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SYMPOSIUM

Best Practices to Promote Field Science Safety

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Synopsis Interventions are necessary to address the ongoing epidemic of sexual harassment and assault in field settings. An evidence-based approach to identifying specific interventions will be most effective at promoting the safety of scientists. We present the results of a workshop conducted by experts in field biology and the study of sexual harassment and assault that identified a comprehensive set of best practices for individuals and organizations. These recommendations are grounded in peer-reviewed scholarship and are separated into four topics: culture change, accountability, policy development, and reporting. The resulting report of the workshop recommends 44 practices, categorized by the resources required for implementation, the time frame of implementation, and the level of organization responsible for implementation. The best practices that we present are designed to support individuals and organizations in the development of field safety plans.

Background

Field sites are locations or places physically removed from the traditional indoor classroom environment and are critical in data collection for scientists and their students. In addition to natural environments, field sites may also include built environments (e.g., experimental mines, rocket test sites, urban parks, and historic preservation sites). Importantly, field sites place academic participants outside the norms and structures of the academy and introduce complicating variables, including non-academic persons, terrain and/or other physically uncomfortable features, and unknown variables that may increase risk. A study found that 26% of studies published in *Ecology* and 11% of studies published in *Conservation Biology* were supported by a field station or marine laboratory (FSML; Wyman *et al.* 2009), an underestimate since this does not include non-FSML field sites. Early-career scientists and students rely on field sites to grow their professional and scientific careers (Klug *et al.* 2002); however, working in field environments presents challenges to safety and accessibility for scientists with diverse identities (Demery and Pipkin 2020). While in the field, scientists may have a less clearly defined domestic and professional separation. In this setting, most researchers spend large amounts of time in close professional proximity to one another, interact more casually among academic ranks, and develop domestic intimacy through shared meals and social time (Geissler and Kelly 2016). This environment presents opportunities for collaboration and collegiality; however, the potential for magnification of power dynamics and harassment also exists because of these conditions (McDermott *et al.* 2022). Further field work often presents higher risks of racial or sexual harassment from residents and law enforcement for historically excluded STEM identities (Black, LGBTQ+, researchers with disabilities; Demery and Pipkin 2020; Jha 2021).

Broadly, sexual harassment is rife in the scientific workplace: Higher education has the second highest rate of sexual harassment across all job sectors (NASEM 2018). In the most comprehensive study to date, Ilies *et al.* (2003) found that 58% of women faculty and staff experienced sexual harassment in the workplace. Rates of harassment in the sciences are higher than average. For example, a survey of undergraduate women in physics indicated that 74% experienced sexual harassment (Aycock *et al.* 2019). Over 10% of all women graduate students at major research universities have reported sexual harassment by a faculty member (Cantalupo and Kidder 2018), and similar patterns emerge across disciplines where women trainees are harassed by supervising men with disproportionately large power imbalances (e.g., Aycock *et al.* 2019; Freedman-Weiss *et al.* 2020; Kisel *et al.* 2020). The natural sciences are particularly impacted because of work in isolated locations such as field camps or oceanographic vessels. Clancy *et al.* (2014) found higher rates of sexual harassment in women field participants (64%), and a recent survey indicated harassment rates of 78% in marine field science (Women in Ocean Science 2022). Moreover, students in the natural and physical sciences underreport incidents of sexual harassment to workplace authorities largely because of institutional barriers (Aguilar and Baek 2020), often compounded by intersectional barriers (e.g., those that relate to interconnected factors of social categories; Crenshaw 1989, Liu 2019). For example, members of historically excluded racial groups, LGBTQ + women, and LGBTQ + professionals of color report more frequent harassment from colleagues than white and/or male colleagues (Dengate *et al.* 2019; Cech and Waidzunas 2021).

The National Academies of Science, Engineering, and Medicine released a landmark report on sexual harassment in (NASEM 2018). This report indicated that legal and policy engagement with sexual harassment has not set the larger academy on a trajectory towards resolving this ongoing problem. The central finding of this report was that harassment perpetuates in institutions because it this conduct is facilitated by organizational climate (2018). Institutions with a higher reporting risk, fewer sanctions, and less likelihood of complaints being taken seriously create permissive environments where sexual harassment can perpetuate. The Report recommends that the academy at large should work on implementing diverse, inclusive, and respectful environments; diffuse power structures and reduced isolation; support systems for those who experience sexual harassment; improved transparency; accountable leadership; and effective sexual harassment training (NASEM 2018).

Field-based science brings scholars outside the confines of traditional laboratory spaces. Thus, safety in field science necessitates procedures and policies that may not preexist in the existing operating manuals (e.g., collective rules and regulations) of STEM institutions. While organizations that facilitate field-based science are beginning to adopt better strategies to prevent and respond to sexual harassment (e.g., the Organization for Biological Field Stations), remote research brings additional physical, logistical, and psychological challenges (Swain 2017). To address the unique field-based safety concerns that of institutions, we developed a workshop centered on formulating best practice guidelines. As federal funding agencies establish new guidelines and expectations for safety plans as part of funding request submissions (e.g., Federal Register 2022), this workshop addressed a timely issue and provides a needed framework on which to scaffold actions.

Workshop design

This paper reports on the outcomes of a workshop designed to increase the visibility, intentionality, and scope of safety in field-based natural sciences disciplines, including the earth, ocean, atmospheric, and ecological sciences. "The Workshop to Promote Safety in Field Sciences"(SIFS) was organized by California State University Desert Studies Consortium (CSU-DS) and the Consortium for Ocean Leadership (COL) and was held March 24–26, 2021. Workshop organizers were A. Kelly (CSU-DS), K. Yarincik (COL), L. Zimmerman (COL), S. Murphy (COL), M. Daly (Stanford University), and E. Simpson (cooperative conflict). The workshop discussed the special problems of remote research settings in harassment prevention, target support, and incident response. Participants were tasked with identifying best practices, making recommendations, and identifying resources required to improve prevention, reporting, and response to incidents of harassment at remote field sites.

Workshop participants included both scientists from across the natural science disciplines and social scientists with expertise in the causes and impacts of sexual harassment. Participation was intentionally broad and interdisciplinary to: (1) open a dialogue between sexual harassment experts and the field research community to identify and develop best practices and recommendations; (2) begin to build, coordinate, and encourage consistency in policy setting and enforcement across field stations and oceanographic platforms; (3) develop recommendations for improved prevention of, reporting of, and response to incidents of sexual harassment instances occurring at remote field locations; and (4)

promote a safe culture for scientists conducting research at remote field stations and on oceanographic vessels.

Workshop participants adopted a set of shared operating premises at the onset of the meeting. These included a definition of sexual harassment (NASEM 2018) that includes unwanted sexual attention; "double jeopardy/triple threat," including impacts for BIPOC women (Clancy et al. 2017) and LGBTQ + people (Olcott and Downen 2020); the existence of interpersonal and structural racism (Weinreb and Sun 2023); that transgender women are women (Mattheis et al. 2020); that socio-historical cultural exclusion of women/femmes and Black, Indigenous, and people of color (BIPOC) communities enables a climate of harassing behavior (Fine et al. 2020); and that 95% of harassment cannot be adjudicated because it does not fall under our current legal structure (Goldberg 2020). These operating premises were developed by the SIFS workshop advisory committee members and presented for discussion at the beginning of the workshop to establish consensus by participants. The operating premises represented a set of shared beliefs and understandings that underpin the recommendations generated from this workshop.

