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What Can Professional Scientific Societies Do to Improve Diversity, Equity, and Inclusion: A Case Study of the American Elasmobranch Society

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Scientific professional societies are reviewing diversity, equity, and inclusion (DEI) practices and policies in response to recent calls for much-needed change. Organizations like scientific professional societies contribute to establishing disciplinary norms, and can influence the diversity of disciplinary workforces in multiple ways through both action and inaction. This paper examines these issues using the American Elasmobranch Society (AES), a medium-sized professional scientific society, as a case study. It consists of three parts: (1) an analysis of the demographics of AES members, leaders, and award winners; (2) an evaluation of a diversity initiative created by the society which includes a survey of program alumni focusing on potential improvements to the program; and (3) a synthesis of recommendations of steps that AES and similarly sized societies can take to better support DEI goals. AES's membership in recent years is more than half women, but 71.5% of all leadership positions in the Society's history (including all but two Presidents) have been held by men since the society was founded in 1983. AES's membership has significantly fewer Black/African-American members than the United States scientific workforce overall, with just 1 member out of over 400 identifying as Black in 2019, and 86.6% of Society leadership positions have been

held by white-presenting members. The Society's diversity initiative has led to some limited professional benefits for awardees, but could benefit from additional resources and support to enact suggested expansions and improvements. We provide a series of actionable recommendations that will make the annual meetings of societies like AES, and the field of chondrichthyan science, safer and more inclusive.

Keywords: diversity and inclusion, marine science, shark, marine biology, professional societies and associations

INTRODUCTION

Disciplines within the world of science, technology, engineering, and mathematics (STEM) are facing a long-overdue examination of the treatment of professionals from historically marginalized and excluded groups, including but not limited to individuals who identify as Black, Indigenous, and People of Color (BIPOC; e.g., Subbaraman, 2020), women (e.g., Llorens et al., 2021), members of the LGBTQIA+ community (e.g., Mallapaty, 2020; Cech and Waidzunas, 2021), and disabled people (e.g., Powell, 2021). When people are marginalized due to their identities, they are subject to exhausting experiences such as outright discrimination possibly preventing employment or promotion, or emotionally taxing and draining "death by a thousand cuts" microaggressions and associated physiological stress (see Dzirasa, 2020). Additionally, the emotional labor of mentoring and supporting students and trainees who face these issues disproportionately falls upon those from historically marginalized backgrounds, even when the student or trainee is not officially their mentee (Jimenez et al., 2019). Individuals who hold multiple marginalized identities (e.g., LGBTQIA+ and Black) can experience additional disenfranchisement or trauma and compounded stressors as a result of their intersecting identities (Crenshaw, 1990; Purdie-Vaughns and Eibach, 2008).

In academia as a whole, 58% of women report experiencing sexual harassment in the workplace (Johnson et al., 2018), but rates within the marine sciences are considerably higher (78%, Women in Ocean Science, 2021). Harassment is most likely to occur early in a scientist's career or during their time as a graduate student, and academic scientists across many disciplines who do fieldwork report male-dominated cultures permissive of sexual harassment and assault (Clancy et al., 2014). These incidents may also occur during scientific conferences, with 17% of respondents reported unwanted touching and/or remarks, and many saying that they did not report these incidents because there are no formal channels for reporting, they felt that decision-makers were friends with their harasser, or they believed their harasser had power over their career and could retaliate (Women in Ocean Science, 2021). A recent survey of 48 marine scientists from historically underrepresented backgrounds (Graham et al., under review) found that scientific professional societies and their conferences were often associated with negative feelings and a sense of not belonging in the field.

Growing recognition of these issues has brought a renewed focus on creating and implementing actionable, equitable solutions (this volume). While some solutions must be enacted at the level of an institutional employer (e.g., a university, governmental agency, or private company), scientific professional societies can also play a role in creating, enacting, and enforcing solutions. Professional societies often set disciplinary norms across institutions, and can contribute directly to the success of young scientists by offering speaking opportunities (e.g., at annual conferences, see Oester et al., 2017), leadership and service opportunities, networking that leads to collaborations or job offers, and grants and other awards. The role of professional scientific societies in contributing to or solving disciplinary diversity, equity, and inclusion (DEI) issues has been discussed in general (Consortium of Social Science Associations [COSSA], 2012) and for many specific disciplines including astronomy (Kewley, 2019), and geology (King et al., 2018). Specifically, professional societies have been recommended to recruit and retain underrepresented minorities as well as to enhance the mentoring of underrepresented minorities (Consortium of Social Science Associations [COSSA], 2012), though we note that merely bringing more people from historically underrepresented backgrounds into an unsafe and unwelcoming environment does not solve these problems.

In recent years, discussions surrounding DEI issues in different disciplines within the marine sciences have occurred for fisheries science (Penaluna et al., 2017; Miles, 2021), coral reef biology (Ahmadia et al., 2021), marine geology (Behl et al., 2021), and marine conservation biology (Smith et al., 2017; Johri et al., 2021). To date, no formal discussion of these issues has occurred for the specific subdiscipline of chondrichthyan biology (the study and management of sharks and their relatives). This field has faced long-term problems with racism, sexism, homophobia, and many other related problems (see Graham, 2017; Whitenack, 2017; Macdonald, 2020).

The potential benefits of professional societies involving themselves in DEI issues may occur as part of addressing structural problems along both sociocultural and organizational pathways. Sociocultural pathways include the need for changing cultures and norms so they are less permissive of racism, homophobia, sexual harassment and assault, and other problematic norms, including altering "perceptions of the appropriate use of power" (Cleveland and Kerst, 1993). This may be especially important in settings like academia, where power differentials can be significant but not explicitly delineated, and senior scientists possess substantial power to influence the career prospects of early career researchers (Benya, 2019). Organizational pathways include changes to power structures, culture and climate, and existing levels of diversity (Bishu and Kennedy, 2020).

Underrepresentation of women and minorities in leadership roles can erode or prevent the formation of "safety conscious" organizational structures (e.g., Alvinius and Holmberg, 2019; Bishu and Headley, 2020).

This and other evidence suggests that, however, well-intentioned, DEI initiatives within academic institutions and professional societies are not always well thought out or effectively implemented, and substantial room for improvement remains (Madzima and MacIntosh, 2021). Key steps in this process would include reflective work within organizations to identify marginalized groups within organizations and the institutional structures, practices, and cultures contributing to that marginalization, and efforts to thoughtfully, intentionally, and specifically intervene around these identified barriers to create more inclusive, safe, and welcoming environments (Madzima and MacIntosh, 2021). Where effective, these interventions will most likely cluster along three key axes: efforts to promote greater diversity, representation, and inclusion, to establish responsive and trusted reporting systems, and to build meaningful accountability measures (Bishu and Kennedy, 2020).

Here we endeavor to provide essential background for conducting such reflective work within our own professional community, and to connect that reflective work to potential interventions across all three axes. We also incorporate an assessment of the complexity and feasibility of proposed interventions based on the current bylaws and regulations of the society and the current role of the society within the broader discipline.

Case Study Background: The American Elasmobranch Society

The American Elasmobranch Society (AES[1]) is the world's oldest and largest professional society focusing on the scientific study and management of sharks and their relatives. Founded in 1983 (see Castro, 2016), AES now has approximately 500 members with some annual fluctuation. AES typically holds an annual conference at rotating North American locations as part of the Joint Meeting of Ichthyologists and Herpetologists, a gathering with three other similarly sized professional societies: the American Society of Ichthyologists and Herpetologists, http://asih.org; the Society for the Study of Amphibians and Reptiles, http://SSARherps.org; and the Herpetologists' League, http://HerpetologistsLeague.org. AES is a taxon-focused society rather than a methodologically focused society, with members who research chondrichthyan fishes and fisheries using a variety of tools and techniques (Ferry and Shiffman, 2014; Shiffman et al., 2020).

The AES Equity and Diversity (E&D) Committee was initially established as an *ad hoc* committee, with members appointed by the sitting president in 2014. The committee's initial role was to develop the conference Code of Conduct (see Favaro et al., 2016), the first version of which was approved by the Board of Directors in December 2017. The Code of Conduct has been intermittently updated since its inception in an attempt to address new or persistent issues, and to offer sufficient protection to all members, and the latest version is available online at http://elasmo.org/pub/AES_CoC_Updated_May31_2018.pdf. The Code of Conduct prohibits discrimination, sexual harassment, retaliation, bullying, and unreasonable behavior, and notes that it also applies to off-venue events that occur under the auspices of the conference. It includes general procedures for reporting an incident that occurs at a conference governed by AES and general procedures for resolution, and was developed based on published examples from other professional societies. It is important to note that the Code of Conduct does not govern or attempt to govern the behavior of members outside of the annual conference aside from during sanctioned AES-related activities, like when interacting on AES social media pages or official AES-related emails, etc. Additionally, though the Code of Conduct process was initiated with majority support from AES membership and leadership, there were (and continue to be) objections to the process and content of the code of conduct from some members from many different perspectives (e.g., some feel that it does not do enough, others feel that it attempts to do too much). Though promoting equity and diversity in the field has champions across all career stages in the society, we have observed significant frustration particularly from early career members at the perceived slow pace of implementation of even basic changes, and a common perception among younger members that some powerful senior members do not consider DEI a problem that is worth addressing. While these discussions are nuanced and complex, there is an easy-to-detect ripple running through the society with many members suggesting that more could and should be done.

