

On increasing equity and inclusion of early-career professionals for conferences and conference networking in Canadian fisheries and aquatic science societies

Christina A.D. Semeniuk^a, Kathleen D.W. Church^b, Felix Eissenhauer^c, Jaime Grimm^d, Robert M. Hechler^d, Bradley E. Howell^e, Silviya V. Ivanova^f, Sandra Klemet-N'Guessan^e, Christine L. Madliger^g, Jessica Reid^h, Kendra A. Thompson-Kumarⁱ, Ivan Arismendi^j, Brooke E. Penaluna^k, Andrea E. Kirkwood^l, and Catherine M. Febria^a

^aDepartment of Integrative Biology and Great Lakes Institute for Environmental Research, University of Windsor, 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada; ^bInstitut des Sciences de la Forêt tempérée (ISFORT), 58 Rue Principale, Ripon, QC J0V 1V0, Canada; ^cDepartment of Biology, Canadian Rivers Institute, University of New Brunswick, Post office Box 4400, Fredericton, NB E3B 5A3, Canada; ^dDepartment of Ecology and Evolutionary Biology, University of Toronto, 25 Willcocks Street, Toronto, ON M5S 3B2, Canada; ^eEnvironmental and Life Sciences, Trent University, 1600 West Bank Drive, Peterborough, ON K9L 0G2, Canada; ^fSchool of Environment, University of Windsor, 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada; ^gDepartment of Biology, Algoma University, 1520 Queen St. E. Sault Ste. Marie, ON P6A 2G4, Canada; ^hDepartment of Biology, Carleton University, 1125 Colonel By Dr, Ottawa, ON K1S 5B6, Canada; ⁱGreat Lakes Institute for Environmental Research, University of Windsor, 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada; ^jDepartment of Fisheries, Wildlife, and Conservation Sciences, Oregon State University, Oregon State University, Nash Hall, 2820 SW Campus Way, Corvallis, OR 97331, USA; ^kPacific Northwest Research Station, USDA Forest Service, 3200 SW Jefferson Way, OR 97331 USA; ^lFaculty of Science, Ontario Tech University, 2000 Simcoe St. N., Oshawa, ON L1G 0C5, Canada

Corresponding author: Christina A.D. Semeniuk (email: semeniuk@uwindsor.ca)

Abstract

As early-career professionals (ECPs) navigate their education and professional development in the aquatic sciences, many seek to build a network to help guide their entrance into the field. As influential organizations, scientific societies play a vital role through hosted conferences, where ECPs can meet and share ideas with others, and find mentors to facilitate their colleagues' journey within the profession. However, not all ECPs are the same, and those from marginalized backgrounds face unique challenges. Here, we provide a perspective on ways scientific societies can ensure all members are provided with equitable opportunity to discover, access, and build career-defining networks at conference events, including the critical role of mentors in navigating obstacles to success. Our recommendations originate from an early-career networking workshop in 2022 at a Canadian fisheries and aquatic sciences conference. The day-long hybrid event comprised interactive activities and discussions on how societies and their conferences can foster and promote inclusive networking for all, including suggestions on maximizing inclusivity for online attendees. This perspective serves as a call to action for scientific societies and senior-career professionals to meaningfully engage with ECPs and marginalized members to promote transformative science.

Key words: networking, positionality, conferences, systemic barriers, mentorship, virtual hybrid events

Positionality statement

Collective positionality/values statement

We are a diverse group of scientists, including scholars, stewards, students, and communicators, who joined the aquatic and fisheries sciences field as recently as a few years to as long as a few decades ago. We primarily live and work with aquatic systems and species found across Turtle Island, in what is now known as Canada and the United States of America (Box 1). We engage in a range of molecular, microbial, species- and habitat-based science approaches, with both theoretical and applied interests. In addition, we represent Indigenous and non-Indigenous/Settler histories, as well

as a diversity of linguistic and racialized identities, able bodies, and gender expressions that are intersectional in nature. We recognize the historical and current discrimination faced by Indigenous and racialized people within aquatic and fishery sciences, as well as other marginalized groups including women and non-binary people, the LGBTQ2S+ community, those with disabilities, caregivers, and first-generation and low-income professionals. The motivation of this work is, in part, to identify career pathways, but also to honour the rights and responsibilities of the communities we represent, in addition to acknowledging those who have been marginalized and unsupported in aquatic and fishery science

Box 1. Positionality statement

Why a positionality statement is important

Research in aquatic and fisheries sciences is rarely free from the influence of human values. Our positionalities inform how we think, what we think about, which questions we ask, and which protocols we will follow to interact with people and non-human subjects. Positionality statements represent the product of intentional reflexivity throughout the research process (Martin et al. 2022) and serve many important purposes.

For the researcher, producing a positionality statement is a way of placing oneself in the context of one's relations—a common protocol among Indigenous Peoples of Turtle Island (i.e., North America). These introductions are a point of connection and obligation that is more commonly shared in research settings among non-white, non-settler folks (Liboiron 2021). When members of the dominant demographic groups fail to introduce themselves in this way, it recentres them as the “unremarkable norm” (Liboiron 2021), othering equity-deserving groups and reinforcing their historical exclusion from scientific research. For this reason, introductions are part of an ethical obligation within research settings (Liboiron 2021). Positionality statements provide an opportunity to reflect on and identify which identities and perspectives are represented in, or missing from, our work (Martin et al. 2022); and follow protocols of gratitude and recognition, both for our own positions and for those of our collaborators (Liboiron 2021). This reflexivity also provides a reminder to those in positions of power of their role in uplifting others.

For the audience, positionality statements show where the researcher's knowledge comes from and to whom they are accountable (Liboiron 2021), which minimizes biases and builds trust. Understanding these relations is an important component of understanding one another and in building strong networks. Sharing positionalities can also foster community by helping to appreciate diversity and by finding points of connection with others that may not be otherwise communicated. Finally, given the historical exclusion, erasure, and disrespect to non-dominant forms of knowledge, especially the history and rights of Indigenous Peoples, communities and knowledge systems, it is important for authors pursuing, publishing, and communicating their work to make visible their connections, relations, and permissions to share privileged information, relationships, and collective knowledges.

What to include in a positionality statement

Positionality statements should reflect the lenses (e.g., philosophical, theoretical, and personal) through which a researcher undertakes their work, as well as relevant facets of identity, and the overall context of the research (Savin-Baden and Major 2013; Holmes 2020). Strong positionality statements consider one's relationship to the work, potential biases, expectations/requests of the engaged community or knowledge keeper(s), acknowledgement of power relations, and how these interconnected components influence the quality and impact of the research or endeavor (Baker et al. 2019; Parson 2019; Martin et al. 2022). When relevant to the research or discussion at hand, positionality statements can include dimensions of identity such as ethnicity, age, religion, disability, ethnicity, socio-economic status, gender, sexual orientation, first language, nation of origin, and/or career experience (Secules et al. 2021). Approaching positionality as relational and reflexive will avoid a “shopping list” of such identity components, and will more specifically consider their impact (Folkes 2023; Secules et al. 2021). Positionality statements can also be collective, as demonstrated here, where it is equally important to avoid abstract delineations of a research team's identities and to think more broadly about the collective research process. In the context of inclusive networking, researchers formulating positionality statements can consider how to minimize bias, create spaces that are safe, center the experiences of participants', contribute to trust-building and provide points of reflection for how a team's diverse perspectives are represented (Martin et al. 2022).

When to offer positionality

It is valuable to consider positionality throughout the process of community and relationship-building, generation of research topics and questions, data collection, and the presentation of scientific findings (Folkes 2022). Articulating positionality is an iterative process that will result in fluid, context-specific statements (Holmes 2020; Secules et al. 2021; Folkes 2022). It may take time to find your positionality (Holmes 2020) and, in some cases, there are personal and professional risks that will dictate whether and which dimensions of one's identity can be safely shared in a positionality statement (Martin et al. 2022). An increasing number of journals now encourage or require positionality statements (Martin et al. 2022); we also suggest that statements of positionality should have a welcome place in networking events where science professionals come together to make connections and to foster new communities of practice.

societies due to systemic racism and discrimination that are at the root of the lack of diversity, equity, and inclusion. We have come to this work in collaboration, understanding and valuing relational networks as a key enabler to meaningful, and successful participation in aquatic and fisheries sciences. We share the understanding that investing in the next generation of science professionals is crucial for

addressing complex current and future societal challenges related to climate change, biodiversity loss, pollution, as well as our shared responsibilities to advancing reconciliation with Indigenous Peoples. We work mindfully to address the Truth and Reconciliation Commission of Canada's 94 Calls to Action (https://ehprnh2mwo3.exactdn.com/wp-content/uploads/2021/01/Calls_to_Action_English2.pdf)

and the ongoing lack of recognition of the United Nations Declaration on the Rights of Indigenous Peoples (<https://social.desa.un.org/issues/indigenous-peoples/united-nations-declaration-on-the-rights-of-indigenous-peoples>). We seek to advance individual and collective changes towards a more inclusive aquatic science community to ensure more impactful and beneficial outcomes for the broader society and for future generations.