Before the start of the workshop, participants identified and prioritized a series of topics in three focus areas: prevention and workplace climate, monitoring and sustainability of initiatives, and reporting/institutional obligation. During the workshop, subgroups within each category organically formed, with participants working on specific topics within a single focus area (Fig. 1). The subgroups used a template to articulate key challenges related to the topic and draft recommendations, existing resources, and resource gaps that could address the problems identified. In developing recommendations, workshop participants considered a variety of audiences, including university leadership, field practitioners and leaders, funding agencies (private and public), government agencies, professional societies, and community organizations. Once participants completed work in their first topic area, they reorganized within the same focus area and self-selected a second topic. This process was iterated twice, for a total of three topics per individual participant. Workshop organizers then compiled the completed templates and synthesized a report (Fig. 1). All participants reviewed the report prior to distribution.

Workshop recommendations and outcomes

This workshop resulted in the identification of four broad categories of recommendations and SMART

(specific, measurable, attainable, relevant, and time-based, Doran et al. 1981) goals within each broad category. The four categories were cultural change, accountability, policy development, and reporting. Within the categories, a total of 44 SMART goals were identified. Among categories, topical themes emerged, including communication (Goals 1.7, 3.1, 3.2, 3.14, 3.16, and 4.4), reporting, (Goals 3.9, 3.10, 3.12, 4.1, 4.2, and 4.3), proactive accountability (Goals 1.5, 2.2, 2.6, and 3.15), consequences and remediation (Goals 2.1, 2.4, 2.5, 3.3, 3.4, and 3.11), incentivization (Goals 1.14, and 3.18), training improvement (Goals 1.4, 1.6, 2.3, 3.5, 3.7, 3.13, and 4.5), community-level change (Goals 1.3, 1.13, and 1.17), local-level change (Goals 1.4, 1.6, 2.3, 3.5, 3.7, 3.13, and 4.5), and change through hiring and evaluation (Goals 1.15, 1.16, 3.17, 3.19, 3.20, and 3.21). Goals were evaluated for their difficulty of implementation, financial burden, and timeline, and the institutions and entities responsible for the implementation of the goal(s) were also identified (Fig. 2).

Culture change

Even with policies in place to address sexual and gender-based harassment at colleges and universities (e.g., Title IX, Meyer and Quantz 2021), members of underrepresented groups continue to experience harassment because such policies do not address its root causes or workplace culture. Many factors contribute to creating a hostile environment and more frequent incidents of sexual harassment, including a male-dominated leadership and workforce common in jobs that are considered atypical for women (Erdech et al. 1995; Fitzgerald et al. 1997; Berdahl 2007; Wilness et al. 2007; Schneider et al. 2011). Nonetheless, NASEM concluded that workplace culture is a defining feature of these environments (2018).

Scientists need to recognize inherent power imbalances within academia and the greater research community, and the need for substantial buy-in from stakeholders to dismantle, then intentionally restructure, this system—focusing on a top-down approach—to ensure diversity, equity, access, inclusion, and justice. Other institutions with male-dominated workforces and large power imbalances (i.e., the United States military; Sadler et al. 2018) have created a framework through which this may be accomplished. Greater diversity within, for example, a research program cannot be achieved if it operates within a larger system that primarily benefits a dominant culture and incentivizes maintaining the status quo (Pettigrew and Martin 1989; Reimer and Eriksen 2022). By acknowledging common truths, the global research community can start to move beyond symbolic recruitment of minoritized individu-

Legend: academic institutions 🎓; government/funding agencies $; research platforms ⚓; field practitioners 🌿; professional societies/community organizations 👥🔬; easy (light); moderate (grey); difficult (black); short-term 🕐; mid-term 🕐🕐; long-term 🕐🕐🕐

	RESPONSIBLE INSTITUTIONS	DIFFICULTY/INVESTMENT	TIMEFRAME

OBJECTIVE 1: CULTURE CHANGE

	RESPONSIBLE INSTITUTIONS	DIFFICULTY/INVESTMENT	TIMEFRAME
1.1 Establish foundational principles for ensuring diversity, equity, inclusion and justice in fieldwork. Continuously evaluate and evolve foundational principles to ensure all voices are heard	🎓$🌿👥🔬	easy	🕐
1.2 Actively work toward culture change in the understanding and valuing of equity, diversity, inclusion and justice initiatives	🎓$🌿👥🔬	moderate	🕐🕐🕐
1.3 Bring diversity and equity scholars from across disciplines into the community to build lasting, meaningful practices for sustaining diverse, inclusive and equitable environments	🎓$🌿👥🔬	moderate	🕐🕐
1.4 Project, program and institutional goals must include personal safety and a healthy workplace climate	🎓$🌿👥🔬	moderate	🕐
1.5 Funders and institutions should emphasize that project goals are not restricted to scientific objectives	🎓$	easy	🕐🕐
1.6 Establish expectations for continued assessment and evaluation of fieldwork conditions by meeting with participants before, during and after field work	🎓$🌿	moderate	🕐🕐
1.7 Normalize and implement giving and receiving constructive feedback as part of regular conversations	🎓 🌿	moderate	🕐🕐🕐
1.8 Conduct Community Readiness Assessments in advance of field trainings to assess a crew's awareness of harassment and safety issues	🎓$*	moderate	🕐🕐
1.9 Conduct scenario-based risk assessment and safety training that involve discussions and include both staff and scientists prior to going into the field	🎓$*	moderate	🕐🕐
1.10 Foster more human/interpersonal conversations in trainings	🎓$*	moderate	🕐🕐
1.11 Conduct safety trainings strategically; do not group them with other types of trainings	🎓$*	easy	🕐
1.12 Conduct bystander intervention training for staff & scientists	🎓$*	easy	🕐
1.13 Employ transformative justice services from outside, expert facilitators and the people from historically excluded communities who do this work	🎓$	difficult	🕐🕐🕐
1.14 Offer commendations at all levels for work that advances equity, diversity, inclusion, justice and safety in the field	🎓$🌿👥🔬	moderate	🕐🕐🕐
1.15 Require diversity, equity, inclusion and justice statements in the hiring process along with CVs and cover letters	🎓^	easy	🕐
1.16 Develop and populate an online inventory of university policies of tenure and promotion and hiring practices that include contributions and scholarship in DEIJ, inclusive mentoring, teaching, research, and leadership	🎓$ 👥	moderate	🕐🕐
1.17 Continue to support working groups, workshops, and other projects to build diversity, equity, inclusion, justice, accessibility, and safety in fieldwork	🎓$ 👥	moderate	🕐🕐🕐

