Gender inequality in the practice of international marine science: case study on the International Council for the Exploration of the Sea

Ellen Johannesen
GENDER INEQUALITY IN THE PRACTICE OF INTERNATIONAL MARINE SCIENCE

Case study on the International Council for the Exploration of the Sea

by

ELLEN JOHANNESEN

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GENDER INEQUALITY IN THE PRACTICE OF INTERNATIONAL MARINE SCIENCE

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Gender Inequality in the Practice of International Marine Science

Case study on the International Council for the Exploration of the Sea

Ellen Johannesen
Canada/Denmark

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of
Doctor of Philosophy in Maritime Affairs

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No. 33, May 2024
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Abstract

The UN Decade of Ocean Science for Sustainable Development aims at transformative change to connect people and the ocean. Innovation necessary for transformational change requires diverse perspectives, therefore women’s perspectives and equal participation are crucial for Ocean science. However, there is widespread evidence of underrepresentation of women especially in governance and decision-making roles. This dissertation aims to critically analyse how gender inequality persists within marine science for the sustainable use of the ocean and to contribute to developing the essential awareness of and strategies for addressing this issue.

Using an intergovernmental marine science organisation as a case study, a feminist participatory action research approach was employed to examine the mechanisms contributing to gender inequality in the International Council for the Exploration of Sea (ICES).

Systematic collection of self-identified gender-disaggregated data is generally lacking across ocean and marine scientific institutes and organisations. This study set out to make visible the state of gender equality and establish a baseline of gender representation in ICES.

Analysis of specific parts of scientific practice, including conference participation, ocean-going field work, and institutional process, in addition to the perspectives of women working in the network, were used to identify barriers and solutions for progressing gender equality. Among the key findings, collection and analysis of gender-disaggregated data is critical to make visible inequality, establishing that while women are well represented at early career stage and as experts working within the ICES network, clear and persistent gender inequality is present at decision-making and senior levels within the organisation.

Cultural and structural barriers for women in ocean-going research were identified, including behavioural norms, family care responsibilities, gender-insensitive ship facilities, and safety concerns. Interventions such as awareness raising, gender-sensitive design of research vessels, and enhanced implementation of gender equality policies are proposed to address these challenges and improve the conditions and representation of women in marine science.

Systemic change should be driven through participatory approaches, recognising the role of formal and informal actions and work towards continuous implementation of gender equality plans to drive institutional transformation.

Interviews with women connected to the ICES network underscore paradoxical perceptions of gender inequality, revealing interpretations influenced by postfeminist sensibilities. Subsequent analysis reveals a nuanced understanding of
barriers and solutions, emphasising the need for multifaceted approaches addressing institutional gender inequality through awareness, understanding, and action at individual, institutional, and societal level, as well as challenging the status quo through disruptive interventions like quotas.

Science institutions that operate gender-blind, without acknowledging the role that gender plays in shaping the formal and informal aspects of institutional practice and culture can inadvertently continue to reinforce gender bias, acting as a barrier to the advancement of women to leadership levels of marine science. Based on the key findings, recommendations are presented for improving gender equality in marine and ocean science.

**Keywords:** gender equality, gender inequality, ocean science, feminist participatory action research, ocean decade, empowering women, gender-disaggregated data.
### Abbreviations

<table>
<thead>
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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>ASC</td>
<td>Annual Science Conference (of the International Council for the Exploration of the Sea [ICES])</td>
</tr>
<tr>
<td>DEI</td>
<td>Diversity, Equity, and Inclusion</td>
</tr>
<tr>
<td>FPAR</td>
<td>Feminist Participatory Action Research</td>
</tr>
<tr>
<td>ICES</td>
<td>International Council for the Exploration of the Sea</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goal</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, Technology, Engineering, Math</td>
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</tr>
</tbody>
</table>
1 Introduction

The importance of gender equality in ocean science and governance institutions is the focus of the project *Empowering Women for the UN Decade of Ocean Science for Sustainable Development* of which this PhD dissertation is part. The interconnection between gender equality and sustainability initiatives is globally recognised in Agenda 2030 and the 17 Sustainable Development Goals (SDGs; Azcona & Bhatt, 2020). While the SDGs are framed as interconnected, the connection between gender equality and ocean health is not explicit in the SDG indicator framework. Marine and ocean science and governance are slow to mainstream gender into their practice, and there are specific challenges to address continuing gender inequality.

The International Council for the Exploration of the Sea (ICES) is a relevant and central organisation to study the role of gender inequality, as it provides marine science for ocean governance in the North Atlantic. Making use of insider access, ICES forms a case study where a Feminist Participatory Action Research approach was adopted to further examine the gendered power structures within the organisation.

1.1 Gender equality, international perspectives, and the sustainable use of the ocean

When this PhD research began in November 2019, the Global Gender Gap report from the World Economic Forum (WEF) that compares the status of gender parity across four main areas of economy, education, health and politics, reported that it would take less than 100 years to close the gap under business as usual (World Economic Forum, 2019). Four years later, following a global pandemic, multiple wars, and the accelerating effects of climate change, the gap has increased, with the projected time to achieve gender parity now estimated at more than 130 years (World Economic Forum, 2022). The WEF analysis also reports that the representation of women in leadership roles compared to entry level in Science, Technology, Engineering, and Mathematics (STEM) is worse than in other professions (World Economic Forum, 2022).
This PhD research also began during the planning phase of the UN Decade of Ocean Science for Sustainable Development. During the early phase, the Ocean Decade and its originally planned six outcomes lacked direct acknowledgment of humans and social science as integral to the aims of the Decade and part of the ocean. The opening panel of the first global planning meeting for the Ocean Decade, held in Copenhagen in May 2019 did not include any women or early career perspectives. The importance of representation in science was better highlighted in the zero-draft implementation plan, where the notion of transformation was described as being central to the Ocean Decade and the aim for “Ocean science that is transformative because of who is doing it or where it is being done and that strives for generational, gender and geographic diversity in all its manifestations” (IOC-UNESCO, 2020). Following the regional planning workshops, an additional outcome was added: “An inspiring and engaging ocean where society understands and values the ocean in relation to human wellbeing and sustainable development.” (IOC-UNESCO, n.d.). These oversights of the human dimension are symptomatic of the epistemic inequalities described by Hornidge et al. (2023) that exist in ocean science, where the full range of relevant scientific disciplines and ocean knowledge systems is not recognised or valued at the marine science–policy interface. The dominance of white male ideologies in western culture has prevailed in ocean science and suppressed other ways of knowing, limiting diversity of thought and representation (Hornidge et al., 2023).

Recognising the inequalities that exist in ocean science and governance institutions is necessary in pursuit of Agenda 2030 and the 17 SDGs. The SDGs aspire to contribute to creating a more sustainable future for all; they are interdependent, with potential co-benefits and trade-offs between them that may influence reaching all the goals (Singh et al., 2018). In their analysis of the relationships between the goals with focus on SDG 14, Singh et al. (2018) found SDG 5: Gender equality - positively associated with the achievement of SDG 14: Life below water.

With women underrepresented in decision-making roles across STEM fields, including marine and ocean science (IOC-UNESCO, 2020), elevating female participation, supported by appropriate institutional structures, can contribute to sustainability. Working towards greater inclusion of women, greater capacity and a broader spectrum of experiences pertinent to the utilisation of ocean resources can contribute to sustainable development. Gender, as well as race and class, can operate as an organisational structure, reproducing inequalities through the masculinisation and feminisation of different roles (Acker, 2006). From a procedural perspective, the idea that gender inequalities are best addressed by incorporating gender analysis across stages of policy development is known as “gender mainstreaming” (Curtin, 2014). Advocates of a gender mainstreaming approach aim to ingrain a gender lens into the formal and informal institutional policies and practices to address inequality (Curtin, 2014).
The concept of social-ecological systems (Berkes & Folke, 1998), is a framework for understanding the complex ways in which the environment and people are interconnected, especially in the context of the use of resources. The ocean is often framed as a social–ecological system, where emphasis is placed on the connections between different parts of the systems and subsystems necessary to make change and manage human activities in support of sustainable development. The institutions that govern the use of resources are critical parts of the ocean social–ecological system. Good governance and democratic institutions are needed to support the achievement of the SDGs (Glass & Newig, 2019). It is important to acknowledge that women continue to be underrepresented in senior roles of ocean science and that more and better data is needed (Brooks & Déniz-González, 2021) to understand and document the ongoing leadership gap. By making visible the contributions of women in ocean sectors such as fishery management, as advocates for approaches that protect a common interest, and recognizing important contributions to sustainable development through inclusive approaches, the ocean is recognised as a social-ecological system that requires women at all levels of ocean governance (Gissi, et al., 2018). Women contribute to the state of the ocean, as both resource users and in conservation work. As ocean stakeholders their diverse perspectives are needed for sustainable resource management, and it is the right of women to equally contribute to ocean science.

As a concept, sustainable development aims to balance economic prosperity, environmental health, and societal equality. Societal equality is intimately linked to human–environmental interactions and therefore is at the heart of the United Nations Agenda 2030 and the SDGs. While the 17 SDGs are framed as interrelated and pivotal to achieve the aims of Agenda 2030, the sectoral focus of each goal can lead to fragmentation. The intersections of SDG 5 Gender equality/Achieve gender equality and empower all women and girls and SDG 14 Life below water/Conserve and sustainably use the oceans, seas, and marine resources for sustainable development are in focus in this research.

Of the agreed indicators for SDG 5, Indicator 5.5 “Ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life” is most relevant to this research.

As part of the implementation plan for SDG 14, the UN Decade of Ocean Science is beginning to mainstream gender equality into its strategic delivery plan with focus on women’s empowerment (Sun, et al., 2022). To achieve SDGs 5 and 14 will require transformational change to current practice to ensure all genders have equal opportunities to contribute to ocean science.

The global commitment to the SDGs recognises that the major challenges facing humanity will require the broadest range of diversity of ideas to stimulate innovation.
and adequately address the needs of all. While gender equality is a right, the ‘business case’ is frequently highlighted, related to how greater gender diversity in companies can significantly contribute to economic growth, provide a source of new talent, and contribute to corporate performance (McKinsey & Company, 2017). Efficiency gains through better gender equality in decision-making may be realised through improved quality in representation, outcomes and performance, as well as embracing new agendas (Profeta, 2017). Research has shown that collective intelligence in groups is positively correlated with the proportion of women (Riedl et al., 2021). Science benefits from diversity and gender balanced representation by improving mechanisms and outcomes of teamwork and by including a greater range of perspectives for problem identification and solving (Nielsen, et al., 2017; Yang et al., 2022). International marine science is a group activity that necessarily requires a broad range of perspectives and expertise to solve challenges.

International environmental frameworks formalise multilateral cooperation to address major global challenges. Explicit gender equality provisions are found in many international environmental frameworks dating back to the 1980s and 90s, as indicated by Table 1.1.1.

<table>
<thead>
<tr>
<th>International Environmental Framework</th>
<th>Year of first inclusion of gender equality provisions</th>
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<tr>
<td>International Union for Conservation of Nature</td>
<td>1984</td>
</tr>
<tr>
<td>United Nations Convention to Combat Desertification</td>
<td>1994</td>
</tr>
<tr>
<td>The Beijing Declaration and Platform for Action for Women, with Section K on environment</td>
<td>1995</td>
</tr>
<tr>
<td>United Nations Framework Convention on Climate Change and the Lima work programme on gender</td>
<td>2014</td>
</tr>
<tr>
<td>Post-2020 Global Biodiversity Framework adopted by the Convention on Biological Diversity</td>
<td>2018</td>
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The inclusion of gender specific provisions in these conventions highlights the importance of specifically acknowledging differential impacts of environmental issues on different genders and the promotion of equality in the realisation of effective environmental management while contributing broadly to the SDGs (Azcona & Bhatt, 2020).

The UN Convention on the Law of the Sea (UNCLOS) is gender-blind, in other words it fails to specifically attend to gender dimensions. Gender sensitive provisions are now starting to be included in UN instruments, for example the recently agreed Biodiversity Beyond National Jurisdiction Treaty. However, Ocean affairs overall have been slow to incorporate gendered perspectives (Goettsche-Wanli, 2019). For example, SDG 14 does not include any gender equality targets or
indicators, which is problematic given the importance of the Ocean for livelihoods (UN Women, 2019). It wasn’t until 2020 that the UN Decade of Ocean Science for Sustainable Development recognised the role of gender by endorsing a specific programme on empowering women. The UN Regular Process for Global Reporting and Assessment of the State of the Marine Environment (World Ocean Assessment) will now, in its third cycle (2021–2025), include gender as a cross-cutting theme and as a specific chapter in the report.

Article 8 of the UN Convention on the Elimination of All Forms of Discrimination against women (CEDAW) specifically requires that:

> States Parties shall take all appropriate measures to ensure to women, on equal terms with men and without any discrimination, the opportunity to represent their Governments at the international level and to participate in the work of international organizations.” (CEDAW, 1981, Article 8).

All ICES Member Countries except for the US have ratified this convention.

At the global scale, women’s access to leadership in international organisations, such as UN specialised agencies including the World Health Organization, United Nations Education, Science and Culture Organization, and International Monetary Fund has been associated with times of crisis or organisational instability (Haack, 2017). This is sometimes referred to as the “glass cliff”, the metaphor used to describe the risky or precarious organisational conditions that exist when women leaders are appointed to an organisation for the first time (Ryan and Haslam, 2005). Limited access and precarious conditions for women’s leadership in international organisations requires institutional reform.

The Global Ocean Science Report (2020), which aims to provide a status and trends of global ocean science capacity, has sensibly revised the language of the key finding (compared to the 2017 report) on gender, confirming that “Women in ocean science continue to be underrepresented, particularly in technical categories” (IOC–UNESCO, 2020, p.25). In 2017, the “key finding” stated that “There is more equal gender balance in ocean science than in science overall. Female scientists represent on average 38% of the researchers in ocean science, about 10% higher than science overall” (IOC–UNESCO, 2017, p. 21). However, the quality and completeness of the data and figures make high-level generalisations difficult to justify. Overall, this 2017 key finding continues to reinforce a dominant perception that women are already included and therefore no additional actions to improve equality in ocean science are needed. The idea that ocean science is doing better on gender representation than other science disciplines is hard to justify when acceptable metrics are not available and basic gender-disaggregated data collection is not standard (Kitada et al., 2023).
1.2 Gender inequality in marine science

Although women may not always be visible in the history of science, they have been participating and making careers in science since the development of science as a profession (Jones, 2019). However, there is a well-documented history of discrimination that has been slow to change (Horrocks, 2019).

Marine and ocean science are broad terms that encompass a wide range of disciplines, commonly studying biology, chemistry, geology, and ecology as well as human dimensions of the seas and ocean. In the ICES context “marine science” is the term frequently used.

Although discrimination and harassment based on gender in the workplace are illegal, the legacy of male dominance in institutions and organisations continues to affect the careers of women today (Ford et al., 2021). Masculinised working cultures can continue to exclude and disempower women. Gender stereotypes contribute to gender bias that can contribute to limiting women’s career advancement (Heilman, 2012). The Role Congruity Theory (Eagly & Karau, 2002) suggests that women in leadership face a double bind by being perceived less favourably than men for leadership positions, as well as being evaluated differently than men as leaders.

A critical feminist perspective of the continued underrepresentation of women in leadership positions in marine and ocean science could interpret this condition as a manifestation of the continued implicit and systemic bias prevalent in a patriarchal society that accepts men’s primacy and the subordination of women and other gender identities.

Evidence of women being underrepresented in the sciences continues to be documented through a variety of approaches, including through documentation of productivity using bibliometric analysis (e.g. Huang et al., 2020; Elsevier, 2020). These bibliometric approaches consider gendered disparities in peer-reviewed publications, useful for understanding publication trends between genders and potentially identifying sources of bias; they are, however, limited for assessing contributions of female scientists more broadly because they only account for scientists who publish work in peer-reviewed publications and exclude operational science practitioners.

The historical domination of men in marine science means that field work is often also not designed to be inclusive of different kinds of people and identities. At sea, women more often experience bullying and harassment, although the full extent is unknown, with a low rate of formal reporting of these incidents (Maia, et al., 2024). Creating safe work environments for ocean science in field work contexts is critical to improving access for a greater range of social identities in ocean science (Amon, et al., 2022).
Gender inequality in science workplaces manifests in a variety of ways, including through the underrepresentation of women in leadership roles (IOC–UNESCO, 2020), as well as discrimination, harassment, the gender pay-gap, and inequity in funding (Shen, 2013; Roper, 2019). The effect of implicit or unconscious bias in science has been shown to favour men, with greater opportunity, salary, and mentoring opportunities offered to male candidates as compared to female candidates with identical qualifications (Moss-Racusin, et al., 2012).

Gender microaggressions are a type of harassment, often experienced by women, that encompass subtle, frequently unintended, and unconscious verbal or behavioural actions that communicate negative or derogatory slights based on an individual's gender. (Kim & Meister, 2023). As reported by Kim and Meister (2023) “These experiences can ignite highly negative reactions, sparking rumination, hypervigilance, and overcompensation, which can facilitate depletion and burnout, leading highly qualified women to question their leadership ability and identity.” (p. 526) Cumulatively, bias and harassment can contribute to the underrepresentation of women in STEM leadership roles.

Critical perspectives of the norms and values that shape science are needed to reveal how they contribute to continuing gender inequality. In science and academia “merit” and “meritocracy”, the idea that compensation, reward, or advancement is based on an individual’s skills and/or competence, is a dominant narrative. Greater critical reflection on the concept of merit is needed to question the criteria used to assess merit, recognise the complex ways unconscious bias can confound ‘objective’ assessment, and recognise that social identity factors can create different starting points and can impact opportunities for advancement. This ‘meritocratic ideology’ prominent in STEM fields creates the conditions to reproduce a cultural hegemony that conceals gender bias, and stalls systemic change (Seron et al., 2018). Focus on self-promotion and individualism favours the advancement of men, and the male dominated cultural hegemony means male sponsorship, mentorship, and networks continue to reinforce the advancement of men and exclusion of women (Bagilhole & Goode, 2001). Merit might not “stick” to competent individuals if there is a mismatch between occupational identity and social identity, for example when women enter male dominated occupations such as marine science and/or leadership roles (Simpson & Kumra, 2016). Efforts to diminish bias, especially within organisational settings that prioritise meritocratic values, can inadvertently activate unconscious biases in individuals that discriminate against women (Castilla & Benard, 2010). The continued attachment to the ideals of meritocracy in science can conceal gender bias, making it difficult to address (Nash & Moore, 2019). By critically reflecting on the concept of merit, organisations and institutions can identify and challenge practices that perpetuate gender inequality and consider more inclusive definitions of merit that recognise a broader range of skills including those associated with femininity and/or other marginalised identities.
1.2.1 Gender and ICES

ICES is an intergovernmental organisation with 20 Member Countries and operates as a platform for marine science coordination in the North Atlantic Ocean. The secretariat based in Copenhagen, Denmark coordinates and supports a network of more than 6000 mostly nationally delegated scientists. More than 1500 of these experts participate annually in the work of more than 150 expert working groups covering a range of thematic marine science areas across science, data, and advice and contributing to sustainable management of human activities in seas and oceans. Delegates from academia or non-governmental organisations may also participate at the specific request of working group chairpersons.

Established in 1902, ICES is one of the oldest intergovernmental organisations in the world. The organisation was initiated through a “gentlemen’s agreement” (Rozwadowski, 2002) and then formalised into an intergovernmental organisation, with the convention signed in 1967. The ICES Secretariat administers the expert nominations from member countries through a central database, which has never collected information on the gender of participants. In many respects the organisation has been operating ‘gender-blind’ for most of its history.

At the international level, marine science facilitates ocean science diplomacy, a process that claims to support progress towards greater sustainability through capacity-building and cooperation, dissemination and exchange of knowledge, and research coordination (Polejack, 2021). With its long history, ICES has played a leading role in developing approaches that have been recognised as a model for modern frameworks for science diplomacy based on its explicit recognition of the necessary connection between science and policy (Robinson, 2020). In a historical analysis of the role of ICES and its contribution to science diplomacy, the influence of individual scientists in creating unique institutional structures for the practice of international marine science is highlighted (Robinson, 2020). Institutions set the “rules of the game” through the norms, practices, and beliefs adopted by institutional actors. When combined with a critical feminist perspective, this begs the question of whether a more sustainable future for the ocean can be realised if the institutions and organisations that generate the evidence for governance and decision-making continue to reinforce gender inequality.

In 2012, the first female General Secretary, Dr. Anne Christine Brusendorff, took office, more than 100 years after the organisation was created. To date, no woman has ever held the office of ICES President (32 Presidents have served up to 2024). Figure 1.2.1 depicts photos of the ICES Council meeting over time, visually demonstrating how little gender and diversity representation has changed, sustaining the dominance of white male perspectives. In the 2019 Strategic Plan, ICES committed to working towards a more “gender balanced” institution (ICES, 2019), a statement Dr. Brusendorff pushed to include, despite internal resistance at
the level of the executive committee (Sun, et al., 2021). The inclusion of this commitment indirectly recognized the existence of gender inequality and the need for specific actions to attend to improving the lack of gender equality within the organisation. The motivation to champion this commitment reflected Dr. Brusendorff’s personal experiences with gender inequality on the job. As the General Secretary, she was able to highlight the importance of addressing gender inequality through an institutional commitment to change. A gender mainstreaming approach, influenced by the conduct of this PhD research, was central to raising ICES institutional awareness and to call attention to the historical lack of recognition of gender inequality across the organisation.

Figure 1.2.1 Photos of the Council meeting in 1904 (top-left), 1948 (top-right), 1988 (bottom-left), and 2018 (bottom-right), demonstrating how little gender representation has changed over time at the Council level. Reproduced with permission from the ICES archive.
1.3 Definitions of central concepts

**Gender and gender equality**

The Gendered Innovations project (Gendered Innovations, n.d.) defines the concept of gender broadly:

Gender refers to sociocultural norms, identities, and relations that: 1) structure societies and organizations; and 2) shape behaviors, products, technologies, environments, and knowledges (Schiebinger, 1999). Gender attitudes and behaviors are complex and change across time and place. Importantly, gender is multidimensional (Hyde et al., 2018) and intersects with other social categories, such as sex, age, socioeconomic status, sexual orientation and ethnicity.

For the purpose of this research, a broad definition of gender as a social construct, and going beyond the binary of male and female has been adopted.

The European Institute for Gender Equality (EIGE) defines Gender Equality as “Equal rights, responsibilities and opportunities of women and men and girls and boys” (EIGE, n.d.)

While this research focuses primarily on inequality experienced by women, a more inclusive definition of gender equality is adopted, recognizing that gender is not a binary concept (Wade & Feree, 2023). When gender is accepted as a concept that goes beyond the binary of female and male, the concept of gender equality must also be expanded to include the aim to realise equal rights, responsibilities and opportunities for people of all genders.

**Gender equality and inequality**

Gender equality and inequality are interconnected in complex ways that may not always be linear (Van den Brink & Benschop, 2012; Grzelec, 2024). Gender inequality arises when rights, responsibilities, and opportunities between genders are not equal.