1 Introduction: the role of networking in scientific societies

Scientific societies have an important role to play in the promotion of transformative science (Meyer-Gutbrod et al. 2023). At a societal scale, they also represent the varied concerns and issues expressed by and affecting our society (Potvin et al. 2018). The main venue for scientific society members to exchange ideas and discuss pertinent issues are conferences. Indeed, through conferences, there is an opportunity to unite diverse researchers and professionals within and across fields, and promote mentorship, networking, outreach, and engagement, especially for early-career professionals (ECPs) (i.e., undergraduate students, graduate students, postdoctoral fellows, research scientists, and community practitioners) (Harris et al. 2022, Ingram et al. 2021; Primus et al. 2022). Scientific conferences can also be critical agents in promoting cultural shifts in equity and inclusion, and can be a benefit to the advancement of ECPs (Sarabipour et al. 2020; Leibnitz et al. 2022).

ECPs attend conferences for varied reasons, from learning about and exchanging recent scientific developments to gaining advice on career development and networking (Segarra et al. 2020). Networking describes the interaction between individuals to acquire connections and exchange information (Seufert et al. 1999); and networking events at conferences can benefit ECPs by exposing them to novel topics in their fields, offering broader perspectives on their research questions, and introducing them to life-long mentors (Turgeon et al. 2018). Social networking at conferences can also allow ECPs to find mentors, other peers, build their community, and combat professional isolation (Marín-Spiotta et al. 2020). Networking is likely one of the most important aspects of career development for ECPs because it enhances hiring success via publishing opportunities (Abbasi et al. 2011) and personal contacts with employers (Hansen 2013; Chapman et al. 2015). Any refrain from networking can thus limit an ECP's career potential (Streeter 2014). By this measure, ECPs are encouraged to know how to effectively network using a variety of means; and actively build networks that not only facilitate knowledge sharing but also link diverse skill sets across different professional areas (Chapman et al. 2015).

Nevertheless, collaborative scientific networking is a deliberate process, and therefore can represent an important barrier in an individual's ability to join or form a wider network. For example, women and racialized minority-groups are not fully included in the US fisheries science academic network, nor in the most prominent positions, due to the residuals from systemic societal sexism and racism (Arismendi et al. 2021). ECPs in addition face economic strain, dissatisfac-

tion with career advancement, and mental health struggles (Osiecka et al. 2022). At a global scale, the fisheries science landscape is characterized by regionalization in knowledge production, suggesting that researchers are not broadly collaborating, and are thus limiting potential gains in terms of pushing the boundaries of fisheries science in new and innovative ways (Syed et al. 2019). Networking opportunities in conferences are no exception (Penaluna et al. 2017). Within these social events, approaching someone unknown is often facilitated by one's pre-existing networks, which allow natural connections to arise from shared contacts or research passions. Generally, the more diverse and comprehensive pre-existing networks are, the easier it is to find common ground with new people. For those who may be limited in their experiences, unfamiliar with networking events, or experience social anxiety, these opportunities can be extremely daunting. ECPs typically rely on mentors or colleagues to find new connections, but those from small networks or lacking guidance may be at a significant disadvantage. Placing a large share of responsibility on ECPs to therefore foster and create their own networks is not realistic, nor is it just.

2 Developing an inclusive networking framework in the aquatic and fisheries sciences: how it all began

Inspired by the article "Nine Proposed Action Areas to Enhance Diversity and Inclusion in the American Fisheries Society" (Penaluna et al. 2017), co-author CADS took the opportunity to present the state of: "Inclusion and Diversity in Canadian Fisheries and Aquatic Sciences: A time to reflect" at the 2019 Canadian Conference for Fisheries Research (CCFFR) on the traditional lands of the Anishinaabek, Haudenosaunee, Lūnaapéewak, and Attawandaron, now known as London, Ontario, and Canada. This presentation explored two main scientific societies in fisheries and aquatic sciences in Canada: the Canadian Aquatic Resources Section of the American Fisheries Society and CCFFR. Specifically, CADS presented the breakdown by (binary) gender of (i) board memberships since the onset of record keeping (since 1948), (ii) awardees (circa 2007, including present occupation), and (iii) authorship order in published papers from the Canadian Journal of Fisheries and Aquatic Sciences (CJFAS since 1980). CJFAS was chosen as the focal journal given its strong record as a major avenue of dissemination for Canadian scientists within aquatic sciences, and its ties to CCFFR via the Stevenson Lectureship, an award instituted in memory of Cam Stevenson, the long-time Editor of CJFAS and CCFFR member, which is awarded annually at the conference.

Given that scientific societies are meant to help unite diverse researchers both across fields and within, provide ECPs with mentorship and promote opportunities for networking, outreach, and engagement, the presentation also included a breakdown and comparison of the top 20 CJFAS author affiliations (i.e., government sector, university, and research institute) from 1980 to 2008 and from 2009 to 2018. This classification was meant to provide insight into any visible shifts in the Canadian fisheries and aquatic sciences

workforce, and identify the major contributing sectors to the discipline. Within the author-affiliation breakdown, CADS also identified affiliations with Indigenous groups (i.e., First Nations, Boards, Councils, Bands, and Communities), whether any papers were Indigenous-led, and collaborations between Indigenous individuals/groups and other resource users. The intent of this examination was to highlight whether, and how, Indigenous-focused issues were being represented in Canadian fisheries and aquatic sciences. The presentation ended with a similar call to [Penaluna and Colleagues \(2017\)](#) on how to encourage equity and inclusion in scientific societies in Canada.

The purpose of discussing the CADS presentation is not to go into the findings specifically, but to reveal how this presentation was the promulgator of (1) the subsequent formation of a Justice, Equity, Diversity, Inclusion, Accessibility, and Indigeneity Committee in CCFFR (which was retained in the 2023 merging of CCFFR and the Society of Canadian Limnologists (SCL) into the Society of Canadian Aquatic Sciences (EDI Co-Chairs: CADS, AK)); (2) the values of the Natural Science and Engineering Research Council of Canada (NSERC) Collaborative Research and Training Experience (CREATE) program, FishCAST (Fisheries Management and Conservation Careers in Science and Technology; Director: CADS, Associate Director: CF 2020–2026); and (3) the FishCAST workshop held at the 2022 CCFFR–SCL conference in the Traditional Territory of the Coast Salish Peoples, now known as Vancouver, British Columbia, which is the focus of this perspective. The workshop seemed the next logistical step in our journey to advance inclusive practices by working together to identify barriers to networking opportunities, sharing our experiences, and recognizing existing and potential interconnections amongst us all.

2.1 Workshop background

The networking workshop was organized and sponsored by FishCAST, which is at present the sole NSERC–CREATE graduate training program in freshwater fisheries management and conservation in Canada. The event entitled “Diversity in Networking: Creating Opportunities For All” was open to conference attendees, and in particular to ECPs to gain an understanding of the importance of inclusive networking practices, and to discuss actions that can lead to greater impacts for society as a whole. Workshop organizers included co-authors CADS, CF, AK, CLM, and KT-K. The ultimate goal of the workshop was to allow ECPs a safe inclusive space to build relationships and a sense of community that would hopefully persist past the workshop’s day.

The workshop was held as a day-long event (9:00–16:30), one day before the start of the conference itself. Recruitment for participants was carried out over social media and through the conference website. There was no fee to attend the workshop, but in-person attendees were required to be registered for the conference; virtual participants attended at no cost. There were no other competing workshops held that day. Over 70 participants registered for the hybrid event, both in person and online, with numbers restricted to the car-

rying capacity of the room. Workshop attendees engaged in a variety of network-building exercises, including relevant and meaningful discussion about dimensions of diversity and inclusion in Canada and responsibilities towards reconciliation with Indigenous Peoples. Participants explored barriers and facilitators to building professional networks, and reflected on their own lived experiences and training. Organizers and speakers facilitated the breakout sessions both virtually (i.e., co-authors CLM and BP) and in person. The workshop presentations were recorded and made accessible to participants who could not join in the morning (e.g., time-zone differences, FishCAST trainees who could not attend).

2.2 Workshop content

The workshop began with a dynamic hybrid plenary talk by co-authors BP and IA that brought to light robust quantitative research on the lack of diversity and inclusion in the American fisheries workforce with relevance to the Canadian and global landscapes. BP presented data ([Penaluna and Arismendi 2022](#)) on the inequity that women and racialized scientists face in securing higher-level positions in academia and government, and the negative impacts of non-inclusive research networks, while IA highlighted the benefits of building a diverse network to increase impactful collaborations in the fields of fisheries and aquatic science, with suggestions of how they might be better fostered ([Arismendi et al. 2021](#)).

