberia (URSS Academy of Sciences Expedition, 1926–1934) and Indonesia (Lake Ranu Lamongan Expedition, 1928–1929) at the beginning of the 20th century. Few pioneer female limnologists took part in these expeditions, such as Penelope M. Jenkin (Percy Sladen Expedition, 1929) and Nadezhda S. Gaevskaya (Lake Baikal Expedition, 1926; Annex 1). Thanks to these expeditions, the field of limnology emerged in other continents and several research stations were founded worldwide.

2.2 | The expansion (of limnology)

From 1930 to 1980, the field of limnology tremendously expanded geographically. Limnological societies were founded across all continents, and many more scientific expeditions departed to South America, Africa, and polar regions. This geographical expansion of the field broadened the knowledge on freshwater ecosystems, until then focused mainly on temperate and boreal areas. Female limnologists pioneered field work in some of these geographical regions (Figure 1). Among others, the research of Armonia Alonso de Aramburu and Margaret M. Smith was critical for describing the taxonomy and distribution of freshwater fish species in Argentina and South Africa, respectively (Alonso de Arámburu & Ageitos de Castellanos, 1949; Smith, 1968), while M. Ann Chapman discovered several freshwater zooplankton species in both New Zealand and Antarctica (Chapman et al., 1976).

During these decades, new research fields were established in limnology, such as paleoecology, biogeochemistry, and population dynamics (Talling, 2008). Women limnologists grew in number and promoted freshwater ecology in different countries through their outstanding work, but did not receive the recognition they deserved from the scientific community during this period. Probably, the only exception was Ruth Patrick, whose research on diatoms as indicators of landscape history and ecosystems health has been widely recognized by limnological societies (Patrick, 1948; Patrick, 1977). However, the work of other women is less known despite its relevance for advancing knowledge in the field. Some of these women hidden in the books of the history of limnology are Margaret B. Davis and Olga Sebestyén, pioneers in using pollen and copepods in lake sediments to study the vegetation and lake history (Davis, 1973; Sebestyén, 1963), Erna Mohr, the first person to determine the age of fish by their ctenoid scales (Mohr, 1927), or Rosemary Lowe-McConnell, one of the first persons to use scuba diving for scientific research (Annex 1).

Women were also pioneers fighting for the conservation of freshwater ecosystems at a time when the dangers of pollution for public health barely pierced the national consciousness. For instance, Ruth Patrick's work on the effects of pollutants on rivers and lakes helped to develop guidelines for the protection of drinking waters in the United States Congress, that passed the Clean Water Act in 1972. Similarly, the seminal book *Silent Spring*, by Carlson (1962), highlighted the ecological problems associated with chemical pesticides, which initiated the modern environmental movement and, at the same time, questioned the scope and direction of modern science.

2.3 | The revolution (of limnology)

In the last decades (1980–2020), research in limnology has boosted both conceptually and empirically as a result of methodological advances in the fields of physics, chemistry, and biology. These methodologies include remote sensing, electronic microscopy, high-frequency sensors, spectrophotometry, liquid and gas chromatography, biomarkers, isotopic analysis, and molecular biology (Hauer & Lamberti, 2011). The implementation of some of these methodologies was led by women, such as Karen G. Porter, whose publication on the use of fluorescent DNA stain (DAPI) for counting aquatic microflora (Porter & Feig, 1980) was highlighted as the most cited article in the 50-year history of the journal *Limnology and Oceanography* (Figure 1). Further, the settlement of monitoring stations in several lakes and river networks across the globe has led to long-term data analysis (Lugo et al., 2012; Lutz et al., 2012), large scale cross-comparison studies (Koricheva et al., 2013; Pollard et al., 2018) and collaborative grass-roots research initiatives such as the Global Lake Ecological Network, co-founded and led in its infancy by Kathleen Weathers (Weathers et al. 2013). In addition, advances in modeling have promoted both theoretical advances on global hydrological, biological, and biogeochemical models (Döll, 2009; Poff et al., 2010), as well as its applied knowledge for ecological management (Varadharajan et al., 2019).

During this period, women have led research in different fields of limnology and the scientific contribution of several of them has been widely recognized by the academic community (Annex 1). For instance, key theories of modern limnology, such as patch-dynamics in aquatic systems (Pringle et al., 1988) or the control point concept (Bernhardt et al., 2017) were developed by women. Further, many female researchers have contributed to increase the knowledge on taxonomy and aquatic species distribution and their interaction with the environment, standing out studies in South America and Asia (e.g., Fang et al., 2013; Hamada et al., 2002; Jacobsen & Encalada, 1998). Finally, female researchers are leading research on new fields, such as freshwater ecosystem restoration (Palmer et al., 2014; Zedler, 2000), urban ecology (Grimm et al., 2004) and translational ecology (Tank, 2017).

Although the number of female limnologists has increased since the beginning of the 20th century, many of them are not fully recognized and their work is not sufficiently visualized (Annex 1 and section below). Indeed, advances in gender balance in the field of limnology are happening at a slower pace than what most of the community members believe. For example, the first PhD thesis in limnology defended by a Spanish woman was granted in 1972 and the first plenary talk given by an African-American female limnologist took place in 2018 at the Association for the Sciences of Limnology and Oceanography (ASLO) (Figure 1). The situation of female limnologists is even worse in some regions such as in South America, Central Africa, or Asia. For instance, not a single woman from India or China, two of the largest countries in the world, co-authored an article between 1945 and 2019 in the top 10 leading journals in ecology and conservation (Maas et al., 2021).

3 | CURRENT SITUATION OF WOMEN IN LIMNOLOGY: BARRIERS AND ACHIEVEMENTS

In this section, we analyze the present situation of women in limnology in order to show current gender barriers and imbalances. We focus on three aspects: (1) gender-biased metrics on academic productivity and performance, (2) the visibility of women limnologists based on scientific conferences and awards, and (3) the work of women as leaders in limnology.