**Human rights**

A human rights–based approach to recognizing gender equality provides a legal entitlement for all people, with a requisite responsibility for States to act to ensure this fundamental condition (Goonesekere, n.d.). Human rights as a concept and legal basis aims to create the conditions for a fair and just society capable of realising the full potential of human opportunities, of which gender equality is an integral component. There are multitudes of UN agreements that enshrine human rights and gender equality and provide the legal framework to advance the status of women and improve gender equality globally. Among others, these include the Universal Declaration of Human Rights (1948), the Convention on the Elimination of All

**Empowerment**

The concept of women’s empowerment can be interpreted in multiple ways, for instance from a neoliberal perspective, focused on the individual and instrumental value of empowering individual women from an outcome and economic perspective (Bacqué & Biewener, 2015). For the purpose of this research empowerment aims to describe and facilitate “shifts in consciousness” and “engagement with culturally embedded normative beliefs, understandings and ideas about gender, power and change” (Cornwall, 2016, p.345). Critically reflecting on the term ‘empowerment’ in discourse on gender inequality is essential for ensuring that empowerment efforts are meaningful, inclusive, and transformative rather than superficial or reinforcing existing power structures. Empowerment of women is defined as: “Process by which women gain power and control over their own lives and acquire the ability to make strategic choices.” (EIGE, n.d.)

While the idea that it is possible to effectively measure “women’s empowerment” can be contested (Kabeer, 1999), other scholars have attempted to define appropriate quantitative approaches (Richardson, 2018). While this research will not try to quantify “women’s empowerment,” it is helpful to refer to Kabeer’s (1999) conceptualization of women’s empowerment as relating the capacity to make choices to “a process of change” (p. 437) and consisting of the interrelated concepts of resources, agency, and achievement; or, as noted by Saini (2017) in her critical analysis of the science that continues to reinforce gender stereotypes, “The cloudy window of the past has so distorted how we see society that we find it hard to imagine it another way. The job ahead for researchers is to keep cleaning the window until we see ourselves as we truly are” (Saini, 2017, p. 237) Empowerment is catalysed through understanding, acknowledging, and revealing continuing inequalities; it is with this knowledge that change can begin.

**Discrimination and Disadvantage**

Overt or direct discrimination based on gender, ethnicity, dis/ability, sexual identity, or other identity markers are illegal in countries bordering the North Atlantic Ocean (the focus area of this case study, and the main source of experts to the ICES network). Nevertheless, there are still many forms of discrimination and unconscious bias that contribute to gender inequality. Sexual and/or gender-based harassment is an issue faced by many women in ocean science. While data on sexual harassment in ocean science is not systematically reported, a 2021 survey from the organisation Women in Ocean Science reported that 78% of the 980 female respondents had experienced harassment in their science workplace or educational
institutional setting. (St Clair, 2021). The ‘motherhood penalty’, is a concept that documents the effect that becoming a mother has on a woman’s career (Powell, 2021). In the science context this becomes evident in the many women that leave STEM careers after the birth of their first child, and the fewer papers published by female scientist mothers, than male scientist fathers (Powell, 2021). The gender pay-gap, and differences in funding (Shen, 2013) are also evidence of the discrimination and bias faced by women working in science fields today.

The intersection of multiple forms of discrimination based on social identity is a critical concept developed by Professor Kimberle Crenshaw known as “intersectionality” (Crenshaw, 1989). This concept highlights that the intersections of a person's identity, and systems of oppression can interact in negative and cumulative ways that affect a person's power and privilege. Racial and ethnic discrimination is also a significant problem in ocean science. In the US, “Less than 2% of graduate students and 1% of tenured faculty in Earth, atmospheric, and ocean sciences identify as Black or African American” (Isma et al., 2023, p. 56). In Kenya, gender and ethnic bias in women’s access to ocean science education has also been documented (Ojwala, 2024). Therefore, gender inequality cannot be treated in isolation, if transformational changes are to address the needs of all women.

Diversity, Equity, and Inclusion (DEI)

Diversity, Equity, and Inclusion is a framework that is used to engage and discuss the importance of addressing systemic inequalities. Diversity acknowledges difference; equity acknowledges the need for fairness and justice, and inclusion is about creating a welcoming environment for everyone. DEI is being advanced both from a social justice, but also an instrumental perspective noting the interrelations between diversity in the workforce and innovation (Kappel et al., 2023). The importance of fostering DEI in ocean science is being recognised from an international perspective, and related concepts and principles are becoming increasingly evident in policy documents, however, we are still far from realising a more inclusive and diverse ocean science workforce (Van Stavel, et al., 2021).

Many social identities are underrepresented in ocean science. Underrepresentation occurs when the membership of an organization does not feature sufficient diversity to represent the views and needs of the populations and communities affected by the actions within its mandate or scope of operation. As a result, underrepresented groups must be identified in a context-specific manner, but often include individuals actively representing the interests of LDCs, LLDCs, and SIDS; ethnic or cultural minorities; women; minority gender identities and/or sexual orientations (e.g., LGBTQIA+); low-income or other socioeconomically disadvantaged groups; those who have a form of disability; and those who are
early in their career without established professional networks. (Van Stavel, et al., 2021, p.2)

At the macroscale, calls of equity and justice in ocean science take a post-colonial perspective to note the continued disparities and unequal power relations between global south and global north researchers, and create working environments eradicated of harassment and discrimination for all minority groups, as well as making ocean research more accessible across all dimensions of diversity (de Vos et al, 2023).

1.4 Research objectives and questions

Research aim
To critically analyse how gender inequality persists within marine science for the sustainable use of the ocean and to contribute to developing the essential awareness and strategies for addressing this issue.

The following objectives are addressed in one or more of the four papers, as well as in the introduction, results, and throughout this kappa.

Objectives
1. Understand and raise awareness about the current state of gender equality in the conduct of marine science and the sustainable use of the ocean;
2. Document mechanisms that contribute to and counteract gender inequality in marine science;
3. With reference to an identified institution, and through a Feminist Participatory Action Research approach, examine gender inequality in international marine science research focused on the North Atlantic Ocean;
4. Make practical and relevant recommendations for improving gender equality in marine science.

Research questions
1. Why are so few women recruited to, retained in, and “empowered” at senior levels in the conduct of marine science?
2. How can a Feminist Participatory Action Research approach lead to improving gender equality and the empowerment of women in an intergovernmental marine science organisation?
3. How can research and evidence inform the development of gender-aware interventions in an intergovernmental marine science organisation?

4. What are potential solutions to greater female recruitment and participation in the decision-making levels in an intergovernmental marine science organisation?

In the research aim, objectives, and questions, the terms “gender equality” and “gender inequality” are both included. The research aims, objectives, and questions are designed to provide a framework for investigating the tension between these concepts, recognising that practices of gender equality and gender inequality interact in a variety of ways (Van den Brink & Benschop, 2012).

**Figure 1.3** Research objectives, questions, and papers overview.

### 1.5 Significance of the study

This research is unique in its focus on the intersection of gender and ocean governance within science institutions. It addresses a gap in the literature by examining the catalysts for initiating a process of change toward greater gender equality within an institutional setting.

Employing an in-depth case study approach to deeply explore institutional gender inequality provides value for both the case and the community studied, while also presenting findings that will be relevant through naturalistic generalisability or transferability, encouraging readers to find resonance with their own experiences or potential applications (Ridder, 2017; Smit, 2017)

Utilising a Feminist Participatory Action Research Approach (FPAR) within a polycentric network organisation offers new insights and first-hand experiences of
the utility of this methodology. The study documents concrete actions taken throughout the research process, illustrating the role of such actions in catalysing and advancing a gender equality agenda within an intergovernmental marine science network.

Moreover, by adopting an insider perspective, the research uniquely demonstrates how FPAR can be applied within the context of an intergovernmental organisation, acknowledging both its strengths and challenges. This approach not only enhances understanding of gender dynamics within scientific institutions but also offers valuable insights for promoting gender equality in complex organisational settings.
2 Theoretical framework and methodology

Theories are essential for social science research. They provide a conceptual framework for understanding, explaining, and predicting social phenomena. In this section the theories and methodology that have informed the research design and analysis are described.

Feminist theoretical approaches recognize an ongoing imbalance of power between genders and are rooted in the principle of equality for all people. Feminist approaches embrace “multiple methodological frameworks”, acknowledge the heterogeneity of women’s experiences, are reflexive and require researchers to question their own bias, and explore societal power relations – with patriarchy viewed as having a central role in reproducing current conditions. Feminist perspectives also recognize intersectionality as a core principle and tool to understand how the experience of race, class, and gender variously combine to affect the experiences of women (Kiguwa, 2019).

Feminist-systems theory (FST) combines and builds on critical systems theory and social ecofeminism but is not limited by these ways of knowing and understanding the world. Stephens et al. (2010) identify five principles for FST:

- adopt a gender sensitive approach;
- value voices from the margins;
- incorporate the environment (a social–ecological system) within theoretical research;
- select appropriate method(ologies); and
- undertake research towards social change.

(Stephens et al., 2010, p. 563)

This research project is informed by these principles, which are reflected throughout the research design. Within this research project, science is viewed as a component of a societal system that continues to enforce inequalities and requires reform to
contribute to the social change needed for a more sustainable future. Science as a concept is variously defined, but generally is an approach that aims to develop “systematic knowledge of the physical or material world gained through observation and experimentation” (Explorable.com & Wilson, 2009). Science claims its authority on the production of knowledge through this systematic process or method that is documented and reproducible. Feminist critical perspectives of science have been developing since the 1970s, questioning the claims of objectivity and authority of science, based on its reductionist approach, dismissal of other disciplines, and worldviews. (Buckingham, 2020)

Critics of early feminist approaches assessed the methods as being too focused on gender, ignoring other types of difference; challenging the validity of personal experience as at odds with scientific method; unable to effectively shift the hierarchy in relationship between the researcher and researched; and criticisms of the emancipatory goal of research as being achievable (Hammersley, 1992).

Feminist Participatory Action Research (FPAR) is adopted as the methodology for this research. FPAR focuses on addressing imbalances of power and problematization of the assumption of researcher neutrality as well as recognizing the research itself as a catalyst for change. An FPAR approach requires going beyond quantitative methods, using qualitative approaches to bring voice to the experiences of those who participate and co-create the knowledge generated from this research (Reid & Frisby, 2008). These principles are aligned with the research objectives outlined in Section 1.3.

With a goal to document mechanisms that contribute to and counteract gender inequality in marine science, centering the representation and experiences of women in both ICES and marine science, FPAR provides an appropriate framework to guide this research. Working with the network of scientists as co-creators of knowledge in the conduct of this study is also consistent with an FPAR approach. By focusing on a specific context, the FPAR case study approach can lend itself to establishing a “thick description” for learning (Ridder, 2017).

FPAR has a series of origins (Lykes & Hershberg, 2012), including action research, an approach that began to develop in the 1940s, recognizing the important link between research, social change, and the link to democracy (Westlander, 2006). Action research, as the name implies, takes focus on a specific context, and some type of change or “action”. As a method, it highlights the important links “...between understanding and change, between theory and practice, and an active co-operation between researchers and the participants in the production of new knowledge”. (Nielsen & Svensson, 2006, p.14). While early action research was concerned with driving social change through participatory approaches, feminist approaches and specific gender considerations were often excluded (Lykes & Hershberg, 2012). Participatory approaches to research aiming to promote social change recognise the
role of the ‘critical consciousness’ that can be raised through learning, and is required to recognise oppression and counteract it (Freire, 2005).

While FPAR methods have multiple overlapping aims and approaches to research as other participatory and action approaches, specific dimensions of FPAR have been developed by Reid and Frisby (2008) while acknowledging that an idealised framework should not be the goal. These dimensions are:

1. centering gender and women's experiences while challenging patriarchy;
2. accounting for intersectionality;
3. honoring voice and difference through participatory research processes;
4. exploring new forms of representation;
5. reflexivity;
6. honoring many forms of action

Many of these dimensions were realised throughout the research process, including working with the ICES community and facilitating dialogue as a tool for co-learning and co-creating the knowledge needed to better recognize and address organisational gender inequality.

Action Research can be described as a continuing spiral of interconnected cycles that revolve through diagnosis, planning action, acting, and evaluating action. This process is not necessarily linear, with phases overlapping (Coghlan & Brannick, 2005). Similarly, FPAR is characterised by iterative phases, aimed at creating change and revealing and interrupting gendered power imbalances. Based on the framework of Ely and Meyerson (2000), an illustration of the FPAR cycle adopted for this research is provided in Figure 2.1.
Using ICES as the specific context (see Section 2.3), insider access (see Section 2.1) was used to study the change towards more gender-aware institutional planning and processes, as committed to in the 2019 ICES Strategic Plan.

Feminist institutionalism analyses power relations, attends to formal and informal rules of institutional cultures, centres lived experiences, and examines how people are included or excluded from the institution based on gender, the effectiveness of reforms to redistribute power, and takes an intersectional perspective. (Chappell & Waylen, 2013; Celermajer et al., 2019, Magnusdottir & Kronsell, 2015; Mackay et al., 2010; Holmes, 2020).

Applying feminist concepts to the study of institutions contributes to understanding the ways in which gender operates within societal structures and can inform institutional reforms to promote equality. Science as an institution mediates the connection of knowledge between ‘experts’ and society, often described as the ‘science-policy’ interface (Rudd, 2015). The demographic representation of science and experts should mirror society overall. A lack of diversity can result in science and research that does not meet the needs of all (Nielsen, 2017). Underrepresentation of women and other social identities may limit the potential science and result in sub-optimal policy and decision making. As an organisation, ICES often centres itself at the science–policy interface of marine resource management.
Examining the cultural practices of marine science from a feminist institutionalist perspective can help reveal the ways in which power is unevenly distributed between gendered actors in science as an institution.

2.1 Positionality

Consistent with a Feminist Participatory Action Research approach, this positionality statement acknowledges my role as a researcher and serves as an exploration of the potential influence of my personal background on the research.

As a highly educated cisgender middle-aged white woman, born in Canada and living in Denmark since 2006, who is also married and a stepmother, I have experienced an incredible amount of privilege in my personal and professional life. My family is culturally Christian/Protestant, and although I am not religious or actively practising Christianity, I consider myself a spiritual person, trusting in science and the universe.

I am an interdisciplinary researcher with a Bachelor of Arts in Urban and Environmental studies, and an International Master of Science in Technological and Socio-Economic Planning - Department of Environment, Technology and Social Studies. After completing my bachelor’s degree, I worked for an aquatic environmental consulting firm, answering the phone in reception and sorting benthic invertebrates in the lab. My desire to work in the field and get out of the office inspired me to an international Master of Science.

My masters project, and living in Copenhagen, connected me to the ICES community in 2007, when I was also researching how the ecosystem approach to human activities in the marine environment was being implemented and operationalised. I was formally employed in the ICES Secretariat in 2009. I worked in various roles, but eventually settled in as the Coordinating Officer from 2011–2023, providing executive support to the General Secretary, Executive Committee, and the Council.

My interest in the gender perspective began to grow, recognizing differentials in the treatment of women working in the Secretariat, including the first female General Secretary. From witnessing the CEO be subjected to ‘mansplaining’, to the way work is valued between masculinised and feminised roles, the gender lens began to bring my understanding of the micropolitics of the organisation into focus.

My professional experiences, including first-hand experiences with microaggressions and witnessing the old boy’s network in ICES, inspired me to act. Recognising that my research project was motivated by the desire to raise awareness
of gender inequality and drive organisational change in ICES, Feminist Participatory Action Research was a natural fit for my methodology.

In 2018, I attended a workshop in the importance of gender disaggregated data in a transboundary water system. That workshop helped me to understand ICES as “gender blind” and that if a goal of the ICES strategic plan is to be more gender-balanced, monitoring progress also requires the collection of gender disaggregated data.

In April 2019, as I helped the ICES General Secretary prepare for her presentation at the WMU’s Third International Women’s Conference on Empowering Women in the Maritime Community, I conducted a count (one year of participation data) of the men and women in the decision-making committees of the organisation. This analysis confirmed the impression that women are currently underrepresented in leadership positions, in national representation (20% female representation), and the chairs of expert groups (30% female representation).

Learning about the importance of the gender perspective at various conferences, including the one at WMU, my interest was sparked to apply this perspective more formally through research on the organisation responsible for the coordination of international marine science.

As an ICES “insider”, I had to carefully navigate the role of both researcher and researched, and aimed to continually reflect on how my perspective influenced the research. By taking on this research, the aim was to engage in a process that would benefit the community while contributing to individual career development.

This positionality is not static, and it evolved as I engaged with the research and as the project developed over time. In the final phase, I submitted my resignation from my formal role in ICES and at the point of writing the kappa am now navigating the shift from insider to outsider role. Leaving behind the practitioner part of my gender equality work over the past four years was difficult. The novelty of the research meant my time and perspective were in demand for speaking and leading initiatives. Although formal recognition did not follow.

Wearing two hats, as both a researcher and an employee of the organisation, could be viewed as a difficult balance to achieve; however, this role matches well with action research. As a feminist and science administrator, my experience provided me with a unique viewpoint to identify opportunities for change. My dual role as an employee and feminist action researcher also made me a “warrior within” as described by Sandler (2015) in her analysis of the interconnected change process that occurs when feminists are engaged as part of a bureaucracy.

During my research I had the opportunity to actively participate in ocean-going research through the Sea Women Expedition to Arctic Norway in November 2022. The expedition comprised women and gender diverse individuals; together we
departed from Tromsø to explore the Norwegian fjords and collect environmental and behavioural data on human interactions with orca. This experience provided me with an amazing amount of confidence and insight into what there is to gain from empowering women and gender diverse people to lead and participate in ocean research. I’m forever changed by my experience of close-up encounters with marine mammals in their habitat and the bonds built with expedition team members.

2.2 Research design

A Feminist Participatory Action Research (FPAR) approach requires a flexible approach to research design, giving attention to voices of all. Action research has been used in feminist research to explore and understand imbalances of power (Amundsdotter, 2006). With a goal to improve the representation of women in both ICES and marine science, FPAR was identified as an appropriate methodology to guide the design of this research. Working with the network of scientists as co-creators of knowledge in the conduct of this study is consistent with an FPAR approach. My aim was to conduct the research in a critically reflexive manner, understanding that my own experiences, perspectives, and positionality influence and are an integral part of the research (Catungal & Dowling, 2021).

The research process was initiated through several strands of inquiry. As an employee of ICES who also conducted research on “my own” organisation, I operated as an internal action researcher; this dual role came with both opportunities and challenges. At ICES my title was “Coordinating Officer”, where I worked directly with senior management to support strategic direction, coordination, and execution of operational tasks. I was the “right-hand” of the General Secretary. I was directly involved in all gender mainstreaming activities of the organisation. The trust built in my professional relationships over 12 years of service provided me with a great deal of access to data, people, and the networks needed to identify, plan, and implement actions necessary to promote change and evaluation. While insider access allowed me to know where to look and how to navigate the system, I aimed to let the community provide the direction, and act as a facilitator.

FPAR also requires making use of opportunities that arise during the course of the project, and my employee role included ongoing interaction with senior management allowing me to collaborate on the identification and negotiation of gender issues and associated actions. There were challenges, and my analysis was aided by the commitment from both the organisation (employer) and employee/researcher to engage in the research respectfully and with commitment to recognizing limitations and being open to change. In the context of FST “A legitimate research effort will demonstrate its quality and worth in terms of
purposeful criteria, determined by the researcher’s relationship with the contexts in which they are embedded.” (Stephens et al., 2010, p. 561). Analysing resistance to change was an exercise in the critical reflection on the embedded context in which I was operating.

Figure 2.2.1 presents a conceptualisation of the FPAR cycle, where cycles are interrelated and stages not discrete. Selected actions and groups engaged with are illustrated. Problem identification of gender inequality in marine science is highlighted in the Global Ocean Science Report and at the organisational level in the 2019 ICES Strategic Plan. A virtual screening of the documentary film ‘Picture a Scientist’ (Shattuck & Cheney, 2020) for the ICES community (with a follow-up survey), ethnographic research log/journal, and quantitative overview of gender ratios across the organisational hierarchy are all actions that contributed to problem identification, data collection, co-creation and awareness raising. The Gender Equality Plan is an organisational action plan that was developed as a direct output of this research. Two smaller sub-groups were facilitated to consider how group

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1 ICES groups are referred to by their acronyms. Council is the Council of national delegates. Advisory Committee (ACOM); Science Committee (SCICOM); Working Group of the Chairs of ICES Groups (WGCHAIRS), Diversity, Equity, and Inclusion (DEI) subgroup.
members (subset of chairs of expert groups) and Council delegates (nationally appointed representatives) could further mainstream gender equality and diversity, equity, and inclusion actions into formal and informal processes within their own sphere of influence. The Gender Equality Plan provides the framework for ongoing further evaluation and outcome review at organisational level.

In order to illustrate how the FPAR methodology was implemented in practical terms, table 2.2.1 presents the FPAR cycle stage, groups engaged and the implementing activities that were facilitated by the researcher with members of the ICES community.

Table 2.2.1 FPAR cycle stage, groups engaged and the implementing activities.

<table>
<thead>
<tr>
<th>FPAR cycle stage</th>
<th>Groups Engaged</th>
<th>Implementing Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem identification &amp; data collection</td>
<td>Executive Committee&lt;br&gt;Participants in the 2021 ASC network session (held online): Gender equality, diversity, equity, and inclusion in ICES community</td>
<td>Screening of the film “Picture a Scientist” and follow-up survey</td>
</tr>
<tr>
<td>Co-creation &amp; awareness raising</td>
<td>Staff&lt;br&gt;Interview participants&lt;br&gt;Co-authors of paper 1&lt;br&gt;All levels: Council/Executive Committee/Bureau Science &amp; Advisory Committee (ACOM &amp; SCICOM) Chairs of ICES expert groups (WGCHAIRS) Members of the Strategic Initiative on the integration of early career scientists (SIIECS) staff</td>
<td>Training&lt;br&gt;Gender mainstreaming through update to policies &amp; procedures&lt;br&gt;Interview process&lt;br&gt;Research &amp; discussions contributing to the 1st gender analysis of conference participation&lt;br&gt;Council DEI subgroup - discussed how they could contribute from a national perspective&lt;br&gt;WGCHAIRS DEI subgroup - discussed how Chairs can contribute and developed recommendations&lt;br&gt;SIIECS - Successfully campaigned for early career representation in ASC keynote addresses, the group now annually run a process and select 1 of 3 keynote presenters. They developed and implemented a transparent process for selecting the keynote, including allowing for self-nomination and&lt;br&gt;this is both co-creation and action - this theme session provided the opportunity for DEI practitioners to showcase the work they are doing on gender equality and DEI, and provide inspiration/knowledge</td>
</tr>
<tr>
<td>Create action plans &amp; act</td>
<td>All levels: Council/Executive Committee/Bureau Science &amp; Advisory Committee (ACOM &amp; SCICOM) Chairs of ICES expert groups (WGCHAIRS) Members of the Strategic Initiative on the integration of early career scientists (SIIECS) staff Participants in the ASC 2023 DEI theme session</td>
<td>Solicited input and feedback on the ICES Gender Equality Plan at committee meetings&lt;br&gt;WGCHAIRS DEI subgroup developed recommendations for how they can work within their sphere of influence to be more inclusive considering aspects of representation, voice and opportunity, and outreach and engagement&lt;br&gt;Council DEI subgroup developed actions and recommendations</td>
</tr>
</tbody>
</table>

36
| Evaluate & review outcomes | Interview participants | Council | Provided draft of paper 4 for comments and/or input on findings, interpretation, and associated narrative
Established mechanism and committed to annually review quantitative indicators and qualitative targets agreed in the Gender Equality Plan |

### 2.3 Case study: ICES

ICES 20 Member Countries\(^2\) around the North Atlantic Ocean collectively aim ‘to be a world-leading marine science organisation, meeting societal needs for impartial evidence on the state and sustainable use of our seas and oceans’ (ICES, 2019, p.4).