Fig. 1a Time frame, difficulty/investment, and responsible institution(s) for objectives. Time frames are estimates within what time frame the recommendation can be accomplished or be meaningfully underway. "Short-term": recommendation may be done by leveraging existing resources. Recommendation could likely be implemented within 1–6 months if allotted the small amount of effort required. "Mid-term": recommendation may require additional institutional resources or organization that involve coordination and staff time. Recommendation may be implemented within 6–18 months. "Long-term": recommendation may require significant coordination between internal and external resources or personnel. At least one year of dedication is expected before meaningful changes are seen. "Ongoing": a standing institutional commitment and effort are required in perpetuity. Recommendation may also work to promote culture change, work that must be a consistent force over time. Difficulty/investment estimates how much effort or resources may be required to implement the recommendation. Institutional barriers to action may need to be removed or overcome, such as existing policies and practices, a lack of funding, and institutional culture. "Easy": recommendation could likely be implemented through existing organizational structures, including existing staff. Few to no institutional barriers (e.g., new policies to be developed/approved; HR processes; legal review/counsel; other bureaucratic processes and challenges) expected. "Moderate": recommendation may require additional institutional resources, a new organization, etc. Institutional barriers may or may not be encountered. "Difficult/High": recommendation may almost certainly require additional funding, resources, and/or staff time. The idea may be fairly straightforward, yet likely to encounter significant institutional barriers, need legal consultation, etc. Investment has the potential for high impact and results. The responsible institution(s) identifies the institution or organization types that have important roles or responsibilities to implement the recommendation. This might include university leadership, research platforms, funding agencies (private and public), field practitioners and leaders, professional societies and community organizations, and government agencies.
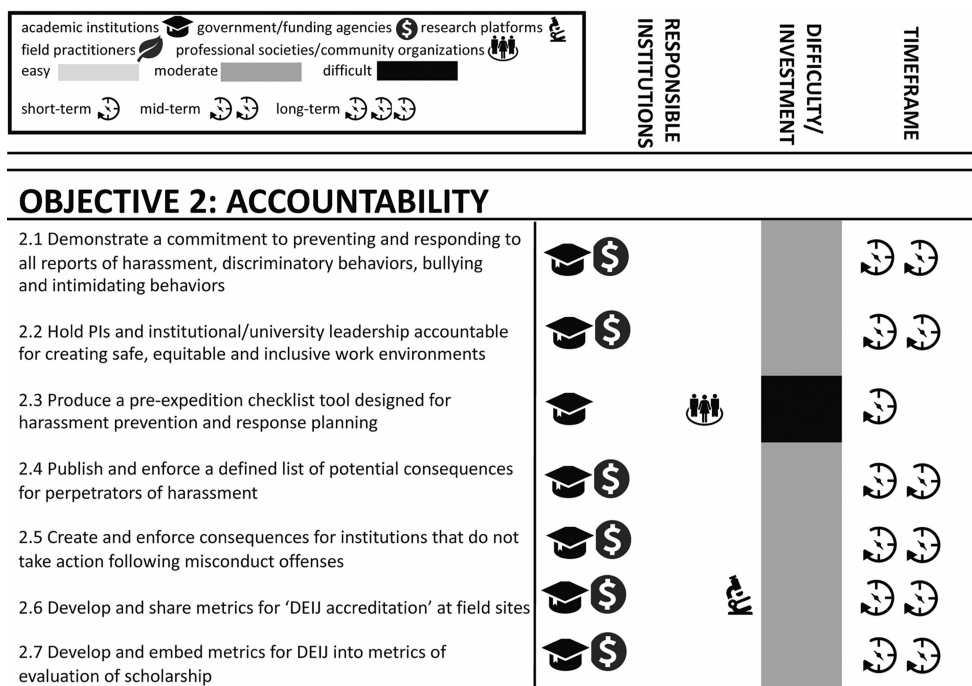
			RESPONSIBLE INSTITUTIONS	DIFFICULTY/ INVESTMENT	TIMEFRAME

academic institutions 🎓 government/funding agencies 💲 research platforms
field practitioners 🌿 professional societies/community organizations 👫
easy ▢ moderate ▢ difficult ▢
short-term 🕐 mid-term 🕐🕐 long-term 🕐🕐🕐

OBJECTIVE 2: ACCOUNTABILITY

	RESPONSIBLE INSTITUTIONS	DIFFICULTY/ INVESTMENT	TIMEFRAME
2.1 Demonstrate a commitment to preventing and responding to all reports of harassment, discriminatory behaviors, bullying and intimidating behaviors	🎓💲	moderate	🕐🕐
2.2 Hold PIs and institutional/university leadership accountable for creating safe, equitable and inclusive work environments	🎓💲	moderate	🕐🕐
2.3 Produce a pre-expedition checklist tool designed for harassment prevention and response planning	🎓 👫	difficult	🕐
2.4 Publish and enforce a defined list of potential consequences for perpetrators of harassment	🎓💲	moderate	🕐🕐
2.5 Create and enforce consequences for institutions that do not take action following misconduct offenses	🎓💲	moderate	🕐🕐
2.6 Develop and share metrics for 'DEIJ accreditation' at field sites	🎓💲 🔬	moderate	🕐🕐
2.7 Develop and embed metrics for DEIJ into metrics of evaluation of scholarship	🎓💲	moderate	🕐🕐

Fig. 1b Continued.

als, and toward implementing structures and practices that mitigate barriers to entry and successful long-term retention, sustainability/proper support, and advancement of underrepresented and/or marginalized people in a reimagined system developed for meaningful, healthy inclusion versus symbolic tokenization (Mugo and Puplampu 2022).

In addition to changing the institutional hierarchies and practices, the everyday workplace climate must be improved for all individuals. While workplace culture is the deep written and unwritten rules and practices of a workplace, workplace climate is how the experience of the workplace is perceived by its participants on a day-to-day basis (Chaudhary and Berhe 2020). Equity in hiring and promotion is essential, but true equity goes beyond participant demographics. Workplaces must be perceived as safe, healthy, and productive by all members of the community.

The recommendations below support improvement to both climate and culture that promote and sustain diversity, equity, inclusion, and justice (DEIJ), and access and safety for all. The current climate of field science is exclusionary, even in subtle ways, which has led to participation in field science that does not reflect society as a whole (Nguyen *et al.* 2022). These recommendations represent a set of tools and actions that may help institutions foster work environments that better support teams and individuals. This is a range of practices and tools that can be implemented by a wide variety of

program support staff and administrators, team leaders, managers, field coordinators, institutions, and organizations.

Establish foundational principles for ensuring DEIJ in fieldwork. Continuously evaluate and evolve foundational principles to ensure all perspectives are addressed
Explicit and clear principles provide a foundation for discussion about issues surrounding DEIJ in STEM so that all participants in field experiences share some common understanding of the systemic barriers in our organizations, disciplines, and society before engaging in dialogue to solve problems related to inequities. These principles need regular reevaluation and updating to reflect current findings from evidence-based social science research and understanding of the sources of inequities and our institutions' roles in promoting safe and inclusive environments.