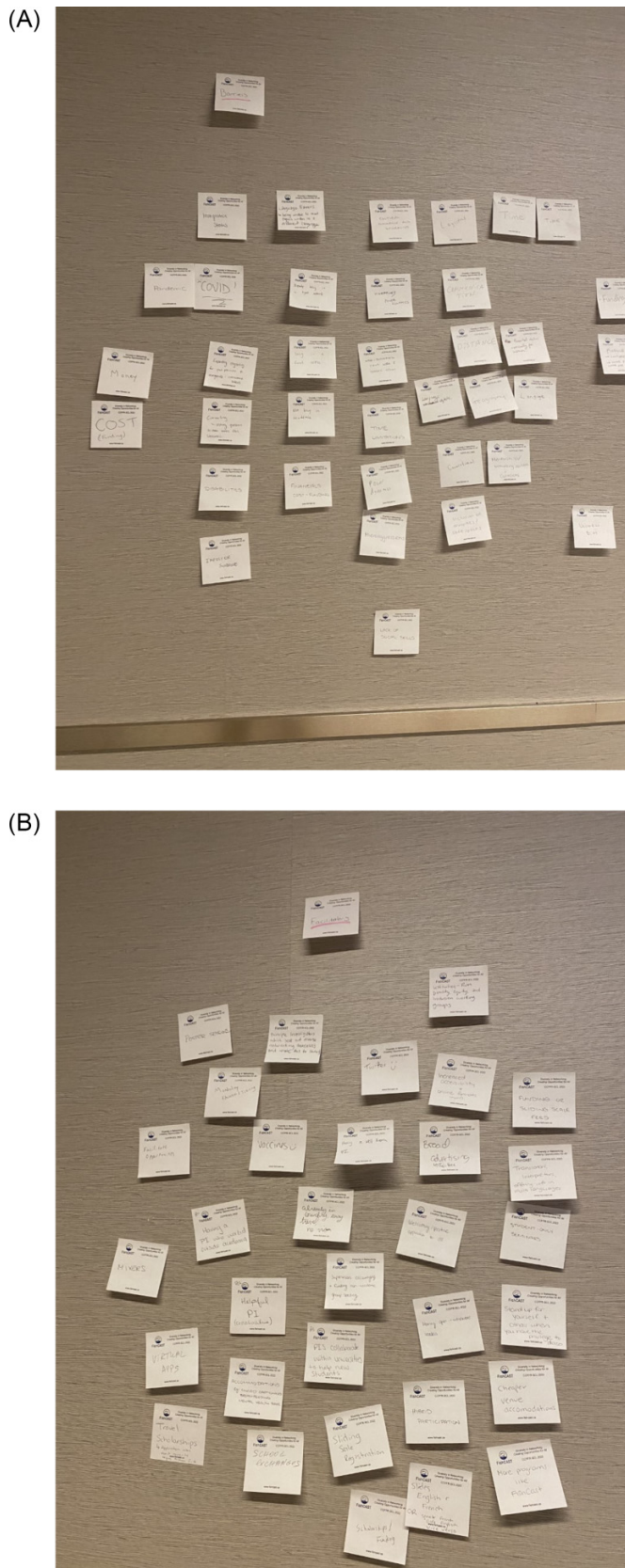
Workshop organizers then held an anonymous “privilege walk”—like activity to raise both self- and general awareness of the various forms of privilege and power amongst the room’s participants. The general idea of the privilege walk was maintained; however, participants stayed seated and were asked to tabulate their own scores. They were instructed to award themselves one point for a privilege that they had and subtract a point for a privilege they did not have. At the end participants were asked to submit their scores anonymously to an interactive presentation software. This allowed participants to gauge their own privilege while not needing to disclose any personal information or experiences. As [Siliman and Kearns \(2020\)](#) suggest, individuals from marginalized groups feel most of the burden in these situations and they feel compelled to constantly explain their situation. Additionally, participants were able to gauge the privilege in the room, and to know where their score fell in relation to the others.

The exercise was intended to enhance how participants related to one another and to foster a team-building environment for inclusive networking ([Milstein and Griego 2017](#)). Organizers then worked with participants to identify topics for multiple small group discussions for both online and in person participants using multiple interactive tools. We had three different topics for our small groups which built on each other. First, we did introductions, shared origin stories (including identifying the Indigenous Territories we both lived and worked in [Figs. 1A and 1B](#)), and identified common threads. Next, we had a discussion of what makes a good network and identified barriers and facilitators in those networks ([Figs. 2A and 2B](#); Table S1). Lastly, we each designed our

Can. J. Fish. Aquat. Sci. Downloaded from cdsciencepub.com by UNIV WINDSOR on 06/29/26
For personal use only.



Fig. 2. Sticky-notes of the (A) barriers and (B) facilitators participants felt were most likely to prevent or encourage networking opportunities at conferences, respectively.



own personal research network and shared them in our small groups to identify whether and how they can overlap. In the next section, we highlight the emergent themes of our workshop regarding inclusive networking. The workshop ended with participants volunteering key terms they felt were most frequently raised and discussed during the workshop (Fig. 3); and what they found most meaningful about the workshop at day's end (Fig. 4).

3 Workshop findings: barriers and facilitators to inclusive networking

In this section, we describe barriers to attendance at academic conferences that would then impede inclusive networking as identified by our workshop participants (Table 1) in chronological order (i.e., barriers to attendance, and barriers while attending). We then highlight potential ways to overcome these barriers and to make Canadian aquatic sciences conferences welcoming, inclusive and accessible to all.

3.1 Barriers to attendance

Tulloch (2020) identifies three major barriers to attendance of a conference that were all represented in the sticky notes of our workshop attendees. The first barrier is event affordability, as the costs for travel, accommodation, and registration can create obstacles, especially for ECPs or marginalized peoples (Niner et al. 2020; Tulloch 2020), while funding opportunities are often limited for participants outside of academia and those based in low-income nations (Fullick 2016; Waruru 2018). The second barrier to conference attendance is accessibility, with the conference location being one of the most important factors (Tulloch 2020). Poor choice of conference location can intensify barriers of affordability, may create new barriers like visa applications (Waruru 2018; Abernethy et al. 2020; Ebrahimi 2022), or could even completely exclude participants (e.g., when held in locations discriminating against racially or sexually marginalized people). Tulloch (2020) found that roughly half of conservation and ecology conferences since 2009 were held in locations that discriminate against certain identities. The third barrier is a lack of amenities such as childcare support, language translation, and closed captioning, which can both exclude people from attending a conference and can also act as barriers while attending.

3.1.1 Barriers while attending

Our workshop participants also identified barriers that occur during conferences that can prevent the inclusion of all participants. Challenges associated with attendee health and safety were listed multiple times, and the risk of a COVID-19 infection was the most prominent. This amplifies barriers already faced by people who have or who care for others with underlying medical conditions, as the severity of COVID-19 infection could increase (Gallo Marin et al. 2021). Workshop attendees also noted that their networking opportunities were hindered by factors associated with mental health such as imposter syndrome (i.e., feelings of self-doubt and

Fig. 3. Word cloud of responses of participants when asked to identify key terms that were most frequently raised and discussed during the workshop.



Fig. 4. Word cloud of responses of participants when asked to describe what they found most meaningful about the workshop at day's end.



inadequacy), which is common among ECPs in the aquatic sciences (Gushulak et al. 2023) and can cause stress, anxiety, and depression (Sonnak and Towell 2001). Imposter syndrome can impact attendee networking by causing them to

downplay their research during interactions with others or can induce stress and anxiety that entirely prevents interactions, thereby also sabotaging future opportunities (Mullangi and Jagsi 2019; Chrousos and Mentis 2020).

Table 1. Barriers and facilitators that emerged in the workshop discussion aimed at promoting inclusive networking in Canadian academic conferences.

Barrier	Facilitator	Timeline (prior or during conference attendance)
Affordability/financial limitations (lack of funding, high conference costs, lack of funding)	Less costly venues for accommodation scholarship/supervisor-funding Tiered or sliding scale registrations Online formats*	Prior
Immigration status	Support for visa applications Early abstract selection results	Prior
Time limitations	Online formats* Poster sessions	Prior
Logistics and safety limitations (time availability, long distances to conference venue, poor transport connections)	Online formats* Altering conference venue locations	Prior and during
Health limitations (disabilities, mental health, at-risk conditions, and COVID-19)	Increased accessibility environment within the venue Quiet zones Closed captioning and sign language translation (in French and English) Online formats* Society-run EDI working groups and EDI-themed conference sessions	Prior and during
Service burden (parental duties and emotional labor)	Lactation areas Support for childcare or onsite childcare/family-friendly room Online formats* Society-run EDI working groups and EDI-themed conference sessions	Prior and during
Language	Providing information in multiple languages (e.g., slides in French, presentation in English) Closed captioning and language support, translators Special sessions/mixers (in other languages or non-academic language)	During
Marginalization of specific individuals/groups (cultural dominance, lack of diversity, and marginalization of specific individuals/groups, microaggressions)	Broad conference advertising Specifically inviting speakers from underrepresented groups Special sessions/mixers (equity-deserving groups only) Society-run EDI working groups and EDI-themed conference sessions Being an ally	Prior and during
Existing tight networks (“old boys club,” lack of social skills, power dynamics, imposter syndrome)	Mentorship program between ECPs and more senior participants Special networking sessions between ECPs and more senior participants Thesis advisor as a champion More programs like FishCAST Longer breaks in between sessions	During
Online formats* (impersonal, unequal experiences for hybrid formats)	Well thought-out sessions to increase online engagement Facilitate interactions between in-person and online attendees	During

*Facilitator that can create new barriers (see section, *Ensuring Inclusivity in the Virtual Space*).