Members of the ICES community originate from a variety of disciplines and professions related to marine and ocean science, for example from biology, oceanography, data science, and modelling, as well as social science. Network members originate from more than 700 different institutes. These include national governmental institutes, primarily those dealing with fisheries and/or the marine environment, academia, nongovernmental organisations, regional organisations (e.g. EU), as well as private industry. While the majority of participants work in ICES Member Countries, there are also more than 500 individual experts from 48 countries that are not signatories to the convention. The organisation is structured into committees that guide and oversee the work of approximately 150 working groups that deliver science and advice. The organisational structure overview is presented in Figure 2.3.1.

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\(^2\) ICES Member Countries: Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Russian Federation, Spain, Sweden, United Kingdom, United States of America
The working culture in the ICES advisory expert groups was studied in the late 2000s. The study reports low job satisfaction, long working hours, large amounts of work travel, and high work pressure (Wilson and Hegland, 2009). A gender analysis of the survey responses reports that only 20% of respondents were women and was related to the low number of women in fisheries science overall. They also note that female respondents reported lower job satisfaction than men, and that “...some female fisheries scientists have related experiences of discomfort in professional situations because of their gender” (Wilson and Hegland, 2009, p.148). The time pressures and working conditions associated with delivering the science needed to inform advice have not been significantly altered since this study was conducted.

Originally established to promote scientific cooperation related to migratory fish stocks, ICES’ remit continues to focus on scientific cooperation, development, and formal scientific advice issued on request to competent authorities on management
of human activities and interactions in marine ecosystems. As an intergovernmental organisation, there are many formal and informal rules that structure participation and access to the ICES network. Some activities are open access and participation relies on self-nomination. Other activities, like access to the groups that conduct the fish stock assessments that are used to develop the official advice on catch opportunities, require national nomination. For most groups, nominations are controlled by the Council Delegate of each Member Country. The rules and nominations are administered by a Secretariat of approximately 75 people that operates from ICES headquarters in Copenhagen.

The database that tracks the participation of the experts does not systematically collect gender-disaggregated data. Adding this parameter is planned for the modernisation of the database in future. Since 2019, self-identified gender-disaggregated data has been collected opportunistically for conferences and events. However, at the start of the project there was no baseline information for understanding the existing gender ratios of experts participating in the work of the organisation. Alternative approaches were then adopted to infer gender and develop an indication of gender representation across the decision-making levels of the organisation. These approaches and baseline information were used extensively throughout the project.

2.3.1 Engaging the ICES community

A component of the “problem identification” in the FPAR cycle was identified by ICES in its Strategic Plan (2019), where gender is mentioned for the first time in a strategic planning document: “Across the entire ICES community we will also continue to cultivate a welcoming, resourceful, diverse, inclusive, and gender balanced, as well as a respectful working environment.” (ICES, 2019, p.15) This provides the framework and institutional justification for the organisational commitment to this research.

As an FPAR researcher I aimed to work as a part of and with the ICES community of scientists to understand the issues and identify solutions. Working with individuals from all institutional levels of the ICES community to co-create deeper understanding of the issues of continuing gender inequalities, and to identify actions to support greater gender equality within ICES, was a central goal of this project. Engagement took place at three levels:

- at an individual level through interviews and personal interactions;
- at an organisational level through regular presentations to different organisational committees and staff of the Secretariat;


at a community level through engagement with various groups to specifically address the chairs of ICES expert groups and a network session at the Annual Science Conference (2021).

An example of individual level engagement is in Paper 1, where quantitative methods and statistical analysis were used to explore how gender and early career participation influences participation in the ICES Annual Science Conference (ASC). I was put in touch with female researchers from the ICES community who had contacted the ICES Secretariat for some specific data on participation. The complete data they were looking for was not available, but their interest in gender data meant my colleague connected us. We agreed to work together, and the supportive female mentors and collaborators urged me, along with the other early career researcher, to take charge of the analysis. This is also consistent with FPAR methodology, in that women of the ICES community had the initial inspiration to investigate how gender and early career status might influence access and visibility at the annual conference. I was able to use my insider status to access the data and, from there, we worked together and highlighted new approaches to analyse variables of participation, as well as making visible gender bias.

Developing a gender equality plan became a central task that I led and coordinated through a broad organisational approval process. An overview used to communicate the process to internal groups is provided in Figure 2.3.2 The figure illustrates the many groups that were engaged to solicit input and feedback on the plan.

![Figure 2.3.2](image)

Figure 2.3.2 The timeline of engagement with various groups of the organisation that culminated in the formal approval of the Gender Equality Plan by all member countries.
2.4 Data collection and analysis

A mixed-methods approach using both quantitative and qualitative methods was used in different parts of the project. A variety of data sources were used in the analysis. Access to organisational data was facilitated by insider access. Both structured and opportunistic strategies for data collection were used to document gender inequality, and to understand the experiences of people working in the ICES community.

Quantitative data in the form of gender-disaggregated ICES network participation data was an important and missing component from the start of the project. Where self-identified gender data was not collected, gender imbalances were made visible by using alternative approaches and online tools to infer gender based on first name (see Paper 1).

Qualitative methods, including surveys and interviews, provided descriptive feedback and context on the experiences of people in the ICES network, with focus on women and other underrepresented groups. Qualitative data was collected through an ethnographic research journal, interviews, surveys, and other feedback tools, providing contextual understanding and greater richness and depth of perceptions of ongoing gender inequality in ICES and marine science institutions, as well as on the research process. A narrative literature review was conducted to synthesise the available literature on gendered barriers to ocean-going research.

My insider perspective provided advanced contextual understanding that facilitated understanding of where to look and how to navigate a participatory process in a complex institutional framework. The data and theories used for analysis and interpretation of the experience of others in survey format and other feedback utilised established quantitative and qualitative methods for analysis. This provided distance between data collection and subjective interpretation. Using tools like coding software helps to further distance my ‘insider’ perspective, while also acknowledging that coding is a subjective and creative process.

2.4.1 Interviews

In order to understand the experiences of women in ICES, semi-structured interviews, ranging between 45 and 90 minutes, were conducted online between December 2021 and January 2023. Interviews were recorded and transcribed using otter.ai software, with the transcription later verified and corrected by the author.

Interviews were conducted with 22 individuals – 21 identifying as women and one identifying as non-binary – originating from 15 countries in the global north. Participants were identified through a purposive sampling method, linked to their
connection to ICES and role in the organisation. All participants were current or past members of the ICES marine scientific community, participating in a number of roles at different levels of the organisation, with the majority nominated as national representatives. Most participants were mid- to late career stage professionals, though four participants were at an early career stage (i.e. 10 years or less since graduation). Data were not collected or volunteered on ethnicity, but the group appeared racially homogenous (white) and originated from countries of Europe and North America. While a range of geographic, disciplinary, and career stage representation was achieved, ethnic and racial diversity was not. This is not so much a sampling bias as a genuine reflection of a lack of ethnic diversity among women in decision-making levels of ICES. This points toward additional barriers facing women of colour working in marine science in the North Atlantic context.

2.4.2 Research log

Feminist ethnographies can provide important detail about the experience of women (Schrock, 2018), and journaling is also used in action research (Coghlan and Brannick, 2005). Accordingly, a research diary was maintained from the start of the project. In Paper 3, I used process documentation, organisational documents, and evidence from the ethnographic field journal (maintained between November 2019 and April 2023) to develop a timeline of events that contributed to the adoption of the ICES Gender Equality Plan.

2.4.3 Analyses

Different analytical approaches were used in different parts of this research project. Using a variety of approaches is consistent with feminist methodology, where appropriate methods should be employed to identify gender bias.

In Paper 1, quantitative analysis was used. Generalized linear mixed effects models (GLMM) and the lme4 package (Bates et al., 2015) in R version 4.0.2. (R Core Team, 2020) were used to explore five years of ICES conference participation data to determine if the covariates gender or career stage showed a significant effect on abstract acceptance or rejection, presentation preference (poster/oral), or presentation type allocated.

In Paper 2, a narrative literature review was conducted to identify barriers to the participation of women in ocean going research, recognising this as an important part of marine scientific practice and career development. The literature was not systematic, instead relying on various search tools to identify the key literature to underpin and develop a narrative review describing the gendered challenges and potential solutions to greater gender equality at sea.
In Paper 3, formal and informal actions were documented, set in a timeline, and mapped to a theory of change and categorised as driver, data collection, co-creation through dialogue, or action. This analysis drew on a variety of data sources including process documentation, organisational documents, ethnographic research log, and online survey of the ICES community about gendered experiences and perceptions working in ICES. Through reflection and analysis of formal and informal actions, an understanding of how a change agenda that led to the initiation, acceptance, and resistance of gender equality initiatives in an IGO is constructed.

Paper 4 was focused on qualitative analysis of data derived from interviews. Transcripts were analysed and coded in NVivo 14, using reflexive thematic analysis (Braun and Clarke, 2006). The underlying assumptions of the coding approach used for the analysis acknowledge that coding is a creative process and that the results are reliant on the intersection of the researcher skills, dataset (participants’ input), and analytic assumptions. In coding the data, a constructivist approach was adopted where the interpretation of meaning and experience is based on understanding that social production of the ICES network occurs through individual and shared perceptions of reality (Byrne, 2022). A dominantly inductive approach was used to develop codes, taking a “data-driven” approach, aiming to emphasise respondent meanings and minimise researcher biases. However, deductive analysis was also used to form themes that would help to answer the research questions.

2.5 Ethical considerations

Ethics is an important research consideration in all sciences. The nature of Feminist Participatory Action Research, including the mixed methods used for data collection, as well as the dual role of researcher and employee/member of the ICES community, and feminist standpoint all require critical reflection to consider the ethical use of the data collection and analytical methods used (Gatenby & Humphries, 2000).

FPAR, especially conducted in my “own” organisation, requires specific considerations. The power relationships within the organisation, and understanding of the political processes required to balance the public role of advocating for change while navigating the internal structures needed to negotiate the change must also be considered ethically (Coghlan & Brannick, 2005).

Issues of informed consent in an evolving research context, maintaining confidentiality when the process is focused on collaboration, and the potential for political consequences (for the researcher and participant) must all be considered carefully in an insider action research context (Coghlan & Brannick, 2005). The ethical approach in the first steps of this research was to be explicit with the ICES
community about my dual role as researcher and labelling where outcomes will be used as part of research. For example, ICES Secretariat staff, the executive committee, the Science Committee, and all chairs of ICES expert groups were informed of my research project and developing case study approach.

Interviewees all provided written consent to participate in the study and were given the opportunity to review and comment on the draft paper prior to publication. This research was approved by the Research Ethics Committee of the World Maritime University.
3  Results and discussion

In the following sections, the research findings from the papers are discussed and evaluated with reference to how they address the research questions. Finally, the interrelation of the paper findings and broader contributions are presented.

Figure 3.0 Overview of how evidence from the papers is linked to the research questions.

3.1 Why are so few women recruited to, retained in, and “empowered” at senior levels in the conduct of marine science?

This question assumes that few women are recruited, retained, and “empowered” in senior levels of marine science. Establishing a baseline of evidence of underrepresentation of women in marine science was an important first step, challenged by the lack of systematically collected self-identified gender-disaggregated data in the ICES network. During the research process, a graphic was
developed (Figure 3.1.1) as a way to visualise ongoing imbalances in gender representation along the organisational hierarchy. In the absence of self-identified gender disaggregated data, alternative approaches to inferring gender were used to develop this graphic as described in Paper 1. The graphic shows the under-representation of women at the top-levels of the organisational hierarchy. The bottom level of the ‘pyramid’ is based on self-identified gender-disaggregated data from the ASC. Without systematically collected gender data for the entire network, the gender ratios at the ASC, the flagship event for the ICES community, was adopted as a proxy for the entire network (base-layer in Figure 3.1.1). Three different versions of this graphic were updated for 2019, 2021, and 2022. Very minor changes are evident when comparing between years.
Figure 3.1.1 was used extensively in presentations and dialogue with the ICES community to document and make visible the presence of gender inequality in representation across organisational levels. Using quantitative approaches was a way to gain legitimacy for working on gender in a gender-blind organisation, by “speaking the language” of the scientists in the ICES community.

A limitation of the approach used to develop Figure 3.1.1 is that it does not follow a specific cohort's progression through the system. However, STEM career progression is rarely linear (Batchelor, et al., 2021), and this is especially true in the context of a network organisation like ICES, where membership at different layers may not be connected to formal promotion. More powerful analysis of gendered differences in participation will be possible when systematic gender disaggregated data is added to the ICES database that tracks members and their organisational roles. What the pyramid figure does effectively communicate is that women are underrepresented in leadership and decision-making roles.

Conference participation at international level is a key part of scientific practice that can impact career development and progression. Investigating demographic differences in conference participation can reveal factors contributing to the continued under-representation of women in marine and ocean science. In Paper 1, the analysis used participation data from the annual flagship event of ICES, the ASC. Each year, the ASC brings together the ICES community in a different member country for networking and knowledge exchange. Statistical approaches were used to analyse potential sources of bias in participation, as well as in awards and highly visible conference roles (e.g. keynote presentations).

To explore the gender and career stage dimensions of participation in the ASC, preferences of presentation type (oral/poster) as well as acceptance and rejection
decisions were investigated using five years of data (2015–2019). The analysis found that early career scientists (self-identified status) were more likely to be women, while established scientists were more likely to be men. Although overall, gender did not show a significant effect on the decisions to “downgrade” requests for oral presentations to poster presentations, early career scientists were, however, significantly more likely to be downgraded than established scientists. Given that more women were often early career scientists, more women than men had their presentations downgraded to less visible presentation formats.

Gender representation in keynote presentations, prizes, and awards was also analysed. The analysis showed that women were underrepresented in keynote presentations, repeatedly only securing one third of slots per year. Women did well in merit awards, which are given based on specific scientific contribution to the conference, winning two-thirds of them. However, in the categories of career level awards that rely on nominations, women represented only 17% of winners in the period of study. By using the gender lens to reflect on outcomes in conference participation and recognition programmes, sources of institutional gender bias became visible. Appropriate quantitative approaches for measuring and monitoring participation to identify and eliminate sources of gender bias in conferences are being explored in the literature (see Tulloch, 2020; Corona-Sobrino et al., 2020).

Overall, Paper 1 highlights how specific parts of scientific practice, including conference participation, which is critical for networking and achieving the visibility needed to progress to leadership and the highest levels of science, can contribute to gender inequality and act as a barrier for women.

In Paper 2, the synthesis of barriers and interventions to address some of the unique gendered challenges of ocean-going field research, helps to further identify aspects of science work that could be hindering the advancement of women in marine science. By reviewing the literature, cultural and structural barriers faced by women in ocean-going research were identified. These fell into four main categories: (1) behavioural/social norms and gender-biased culture in science and at sea; (2) failure to provide for balancing duties of family care with extended periods away from home; (3) gender-insensitive design of ship facilities, operations, and personal protective equipment (PPE); and (4) the need for a safe working environment at sea; i.e., gender-related aspects of health, safety, and personal security at sea. To overcome these barriers, the following interventions are suggested: (1) greater awareness raising and training to shift destructive mindsets as well as affecting behavioural and cultural change; (2) consideration of gender-sensitive design and safe operation of research vessels; and (3) more comprehensive and effective implementation of gender equality policies for research at sea. Figure 3.1.2 summarises the findings, listing identified barriers and suggested interventions.
By identifying gendered challenges faced by women who work in research at sea, Paper 2 contributes to the identification and awareness of field specific challenges that may be contributing to the underrepresentation and progression of women in marine science. Since the publication of Paper 2, similar challenges have recently been reported by Amon et al., (2022) and there is a growing momentum regarding the need for gender sensitivity in ocean science (Legg et al., 2023).

In Paper 3, the institutional dimensions of gender inequality are analysed through FPAR and Feminist Institutionalism. In this analysis, the FPAR research process is considered from a timeline perspective and the institutional dimensions considered. Here, the organisation is framed as gender-blind and navigating a transition to becoming more gender aware. As an institution, the organisation has been built by “natural” scientists, whose disciplinary training results in positivism operating as a dominant paradigm where the organisation is assumed to operate meritocratically and without gender. Science institutions that operate gender-blind, without acknowledging the role that gender plays in shaping the formal and informal aspects of institutional practice and culture can inadvertently continue to reinforce gender bias, acting as a barrier to the advancement of women to leadership levels of marine science. As noted by Benschop and Verloo (2011), strategies and plans aimed at addressing gender inequality must engage with both individual actions and structural changes to effectively orchestrate essential systemic transformations.
The interviews conducted with women and one non-binary member of the ICES community was the focus of Paper 4. Participants identified barriers and solutions to gender equality, an overview of the results of the analysis is provided in Figure 3.1.3. Some of their responses were analysed using postfeminism, the idea that gender equality has already been achieved, as a concept for understanding the repudiation of gender inequality. A postfeminist pragmatism is a way that women can understand their own success in male dominated sectors (e.g. see Nash & Moore, 2019). A postfeminist pragmatism can be expressed by framing gender inequality in the past and, in other places, framing being female as an advantage, and accepting the status quo (Gill et al., 2017). Examples of rationalisation through postfeminist pragmatism are provided in paper 4. Paper 2 also documents the framing of inequality incidents, including bias, discrimination, and harassment as happening in other places. Few interviewees, as described in paper 4, felt gender influenced career progression, while simultaneously acknowledging under-representation and a need for interventions in ICES, highlighting a gender inequality paradox where inequality in the system is acknowledged but the influence on an individual's career is not.

The barriers identified by respondents echo many of the issues identified in the literature review. At the individual level, a majority discussed the role of gender and social dynamics. They also highlighted the general lack of awareness of gendered issues in marine science workplaces, the role of unconscious bias and/or “hidden” structures in science, microaggressions, and tokenism that challenge the progression of women and underrepresented groups. The intersections of privilege and power in marine science, based on identity, were also recognised, noting the racially homogenous nature of the ICES network.

Many of the participants discussed the role of ‘imposter syndrome’, highlighting how aspects of a postfeminist sensibility operates to put focus on individual over institutional or systemic gender equality actions. Multiple respondents were keen to signal the importance of “merit”, “competence”, or “abilities” as key factors in what should be valued for progression, without critical reflection on how merit is assessed. A critical assessment of the concept of “merit” is also needed to address the bias in ICES awards identified in Paper 1. Some feminist theorists contend that merit-focused systems, which claim to convey impartial excellence, consistently harbour inequalities and are not free from bias and subjectivity (see: Seron et al., 2018; van den Brink & Benschop, 2012; Nash & Moore, 2019; Bagilhole & Goode, 2001).

Analysis of the interviews included identification of barriers related to the structure of science work as difficult for people with caring responsibilities, most often women. High workloads and long hours often connected to career progression can challenge work-life balance. Policy and financial constraints, along with significant
administrative efforts, limit national-level institutional requirements for advancing to higher researcher roles in the workplace. Evaluations, crucial for progression, may be subjectively conducted and can be challenging when advancement is controlled by a single 'gatekeeper.'

Informal aspects of culture, including incivility and disrespectful communication as well as instances of ambiguous gender discrimination that are difficult to articulate were also discussed by interviewees as contributing factors to gender inequality. Incidents of ambiguous gender discrimination are commonplace in the lives of women and need to be addressed to advance gender equality (Doering et al, 2023). Especially relevant for a science network, is further consideration of the role unequal access to informal networks plays in progression to formal leadership roles. Respondent perceptions of organisational leadership and decision-making roles suggests there are differences in perceptions and motivations to take on certain roles. Societal level issues including gender roles and stereotypes continue to influence science culture and values. These identified barriers echo findings of similar studies aimed at promoting gender equality in interdisciplinary research institutes (Shellock et al., 2022).

Figure 3.1.3 Barriers and solutions to gender inequality described in Paper 2.

3.2 How can a Feminist Participatory Action Research approach lead to improving gender equality and the empowerment of women in an intergovernmental marine science organisation?
Measuring “improvement” of gender equality is not a straightforward task. Gender equality is not only about quantitative indicators like representation in an institution but also related to experiences of power, agency, and discrimination. In Paper 3, an approach was developed to analyse the different components of the Feminist Participatory Action Research (FPAR) process as illustrated in Figure 3.2.1. By detailing how specific drivers, data collection, co-creation through dialogue, and actions contributed to the FPAR process in an iterative manner over time, both the formal and informal actions that contributed to catalysing change and supported the development of the ICES Gender Equality Plan are set in a timeline. This approach documented and made visible the variety of “actions” that can contribute to progressing an institutional gender equality agenda.

Figure 3.2.1 A Feminist Participatory Action Research Process/ King (2020) Theory of Change mapped to the ICES process.

Gender inequality in marine science requires systemic change at institutional level. Participatory and collaborative approaches were suitable to observe progress of a gender equality agenda in an intergovernmental marine science organisation. Formal and informal actions were documented, set in a timeline, and mapped to a theory of change. The analysis illustrates how FPAR can be applied in an intergovernmental organisation, with multiple factors, including drivers, data collection, co-creation through dialogue, and specific actions contributing to driving the change agenda. The results are discussed in the context of how gender equality action plans need to be continually enacted to realise change.
A major driver for change identified was the appointment of the first female ICES General Secretary. Her leadership and experiences were central to the recognition of gender inequality being accepted as an organisational strategic priority. By drawing on a variety of data sources that document the many actions that contributed to the FPAR approach, the importance of critical acts to progress a change agenda are highlighted. Critical acts can come in a variety of forms. For example, together with colleagues in the Secretariat, it was agreed to make 2021 a year focused on gender. This was initiated by offering a virtual screening of the film “Picture a Scientist” (Shattuck and Cheney, 2020) for members of the ICES community and then facilitating feedback and discussions. Anonymous feedback was solicited via an online survey from the community about gendered experiences and perceptions working in ICES.