Actively work toward culture change in the understanding and valuing of DEIJ initiatives
Everyone deserves to participate in science free from harassment, hostility, and violence. Increasing representation will not, on its own, bring the benefits of a diverse workforce (e.g., increased workplace safety, Butler-Henderson *et al.* 2018; greater application of the work, increased innovation, and impact, Bowman and Stoof 2019). Institutions must have leadership willing to learn and reshape power structures and build trust
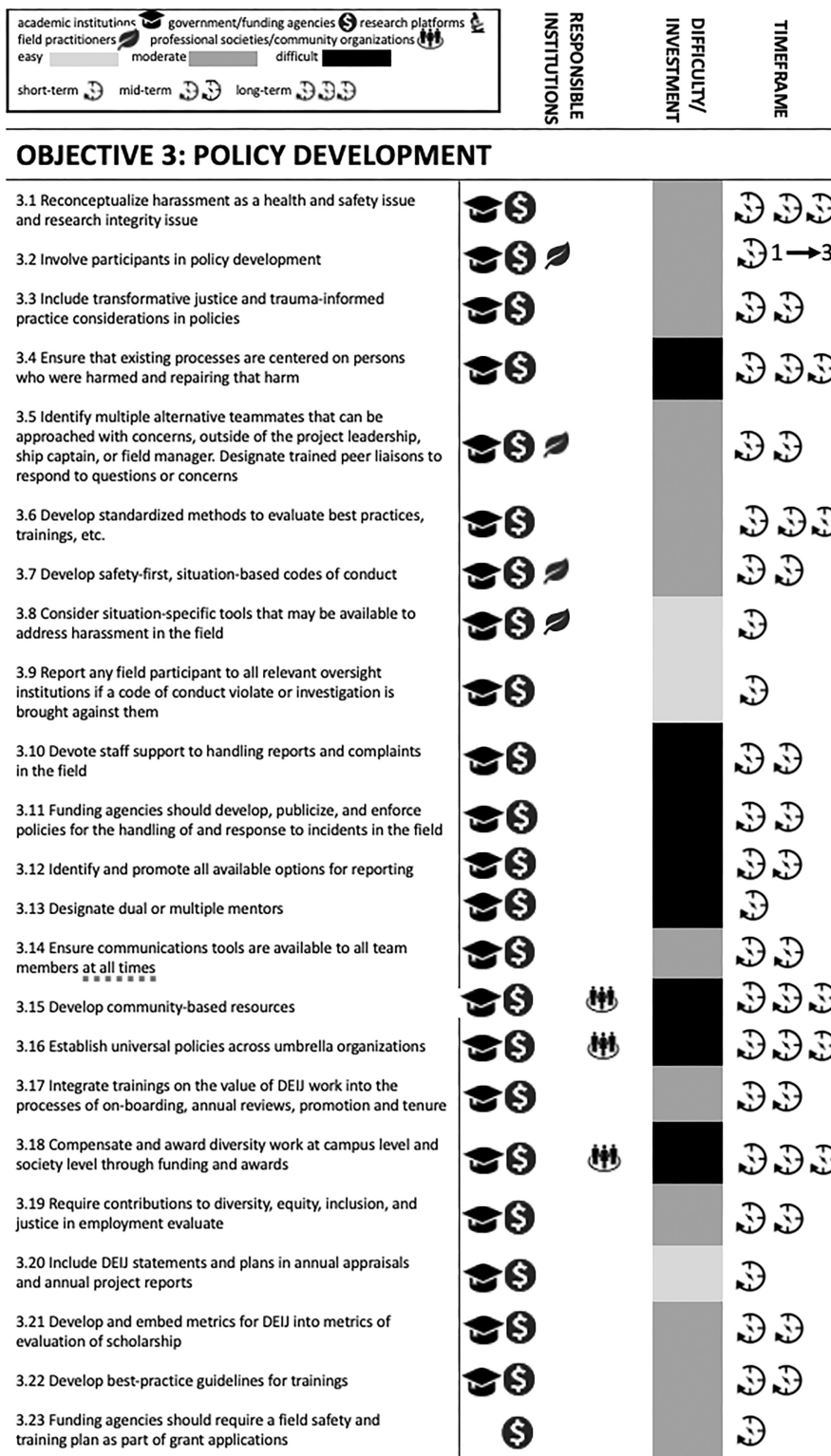
Fig. 1c Continued.

to create cultures where every individual feels equally seen, heard, developed, and engaged. This could be accomplished in part with trainings or forums that build understanding of how systems of privilege and oppression operate in the wider organizational culture and provide opportunities to learn from one another.

academic institutions 🎓 government/funding agencies 💲 research platforms 🔬 field practitioners 🍃 professional societies/community organizations 👫 easy · moderate · difficult · short-term 🕐 mid-term 🕐🕐 long-term 🕐🕐🕐	RESPONSIBLE INSTITUTIONS	DIFFICULTY/ INVESTMENT	TIMEFRAME

OBJECTIVE 4: REPORTING

	RESPONSIBLE INSTITUTIONS	DIFFICULTY/ INVESTMENT	TIMEFRAME
4.1 Clearly develop and communicate options for reporting.	🎓💲		🕐🕐
4.2 Designate a diverse set of people to report to in the field.	🎓💲		🕐🕐🕐
4.3 Develop reporting for minor transgressions	🎓💲🍃	■	🕐🕐🕐
4.4 Make communication devices and emergency transportation available to all staff.	🎓💲🍃		🕐
4.5 Develop a field climate survey.	🎓💲🍃		🕐

*Specifically, those that fund or facilitate training
^Specifically, HR departments

Fig. 1d Continued.
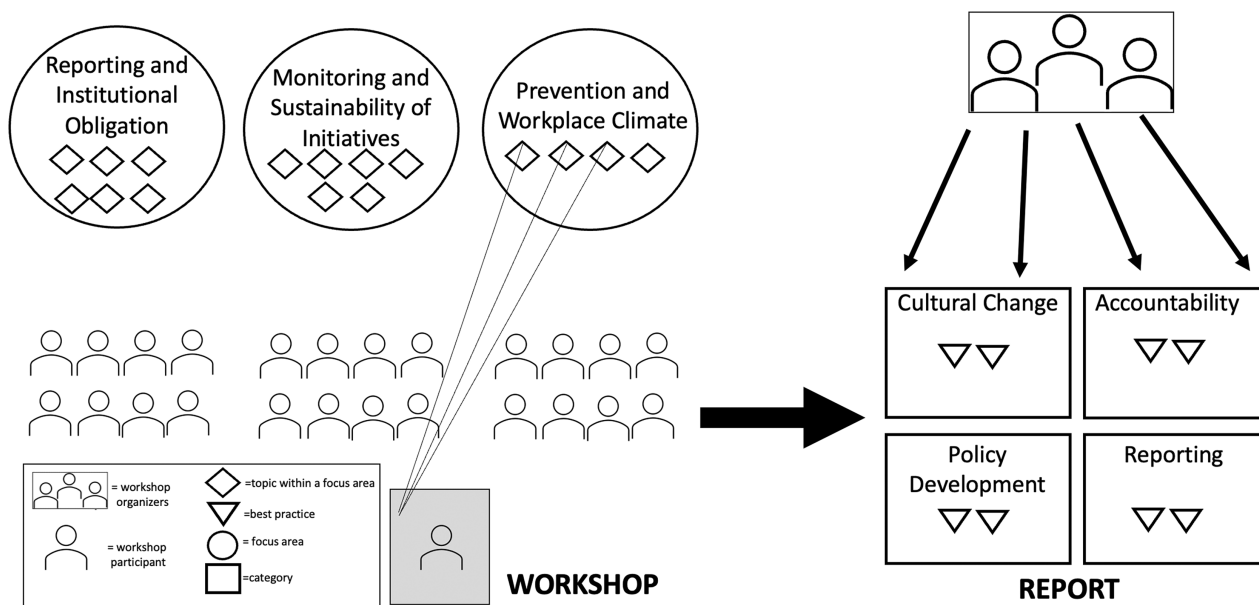
Fig. 2. Diagram of workshop structure and report preparation structure. Participants worked within single focus areas but participated in up to three topic areas within the focus area, and the workshop organizers assembled topics into four categories with best practices listed within each category.