In 2018 the membership voted to make the E&D Committee a standing committee.[2] The roles of the E&D Committee are, as of this writing, to review and update the Code of Conduct, educate the Society membership about DEI issues, serving as points of contact for reporting code of conduct violations, and selecting the Young Professional Recruitment Fund (YPRF) awardees.

American Elasmobranch Society leadership is elected by members, following selection of the slate of candidates by an elected nominating committee (see bylaws in Supplementary Material or linked online here: http://elasmo.org/bylaws). Any member can nominate another member in good standing for any position, and members may also self-nominate. Nominees who agree to run for a position may (or may not) be placed on the ballot by the nominating committee, whose deliberations and procedures are confidential with a process that varies from year to year.

American Elasmobranch Society also has a professional code of ethics that applies to members of the field in general, not just at the annual meeting. This code of ethics focuses on scientific integrity when performing and publishing research, but includes an anti-discrimination clause. The code of ethics notes that members have an affirmative duty to publicly criticize misrepresentations of the state of knowledge related to the scientific study or management of chondrichthyan fishes. The code does not currently include a procedure to report or investigate violations, or a description

[1] http://elasmo.org

[2] http://elasmo.org/bylaws

of any possible consequences. The text can be found in Supplementary Material or online at http://elasmo.org/pub/AES-Code-of-Ethics-v1.pdf.

Like many professional scientific societies and the scientific community as a whole, AES and its members are not immune from DEI challenges, with incidents including but not limited to unwanted touching and inappropriate and discriminatory remarks, including in the laboratory, in the field, and at the annual meeting (Graham, 2017; Whitenack, 2017; Macdonald, 2020). Some examples include actions that rise to the criminal level (e.g., several incidents reported in Macdonald, 2020), and as in much of academia, "whisper networks" (*sensu* Tuerkheimer, 2019) in which new members may be warned about potentially predatory senior members. Considering the personal experiences of several authors on this contribution (largely but not exclusively female authors), one could argue that it is common knowledge that particular members within the larger society repeatedly display inappropriate and problematic behavior. Individuals such as these, while few in number, have a hugely disproportionate effect on culture and community within the society, with similar patterns reported in other societies like AES. The society has had limited means for or success at taking concrete actions to address these problems. This challenge is compounded by the lack of formal training of AES officers on best practices for objectively evaluating and acting upon reports of Code of Conduct violations, and a lack of resources necessary for hiring external professionals to provide these. As of this writing, only one AES member has received AES-sponsored external training for the purpose of serving as a Society safety officer.

Case Study Background: The Young Professional Recruitment Fund

In an effort to improve the AES's membership diversity, the YPRF award was established in 2014 in partnership with the diversity in STEM non-profit organization DiverseScholar, publisher of the career portal, MinorityPostdoc.org. Though independently conceived, the YPRF award is broadly similar to other professional society's mentoring fellowships (reviewed recently among biology organizations, see Segarra et al., 2020a,b). The goal of the YPRF award program is to seek out early career researchers, managers, and environmental advocates from historically underrepresented backgrounds and bring them into AES with a complementary membership, enhancing the diversity of the society while providing professional development and networking opportunities for awardees.

The YPRF is currently funded by AES, with a program administrator who is responsible for planning professional development trainings, identifying and putting awardees in contact with specific mentors, and communicating with awardees. This is a competitive program that draws many applicants, with awardees chosen by AES's E&D Committee (since 2019). Potential applicants to the program are recruited *via* social media (including professional Facebook groups and twitter accounts with a focus on hashtags used by diversity in STEM conversations), professional listservs, and word of mouth.

While AES membership offers a significant discount for annual meeting registration costs (the 2021 JMIH meeting costs $200 for members and $250 for non-members), and members in their second year of membership are eligible to apply for student travel support, the YPRF program itself does not include travel support for the meeting. This differentiates the YPRF from programs in other similarly sized societies (e.g., the Cashner program at the American Society of Ichthyologists and Herpetologists, and Segarra et al., 2020a,b recommends such travel support to improve the diversity of a professional society).

A major benefit to YPRF awardees are the monthly professional development discussions, which are targeted at YPRF but open to the entire membership, and hosted in the AES Facebook group, which counts over 1,500 chondrichthyan scientists, conservation advocates, and natural resource managers in its membership. For awardees interested in specific technical topics, the opportunity to speak directly with senior AES members can be arranged. With the assistance of the YPRF program coordinator, awardees are encouraged to develop their professional network of relationships to extend beyond their YPRF award year, and are encouraged to renew their membership after their complementary year of membership ends.

Eligibility requirements are as follows. The YPRF program is designed to bring new members into the Society, and therefore people who have been members in the past are ineligible. Applicants must have a genuine professional interest in chondrichthyan research or management as a career, as opposed to non-professional "shark enthusiasts." Applicants must be early-career chondrichthyan research professionals, defined as a current or prospective graduate student or someone within 5 years of their terminal degree, such as postdoctoral researchers, junior faculty, or early-career resource manager or non-profit advocacy organization employee. Applicants must also self-identify as belonging to a community that is historically underrepresented within AES, which includes underrepresented minority groups in the United States as well as early career scientists, advocates, and managers from the Global South.

The goal of this paper is to reflect on the current status of DEI issues within our society, identify published best practices that contribute to resolving these challenges, and to recommend tangible, actionable ways in which professional societies can improve and work toward solving these challenges. To do this, we use the AES as a representative case study, as AES is a medium-sized United States-based professional scientific society that is in many ways typical and representative in terms of the resources and governance structures available to solve DEI challenges. The manuscript consists of three parts: (1) an analysis of the demographics of AES members, leaders, and award winners as compared with National Science Foundation (NSF) statistics for United States-based scientists and engineers; (2) an evaluation of AES's diversity initiative and a survey of what alumni believe worked and could be improved about the program; and (3) a synthesis of recommendations about what scientific conferences and societies can do to improve their DEI practices.

Research Questions

This project was undertaken to assess six research questions: (1) What are the demographics of the membership of the American Elasmobranch Society? (2) How do those demographics differ from those of AES leadership, the scientific workforce in the United States overall, and the United States population overall? (3) Have there been notable changes in the demographics of AES over time? (4) What do alumni of AES's diversity initiative think the YPRF program does well? (5) What do alumni of AES's diversity initiative think the YPRF program needs to improve upon? and (6) What suggested improvements to improve a professional society's DEI issues could AES implement?

Our goal is for this manuscript to be useful to AES and to other professional scientific societies with similar DEI challenges and similar goals to improve their institutional culture.

MATERIALS AND METHODS

Demographics of American Elasmobranch Society Members, Leaders, and Conference Award Winners

Following Arizona State University Institutional Review Board permit #00013030 and with the written support of the 2019–2020 AES Executive Committee, we obtained all available membership data for the AES. Only the lead author DS had access to all raw data through this project, though co-author TW independently had access to these data through her role as AES's Secretary. Other coauthors were given anonymized subsets of these data to assist with analysis. AES record keeping has been inconsistent over the years, which *means* that complete comparative data across the lifetime of the Society was not available. This dataset allowed us to assess several axes of diversity within AES, including career stage (students vs. professional members), gender, and racial/ethnic identity. For the years 2001–2019, AES offered a variety of membership levels, which have recently been simplified and combined. To allow for easy comparison, we sorted membership type into "student" (typically but not always graduate students) and "professional" (anything other than a current or recent-enough-to-still-qualify-for-student-membership student).

Since 2019, AES has distributed a voluntary demographic survey of membership, which we obtained and compared with publicly available NSF statistics about the diversity of the United States STEM workforce and associated statistics about the United States' population. We note that while these NSF statistics are the best available comprehensive data source, they only focus on the United States, and do not include certain categories of interest here (e.g., there is a "do not wish to disclose" option for gender, but not a non-binary option). AES's voluntary demographic survey asks about gender, age, professional career stage, employer type, ethnicity, and country of residence.

American Elasmobranch Society is led by an elected volunteer Board of Directors who serve 5-year terms, and an elected volunteer Executive Committee whose structure has changed over the years but currently consists of a President, Treasurer, Secretary, Immediate-Past-President, President-Elect, and Meeting Management Committee Representative. The list of past AES leaders and award winners were all publicly available, and accessed through, Elasmo.org/history and publicly available business meeting minutes) and therefore did not require IRB or Society Leadership approval to access. For each senior leader (Board of Directors member and Executive Committee member) or major award winner (Best Student Poster, Best Student Talk, Research Grant Awards), a list of names was extracted.