Ninety-four responses were received, primarily from Europe (68%), with more female responses (54%) than male (45%). A large proportion (47%) of respondents had been working in ICES for 5–15 years. Almost one third of respondents reported experiencing gender-based harassment (defined broadly, inclusive of microaggressions) while working on ICES related activities. A majority (63%) of respondents reported that they did not have the impression that gender representation in ICES activities was equal. Fifty-four percent of respondents reported that if they had witnessed or experienced harassment they would not know how to register a complaint, or to whom. Respondents were also given the opportunity to share additional details about experiences. A range of experiences and viewpoints were provided, the majority of which related to implicit bias and microaggressions. This survey provided important information about the broad level perceptions of the ICES community on the status of gender equality, as well as qualitative descriptions of specific (negative) experiences that highlighted the importance of more institutional reflection on the formal and informal processes needed to address inequality. These survey responses triggered several actions, including ensuring information about how to report harassment was formally included at the start of all ICES meetings, and the initiation of a broader reform process to update and collate all documents relevant for a code of conduct, to explicitly outline the expectations of behaviour when participating in ICES activities.

These acts created important conditions for raising the profile of gender equality as an issue being advanced in ICES. This was an important and timely exercise. In 2022, the EU implemented a requirement for all organisations receiving EU Horizon Europe research funding to have a gender equality plan. As the de facto gender focal point in the organisation, it became my task to lead the development of the Gender Equality Plan. The participatory process (overview provided in Figure 2.3.1) was developed to bring elements of FPAR to the formal intergovernmental context. While this new EU requirement could have been implemented as merely a “box-
ticking” exercise, having a gender researcher on staff provided an opportunity to advance a “bottom-up” approach.

Analysing change also requires consideration of resistance to change. While some types of resistance were identified at individual and institutional level (see analysis in Paper 3), there was also a good deal of support for developing the Gender Equality Plan that was critical for my own commitment and institutional uptake of the work.

The realisation and approval of the ICES Gender Equality Plan in October 2022 is an institutional expression of an ongoing commitment to working on gender equality. However, as outlined in Paper 3, the existence of a policy or plan does not necessarily translate into improved gender equality outcomes (Ojwala et al., 2022).

Paper 3 also highlights how FPAR is useful for gender equality policy research as it prioritises the active participation and empowerment of women and gender minorities in the research process, with the potential for greater policy relevance and effectiveness through an inclusive approach.

On Paper 1, by working with female members of the ICES community, who identified this research as an important priority for which they were willing to find time for helping with the analysis, this was consistent with FPAR methodology. These women themselves wanted to understand how their own unconscious bias may be influencing who gets visibility at the conference. The findings of the study were also presented at the ICES ASC 2021, raising awareness of gender issues and analytic approaches useful for the organisation to further gender mainstreaming approaches and potential policy reforms.

In paper 4, the analysis focuses on interviews conducted with women in the ICES community. By centering the voices of women underrepresented in formal leadership roles in the network, their experiences brought depth and deeper understanding of the mechanisms that are continuing to contribute to institutional gender inequality. While gender equality work is work for people of all genders, centering the experiences of women was an important element of FPAR. The draft paper was also sent to interviewees for their comments and feedback on how their inputs were used for the analysis, acknowledging their role in the development of the knowledge produced.

Paper 4 also discusses how metaphors are relevant for effective communication on barriers to gender equality. The firewall metaphor developed by Andersson et al. (2022) was identified as particularly illustrative. A firewall restricts access to secure computer networks and, with its focus on process, is a useful metaphor for thinking about the complexities of organisational discrimination. The formal and informal barriers require understanding and connection to pass through, which helps to convey understanding about how individuals construct the pathways for access to progression in an organisation. Figure 3.2.2 is a slide developed to facilitate a
discussion on how Member Countries/national institutes are approaching succession planning for greater diversity with the ICES science and advisory committees in September 2023. The “codes” were identified through informal discussions with members of ICES Secretariat staff, leadership, and community and were recorded/extracted from my ethnographic research log. The metaphor of the firewall helps to facilitate intersectional understanding of how different barriers can block or facilitate access to the ICES network.

This project aimed to understand the mechanisms that contribute to gender inequality in the practice of international marine science through a case study approach. Working as a lone researcher with a large network organisation through an FPAR approach meant taking a pragmatic approach to engaging with the community. While dialogue was facilitated through regular meetings with different committees and groups, interviews were only conducted with women/non-binary members of the organisation. Centering the voices of the underrepresented is consistent with an FPAR approach; however, there is likely much to be learned and gained from people of all genders working in ocean science.

Feminist Participatory Action Research is often described as a spiralling cycle, aiming to evaluate and iterate actions overtime. A four-year PhD project is a relatively short time frame for analysis to be able to detect if interventions have resulted in lasting change in support of gender equality. While at the end of this project I left my formal role at the ICES Secretariat, my hope is that a solid platform for work on gender equality has been left behind to be continued and progressed.
While it may challenge the scope of the timeframe of this project to evaluate if the interventions developed and implemented have led to improvements to gender equality and the empowerment of women, it is important to note that measuring ‘improvement’ can be considered in multiple ways. The FPAR approach culminated in the approval of a gender equality plan (GEP). From an institutional perspective, it could be evaluated that there has been an improvement, with the adoption of the GEP signifying institutional recognition and commitment to the need for action. Part of the value of this research was in exploring the intricacies involved in reaching institutional commitments. From the outside, the adoption of GEP is visible, while this research has documented the intricacies including resistances, and acceptance. Issues of gender equality and diversity, equity, and inclusion are now regular features of the agenda of committee meetings. This signals a move from a gender blind to more gender aware approach that starts to provide the conditions for equality improvements.

Detecting improved gender equality in terms of more balanced gender representation at leadership levels, will require continual action, assessment, and monitoring. However, the process has been valuable, empowering the community by normalising the discussions of gender equality and DEI, providing the vocabulary, and familiarising concepts like unconscious bias. The FPAR process revealed how new and ongoing data collection helped to raise awareness about gender inequality within the organisation, identify challenges to address, and appropriate interventions to make. This organisational experience is considerably valuable and potentially applicable for other similar organisations.

3.3 How can research and evidence inform the development of gender aware interventions in an intergovernmental marine science organisation?

As previously discussed, making visible inequality was an important part of gaining the legitimacy for bringing the gender equality agenda to the decision-making levels of the organisation. By making inequality visible, the community was prepared to act in formal (approval of the Gender Equality Plan) and informal ways (e.g. participating in the ASC network session on Diversity, Equity, and Inclusion).

Quantitative approaches, often excluded or discounted in feminist methods, can be used to make visible inequality and inform interventions aimed at generating change at institutional level. These approaches, however, lack the capacity to bring more contextual information required for in-depth understanding. Qualitative methods are also needed.
In Paper 1, the approach of quantitative analyses of conference participation data through the gender lens was novel for the organisation, providing opportunity and evidence for institutional reflection on process changes required to address processes revealed to be favouring one gender over another. The findings of Paper 1 underscore the value of using data-driven approaches to gender-sensitive and career stage organisational policies that have the potential to influence scientific careers. Other indicators and evidence from conference prize-giving and recognition awards point to a gender gap remaining at senior levels, highlighting the need for further actions as well as monitoring and researching conference participation from a gender perspective.

Through informal interactions with the various committees responsible for the processes that govern the allocation of keynote presenters and awards, based on the evidence provided, the need for reflection and procedural changes have been initiated. An example of an informal change was the uptake of a tool to assess how well the text of the call for nominations for ICES awards uses gendered language that might influence who is nominated.

The idea that gender equality in marine science can be achieved by waiting for the seemingly imminent cohort of women to rise up through the leadership ranks and is simply a “matter of time” is still prevalent, also among female members of the ICES community, as outlined in Paper 3. By highlighting continuing imbalances in representation, as well as evidence of specific incidences of harassment and bias, the need for institutional action was recognised. Documenting resistance to change also provides important evidence for where further actions are needed (Mergaert & Lombardo, 2014).

Many of these institutional changes were made possible by “insider” status, where it was possible to gather evidence on both the formal and informal processes and lobby/work with the appropriate committee or decision-maker to identify and implement formal interventions. For example, the need for an ongoing mechanism to document specific incidents of harassment and bias was recognised. Working with Secretariat staff and leadership, the acquisition of an anonymous reporting tool was negotiated, as well as developing the accountability mechanisms required to address anonymous reports in a network organisation.

While working on the inside provided many opportunities to advance change from that perspective, the utility of external approaches was not explored. External pressure could also drive change, for example through media interest or other types of exposure that communicates the inequality in a publicly funded institution. Highlighting researcher experiences with resistance to gender equality change can both be cathartic for the researcher and highlight where further actions are needed to achieve transformational change (Bleijenbergh, 2017).
Discussions with women in a marine scientific network highlight perceptions of gender inequality, revealing paradoxical interpretations of individual and institutional experiences. Some perceptions were linked to a postfeminist sensibility (Gill et al., 2017), where attachment to gender-neutrality and merit rationalised gender equality paradoxes in science organisations and workplaces. The subsequent analysis explores participant views on barriers and solutions in addressing gender inequality in marine science, revealing a nuanced understanding of the issue across various scales and illustrating how the issues are nested and interconnected. Inequality is seen as something that happened in the past or will soon be eliminated given the prevalence of women in the system. The formal IGO rules that prescribe access to membership are accepted and unquestioned, though support for disruptive interventions such as quotas should be further explored. The findings emphasise the need for a multifaceted approach to addressing institutional gender inequality involving awareness, mentorship, structural changes, and societal shifts.

A potential limitation of the findings of the analysis of interviews with women (Paper 4) is the purposive sampling strategy. Participation was limited to those who are or were at some point part of the ICES network. Therefore, it is likely that some barriers have not been identified as it was not possible to sample people “excluded” from the network.

3.4 What are potential solutions to greater female recruitment and participation in the decision-making levels in an intergovernmental marine science organisation?

During the research process, a variety of potential solutions were identified that can contribute to greater gender equality in marine science and are required to support women to access and retain leadership roles.

In Paper 1, the importance of making visible gender inequality in scientific practice is highlighted. Without formal recognition of the existence and sources of inequality, it will be impossible to change. Ensuring equal opportunities in all parts of organisational practice is a precondition for supporting greater gender diversity, also in leadership roles. Critical reflection on all types of organisational and individual behaviours can contribute to identifying improvements in process and practice in support of gender equal career progression. The findings in Paper 1 underscore the importance of using data-driven approaches to gender-sensitive and career stage organisational policies that have the potential to influence scientific careers.
In Paper 2, specific recommendations are provided to help gender equality in field work through (1) greater awareness raising and training to shift destructive mindsets as well as affecting behavioural and cultural change; (2) consideration of gender-sensitive design and safe operation of research vessels; and (3) more comprehensive and effective implementation of gender equality policies for research at sea.

Paper 3 highlights how participatory approaches to developing gender action plans can help generate visibility and awareness and buy-in for actions to progress gender equality. While a major outcome was the adoption of the Gender Equality Plan, further exploration of ways to adapt the current rules framework (e.g. the Convention or Rules of Procedure) to further mainstream expectations of gender equality in representation and institutional practice could be further explored.

In Paper 4, a range of solutions were identified by participants that require actions across individual, organisational, and societal levels. At the individual level, awareness of gender and social dynamics, especially among leaders was frequently discussed by participants as an important strategy. While raising awareness was coded at the individual level, the interconnection and nesting of the solutions is emphasised, given the role that institutions can play in raising awareness and putting focus on inequality and bias. As noted by Benschop & Verloo (2011), organisational change must “...address both the individual and structural levels in order to organize needed systemic transformations” (p.287). Mentorship was also a strongly supported factor for career progression but must be attended to carefully. One participant referred to her experience with connecting through a formal mentorship programme as “mysterious”, reflecting that the quality of the interpersonal connection between mentor and mentee may be a factor in formal mentorship programmes that can be difficult to pre-arrange.

Voice and opportunity was also a strong theme, where participant responses that reflected on how their own progression was supported by having visibility and the opportunity to try a variety of different tasks. ICES network leadership roles have provided participants with some of those opportunities. The importance of gender sensitive considerations in recruitment and related processes was also noted by participants.

At the organisational level, participants discussed formal and informal changes to the structure of work that could facilitate greater participation in ICES. Focus on fostering a workplace environment to manage an informal culture that may lead to elevated voices, stress during meetings, and pressure from deadlines. Creating family-friendly work environments, supportive leaders, fostering teamwork and collaboration, as well as balanced and fair recruitment processes were all potential solutions discussed by participants. The importance of networking was also frequently discussed by a majority of participants, which highlights the importance of creating an inclusive environment and reflecting on the barriers to network
access. Issues specific to ICES, were related to the international experience it can provide that is critical for career development and progression.

There was also strong support for quotas and other types of positive discrimination as well as balanced representation and role models. Further investigation of disruptive approaches, such as quotas for representation in decision-making levels of the organisation should be further explored, not as a standalone “fix”, but as part of a suite of context specific interventions that also aim to change the system. Engaging Member Countries in a process to help them commit to greater gender balance in the system is needed. A variety of alternatives could be explored, including gender balance in representation targets over time, e.g. nominations to decision-making roles should be balanced over a five-year period. However, quotas or targets will not address the parts of masculinised working cultures that must also be changed to support greater inclusion of women and other marginalised groups. As described by Acker (1990), organisations are built for an idealised worker, who can work long hours with a narrowly defined role that serves only the needs of the organisation. This idealised image of a worker is one of a person that works full-time, has a lifelong occupation, with family obligations and caring responsibilities not factored in or assumed to be taken care of by a partner. While this idealised version is abstracted from a gendered body, in actuality this is a man, while the feminised worker is assumed to have caring obligations outside of work and does not fit as seamlessly with this idealised worker. In this way, workplaces have been constructed in a gendered way that must be challenged to realise more supportive working environments and greater gender equality at work.

Creating gender-equal conditions for ocean-going field research conducted by national institutes will also contribute to greater gender equality in ICES. Finding solutions to create more gender-equal conditions in the national institutes that are the main contributors of experts to ICES work is clearly interlinked. During the feedback sessions related to the ICES Gender Equality Plan, feedback from the group “Strategic Initiative on the Integration of Early Career Scientists” pointed out the important connection between the relationships and dynamics that happen at sea can translate into the dynamics in ICES working groups. Both positive and negative dynamics can be fostered and need attending to. If few women have the opportunity to participate in fieldwork, access to the ICES network can in turn be limited. Therefore, the “solutions” to creating more inclusive fieldwork highlighted in Paper 2 are also relevant for creating more opportunities for women in ICES.

In summary, identifying and making visible parts of institutional practice that are contributing to inequality, and taking action to address these inequalities are critical acts. Taking a range of actions is necessary to create conditions necessary to support a greater diversity of leaders in decision-making parts of an intergovernmental science organisation.
3.5 Recommendations

Table 3.5.1 identifies key findings from the papers and links them to practical and relevant recommendations for improving gender equality in marine science, a defined objective of the research.

<table>
<thead>
<tr>
<th>Key findings</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper 1</td>
<td>Continue to advocate for the collection of gender-disaggregated data and mainstream the idea “gender data is ocean data”</td>
</tr>
<tr>
<td>There is value in using gender focused data-driven approaches to evaluating organisational practice policies that have the potential to influence scientific careers</td>
<td></td>
</tr>
<tr>
<td>Paper 2</td>
<td>Promote training and awareness of gender bias and challenge traditional social norms in science and at sea</td>
</tr>
<tr>
<td>Specific gendered challenges exist in fieldwork in ocean research</td>
<td></td>
</tr>
<tr>
<td>Implement gender sensitive design and operation of research vessels</td>
<td></td>
</tr>
<tr>
<td>Ensure effective implementation of gender equality policies at sea</td>
<td></td>
</tr>
<tr>
<td>Paper 3</td>
<td>Use participatory approaches to identify and build support for changes to formal and informal policies, practice, and culture</td>
</tr>
<tr>
<td>FPAR approaches are valuable for institutional contexts</td>
<td></td>
</tr>
<tr>
<td>Paper 4</td>
<td>Continue to confront gender inequality through quantitative and qualitative approaches</td>
</tr>
<tr>
<td>Postfeminist ideas and science values of meritocracy can make recognising gender inequality difficult</td>
<td></td>
</tr>
<tr>
<td>Discounted interventions (e.g. quotas) should be further explored for their potential to disrupt gendered power structures in a marine science IGO.</td>
<td></td>
</tr>
<tr>
<td>Qualitative analysis provides contextual information critical for understanding persistent gender inequality</td>
<td></td>
</tr>
</tbody>
</table>

Marine scientific organisations are responsible for the growing body of knowledge on the world’s oceans. While there is much more to discover, it is striking that e.g. the ICES marine data portal boasts “over 300 million measurements to explore and download”, (ICES Marine data, n.d.) yet the organisation has to date been unable to move forward on creating the infrastructure required to allow for the collection of gender-disaggregated data for its network participants.

Collecting gender data is essential for promoting equity, enhancing effectiveness, empowering communities, addressing gender-based inequality, and fostering innovation in ocean-related activities and governance. It helps ensure that ocean management and conservation efforts are equitable, inclusive, and responsive to the needs and priorities of all people, regardless of gender. Science must begin to recognise and mainstream the idea that gender data is ocean data.

The iterative nature of empowerment requires continual training to help people of all genders contribute to changing the culture and system to make ocean science more inclusive for a greater range of social identities.
3.6 Contributions to academic understanding: gender equality and inequality in marine science

With the research aim “to critically analyse how gender inequality persists within marine science for the sustainable use of the ocean and to contribute to developing the essential awareness and strategies for addressing this issue” the papers of this thesis document how the status quo can be challenged through evidenced-based and participatory approaches. Engaging a wide range of people across institutional levels contributed to achieving institutional acceptance of the need to tackle gender inequality, and commitment to make progress on gender equality through the approval of a gender action plan. The papers present and further develop methods, concepts, and theories relevant for documenting and analysing institutional inequality in the marine science and intergovernmental context, as well as community engagement, to facilitate reflection and contribution to solutions. By engaging the community at a variety of scales (individual participants, committees, broader network of participants at the Annual Science Conference) greater awareness of the factors that contribute to inequality were identified, as well as actions to progress gender equality, and thereby support diversity, equity, and inclusion.

Paper 1 capitalised on the opportunity to work with ICES researchers and test methods that make gender inequality visible, in the absence of self-identified gender disaggregated data. The process contributed to developing the evidence that fed into the discussions about the need for institutional change. The paper contributes to the growing body of research using quantitative methods to document inequality and make explicit inequality in the scientific practice of conferences and events. Conference participation is an important part of scientific practice, and awards/recognition programmes require critical reflection to consider how the execution of these programmes may be contributing to gendered and other types of bias.

A desk study of barriers to women’s participation in ocean-going field studies developed into paper 2, identifying potential solutions and strategies to facilitate more equitable participation in field work often linked to successful careers in marine and ocean science. The paper identifies gendered barriers to ocean-going research and contributes to the identification of specific challenges to be addressed to create a safe and enabling environment for women and underrepresented groups. This paper documents the specific challenges of marine and ocean science, highlighting that a gender sensitive approach to designing and executing field work is needed.

Conducting an FPAR project requires both advance planning, as well as flexibility to respond to the needs and priorities of the community in focus. Paper 3 documents
and critically reflects on the entire FPAR process, highlighting the need to address formal and informal parts of culture. Paper 3 also documents how an FPAR process can be applied to the IGO context and reveals the factors that catalysed a gender equality change agenda. Demonstrating that formal and informal parts of organisational culture must be addressed and critical acts can come in a variety of shapes and sizes.

Paper 4 highlights the experiences and perceptions of women with established links to the ICES community, identifying barriers and challenges, as well as solutions to support greater gender equality in marine and ocean science careers. By identifying paradoxical responses from respondents, the complexity of addressing gender inequality is further visible. The application of postfeminist theory can be used to understand individual perceptions of inequality. Raising critical perspectives of “merit” in science is critical for transforming and contributing to “consciousness raising” that contributes to empowerment. Metaphors can help to communicate complex concepts using intersectional perspectives to understand the complex interrelation of factors that can allow some individuals to access and progress in a network organisation.

Cumulatively, the papers make a contribution to documenting how feminist approaches can help progress a gender equality agenda in the IGO context, as well as how gender inequality persists in marine and ocean science.

3.7 Case study research and generalisability

The case study approach employed in this project has provided the opportunity for in-depth examination of institutional gender inequality, using multiple forms of data collection. There are many ways to design case study research, with implications for the generalisability of the results. This case study methodology follows the social constructivist approach, selecting an intrinsic case, where the case itself is of interest, aiming to describe “thickly”, and aiming to learn about the context in which the phenomena (gender inequality) occurs, acknowledging differences in interpretation (Ridder, 2017). This approach provides value for the case itself, for the community in focus, and the researcher. Case study approaches have been critiqued for their capacity to establish representativeness and generalisability, however it is important to acknowledge that there are different types of generalisability. The outcomes of this research will occur through ‘naturalistic generalisability’ or ‘transferability’ (Smith, 2017). These types of generalisability rely on the reader to find resonance with their own experience, or potential to use the methods and findings to their own case.
Making gender equal international marine science is important for social justice, but also to promote diversity of thought critical for all science and innovation. In the context of studies like Giakoumi et al. (2021), that present evidence of persistent bias in marine science in Europe, the inequality persistent at international level is likely a magnification of the inequality experienced in national and sub-national marine science institutes. Conducting this work in a network organisation like ICES, with more than 700 institutes represented by individual experts, means this work is likely to have synergistic effects, by raising awareness and empowering researchers and practitioners beyond ICES itself through processes of inter-organisational learning (Solheim & Moss, 2021).

### 3.8 Representativeness and intersectionality

The research design was focused on gender equality from a feminist perspective, and therefore privileging the voices of women was a part of the sampling strategy for interviews. However, it is important to attend to the many intersections of women's identities and acknowledge women are not a homogenous group, with different backgrounds and experiences. Systemic change must seek to improve the conditions and remove barriers for women in all of their diversity.

Research using available data sets and making inequality visible by post hoc inferring gender based on first name limited the analysis to the binary and is no replacement for self-identified gender disaggregated data. The recommendation from this research is that ICES systematically collects gender disaggregated data with four responses: male, female, prefer to self-describe, prefer not to answer. This constellation of responses creates an inclusive framework that does not “other” those who identify beyond the binary. The collection of gender disaggregated data must be sensitive to its intended use (Lindqvist et al., 2018), and in the context of an IGO wanting to understand the demographic composition of its community, these categories are sufficient. Collecting data on other types of demographic characteristics and underrepresented groups will require more consideration and be sensitive to the complexities of data collection at international level, given that underrepresentation must be defined in a context specific manner. For instance, the General Data Protection Regulation of the EU puts in place specific provisions to protect personal data that make specific infrastructure demands on the collection of certain types of demographic data (Van Stavel, et al., 2021). Gender is a very visible indicator of diversity, and while more demographic data for instance on ethnicity would provide a more powerful analysis, using available data made inequality visible, and provided the impetus for institutional actions on diversity, equity, and inclusion.
The sampling strategy for interviews with women of the ICES network was based on a purposive sampling strategy, selecting women from the leadership and decision-making levels, this resulted in the perception of an all-white sample, this highlights the additional barriers at work against women of colour, and/or other underrepresented social identity categories working in marine science and that more work is needed to create enabling conditions for a greater diversity of women (Isma et al., 2023). Working on actions to create greater access to marine and ocean science for people with disabilities is also an important aspect for fostering diversity (Bower et al., 2023). Working towards greater inclusion of a broader range of social identities in marine and ocean science in the North Atlantic context at IGO level will require national level strategies, as national institutes are in many respects the “gatekeepers” for network experts. However, the FPAR process of this research fostered work in sub-groups developed that developed recommendations to support culture and operational changes from a broad DEI perspective. At the 2023 annual science conference DEI theme session, approaches for engaging youth from underrepresented and historically marginalised communities were presented. Future research should consider a greater range of experiences and barriers for a range of social identities that are underrepresented in marine science at the IGO level.