3.1 | Assessment of research performance

Among all current forms of discrimination in research, a well-known gender bias is derived from the metrics used to assess the quality of research, including the number of publications or citation-based metrics such as the h-index (Andersson et al., 2021; Huang et al., 2020). In most scientific disciplines, including limnology, women generally have less publications and lower h-index values than men (Kelly & Jennions, 2006; Leimu & Koricheva, 2005; Symonds et al., 2006). An evaluation performed on the publications on limnology by authors for the years 2000–2009 and affiliated to Spanish and Portuguese (i.e., Iberian) institutions, identified that women were first authors of 44% of the publications (Obrador & Bonada, 2014; Sánchez-Montoya et al., 2016). Further analyzing that data set (see Annex 2), we have identified that the 10 women with more first author publications for the period, had a median h-index of 24.5 (spanning 17–61) while that value was 41 (spanning 25–130) for the 10 men with more first author publications. However, women were younger, with research seniority (years since first publication) between 6 and 22, while for men it was between 6 and 30. Across all the authors, the median number of publications as first author per year was 0.10 both for women and men.

Rather than unflawed indicators for research performance, multiple evidences have shown that citation-based metrics usually reflect discrimination and/or distinct work habits and research priorities between women and men. First, citation-based metrics discriminate against women by favoring particular types of research. Women are more likely to conduct empirical research, which generates publications more slowly and receives less citations than theoretical studies (Haller, 2014) or review articles (Bendels et al., 2018). For example, in our analysis of Iberian limnology, most of the "solo" publications, that typically consist of invited opinion or review articles, were authored by men (63%; Sánchez-Montoya et al., 2016). Second, when the h-index is weighted by the number of publications (Figure S1 in Annex 2), women accumulate similar or even more citations than men, suggesting that women focus more on quality than quantity (Symonds et al., 2006). Third, men cite their own publications more frequently than women (Cameron et al., 2016; Kelly & Jennions, 2006), which can increase the number of total citations and the h-index (Cameron et al., 2016). All in

all, citation-based metrics threaten women's ability to obtain employment, career advancement, and research funding (Downes & Lancaster, 2020).

As a result of the aforementioned phenomena, quantitative metrics have been recently considered flawed to measure scientific competences (MacRoberts & MacRoberts, 2018; Ricker, 2017). Several initiatives have emerged to promote changes in the ways scholarly research is assessed. As an example, the Declaration On Research Assessment (DORA; https://sfdora.org/) has the objective to identify the flaws of current research assessment methods and facilitate the implementation of new approaches. DORA also provides multiple resources to avoid unintended cognitive and systematic biases in research evaluation through community engagement, partnership with other organizations, advising academic institutions and funders or convening meetings with diverse stakeholders to work toward system change. Several research foundations worldwide are starting to adhere to those principles. The European Research Council, for instance, formally endorsed DORA in July 2021 and now candidates are explicitly asked not to include the Journal Impact Factor in their applications. We encourage universities and other academic institutions to adhere to DORA and recommend the future evaluation of the impact of such implementation on institutional diversity.

3.2 | Women visibility in academic conferences and awards

Academic conferences are crucial events for researchers as they are major scenarios to disseminate and learn about scientific advances. They also offer a public context where status and prestige may be displayed and bring opportunities for networking and visibility, boosting academic success (Egri, 1992; Hinsley et al., 2017). Gender biases have been reported in the arena of conferences and scientific meetings, including the abstract selection (Yentsch & Sindermann, 2013), coauthor lists (Hanson et al., 2020), plenary speakers (Farr et al., 2017), and oral presentations (Ford et al., 2018; Sánchez-Montoya et al., 2016). Further, women speak less time than men when presenting their work (Jones et al., 2014) and ask fewer and shorter questions (Hinsley et al., 2017; Käfer et al., 2018; Pritchard et al., 2014).

In limnological conferences, the scarce information available suggests that women are invited as plenary speakers more often than 5 years ago, an indication that their visibility is increasing in scientific meetings (Figure 2a). For example, at the conference of the Iberian Association of Limnology (AIL; www.limnetica.es), only three women presented plenary talks between 1981 and 2008: Dolors Planas (1983), Colette Serruya (1989), and Věra Straškrabová (1991, 2002). Interestingly, the number of women invited as plenary speakers significantly increased from 2014 (Figure 2), coinciding with the establishment of the Gender & Science working group in the association. Still, women were underrepresented or even absent as plenary speakers in recent limnology conferences (e.g., women have not reached one third of the plenary speakers at the conferences of the International Society of Limnology [SIL; https://limnology.org/] or at the Symposium for European Freshwater Sciences [SEFS]). Further, the number of attendees during keystone and plenary talks is still lower for female than for male speakers (Lupon et al., 2021), indicating that self-reflection on gender bias by conference organizers and attendees is urgently needed.

Awards are also a good indicator of professional and scientific recognition. Although trends are changing, there are still substantial differences between the number of awarded men and women. In other disciplines, young women researchers receive more awards than men (Ma et al., 2019), but this is not the case in the limnological associations, where the only exception were the early-career researchers' awards at ASLO (Figure 2b). Moreover, we also found that the awards and tributes to the entire scientific career are mostly held by male limnologists (Figure 2b) in agreement with findings across other disciplines, showing that men still win the most prestigious and monetary awards, despite comparable quality of work (Ma et al., 2019).

3.3 | Women leadership in freshwater sciences

Reaching positions of maximum responsibility in universities, research centers, and scientific societies is key to boost leadership and promote women's visibility. However, gender bias is astonishingly present in the highest echelons of the scientific career. In 2010, less than 20% of Chairs were women at European universities and research institutes in the area of Natural Resources (de Madariaga et al., 2011; O'Dorchai et al., 2009).