Following Whitenack et al. (2021), one author (RB) searched for formal online biographies and photographs of each leader or student award winner. Biographies were scanned for the use of pronouns, noting that people can be misgendered in an official biography and that pronouns and gender identities can change. Photographs were examined to assess if the member would likely be considered white-presenting by a United States audience (i.e., would most white people consider them white, modified from Ginsberg(ed.), 1996). Uncertainty (n = 8, 11.8%) resulted in authors DS and LW discussing the issue and coming to a decision. Only people for whom photos could be found were included in race analysis, and only people for whom biographies were found were included in the gender analysis. We note that someone presenting as white may hold other minoritized identities.

A Case Study of the American Elasmobranch Society's Young Professional Recruitment Fund Diversity Initiative

As of 2021, the program has awarded memberships to 104 early career scientists, of which 91 (87.5%) are alumni who have completed their YPRF scholarship year. The 81 alumni for whom we could find current contact information (not including the three YPRF alumni who are coauthors on this study) were sent a voluntary anonymous online survey by then program administrator (author DS) asking for their thoughts about the program, with a focus on identifying what worked, what did not, and suggestions for improvement. Most questions were free response, and some were multiple choice. Thirty alumni (response rate = 37%) completed all required questions on the survey and had their responses counted here, though several questions were not required and not every alumnus answered every question. This survey was covered by Arizona State University Institutional Review Board permit #00013030.

Progress: What Can Professional Societies Like American Elasmobranch Society Do to Help?

The coauthors on this study represent thought leaders in improving STEM fields' issues with DEI along multiple axes of diversity, with several having co-founded organizations dedicated to these causes. Coauthors were asked to synthesize recommendations from their organizations and to provide key

references from their personal libraries. Additionally, coauthors on this study have been working on improving DEI issues within AES (or their other societies) for years, including speaking with many concerned members, and were encouraged to submit their own specific suggestions for improvement. This was supplemented by a Web of science search for keywords related to diversity equity and inclusion in STEM and an in professional societies.

Suggestions were compiled, and then organized both by which aspect of institutional culture and climate would be affected and by difficult of implementation. Following Bishu and Kennedy (2020) these recommendations are structured into three axes: efforts to create greater diversity representation and inclusion, attempts at establishing responsive and trusted reporting systems, and work to create meaningful accountability. We note that most suggestions here fall into the "create greater diversity representation and inclusion," but that all three are extremely and profoundly important. Some proposed solutions straddle multiple aspects of institutional culture and climate.

Difficulty of implementation is based on the current structure and powers of the AES leadership as determined by our society's bylaws. The available options range from very easy (e.g., could be implemented by a Presidential directive, Board of Directors vote, or request to the annual conference meeting manager with no significant costs or rule changes) to more complex (e.g., would require moderate to significant costs and bylaw changes, or a reimagining of the role of the professional society within the broader discipline). Some proposed solutions straddle multiple degrees of difficulty to implement.

RESULTS: DEMOGRAPHICS OF AMERICAN ELASMOBRANCH SOCIETY MEMBERS, LEADERS, AND CONFERENCE AWARD WINNERS

From 2001 to 2019, an average of 43% of AES members were students (**Figure 1**). Student members, who notably have less financial security and professional power than senior members, are a major part of AES's current structure and contribute meaningfully to meeting operating expenses. Additionally, we note that while the structure of the society's membership has changed with the percentage of student members increasing, the structure of the society's leadership has not, potentially contributing to stated concerns that leadership is insufficiently responsive to student priorities like equity and diversity issues.

Demographics of American Elasmobranch Society Membership

Results show that AES (53.9% of members in 2019) has a higher percentage of women members than the United States resident population (50.8% of the United States population in 2017) or the United States scientific workforce (47.6% in 2017 as noted in the NSF statistics, **Figure 2**) or NSF survey of employed scientist or engineers, with one member who identified as non-binary in 2019 and two who selected "I prefer not to answer this question" out of approximately 400 members that year.

In terms of race and ethnicity, AES has a substantially higher percentage of white/Caucasian members (79.3% of members in 2019) than the United States population (63.9%) or the United States scientific workforce (71%), and significantly fewer Black/African American members than either group; only one AES member identified as Black/African American in 2019 despite 12.3% of the United States population being Black. AES membership also is underrepresented in terms of Native American and Alaska Native members and Hispanic/Latino members, but membership from these groups is more comparable to the United States scientific workforce. We note that neither the NSF data nor the AES data disaggregate United States Citizens or Green Card holders with Hispanic/Latino backgrounds from those living and working in Latin America. The percentage of Asian AES members is comparable to that of the United States population, but lower than the United States scientific workforce (**Figure 3**).

Demographics of American Elasmobranch Society Leaders and Conference Award Winners

A total of 82 different people served in analyzed AES leadership positions since 1983, with many serving in multiple roles in different years. Fifty-four of these 82 used he/him pronouns, 21 used she/her pronouns, and official biographies containing pronouns could not be found for 7. Of leaders elected to more than one term on the Board of Directors, 21 used he/him pronouns and 1 used she/her pronouns. Seventy-one (93%) were white-presenting, 5 (7%) were not white-presenting, and photographs could not be found for 6. Twenty of 21 (95%) female leaders were white-presenting, and 49 of the 54 (91%) male leaders were white-presenting. As of this writing, AES has had just one female president who served a full term (i.e., author LF) and another who did not serve a full term, though

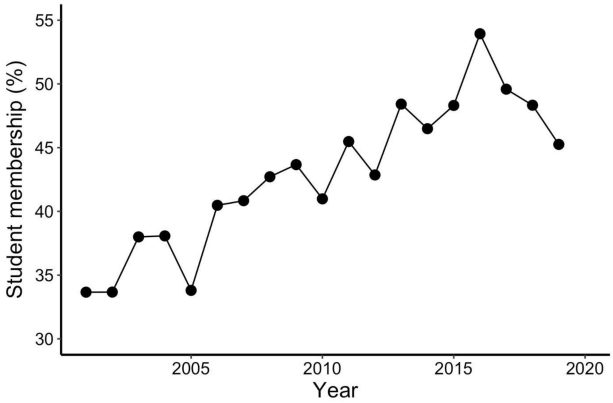

FIGURE 1 | Percent of AES members who had a student membership.

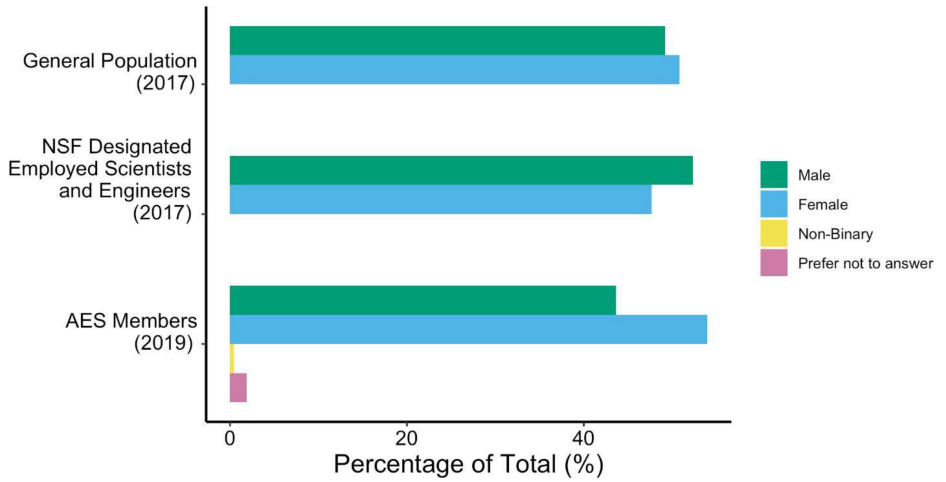

FIGURE 2 | Gender of AES members compared with National Science Foundation statistics.

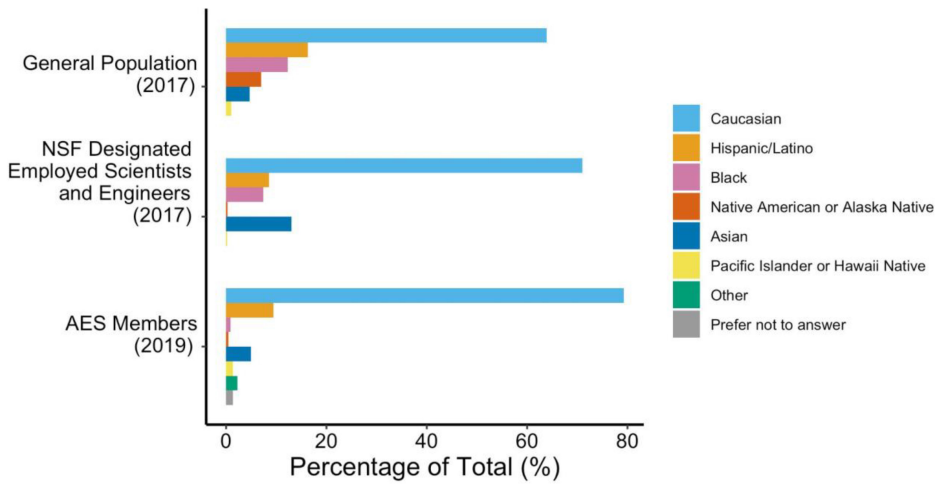

FIGURE 3 | The race/ethnicity of AES members compared with National Science Foundation statistics.

another woman was recently elected to begin her presidency in January 2022.