People from marginalized communities face additional barriers that are absent for those from the dominant groups either based on ethnicity, sexual orientation, gender identity, language, health status, and/or nationality. Here, we highlight only a few of these barriers identified by our workshop participants, with the goal of increasing awareness for people from more privileged backgrounds and ideally leading to more support, empathy, and allyship for people from marginalized communities. For members of equity-deserving groups in the Canadian aquatic sciences, feelings of otherness due to cultural dominance and a lack of representation

can create challenges that limit participation in conferences. Subtle verbal and non-verbal communications of negativity and hostility known as microaggressions can also further amplify feelings of otherness and of not belonging (Miles et al. 2020; McMillon-Brown 2021). Our workshop participants also identified a lack of safe spaces as well as power dynamics as barriers to networking. These barriers are associated with sexual harassment and assault which are unfortunately common occurrences at conferences and are most often experienced by (assumed cis-gender) women from the direction of (assumed cis-gender) men (Flores 2020; Faulkner and Adams

2021). While not directly discussed, it should also be noted that additional issues that may impede conference networking abilities include cultural differences regarding norms for assertive behaviour (e.g., [Lu et al. 2020](#)) and a lack of knowledge or understanding of the unspoken rules of academia (i.e., “The Hidden Curriculum of Academia”; [Estien et al. 2023](#)), especially for first-generation ECPs ([Gardner and Holley 2011](#)).

3.2 Facilitators

Understanding how social identities, backgrounds, experiences, and perspectives may impact participation and engagement in events can help to overcome barriers. As a first step, an acknowledgement and address of power dynamics, including positionality and privilege, is needed ([Holmes 2020](#)). For example, featured, keynote or plenary talks at conferences are of significant importance for any event, but also for career development because they enhance the international scientific profile of a researcher. Thus, an effort to include individuals from underrepresented groups into these roles would boost careers, as well as showcase the organizers’ commitment to diversity and inclusivity, which would help foster open-mindedness among all attendees and an overall sense of inclusivity ([Segarra et al. 2020](#)).

During our workshop, attendees further identified the following factors that would facilitate conference attendance and promote inclusive networking: avoiding discrimination and raise awareness; lowering conference costs; having workshops focused on ECPs such as the FishCAST workshop; and increasing accessibility both in-person and with online formats. To avoid discrimination and promote an inclusive environment, many options were offered. First was the creation and implementation of a code of conduct that outlines expected behaviour, explicitly prohibits harassment and discrimination, lists consequences for violations, and encourages inclusivity through open mindedness ([Foxy et al. 2019](#); [Stefanoudis et al. 2021](#)). Having a harassment reporting structure handled by a neutral and external third party would also address power imbalances and lack of anonymity that might arise by disclosing information about fellow peers. Next, the use of inclusive language, and the avoidance of any assumptions regarding people’s gender, ethnicity, sexuality, ability, or any other aspects of their identity should be encouraged in all written and oral communications. Space should be provided for all participants to indicate their preferred name, all participants should be encouraged to share their personal pronouns and social identities, and conferences should provide a diversity and inclusion and bystander training sessions for all staff and volunteers to increase awareness and sensitivity to issues of bias and discrimination. For further recommendations on creating inclusive scientific meetings beyond the discussions held in our workshop, we refer readers to: <https://500womenscientists.org/inclusive-scientific-meetings>.

In an attempt to lower conference costs, a recurring suggestion was shifting away from scheduling conferences on weekends or around religious and cultural holidays, as that may not only help reduce hotel costs ([Estien et al. 2021](#)), but

also respect the diverse backgrounds of all participants. Further ideas of cost-cutting measures included scholarship and sliding-scale or tiered registrations based on the individual’s career stage, self-identity in equity-deserving groups, and income of country of residence ([Niner and Wasserman 2021](#)). Tiered and sliding-scale registration also benefit ECPs by lowering registration costs while still allowing the hosting organization to recoup part of the conference expenses from other sources/sponsors. We acknowledge the extra cost for organizers this may entail, and hope this paper and others will encourage organizers to find ways to fundraise using means other than creeping registration fees.

The creation of networking opportunities that are specifically designed to connect people that have diverse backgrounds, perspectives, and positionalities were all highly favoured by attendees (although see [Musgrove et al. 2024](#)). Furthermore, facilitating small group discussions within these workshops can promote deeper engagement among participants. To enhance participation, a structure-to-conversation approach (i.e., start with structured question/answer, then progress to a conversational discussion for each topic/question) can lower initial nervousness, reduce forced conversations, and encourage spontaneity, while additional time and on-demand “discussion bubbles” can facilitate discussion of questions of particular interest ([Bottanelli et al. 2020](#)). Lastly, by facilitating a workshop prior to the conference such as the FishCAST workshop, those with no prior connections can benefit from the added opportunity to meet some friendly faces to help them settle in for the following days of non-stop lectures and meetings.

Suggestions for increased accessibility were highly varied and comprehensive. Attendees felt caregiver support needed to be viewed as a vital component of conferences, especially those that occur over several days. [Bos et al. \(2019\)](#) recommends consulting with potential caregiving registrants during the planning phase of the conference; while [Saccarelli et al. \(2021\)](#) suggests having a designated person as a point of contact exclusively for parents with questions and concerns if on-site childcare is offered. Workshop attendees fully recognized caregiving duties as a barrier to conference attendance, and suggested on-line and hybrid formats as a potential solution for those with caregiving responsibilities as well as those who also did not have the financial means to attend ([Niner and Wasserman 2021](#)). Indeed, virtual and hybrid events can also remove barriers related to financial cost, travel time and/or logistics compared to in-person conferences for underrepresented groups (see section below; [Sarabipour 2020](#); [Estien et al. 2021](#)). Although a fee for virtual or hybrid registration would be necessary to cover the cost of audio-visual assistance and internet service, conference organizers could show that they value those attending from afar by keeping the fee modest. For more information on best practices for normalizing children and families at scientific conferences beyond our workshop’s discussions, please see: https://medium.com/@socialmedia_8796/normalizing-children-and-families-at-scientific-conferences-2d1772f567b3; [Calisi and A Working Group of Mothers in Science, 2018](#).

English is a common language among researchers; however, in an increasingly digital and connected world being

able to communicate among collaborators in several different languages across continents is essential to growing research circles (Amano et al. 2016). Participants suggested having slides in English as well as French to incorporate both official Canadian languages. Additionally, conferences can include written resources in multiple languages and provide language support when possible (Khelifa et al. 2022). To ensure participants with disabilities can fully engage in all aspects of the event, closed captioning, sign language interpretation, and other accommodations should be supported (Bottanelli et al. 2020; Huyck et al. 2021), while subtitles should be available in multiple languages to prevent the exclusion of participants that do not speak the dominant language (Parncutt et al. 2021). To facilitate widespread participation, all presenters can receive information about how to make their presentations more accessible (using automated closed-captioning, minimum font size, avoiding colors that are problematic for people who are color-blind) when their talks are accepted. The exchange of research knowledge and best practices is an essential part of conferences, and additional resources can ensure the full participation of all attendees.

Increasing accessibility for those who have physical limitations, mental health barriers, and compromised immune systems through offering virtual or hybrid conferences has become an increasingly common occurrence. Indeed, there are challenges to ensuring virtual inclusivity; however, the following section is dedicated to steps that can help create cohesion between in-person and online participants.

3.3 Ensuring inclusivity in the virtual space

Virtual and hybrid approaches can contribute to increasing the diversity, equity, and inclusion of participants at scientific conferences by diminishing barriers associated with economic costs, career stage, geographic location, and gender, sometimes by orders of magnitude (Skiles et al. 2022; Wu et al. 2022). While many conference participants feel that the knowledge-sharing components of conferences can be very successfully accomplished with online platforms, networking, and spontaneous social interaction are more difficult to recreate virtually (Skiles et al. 2022). For example, over 75% of participants that completed a post-conference survey following the 2020 meeting of the International Society for Applied Ethology indicated that the absence of social interaction was the most significant disadvantage they experienced (Chou and Camerlink 2021). Indeed, one of the largest challenges for promoting inclusive networking in virtual and hybrid settings is facilitating both formal and informal spaces for conversation. Attendees can experience screen fatigue that minimizes their enthusiasm for participation (Foramitti et al. 2021), making the purpose, accessibility, and usability of these spaces an important consideration. Yet, virtual/hybrid options such as question forums can make it easier for participants, particularly ECPs, to initiate conversations with keynote speakers and researchers they consider to be influential in their fields (Foramitti et al. 2021). Here, we provide a discussion and practical list (Table 2) of suggestions for ensuring virtual inclusivity at scientific conferences, espe-

cially hybrid meetings, with particular emphasis on creating networking opportunities.