Bring diversity and equity scholars, from across disciplines, into the field science community to help build lasting, meaningful practices for sustaining diverse, inclusive, and equitable environments

While existing diversity literature should be recognized and drawn from, there is a need to bring diversity scholars and experts directly into the scientific community and compensate them appropriately for their work. Natural sciences often lack collaborations with researchers in psychology education, science and technology studies, sociology, and organizational leadership. These disciplines bring important perspectives to DEIJ work that may otherwise be missed to support meaningful diversity initiatives and support structures (and avoid "tokenism"). A first step would be to identify scholar groups and "connectors" that can help bring together diverse disciplines.

Project, program, and institutional goals must include personal safety and a healthy workplace climate

Institutionalizing goals for safety and a workplace climate that is positive and supportive of all will create the need for concrete actions, initiatives, and metrics to reach those goals, as well as for evaluating and reporting progress.

Funders and institutions should emphasize that project goals are not restricted to scientific objectives

Emphasizing that project goals should ensure safety and a safety-reinforcing climate will incentivize reporting (informal or formal) of incidents and issues, and address reluctance to report due to perceived impact on the science mission or operations. Proposal reviewers, program officers, and project leads should not compromise safety, equity, or inclusion for scientific output.

Establish expectations for continued assessment and evaluation of fieldwork conditions by meeting with participants before, during, and after field work

Conducting formal or informal debriefs with participants can be a helpful tool to promote communication and awareness, whether in individual or group settings. Rather than waiting for complaints to come up the ladder, these scheduled check-ins with all participants should be part of the process before, during, and after field work. These check-ins can focus on both positive and negative experiences and help to identify the barriers that participants face within their work environment. Anonymized data should be collected to monitor ongoing issues and program efficacy with special care to protect individuals in vulnerable situations. Supervisors, FSML, ship administrators, or other leaders should be trained to reach out directly to participants for status checks, including those not directly in their chain of command. In addition, options for non-chain of command reporting should be made available.

Normalize and implement giving and receiving constructive feedback as part of regular conversations

Regular, open, and constructive feedback can help identify and respond to issues early, before they become severe. While it may be impossible to eliminate all issues, early response can mitigate their impacts and potential reach. Further, recognition of worker diversity and acknowledgement of existing power dynamics are essential to facilitating this feedback. If these conversations are part of the daily workplace, all parties will be less likely to view these conversations as punitive or targeted (Leyerzapf *et al.* 2018). Develop ways to normalize constructive criticism in pre-project planning conversations, onboarding, staff meetings, and more.

Conduct community readiness assessments in advance of field trainings to assess a crew's awareness of harassment and safety issues

As defined by the University of Kansas' Center for Community Health and Development, "community readiness" describes the degree to which a community is ready to act on an issue (Andersen-Carpenter *et al.* 2017). If the community is not prepared to take on new information (e.g., field safety, culture, harassment, etc.), then it will not be effective. Therefore, a community readiness assessment is a vital pre-training tool that can help training staff tailor curriculum to that community and maximize impact, but is currently widely underutilized in the field sciences. Ensure that the training staff, including contractors, includes a program evaluation component in their curriculum.

Conduct scenario-based risk assessment and safety trainings that involve discussions and include participants, staff, and scientists prior to going into the field

Field site participants, staff, and scientists must understand the risks specific to the scientific mission, including interpersonal safety. Conduct risk assessments for field environments and research teams. Project leaders, staff, and participants should work through potential emergency scenarios before traveling to the field. Identify individual obligations, including reporting and resources for witnesses of misconduct or emergency incidents. Consider barriers to inclusivity in these assessments, including needs for alternative formatting, language, and/or institutional or systemic barriers.

Foster more human/interpersonal conversations in trainings

Standalone training videos lack context or guidance throughout the viewing process and may present a barrier for low-vision individuals, and field scientists cannot assume that people implicitly understand field work harassment. Adding an element to field training that includes personal communication and human connection can better facilitate and translate the significance of field safety (McDermott *et al.* 2022). This may include an explanation of what a safe field/vessel culture includes, and how serious leaders take pre-recorded information, training, and protocols. For example, this interpersonal dialogue is needed between the crew and the captain or the marine technician of the vessel (the individual responsible for working with the science party and crew directly and providing orientation and anti-harassment policies). Post-training discussions and surveys should be implemented to gauge the effectiveness of training.

Conduct safety trainings strategically; do not group them with other types of training

Field safety training should be embedded into broader culture-change efforts. They are best offered in manageable "doses." For example, offer initial training of foundational messages pre-field work, followed by additional sessions throughout the field time or right before field assignments. These practices will help avoid training burnout (Salanova *et al.* 2000). Field safety training time should be compensated in the same ways that other work is and should not be expected to take place outside of or in addition to other work.

Conduct bystander intervention training for staff and scientists

Bystander or upstander intervention, which calls on individuals to engage in prosocial helping behavior by intervening when they witness inappropriate or harmful behaviors or actions, is one approach recommended by the 2018 NASEM report for reducing the prevalence and mitigating the negative impact of these behaviors when they occur. Bystander intervention training, such as provided by *ADVANCEGeo* (Ali *et al.* 2021), *GreenDot* (Coker *et al.* 2011), and *Building a Better Fieldwork Future* (BBFF 2023) can be transformative for field culture. These trainings teach field participants to prevent and respond to incidents in the moment and set expectations for acceptable behavior.

Employ transformative justice services from outside, expert facilitators and the people from historically excluded communities who do this work

Transformative justice is a framework and approach for responding to violence, harm, and abuse that seeks to respond to violence without creating more violence, and to reduce harm by making things right together (Nocella 2011). Transformative justice not only addresses the current incident so that the person(s) harmed feel safe and the harm is repaired, but also changes the conditions such that similar future incidents are less likely to occur. This process is best managed by an independent or third-party transformative/restorative justice facilitator. Even if such services are available at an institution, the person(s) harmed may have concern over the facilitator's (real or perceived) interest or responsibility to the institution in the outcomes of the process. Transformative justice services are offered by nonprofits or other types of small businesses (e.g.,). Institutions and funding agencies should have dedicated money or flexible and expedited grant processes available to support outside services for transformative justice.

Offer commendations at all levels for work that advances equity, diversity, inclusion, justice, and safety in the field

The current culture around DEIJ work is often negative and reactive (Spataro 2005; Kung *et al.* 2023). Creating a positive, proactive culture can help normalize the importance of this work, recognize individuals who are making a difference, and change the tone of the conversation around this topic.