One of the most widespread indicators of the underrepresentation of women in scientific fields is the glass ceiling effect (Cotter et al., 2001) that prevents women from reaching lead positions in academia. The glass ceiling index (GCI) is used as a relative index comparing the proportion of women in academia (i.e., grades A, B, and C) with the

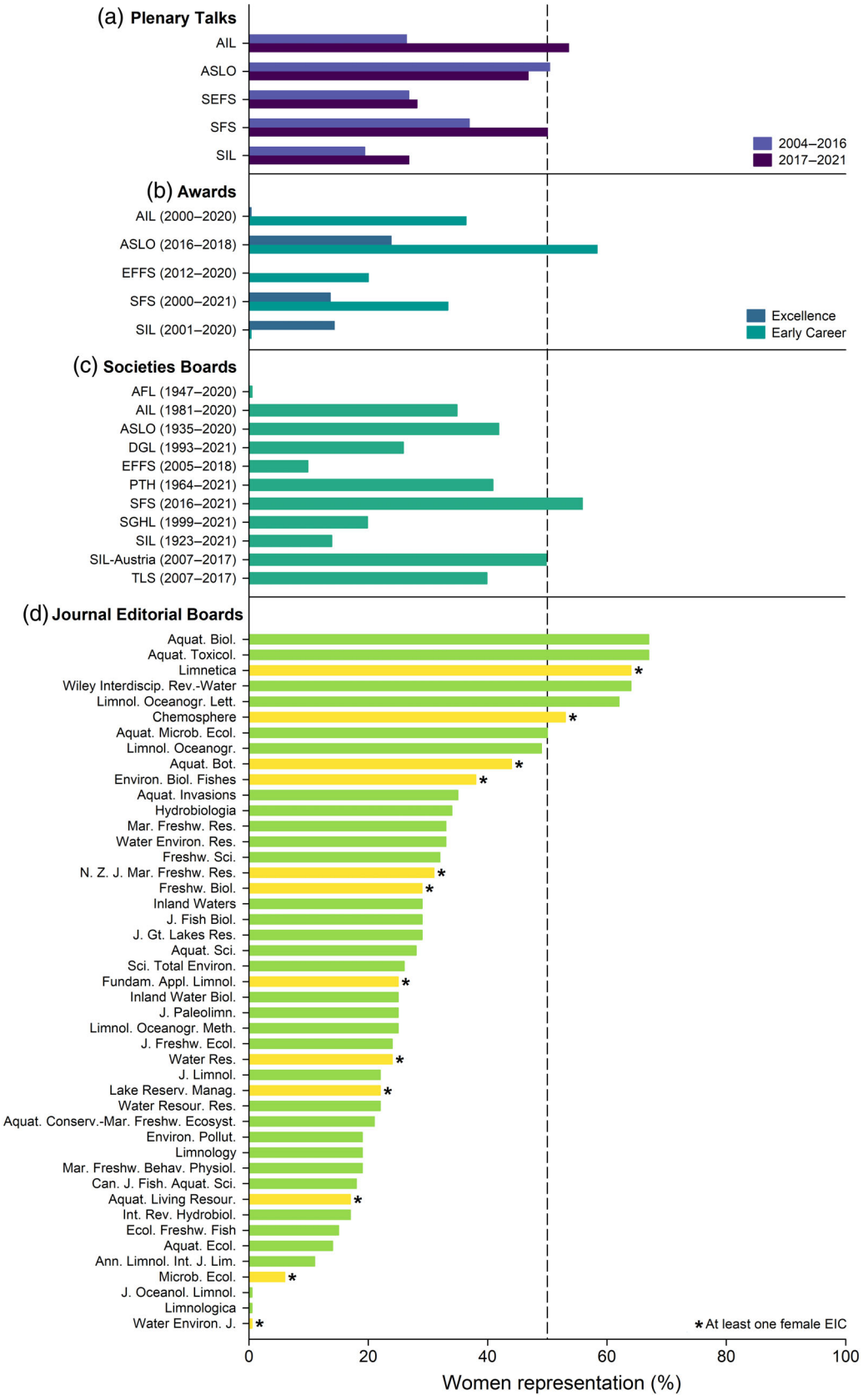

FIGURE 2 Legend on next page.

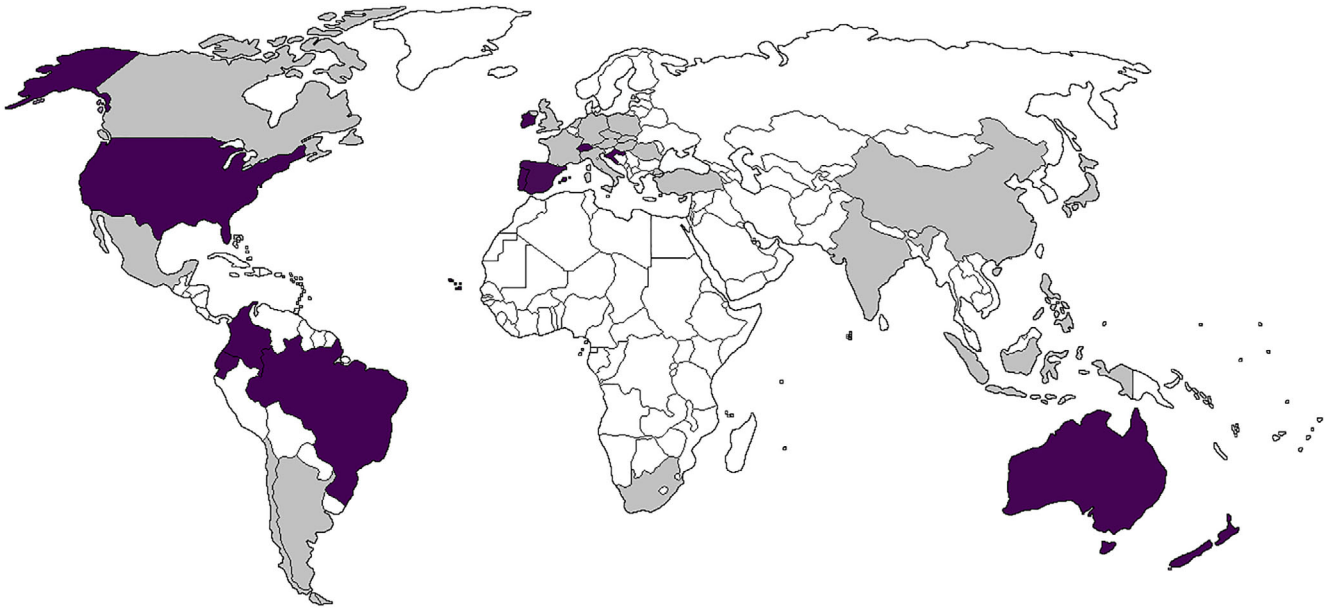

FIGURE 3 Map of freshwater societies with male (gray) and female (purple) presidents in November 2021. Within the 32 societies analyzed (Annex 2), there are only 10 women presidents: Alisha Steward (Australian Freshwater Sciences Society, AFSS), Andrea Encalada (Red Ecuatoriana de Limnología), Ashley Moerke (Society for Freshwater Science, SFS), Dorothea Hug Peter (Swiss Society for Hydrology and Limnology, SSHL), Jeimmy Walteros (Red Colombiana de Limnología, RCL), Kate McArthur (New Zealand Freshwater Sciences Society, NZFSS), Luciana Gomes Barbosa (Associação Brasileira de Limnologia, ABLIMNO), Mary Kelly-Quinn (Irish Freshwater Sciences Association, IFSA), Núria Bonada (Asociación Ibérica de Limnología, AIL), and Renata Matoničkin Kepčija (Croatian Association of Freshwater Ecologists, CAFE)