Virtual and hybrid events are inherently inclusive, as online spaces can remove class barriers by removing travel and accommodation costs, and time costs for many researchers with care-giving responsibilities such as those with young children, aging or sick parents, and high-maintenance pets (Levitis et al. 2021; Parncutt et al. 2021; Skiles et al. 2022; Stefanoudis et al. 2021). Finally, although the worst of the COVID-19 pandemic is hopefully past, many immunocompromised people, or those with pre-existing medical or health conditions, are still at risk from possible exposure to respiratory viruses from crowded in-person events, including the travel that is required to attend such events. People that struggle with their mental health may also find conference attendance too stressful or exhausting (i.e., Estien et al. 2021).

Although online and hybrid spaces can be inherently more inclusive for networking events relative to in-person only events that require travel, there is still room for improvement. Certainly, networking and inclusivity require a particular consideration during virtual and hybrid events. To ensure inclusivity in these contexts, intentional effort is needed to prioritize equity and social justice in event design; it is also key to recognize and acknowledge the different personalities of the attendees as well as the enablers of the event (Sarabipour 2020). An often overlooked, but vital, aspect to hosting a successfully integrated workshop for both virtual and in person attendees is to have dedicated team members for each modality, which ensures that each team member can be fully committed to their role, as well as effective training (e.g., facilitation skills, bystander intervention training) to ensure a positive event. Positions for a successful hybrid or online event include the presenter, host (could be combined with presenter), a dedicated chat room moderator, a note taker (can also take attendance), and co-hosts for each breakout room. Prior to the FishCAST conference, our core administrative team ensured that there were hosts in both the virtual and in-person spaces. Each space and host should feel comfortable in their role, and each role should be given equal importance during preparation and throughout the duration of the workshop. Virtual hosts should be able to fulfill their hosting duties without interruption, to build rapport with the virtual participants. As well, hosts should bring their own headsets, while your group could also supply extras if necessary, as headsets can help drown out any background noise and create a more inclusive feeling in the virtual space. Breakout rooms were also enabled during the FishCAST conference to facilitate more intimate interactions among the online participants. As one participant recalled, “I really enjoyed working in breakout groups. Having a facilitator [enabler] made a huge difference and was fantastic.” This sentiment was shared by another participant that shared “assigning a lead was very helpful”. The presence of both the dedicated virtual host and the breakout room hosts share the message that the virtual attendees are taken seriously, and that their presence is appreciated and validated. Levitis et al. (2021) suggest that virtual hosts can post questions anonymously for those that are uncomfortable asking on their own,

Table 2. List of potential techniques that can be used to help ensure inclusive networking opportunities in virtual spaces.

Technique	Description/example	Reference
Virtual reality tools that create new conference environments.	The app Gather.town allows conference participants to enter and navigate a virtual room as an avatar, and to initiate video or audio chats with other avatars in close proximity.	Parncutt et al. 2021; Skiles et al. 2022
Machine learning to facilitate interactions and discussions between participants with shared research interests.	Algorithms and apps that use machine learning can be used to match participants with shared research interests in virtual discussion rooms.	Sarabipour 2020
Creation of conversation forums associated with specific topics or events that can be accessed following the conference.	Conversation forums allow conversations to be continued without initiating new conversations, which can be intimidating for some participants. Given that poster sessions are often highly social events that foster conversations among participants, these types of longer-term forums can also be attached to virtual poster halls on the conference website to support connections.	Bottanelli et al. 2020; Foramitti et al. 2021; Parncutt et al. 2021
Introduction channel/forum	Participants can introduce themselves as an opportunity to build community and find potential collaborators.	Bottanelli et al. 2020; Foramitti et al. 2021
“Virtual hallways” that are moderated by volunteers.	Virtual hallways allow attendees to interact with one another outside of scheduled sessions, to simulate an in-person conference experience.	Song et al. 2021
Daily “check-ins” facilitated by conference planners/volunteers.	Check-ins can be used to create safe spaces for students to connect, especially if they are facilitated by participants that belong to society or conference specific diversity groups.	Estien et al. 2021
Use interactive tools to promote meaningful dialogue.	Leverage chat features, polls, and whiteboards.	Schmidt-Crawford et al. 2021
Leverage Twitter to share conference presentations, tag collaborators/funding sources, using field-specific hashtags.	Participants can network both within and beyond the conference participant pool by using threads linked to their presentations.	Estien et al. 2021
Socializing events with opportunities for online participants to be randomly assigned to breakout rooms.	Examples for well-organized events include: (i) early-career/student socials; (ii) conference closing socials; (iii) icebreaker events; (iv) focus groups where participants can spontaneously join to discuss specific topics; (v) supervisory or mentorship match-ups that connect senior and junior participants; and (vi) free sessions that allow participants to create their own breakout rooms/meetings of any size.	Estien et al. 2021; Parncutt et al. 2021; Stefanoudis et al. 2021

Note: Many of these techniques ensure there is a virtual space, so that virtual conference attendees do not miss out on the networking opportunities that are available for in-person attendees.

while the live chat function can build community connections through audience inquiries and discussion. A safe and respectful environment where all attendees feel comfortable expressing their ideas and opinions encourages discussions among diverse perspectives and contributes to the overall inclusivity of the event (Wilson et al. 2004; Table 1). To further address positionality and privilege, networking opportunities should be structured in ways that ensure equal access in opportunities for all attendees regardless of their positionality (Emery et al. 2021), such

as structured mixers with clear code-of-conduct guidelines that pair researchers from opposing positionalities (although see Musgrove et al. 2024). Such events have the potential to help establish mentorship or collaboration relationships (Sarabipour 2020). Also, pairing virtual participants with in-person attendees for hybrid events could also aid and facilitate representation and/or engagement for virtual participants. As many barriers can be quickly and easily removed by including online and hybrid networking events at conferences, further development of these online spaces at confer-

ences (Table 2) can facilitate the achievement of diversity, equity, and inclusion for all in academia.

4 A final note: scientific societies and mentorship

Scientific societies that are well networked in a multi-tiered and -dimensional fashion have the potential to serve as agents of change that effectively address diversity and inclusion issues (Penaluna et al. 2017; Potvin et al. 2018). For instance, conference networking can help ECPs to establish an identity within a field, especially for scientists from equity-deserving groups, who often feel marginalized and isolated (Marín-Spiotta et al. 2020). Despite this promise, scientific collaboration networks that coalesce at conferences remain exclusionary, even with recent efforts in improving participant diversity, as these networks are still mostly established white men from privileged universities (Davies et al. 2021). Society conferences can also establish networks amongst a multitude of resource sectors, providing ECPs with cross-sector and cross-discipline opportunities, including with managers, researchers, and policy makers. These afforded opportunities are relevant for careers in fisheries and aquatic sciences beyond academia and play a large role in both moving science into the public realm and in informing critical policy and decision-making (Davies et al. 2021). Nonetheless, the major affiliations of conference attendees at Canadian conferences in fisheries and aquatic sciences are currently government (federal and provincial) and universities (CADS, unpub. data). Moreover, when asked for reasons for not attending these Canadian-based aquatic-science conferences, non-academic partners (excluding government) in the co-authors' own networks have expressed sentiments of "not belonging" (CADS (personal communication)). As such, increasing non-academic partner participation in networking events at conferences is also critical to diversify and innovate the field.

As the knowledge that emerged from our own workshop demonstrates, scientific conferences can overcome these barriers by intentionally holding networking events or workshops. These can include pre-planned or spontaneous events, such as receptions, luncheons (or health breaks), and intentional multi-mentoring networking sessions with peers and "near-peers" structured around shared career or scientific interests (Montgomery and Page 2018; Ahern-Dodson et al. 2020; Segarra et al. 2020). Unfortunately, in the co-authors' own experiences, without intentional implementation of mentoring schemes by conference organizers, self-organized sessions by participants can be entirely made up of ECPs, defeating the purpose of being able to obtain career advice and scientific development support. A promising solution is that of establishing a mentorship network within the society that is then carried over into conference meetings. Mentorship is a bidirectional relationship that can come in a variety of forms, including peer, supervisor, career development mentor, and/or personal mentor (Davies et al. 2021). Mentors can enrich networking experiences by providing training or preparation opportunities prior to an event. An example of good mentoring practice occurs at American Geophysical Union conferences and Ocean Sciences meetings

that employ Mentoring365 Live, where undergraduate students, graduate students, and ECPs are paired with more experienced attendees during the meetings and provided guidance (e.g., resumé or C.V. feedback) and relationship-building tools to make these conference events as meaningful as possible. Indeed, many opportunities can come about from this mentoring, such as research positions, funding, awards, collaborations, friendships, and field experiences.