The structure and size of AES's Board of Directors and Executive Committee has changed over the years, and roles last between 2 and 5 years. To simplify calculations, one leader in place for 1 year was counted as a "leadership position," and as of 2021 there have been 902 "leadership positions" in the history of AES. Six hundred and forty-five (71.5%) have been held by men, and 181 have been held by women. Seven hundred and eighty-two (86.6%) have been held by white-presenting members, and just one President has not been white-presenting. For much of the society's history, these leadership positions have been held entirely by white-presenting men apart from one member (**Figure 4**), and while the percentage of women leaders has increased in recent years, the percentage of non-white leaders has not. We note again that terms last a variable length of time, and some people may serve multiple terms or serve in multiple leadership roles non-concurrently, which means that the observed pattern is explained by a combination of more leadership positions going to men and/or white-presenting members in any given year, more men and/or white-presenting members getting multiple different leadership positions, and the leadership positions with a longer term more often going to men and/or white presenting members. Some of this phenomenon of this is likely due to some members being more willing or able to volunteer repeatedly, though part of the reason why white males are more willing to serve in leadership positions (and why women or people of color may be less willing) may be related to institutional culture and climate (see Hewlett et al., 2008). We recommend that future AES nominating committees prioritize diversity in the slate of available leadership candidates.

We are also aware of cases where non-white candidates have been nominated for leadership positions and have agreed to run for the position, but their names were not on the final ballot sent

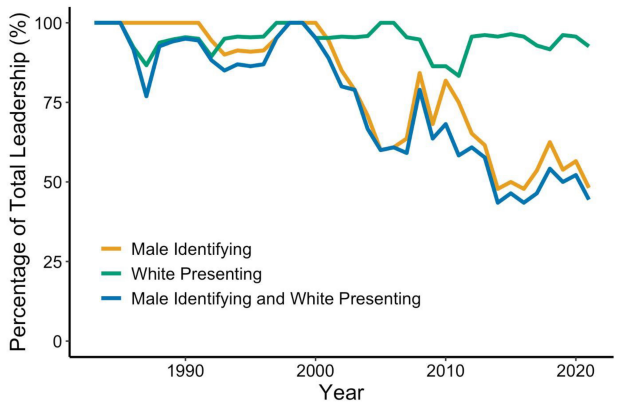

FIGURE 4 | The percentage of AES leaders in any given year that identified as male, are white presenting, or both.

for members to vote on. As nominating committee deliberations (including who was nominated, who among the nominees was selected for the slate of candidates and who wasn't, and why some nominees were not selected) are confidential and no records are kept, we do not have the data to evaluate the extent to which this has occurred or why. We recommend some possible solutions to this problem, centered around simple transparency.

The Society offers a variety of student research and travel grants, as well as conference-related awards for the best student poster and best student talk, which can professionally benefit early career researchers who receive them. These are currently not available to postdoctoral scholars who fall between the ranks of student and faculty. A total of 90 different people have won major student awards (i.e., best student talk, best student poster, student research award), with some winning multiple awards in different years. Thirty-nine (43%) were given to students who use he/him pronouns, 42 (47%) were awarded to students who use she/her pronouns, and pronouns could not be found for the remaining 9%, a pattern generally consistent with student member demographics. Seventy-nine (87.7%) of awards were given to white-presenting students.

RESULTS: A CASE STUDY OF THE AMERICAN ELASMOBRANCH SOCIETY'S YOUNG PROFESSIONAL RECRUITMENT FUND DIVERSITY INITIATIVE

Fifty-seven percent of respondents had heard of AES prior to applying for the YPRF program. Those who had not noted that they did not have mentors in chondrichthyan science or management at the time they applied, or that the society is less well known in some parts of the world. The two most common reasons cited for not joining AES prior to applying for the YPRF program were (1) the cost of membership (with several noting that the $25 student membership fee is a significant expense for early career researchers in the Global South), and (2) uncertainty whether the society is open to non-Americans. Two respondents reported that they had long been considering joining the society, and the YPRF program made that decision easier for them.

Fifteen respondents (50%) reported that their professional goals are to be academic scientists, while 11 (37%) reported that their goals are to work for an environmental non-profit organization. Two respondents wished to work for a government management agency, and two had "other" goals, with no detail provided. A plurality of respondents reported that the YPRF program was "somewhat helpful" or "only a tiny bit helpful" in achieving their goals (9 respondents or 30% each), 7 (23%) respondents reported that the program was "not really helpful," and 4 (13%) reported that it was "extremely helpful."

The most common professional benefit reported by YPRF alumni was "meeting international colleagues" (N = 15, 50%), with eight of these respondents reporting that those international colleagues have since become collaborators, mentors, or thesis committee members. Twelve respondents (40%) reported that being able to ask technical or professional questions to the community was professionally beneficial to them, with four reporting that this led directly to helping them solve a methodological question. Nine respondents reported that they found the professional development chats in the AES Facebook group to be useful, and seven reported that they found the mentorship component useful.

Nine respondents (30%) reported that they attended an annual meeting, with four of those noting that they renewed their AES membership after their YPRF year and then got AES travel support as student members. A further 11 (37%) said that they would attend an AES annual meeting if travel support was available. More respondents who attended an AES annual meeting found the YPRF program professionally useful than those who did not attend an AES annual meeting, though two respondents who found the program "not useful at all" did report attending a meeting. Thirty-five YPRF alumni renewed their membership at the conclusion of their YPRF scholarship year (38.4% of YPRF awardees, AES Secretary Tonya Wiley, personal communication). Of the respondents who did not renew their membership, none revealed why they did not do so in this survey.

Several specific suggestions for improving the YPRF program were made by alumni, mostly focusing on expanding the benefits offered to awardees, which would require increased resources from the Society. The most common suggestion, which seven members requested, was YPRF-specific travel funding to attend the annual meeting, and three respondents noted that the Cashner Award (the analogous program at the American Society for Ichthyology and Herpetology) attempt to do this. Four alumni suggested that an expanded or more formalized and structured mentorship program would be helpful, especially one in which existing members with specific skill sets would serve as mentors to students with similar research interests and professional goals. Currently the mentorship program is relatively informal; it generally consists of an awardee telling the YPRF coordinator that they would like to learn a particular skill, and the program coordinator

reaching out to a specialist in their professional network for assistance.

Four YPRF alumni suggested the creation of virtual check-ins and hangouts, which can have a specific theme or topic, such as "feeding ecology chat," in which we invite AES members knowledgeable about this topic, or just to get to know one another and YPRF alumni. One specific example provided by a respondent suggested an organized program for YPRF scholars who attend the annual meeting to receive guidance, similar to the ESA SEEDS program at the Ecological Society of America meeting (a specific example provided by the respondent which is an organized program where first-time conference attendees are paired with an experienced attendee)—this member noted that they felt lost and overwhelmed when attending AES in person. One respondent noted that the AES member directory was difficult to use for searching for someone with a specific skill set rather than someone in a specific region. One noted that the program could benefit from translation services, as discussions are only available in English.

Four (13%) noted that they had personally experienced racism or sexism from AES members, including inappropriate and offensive comments from senior members. These respondents suggested that inviting more members from historically underrepresented backgrounds to join the Society, or any society, without also working to create a more welcoming environment, will not create meaningful solutions to membership under-representation.

RESULTS: WHAT CAN PROFESSIONAL SOCIETIES LIKE AMERICAN ELASMOBRANCH SOCIETY DO TO HELP?

These data, along with numerous anecdotal reports from within the field of chondrichthyan science (Graham, 2017; Whitenack, 2017; Macdonald, 2020) and from science more broadly (Clancy et al., 2014; Women in Ocean Science, 2021), illustrate the extent to which both reflection on current challenges and tangible steps toward improving them is necessary for AES. DEI goals including an inclusive culture, diverse membership, and representative leadership are not currently being achieved.

To contribute to addressing these complex and challenging issues, here we present a partial synthesis of recommendations from a variety of sources related to DEI issues in academia and STEM culture in general, as well as for professional societies and marine science in particular (**Table 1**).

Though developed with grounding in the rules and realities of AES, it is our hope that these recommendations are broadly applicable to professional societies that are similar in size and scope and face similar current challenges and have similar resources and governance structures available to solve these problems. This is not intended as a checklist (i.e., do these things and all problems are fixed), but as a starting point in a long and constantly evolving conversation that requires dynamic solutions as societies change and grow.

Solutions That Will Contribute Toward Greater Diversity, Inclusion, and Representation

Easy to Implement Solutions

Publicly Amplify Voices of Those Who Have Been Minoritized Using Existing Communications Channels, and Create New Channels If Necessary

An effective strategy that carries almost no financial cost is to use Society communication channels to amplify the voices of scientists from underrepresented backgrounds who are already present within the Society or field (see Miriti et al., 2020; Remmel, 2021). Being a featured scientist in a professional society's newsletter, journal, or social media can serve as a professional boost, especially for early career researchers, and can be especially professionally beneficial for members from historically underrepresented backgrounds. Societies in general, including AES, have a mixed record of publicizing the achievements of members from historically underrepresented backgrounds, which was one of the reasons for the founding of the independent-from-AES Minorities in Shark Sciences[3] in 2020. AES has a Twitter account (managed by the AES editor, who as of this writing is co-author CB), which shares research written by or relevant to the membership; this channel could be used to highlight the work of members from underrepresented backgrounds.