proportion of women in top academic positions (i.e., grade A, equivalent to full professor in most countries). A score higher than 1 indicates glass ceiling effect, meaning that women are less represented than men in top academic positions than in academia. In 2016, all the countries from the European Union had an index well above 1 (mean GCI = 1.64). Additionally, although the average GCI slightly improved between 2013 and 2016 for the EU-28 (reduction of 0.04), for some countries like Spain, Germany, or Hungary it remarkably increased (0.09, 0.43, and 0.37, respectively; European Commission, 2019). The same year, an analysis of the gender distribution within career stages of the members of the Iberian Association of Limnology showed a GCI of 1.77 (Sánchez-Montoya et al., 2016), confirming that is harder for women in limnology to reach the highest academic positions in Spain and Portugal.

Likewise, the analysis of the demographics of 32 limnological societies worldwide (see Methods in Annex 2) showed that women still play a secondary role in most governance and executive boards. In November 2021, the presence of women on boards of directors was generally less than 50% (Figure 2c); and only 10 societies (i.e., 31%) had a woman as president (Figure 3). Further, no woman had chaired long-standing limnological associations, such as the Association

FIGURE 2 Representation of women in the field of limnology: (a) women as plenary speakers in conferences, (b) women as winners of awards, (c) women in the boards of societies, and (d) women in the editorial boards of scientific journals. In panel (a), bars represent the average value of women representation for the years 2004–2016 (blue) and 2017–2021 (purple). In panel (b), bars represent the average value for early-career (turquoise) and excellence (dark blue) awards. The period analyzed for each society is indicated in parentheses. In panel (c), bars are the average value for all boards during the history of each society. The period analyzed for each society is indicated in parentheses. In panel (d), bars represent the proportion of women in the associated editors' board ordered from higher to lower proportion. Yellow bars show those journals where at least one Editor in Chief is a woman. The vertical dashed line indicates a women representation of 50%. Abbreviations for societies and conferences are: AFL, Association Françoise de Limnologie; AIL, Asociación Ibérica de Limnología; ASLO, Association for the Sciences of Limnology and Oceanography; DGL, German Limnological Society; EFFS, European Federation for Freshwater Sciences; PTH, Polish Hydrobiological Society; SEFS, Symposium for European freshwater Sciences; SFS, Society for Freshwater Sciences; SGHL, Swiss Hydrological & Limnology Society; SIL, International Society of Limnology; SIL-Austria, Austrian Limnological Association; and TLS, Turkish Limnological Society

Françoise de Limnologie (AFL), the European Federation for Freshwater Sciences (EFFS), the Austrian Limnological Association (SIL-Austria), or the Turkish Limnological Society (TLS). However, there are some scientific societies that are making the difference in this field, such as the British Freshwater Biological Association (FBA), where 60% of the presidencies have been held by women (Catalán et al., in press).

The gender gap in leadership positions can also be evaluated based on the proportion of women who apply and get projects, grants, and fellowships. According to the *She Figures* report (European Commission, 2019), less than 30% of national and international research projects in STEM are led by women. In this vein, women only received 23% of the European Research Council grants within the Life Sciences area during 2007–2016, although 30% of the applicants were women, which also translated to a lower success rate for women than men. Similarly, the proportion of projects led by women and funded by the Spanish Ministry within the area of Environmental Sciences and Technology in 2018, was 40% and 22% for the two main calls: Research Challenges and Knowledge Generation, respectively. In both calls, women also had a lower application success rate than men: 36% versus 40% for the Research Challenge call, and 39% versus 46% for the Knowledge Generation call (AEI, 2018).

The gender bias in leadership roles of scientific groups is also evidenced by the position that women hold in scientific publications. Taking the publications of limnologists affiliated to Spanish and Portuguese institutions (see above), only 37% of the solo author publications were authored by women; and women only signed 26% of publications as last author, which is the author position usually occupied by the senior author and leader of the research group (Sánchez-Montoya et al., 2016). Similar results were found for the journal *Functional Ecology* during 2010–2014: 26% of solo authors were women; and women signed 43% and 25% of the publications as first and last authors, respectively (Fox et al., 2016). Such bias also pervades the leadership role in editorial boards (Figure 2d). Women acting as associated editors in 45 limnology and freshwater sciences journals represented less than one third of the board (29% ± 17%; mean value ± SD). The median representation of women was 35%,

BOX 1 Initiatives on gender equity in the field of limnology

Earth Science Women's Network (ESWN). ESWN is a nonprofit organization dedicated to increasing diversity across geosciences with emphasis on creating and supporting a nurturing community, working for cultural change to eliminate barriers to a diverse scientific workforce, and empowering scientists through professional development (https://eswnonline.org/).

Justice, equity, diversity, and inclusion (JEDI) task force by the Society for Freshwater Science (SFS). Aims at breaking down barriers for underrepresented groups in SFS through a set of intentional and clear actions (https://freshwater-science.org/justice-equity-diversity-inclusion-jedi-task-force).

Special issue in hydrological processes: Women advancing research on hydrological processes, by Tetzlaff et al. (2021). Features invited contributions by women scientists at an advanced career stage who have made sustained contributions to the study of hydrological processes.