While gender inequality is persistent across STEM fields (Charlesworth & Banaji, 2019), focusing on the specific conditions in marine and ocean science provides opportunities for understanding context specific actions required across scales (Shellock et al., 2022). While some sources claim ocean science is doing 10% better than other areas in representation (IOC-UNESCO, 2017), representation alone is not a sufficient measure of gender equality (Grzelec, 2024). There is some indication in some areas, like the US, that women are at or above parity in obtaining PhDs in Ocean science, while there are still disparities in leadership roles (Lewis et al., 2023).

Ocean science, similar to other earth sciences, including polar research and geology, requires field work to support understanding, data collection, and leading publications required for career progression. This makes attending to creating inclusive and safe fieldwork opportunities a priority for action (Amon et al., 2022) and an important part of a holistic approach to addressing inequality in ocean and marine science.

Gendered patterns exist in international research collaborations (Uhly et al., 2017), making international marine science networks important sites for progressing inclusion and helping to establish international networks.
4 Concluding remarks

4.1 Conclusions

This research has fulfilled its aim to critically analyse how gender inequality persists within marine science for the sustainable use of the ocean and to contribute to developing the essential awareness and strategies for addressing this issue.

By focusing on an IGO that coordinates marine science in the North Atlantic Ocean, a broad picture and in-depth description developed providing insights and understanding of how gender inequality manifests and how actions are catalysed to support gender equality. Working with a large network organisation through a participatory process contributed to raising awareness about the current state of gender equality in marine science, given a broad audience inherent in the organisational structure.

Feminist theories, including feminist systems theory, feminist institutionalism, and feminist international relations theories provide important frameworks and tools for understanding the mechanisms contributing to gender inequality. By using the gender lens to put focus on the formal and informal processes that contribute to inequality in the institutions of marine and ocean science, in specific organisations like ICES, the utility of these approaches is highlighted, and mechanisms that contribute to and counteract gender inequality have been documented. Institutional practice and unconscious bias continue to reinforce gender (and likely other kinds) of inequality.

The research presented in this thesis has shown that few women have been recruited to, retained in, and “empowered” at senior levels in the conduct of marine science due to a range of factors stemming from formal and informal aspects of working culture in marine science that create barriers to opportunity. Bias in institutional practice like conferences and awards, as well as in field work remains. Unconscious bias at institutional and individual levels continues to reinforce gender discrimination in career progression. The narrative of science as an objective meritocratic working environment supports the resistance to seeing science institutions as gendered, and slow progress on gender equality.

While it is possible to identify practice and process across levels that can act as solutions and barriers, some of the issues that lie “beneath the surface” are
counteracting the progression of gender equality – the elements of postfeminist pragmatism, focus on individual responsibility to fit into the current system, and links to meritocracy make gender inequality difficult to articulate and address. By failing to acknowledge the gendered nature of international research collaboration, a gender unequal system at the international level will continue to reinforce the underrepresentation of women at senior levels of marine and ocean science.

An FPAR approach was critical to uncovering and understanding these mechanisms. It also helped to progress a gender equality agenda and the empowerment of women in an intergovernmental marine science organisation by engaging a network of scientists across institutional levels. Actions manifested in a variety of ways and across different levels, raising awareness and taking up space to discuss gender inequality and DEI. This process empowered the community to agree to an institutional level commitment evident in the adoption of a gender equality plan.

When researching change, it is important to note some instances of resistance were documented, but others go undocumented. Making gender equality a priority for a greater range of social identities, especially men, is an ongoing challenge.

Reid and Frisby’s (2008) description of the dimensions of FPAR, asks researchers to use, develop, and critique the framework to “…open up new possibilities for engaging in more reflexive, collaborative, and transformative FPAR” (p. 96). This research has further developed institutional approaches to applying FPAR and highlighting how embedded insider roles can help advance institutional actions for progressing gender equality.

Applying an FPAR approach to driving a change agenda in a marine science IGO has shown how the methodology can be scaled up from small group-based initiatives to an organisation. There are trade-offs in FPAR approaches (Reid & Frisby, 2008); while smaller group based FPAR can empower individuals, “actions” can have limited systemic or institutional impact. In this research, by engaging the community broadly, it was possible to get buy-in from across the organisation to support the approval of the Gender Equality Plan.

While a lot was achieved in ICES through this Feminist Participatory Action Research project, a lot remains to be done. Approving a Gender Equality Plan is an important institutional commitment to change. However, being overly concerned with indicators and targets can put focus on demonstrating instead of “doing” gender equality (Ahmed, 2007). Continuing action is needed to further realise positive change.

Culture change can be most effectively realised by embracing participatory approaches and using evidence to document inequality and inform the development of systemic interventions and actions. Developing actions for a specific institutional context is both labour intensive and more likely to have specific impact. More
difficult is considering if any of the interventions will have a lasting and significant effect. Progress does not always advance in a linear fashion, and progress can be undone. While balanced representation is important, gender equality is more than just 50:50 gender ratios across organisational levels. Measuring and progressing change requires ongoing engagement and interventions, employing qualitative data. There is a prevailing assumption that gender equality in marine and ocean science, especially in leadership roles, will be achieved as a “matter of time”. The assumption that as greater numbers of women are qualified, they will move up the ranks, needs to be continually challenged. Institutional, systemic, and individual bias continues to reproduce inequality. Gender equality will not be solved without interventions that can shift the culture in science workplaces, organisations, and institutions to make the experience of conducting research and practising marine science equitable and inclusive of people of all genders and social identities.

4.2 Further research

In future research, finding ways to sample and learn from those who have been “excluded” from the ICES network could provide further insights. Taking a more actively intersectional approach could facilitate understanding how to improve institutional accessibility for a greater range of social identities.

This research has also highlighted the importance of conducting case studies of ocean science organisations, with implications for opportunities to share knowledge and good practices. The usefulness of FPAR in the intergovernmental context was evident in this research and its potentials can be further explored to address gender inequality in future research on science institutions.

With men continuing to dominate leadership roles in marine and ocean science, research into masculinities in marine science (See e.g. Milam & Nye, 2015) could also have important implications for finding ways to accelerate progress on gender equality in ocean science.

4.3 Epilogue

Using FPAR methodology provided many benefits to this research, including empowering a community to engage in an organisational change process. Operating from an insider perspective, with in-depth understanding of a complex organisational structure, provided a unique opportunity to apply the gender lens to challenge the status quo, and raise awareness about ongoing gender inequality, and
develop a thick description of the process. The usefulness of an “insider” approach is also evident from this research, where it was possible to directly advocate for and direct priority actions identified by the community. However, the duality of the insider role can also challenge the utility of FPAR, as not all relevant evidence and experiences could be included in the analysis. During the research process, many women sought me out to recount their experiences and to have them documented and included. While their experiences informed understanding of the issues, some evidence must remain confidential.

I have now concluded my time as an insider researcher at ICES. I hope the platform built through this research will provide the space for this work to continue. There is evidence that focus on gender equality will continue; some of these indications are presented below.

By highlighting gender bias in institutional practices such as the underrepresentation of women in highly visible conference roles, an ongoing discussion has been sparked in the responsible committee. The focus is on how to change the process of selecting a keynote presentation in a way that achieves the goals of the organisation in a more transparent and equitable way.

After convening the first diversity, equity, and inclusion (DEI) network session (2021) and the first DEI theme session (2023) at the ASC as part of this research project, others are now starting to also take initiative to lead similar sessions on these important science topics. The 2023 call for theme session proposals for the 2024 ASC resulted in an independent proposal (i.e. written by a member of the ICES community) on "Creating supportive fieldwork environments in marine sciences" and chosen as a network session by the ICES Science Committee. This forms evidence that there is now broad acceptance, legitimacy, and understanding of the need for ongoing research and knowledge co-creation on issues of how science is practised for equity and inclusion.

Changes in the upper layers of the “wonky pyramid” depicting gender ratios in ICES (Figure 3.1.1) may soon be visible. In 2023, for the first time in the history of the organisation, two women were elected and will serve on the ICES (Executive Committee) at the same time for a three-year term. However, overall, within the many layers of the organisation, women continue to be underrepresented in leadership roles.

The World Maritime University, Sasakawa Global Ocean Institute, Canada Department of Fisheries and Ocean—sponsored Empowering Women for the UN Decade of Ocean Science for Sustainable Development programme brought together intergovernmental organisations mediating ocean science and governance to exchange knowledge through a high-level advisory board and online meetings. A recurring idea that circulated (that also signals acceptance of the status quo) was that
there is little that can be done from the Secretariat position to affect change in gender equality, given that Member Countries are responsible for nominations. While Member Countries are ultimately responsible for deciding which national experts participate in the work of IGOs, this project has demonstrated how Secretariats can provide opportunities to raise awareness of institutional inequality and provide opportunities for action. Working with member country representatives (in ICES referred to as Council Delegates) in a sub-group setting provided the opportunity to self-reflect and consider what they from both an individual and national process level change to be more intentional in attending to greater gender equality, as well as diversity and inclusion more broadly in process and representation.

In the final phase of my PhD journey, I decided to leave my position at the ICES Secretariat. To maintain momentum, a new champion will be needed. Following through on the commitments outlined in the Gender Equality Plan, including committing resources and recognizing gender equality work as a professional role will be an important part of capitalising on the momentum built during the course of this project. I hope the FPAR process will continue to have impact at both micro and macro level such as helping to normalise reflecting on gender in science and the institutional culture, setting the organisation on a path to greater gender equality by explicitly recognising that there are gendered processes at work.
5 References


Convention on the Elimination of All Forms of Discrimination against women (CEDAW), opened for signature on 18 December 1979, (entered into force 3 September 1981)


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Appendix 1: ICES Gender Equality Plan

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ICES Guidelines and Policies

ICES Gender Equality Plan

Version 1 | December 2022

Recommended format for purpose of citation:

Background

Guideline scope

This Gender Equality Plan (GEP) for ICES describes objectives and targets. It also describes initiatives in place and under-development in the context of the qualitative and quantitative targets to evaluate progress towards achieving gender equality, empowering women, and underrepresented groups.

Development and Review Process

The ICES Gender Equality Plan was approved by the ICES Council at its annual meeting, October 2022. Progress on the plan will be reported to Council annually, with updates implemented as needed, and major revisions linked to the strategic planning cycle.

Prior to Council approval, the Gender Equality plan was presented and reviewed by the main organizational committees including Bureau (executive committee of the Council), Advisory Committee, Science Committee, WGCHAIRS (Chairs of ICES Working Groups), Strategic Initiative on the Integration of Early Career Scientists (SIIECS), and Secretariat staff. This consultation took place during 2022, with further input on targets, indicators, and actions incorporated into the plan.
1 Introduction

1.1 Vision

ICES is committed to achieving gender equality and empowering women, and members of underrepresented groups in our science network. Science is a critical component of a sustainable social-ecological system, and must be equitable and diverse to effectively meet societal needs for impartial evidence on the state and sustainable use of our seas and oceans. To this end, ICES is committed to mainstreaming gender equality, and principles that support diversity, equity, and inclusion broadly in its governance, working structures, programmes, and service delivery.

1.2 Objective

The objective of advancement of gender equality, diversity, equity, and inclusion at ICES is to fully realize the professional and human potential, for all genders and identities through an inclusive international working environment, equal employment opportunities, and to provide improved services that contribute to the sustainable management of human activities in our seas and ocean.

1.3 Current status of gender equality in ICES

The 2019 ICES Strategic Plan set the foundation for further work on fostering a diverse, inclusive, and gender balanced organization. Work towards this commitment has progressed through internal actions and dialogue, and support for PhD research linked to the project Empowering Women for the UN Decade of Ocean Science for Sustainable Development in partnership with the World Maritime University.

This gender equality plan has been developed drawing on available information. During 2021, ICES began a scoping phase that included dialogue with the ICES community, a virtual screening of the film “picture a scientist”, and follow-up survey that provided further insights into the experiences of people working in the network and highlighting where action is needed to create a more inclusive organization. See Appendix 2 for details.

ICES currently lacks a dynamic overview of how different genders are represented across the organization. A static picture of gender ratios in ICES at different levels for 2019 was developed providing initial information on the imbalance between genders. An imbalance between genders is also found at Secretariat level. With women well represented in the marine science community, a plan is needed to create an inclusive working environment, rectify these imbalances, and ensure women, and other under-represented groups are able to equitably contribute to the work of the organization at all levels.

1.4 Implementation

Implementation of the interim Gender Equality Plan will be conducted in an on-going and iterative manner. The main action is developing and drafting the full plan by end 2022, with identified actions to be implemented on an on-going basis.
1.5 Monitoring

Monitoring and progress on the actions and targets outlined in this plan will be reported annually at the ICES Council meeting.

Annex 2 provides a description of initial input from the ICES network in 2021.

1.6 Gender Equality Targets and Indicators summary

Progress on gender equality must be measured through a range of both qualitative and quantitative targets and indicators. Table 1 provides a summary of the high-level targets and indicators that will be monitored and reported on. Current status and further and actions on these targets is described in the following sections.

Table 1. List of proposed qualitative and quantitative gender equality targets and indicators.

<table>
<thead>
<tr>
<th>Qualitative targets</th>
<th>Quantitative Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>A gender-fair organizational, network, and personnel development</td>
<td>ICES network/institutional level</td>
</tr>
<tr>
<td>An inclusive working culture accustomed to discussing issues of gender equality,</td>
<td>Proportion of people by gender serving in decision-making roles (Council, ACOM, SCICOM)</td>
</tr>
<tr>
<td>diversity, equity, and inclusion</td>
<td>Proportion of people by gender chairing ICES expert groups</td>
</tr>
<tr>
<td>A family friendly working environment</td>
<td>Resources allocated to gender equality, diversity, equity, and inclusion</td>
</tr>
<tr>
<td>A working environment that protects against all forms of harassment and violence</td>
<td>Proportion of leadership who have participated in gender training</td>
</tr>
<tr>
<td>An organisation with professionalized gender equality work</td>
<td>Number of groups with Resolutions/Terms of Reference specifically dedicated to gender</td>
</tr>
<tr>
<td>An awareness of sex/gender issues in research and projects</td>
<td>equality, diversity, equity, and inclusion</td>
</tr>
<tr>
<td></td>
<td><strong>Secretariat</strong></td>
</tr>
<tr>
<td></td>
<td>Proportion of staff by gender in professional grade roles</td>
</tr>
<tr>
<td></td>
<td>Proportion of staff by gender in general service category</td>
</tr>
<tr>
<td></td>
<td>Proportion of leadership who have participated in gender training</td>
</tr>
<tr>
<td></td>
<td>Gender pay gap indicator</td>
</tr>
</tbody>
</table>
1.7 Gender-fair organizational and personnel development

ICES is working towards gender-fair organizational and personnel development. This has begun with an ongoing review of ICES policies and practice with the aim to improve on the sensitivity of all policies and practice, including external and internal communication documents. This includes appropriate guidance on gender sensitive language, images that are equal in representation, and avoid reinforcing negative gender/racial/ethnic stereotypes.

There is currently a gender imbalance across the decision-making levels of the organization, with women occupying approximately 20% of decision-making roles. Strategies to address this imbalance are currently being evaluated, and member countries are being encouraged to reflect on diversity in the nominations process as a first step while other strategies will be further considered as part of the development of the GEP.

Within the Secretariat there is also a gender imbalance between staff grades, with women occupying only around 25% of professional staff positions, while 75% of staff in the general service category are women. The annual Secretariat report to Council will include figures on staff development by gender. Ensuring recruitment processes are created and conducted in a way that supports equal opportunity is an existing goal that will continue to be strengthened.

The internal Secretariat workplace assessment process is considering gendered aspects within the action plan, and new strategies are needed to address limited job growth potential and ensure gender fair development for staff.

1.8 An inclusive working culture accustomed to discussing issues of gender equality, diversity, equity, and inclusion

An inclusive working culture accustomed to discussing issues of gender equality, diversity, equity, and inclusion needs to be fostered in the ICES community to create positive change. The importance of creating a diverse, inclusive, as well as gender balanced organization have been explicitly recognized in the 2019 ICES Strategic Plan. Work to achieve this goal through awareness raising has been ramping up through partnership in projects, specific events, and discussions within leadership teams, and at committee, and expert group level.

Diversity, Equity, and Inclusion training with specific focus on gender awareness was provided to Secretariat staff in January 2022, with a view to developing training for the wider ICES network as a next-step.

The ICES flagship event, the Annual Science Conference (ASC) will be reviewed by organizers to consider how the event can better support the goals of diversity, equity, and inclusion, with monitoring and reporting on gender representation following each event as an important component.

The 2021 Annual Science Conference was the first event to host a specific session on gender equality, diversity, equity, and inclusion, ensuring these types of sessions regularly provide a venue for awareness raising, discussion, and identifying further organizational actions forms part of this plan. See Appendix 2 for more information on the findings of the session.
1.9 Create a family friendly working environment

Creating a family friendly working environment is critical to inclusion and gender equality. Considerations for workload, working times, and infrastructure to support those with caring responsibilities are critical components of creating working conditions that support equitable participation in ICES activities.

The remote work period associated with the COVID-19 pandemic brought opportunities and challenges, providing greater accessibility for some, while also contributing to increased workloads for the expert network, as well as Secretariat staff. Workloads need to be manageable, especially for Chairs of expert working groups. Individuals with caring responsibilities may find it more difficult to take on additional ICES responsibilities if the workload is too great.

Given the international nature of ICES work, the burden of inconvenient meeting times needs to be shared across time zones, recognizing that those with caring responsibilities often have additional time constraints.

Further consideration of how to provide facilities for childcare, to support nursing mothers, or others with additional or unique needs at all ICES events, as well as in the new ICES HQ building (move projected for 2023), are important considerations that will be further developed.

Under the guidance of the Council, the General Secretary is responsible for the safe, secure and equitable working environment of the secretariat. The current staff rules provide ICES staff with access to parental leave benefits consistent with Danish standards, with periods of leave available for mothers and fathers. ICES staff also have the possibility to use flexible working times, and work from home arrangements which support families and caregivers. However, greater numbers of remote and hybrid meetings in the ICES network will require new strategies to ensure both the ICES network and Secretariat staff can realize an appropriate work-life balance, regardless of family situation.

1.10 Protection against all forms of harassment and violence

Protection against all forms of harassment and violence is also a workplace imperative for diversity, equity, and inclusion. All participants in ICES work should be familiar with ICES values, expectations for professional behaviour, as well as how to report any incidents. Reporting lines need to be sensitive to protecting those who report incidents, and capacity developed to allow for anonymous reporting.

A new code of ethics and professional conduct has been developed, consolidating existing documents and further outlining expectations for behaviour and accountability. Further evaluation of appropriate reporting lines is in development.

1.11 Professionalization of gender equality work in ICES

Given the importance of gender equality, diversity, equity, and inclusion, dedicated resources are required to professionalize this work within the network as well as the Secretariat, as well as to implement identified actions. At the 2021 Council meeting, recommendations aimed at facilitating the transition to a post-pandemic reality and new ways of working for the ICES community, specifically recognized that gender awareness needs further development within the organization. The Council supported allocation of funding for a position to support further development of this work in the organization. Implementation of these recommendations is planned for 2022.
1.12  Sex and gender in research

Ensuring appropriate considerations of sex and gender are accounted for in research is critical for developing best available science. New projects and research should employ available tools to critically evaluate if appropriate considerations are accounted for throughout the project lifecycle.

GenderWave is a digitool to support incorporation of gender perspectives into marine research and innovation that could help facilitate such considerations. [https://oceanrep.geomar.de/50308/1/GenderWave_FINAL_11.08_page%20numbering.pdf](https://oceanrep.geomar.de/50308/1/GenderWave_FINAL_11.08_page%20numbering.pdf)

The Gendered Innovations project also highlights the critical importance of sex and gender analysis in marine science. [https://genderedinnovations.stanford.edu/case-studies/marine.html](https://genderedinnovations.stanford.edu/case-studies/marine.html)
2 Quantitative targets

Collecting gender disaggregated data is necessary precondition for the monitoring of targets and indicators and assessment of progress. For the wider ICES network, ICES is in process of developing a systematic approach for collecting gender disaggregated data according to best practice methods (self-identified, beyond the binary, GDPR compliant) that will support routine monitoring of gender representation in all ICES activities. In the interim, alternative approaches will be used for reporting as described below. Further consideration of specific targets, supporting actions, and timelines will be developed during 2023.

For Secretariat staff, where this data is already available the ratios (proposed list below) will start to be routinely calculated and form part of the annual reporting to Council starting in 2022.

Gender disaggregated data is being routinely collected for conferences and events since 2019.

The following list of indicators is an initial proposal to begin tracking progress on gender equality in ICES at both the scale of the organization, and the Secretariat.

### 2.1 ICES network/institutional level

- Proportion of leadership who have participated in gender training
- Proportion of people by gender chairing ICES expert groups
- Proportion of people by gender serving in decision-making roles (Council, ACOM, SCICOM)
- Resources allocated to gender equality, diversity, equity, and inclusion
- Number of groups with Resolutions/Terms of Reference specifically dedicated to gender equality, diversity, equity, and inclusion. (Add a specific code to the Science Plan/ or create a Council priorities list for tracking in the developing – to be further discussed)

### 2.2 Secretariat

- Proportion of staff by gender in professional grade roles
- Proportion of staff by gender in general service category
- Proportion of leadership who have participated in gender training
- Gender pay gap indicator
Annex 1: Gender Equality qualitative targets and actions summary

| Qualitative targets and actions summary |
|--------------------------|--------------------------|
| **Targets**              | **Actions**              |
| Gender-fair organizational and personnel development | Organisation  |
|                          | Organizational gender mainstreaming – Ensure that all communications, policies, practices, and awards are gender sensitive |
|                          | Secretariat  |
|                          | Regular reporting and reflection on gender imbalance in the Secretariat |
|                          | Continued commitment to equal opportunity recruitment processes |
|                          | Consider new strategies for gender fair development that addresses limited job growth potential within the Secretariat |
|                          | Network  |
|                          | Address gender imbalance in decision-making roles – encourage reflection on diversity in the nominations process and seek input on additional strategies from member countries |
| An inclusive working culture accustomed to discussing issues of gender equality, diversity, equity, and inclusion | Raise awareness of gender equality through participation in projects, specific events, and recurring agenda items at all organizational levels |
|                          | Gender equality, diversity, equity, and inclusion training for all organizational levels |
|                          | Annual Science Conference – commit to greater gender parity in all aspects, monitoring, and publish/report on gender representation |
|                          | Annual Science Conference – host a diversity and inclusion event or session at every conference |
| A family friendly working environment | Review workload, working times, and infrastructure to support families from both Secretariat and network perspective. |
|                          | Ensure facilities for childcare/to support nursing mothers, and others with caring responsibilities at ICES HQ, as well as Annual Science Conference/symposia or other co-sponsored events. |
| Protection against all forms of harassment and violence | A “new” code of ethics and professional conduct that includes commitments to gender equality |
|                          | appropriate lines of accountability for reporting incidents of harassment, including capacity for anonymous reporting |
| Professionalization of gender equality work in ICES | Allocation of funds for a new position through recommendation of the BSCGC19 |
| Sex/gender in research | Encourage use of/raise awareness of GenderWave tool to assess sex and gender sensitivity of all new projects |
Annex 2: Summary details of selected outcomes of discussions with the ICES Community.