However, this is not enough. In contrast, we highlight one example from a larger society, the Society for Integrative and Comparative Biology[4] (which many AES members are also members of), which has a "Public Affairs Committee" responsible for choosing which member research to feature in press releases and on the Society website. AES and similar medium-sized societies could institute the same strategy. AES, for example, recently created an *ad hoc* "Outreach and Education Committee," which could fill some of this need if charged with the mission to do so. We suggest that official society blogs also could include interviews with featured members. Additionally, at the annual meeting, such members could be invited to give opening plenaries. Societies like AES have presidents who serve for more than 1 year, and thus often give a plenary their first year and appoint another member to give a plenary the following year. This represents another high-profile platform for members from historically underrepresented backgrounds to present their work, and their journeys, though we note that asking BIPOC scientists to speak only about DEI issues and not their own research is a common problem in STEM.

The lockdown associated with the COVID-19 pandemic led to the emergence of virtual seminar series run through Zoom and other platforms, providing more speaking opportunities for members and a further source of value for members who watch these talks. A society-branded virtual seminar series could be established to air throughout the rest of the year when the annual meeting is not occurring to provide another career-boosting platform for early career members, including members from

[3]MISSelasmo.org

[4]SICB.org

TABLE 1 | A summary of suggestions to improve the DEI issues surrounding AES.

Recommendation	References for further reading
CONTRIBUTING TO GREATER DIVERSITY, INCLUSION, AND REPRESENTATION	
Easy to implement solutions	
Publicly amplify voices of those who have been minoritized using existing communications channels (social media, websites, plenary talks), and create new channels (virtual seminar series) if necessary	Miriti et al., 2020; Remmel, 2021
Make meeting spaces more accessible and inclusive, including wheelchair accessibility, an accessibility coordinator, trans and non-binary friendly restrooms, dietary restriction and allergy friendly food, no longer centering alcohol, and having quiet/meditation/prayer rooms and nursing rooms	Boyt, 2021
Nametag options to improve inclusivity, such as pronouns and associated member education, thoughtful use of "ally" badges following training, and indicating comfort levels with physical proximity to others and touch	Miles, 2021
Make conference talks and Q&A more inclusive and safe, including color and font suggestions, closed-captioning and microphone use when possible, and carefully moderates Q&A sessions	Hinsley et al., 2017; Irish, 2020; Boyt, 2021
Consider diversity equity and inclusion in awards and grants (and if applicable, publications), possibly through involving the equity and diversity committee in award nominations to ensure that members with troubling histories are not honored	Johri et al., 2021
Improve the searchability and usability of the membership directory to allow full participation from members who don't know everyone	Survey (this study)
Solutions that are moderately complex to implement	
Provide educational opportunities for members and leaders focusing on equity and diversity issues, including book or journal clubs and offering trainings to members who want it	
Establish formal mentor networks, possibly by expanding the YPRF program	Smith et al., 2017; Giakoumi et al., 2021; Johri et al., 2021
Lower the barriers to joining or continuing to participate in the society	Survey (this study)
Make meetings more accessible to parents through childcare options and nursing rooms	Gould, 2018; Giakoumi et al., 2021
Ensure diversity of speakers especially for high-profile symposia	Ford et al., 2019
Create an award honoring contributions to DEI, or other aspects of improving the culture of the field	
Solutions with significant costs or difficulty	
Expand the Young Professional Recruitment Fund program following alumnus suggestions including expanded mentorship and dedicated travel support	Survey (this study)
Meeting location and physical meeting spaces	Boyt, 2021
Continuation or expansion of hybrid attendance options	Niner et al., 2020; Sarabipour, 2020
Ending unpaid internships	Fournier and Bond, 2015; Chaudhury and Colla, 2021; Osiecka et al., 2021
Ending parachute science	De Vos, 2020; Belhabib, 2021; Trisos et al., 2021
RESPONSIVENESS, TRUSTED REPORTING SYSTEMS, AND TRANSPARENCY	
Solutions that are simple to implement	
Make DEI initiatives and information publicly available and transparent	
Solutions with moderate difficulty	
If we can't restrict attendance, publicize who is attending and allow people to cancel their own attendance	
Solutions with significant difficulty	
Information sharing about problematic members between conferences	
SOLUTIONS THAT WILL IMPROVE ACCOUNTABILITY	
Solutions that are simple to implement	
Prioritize diversity and transparency in nomination and election processes	Penaluna et al., 2017
Solutions with moderate difficulty	
Expand the professional code of ethics to change the culture of the field	
Solutions with significant difficulty	
Create a process by which someone can be excluded from future meeting participation for egregious violations	
Hire an independent safety officer	

historically underrepresented backgrounds. Care must be taken when choosing which members and which research to feature to ensure that not only are we featuring members across multiple axes of diversity, but also that we are asking members from underrepresented groups to speak about their research and not exclusively about DEI topics (unless DEI topics are the focus of their work).

Make Meeting Spaces More Accessible and Inclusive

The physical spaces where annual conferences take place and their various amenities need to be considered when making meetings more accessible and inclusive to make sure that disabled members can physically attend professionally beneficial events. At all meetings, there should be clearly designated spaces within all meeting rooms for members in wheelchairs or other designated places for disabled attendees to sit, and there should be a clear pathway (wide enough for wheelchairs and without wires or other attendees' bags on the floor) to get to those spaces from the hallway of the meeting center (Boyt, 2021). Coffee breaks and other networking and social activities should include stools or chairs, as not everyone can stand for long periods of time, and there should be assistance available at conference meals featuring buffets for those who cannot reach the food easily (Boyt, 2021). To facilitate understanding the needs of members and attendees, meeting registration forms should contain an optional place to request specific accommodations they will need, or an anonymous portal for sharing such information (Boyt, 2021).

If professional societies required that event venues provide certain dedicated spaces, it would contribute to inclusive meetings. For example, requiring gender neutral bathrooms at conference venues, and placing signage indicating that people can and should use the restroom of their choice, can make meetings safer and more welcoming for trans and non-binary members, though we note that this must be complemented by member education and actions to prevent trans and non-binary members from harassment. Similarly, having a private space for nursing parents attending the meeting would increase participation by parents at a particularly vulnerable time in their career, when they may already be taking time off for childbirth or child care. Many meeting venues already offer such spaces as required by law, and others could easily do so if a request was issued by the annual conference's meeting manager or committee. Many sites or locations seeking to host meetings will readily provide such accommodations, and simply need to be made aware of the need. These easy-to-implement changes will make it easier for trans, non-binary, and/or nursing members to attend the meeting.

At coffee breaks or conference-sponsored meals, options should be available to meet a range of dietary needs including but not limited to gluten-free, dairy-free, nut-free, kosher, halal, vegan, and vegetarian. This would help ensure networking times are inclusive of people with religious, medical, or personal dietary requirements, and most event space caterers can provide these options if they are aware of the need. Making sure that there are at least some food options that all members can eat helps ensure that all members can participate in these professionally important networking evenings.

In a similar vein, many conference-associated networking events center around alcohol (we note here that there is an important distinction between events where alcohol is available and events where alcohol is centered). This may lead to individuals with a personal or family history of addiction, or with certain religious beliefs, feeling excluded from these career-building social events—and without blaming victims or excusing perpetrators, we note that the presence of alcohol may lead to additional instances of inappropriate behavior. Shifting the emphasis of networking, and the times of day when these events occur, away from alcoholic beverages reduces the likelihood that such individuals will feel excluded and may contribute to creating safer conferences.

To facilitate inclusivity for attendees who need quiet places for prayer or meditation, meetings should have a designated quiet room. This would also help provide a place of sanctuary for individuals with sensory overload or sensory processing disorders.

Nametag Options to Improve Inclusivity

Allowing members to put their pronouns on conference attendee nametags (Miles, 2021) could help normalize the inclusion of trans and non-binary members while reducing the chance of unintentional misgendering during conversations. However, the authors have observed members express confusion at the presence of pronouns on name tags, and have observed outright mockery of the concept, so we suggest doing this in concert with member education initiatives and other actions to protect trans and non-binary members from harassment. Miles (2021) also recommends using gender-neutral language in conference announcements and communications.

Some conferences provide attendees with the option to indicate on their attendee name tag (*via* a sticker, pin, or different colored name tag lanyard) that they are an ally. While this may help alert a meeting attendee from a historically underrepresented background who they can go to for help if needed, we caution that some people may consider themselves allies without necessarily knowing how to assist in common problematic situations, and additionally note that best practices state that "ally" should be a title bestowed on someone and not one that should be self-identified. We recommend that ally skills workshops and professional development training be offered to members, as the Society for Integrative and Comparative Biology does, and that this kind of training be strongly recommended or required before self-identifying as an ally with a voluntary pin.