Google group WomenInHydrology. Mailing list created to encourage and foster the participation of female hydrologists in the community, promoted by the Hydrological Sciences (HS) Division of the European Geosciences Union (EGU). To join the group: https://groups.google.com/g/womeninhydrology

Equality, Diversity, and Inclusion (EDI) Working group of EGU. Aims to promote and support equality, diversity, and inclusion in the Earth, planetary, and space sciences, with a focus on EGU activities. https://www.egu.eu/structure/committees-and-working-groups/edi/

Gender and Science Group from the Iberian Association of Limnology (AIL). Since 2013, acts as gender observatory within AIL, engages activities to claim the role of women within the scientific community, and promotes gender equity measures in institutions directly or indirectly related to Limnology. In their website, they curate different initiatives promoting women across sciences and discussing gender issues (https://www.genderlimno.org).

SIBECOL D&I Commission. The Diversity and Inclusion Commission of the Iberian Society of Ecology (SIBECOL). Created in 2020, it aims to celebrate, protect, and raise awareness about diversity within SIBECOL members. Their priority is the inclusion of those groups that have been historically excluded from the scientific community.

ranging from 0% (*Journal of Oceanography and Limnology; Limnologica; Water Environmental Research*) to 67% (*Aquatic Biology*). Additionally, only seven journals had a female editor-in-chief acting solo (10%), while that number was 24 (53%) for males. This number rises to 12 if considering shared editor-in-chief roles (21%) for women and to 31 (69%) for men. None of the journals with shared editor-in-chief roles had a team entirely composed of women, while that was the case for men in six out of 11 journals. These results are in line with those in Vila-Concejo et al. (2018) for the field of coastal engineering. In the light of their results, they highlighted that women are better represented in prestige roles when the path to reach those roles is clearly outlined and women can self-nominate or come forward, rather than when the path is through invitation-only (commonly used in editorial boards).

Barriers to promotion exist at multiple levels: cultural, structural, linked to the organizational environment and individual. Some actions to remove those barriers demand institutional-level changes that might need long time windows to be developed, but others can be easily implemented through the limnological associations and our individual choices based on awareness. Those include, among others, mentoring programs, active support of women participation in conferences, avoidance of gatekeeping practices (e.g., invitation-only paths) or using more fair criteria for evaluation (Francis & Stulz, 2020). A summary of initiatives working for gender equity in the field of limnology is shown in Box 1.

4 | CONCLUSION

In summary, the potential of women in limnological research has not yet been fully unfolded. A proactive attitude from scientists, research institutions, and scientific associations can be essential to reduce the existing barriers for women. Some examples of actions that could be taken are: acknowledging historical gender barriers, biases and discrimination in freshwater sciences research; establishing double-blind review in journals and project calls; supporting the participation of women with family duties in scientific meetings; or guaranteeing gender equality in scientific committees and councils. The success of these strategies and diversity interventions requires considering other historically underrepresented groups and their intersection with gender identity (Miriti et al., 2021). We must work diligently, be more aware of barriers for women, and at the same time embrace models of leadership and scientific management different from those currently established. Only in this way will we be able to achieve gender balance not only in our professional careers, but also in the other dimensions of our lives.

AUTHOR CONTRIBUTIONS

Núria Catalán: Conceptualization (lead); data curation (lead); methodology (lead); visualization (supporting); writing – original draft (lead); writing – review and editing (lead). **Maria Anton-Pardo:** Writing – original draft (equal); writing – review and editing (equal). **Anna Freixa:** Writing – original draft (equal); writing – review and editing (equal). **Pablo Rodríguez-Lozano:** Writing – original draft (equal); writing – review and editing (equal). **Mireia Bartrons:** Writing – original draft (equal); writing – review and editing (equal). **Susana Bernal:** Writing – original draft (equal); writing – review and editing (equal). **Ana Genua-Olmedo:** Writing – original draft (equal); writing – review and editing (equal). **Clara Mendoza-Lera:** Writing – original draft (equal); writing – review and editing (equal). **Gabriela Onandía:** Writing – original draft (equal); writing – review and editing (equal). **Xavier Benito:** Writing – original draft (equal); writing – review and editing (equal). **María Mar Sánchez-Montoya:** Writing – original draft (equal); writing – review and editing (equal). **Miguel Cañedo-Argüelles Iglesias:** Writing – original draft (equal); writing – review and editing (equal). **Ada Pastor:** Writing – original draft (equal); writing – review and editing (equal). **Anna Lupon:** Conceptualization (equal); data curation (equal); methodology (equal); visualization (lead); writing – original draft (lead); writing – review and editing (lead).

ACKNOWLEDGMENTS

The authors of this article are proudly members of the Gender&Science AIL group, which aims to promote diversity, inclusivity, and equity for limnologists (www.genderlimno.org). We sincerely thank the Iberian Association of Limnology (AIL) for their support in our activities.

FUNDING INFORMATION

Núria Catalán was funded from the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska-Curie grant agreement No. 839709. Anna Freixa was funded by MCIN/AEI through the Juan de la Cierva

program (IJC2019-039181-I). Pablo Rodríguez-Lozano was supported by a Juan de la Cierva-Incorporación fellowship (IJC2019-041601-I). Gabriela Onandía was supported by the German Federal Ministry of Education and Research BMBF within the Collaborative Project "Bridging in Biodiversity Science-BIBS" (01LC1501A-H). Anna Lupon was funded by the Government of Catalonia and the European Commission through the program Beatriu de Pinós (BP-2018-00082).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The full list of distinguished female limnologists (Annex 1) and the datasets supporting our findings are available in Zenodo, with the identifier doi: 10.5281/zenodo.7104480.

ORCID

Núria Catalán https://orcid.org/0000-0002-2433-4190
Maria Anton-Pardo https://orcid.org/0000-0003-1722-9867
Anna Freixa https://orcid.org/0000-0003-1149-6526
Pablo Rodríguez-Lozano https://orcid.org/0000-0002-5130-8107
Mireia Bartrons https://orcid.org/0000-0003-0617-9577
Susana Bernal https://orcid.org/0000-0002-6726-8840
Ana Genua-Olmedo https://orcid.org/0000-0002-0293-1664
Clara Mendoza-Lera https://orcid.org/0000-0002-3222-2498
Gabriela Onandía https://orcid.org/0000-0001-9597-1923
Xavier Benito https://orcid.org/0000-0003-0792-2625
María Mar Sánchez-Montoya https://orcid.org/0000-0001-8179-7805
Miguel Cañedo-Argüelles Iglesias https://orcid.org/0000-0003-3864-7451
Ada Pastor https://orcid.org/0000-0002-7114-770X
Anna Lupon https://orcid.org/0000-0001-6655-8531

RELATED WIREs ARTICLES

Gender and climate change

REFERENCES

AEI. (2018). *Informe de las convocatorias de Proyectos de I+D "Generación de Conocimiento" y Proyectos de I+D+i "retos Investigación" del año 2018*. Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación.