**WGCHAIRS discussion – January 2021**

In order to start the discussions within the ICES community on how to make our organization more diverse and inclusive, an online viewing of the documentary ‘Picture a Scientist’ was hosted. 419 people watched the film as part of the ICES event. The documentary takes an evidence-based approach to explore the challenges faced by women working in science today, exploring the role of implicit bias and gender-based harassment as a cause for under-representation.

A survey was sent after the film to gather more information from the ICES community. The analysis of the results continues, however, the initial results shared experiences of harassment and unconscious bias also present in the ICES Community.

During the discussion, appreciation for the evidence of the under-representation of women and support for the collection of gender-disaggregated data were noted. A range of suggestions were provided by Chairs including:

- Chairs are empowered to improve the diversity in their own work through the “Chair-invited member” mechanism.
- Specific training could be explored. For Chairs, this would also be helpful in the current context of remote meetings and the need to ensure everyone is heard during discussions.
- Continuing to include gender equality, diversity, and inclusion to agendas of ICES committee meetings.
- Formal communication with Member Countries, highlighting gaps in diversity.

**ASC discussion – September 2021**

The session was well attended with 60 (peak) participants. Mentimeter questions were used to engage audience and gather feedback with 40 participants actively responding. Based on the responses, participants were mostly from Europe, and a majority based in Northern Europe, 20% based in North America, additional attendee locations included Iceland, and Africa. In terms of gender diversity, 73% female, 25% male, and one person identifying as preferring to “self-describe”. There was a good mix of participants with varying levels of experience participating in ICES activities, 17% indicating this was their first ICES event, 29% indicating less than 5 years (and a potential proxy for early career status), 27% indicating 5-15 years, and 27% also for 15+ years.

Respondents were asked to indicate if they identified with an underrepresented group in the ICES community. This was defined broadly (including but not limited to gender identity, nationality, racial, or ethnic diversity, sexual orientation, career stage, class, disability, neurodiversity, among other things) and left to participants to acknowledge themselves. Among responses, 32% identified as “underrepresented”, 17% were unsure, and the majority (51%), did not identify as underrepresented. While women have been identified as underrepresented in decision-making roles within ICES, and this was discussed at the session, a majority of females (70%), did not identify as underrepresented, this may also relate to an unclear context provided by conveners for the definition of “underrepresentation”.
Respondents were also asked to indicate if they had ever experienced gender-based harassment, (also defined broadly), 8% (3 respondents) reported never having experienced gender-based harassment while working in marine science, while 17.5% responded “once or twice”, 72.5% “A few times”, and 2.5% (1) reporting “often”. The question was asked in a broad way, so it is difficult to speculate if these occurrences happened in ICES or national contexts. Regardless, given the very few instances of harassment ever being reported to the Secretariat (as directed by the current policy outlined in ICES “meeting etiquette”) it demonstrates the need for specific actions to prevent further instances, through awareness, training, and developing clear lines of accountability.

Read the full network session report online.
Annex 3: Quantitative Indicators – status 2022

<table>
<thead>
<tr>
<th>ICES network/institutional level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of people by gender serving in decision-making roles (Council, ACOM, SCICOM)</td>
<td>Approximately 20% female and 80% male (based on 2021)</td>
</tr>
<tr>
<td>Proportion of people by gender chairing ICES expert groups</td>
<td>Approximately 39% female and 61% male (based on 2021)</td>
</tr>
<tr>
<td>Resources allocated to gender equality, diversity, equity, and inclusion</td>
<td>Secretariat training – staff time approximately DKK 144,000</td>
</tr>
<tr>
<td>Proportion of leadership who have participated in gender training</td>
<td>Both ACOM &amp; SCICOM Chair participated in 2022</td>
</tr>
<tr>
<td>Number of groups with Resolutions/Terms of Reference specifically dedicated to gender equality, diversity, equity, and inclusion.</td>
<td>To be calculated, but at least one in 2022: SIIECS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secretariat</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of staff by gender in professional grade roles</td>
<td>22% women 78% men</td>
</tr>
<tr>
<td>Proportion of staff by gender in general service category</td>
<td>68% women 32% men</td>
</tr>
<tr>
<td>Proportion of leadership who have participated in gender training</td>
<td>80% participated in training in 2022</td>
</tr>
<tr>
<td>Gender pay gap indicator</td>
<td>Indicator calculation method still in development</td>
</tr>
</tbody>
</table>
7 Appendix 2: Papers included in this dissertation

**Paper 1**  

**Paper 2**  

**Paper 3**  
Johannesen, E. (2023). Participatory approaches in support of institutional actions to advance gender equality in ocean science in the IGO context. *(Submitted)*

**Paper 4**  
Gender and early career status: variables of participation at an international marine science conference

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Conference participation is an important part of academic practice and contributes to building scientific careers. Investigating demographic differences in conference participation may reveal factors contributing to the continued under-representation of women in marine and ocean science. To explore the gender and career stage dimensions of participation in an international marine science conference, preferences of presentation type (oral/poster) as well as acceptance and rejection decisions were investigated using 5-years of data (2015–2019) from an International Marine Science Conference. It was found that early career scientists were more likely to be women, while established scientists were more likely to be men. Although overall, gender did not show a significant effect on the decisions to “downgrade” requests for oral presentations to poster presentations, early career scientists were significantly more likely to be downgraded than established scientists. Given that more women were often early career scientists, more women than men had their presentations downgraded. Other indicators and evidence from conference prize-giving and recognition awards point to a gender gap remaining at senior levels, highlighting the need for further actions as well as monitoring and researching conference participation from a gender perspective.

Keywords: abstract acceptance, early career, gender, marine science, ocean science, oral, poster, presentation, science conference participation, scientists.

Introduction

Gender

Science has been historically dominated by men (Jones, 2019), although with important advances for women achieved over the past 100 years (Saini, 2017; Horrocks, 2019). Despite these positive trends, women continue to be under-represented in sciences, including marine and ocean sciences (UNESCO, 2015; Huang et al., 2019; IOC-UNESCO, 2020; Giakoumi et al., 2021), and face a multitude of challenges for career progression and in leadership positions (Shellock et al., 2022). Such challenges may be observed in a variety of scientific opportunities that women may access during their careers, such as scientific conferences. Scientific conferences are an important part of academic practice, with a tradition dating back at least to the 17th century (Hauss, 2020). Conferences can provide the venue for communication processes that have been shown to lead to the production of scientific knowledge [Lafort et al., 2013, and can provide participants with increased visibility, new skills, ideas, and contacts (Cherstrom, 2012; Oester et al., 2017)]. Conferences bring scientific communities together, facilitate networking with others working in the discipline or field, and provide opportunities for the initiation of new collaborations and career development (Walters et al., 2019). International conferences provide opportunities to engage with a more geographically and/or culturally diverse group of people than in a local setting. They therefore have a multitude of scientific and societal implications (Hauss, 2020).

Early career

People in early career stages also face discrimination and bias [Implicit or unconscious bias is a phenomenon that recognizes behaviours and attitudes may not always operate consciously, and can lead to discrimination of specific groups, with negative stereotypes unknowingly influencing associations with e.g. gender, race, or age (Greenwald and Banaji, 1995)] in marine and ocean science. A survey of Early Career Ocean Professionals (ECOPs) (Here we adopt the term Early Career Ocean Professional in an effort to be as inclusive as possible, recognizing people in early career stages may be pursuing various career paths and in the literature are variously referred to as Early Career Scientist, or Early Career Researcher.) reports major economic barriers, including unpaid work and harassment, contributing to mental health issues (Osiecka et al., 2022). These types of structural challenges faced by ECOPs have been exacerbated by the COVID-19 pandemic, and access to networking opportunities is an important part of ECOP well-being (Schadeberg et al., 2022). Conference attendance for early career participants may be influenced by demographics, where participants from minoritized groups may face systemic or other types of bias and discrimination, as well as issues related to accessibility and the purpose or value of attending (Timperley et al., 2020). ECOPs help to develop marine and fisheries science, with important contributions to the peer-reviewed literature (Smolinski et al., 2022). Valuing and ensuring ECOP representation in scientific societies is important, given their important contributions and
volume of work; their views should be included in shaping future research directions (Bankston et al., 2020). Conference participation can be an important first exposure and engagement of ECOPs in a scientific society.

**Gender representation at conferences**

Conference participation should be open to all members of scientific communities to participate on an equal footing (Tulloch, 2020). For people in early career stages, participation at conferences is an important part of building an academic career, though if conferences have not explicitly considered how to cater for and include ECOPs, the experience of participating can leave them with the feeling of having invested a greater amount of energy than benefit gained (Ridde and Mohindra, 2009). Academic science conference attendance can help establish reputations and bolster careers (Leon and McQuillin, 2020), and balanced gender representation at conferences is important both as a matter of equality, but also as a measure working against the implicit bias prevalent in science (Calaza et al., 2021). Balanced gender representation at conferences also positively influences the social climate and ultimately the perception of the scientific community, which may influence the retention of women (Biggs et al., 2018).

**Women in marine science conferences**

A balance of genders in conference participation may not automatically translate into equal outcomes in terms of visibility or voice. There are examples in North American contexts that document that even in academic societies where women are well represented, there is evidence of continuing bias towards male contributions, with men giving more oral than poster presentations and women giving more poster than oral presentations (Isbell et al., 2012). A study of verbal contributions at German sociological conferences found gender differences in word density, with the length of women’s contributions increasing when a majority of women are present and decreasing word density with age. No such effect is present for men, increasing when a majority of women are present and decreasing when a majority of men are present (Calaza et al., 2017). Where conference participation is gender-balanced by attendance, equal visibility of women at conferences is not guaranteed; some studies have shown that women are self-selecting less visible presentation styles (Jones et al., 2014) and more likely to reject invitations to speak (Schroeder et al., 2013).

**Downgrading to posters**

Given the high-volume of scientific information available at an international science conference, poster presentations are often associated with lower levels of prestige, as they compete for attention among conference participants, and with low-visibility constrain opportunities for networking (Rowe and Dragan, 2015), which is an important reason for ECOPs and all participants to attend international science conferences (Oester et al., 2017). While posters may suffer from a lack of prestige in the conference setting, they are an important part of social academic practice. Accepted posters provide access to the conference experience, allowing new researchers to develop presentation skills, and can meet the threshold for an employer to provide travel funding for physical participation at the conference (MacIntosh-Murray, 2007).

If women are disproportionately self-selecting less prestigious poster presentations at conferences and engaging differently than male counterparts in other aspects of academic practice, this may contribute to the “Matilda effect” (the systematic undervaluation of the scientific contributions of women; Rossiter, 1993) with potential implications for funding and other metrics of academic success (Jones et al., 2014).

**Objectives of this study**

To explore the different kinds of involvement of women and men in scientific conferences, this paper reports on research that explores the gender and early career dimensions of participation in the ICES ASC, investigating preferences of presentation type as well as acceptance and rejection decisions. Using anonymized data from the ICES ASC submissions over a 5-year period from 2015 to 2019, we investigate whether the fate (reject/accept—oral/poster) of the abstracts is influenced by whether the submitter is an early career professional and their gender. We discuss the results in light of the notion that, for many conference participants, an oral presentation has more prestige than a poster presentation (MacIntosh-Murray, 2007).

**Case study: ICES annual science conference 2015–2019**

The International Council for the Exploration of the Sea (ICES) is an intergovernmental marine science body with a focus on the North Atlantic Ocean and adjacent seas. Each year ICES organizes an annual science conference (ASC) with an open call for abstracts across a wide-range of up to 18 parallel marine science themes. The annual conference attracts 500–700 participants; three keynote presentations are given, and participants share their research findings through posters or oral presentations. Recognition of scientific merit is awarded for the best presentation, the best poster, the two best early career presentations, and the one early career best poster (Merit Awards Section).

When submitting abstracts to the ICES ASC via an online submission system, submitters can express their preference for an oral or poster presentation. Theme sessions are proposed by conveners, and following acceptance of that theme session by the scientific committee, conveners have the responsibility to decide whether to reject or accept an abstract submitted to their session and, when accepted, whether it is for an oral presentation or a poster. When time slots for oral presentations are limited, conveners may decide to accept abstracts as posters, despite the submitter’s preference for an oral presentation. In other cases, decisions to “downgrade” a requested oral presentation to a poster, may reflect that an abstract is evaluated as not communicating sufficient quality to be awarded an oral presentation slot.

**Method**

Data were extracted from the ICES database on ASC abstract submissions for the years 2015–2019. The period of study was *2020 ICES Annual Science Conference Guide for Conveners. Unpublished guidelines.*
chosen to match the implementation of the fully online digital submission system, including the associated decisions on acceptance and rejection.

The data extracted included the abstract submitter’s name, self-identified early career scientist status (yes/no), abstract submitter presentation preference (poster/oral), convener decision (accepted/rejected), and presentation preference received (yes/no). The analysis focused on the individual submitter (presenter) of the presentation, although the majority of submissions represent multiple author contributions. Assignment of gender based on first name was conducted post hoc, using the software genderize.io. This method of gender inference limits gender to the binary (male/female), excluding other gender identities, and can potentially misidentify gender for unisex names, introducing additional potential bias (Lockhart et al., 2023). However, in the absence of self-identified gender data, genderize.io is an accessible tool suitable for this context (Santamaria and Mihaljević, 2018). Country/regional information was collected in the abstract submission database by use of a free text field, with a high variation in the type of information provided by submitters. With high-researcher mobility, and the data collected not necessarily intended to reflect country of origin, this parameter was not utilized in the gender inference process. Each record and the associated gender inference by first name receive a value calculated by the tool that indicates the confidence of the inferred gender. Records that resulted in a confidence value of >80% (37 records) were checked by internet searches with gender identity inferred from publicly available images on the internet (e.g. Research Gate).

A randomized validation exercise was conducted to compare the results of the gender inference of the genderize.io package with manual searches (see Supplementary Materials). Given 1952 unique persons in the dataset, we used a random number generator (https://stattrek.com/statistics/random-number-generator) to select IDs to verify inferred gender manually through internet searches. We checked 100 IDs, equivalent to ~5% of the unique IDs. A table of 100 numbers was produced according to the following specifications: Numbers were randomly selected from within the range of 1–1952, and duplicate numbers were not allowed. Manual internet searches used all available information, including both first and last name and, in one case, looking back to the original abstract to find the full name, resulting in 100% verification of inferred genders for all IDs checked. Where gender could not be inferred, records were excluded from the analysis (three records were removed). Following the assignment of gender (limited to male/female), unique identification numbers were assigned to individual persons, prior to removal of the names from the dataset as part of the anonymization process in advance of the analysis.

The data were analysed in R version 4.0.2 (R Core Team, 2020). We used generalized linear mixed effects models (GLMM) and the lme4 package (Bates et al., 2015) to explore if the covariates gender or career stage [i.e. Early Career (EC) or Established Scientist (ES)] (Established scientist used as a label here, but recognizing not all professionals attending the conference may be scientists), showed a significant effect on abstract acceptance or rejection, presentation preference (poster/oral), or presentation type allocated, with random intercept of unique identification number, to account for those who attend the conference regularly, and/or submit more than one abstract in a given year.

After an initial review of the data, it was decided to analyse all 5-years of data as a single sample, identifying a major increase in rejection rates for 2018–2019 and limiting comparability between years. This increase in rejection rates was the result of a policy change implemented by conference organizers in 2018, mid-way through the sample period, to limit the length of theme sessions, restricting available time slots for oral presentations.

Results

There were 1242 female (46%) and 1510 male (54%) abstract submissions (n = 2752), comprising 1952 unique persons/unique identities (the same individual may have attended more than one conference or submitted more than one abstract). On average 148 posters (± 4.4 (SE)) and 330 oral presentations (± 10.6 (SE)) are given, each year (2015–2019).

Gender and career stage of submissions

Focusing first on the career stage (of all submissions), we found that EC were more likely to be female (687 females and 558 males) and ES were significantly more likely to be male (555 females and 952 males) [GLMM (p < 0.01) see Supplementary Materials for model outputs].

Rejection rate

Of the total submissions, 6% (n = 168) of female submissions and 7% (n = 193) of male submissions were rejected. Of the total submissions, 7% (n = 187) of EC submissions were rejected (female n = 110 or 8.9% of all female submissions, and male n = 77 or 5% of all male submissions), and 6% (n = 174) of ES submissions were rejected female n = 58 (4.6% of all female submissions) and male n = 116 (7.7% of all male submissions). When we looked at the effects of gender and career stage on the rejection rate we found the effect of gender was not significant, but the effect of career stage (EC) was significant [GLMM (p = 0.02) see Supplementary Materials for model outputs].

Presentation preference

EC submitted requests for 1023 oral presentations and 222 poster presentations (45% of the total submission); of these submissions, 187 (144 oral presentations and 43 poster presentations) were rejected. ES submitted requests for 1325 oral presentations and 182 poster presentations (55% of total submissions); of these 174 abstracts (145 oral presentations and 29 posters), 29 were rejected.

Downgrades

Some requests for oral presentations (n = 439) were “downgraded” to poster presentations (see Figure 1). Using the GLMM model, we found no effect of gender on the “downgrading” decision; only the effect of EC was significant [GLMM (p = 0.03) see Supplementary Materials for model outputs]. The interaction effect between the fixed effects was not significant [GLMM (p = 0.43); see Supplementary Materials for model outputs].

Many more abstracts were submitted for oral presentations (n = 2348) than poster presentations (n = 404). The lme model was also used to explore if there was a preference for presentation type by gender or career stage (see Figure 2), and no evidence of a gender [GLMM, (p = 0.12) see Supplemen-
Figure 1. Proportion by gender and career stage of accepted submissions that preferred oral presentations and were downgraded to poster presentations (ES = Established Scientist, EC = Early Career; x-axis = number of downgrades).

Figure 2. Presentation preference of abstracts by gender and career stage (ES = Established Scientist, EC = Early Career Scientist; x-axis = number of individuals).

When we looked at the effect of gender and career stage on presentation types given (see Figure 3), we found career stage was significant [GLMM ($p < 0.001$) see Supplementary Materials for model outputs] with ES giving more oral presentations, as well as gender was also significant [GLMM ($p < 0.01$) see Supplementary Materials for model outputs] with a majority of male ES giving oral presentations (37% of all oral presentations, or 64% of oral presentations given by established scientists).

The ICES ASC event in 2019 was the first year that the organization began to collect self-identified gender disaggre-
gated data at registration for participants. In that year, conference participants were 50% males, 48% females, and 2% preferred not to answer. Looking at total presentations in that year also shows a similar split, with female participants giving 49% of all presentations and male participants giving 51% of all presentations. Broken down by presentation type in 2019, women gave 46% of oral presentations and 54% of poster presentations.

Results—prizes and awards

In ICES, there are also different recognition programmes that were developed to acknowledge the achievements of scientists spanning an entire career. The *Prix D’Excellence* “recognizes the highest level of achievement in marine sciences and important contributions to ICES vision”. All four recipients since 2008 were male. The *ICES Outstanding Achievement Award* has been awarded 13 times since 2005 and only twice to women (see Figure 4).

Keynote presentations

In the ICES ASC context, the Science Committee (The ICES Science Committee is made up of one representative from each of the 20 ICES member countries.) is responsible for the nomination and selection of keynote presentations. In the period of study 2015–2019, only 30% of keynote presentations were given by women (n = 5), or 1 of 3 slots per year (see Figure 5). In one of the years (2018), two men were co-presenters in one of the three keynote slots (see Table 1).

Merit Awards

The ICES ASC presents merit awards to recognize scientific contributions at the conference, and 70% of awards (all categories combined; see Figure 6) were awarded to women in the
period of study, highlighting that women are well recognized when judged on their specific scientific contribution.

**Discussion**

**Individual scientific contributions and participation**

In summary, we found no significant evidence of gender bias around (1) acceptance of abstracts and (2) presentation preference, while oral presentations were given mostly by men. Early career professionals were more likely to have their abstracts rejected and requests for oral presentations downgraded to presenting posters. While gender did not show a significant effect on the decisions to downgrade requests for oral presentations to poster presentations, women are more often early in their careers, and therefore overall more women had their presentations downgraded.

In-depth analysis of this conference participation dataset, including demographic information such as gender and career stage, reveals important information about participation in an international marine science conference, providing insights beyond registration data.

Our analysis focused on the abstract decisions, presentation preference, and presentation type awarded and demonstrates that career stage and gender are interconnected in complex ways and important factors in understanding potential sources of bias that may influence who participates in a conference. While our study did not identify significant gender bias in aspects of the submission of individual scientific contributions in conference participation, given the continued under-representation of women in marine and ocean science leadership roles (Arismendi and Penaluna, 2016; Giakoumi et al., 2021), critical reflection and monitoring of sources of potential bias in institutional processes remain important. Corona-Sobrino et al. (2020) suggest a range of indicators should be used to monitor and track gender balance, assess progress, and implement corrective actions for a more holistic approach to addressing the gender gap at academic conferences. In order to evaluate if the balance of conference participation is representative of the gender balance of ocean scientists overall, a baseline is required (Corona-Sobrino et al., 2020). Defining the total number of people of different genders in international multi-disciplinary fields like marine and ocean science can be difficult compared to single-discipline fields where it may be easier to compare, for example, using numbers of graduates.

To approach this question, the Global Ocean Science Report (GOSR; IOC-UNESCO, 2020) has developed an international conference participation indicator to assess the involvement of women in ocean science by region at the global level. The GOSR reports that women account for 39% of ocean scientists globally (IOC-UNESCO, 2020), which might be an over-estimate given the massive range reported between countries (7–70%) and major institutional and country data gaps. At the same time, “Women represent 48% of the participants in conferences on ocean science in general” (IOC-UNESCO, 2020, p. 103). Comparing almost 50–50 male/female total participation in the ICES ASC 2019, suggests “good” status on this conference participation indicator (Corona-Sobrino et al., 2020). Absolute numbers or percentages of participation in a conference provide a limited picture of the engagement of women in ocean science and overlook representation by career stage as an important indicator of the status and influence of women in the discipline. The results of this study are contributing to closing this knowledge gap and show what kind of analysis can be used to make biases towards gender or career stage explicit.