Some conferences also allow attendees the option to indicate their comfort level with things like hugs or other physical touching *via* a sticker or different colored nametag lanyard. We have observed this primarily in the context of conferences in the era of COVID-19 when some people may be comfortable attending a meeting but still choose to engage in social distancing, but the same principle can be more broadly applicable. There are many valid reasons why members might prefer that strangers not touch them, and we are aware of cases where students have decided not to attend future AES meetings because of unwanted hugs and other touching.

Make Conference Talks and Q&A More Inclusive and Safe

An important goal of attending conferences is to catch up on research, which takes the form of watching and listening to talks

by colleagues. It is therefore important that, to the extent possible, these talks be accessible. There are typically no requirements for font sizes or color schemes in presentations (see Irish, 2020), leading to presentations that are all but impossible for some members to read, resulting in missing key information. While some conference talk slide deck designs are a matter of personal style, suggesting or requiring some minimum standards for accessibility could make the slides easier to read without infringing on individual stylistic choices.

Conference centers often have a microphone for speakers to use, for example, but many speakers choose not to use these because they incorrectly assume that anyone can hear them if they just speak loudly. Using a microphone and speaking instead of shouting tends to improve clarity and therefore understanding. Further, recorded talks, such as for recent online or hybrid meetings, are usually not required to offer closed captioning, though many chose to use this free feature during the COVID-19 pandemic. We recommend that microphone use be required for all in-person talks, and automatic closed captioning is turned on for all hybrid and online talks (see Boyt, 2021). Whenever possible, conferences should strive to make a sign language interpreter available if needed, but we recognize that this comes with a significant monetary cost. These changes would make it easier for people to read conference talk slides and hear conference talk presentations, maximizing the benefits of attending a meeting.

While the Q&A section of a conference presentation is important for the integrity of the field and professionally beneficial for the presenters, some questions are inappropriate in content or tone, and there are clear patterns in who asks more (and more hostile, and less professionally relevant) questions (Hinsley et al., 2017). Session moderators could, but rarely do, step in when inappropriately hostile questions are asked, possibly because moderators are usually less advanced in their career stage and the hostile questioner may have power over them. Clear guidelines and training for session moderators could help, as could Society leaders requesting that repeat offenders confine their questions to the boundaries of professional decorum, and possibly restricting certain repeat offenders from asking questions at all. This could potentially be tied to the Code of Conduct and/or Code of Professional Ethics. These changes would make early career presenters more willing to present their research without fear of inappropriate hostility by senior scientists who behave inappropriately, and could do so while still allowing the professionally important Q&A session.

Consider Diversity Equity and Inclusion in Awards and Grants (and If Applicable, Publications)

American Elasmobranch Society offers several competitive grants for student research, as well as honoring the best talk and poster. AES does not currently operate a society journal, but many comparable societies do. Ensuring that opportunities for these awards, grants, and publications are equitably distributed should be a priority (Johri et al., 2021).

Additionally, professional society awards are sometimes given to people who hold views or perform actions that are not compatible with the spirit of various codes of ethics or inclusivity statements, more often than not to the detriment of underrepresented groups. These views and actions are sometimes well known but dismissed as a concern since society awards are often meant to celebrate "research excellence." We suggest that recognition of research excellence should be conditional upon collegial and supportive behavior. One way to do this is to require a brief personal statement about contributions to DEI, mentoring, and similar, from each person nominated for an award. In addition, individuals writing letters of recommendation should be required to state that their nominee has, to their knowledge, consistently upheld the relevant Society code of conduct and code of professional ethics. The E&D Committee should also be consulted about whether awardees are appropriate. We wish to flag this issue within AES especially with respect to lifetime achievement awards for senior members, such as the Distinguished Fellow of the Society award.

Other Easy to Implement Solutions That Would Contribute to Diversity Inclusion and Representation

One of the benefits of belonging to a scientific professional society is professional networking. Currently, the AES maintains a member-access-only directory of current and former members as a service for those who wish to contact each other. However, a YPRF alumnus suggested that this member directory could be improved to add value to members and to make it easier for new members less familiar with the field to use. For example, if someone wanted to find contact information for leading chondrichthyan endocrinologist John Doe, they could search for his name in the directory, but the directory does not allow people to search for people in the society whose research includes endocrinology if one doesn't already know their names. This poses a barrier to full participation in the society for people new to the field, though we note that some members may have concerns about this leading to an increase in e-mails from prospective students.

Solutions That Are Moderately Complex to Implement

Provide Educational Opportunities for Members and Leaders

Some AES members do not consider DEI issues to be a priority, while others do not know the most effective ways that they can help or know the full extent of the problems. To contribute to solving these problems, the AES E&D Committee is tasked with providing member education opportunities on DEI issues including both problems and solutions (see bylaws in Supplementary Material, available online here: http://elasmo.org/bylaws). This could take the form of no-cost book or journal clubs centered on DEI readings, brief regular email updates or posts in the AES Facebook group, and more. Professional development training and webinars have significant costs associated with them, but we urge Society leadership to budget for these, because they meet a stated member need and are considered best practice.

Given the impact that professional society leadership has on the climate of the organization, some society leaders could receive specific training on building and managing diverse, inclusive, and safe communities. A variety of options exist for these types of trainings, including virtual training any time or an in-person workshop immediately before, during, or after the annual

meeting. While these workshops can be a significant expense, budgeting for diversity training is an important part of making a conference inclusive and safe (Barrows et al., 2021), and such training can even be extended to the membership at large, making the expense a better value overall for the society.

Establish a Mentor Network

An organized and supported mentor network for early career members of underrepresented backgrounds (e.g., Smith et al., 2017 for racial minorities, or Giakoumi et al., 2021 for women and gender minorities), which could take the form of an expanded YPRF program, could help members to navigate professional hurdles while building professional networks. This can include an organized meetup at the annual meeting (including mentorship for first-time conference attendees as with ESA's SEEDS program), as well as conversations during the rest of the year (as with the Association for the Sciences of Limnology and Oceanography's Multicultural Program[5]). This program could be modeled off of the successful mentorship network created and used by the organization Minorities in Shark Science (see text footnote 3) or could even operate in partnership with them and their mentors, who are either MISS members or "friends of MISS," a program for allies that includes a vetting process. We note that mentorship of underrepresented minorities often falls disproportionately on the shoulders of underrepresented minority faculty (Jimenez et al., 2019; Johri et al., 2021), and suggest that strategic society support can alleviate some of this.

Lower the Barriers to Joining or Continuing to Participate in the Society

Some professional societies allow prospective members to simply fill out a form, pay a fee, and join, while others have additional standards which can serve as barriers to entry. Until 2019, AES required all new members to have a current member as a sponsor. While the goal of this requirement was to screen out non-professional "shark enthusiasts" whose past involvement in scientific discussions at AES have been disruptive, the effect was excluding early career scientists who might not yet know any current members who could sponsor them. The decision to eliminate this requirement has helped new members to join who otherwise could not have, and we encourage other societies operating under this model to consider a similar change.

Additionally, membership fees, while vital for the operation of the society and usually designed to be affordable (AES's student member annual fee is, as of this writing, $25 USD) and/or paid by a member's institution and not out of pocket, can pose a barrier to entry and participation. The YPRF program covers the membership fees of a few early career members each year, which has contributed to growing the diversity of AES. However, other solutions can further lower barriers to participation. For example, the registration page of the 2020 virtual International Marine Conservation Congress offered people the chance to pay not only for their own registration, but to pay more to help cover the cost of prospective attendees from the Global South. Professional (non-student) AES members could be offered the opportunity at the time of membership renewal to pay more to help cover the cost of a student membership, or potentially to donate toward travel funds for YPRF awardees, which would help lower barriers to participation by reducing or removing costs for members for whom cost is a challenge.

There are also potential barriers to continued participation in the society. While AES offers a variety of types of financial support to student members (reduced cost memberships, reduced cost meeting registration, dedicated travel support, and competitive research grants), once someone completes graduate school, they no longer have access to this support. While Postdocs, early career faculty, and entry-level government or environmental non-profit employees are certainly more financially secure than graduate students, they are less financially secure than more senior members despite being treated the same by the existing AES benefits structure. Some form of sliding scale, which could even take the form of counting people as students for a few years after they graduate, would help make sure that members can still participate in the field after they complete graduate school but before they have a financially secure mid-career position.

Make Meetings More Accessible to Parents

Members who are also parents face a heavy burden as they try to remain in a competitive field, share their research, and raise children. Providing childcare at professional meetings can ensure that parents, especially of younger children, are able to fully participate. Nurturing support networks for new parent scientists along with childcare can further reduce the incidences of "leaky pipeline" that sees primarily a loss of women scientists. Offering childcare opportunities at the annual meeting can allow parents to more easily attend and benefit from the professional connections made at conferences (Gould, 2018; Giakoumi et al., 2021). We are aware of many members, but particularly women, who have not been able to attend annual meetings because of the lack of available childcare. As of this writing, we recognize that that the JMIH childcare issue has been resolved after a surprisingly lengthy set of negotiations. However, we urge careful monitoring of the situation, data collection about use of the service, and encourage other conferences to offer this option using the "best practices" that can be gathered by JMIH societies including AES.