Alonso de Arámburu, A. S., & Ageitos de Castellanos, Z. J. (1949). Algunos datos sobre la alimentación de las ampularias. *Notas del Museo de La Plata: Zoología*, *14*, 31–34.

Andersson, E. R., Hagberg, C. E., & Hägg, S. (2021). Gender bias impacts top-merited candidates. *Frontiers in Research Metrics and Analytics*, *6*, 594424.

Catalán, N., Bartrons, M., Benito, X., Bernal, S., Cañedo-Argüelles, M., Bravo, A. G., Genua-Olmedo, A., Mendoza-Lera, C., Pastor, A., Sánchez-Montoya, M. M. & Lupon, A. (in press). Limnólogas: pasión por el estudio de las aguas continentales. In M. I. C. Salle-Bogotá & J. Walteros (Eds.), *Mujer del Agua*. Universidad La Salle.

Bell, S., O'Halloran, K., Saw, J., & Zhao, Y. (2009). *Women in science: Maximising productivity, diversity and innovation*. Federation of Australian Scientific & Technological Societies (FASTS).

Bendels, M. H. K., Müller, R., Brueggmann, D., & Groneberg, D. A. (2018). Gender disparities in high-quality research revealed by nature index journals. *PLoS One*, *13*, e0189136.

Bernhardt, E. S., Blaszczak, J. R., Ficken, C. D., Fork, M. L., Kaiser, K. E., & Seybold, E. C. (2017). Control points in ecosystems: Moving beyond the hot spot hot moment concept. *Ecosystems*, *20*(4), 665–682.

Blackburn, H. (2017). The status of women in STEM in higher education: A review of the literature 2007–2017. *Science & Technology Libraries*, *36*(3), 235–273.

Cameron, E. Z., White, A. M., & Gray, M. E. (2016). Solving the productivity and impact puzzle: Do men outperform women, or are metrics biased? *Bioscience*, *66*(3), 245–252.

Carpenter, K. E. (1924). A study of the fauna of rivers polluted by lead mining in the Aberystwyth district of Cardiganshire. *Annals of Applied Biology*, *11*(1), 1–23.

Carson, R., (1962). Silent Spring. Houghton Mifflin.

Chapman, M. A., Lewis, M. H., & Stout, V. M. (1976). *Introduction to the freshwater crustacea of New Zealand*. Collins.
Cotter, D. A., Hermsen, J. M., Ovadia, S., & Vanneman, R. (2001). The glass ceiling effect. *Social Forces*, *80*(2), 655–681.
Davis, M. B. (1973). Redeposition of pollen grains in lake sediment. *Limnology and Oceanography*, *18*(1), 44–52.
de Madariaga, I. S., de la Rica, S., & Dolado, J. J. (2011). *Libro Blanco. Situación de las Mujeres en la Ciencia Española*. Ministerio de Ciencia e Innovación.
Downes, B. J., & Lancaster, J. (2020). Celebrating women conducting research in freshwater ecology... and how the citation game is damaging them. *Marine and Freshwater Research*, *71*(2), 139–155.
Drury, B. J., Siy, J. O., & Cheryan, S. (2011). When do female role models benefit women? The importance of differentiating recruitment from retention in STEM. *Psychological Inquiry*, *22*(4), 265–269.
Döll, P. (2009). Vulnerability to the impact of climate change on renewable groundwater resources: A global-scale assessment. *Environmental Research Letters*, *4*(3), 035006.
Egri, C. P. (1992). Academic conferences as ceremonials: Opportunities for organizational integration and socialization. *Journal of Management Education*, *16*, 90–115.
European Commission. (2019). *She figures 2018*. Publications Office of the European Union, doi:https://doi.org/10.2777/936
Fang, F., Sun, H., Zhao, Q., Lin, C., Sun, Y., Gao, W., Zhou, J., Xu, J., Ge, F., & Liu, N. (2013). Patterns of diversity, areas of endemism, and multiple glacial refuges for freshwater crabs of the genus Sinopotamon in China (Decapoda: Brachyura: Potamidae). *PLoS One*, *8*(1), e53143.
Farr, C. M., Bombaci, S. P., Gallo, T., Mangan, A. M., Riedl, H. L., Stinson, L. T., Bennett, D. E., Wilkins, K., Nogeire-McRae, T., & Pejchar, L. (2017). Addressing the gender gap in distinguished speakers at professional ecology conferences. *Bioscience*, *67*(5), 464–468.
Forbes, S. A. (1887). The Lake as a Microcosm. *Bulletin of the Peoria Scientific Association*, 77–87.
Ford, H. L., Brick, C., Blaufuss, K., & Dekens, P. S. (2018). Gender inequity in speaking opportunities at the American Geophysical Union fall meeting. *Nature Communications*, *9*(1), 3–8.
Forel, F.A., (1982). *Le Léman, monographie limnologique*. Librairie de l'Université.
Fox, C. W., Burns, C. S., Muncy, A. D., & Meyer, J. A. (2016). Gender differences in patterns of authorship do not affect peer review outcomes at an ecology journal. *Functional Ecology*, *30*(1), 126–139.
Francis, L., & Stulz, V. (2020). Barriers and facilitators for women academics seeking promotion: Perspectives from the inside (AUR 62 02). *Australian Universities' Review*, *62*, 47–60 https://issuu.com/nteu/docs/aur_62_02
Grimm, N. B., Arrowsmith, J. R., Eisinger, C., Heffernan, J., Lewis, D. B., MacLeod, A., Lewis, D. B., Prashad, L., Rychener, T., Roach, W. J., & Scheibley, R. W. (2004). Effects of urbanization on nutrient biogeochemistry of arid-land streams. In *Ecosystem interactions with land use change* (pp. 129–146). American Geophysical Union.
Haller, B. (2014). Theoretical and empirical perspectives in ecology and evolution: A survey. *Bioscience*, *64*, 907–916.
Hamada, N., McCreadie, J. W., & Adler, P. H. (2002). Species richness and spatial distribution of blackflies (Diptera: Simuliidae) in streams of Central Amazonia, Brazil. *Freshwater Biology*, *47*, 31–40.
Hanson, B., Wooden, P., & Lerback, J. (2020). Age, gender, and international author networks in the earth and space sciences: Implications for addressing implicit bias. Earth and space. *Science*, *7*(5), e2019EA000930.
Hauer, F., & Lamberti, G. (2011). *Methods in stream ecology*. Academic Press.
Hinsley, A., Sutherland, W. J., & Johnston, A. (2017). Men ask more questions than women at a scientific conference. *PLoS One*, *12*(10), e0185534.
Holman, L., Stuart-Fox, D., & Hauser, C. E. (2018). The gender gap in science: How long until women are equally represented? *PLoS Biology*, *16*(4), e2004956.
Huang, J., Gates, A. J., Sinatra, R., & Barabási, A. L. (2020). Historical comparison of gender inequality in scientific careers across countries and disciplines. *Proceedings of the National Academy of Sciences of the United States of America*, *117*, 4609–4616.
Jacobsen, D., & Encalada, A. (1998). The macroinvertebrate fauna of Ecuadorian highland streams in the wet and dry season. *Archiv für Hydrobiologie*, *142*, 53–70.
Jones, T. M., Fanson, K. V., Lanfear, R., Symonds, M. R., & Higgie, M. (2014). Gender differences in conference presentations: A consequence of self-selection? *PeerJ*, *2*, e627.
Kelly, C. D., & Jennions, M. D. (2006). The h index and career assessment by numbers. *Trends in Ecology & Evolution*, *21*(4), 167–170.
Koricheva, J., Gurevitch, J., & Mengersen, K. (Eds.). (2013). *Handbook of meta-analysis in ecology and evolution*. Princeton University Press.
Käfer, J., Betancourt, A., Villain, A. S., Fernandez, M., Vignal, C., Marais, G. A., & Tenaillon, M. I. (2018). Progress and prospects in gender visibility at SMBE annual meetings. *Genome Biology and Evolution*, *10*(3), 901–908.
Lake, M. (1999). *Getting equal: The history of Australian feminism*. Allen & Unwin.
Leimu, R., & Koricheva, J. (2005). What determines the citation frequency of ecological papers? *Trends in Ecology & Evolution*, *20*(1), 28–32.
Lester, R. E., & Rosten, C. M. (2020). Women in freshwater science: Challenges and solutions for achieving equity. *Marine and Freshwater Research*, *71*(2), i–v.
Lugo, A. E., Scatena, F. N., Waide, R. B., Greathouse, E. A., Pringle, C. M., Willig, M. R., Walker, L. R., Vogt, K. A., González, G., McDowell, W. H., & Thompson, J. (2012). Management implications and applications of long-term ecological research. In *A Caribbean Forest tapestry, the multidimensional nature of disturbance and response* (pp. 305–360). Oxford University Press.
Lupon, A., Rodríguez-Lozano, P., Bartrons, M., Anadon-Rosell, A., Batalla, M., Bernal, S., Bravo, A. G., Capdevila, P., Cañedo-Argüelles, M., Catalán, N., Genua-Olmedo, A., Gutiérrez-Cánovas, C., Feio, M. J., Lucati, F., Onandia, G., Poblador, S., Rotchés-Ribalta, R., Sala-