Our analysis suggests that overall, there was no gender bias influencing the decision-making process to accept or reject submitted abstracts. However, implicit gender bias can influence decision outcomes (Moss-Racusin et al., 2012; Calaza et al., 2021) and contribute to the barriers faced by women in STEM careers. Reviewing decision outcomes from a gender and career stage perspective is important to understanding potential sources of bias in institutional processes and systems. With only 6% of total abstracts rejected and no gender bias identified in the initial accept or reject decision, this finding supports the finding of Corona-Sobrino et al. (2020) in their development of an indicator framework, where acceptance and rejection were excluded as an indicator from their diagnostic tool in the final framework for evaluating gender roles and inequalities, given that there is generally a high acceptance rate for science conference submissions in general. However, our analysis found early career professionals were more often rejected. Given the importance of conference participation for networking building and career development and abstract acceptance as a barrier to entry, finding ways to support improved abstract quality for early career ocean professionals could be explored.

Our findings of greater numbers of women at early career stages with fewer women as established scientists is consistent with the findings of a recent study of European marine science research institutes identifying a persistent gender bias in marine science with a gender balance of PhD students and recent graduates but fewer women at higher-level positions (Giakoumi et al., 2021), reflecting the “leaky pipe”, a metaphor that is often used to describe the under-representation of women in higher-levels of academia and in STEM fields (Berryman, 1983; UNESCO, 2015). While there are many career paths that are often not linear, new metaphors, such as “the vanishing box” (Etkowitz and Ranga, 2011) or “the
We found no preference for specific presentation types influenced by gender or career stage. Female self-selection of less visible presentation types (shorter talks or poster presentations) has been identified in studies from other disciplines (Isbell et al., 2012; Jones et al., 2014; Schroeder et al., 2013). But at the ASC, all genders and career stages prefer an oral presentation, supporting the assumption that oral presentations are associated with greater prestige. Here, the finding that early career professionals are more often downgraded to poster presentations and are more often women highlights the influence that decisions of theme session conveners can have on the visibility of conference participants (MacIntosh-Murray, 2007). Being allocated a poster presentation has implications for both the visibility of individual participants as well as the specific scientific contributions that they are presenting. The “Diversity–Innovation paradox in science” illustrates how novel scientific contributions from underrepresented groups have less uptake and are discounted (Hofstra et al., 2020). Strategies to create enabling conference environments for people in early career stages, women, and other under-represented groups are imperative for both equality and better science (Niehen et al., 2017; Calaza et al., 2021). Specific guidelines and criteria could help session conveners foster greater inclusion, ensure a range of diversity, and tackle implicit bias through intentional consideration of gender and early career representation and the balance of allocation of oral and poster presentations in sessions (Tulloch, 2020).

Improving gender balance in keynote presentations

Recent studies of global conservation and ecology conferences have shown improved gender balance among keynote presenters over time, with women giving 47% of talks 2009–2020 (Tulloch, 2020), while earlier analysis found lower representation of 15–35% women keynote presentations 2000–2015 (Farr et al., 2017). Keynote presentation slots in our analysis were not balanced by gender. The ICES Science Committee, which is responsible for organizing the ASC and selecting keynote presenters, includes a nationally appointed member from each of the 20-member countries. In 2019, women made up only 20% of members, although our analysis showed that, measured by conference participation, women are equally active in ICES-related science as men. Isbell et al. (2012) found that the gender make-up of organizing committees influences the composition of symposia, with fewer women invited to all-male-organized symposia as compared to symposia organized by women. With the data presented here documenting that women are well represented at the conference and the reference condition noted by the GOSR of 39% of ocean scientists being women, this is evidence of an under-representation of women in high-profile participation roles at the conference, such as keynote presentations. An intervention strategy to tackle this bias described in the journal Nature describes the implementation of a code of conduct and a pledge to eliminate all-male panels. Eliminating all-male panels improved the representation of women in keynote presentation slots from 29 to 48% over 6 years (Nature, 2021). A code of conduct for science conferences, setting expectations for behaviour and outlining consequences for violations, are important tools for fostering safe working conditions and signaling commitment to equity and inclusion, but are not yet standard practice (Favaro et al., 2016; Foxx et al., 2019; Tulloch, 2020).

However, the presence of a code of conduct, may not directly influence improved gender balance in highly visible conference roles, such as keynote presenters (Tulloch, 2020). An in-depth review of the keynote selection process to identify and counteract potential sources of bias in the nominations, selection, or acceptance stage, could help to improve the diversity of profiles of keynote presenters. To attract a greater diversity of keynote presenters, offering more supportive conditions at conferences to facilitate the participation of women, and others with caring responsibilities, such as explicitly welcoming

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<td>Location</td>
<td>Gothenburg, Sweden</td>
<td>Hamburg, Germany</td>
<td>Fort Lauderdale, USA</td>
<td>Riga, Latvia</td>
<td>Copenhagen, Denmark</td>
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<tr>
<td>Keynote presenters</td>
<td>1 woman, 2 men</td>
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Table 1. ICES ASC conference location, year, and gender of keynote presenters.
children, and/or providing subsidies or grants for childcare, can also contribute, especially for those in early career stages (Calisi et al., 2018).

Recognition programmes

A gender bias has been observed in many scientific recognition programmes; a recent study of Nobel Prize nominations from 1901 to 1964 showed that of the 10818 nominations, only 98 were for women (Modgil et al., 2018). These authors evaluate that the low number of nominations (and winners) is caused by a diverse set of social factors, including male dominance on selection committees. Another study found that all six scientific societies studied “...had twice as many women receiving awards for service, teaching, mentoring, and communication as those receiving awards that recognize senior scholarship and research” (Holmes et al., 2011). A Canadian review of prestigious STEM awards found that women represented >25% of award winners (with the exception of one where female recipients were found to be 44% of winners; Baker and Vasseur, 2021). Bias can be introduced at the nomination or selection stage; therefore, gender mainstreaming strategies using evidence-based approaches (Grogan, 2019; Carnes et al., 2003) should be implemented to reform prize and award processes to reduce bias. Nomination calls should be advertized broadly, and being transparent about the nominations process and publishing data about the gender of nominators and nominees can also help to improve diversity over time (Nature, 2022). Strategies for the selection stage should include improving diversity on the selection committee; having diversity, equity, and inclusion policies and training; raising awareness and providing training on implicit and explicit bias; increasing the visibility of women role-models; ensuring fair and equitable outreach efforts; training on gendered language implications; reforming letters of reference; and using specific and measurable evaluation and assessment criteria based on current achievements (Holmes et al., 2011; Baker and Vasseur, 2021). ICES Awards currently lack specific criteria for the diversity of the awards committee; instead, the description of the committee focuses on representing organizational roles. Given the lack of gender diversity among the recipients of ICES Awards, consideration of strategies such as those proposed by Baker and Vasseur (2021) and Holmes et al. (2011) may be appropriate.

Although not all conferences allocate awards, where they are present, they provide additional documentation and evidence that should be used for institutional reflection on gender bias overall. They can also be used to review if the criteria and processes for award nomination and selection do not preferentially treat one gender over another and, therefore, continue to reinforce or exacerbate the gender gap in marine science. This is relevant in the ICES conference context as the awards ceremonies feature prominently in the plenary sessions, giving awardees visibility and building credibility. With “Gaining credibility” highlighted among the top-10 gendered challenges experienced by women leaders in interdisciplinary marine science (Shellcock et al., 2022), ensuring equality of opportunity for all types of awards is important for contributing to gender equality in marine and ocean science.

With at least one year of the ASC (2019) balanced by gender in terms of registration, our findings highlight that, while gender may not be significantly influencing decision outcomes, men continue to dominate visible conference roles like keynotes and awards presented to honour an entire career of academic achievement, negatively reinforcing the gender gap in marine science. This in-depth analysis challenges the GOSR statements that use basic participation data from international conferences as an indicator and signal that “Female ocean scientists are increasingly talking to the world” (IOC-UNESCO, 2020, p. 29). We highlight that although the contributions of women are being recognized through merit awards specifically to their contributions, this is not being translated into visibility as keynote presenters or career-level awards and recognition.

Collecting gender disaggregated data

The need for greater attention to the collection of gender-disaggregated data in marine and ocean science is needed to monitor progress towards gender equality, especially in the context of the UN Decade of Ocean Science for Sustainable Development (2021–2030; Brooks and Déniz-González, 2021). Analysis of the gender gap in many fields has been advanced by the development of software that can infer gender based on name; however, this approach must be used with caution, recognizing its limitations (Lockhart et al., 2023), and not replace a commitment to collecting self-identified gender data in an inclusive manner. On balance, these tools can provide a historical perspective valuable for making visible the continuing gender gap in science. Inferring gender based on name has helped to make previously gender-blind datasets useful for analysing the participation and contribution of women in fields that are considered male-dominated, like academia and fisheries (Elsevier, 2020; Szymkowiak, 2020), revealing new insights important for understanding the gender gap, career progression, and informing appropriate interventions. However, it also demonstrates the importance of the collection of gender-disaggregated data in support of fostering diverse and inclusive conferences with balanced representation and facilitating monitoring of the participation process. To bypass the limitations of such software, and comply with personal data collection best practices (Lindqvist et al., 2018), data prompts must be voluntary, and facilitate that participants can report their own gender, beyond the binary, in support of a more inclusive setting. Institutional commitment to regular and systematic analysis of gender-disaggregated data and conference participation can support further investigation of trends over time to determine if, e.g. using our data, this large cohort of female early career professionals increases recruitment of established scientists to the ICES community.

Intersectional approaches needed

While our data did not allow for investigation of how race, ethnicity, or (dis)ability intersects with gender, others have demonstrated that people at these different intersections experience greater levels of discrimination and harassment working in science (Clancy et al., 2017; Bernard and Cooperdock, 2018; Eaton, Saunders, Jacobson et al., 2020; Edge, 2020). Specific strategies for creating enabling conference conditions free from harassment are needed. Collecting diversity data and aiming to understand the experiences of participants could help to design appropriate interventions (Tulloch, 2020). Specific conference sessions on gender and diversity, equity, and inclusion (DEI) more broadly can help to influence attitudes and perceptions and can be an indicator of organiza-
tional commitment to closing inequities in the science system (Corona-Sobrino et al., 2020). With no conference events or sessions specifically addressed to gender or DEI in the period of study, this is another opportunity for the ICES ASC to improve, address the importance of critical gender awareness in science, and work towards fostering a more inclusive conference experience. The need for specific actions to create an enabling conference environment for women, as well as other under-represented groups, is highlighted by our analysis. A greater understanding of the demographics of conference participants can signal to organizers that further resources and efforts should be used to provide support to female early career professionals. Strategies for supporting early career women’s advancement in their career, including “…early and equitable career development opportunities” (Shellock et al., 2023) have been highlighted, and scientific communities must consider the opportunities provided by conference participation. Offering childcare, breastfeeding facilities, and other family friendly services in conference organization can help support the participation of women (across career levels) and others with caring responsibilities at conferences (Farr et al., 2017). Hybrid conferences that facilitate remote participation may also help to improve accessibility and accommodate those with caring responsibilities or others who may not have the resources required to travel (Tulloch, 2020). At the same time, this intervention can be a double-edged sword. If conveners argue that a hybrid conference will allow, e.g. young parents to participate from home, there is a risk that they will overlook the importance of establishing a family friendly infrastructure at the actual conference. This could lead towards participation bias where only people with no caring responsibilities can profit from in-person peer networking.

Future directions
A variety of additional institutional actions could be implemented, providing scope for further research and actions towards equitable conference conditions. Further development of conference participant experience forms could provide further information on participant motivation for presentation type (e.g. poster or oral presentation), as well as motivations for attending the conference or reflections on feelings of inclusiveness or belonging at the conference. Greater and improved demographic data collection for participants and abstract submitters, including participant country of origin, could provide the basis for monitoring changes in diversity as well as how inclusive conference conditions might influence participant experience, including if the gender of keynote presenters influences the gender balance of abstract submissions, or if conditions influence repeat attendees. The mechanisms that lead to the underrepresentation of women in keynote presenter roles as well as in recognition programmes should be further investigated. Qualitative information on the motivations of early career ocean professionals for participating in the ASC and presentation preferences could also provide insights into what role conferences play in career progression for people of all genders.

Continued monitoring of the gendered and early career dimensions of ASC participants could help to explore the female majority of early career professionals identified in the data. There might be factors which influence men to not specifically identify as early career, or other potential issues with relying on self-reported data. Expanded collection of demographic data over longer time periods can also be used to further investigate gendered early career retention in the marine scientific community.

Limitations
A limitation of our study was the necessary aggregation of data over 5-years, explained earlier by changes to the boundary conditions limiting the number of presentations mid-way through the period of analysis. However, this inevitably prevented comparisons between locations and over time. New approaches will be needed to assess how the online and hybrid conferences formats recently adopted (by ICES, but many other conferences as well) will influence gendered and early career dimensions of participation, and how to compare between years with different participation models. Another future direction could be to analyse if there is an influence of gender or career stage of theme session conveners on their decision outcomes.

Additional data and analysis should be used by organizers to better tailor interventions aimed at improving participant experience, thereby fostering greater diversity and inclusion in marine science. Improved collection of gender disaggregated data in inter-disciplinary marine science beyond conference participation is an opportunity for inter-governmental organizations like ICES to collect and publish, providing improved information on the baseline of gender representation in the field.

Conclusions
Our results found no significant evidence of gender bias around (1) acceptance of abstracts or (2) presentation preference, while oral presentations were given mostly by men. However, early career professionals were more likely to have their abstracts rejected and have oral presentations downgraded to posters. While gender did not show a significant effect on the decisions to downgrade requests for oral presentations to poster presentations, women are more often in their early careers, and therefore more women than men have their presentations downgraded. Using additional indicators based on gender representation in keynote presentations and awards, evidence of a gender gap remains, highlighting the need for greater focus on institutional actions to reduce potential sources of bias as well as monitoring and research into conference participation from a rich, beyond binary, gender perspective at the ASC. To counteract implicit bias, carefully managed policies are needed to help realize a gender-diversity dividend in science, where more diverse teams have been shown to improve collective decision-making and strengthen science by including diverse perspectives and a wider frame of reference to support the development of new knowledge (Nielsen et al., 2017; Saini, 2017; Schiebinger et al., 2011–2020). Greater inclusivity in the marine science community requires ongoing critical reflection of both organizational and individual behaviours. Our findings underscore the importance of using data-driven approaches to gender-sensitive and career stage organizational policies that have the potential to influence scientific careers.

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**Supplementary data**

Supplementary material is available at the ICES/JMS online version of the manuscript.

**Conflict of interest statement**

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

**Author contributions statement**

E.J. conceptualization, data cleaning and preparation, data analysis and interpretation, writing the original draft, review, and editing. F.B. conceptualization, randomized data validation, writing, review, and editing. D.D. conceptualization, randomized data validation, writing, review, and editing. S.K. conceptualization, data analysis, and interpretation*. All authors discussed the results and contributed to the final manuscript.

*Sarah Kraak, who sadly passed away in January 2022, is the last author on this paper. Sarah was motivated to understand how her own decisions (as a regular theme session convenor at the ICES Annual Science Conference) might be influencing representation and visibility, and she was inspired to analyse the ICES abstract submission database from a gender and career stage perspective. Sarah provided support and guidance to the early career researchers leading and conducting the research and analysis. Her guidance will be missed a lot.

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**Data availability statement**

The data underlying this article will be shared on reasonable request to the corresponding author.

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COMMENTARY

The Sea Change Needed for Gender Equality in Ocean-Going Research

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ABSTRACT

Since the 1950s, there has been an increase of women participating in ocean-going science. However, the number of women scientists in the field remains significantly less than that of men, especially in senior roles. In this commentary, we take a feminist perspective to understand the challenges women face in pursuing a career in ocean-going science. Based on the limited literature and reports of women in ocean-going research, we identified several cultural and structural barriers and constraints faced by women. These fell into four main categories: (1) behavioral/social norms and gender-biased culture in science and at sea; (2) failure to provide for balancing duties of family care with extended periods away from home; (3) gender-insensitive design of ship facilities, operations, and personal protective equipment (PPE); and (4) the need for a safe working environment at sea; i.e., gender-related aspects of health, safety, and personal security at sea. To overcome these barriers, the following interventions are suggested: (1) greater awareness raising and training to shift destructive mindsets as well as affecting behavioral and cultural change; (2) consideration of gender-sensitive design and safe operation of research vessels; and (3) more comprehensive and effective implementation of gender equality policies for research at sea.

Keywords: gender, ocean science, field work

Women in Ocean Science

In the 1950s, an aspiring young woman marine biologist, Roberta Eike, studying at the Woods Hole Oceanographic Institute (WHOI) in the United States, like all women at WHOI at the time, was repeatedly denied the opportunity to participate in work at sea (Freiburger et al., 2020). Fed up with discrimination, she took things into her own hands and stowed away on the institute’s Research Vessel. Although this did not end at all well with Ms. Eike’s dismissal from WHOI, her story made newspaper headlines and marked a turning point in attitudes toward women researchers at sea. Six years later, WHOI officially permitted women to participate on their research vessels and other institutes in the United States, and Western Europe followed suit (Bonatti & Crane, 2012).

The participation of women researchers at sea has increased in the past 50 years; women have advanced the field immeasurably, and there are several present-day examples of extraordinary women leaders in marine science (National Geographic, 2019). Despite this progress, recent studies provide evidence that effective representation of women in marine science remains far from equal and fair. The scale of this problem has, to a substantial extent, been hidden due to a lack of systematic collection of gender-disaggregated data on the global workforce in ocean science. Indeed, the best known, and as far as we are aware only, attempt to assess gender ratios in ocean science at the global scale is the Intergovernmental Oceanographic Commission of UNESCO’s (IOC-UNESCO) Global Ocean Science Report (IOC-UNESCO, 2020). This report suggests women make up around 38% of marine scientists. However, this figure is likely an overestimate given only 50 out of 150 member states responded to the survey of the report and it is implausible to suggest that states with poor records concerning the representation of women in ocean science were hesitant to participate in the survey (Sun et al., 2021). Moreover, this figure does not account for career stage or the phenomenon known variously as the “leaky pipeline” (Etzkowitz et al., 1994; Shaw & Stanton, 2012), or perhaps more appropriately as a “vanishing
box” (Etzkowitz & Ranga, 2011) or the “braided river” (Batchelor et al., 2021), whereby women become progressively less represented in more senior positions. For example, women are underrepresented in ocean science across higher educational institutes in Kenya, especially at senior levels (Ojwala et al., 2022). In the United States, substantial progress has been made in higher education with roughly 50% of ocean science doctoral degrees now obtained by women (Lima & Rheuben, 2021). However, less than 30% of chief scientists on research vessels in the United States and Europe have been women, and women are consistently underrepresented in senior positions (between 12% and 24%) in marine scientific institutions (Orcut & Cetinić, 2014). Women are also less likely than men to be awarded major research grants in ocean science and are less likely to be first authors on ocean science publications (Giakoumi et al., 2021; Lima & Rheuben, 2021). This substantially inequitable situation comes at a time when there is an urgent need to deliver the best possible research from ocean scientists regardless of their gender to help deliver sustainable development of the global ocean.

A Vision for Gender Equality in Ocean Science by 2030

In 2021, the United Nations through the International Oceanographic Commission of UNESCO launched its flagship marine science program ‘The Decade of Ocean Science for Sustainable Development’ (Ocean Decade). The Ocean Decade is committed to advance knowledge for sustainable development and co-developing solutions through innovative, transdisciplinary, co-designed research. The process is formulated to respect inclusivity and to empower women and other under-represented groups (Estes et al., 2021; Howell et al., 2020). Gender equality primarily seeks to address the fundamental human right of fair and equal opportunity, but achieving it also stands to benefit society in all sorts of ways from increased collective intelligence, improved decision making, increased prosperity, a better work-life balance, improved environmental status, and a more sustainable future (Nielsen et al., 2017). Evidence suggests that women principal investigators are more collaborative and create more diverse teams and research and research-related activities than their male counterparts (Lima & Rheuben, 2021). While pursuing gender equality, it is important to consider the intersections of a broad range of identities that may affect the experiences of ocean scientists. The intersections of gender, age, race, ethnicity, class, and sexual orientation must be considered to prevent advancing a particular stereotype of equality, and leaving marginalized groups behind (Taylor, 2015). While our analysis focuses on women, it has specific relevance for challenges faced by non-binary and gender-nonconforming scientists. This goes to the heart of the vision for the Ocean Decade, which, if it is to achieve its transformational aspirations, needs to ensure that gender equality is practiced in action.

In 2019, in anticipation of the importance of gender equality for the Ocean Decade, and to directly address the issue, the Department of Fisheries and Oceans, Government of Canada awarded the World Maritime University a contract to begin a capacity development and action research program on the theme of Empowering Women for the United Nations Decade of Ocean Science for Sustainable Development, which has since been officially endorsed by IOC-UNESCO as a “Decade Action” (Sun et al., 2021). Among many gender-related themes the program addresses is the challenges faced by women in participating and being effectively represented in ocean-going research.

Why Challenges Remain in Ocean Science for Equal Participation of Women

Experience of working at sea is important to, if not a prerequisite for, career progression in ocean science. Anything therefore that hinders participation in sea-going research will likely be detrimental to career prospects as a marine scientist (Amon et al., 2022). Working at sea does present demanding conditions and physical and psychological challenges such as living in cramped conditions in close proximity to others, sea-sickness, safety hazards, and isolation; however, there is no particular reason why this should be more prohibitive to the participation of women than men per se. The problem must therefore lie in societal attitudes, cultural intransigence, failure to recognize the barriers to women’s participation, ineffective implementation of gender-sensitive policies, and a lack of practical and technical solutions. It is recognized that different ocean science disciplines require particular vessel types, designs, and sampling equipment, and these present different risks and challenges for working at sea. Accordingly, we analyze barriers to women’s participation across the range of ocean-going research with a particular focus on...
workplace culture and operating platforms and present avenues for how it can become more enabling for women.

**Barriers to Women Participating in Ocean-Going Research**

Four main types of barriers to women’s participation and progression in ocean-going research are apparent from the literature.

1. **Social Norms of a Traditionally Male-Biased Work Sector**

The participation of women has been especially bad in the ocean and maritime sciences, which have traditionally been associated with male-dominated and chauvinistic work cultures, misogynistic attitudes, and abusive behavior such as microaggressions, tokenism, stalking, sexualizing or aggressive comments, unwanted physical contact (Amon et al., 2022), bullying, and sexual harassment (Carballo Pineiro & Kitada, 2020). Traditional mindsets and patriarchal norms are arguably the biggest hurdles to the participation of women in ocean-going research and, indeed, remote field research more generally (Simmonds, 2014).