Require DEIJ statements in the hiring process along with CVs and cover letters

A DEIJ statement should be viewed similarly to a research or teaching statement and may include DEIJ-related actions, goals, or personal philosophies. Develop criteria for the evaluation of these statements that addresses specific program-level features. Further, require attestations to upholding the project/program/institute code of conduct by all staff, students, primary investigators (PIs), and other participants as part of the hiring process.

Develop and populate an online inventory of university policies of tenure and promotion and hiring practices that include contributions and scholarship in DEIJ, inclusive mentoring, teaching, research, and leadership

Best practices for including DEIJ in hiring, tenure, and promotion need to be consolidated and disseminated to institutions. As there is currently large variability within and between institutions, this would provide progressive examples to universities of all sizes and potentially lead to institutional peer pressure if institutions with recognized value on DEIJ leads to stronger talent recruitment.

Individuals' promotion of safe and inclusive practices should be embedded in hiring, promotion, and tenure processes. As DEIJ-related policies are put into place, they should be evaluated for their effectiveness in reaching the diversity goals and objectives of the institutions. Metrics for evaluation will need to be identified, and these metrics themselves should be evaluated and refined so that they impact decision making and outcomes. Include education on the appropriate use and misuse of metrics used to evaluate scholarship. For example, impact factors are generally based on subscribership (which are based on generalist content for a field) and should not be used to evaluate the quality of an individual paper or scholar. Consider the full contribution of the scholar to the field, including their support of DEIJ practices and their conduct as a colleague and mentor. Priorities in hiring, promotion, and funding shape the priorities of the field and define what work is valued.

Continue to support working groups, workshops, and other projects to build DEIJ, accessibility, and safety in fieldwork

Building a continuum between activities so that they naturally build on one another to advance these common goals is important; unfortunately, funding and resources for these activities and collaboration between them are scarce. This leads to non-cohesive and disjunct efforts that may duplicate themselves or provide little continuity.

Accountability

Workshop participants identified a need for greater accountability, mainly at the institution or university leadership level, to support a positive field climate and drive behavioral and cultural change in field science communities. Accountability relates to many of the recommendations around culture change and policy development. Clear policies are part of accountability, as are transparent and effective responses to incidents of harassment.

Leadership structures matter. Leaders must demonstrate a top-down commitment to preventing harassment and supporting targets. Environments perceived as more permissive of sexual harassment can lead to greater occurrences of harassment and overall reluctance by targets to report (Benzil *et al.* 2020). Funding agencies and other external groups can play a role in accountability by developing and enforcing policies for institutions to share findings of harassment (e.g., NSF 2018). Institutions should take care that individuals are properly trained and that different pathways for reporting are held to the appropriate levels of accountability. The following recommendations illustrate how funding entities, institutions, and PIs can work together towards greater accountability when it comes to sexual and gender harassment.

Demonstrate a commitment to preventing and responding to all reports of harassment, discriminatory behaviors, bullying, and intimidating behavior

Behavior does not have to rise to the level of illegality for it to be harmful to team members and team missions. Do not rely solely on the narrow scope of Title IX to address these issues, especially in multi-institutional settings. When possible, address issues before they meet the criteria of "severe and pervasive." Address all issues of harassment and discrimination, whether they are targeted at sex and gender or not. Finally, ensure that your policies address all parties involved in a project, whether they are outside vendors, university students, agency scientists, or even the public.

Hold senior scientists and institutional/university leadership accountable for creating safe, equitable, and inclusive work environments

PIs and Chief Scientists (CSs) have a broad responsibility for safety as it relates to project success. Implementing some of the recommendations in this report can support PIs/CSs in upholding institutional policies and ensuring safety and inclusivity (e.g., developing a safety plan, developing and utilizing a pre-expedition checklist focused on safety, conducting trainings, and ensuring access to information and communication). This can be incentivized through promotion and tenure, where commitments to culture-positive contributions are valued and considered. It can also be incentivized by funding agencies by making a safety plan a mandatory and reviewed component of proposals.

Produce a pre-expedition checklist tool designed for harassment prevention and response planning

A pre-expedition checklist can be an effective resource for field experience leaders in harassment prevention planning and accountability (Hales and Pronovost 2006). A checklist should cover items such as codes of conduct, policies (e.g., alcohol and drugs, privacy, and pregnancy), training, reporting mechanisms, and resources and ensure field participants are adequately prepared and knowledgeable about proper planning, prevention, and response practices before entering the field. The checklist should be publicly available so that field participants can download and use it (Table 1).

Create, distribute and enforce a defined list of potential consequences for perpetrators of harassment

Develop a defined list of non-legal consequences for different levels of infractions, and make it known to all participants. A clear set of consequences for different levels of infractions will (1) encourage reporting by affirming that an incident deserves investigation; (2) make the consequences more transparent to offenders; (3) potentially deter behaviors; and (4) provide support to reporters and responding staff. The academy and funding agencies should lead this effort.

Create and enforce consequences for institutions that do not act following misconduct offenses

Institutions should be held accountable for responding to and taking action to address incidents of harassment. This could be achieved via external inquiries or investigations led by third parties (e.g., funding entities or agencies), which avoids the pitfalls of institutions investigating themselves. For example, if a death or serious injury takes place at a field station or on a vessel, the funding agency participates in or leads the investigation, but at present, violations of DEIJ policies

Table 1. Pre-expedition checklist

Category	Checklist Item	Responsibility
Code of conduct	Create a code of conduct that includes shared norms and values, including acknowledgement of challenges for multiple gender identity, sexual orientation, race, ethnicity, disability, religion, and other identity groups	Leadership
	Include discipline for infringing on code of conduct	Leadership
	Include expectations for international and/or external participants	Leadership
	Ensure all participants read, understand, and sign code of conduct	All participants
Prevention policies	Establish a sexual misconduct policy that clearly defines harassment and assault	Leadership
	Establish and communicate alcohol and drug policy	Leadership
	Establish and communicate pregnancy and lactation policy	Leadership
	Communicate and understand policies for accessibility, privacy, hygiene, and switching sleeping quarters	All participants
Pre-field training	Complete required institutional harassment training	All participants
	Ensure external participants have completed host institution trainings and that trainings are accessible to all participants	Leadership
	Complete interactive, scenario-based, trauma-informed bystander intervention, and/or violence prevention training	All participants
	Complete implicit bias/intersectionality training	All participants
Pre-field training	Complete required institutional harassment training	All participants
	Ensure external participants have completed host institution trainings	Leadership
	Complete interactive, scenario-based, trauma-informed bystander intervention, and/or violence prevention training	All participants
	Complete implicit bias/intersectionality training	All participants

A pre-expedition checklist can be an effective resource for PIs and other field station/ship leaders in harassment prevention planning and accountability. Such a checklist will ensure field participants are adequately prepared and knowledgeable about proper planning and prevention practices before entering the field. The template below is a draft checklist, which should be further refined and tailored to specific field site, station, or platform needs. The template should not supersede existing federal and/or state laws, or university policies, but should be used in addition to those.

(even those set forth by the funding agency) result in no penalties.