Bubaré, A., Sánchez-Montoya, M. M., ... Pastor, A. (2021). Towards women-inclusive ecology: Representation, behavior, and perception of women at an international conference. *PLoS One*, *16*(12):e0260163.

Lutz, B. D., Mulholland, P. J., & Bernhardt, E. S. (2012). Long-term data reveal patterns and controls on stream water chemistry in a forested stream: Walker branch, Tennessee. *Ecological Monographs*, *82*(3), 367–387.

Ma, Y., Oliveira, D. F., Woodruff, T. K., & Uzzi, B. (2019). Women who win prizes get less money and prestige. *Nature*, *565*, 287–288.

Maas, B., Pakeman, R. J., Godet, L., Smith, L., Devictor, V., & Primack, R. (2021). Women and global south strikingly underrepresented among top-publishing ecologists. *Conservation Letters*, *14*(4), e12797.

MacRoberts, M. H., & MacRoberts, B. R. (2018). The mismeasure of science: Citation analysis. *Journal of the Association for Information Science and Technology*, *69*(3), 474–482.

Makarova, E., Aeschlimann, B., & Herzog, W. (2016). Why is the pipeline leaking? Experiences of young women in STEM vocational education and training and their adjustment strategies. *Empirical Research in Vocational Education and Training*, *8*(1), 1–18.

McCullough, L. (2020). Proportions of women in STEM leadership in the academy in the USA. *Education Sciences*, *10*(1), 1.

Merrill, H. B. (1893). The structure and affinities of Bunops scutifrons. *Transactions of the Wisconsin Academy of Sciences, Arts, and Letters*, *9*, 319–342.

Miriti, M. N., Bowser, G., Cid, C. R., & Harris, N. C. (2021). Overcoming blind spots to promote environmental justice research. *Trends in Ecology & Evolution*, *1927*, 269–273.

Mohr, E. W. (1927). Bibliographie der Alters-und Wachstums Bestimmung bei Fischen. *ICES Journal of Marine Science*, *2*(2), 236–258.

Monti, R. C. (1929). *The comparative limnology of insubric lakes*. L'universale.

Moore, E. (1923). Octomitus salmonis, a new species of intestinal parasite in trout. *Transactions of the American Fisheries Society*, *52*, 74–97.

Moore, E. (1926). Some features of the stream survey undertaken in New York state. *Transactions of the American Fisheries Society*, *56*, 108–121.

Morgan, A. H. (1930). *Field book of ponds and streams: An introduction to the life of fresh water*. G. P. Putnam's Sons.

O'Dorchai, S., Meulders, D., Crippa, F., & Margherita, A. (2009). *She figures 2009–statistics and indicators on gender equality in science*. Publications Office of the European Union.

Obrador, B., & Bonada, N. (2014). Limnological research in the Iberian Peninsula: A ten-year survey of published literature. *Limnetica*, *33*, 175–188.