Importantly, mentorship can also be an equalizing force as it can alleviate barriers of entry for underrepresented groups by providing access to networks, and by creating a community of cultural identity. Networking and mentoring events for affinity groups at conferences are an integral aspect, connecting people with similar identities, and greatly increasing sense of belonging and retention (Musgrove et al. 2024). For example, the American Meteorological Society hosts the Color of Weather reception to enhance diversity; the Association for the Science of Limnology and Oceanography has developed a Multicultural Program that features the meeting-mentor program at their conferences; similar to the Ecological Society of America SEEDS Program (Strategies for Ecology Education, Diversity, and Sustainability). Each of these venues serves to promote equity and inclusion for students and professionals from marginalized backgrounds. In fact, overlapping social and professional networks contribute to a stronger sense of group identification and sense of belonging (Ahern-Dodson et al. 2020). This synergy, in turn, leads to greater capacity for innovation, transformation to a fair and inclusive culture (Davies et al. 2021), and attraction and retention of a diverse, high-performing, committed, and job-satisfied workforce (Penaluna et al. 2020). These same benefits for ECPs can be realized through established mentorship programs in scientific societies and their associated conferences as well. Given the current state of fisheries and aquatic sciences in Canada and the lack of formalized widespread mentoring of ECPs within these disciplines (Turgeon et al. 2018), we call on Canadian science societies to pursue this collaboration-network-mentorship approach.

Acknowledgements

We wish to thank all the participants, both in person and virtual, of our workshop. A. Engler provided valuable insights into the development of early versions of this manuscript. The workshop would not have been possible without the support of the scientific-program organizing committee, and the former CCFR–SCL societies.

Article information

History dates

Received: 1 February 2024

Accepted: 20 June 2024

Accepted manuscript online: 18 July 2024

Version of record online: 28 October 2024

Copyright

© 2024 Copyright remains with the author(s) or their institution(s). Permission for reuse (free in most cases) can be obtained from copyright.com.

Data availability

Data generated or analyzed during this study are provided in full within the published article.

Author information

Author ORCIDs

Christina A.D. Semeniuk <https://orcid.org/0000-0001-5115-9853>

Kathleen D.W. Church <https://orcid.org/0000-0002-7096-6869>

Jaime Grimm <https://orcid.org/0000-0002-2462-1464>

Robert M. Hechler <https://orcid.org/0000-0002-9961-7179>

Bradley E. Howell <https://orcid.org/0000-0001-8552-6957>

Silviya V. Ivanova <https://orcid.org/0000-0003-2886-8533>

Christine L. Madliger <https://orcid.org/0000-0002-8554-0764>

Ivan Arismendi <https://orcid.org/0000-0002-8774-9350>

Brooke E. Penaluna <https://orcid.org/0000-0001-7215-770X>

Andrea E. Kirkwood <https://orcid.org/0000-0003-2947-574X>

Catherine M. Febria <https://orcid.org/0000-0002-3570-3588>

Author contributions

Conceptualization: CADS, KDWC, FE, JG, RMH, BEH, SVI, SK, CLM, JR, KAT, IA, BEP, AEK, CMF

Funding acquisition: CADS

Project administration: CADS, KAT

Writing – original draft: CADS, KDWC, FE, JG, RMH, BEH, SVI, SK, CLM, JR, KAT, IA, BEP, AEK, CMF

Writing – review & editing: CADS, KDWC, FE, JG, RMH, BEH, SVI, SK, CLM, JR, KAT, IA, BEP, AEK, CMF

Competing interests

The authors declare there are no competing interests.

Funding information

We are grateful for the funding provided by the Natural Science and Engineering Research Council of Canada (NSERC) through their CREATE program, and the University of Windsor for sponsoring the event.

Supplementary material

Supplementary data are available with the article at <https://doi.org/10.1139/cjfas-2024-0033>.

References

- Abbasi, A., Altmann, J., and Hossain, L. 2011. Identifying the effects of co-authorship networks on the performance of scholars: a correlation and regression analysis of performance measures and social network analysis measures. *J. Inf.* 5(4): 594–607. doi:10.1016/j.joi.2011.05.007.
- Abernethy, E.F., Arismendi, I., Boegehold, A.G., Colón-Gaud, C., Cover, M.R., Larson, E.L., et al. 2020. Diverse, equitable, and inclusive scientific societies: progress and opportunities in the Society for Freshwater Science. *Freshwater Sci.* 39(3): 363–376. doi:10.1086/709129.
- Ahern-Dodson, J., Clark, C.R., Mourad, T., and Reynolds, J.A. 2020. Beyond the numbers: understanding how a diversity mentoring program welcomes students into a scientific community. *Ecosphere*, 11(2): e03025. doi:10.1002/ecs2.3025.
- Amano, T., González-Varo, J.P., and Sutherland, W.J. 2016. Languages are still a major barrier to global science. *PLoS Biol.* 14(12): e2000933–e2000933. doi:10.1371/journal.pbio.2000933. PMID: 28033326.

- Arismendi, I., McLaughlin, K.R., and Penaluna, B.E. 2021. The U.S. academic fisheries co-authorship network under the lens of diversity and inclusion. *Fisheries*, 46(8): 372–382. doi:10.1002/fsh.10618.
- Baker, K., Eichhorn, M.P., and Griffiths, M. 2019. Decolonizing field ecology. *Biotropica*, 51(3): 288–292. doi:10.1111/btp.12663.
- Bos, A.L., Sweet-Cushman, J., and Schneider, M.C. 2019. Family-friendly academic conferences: a missing link to fix the “leaky pipeline”? *Polit. Groups Identities*, 7(3): 748–758. doi:10.1080/21565503.2017.1403936.
- Bottanelli, F., Cadot, B., Campelo, F., Curran, S., Davidson, P.M., Dey, G., et al. 2020. Science during lockdown from virtual seminars to sustainable online communities. *J. Cell Sci.* 133(15): jcs249607. doi:10.1242/jcs.249607.
- Calisi, R.M., a Working Group of Mothers in Science. 2018. Opinion: how to tackle the childcare-conference conundrum. *Proc. Natl. Acad. Sci.* 115(12): 2845–2849. doi:10.1073/pnas.1803153115.
- Chapman, J.M., Algera, D., Dick, M., Hawkins, E.E., Lawrence, M.J., Lennox, R.J., et al. 2015. Being relevant: practical guidance for early career researchers interested in solving conservation problems. *Global Ecol. Conserv.* 4: 334–348. doi:10.1016/j.gecco.2015.07.013.
- Chou, J.Y., and Camerlink, I. 2021. Online conferences as an opportunity to enhance inclusiveness in animal behaviour and welfare research: a case study of the ISAE 2020 virtual meeting. *Appl. Anim. Behav. Sci.* 241: 105369. doi:10.1016/j.applanim.2021.105369.
- Chrousos, G.P., and Mentis, A.-F.A. 2020. Imposter syndrome threatens diversity. *Science*, 367(6479): 749–750. doi:10.1126/science.aba8039.
- Davies, S.W., Putnam, H.M., Ainsworth, T., Baum, J.K., Bove, C.B., Crosby, S.C., et al. 2021. Promoting inclusive metrics of success and impact to dismantle a discriminatory reward system in science. *PLoS Biol.* 19(6): e3001282. doi:10.1371/journal.pbio.3001282.
- Ebrahimi, O.V. 2022. Why scientific conferences must mitigate structural barriers. *Nat. Human Behav.* 6(8): Article 8. doi:10.1038/s41562-022-01417-4.
- Emery, N.C., Bledsoe, E.K., Hasley, A.O., and Eaton, C.D. 2021. Cultivating inclusive instructional and research environments in ecology and evolutionary science. *Ecol. Evol.* 11(4): 1480–1491. doi:10.1002/ece3.7062.
- Estien, C.O., Chapman, M., Schell, C.J., Lowy, N., and Gerson, J.R. 2023. Demystifying the graduate school application process. *Bull. Ecol. Soc. Am.* 104(1): e02029. Available from <https://www.jstor.org/stable/48708236>. doi:10.1002/bes2.2029.
- Estien, C.O., Myron, E.B., Oldfield, C.A., and Alwin, A. 2021. Virtual scientific conferences: benefits and how to support underrepresented students. *Bull. Ecol. Soc. Am.* 102(2): 1–12. doi:10.1002/be.
- Faulkner, S.L., and Adams, T.E. 2021. #YouToo: notes on sexual harassment and assault in the academy. *Int. Rev. Qual. Res.* 14(2): 266–275. doi:10.1177/1940844721991085.
- Flores, N.M. 2020. Harassment at conferences: will #MeToo momentum translate to real change?. *Gender Educ.* 32(1): 137–144. doi:10.1080/09540253.2019.1633462.
- Folkes, L. 2023. Moving beyond ‘shopping list’ positionality: using kitchen table reflexivity and in/visible tools to develop reflexive qualitative research. *Qual. Res.* 23(5): 1301–1318. doi:10.1177/14687941221098922.
- Foramitti, J., Drews, S., Klein, F., and Konc, T. 2021. The virtues of virtual conferences. *J. Cleaner Prod.* 294: 126287–. doi:10.1016/j.jclepro.2021.126287.
- Foxx, A.J., Barak, R.S., Lichtenberger, T.M., Richardson, L.K., Rodgers, A.J., and Webb Williams, E. 2019. Evaluating the prevalence and quality of conference codes of conduct. *Proc. Natl. Acad. Sci. USA*, 116(30): 14931–14936. doi:10.1073/pnas.1819409116.
- Fullick, M. 2016. It's time to rethink academic conference funding. University Affairs. Available from <https://www.universityaffairs.ca/opinion/speculative-diction/its-time-to-re-think-academic-conference-funding/> [accessed November 2023].
- Gallo Marin, B., Aghagholi, G., Lavine, K., Yang, L., Siff, E.J., Chiang, S.S., et al. 2021. Predictors of COVID-19 severity: a literature review. *Rev. Med. Virol.* 31(1): e2146. doi:10.1002/rmv.2146.
- Gardner, S.K., and Holley, K.A. 2011. “Those invisible barriers are real”: the progression of first-generation students through doctoral education. *Equity Excellence Educ.* 44(1): 77–92. doi:10.1080/10665684.2011.529791.