Ensure Diversity of Speakers

While some other professional societies report significant issues with the gender or racial balance of speakers who are selected or invited to present their work at the society's conference (e.g., Ford et al., 2019), JMIH operates under a different model. Anyone can submit an abstract, and almost all abstracts are accepted. Abstracts are currently screened for professional relevance only and not for perceived major impact or importance of the work. AES as well as the other societies participating in JMIH also have an annual symposium, a set of themed invited and featured talks whose presenters have access to supplemental travel funds offered by AES. While some symposium organizers have done an excellent job of ensuring speaker diversity, rules or guidelines to ensure such diversity do not currently exist, so the extent to which diversity is successfully achieved varies from symposium to

[5]https://www.aslo.org/opportunities-in-aslo/aslo-multicultural-program/

symposium (e.g., Byrne, 2021). Since the symposium consists of some of the highest-profile research at the AES meeting, and the only talks whose speakers receive official society travel support, it is important that diversity of speakers be prioritized.

Create an Award Honoring Contributions to Diversity, Equity, and Inclusion, or Other Aspects of Improving the Culture of the Field

Awards reflect a professional society's values and contribute to setting culture and other norms. Therefore, while it is extremely important to avoid giving awards to bad actors despite their other contributions, there should also be tangible professional benefits with prestige (or even associated funding) to members making important contributions in this arena.

Other Solutions That Are Moderately Complex to Implement

As previously discussed, it is important for professional societies to highlight the work of their members from historically underrepresented backgrounds. Societies such as the Canadian Society for Ecology and Evolution currently offer grants to BIPOC scientists to make outreach-focused videos about their research. This could take the form of contracting a skilled digital video editor, and a video about a scientist's work could also be offered as a prize for student research awards.

Solutions With Significant Costs or Difficulty

Expand the Young Professional Recruitment Fund Program Following Alumnus Suggestions

Results from this study show that the YPRF has been moderately successful at achieving its goals, but could be improved. These improvements would require significant society funds and other resources including time. AES, like many societies, offers competitive travel scholarships to student members after their first year. As travel costs are the main reason that YPRF scholars surveyed in this manuscript report not attending the meeting, funding in this area could make a large difference to inclusion. We suggest an expansion of AES' YPRF program, to include dedicated travel support to awardees (see Tulloch, 2020), which could help improve the diversity of attendees by allowing YPRF awardees to more easily and fully participate, and also suggest a formal mentorship program for first-time AES conference attendees (targeted at the YPRF awardees but open to anyone) as suggested by YPRF alumni.

The YPRF program could also be meaningfully and usefully expanded in other ways, possibly through partnerships with comparable programs in other societies. We also suggest the creation of a "YPRF member of the year" award which could come with a small grant for research or education purposes. This award could be based off of engagement with the program or other accomplishments while a part of the program.

Additionally, following recommendations from YPRF alumni in this survey, we recommend more fully involving awardees and alumni in goal-setting for the program. We also recommend regular check-ins and updates to the program.

Meeting Location and Physical Meeting Spaces

Like many scientific conferences, AES and JMIH are hosted in rotating locations. While regional parity is important from the perspective of travel costs, other considerations about the meeting location must also be taken into consideration. LGBTQIA+ members face a difficult choice professionally if conferences are booked in states or countries where they are not welcome due to discriminatory laws, and other members face difficult choices about attending meetings in cities that see frequent racial violence. We suggest that conference organizers take current events into account, and follow the guidelines of the State of California and not hold conferences in states where California employees cannot be reimbursed for state-funded travel without special requests. Since this list is updated regularly in response to discriminatory laws against the LGBTQIA+ community, the leadership of AES or JMIH can simply monitor the existing list without having to make their own, though we note this requires scientists who live in states with discriminatory laws to always have to travel to meetings.

It is also important that the meeting venue including lodging and offsite event spaces be ADA accessible (including parking, braille on signage ramps and elevators, accessible bathrooms, instructing conference center staff to take care not to leave AV cables on the floor of the meeting rooms, and ensuring that all venues have doors wide enough to accommodate wheelchairs) (Boyt, 2021). Additionally, any meeting-associated activities should either be held in that same location, or accessible transportation options should be provided to those who need it (Boyt, 2021). Boyt (2021) also recommends adding an accessibility officer to the meeting leadership team, who could be the point person for coordinating all accessibility issues.

Continuation or Expansion of Hybrid Attendance Options

Virtual conferences or conferences with "hybrid" remote attendance options, which have become the norm due to the COVID-19 pandemic, have made scientific meetings affordable and accessible to more people all over the world (Niner et al., 2020; Sarabipour, 2020). Though many regular attendees of annual conferences are eager to return to in-person meetings, we urge leaders to keep accessible hybrid options, which can take a variety of forms. We recognize that adding a second modality to a conference is not free, and implementing this comes with its own set of challenges. However, the accessibility benefits to a well-run hybrid meeting, including having recordings of all or many talks available after the meeting and allowing members who medically or financially cannot travel to participate in meetings, make the challenges worth undertaking. We encourage a continued discussion about how to most effectively accomplish these goals, possibly in the form of a dedicated high-level society task force.

Ending Unpaid Internships

Unpaid or pay-to-participate internships (Osiecka et al., 2021) within the field of chondrichthyan science are common. Some high-profile internships require volunteers to pay upwards of $1,000 a month to participate, with few or no known internal options for those who cannot afford to pay this amount. However, we note that MISS currently fundraises to pay for some of their members to participate in some high-level internships that would otherwise be unaffordable for them.

This means that the ability to pay for such an experience becomes a professional barrier for non-affluent students, and because of well-documented correlations between racial group and socioeconomic status in the United States (Chaudhury and Colla, 2021), diversity and inclusivity suffers (Fournier and Bond, 2015). Most societies, including AES, have no authority to govern internship payment practices in programs run by their members, but could issue a set of general recommendations for equitable technician and intern labor that members would be urged to follow, which could be part of the code of professional ethics. Or, more simply, societies could rule that society-owned communication tools, like a Facebook group, twitter account, blog and podcast, cannot be used to advertise such positions. We encourage a high-level, cross-society discussion about the issue of unpaid and pay-to-participate internships, which must consider solutions in order to increase equity and accessibility.

Ending Parachute Science

Parachute science is defined as situations in which scientists from wealthy (western) nations perform field work in a developing nation with little effort to include or train local scientific experts or share data and findings (De Vos, 2020). It is rampant in both marine science and in the broader field of ecology (Belhabib, 2021; Trisos et al., 2021). The code of professional ethics of most societies, to our knowledge, currently does not govern this harmful and common practice, but could be expanded to do so. We know of no instance where conference abstracts and research award applications are screened for this (or other issues surrounding the code of professional ethics), but such processes could be easily modified to accommodate consideration of these practices. Moreover, guidelines could be provided whereby authors and applicants would need to confirm the absence of such practices in their research, much like scientific researchers using animals must acknowledge that proper protocols were established and followed. We note that, to our current knowledge, the ethical use of animals in research is not commonly screened in abstracts, but more commonly considered by journals at the publication stage. Thus, it may be appropriate for societies that manage journals to make this change. As such, similar society guidelines could be drafted to guide journal editors in this process.

Responsiveness, Trusted Reporting Systems, and Transparency

Solutions That Are Simple to Implement

Make Diversity, Equity, and Inclusion Initiatives and Information Publicly Available and Transparent

All relevant information about DEI issues could be placed front and center in a dedicated website, as another larger society, the Ecological Society of America, has done with its dedicated page on their official website for "diversity in ecology,"[6] or in the American Geophysical Union's annual report on DEI.[7] This page includes the Society's policy statements on diversity, links to reports and task force recommendations, external resources, and ways to report issues, all in one place. AES, like many medium-sized societies, currently does not have this, but could create this relatively easily, and could also include ways for allies to help and expert-curated resources to learn more about these important issues. This could be a task for the aforementioned Outreach and Education Committee within AES, along with keeping these up to date year after year. Making this information more easily available and accessible can help members to make informed choices about their attendance and participation, and can make improvements easier to facilitate.

Many small-to-medium sized societies like AES have issued public statements about broader societal issues surrounding diversity and inclusion, but do not currently have an official society-specific diversity and inclusion statement, in contrast to larger organizations, like the Ecological Society of America. Such a statement should be created, and updates to the code of conduct and code of ethics should be tied to it, and provided in the dedicated website mentioned above.

Finally, to the extent possible without revealing confidential information, members should be kept updated about the status of DEI issues, including investigations regarding code of conduct violations, such as number and type of incidents, resolutions, and so forth. This discussion should also include more detail about reporting processes and consequences in general, as many members are unaware of these processes, and in some cases the rules aren't available anywhere. As such, careful discussions can serve as both educational opportunities and opportunities to reset culture and expectation.