Palmer, M. A., Hondula, K. L., & Koch, B. J. (2014). Ecological restoration of streams and rivers: Shifting strategies and shifting goals. *Annual Review of Ecology, Evolution, and Systematics*, *45*, 247–269.

Patrick, R. (1948). Factors affecting the distribution of diatoms. *Botany Reviews*, *8*, 473–524.

Patrick, R. (1977). Ecology of freshwater diatoms. In D. Werner (Ed.), *The biology of diatoms* (pp. 284–332). University of California Press.

Poff, N. L., Richter, B. D., Arthington, A. H., Bunn, S. E., Naiman, R. J., Kendy, E., APSE, C., Acreman, M., Bledsoe, B. P., Freeman, M. C., Henriksen, J., Jacobson, R. B., Kennen, J. G., Merritt, D. M., O'Keeffe, J. H., Olden, J. D., Rogers, K., Tharme, R. E., & Warner, A. (2010). The ecological limits of hydrologic alteration (ELOHA): A new framework for developing regional environmental flow standards. *Freshwater Biology*, *55*(1), 147–170.

Pollard, A. I., Hampton, S. E., & Leech, D. M. (2018). The promise and potential of continental-scale limnology using the US Environmental Protection Agency's National Lakes Assessment. *Limnology and Oceanography Bulletin*, *27*(2), 36–41.

Porter, K. G., & Feig, Y. S. (1980). The use of DAPI for identifying and counting aquatic microflora. *Limnololgy & Oceanography*, *25*, 943–948.

Pringle, C. M., Naiman, R. J., Bretschko, G., Karr, J. R., Oswood, M. W., Webster, J. R., Winterbourn, M. J., & Welcomme, R. L. (1988). Patch dynamics in lotic systems: The stream as a mosaic. *Journal of the North American Benthological Society*, *7*(4), 503–524.

Pritchard, J., Masters, K., Allen, J., Contenta, F., Huckvale, L., Wilkins, S., & Zocchi, A. (2014). Asking gender questions: Results from a survey of gender and question asking among UK astronomers at NAM2014. *arXiv*.

Ricker, M. (2017). Letter to the editor: About the quality and impact of scientific articles. *Scientometrics*, *111*, 1851–1855.

Sebestyén, O. (1963). *Bevezetes a LimnolegiabL (an introduction to limnology)*. Academy Press.

Smith, J. L. B. (1968). *Ichthyological papers 1931–1943*. J.L.B. Smith Institute of Ichthyology, Rhodes University.

Symonds, M. R., Gemmell, N. J., Braisher, T. L., Gorringe, K. L., & Elgar, M. A. (2006). Gender differences in publication output: Towards an unbiased metric of research performance. *PLoS One*, *1*(1), e127.

Sánchez-Montoya, M. M., Pastor, A., Aristi, I., del Arco, A. I., Antón-Pardo, M., Bartrons, M., Ruíz, C., Feio, M. J., Gallardo, B., Chappuis, E., & Catalán, N. (2016). Women in limnology in the Iberian Peninsula: Biases, barriers and recommendations. *Limnetica*, *35*, 61–72.

Talling, J. F. (2008). The developmental history of inland-water science. *Freshwater Reviews*, *1*(2), 119–141.

Tank, J. L. (2017). Translational ecology in my own backyard: An opportunity for innovative graduate training. *Frontiers in Ecology and the Environment*, *15*, 599–600.

Tetzlaff, D., Boyer, E., Doody, T., Jefferson, A., & Molini, A. (2021). Women advancing research on hydrological processes: Preface. *Hydrological Processes*, *35*(7), e14267.

Varadharajan, C., Faybishenko, B., Henderson, A., Henderson, M., Hendrix, V. C., Hubbard, S. S., Newman, A., Kakalia, Z., Potter, B., Steltzer, H., Versteeg, R., Agarwal, D. A., Williams, K. H., Wilmer, C., Wu, Y., Brown, W., Burrus, M., Carroll, R. W. H.,

Christianson, D. S., … Enquist, B. J. (2019). Challenges in building an end-to-end system for acquisition, management, and integration of diverse data from sensor networks in watersheds: Lessons from a mountainous community observatory in East River, Colorado. *IEEE Access*, *7*, 182796–182813.

Vila-Concejo, A., Gallop, S. L., Hamylton, S. M., Esteves, L. S., Bryan, K. R., Delgado-Fernandez, I., Joshi, S., Guisado-Pintado, E., da Silva, G. M., Ruiz de Alegria-Arzaburu, A., Power, H. E., Senechal, N., & Splinter, K. (2018). Steps to improve gender diversity in coastal geoscience and engineering. *Palgrave Communications*, *4*(1), 1–9.

Waterton, C. F. J., Toogood, M. D., & Heim, M. W. (2019). Women in freshwater science: Invisible histories? *Marine and Freshwater Research*, *71*(2), 255–259.

Weathers, K. C., Hanson, P. C., Arzberger, P., Brentrup, J., Brookes, J., Carey, C. C., Gaiser, E., Gaiser, E., Hamilton, D. P., Hong, G. S., Ibelings, B., Istvánovics, V., Jennings, E., Kim, B., Kratz, T., Lin, F. P., Muraoka, K., O'Reilly, C., Rose, K. C., … Zhu, G. (2013). The global Lake ecological observatory network (GLEON): The evolution of grassroots network science. *Limnology and Oceanography Bulletin*, *22*(3), 71–73.

Yentsch, C. M., & Sindermann, C. J. (2013). *The woman scientist: Meeting the challenges for a successful career*. Plenum Publishing Corporation.

Zedler, J. B. (2000). Progress in wetland restoration ecology. *Trends in Ecology and Evolution*, *15*(10), 402–407.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Catalán, N., Anton-Pardo, M., Freixa, A., Rodríguez-Lozano, P., Bartrons, M., Bernal, S., Genua-Olmedo, A., Mendoza-Lera, C., Onandía, G., Benito, X., Sánchez-Montoya, M. M., Cañedo-Argüelles Iglesias, M., Pastor, A., & Lupon, A. (2022). Women in limnology: From a historical perspective to a present-day evaluation. *WIREs Water*, e1616. https://doi.org/10.1002/wat2.1616