- Gushulak, C.A.C., Bodmer, P., Carvalho, C.R., Gladstone-Gallagher, R.V., Lee, Y.P., Lowman, H.E., et al. 2023. The silent mental health and well-being crisis of early career researchers in aquatic sciences. *Limnol. Oceanogr. Bull.* **32**(1): 16–17. doi:[10.1002/lob.10539](https://doi.org/10.1002/lob.10539).
- Hansen, K. 2013. A foot in the door: networking your way into the hidden job market. Ten Speed Press.
- Harris, L.A., Grayson, T., Neckles, H.A., Emrich, C.T., Lewis, K.A., Grimes, K.W., et al. 2022. A socio-ecological imperative for broadening participation in coastal and estuarine research and management. *Estuaries Coasts*, **45**(1): 38–48. doi:[10.1007/s12237-021-00944-z](https://doi.org/10.1007/s12237-021-00944-z).
- Holmes, A.G.D. 2020. Researcher positionality—a consideration of its influence and place in qualitative research—a new researcher guide. *Shanlax Int. J. Educ.* **8**(4): 1–10. doi:[10.34293/education.v8i4.3232](https://doi.org/10.34293/education.v8i4.3232).
- Huyck, J., Anbuhl, K.L., Buran, B.N., Adler, H.J., Atcherson, S.R., Cakmak, O., et al. 2021. Supporting equity and inclusion of deaf and hard-of-hearing individuals in professional organizations. *Front. Educ.* **6**: 755457. doi:[10.3389/feduc.2021.755457](https://doi.org/10.3389/feduc.2021.755457).
- Ingram, J.C., Castagno, A.E., Camplain, R., and Blackhorse, D. 2021. Role of professional societies on increasing indigenous peoples' participation and leadership in STEM. *Front. Educ.* **6**. doi:[10.3389/feduc.2021.753488](https://doi.org/10.3389/feduc.2021.753488).
- Khelifa, R., Amano, T., and Nuñez, M.A. 2022. A solution for breaking the language barrier. *Trends Ecol. Evol. (Amsterdam)*, **37**(2): 109–112. doi:[10.1016/j.tree.2021.11.003](https://doi.org/10.1016/j.tree.2021.11.003).
- Leibnitz, G.M., Gillian-Daniel, D.L., Greenler, R.M.C.C., Campbell-Montalvo, R., Metcalf, H., Segarra, V.A., et al. 2022. The inclusive professional framework for societies: changing mental models to promote diverse, equitable, and inclusive STEM systems change. *Front. Sociol.* **6**. doi:[10.3389/fsoc.2021.784399](https://doi.org/10.3389/fsoc.2021.784399).
- Levitis, E., Gould van Praag, C., Gau, R., Heunis, S., DuPre, E., Kiar, G., et al. 2021. Centering inclusivity in the design of online conferences—An OHBM—open science perspective. *Gigascience*, **10**(8): 1–14. doi:[10.1093/gigascience/giab051](https://doi.org/10.1093/gigascience/giab051).
- Liboiron, M. 2021. Pollution is colonialism. Duke University Press.
- Lu, J.G., Nisbett, R.E., and Morris, M.W. 2020. Why East Asians but not South Asians are underrepresented in leadership positions in the United States. *Proc. Natl. Acad. Sci. USA*, **117**(9): 4590–4600. doi:[10.1073/pnas.1918896117](https://doi.org/10.1073/pnas.1918896117).
- Marín-Spiotta, E., Barnes, R.T., Berhe, A.A., Hastings, M.G., Mattheis, A., Schneider, B., and Williams, B.M. 2020. Hostile climates are barriers to diversifying the geosciences. *Adv. Geosci.* **53**: 117–127. doi:[10.5194/adgeo-53-117-2020](https://doi.org/10.5194/adgeo-53-117-2020).
- Martin, J.P., Desing, R., and Borrego, M. 2022. Positionality statements are just the tip of the iceberg: moving towards a reflexive process. *J. Women Minorities Sci. Eng.* **28**(4). Available from <https://dl.designresearchsociety.org/jasdr/jasdr2023/shortpapers/41>. doi:[10.1615/JWomenMinorSciEng.2022044277](https://doi.org/10.1615/JWomenMinorSciEng.2022044277).
- McMillon-Brown, L. 2021. Implementing diversity, equity and inclusion efforts at conferences. *Nat. Energy*, **6**(11): 1000–1002. doi:[10.1038/s41560-021-00926-2](https://doi.org/10.1038/s41560-021-00926-2).
- Meyer-Gutbrod, E., White, L., Schieler, B., Behl, M., and Park, S. 2023. The role of professional societies in advancing diversity, equity, inclusion, justice, and accessibility in the fields of coastal and ocean science. *Oceanography*, **36**(4): 124–131. doi:[10.5670/oceanog.2024.135](https://doi.org/10.5670/oceanog.2024.135).
- Miles, M.L., Brockman, A.J., and Naphan-Kingery, D.E. 2020. Invalidated identities: the disconfirming effects of racial microaggressions on black doctoral students in STEM. *J. Res. Sci. Teach.* **57**(10): 1608–1631. doi:[10.1002/tea.21646](https://doi.org/10.1002/tea.21646).
- Milstein, T., and Griego, S. 2017. Environmental privilege walk: unpacking the invisible knapsack. In *Environmental communication pedagogy and practice*. Routledge. pp. 212–216.
- Montgomery, B.L., and Page, S.C. 2018. Mentoring beyond hierarchies: multi-mentor systems and models. National Academies of Sciences, Engineering, and Medicine Committee on Effective Mentoring in STEM. **92**(2): 146–177.
- Mullangi, S., and Jaggi, R. 2019. Imposter syndrome: treat the cause, not the symptom. *JAMA*, **322**(5): 403–404. doi:[10.1001/jama.2019.9788](https://doi.org/10.1001/jama.2019.9788).
- Musgrove, M.M.C., Ko, M.E., Schinske, J.N., and Corwin, L.A. 2024. Broadening participation in biology education research: a role for affinity groups in promoting social connectivity, self-efficacy, and belonging. *CBE Life Sci. Educ.* **23**(1). doi:[10.1187/cbe.23-01-0004](https://doi.org/10.1187/cbe.23-01-0004).
- Niner, H.J., Johri, S., Meyer, J., and Wassermann, S.N. 2020. The pandemic push: can COVID-19 reinvent conferences to models rooted in sustainability, equitability and inclusion? *Socio-Ecol. Pract. Res.* **2**(3): 253–256. doi:[10.1007/s42532-020-00059-y](https://doi.org/10.1007/s42532-020-00059-y).
- Niner, H.J., and Wassermann, S.N. 2021. Better for whom? Leveling the injustices of international conferences by moving online. *Front. Marine Sci.* **8**. doi:[10.3389/fmars.2021.638025](https://doi.org/10.3389/fmars.2021.638025).
- Osiecka, A.N., Wrobel, A., Hendricks, I.W., and Osiecka-Brzeska, K. 2022. Being ECR in marine science: results of a survey among early-career marine scientists and conservationists. *Front. Marine Sci.* **9**. doi:[10.3389/fmars.2022.835692](https://doi.org/10.3389/fmars.2022.835692).
- Parncutt, R., Lindborg, P., Meyer-Kahlen, N., and Timmers, R. 2021. The multi-hub academic conference: global, inclusive, culturally diverse, creative, sustainable. *Front. Res. Metrics Anal.* **6**: 699782. doi:[10.3389/frma.2021.699782](https://doi.org/10.3389/frma.2021.699782).
- Parson, L. 2019. Considering positionality: the ethics of conducting research with marginalized groups. In *Research methods for social justice and equity in education*. Springer International Publishing. pp. 15–32. doi:[10.1007/978-3-030-05900-2_2](https://doi.org/10.1007/978-3-030-05900-2_2).
- Penaluna, B.E., Arismendi, I., Moffitt, C.M., and Penney, Z.L. 2017. Nine proposed action areas to enhance diversity and inclusion in the American Fisheries Society. *Fisheries*, **42**(8): 399–402. doi:[10.1080/03632415.2017.1345549](https://doi.org/10.1080/03632415.2017.1345549).
- Penaluna, B.E., Shively, D., Roper, B.B., Cervený, L.K., Witt, S., and Rothlisberger, J.D. 2020. Mentoring relates to job satisfaction for fish biologists: a longitudinal study of the USDA Forest Service. *Fisheries*, **45**(12): 656–663. doi:[10.1002/fsh.10500](https://doi.org/10.1002/fsh.10500).
- Penaluna, B.E., and Arismendi, I. 2022. The gender gap: women as authors and leaders in international publications in Fisheries science. *Ref. Modul. Earth Syst. Environ. Sci.* **4**: 511–519. doi:[10.1016/B978-0-12-819166-8.00162-6](https://doi.org/10.1016/B978-0-12-819166-8.00162-6).
- Potvin, D.A., Burdfield-Steel, E., Potvin, J.M., and Heap, S.M. 2018. Diversity begets diversity: a global perspective on gender equality in scientific society leadership. *PLoS One*, **13**(5): e0197280–e0197280. doi:[10.1371/journal.pone.0197280](https://doi.org/10.1371/journal.pone.0197280).
- Primus, C., Zimmerman, A.N., Avanthia, T.K., Block, K.F., Brown, C.G., Burton, M.D., et al. 2022. Scientific societies fostering inclusivity in the life sciences through engagement of undergraduate scientists. *Front. Educ.* **7**. doi:[10.3389/feduc.2022.757816](https://doi.org/10.3389/feduc.2022.757816).
- Saccarelli, C.R., Keenan, K.E., Shimron, E., Kasper, L., Keilholz, S.D., Wald, L.L., and Morris, E.A. 2021. The path to parent-inclusive conferences. *J. Am. Coll. Radiol.* **18**(2): 334–336. doi:[10.1016/j.jacr.2020.06.0277](https://doi.org/10.1016/j.jacr.2020.06.0277).
- Sarabipour, S. 2020. Virtual conferences raise standards for accessibility and interactions. *eLife*, **9**. doi:[10.7554/eLife.626688](https://doi.org/10.7554/eLife.626688).
- Sarabipour, S., Khan, A., Seah, S., Mwakilili, A.D., Mumoki, F.N., Sáez, P.J., et al. 2020. Evaluating features of scientific conferences: a call for improvements. *BioRxiv*. doi:[10.1101/2020.04.02.022079](https://doi.org/10.1101/2020.04.02.022079).
- Savin-Baden, M., and Major, C.H. 2013. Qualitative research: the essential guide to theory and practice. Routledge.
- Schmidt-Crawford, D.A., Lindstrom, D.L., and Thompson, A.D. 2021. Moving online in 2020: lessons learned from successful virtual conferences. *J. Digital Learn. Teach. Educ.* **37**(1): 4–5. doi:[10.1080/21532974.2020.18559499](https://doi.org/10.1080/21532974.2020.18559499).
- Secules, S., McCall, C., Mejia, J.A., Beebe, C., Masters, A.S., Sánchez-Peña, L.M., and Syvante, M. 2021. Positionality practices and dimensions of impact on equity research: a collaborative inquiry and call to the community. *J. Eng. Educ.* **110**(1): 19–43. doi:[10.1002/jee.20377](https://doi.org/10.1002/jee.20377).
- Segarra, V.A., Primus, C., Unguez, G.A., Edwards, A., Etson, C., Flores, S.C., et al. 2020. Scientific societies fostering inclusivity through speaker diversity in annual meeting programming: a call to action. *Mol. Biol. Cell*, **31**(23): 2495–2501. doi:[10.1091/mbc.E20-06-0381](https://doi.org/10.1091/mbc.E20-06-0381).
- Seufert, A., Von Krogh, G., and Bach, A. 1999. Towards knowledge networking. *J. Knowl. Manage.* **3**(3): 180–190. doi:[10.1108/13673279910288608](https://doi.org/10.1108/13673279910288608).
- Siliman, S., and Kearns, K. 2020. Intersectional approaches to teaching about privileges. *Radical Teach.* **116**(116): 47–54. doi:[10.5195/rt.2020.695](https://doi.org/10.5195/rt.2020.695).
- Skiles, M., Yang, E., Reshef, O., Muñoz, D.R., Cintron, D., Lind, M.L., et al. 2022. Conference demographics and footprint changed by virtual platforms. *Nat. Sustain.* **5**(2): 149–156. Available from <https://www.nature.com/articles/s41893-021-00823-2>. doi:[10.1038/s41893-021-00823-2](https://doi.org/10.1038/s41893-021-00823-2).
- Song, J., Riedl, C., and Malone, T.W. 2021. Online mingling: supporting ad hoc, private conversations at virtual conferences. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*