Solutions With Moderate Difficulty

If We Can't Restrict Attendance, at Least Publicize Who Is Attending and Allow People to Cancel Their Own Attendance

Sexual assault is common in isolated field stations in many disciplines (see Clancy et al., 2014; Demery and Pipkin, 2021), as is sexual harassment (Women in Ocean Science report), and both occur in the field of chondrichthyan research (Graham, 2017; Whitenack, 2017; Macdonald, 2020). If this doesn't occur at a society meeting, most societies, including AES, would have no official way of responding to it, or preventing a perpetrator from attending future meetings. This means that a victim of sexual harassment or assault that occurred outside of the conference would have to decide whether to attend and risk encountering the person who harassed and/or assaulted them, or to not attend and to miss out on professional opportunities. Most often, it appears it is the latter choice. While restricting the attendance of bad actors is strongly preferred here as it punishes the perpetrator rather than the victim, this may not be possible under current society rules and bylaws. At the very least, making registered attendee lists public in advance, and offering people the opportunity to cancel their registration with no financial penalty if they learn that certain people are attending, would help members to avoid stressful or traumatic encounters.

Solutions With Significant Difficulty

Information Sharing About Problematic Members

We are aware of cases where someone has been restricted from attending one professional conference due to bad behavior,

[6]https://www.esa.org/about/diversity-in-ecology/#gsc.tab=0

[7]https://www.agu.org/-/media/Files/Learn-About-AGU/AGU_Annual_Ethics_Report_2020.pdf

and simply attends a different conference where organizers are unaware of (or more tolerant toward) that bad behavior. If someone has been restricted from attending one scientific conference because of reprehensible behavior, this information should be shared with other related professional conferences to avoid simply passing the buck between events. Similarly, information sharing between professional societies and the institutions that employ their members is important to ensure that appropriate consequences occur. This requires an accepted and somewhat uniform (or at least comparable) code of conduct and similar documents between professional societies be put in place, so that members are not banned from multiple societies without proper investigation and options for recourse. However, this should be possible once DEI-friendly society culture and norms are established.

Solutions That Will Improve Accountability

Solutions That Are Simple to Implement

Prioritize Diversity and Transparency in Nomination and Election Processes

Currently, ensuring diverse representation among possible candidates for elected society leadership positions (e.g., Penaluna et al., 2017) is not a stated priority for AES's nominating committee, so outputs vary from year to year. While there is language in the AES constitutional bylaws encouraging the E&D Committee to include members from historically underrepresented backgrounds, the burdens of service often fall disproportionately on scientists from underrepresented backgrounds (Jimenez et al., 2019), so we suggest a balance between including diverse perspectives and sharing service burdens. Making a good faith effort to ensure that there are options for candidates from diverse backgrounds would help to reverse the trend documented in this paper, showing that while AES is increasingly diverse, leadership is overwhelmingly not. Additionally, there is no process to ensure that eligible members who are nominated for positions appear on the ballot, leading to concerns that eligible and interested members from historically underrepresented backgrounds are nominated and willing to serve in leadership roles but not offered the opportunity to run in the election. Nomination methods that allow societies to provide transparency about who was nominated, and who was or was not selected to be on the ballot (and, to the extent possible, why that was), could be a useful solution to this, and could also help to prevent candidates who run for office specifically to obstruct diversity measures from being enacted.

Additionally, requiring those members that are nominated, and/or do appear on the ballot, to provide a statement explaining their interest and qualifications for such positions can eliminate elections that are essentially popularity contests, based solely upon name recognition with no information about what the candidate would actually do in the role. This last action can help to ensure that diverse candidates, who have had fewer opportunities to achieve name recognition, for all of the aforementioned reasons, can still be elected to office.

Finally, societies should also create an annual review and revised goal-setting process relating specifically to DEI issues. This should result in a detailed report available to members as well as prospective members.

Solutions With Moderate Difficulty

Expand the Professional Code of Ethics to Change the Culture of the Field

Often a professional society's rules only govern member behavior at official society events. This is generally the case with AES, for example, with the exception of the general code of professional ethics, which governs member behavior at all times (not just during the conference). However, many common issues in the field occur during the 51 weeks a year outside of the annual meeting, and expanding the role of the code of ethics could. Since most societies, including AES, have already initiated a professional code of ethics governing behavior of members outside of the annual meeting, and since members, especially, but not exclusively, elected leaders, represent the society not just during meetings, there is value in considering the role of society standards of behavior and ethics, and how they can influence behavior within the broader discipline beyond the annual conference. This could take the form of an expanded and reimagined AES professional code of ethics. This expanded professional code of ethics should include a process for investigation of violations and consequences for those violations, similar to the conference code of conduct. It should include equitable treatment of mentees, employees, and colleagues. It should include an affirmative duty for a member who witnesses violations of any sort to call them out or report them—currently the only affirmative duty is to call out misrepresentations of chondrichthyan science. A combination of member education from the E&D Committee and consequences for violating professional ethics is likely required to significantly change the culture of the field.

Solutions With Significant Difficulty

Create a Process by Which Someone Can Be Excluded From Future Meeting Participation for Egregious Violations

Despite some egregiously bad behavior by some members, there is currently no clear process by which someone can be excluded from future meeting participation. Most professional societies do not have the capacity or jurisdiction to investigate incidents that occur outside of the conference, but in cases where an external investigation occurred and due diligence was followed, a society could restrict the attendance of people who have committed unacceptable behavior, making the meeting safer for all attendees. This could take the form of expanding the professional code of ethics to include safe and respectful treatment of students in the field, including restrictions from attending the annual meeting as a consequence of severe violations of the code of professional ethics, or other possible procedures. We note here that making it easier for people from historically underrepresented minority groups to participate in meetings may be of limited value of those meetings are not made more safe and welcoming, and restricting the attendance of bad actors is key to making meetings safe and welcoming. In the past, discussions of this topic have been

dismissed with concerns about how complicated it would be to implement such a rule change, but it is vitally important.

Hire an Independent Safety Officer

The task of investigating issues that are reported can be complex. Hiring an independent, professionally trained safety officer to investigate and adjudicate violations of the code of conduct that occur at meetings is an important step, as it eliminates concerns about a "good ol' boys club" that protects some members from consequences. However, this can be a significant expense. Training a member to serve in this role can reduce this expense, though it is crucial that such a person be seen as impartial and is protected from any possible backlash or retaliation.

CONCLUSION

Professional scientific societies, and the decisions their leaders make, could play a more significant role in improving the culture and practices of science, particularly as they related to DEI issues. Although past initiatives have made progress, major issues remain.

Demographics of American Elasmobranch Society Members, Leaders, and Conference Award Winners

A key component of improving the culture and practices of an organization is analysis of and reflection upon current norms. This analysis of the demographics of AES members and leaders reveals some cause for concern. While a slight majority of AES members are women, a large majority of AES leaders are men, though the rate of (white-presenting) women in leadership positions is increasing in recent years. The AES membership is severely underrepresented in terms of racial and ethnic minorities, and the AES leadership is nearly entirely white-presenting. Though to some extent this is a consequence of who is willing to serve in a time-consuming and unpaid position, we note that despite hundreds of members, many leadership positions are held by the same individuals over and over. This level of data analysis cannot determine to what extent this is a problem with recruitment of people of color into the society and to what extent it is a problem with retaining those members, but the success of organizations like Minorities in Shark Sciences (see text footnote 3) have shown that there are hundreds of women of color who are interested in this field.

A Case Study of the American Elasmobranch Society's Young Professional Recruitment Fund Diversity Initiative

The YPRF program's goals are to contribute to a more diverse and inclusive AES. Survey responses from alumni of the Young Professional Recruitment Fund program suggest that the program is professionally useful to some (but not all) awardees, and can be made more useful with some additions and improvements to the program. Specific suggestions include dedicated travel funding for YPRF awardees that would allow for full participation in the annual AES meeting, as well as a more organized and formal mentorship program. Successfully accomplishing these goals would require additional support from AES in the form of both funding and time from leaders. This will also require dedicated leadership inside and outside of the society's formal leadership structure in the form of people willing to advocate for improved inclusivity in the society, and creating additional or improved pathways for members to speak up about their negative experiences from problematic AES members, noting that doing this can carry professional risks to the reporters if complementary actions aren't taken. Additionally, this program may benefit from organized collaboration with similar programs in other societies. We recommend additional and ongoing collection of feedback from YPRF alumni to further improve the program, including involving awardees and alumni in goal-setting and restructuring of the program.

What Can Professional Societies Like American Elasmobranch Society Do to Help?

Small to medium-sized societies like the AES have an opportunity and responsibility to improve their practices despite their resource constraints, and may even have an advantage over some larger societies to more-flexibly make the necessary changes. Here we have issued a series of recommendations, based upon established effective strategies and best practices, that AES and other societies can take to make science safer and more welcoming for all.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Arizona State Institutional Review Board permit #00013030. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Following the terms of the IRB permit, participation in the survey was considered to be informed consent.

AUTHOR CONTRIBUTIONS

DS and LF designed the study and coordinated the planning. GS designed the figures. RB performed the demographic analysis of society leaders and award winners. All authors contributed to data analysis and synthesis of recommendations.

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