Develop and share metrics for DEIJ accreditation at field sites

Program and research leaders should create metrics for DEIJ best practices at field stations, ocean vessels, and other research platforms. Metrics can include the quality of codes of conduct, reporting mechanisms, response structures, safe and gender-inclusive facilities and policies, inclusive and accessible data collection work plans and schedules, etc. Encourage routine self-assessment and include assessments in funding proposals, routine safety inspections, and other similar reviews.

Policy development

In the field research environment, with its additional risks and lack of resources, there are far fewer and less clear policies and enforcement regulations in place than in a traditional research setting. Data from Clancy *et al.* (2014) show that 64% of respondents had personally experienced sexual harassment at field sites, and only 20% encountered sexual harassment policies at these field locations. To effectively address and pre-vent sexual harassment in the field, rules, and policies around harassment—and the consequences for noncompliance—must be clear, and the policies should be tailored to the field research environment (Nelson *et al.* 2017).

Institutional policies must be updated to reflect the values of safe and inclusive workplaces. Policies must provide structural support for targets of harassment, incentivize better behaviors and practices, and prescribe consequences for misconduct. Institutional policies should promote the cultural change needed to prevent and respond to harassment; these policies should also address the widespread and harmful harassing behaviors that fall short of the extreme and rarer cases of criminal behavior. These policies should also be target-centered by supporting the safety and careers of the targets of harassment, in addition to addressing the misconduct of harassers. Policy development must include the development of the institutional structures to support these policies, through funding, oversight, reporting structures, and trainings.

The policy recommendations here can largely be implemented at all institutional levels, from small field crews to university systems. The recommendations fall within several major themes: (a) ensuring policies protect those harmed by misconduct and center their

needs following incidents of harassment, (b) addressing harassment within existing safety policies and training infrastructure, (c) making available multiple and clearly-defined pathways for reporting and responding to harassment in the field, (d) incentivizing safe and inclusive work, (e) coordinating harassment prevention and response across multi-institutional field situations, and (f) assessing and evaluating harassment prevention and response programs.

Reconceptualize harassment as a health and safety issue and research integrity issue

Harassment and discrimination are a health and safety issue and should be included in existing safety planning, trainings, policies, and incident reporting and response. Safety plans should be required by all relevant institutions, such as funders and universities, before fieldwork is approved. Include harassment as violations of scientific ethics policies (e.g., AGU 2017). By including harassment as a violation of research integrity at the same level as fraud, the seriousness of training and prevention will be made keenly obvious and elevated to an issue of workplace compliance (i.e., O'Callaghan *et al.* 2022).

Involve participants in policy development

Involving field research participants in the development of policies and codes of conduct can better tailor them to the individual field sites, participants, and project/program goals, as well as encourage broad support from the team at all levels of seniority.

Include transformative justice and trauma-informed practice considerations in policies ensure that existing processes are centered on persons who were harmed and repairing that harm

Transformative justice addresses the current incident, so that the person(s) harmed is safe and works to change the conditions such that similar future incidents are less likely to occur (Nocella 2011). Trauma-informed practices identify and limit potential triggers to reduce the re-traumatization of victims and protect their mental and emotional health (e.g., Davidson 2017).

Investigations should center on protecting the targets of harassment, and remedying any harms, and shift focus away from protecting institutional liability. This can be accomplished by including transformative justice and trauma-informed practice considerations in policies, through consultation with expert facilitators in those fields (Nocella 2011; Davidson 2017).

Identify multiple alternative teammates that can be approached with concerns, outside of the project leadership. Designate trained peer liaisons to respond to questions or concerns

Especially in the remote settings of research vessels and field camps, identification of several people of various genders and levels of seniority who can serve as approachable points of contact for concerns and/or reporting is essential (Kirkner *et al.* 2022). People are often more comfortable talking to people of the same gender or level of hierarchy. Therefore, multiple demographically diverse liaisons should be identified to support participant questions and should represent both the science and staff sides of field research. These liaisons can be on- or off-site, but should be readily available, accessible, and properly trained to respond, answer questions, work with diverse needs and accommodations, and prepare documentation. Include options that do not feed to the Title IX office and who are not mandatory reporters, including private, no-questions-asked access for reaching resources elsewhere.

Develop standardized methods to evaluate trainings

Training programs are rarely monitored for effectiveness. Training programs should build evaluation into their structures, working with their customers and constituents and engaging experts in program evaluation to define and establish an evaluation effort based on metrics that can be monitored and used to inform revision to programs and practices. Evaluation must be properly funded to collect reliable data to inform continuous program improvement.

Develop safety-first, situation-based codes of conduct and consider situation-specific tools that may be available to address harassment in the field

Situation-specific codes of conduct should be developed to protect participant safety and the academic mission (Gaughan *et al.* 2016). These codes of conduct should clearly articulate individual misconduct that deteriorates the academic environment and prevents successful collaboration and an effective team dynamic. Codes of conduct must include the issue of the role of academic power dynamics in enabling harassment. A situation-specific code of conduct with consequences can help to navigate issues where Title IX is not applicable or effective. Importantly, the legal codes and frameworks may not be sufficiently situationally tailored to address all the unique ways in which field science risk may need to be mitigated. By creating a code of conduct and not waiting for the existing legal framework to "catch up," scientists can expedite effective change.

PIs and field leadership should research and consider employing options for responding to incidents in the field that may be available in specific situations or when Title IX will not apply. For example, maritime law may be applicable in ship-based research scenarios and offer a more agile process and options for responding to certain incidents in the field (Pineiro and Kitada 2020).

Report any field participant to all relevant oversight institutions if a code of conduct violation or investigation is brought against them

Field research often involves multiple institutions with unclear jurisdictions in cases of misconduct. In cases of reported harassment, assault, or other misconduct, reports and any investigation findings should be shared with the home institutions and funders of the alleged perpetrators, in addition to the notifying institutions hosting the research. Field participants should be made aware of and agree to this policy prior to fieldwork, and the privacy of all parties should be protected to the greatest extent possible.

Devote staff support to handling reports and complaints in the field

Dedicated personnel should be identified to receive complaints, investigate, and take timely action to reports of harassment in the field. Devoting trained staff to this endeavor allows effective response. In addition, these staff should also maintain reports to identify repeated or pervasive behavior. In cases where it may not be feasible to have such a staff person at the research site (e.g., a berth space on a ship), off-site (i.e., shore-based or university-based) staff are an option, but they must be reachable anytime by all participants by a communication device (such as a satellite phone) with full privacy and unrestricted availability. In addition, in the specific case of a satellite phone, relay calling, text messaging, translation services, and other options to accommodate diverse needs should be made available.

Funding agencies should develop, publicize, and enforce policies for the handling of and response to incidents in the field

Funding agencies should have clear policies that emphasize a broader value system beyond science output, encourage reporting, and reduce the barriers to and negative impacts of reporting. Policies can emphasize the myriad costs that result from incidents of harassment, such as harm to staff and facilities and lost opportunity for science (Marin-Spiotta et al. 2023). Policies should also emphasize consequences for individuals, such as the outcome of future funding proposals. Some agencies have developed policies that begin to accomplish this recommendation, but further steps can build on policies for handling other types of incidents in the field (see NSF 2023).