- (CHI '21). Association for Computing Machinery, New York, NY, USA, Article 340. pp. 1–10. doi:[10.1145/3411764.3445776](https://doi.org/10.1145/3411764.3445776).
- Sonnak, C., and Towell, T. 2001. The impostor phenomenon in british university students: relationships between self-esteem, mental health, parental rearing style and socioeconomic status. *Person. Indiv. Differ.* **31**(6): 863–874. doi:[10.1016/S0191-8869\(00\)00184-7](https://doi.org/10.1016/S0191-8869(00)00184-7).
- Stefanoudis, P.V., Biancani, L.M., Cambrono-Solano, S., Clark, M.R., Copley, J.T., Easton, E., et al. 2021. Moving conferences online: lessons learned from an international virtual meeting. *Proc. R. Soc. B Biol. Sci.* **288**(1961): 20211769. doi:[10.1098/rspb.2021.1769](https://doi.org/10.1098/rspb.2021.1769).
- Streeter, J. 2014. Networking in academia: generating and enhancing relationships with your acquaintances and colleagues will create a diverse network of sponsors eager to help you succeed. *EMBO Rep.* **15**(11): 1109–1112. doi:[10.15252/embr.201439626](https://doi.org/10.15252/embr.201439626).
- Syed, S., ní Aodha, L., Scougal, C., and Spruit, M. 2019. Mapping the global network of fisheries science collaboration. *Fish Fish.* **20**(5): 830–856. doi:[10.1111/faf.12379](https://doi.org/10.1111/faf.12379).
- Turgeon, K., Hawkshaw, S.C., Dinning, K.M., Quinn, B.K., Edwards, D.N., Wor, C., et al. 2018. Enhancing fisheries education and research through the Canadian Fisheries Research Network: a student perspective on interdisciplinarity, collaboration and inclusivity. *FACETS*, **3**(1): 963–980. doi:[10.1139/facets-2017-0038](https://doi.org/10.1139/facets-2017-0038).
- Tulloch, A.I.T. 2020. Improving sex and gender identity equity and inclusion at conservation and ecology conferences. *Nat. Ecol. Evol.* **4**(10): Article 10. doi:[10.1038/s41559-020-1255-x](https://doi.org/10.1038/s41559-020-1255-x).
- Waruru, M. 2018. African and Asian researchers are hampered by visa problems. *Nature*, doi:[10.1038/d41586-018-06750-1](https://doi.org/10.1038/d41586-018-06750-1).
- Wilson, B.G., Ludwig-Hardman, S., Thornam, C.L., and Dunlap, J.C. 2004. Bounded community: designing and facilitating learning communities in formal courses. *Int. Rev. Res. Open Distributed Learn.* **5**(3): 1–22. doi:[10.19173/irrodl.v5i3.204](https://doi.org/10.19173/irrodl.v5i3.204).
- Wu, J., Rajesh, A., Huang, Y.N., Chhugani, K., Acharya, R., Peng, K., et al. 2022. Virtual meetings promise to eliminate geographical and administrative barriers and increase accessibility, diversity and inclusivity. *Nat. Biotechnol.* **40**(1): 133–137. doi:[10.1038/s41587-021-01176-z](https://doi.org/10.1038/s41587-021-01176-z).