Identify and promote all available options for reporting incidents

Situationally appropriate institutional resources should be identified and deployed when an incident occurred. Redundant points of contact at each institutional resource allow for more reliable access. These reporting resources should be identified and made available to all participants in advance of going into the field, including in a secure and accessible electronic format that participants can access any time in privacy. Communication devices, such as satellite phones, and private spaces should be made available and accessible without restriction for phone calls and conversations around reporting.

Designate dual or multiple mentors/advisors (mentoring committees)

Within the academy, to reduce the power of any single supervisory individual, a minimum of two advisors should be assigned to any advisee. This is especially applicable for early-career individuals (e.g., grad students, postdocs, assistant professors, etc.). Departmental "bridge" funding should be available to support students/postdocs if they need to switch mentors/advisors so that personal financial risk is not a barrier to reporting.

Ensure communications tools are always available to all team members

Remote field work can make external communication challenging when cellular service and internet are limited. Reliable communication tools, such as satellite phones, should be accessible by anyone at any time, without a gatekeeper, for use in privacy.

Establish universal policies across umbrella organizations

Establish universal policies that can apply to the large societies/agencies that govern field work (i.e., UN-OLS, OBFS, etc.). These should include pre-, during, and post-expedition policies. Many research sites are multi-institutional in participation and/or governance, and researchers frequently move between institutions. However, gaps in institutional jurisdiction and information-sharing allow perpetrators of harmful conduct to move on to new institutions or worksites without consequence. Universal policies can include common codes of conduct and shared consequences

between organizations, such as denial of future participation, funding, or hiring.

Develop community-based resources

Resource and knowledge sharing across institutions helps to develop and disseminate best practices in preventing and responding to harassment. Scientific research itself is collaborative and cross-institutional, and anti-harassment practices should be no different. For example, community-based codes of conduct with enforceable consequences for violation (e.g., suspension, participation bans, repatriation; ADVANCEGeo 2023) can be helpful for building consistency that improves prevention, response, and scientific culture, and cross-institutional sharing of harassment reports can mitigate the "pass the harasser" problem.

Integrate trainings on the value of DEIJ work into the processes of on-boarding, annual reviews, promotion, and tenure

Integrating DEIJ trainings into various stages of career advancement, including undergraduate students, will signal that the organization takes DEIJ work seriously and better support individuals already doing DEIJ work at that organization.

Compensate and award diversity work at campus level and society levels through funding and awards

DEIJ work is often executed as an "invisible" service or labor by individuals donating their own time, money, and/or energy on top of their funded and evaluated work (Sveinson *et al.* 2022). This places a disproportionate burden on those faculty and staff committed to improving DEIJ at their institutions and ensures slower progress (Jones *et al.* 2021). Diversity work should be recognized and supported financially by institutions and societies to adequately compensate dedicated staff, incentivize more DEIJ-related work, and show a serious commitment on behalf of the organization.

Include DEIJ statements and plans in annual appraisals and annual project reports

Many institutions have incorporated COVID-19 impact statements or plans into annual appraisals and reports (Smalley 2021). Statements on diversity levels, efforts, and the impacts of DEIJ work should similarly be reported.

Develop best-practice guidelines for trainings

There are many different types of training and groups who offer them. A set of community-endorsed best practice guidelines could help institutions in identifying and selecting the right options for them. Undertaking this will require funding to support research and convening and may be done in collaboration with established groups undertaking this work (e.g., *ADVANCEGeo*). Best practices should incorporate the following: (1) Trainings that are tailored to the specific field situation and include harassment prevention and response; (2) monitoring metrics and evaluation that are built into training from the beginning.; (3) reduced training "burnout." Conduct initial foundational training before field work and then continue throughout the field time or right before field assignments; (4) Discussion integrated into the training. Standalone videos are not ideal and require context and dialogue to be most effective. As field participants and supervisors experience the trainings regularly—and may sometimes opt out because of that—a facilitated dialogue between the field teams and new science party would support team building and shared expectations of conduct; and (5) consideration of language barriers for non-native English speakers.

Reporting

Incident reporting is a critical piece of harassment prevention and response. Victims may not always recognize discrimination or may refrain from reporting discriminatory behavior for a variety of reasons, including fear of repercussions, a lack of awareness or clarity of how to report, ambiguity of rules, or dissatisfaction with results (Clancy *et al.* 2014). Reporting may be complicated because the research station or vessel may be owned and operated by a different institution from the victim's and the perpetrator's, with different policies and practices. Reporting in remote research situations is especially challenging due to the multi-institutional work sites, remote locations, small team sizes, unclear behavior expectations, and interpersonal power dynamics, among other factors (Nelson *et al.* 2017). Effective reporting mechanisms allow victims to seek justice and enable necessary consequences for perpetrators. Reporting also allows evaluation of institutional efforts to prevent harassment, provide justice, and to refine practices and policies to better serve the community. The recommendations below aim to improve and diversify mechanisms for reporting to better support targets.

Clearly develop and communicate options for reporting

Situationally, there may be one or several institutional entities that can act, and everyone should know their available options. When an incident occurs, it is important that targets or witnesses have privacy and access to reporting resources in place. Participants should have reviewed these resources in advance of the cam-

paign and have access to policies and support mechanisms. Examples include flyers in private spaces, such as quarters or restrooms, and electronic copies of resource lists that are accessible on personal devices. When multiple institutions are represented on a project, institutional reporting/responding contacts should be listed for all institutions. Third-party services outside these institutions, such as local crisis centers and national helplines, should also be included. Reporting information should also include the types of responses expected and/or services offered, such as whether the party is a mandatory reporter, a confidential advocate, a crisis counselor, or another type of responder.

Develop reporting for minor transgressions

Individual minor transgressions may not warrant a Title IX investigation, but they demonstrate detrimental behavior when aggregated. This allows issues to be raised that can be addressed without formal repercussions. A system to report minor/medium transgressions that do not lead to a Title IX investigation could enable corrections for an individual (especially if the incidents were unintentional) and establish a paper trail while protecting the victim from retaliation.

Develop a field climate survey

To identify systemic problems and provide an internal mechanism for action and improvement, a field survey/assessment should be developed. The survey should be developed by or in collaboration with experts in designing workplace climate surveys and use validated tools to ensure reliable and useful data. The survey can be anonymous. This is not an ideal tool for reporting specific incidents but can be a way to report climate and culture-related concerns ranging from individual behaviors to more systemic problems and support long-term assessment of a field station, platform, or program.

Conclusions

Recommendations for change represent a starting point. Ultimately, they can guide audiences and actors in field science in implementing new actions to improve the conditions at their sites. However, without sufficient resources and institutional buy-in, the scope of change will remain limited. We identify prerequisites needed to advance each recommendation and estimate difficulty based on resources needed from home institutions. Recommendations labeled as "difficult" should not be overlooked or delayed simply by virtue of being challenging to undertake, as many of the more difficult actions may have the potential for the highest

impact. Many of these recommendations may already be implemented or partially implemented by individual organizations or advancing through the work of grassroots groups. Sustained coordination and consistency will be key to widespread science community adoption and culture change.

Conflict of interest

No conflicts of interest to report.

Data availability

The full report produced by this workshop can be viewed online here: https://zenodo.org/record/560495 6#.Y9-V8y-B0rZ

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