The problem may be more or less severe depending on the nature of research. Certain disciplines—for example, marine geology and oceanography—require large state-of-the-art research vessels. Such research vessels are often managed by governments, agencies, or large multinational corporations and have high standards of equipment, accommodation, and crews that may have received some form of cultural diversity awareness training. Despite this, there is no guarantee of a safe working environment for women, as highlighted recently by Harvey (2020) on polar research vessels. On the other hand, some types of fisheries research involve putting observers on fishing vessels to monitor operations and catches (Ewell et al., 2020) or use commercial fishing vessels as a cost-effective way to undertake research. Fishing crews are almost exclusively male-dominated, featuring crews unlikely to be trained in gender sensitivity and generally lacking in specific provisions for women on board. Further, cultures may persist that prohibit women aboard because of baseless superstitions that women brought bad luck at sea (Bonatti & Crane, 2012), a falsehood that is still evident from artisanal fisheries to industrial fishing trawlers (FAO, 2015). For example, in Nigeria and Kenya, superstitions prevail that a woman on board a ship or fishing boat will bring bad luck to the fishery, reducing the quantity of fish caught (CISP, 2018). Such misplaced but often deeply held beliefs and taboos unfortunately still hinder women from active participation in ocean science and fisheries research (Ikeogu et al., 2020).

Some traditional male cultural norms see women on a vessel as a distraction to their work, a source of sexual temptation, jealousies, and thus potential conflict aboard or an invasion of privacy to the crew (Kitada & Langåker, 2017). This can manifest in many different ways and was recently reported in relation to clothing restrictions that effectively only applied to women (Harvey, 2020). Moreover, there can be a perception that women are unable to perform the same role as a man or to the same level of proficiency. The excuse is often that the work involved at sea is contingent upon personal physical strength, but in nearly all cases with appropriate design and technology, there is no justification for excessive physical strength to be a necessary prerequisite to undertake a task. For example, in a recent case study, weight-lifting limits were used as a pretext to exclude women scientists from participating in an activity on a polar research cruise (Harvey, 2020).

Ingrained perceptions of what it takes to be a mariner or fisher create an exclusive and exhausting social atmosphere that can be offensive and degrading to women. Under such circumstances, women may be forced to find a means of coping through identity management strategies such as adopting masculine attitudes (Kitada, 2013), leading to feelings of discomfort and lack of dignity. This is likely to be especially problematic for research that involves the use of fishing vessels and observer programs where women fisheries observers tend to be few and far between. A particularly pertinent example in this context is that there is only one woman fisheries observer in the entire observer program run by the Pacific Islands Forum Fisheries Agency (FFA, 2019).

Changing behaviors and cultural norms is possible, but is often a time-consuming process involving a diverse and interconnected suite of actions and interventions including formal policy development, education, and specific cultural change strategies such as gender mainstreaming (FAO, 2013). For example, the National Oceanic and Atmospheric Administration ran a program of gender awareness training for fishers involved in its Alaskan observer program. It took years for women to be generally accepted by the fishing industry, but now, roughly 350 women are integrated...
into the program (Wang & DiCosimo, 2019). In response, most marine science institutions that run at-sea science programs have introduced gender equality and sexual harassment policies (Hamann et al., 2020). An example from the United States is the University National Oceanographic Laboratory System, where a special committee to tackle gender and other diversity-related issues was created called “Maintaining an Environment of Respect Aboard Ships.” Diversity training programs should serve to both raise awareness of issues and promote positive interactions among people of all genders. However, if too much emphasis is placed on one gender over another, this can lead to the male workforce disengaging and lead to the problem being exacerbated (Bezrukova et al., 2016). We were unable to find any literature related to how effective gender diversity training has been for modern-day research vessels.

Another positive influence to change behavior is the existence of role models. Women, especially at junior levels, participate more actively and feel less anxious when working in mostly female or gender-equal groups compared to male-dominated groups (Dasgupta et al., 2015). Role models in senior positions can serve a crucial function in this respect, motivating women to engage in ocean-going research by demonstrating routes to success and ensuring junior female staff are fairly treated and respected (Dragomir et al., 2018). Institutes need to focus on a more inclusive recruiting process and promoting women into senior positions and providing role models for junior women colleagues. Women and girls should be actively encouraged to pursue their ocean science, maritime education, and careers at sea as is seen, for example, in India, where maritime training institutions such as the Anglo Eastern Maritime Academy offer 50% fee waivers for women (ISWAN, 2020).

2. Extended Periods Away and Care-Giving Obligations

Ocean-going research often necessitates extended periods away from family and home. For women with caring responsibilities, it may mean participation is limited or impossible at times. Nevertheless, even if participating in sea-going research is not possible at times, there are ways to minimize the career impact and retain a participatory role. With virtual online technology evolving ever faster, there are increasing options to participate remotely, such as live streaming of data collection, visual surveys, and specimen identification (Fundis et al., 2012). Virtual at-sea participation is one way to provide greater accessibility and overcome temporary incompatibility with family-caring periods of life, enabling ongoing active involvement in research activities until such time that sea-going participation becomes feasible again. Institutions will need to invest in technological solutions to participation if they are to provide and maintain fair and equal opportunities for women across their careers. Redesigning ocean research cruise programs around a diverse range of workers is necessary. Dividing the research cruises into shorter blocks with interchangeable personnel may be one way to accommodate scientists for whom caring duties mean extended periods away from home are difficult. Providing subsidies for care-giving duties while at sea could also provide support to those without the extended networks needed to balance work and family obligations. Such provisions would also encourage male researchers to participate in caring duties while sharing sea-going workloads with women researchers.


The design of a ship can present specific challenges to women. Cramped spaces and corridors can result in intentional or unintentional infringement of personal space by colleagues and increased risk of harassment. Most modern-day research vessels have ample space and cabins with en-suite toilet facilities; however, facilities elsewhere on the ship are often shared and the default generic toilet design is usually around the assumption of the needs of men rather than women. Ship toilet systems usually prevent flushing of anything other than human waste thus discrete provisions for disposal of sanitary products should be available (Anglo-Eastern, 2017).

Despite much improvement generally to the health and safety of research vessel operations, a gender-sensitive perspective is rarely specifically considered or referenced in ship technical specifications and operations. A case in point is the European Marine Board’s recently published report “Next Generation European Research Vessels Current Status and Foreseeable Evolution” (Nieuwejaar et al., 2019); the report makes no specific mention of gender and fails to consider the changing gender demographic of the research workforce. Ocean-going research often requires some degree of manual handling of equipment and samples. While any heavy lifting of instruments or maneuvering of equipment should be mechanically aided and completed by trained crew,
not scientists, there may be less obvious aspects than can be obstructive to women. In fisheries research, for example, sorting catches and lifting of sampling baskets or boxes should be designed so that they can be safely lifted and maneuvered by women. There is a clear need for gender to be taken into account at the design phase of future generations of marine research vessels, not least to eliminate potential disincentives for women to take up these roles and to forestall the need for costly retro-fitting exercises at a later date.

4. Health, Safety, and Personal Security at Sea

Working at sea is inherently more risky than land-based occupations. PPE is considered the first line of defense to prevent accidents and keep maritime workers safe. Product design, however, is often gendered, and PPE is often designed for the needs and fit of men’s bodies, rather than women (Criado-Perez, 2019). The protective efficacy relies on the equipment, e.g., gloves, harnesses, life-jackets, immersion suits, hard hats, and safety goggles, being the appropriate size and fit for the individual; otherwise, they are ineffective and may even actually increase the likelihood of injury or accident (Chirp Maritime, 2019; Fullenkamp et al., 2008).

Personal security can also be of concern for women at sea. Most modern-day research vessels have single berth cabins with locks; however, on older and smaller vessels, for safety reasons relating to collision and escape, cabins below deck may be shared or only have curtain separations. Doors without locks can present unacceptable risk to women on board a ship with a male-dominated crew due to sexual harassment, which is a major concern at sea for women (Carballo Pinoeiro & Kitada, 2020). This is underscored by a recent survey conducted by the non-profit organization Women in Ocean Science, which alarmingly found 78% of ocean scientists had experienced some form of sexual harassment, with 46% of these incidents identified as having taken place during fieldwork (St Clair, 2021). The risks and effects of harassment at sea also tend to be compounded by isolation, an issue that could be alleviated through communication technology and personal instant/emergency access to a satellite phone, for example.

A supporting policy framework is a necessary first step to help prevent and eliminate sexual harassment at sea for both men and women. However, given the sensitive nature of these issues and reluctance to report incidents, it is important to focus on prevention and changing the culture on board research vessels to support an environment of respect for women. Of note here, the Baltic Gender project has started to develop and implement the use of sexual harassment prevention strategies on European research vessels (Hamann et al., 2020). While prevention is key, mandatory, safe, confidential, and robust reporting frameworks and mechanisms are also needed to protect all scientists from harassment, regardless of gender, holding harassers accountable for their actions, and ensuring victims do not face repercussions from reporting (Amon et al., 2022; St Clair, 2021).

Fisheries observers represent a particularly vulnerable workforce (McVeigh, 2020) since they are more often alone and can be treated with suspicion by the fishing crew since they are seen to be enforcing compliance. In the Alaskan fisheries where women are well represented in the observer program, 12.5% are reported some form of sexual harassment (Wang & DiCosimo, 2019). Elsewhere, most accounts of sexual harassment likely go unreported or are anecdotal and poorly documented.

Conclusions

The participation of women in ocean-going research has increased in recent decades, and the active institutional discrimination against women scientists such as Roberta Eike is largely gone. Nevertheless, certain male-biased cultures, beliefs, societies, and institutions persist and continue to create conditions that constrain and hinder female participation and perpetuate gender inequality in this field. While numerous barriers to women’s participation in ocean-going science remain, this commentary has sought to demonstrate that diverse options exist to overcome these obstacles. Changing behaviors to overcome negative working environments in ocean-going research for women scientists could be promoted through diversity training for all cruise participants and the establishment of mandatory Codes of Conduct, including harassment and bullying policies, circulated to all participants prior to a research cruise, enforced for the duration, and reported on upon completion (Amon et al., 2022). This may be reinforced through the establishment of standards by intergovernmental organizations involved in ocean science ensuring capacity-building targets are transparent and safe (Amon et al., 2022).

Gender-insensitive design of vessel working spaces, living quarters, safety equipment, and working platforms act to compound the cultural problem.
A modern-day at-sea career in marine science has no place for trials of strength, endurance, and unnecessary risk taking and must prioritize a safe and respectful working environment. Institutions, vessel operators, and individuals are responsible for embracing the cultural, technical, and structural change required to make women and a diverse range of identities feel confident, valued, and able to contribute to all aspects of marine research. It is also crucial that gender-disaggregated data and incidents of harassment during ocean research are collected for transparent assessment, evaluation, and monitoring by research agencies and donors. The importance of women role models in senior positions in ocean-going research cannot be overemphasized. Specific provisions to support scientists with caring duties while away from home should become standard. It is crucial that as ocean science moves forward, gender is considered from the outset in research vessel design, safety, training, cruise planning, and institutional culture. By embracing gender equality, marine science will benefit not only from an increased and diverse pool of talent, but from an improved workplace for all.

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References


Title: Participatory approaches in support of institutional actions to advance gender equality in ocean science in the IGO context

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Abstract
To address gender inequality in marine science systemic changes are needed at institutional level. Participatory and collaborative approaches were used to progress a gender equality agenda in an intergovernmental marine science organization. The International Council for the Exploration of the Sea (ICES) was chosen as a case study. Formal and informal actions related to organizational process and gender equality were documented, set in a timeline, and mapped to a theory of change. The analysis illustrates how Feminist Participatory Action Research (FPAR) can be applied in an intergovernmental organization, with multiple factors, including drivers, data collection, co-creation through dialogue, and specific actions contributing to driving a change agenda. The results are discussed in the context of how gender equality action plans need to be continually enacted to realize change. The application of FPAR resulted in institutional change through raising awareness, eventually culminating in the development and acceptance of a formal gender equality plan for ICES.

1.0 Introduction
Tackling gender imbalances in ocean governance is a critical opportunity to advance the sustainability agenda focused on the 17 inter-connected Sustainable Development Goals, including gender equality and life below water (Gissi, Portman, & Hornidge, 2018). Intergovernmental organizations (IGOs) play an important role in international relations and global governance, acting as a platform for multilateral cooperation, coordination, and collaboration, and by providing
technical expertise in specialized areas, such as marine and ocean science. Multiple barriers remain
to the advancement of women to leadership roles in marine and ocean science and decision-making
(Shellock and Maltby, 2023). Creating marine science institutions that can support a diversity of
leaders, including women and other underrepresented groups requires transformation.
Understanding the factors that contributed to the adoption of a change agenda for gender equality
at the level of an IGO can provide important insights into how such changes are motivated and
progressed.
Participatory approaches to organizational change towards greater equality can create a space for
engagement through the empowerment of organisational members that can help to address
systemic inequality through the production of practical knowledge and outcomes (Reason &
Bradbury, 2007). This paper analyzes how feminist participatory action research approaches can
progress gender equality and the empowerment of women in an intergovernmental marine science
organization, analyzing the process of developing collaborative efforts that resulted in the creation
of a gender equality plan. One main question guides this research:

● How can feminist participatory action research methods be applied in the IGO context?
While there are many studies that review gender action plans and their implementation, there is
little research that has also analyzed the factors that catalyzed the initiation of a change process.
Progress towards equality requires critical acts, while identifying what qualifies as “action” can be
nebulous. This paper documents phases in institutional awareness, understanding, and action on
gender equality, as well as the drivers, data collection, co-creation through dialogue, and actions
that contributed to recognizing inequality and initiating and progressing a change agenda. The
analysis highlights that actions are needed across scales and throughout the process. The paper
begins with reviewing the evidence for continuing gender bias in marine and ocean science, and
describes feminist participatory action research, and the theoretical perspective used for the
2.0 Gender inequality in ocean and marine science

The Ocean is a complex social ecological system that requires effective governance and management of human activities at appropriate scales for sustainability (Charles, 2012). The UN Decade of Ocean Science for Sustainable Development (The Ocean Decade) was launched by IOC-UNESCO to achieve transformational change in the way science operates to achieve progress towards the SDGs (Ryabinin et al., 2019). The Ocean Decade endorsed programme Empowering Women for the UN Decade of Ocean Science for Sustainable Development has recognized the importance of addressing gender inequality in international intergovernmental organizations to achieve transformation (Sun et al., 2022). In order to achieve these transformational aims, greater recognition of social science is needed to support reflexive ocean science (Vadrot et al., 2022).

IGOs with the responsibility to provide the evidence base for decision-making on the marine environment, must build and safeguard trust with all actors who rely on the evidence produced and, among other things, by ensuring expert teams are sufficiently diverse in terms of gender, career stage, and geographic representation (Cvitanovic, et al., 2021). Within the field of ocean science, women are claimed to be well-represented, with some sources claiming women constitute 39% of the global ocean science workforce, which is touted as 10% better than science overall (UNESCO, 2020). However, the representativeness of these figures has been questioned based on low response rate and methodology (Kitada et al., 2023) and they fail to communicate the reality of ongoing gender imbalance in leadership.

Continuing gender inequality in marine and ocean science is highly visible in the underrepresentation of women in leadership roles, but manifests in a variety of ways. While marine science is a historically male dominated field, specific calls for greater representation of women in fisheries science and related fields have been made for more than 30 years (Pauly, 1989; Shellock
and Maltby, 2023). In the US and EU, women have been earning more than 50% of the PhDs in fields relevant to marine and ocean science since at least 2016 (Brooks and Dénis-González, 2021; Cook et al., 2022). While women are now at or above parity with accreditation of the skills necessary to work in the field of marine and ocean science, a global survey of marine scientists and practitioners indicated that there is a majority perception that the underrepresentation of women in leadership positions is detrimental to the effective realization of science for sustainable outcomes for the marine environment (Giakoumi et al., 2021).

While the need for cross-disciplinarity in marine and ocean science has been recognized to avoid the “tunnel-vision” of specific disciplines leading to simplistic fixes that fail to address the complexity of social, ecological, and economic dimensions of fisheries management (Degnbol et al., 2006), recognizing how inequality may also influence marine science and advisory outcomes is happening more slowly.

While equality is a matter of social justice, ocean and marine science also requires that diverse perspectives are represented to bring “strong objectivity” to its practice, acknowledging that research is not value free, and the absence of diversity among communities of researchers creates conditions where the capacity is limited to detect how their own lived realities influence research “assumptions, policies, and practices” (Harding, 2015, p.151). There is also mounting evidence of the improved scientific outcomes associated with more diverse teams, boosting collective intelligence (Nielsen, et al., 2017, Riedl et al., 2021, Yang et al., 2022). While this research has focused on gender and the underrepresentation of women in an IGO, it is critical to recognize that to address inequality in ocean science, many systems of power and oppression including, among others, race, ethnicity, and class, intersect to affect power and privilege (Axelrod el al., 2022).

2.1 Initiating change

Initiating change must start with recognizing institutional inequality and the invisible barriers that women, and other marginalized groups face at work that delay career progression and contribute to
inequality, in all workplaces (King, 2020; McKinsey & Company, 2017), but also in marine
scientific research institutions (Shellock, et al., 2023; Johri et al., 2021). Change is needed at
network, institution, and system level to address gender inequality (Shellock, et al., 2022).
Organizational change management, particularly participatory approaches, can help support the
realization of desired outcomes, but effectiveness can interact with the perception of urgency for
change (Lines, 2004).
While a multitude of strategies have been attempted to promote organizational change for gender
equality, some suggest collaborative, dynamic, and context specific processes with multiple
feedback loops that address both individual and structural actions that will be needed to achieve
transformative change (Benschop & Verloo, 2011). Studying organizational practice can reveal the
context specific ways in which gender equality and inequality practices interact to produce
unintended consequences, like focusing on data collection distracting from actions focused on
making change (Grzelec, 2024). Within a complex institutional framework, and at an international
level, fostering change in an IGO presents specific and unique challenges, given that representation
is not directly controlled by the organization, and relies on nominations from national governments
and other stakeholders (Sun et al., 2021).

2.2 Critical perspective of institutions
To understand ongoing inequality at the institutional level, feminist perspectives consider gendered
power dynamics. While institutions have the potential to help organize factors in daily life, as venues
for the development of standards of practice, they can also have deeply ingrained power imbalances
resulting from historical developments, established norms and practices which provide resilience,
but can also constrain change. This path dependency helps to consolidate past practice but limits the
capacity for transformation (Magnusdottir & Kronsell, 2021).
Feminist institutional perspectives highlight the need to attend to both the formal and informal rules
that contribute to gendered power imbalances (Chappell and Waylen, 2013; Celermajer et al., 2019,
Magnusdottir & Kronsell, 2021, 2021; Mackay et al., 2013). Analysing women’s inclusion and exclusion, lived experiences and engagement, as well as the effectiveness of reforms aimed at the redistribution of power is the main focus of feminist institutional scholars (Holmes, 2020). Examining the cultural practices of marine science from a feminist institutionalist perspective can help reveal the ways in which power is unevenly distributed between gendered actors.

As “affective arrangements” institutions can be analyzed through their materialities, actors, and imaginaries to understand “the many lives” of a singular institution, here the approach acknowledges that the experience of interacting, being influenced by, or working within a particular institution is experienced differently at different scales and by different individuals (Churcher, Calkins, Böttger, and Slaby, 2023).

Feminist international relations theory highlights how the role of women has been downplayed in international politics and seeks to rectify this by analyzing the iterative relationship between gender and international politics. This includes examining the ways in which gender norms and expectations are reproduced and reinforced through international institutions and practices, as well as how gender can be used to challenge and transform these structures (Zalewski, 2010).

Scholars of Feminist International Relations (IR) and feminist institutionalism have identified synergies in combining these theoretical approaches to help understand and reveal the gendered nature of institutions operating at international level (Holmes, et al., 2018). “Studying up” in feminist IR has meant to study institutions by centering power analysis (Holmes, et al., 2018). These critical feminist perspectives provide a helpful theoretical lens to understand inequality in an international marine science organization, and how and why individuals “choose to comply or challenge an institution’s gendered logic of appropriateness, and expose the gendered, classed and racialised power relations within and between national, regional and international institutions operating within the international system” (Holmes, 2020, p. 219). These theories are then very relevant for analyzing the context which gave rise to the initiation of change agenda in an IGO.
2.3 ICES as a case study

The International Council for the Exploration of the Sea (ICES) is an intergovernmental organization that works to coordinate marine science in the North Atlantic Ocean and adjacent seas. The Secretariat of ICES has approximately 75 employees, which coordinates a broader science network of around 6000 experts from 20 countries working in 150 specialist groups.

ICES is a historically male-dominated organization, founded in 1902 by scientists who recognized the need for international cooperation on research of migratory fish-stocks (Rozwadowski, 2002). It now develops science and provides advice to competent authorities on management of human activities and interactions in marine ecosystems.

Based on a 2019 commitment in the ICES strategic plan, various initiatives have been developing to support diversity, equity, and inclusion. Participatory processes have been in focus as the organization has initiated actions across institutional levels. Prior to the adoption of the 2019 strategic plan, the organization had been operating “gender-blind”, with no attention paid to the role of gender in its operations. However, at the end of 2022, the Council adopted a Gender Equality Plan. The “natural” science focus of this organization, and the individuals that enact its existence through norms and practice, contributes to an underlying disciplinary bias that has relied on positivist understandings of the organization, a dominant “scientific” view that the organization operates meritocratically and without gender.

3.0 Theory and Methodology

3.1 Feminist Participatory Action Research

Research rooted in feminism shares common principles and values that aim for social transformation; acknowledges the centrality of research positionality; participatory engagement with the community of interest; and appropriate methods that reveal the complexity of human experience (Jenkins et al., 2019). These same themes are also evident when feminism is combined
with participatory action research, combining approaches which can improve the social robustness of interactive research (Gunnarsson, 2007).

Feminist participatory action research (FPAR) is a research methodology, a high-level framework, and conceptual paradigm that necessarily requires adaptation to the specific context with multiple and appropriate methods employed (Frisby et al., 2009; Gatenby & Humphries, 2000; Reid et al., 2006; Reid, 2004, Shimei and Lavie-Ajayi, 2022, Smith et al., 2010). FPAR is useful for gender equality policy research as it prioritizes the active participation and empowerment of women and underrepresented groups in the research process, with the potential for greater policy relevance and effectiveness through an inclusive approach. With a focus on building participatory processes, FPAR has the potential to foster the generation of context specific knowledge that can help inform transformative gender equality policies. The importance of engaging with the community being researched is emphasized, acknowledging the interplay between the researcher and researched, and centering the voices of the community to influence the research questions, design, and implementation. The goal is to co-create knowledge and foster change, with benefits and empowerment for participants in focus. FPAR also aims to acknowledge many forms of “action” (Reid & Frisby, 2013). Policy research and outcomes will be improved, when they account for the lived realities and challenges faced by marginalized groups.

FPAR is an approach rooted in acknowledging the researcher as an agent of change and working with the community to identify and implement a change agenda. It is the process of participating in the research and implementation that contributes to the empowerment of participants (Gatenby & Humphries, 2000). Feminist perspectives require a recognition that the research is shaped by the researcher, and “strong objectivity” (Harding, 2015), which requires critical reflection on the intersecting positions that a researcher holds as an individual, acknowledging that this influences the research and outcomes. To that end, it is important to outline at the outset my own positionality as a woman and lead researcher, who operated as an organizational “insider”.
My access to the organization for research on the change agenda was facilitated as a long-term, and trusted ICES staff member who worked closely with the General Secretary (CEO) and Executive Committee (Bureau) of the Council for over 10 years. However, taking an “insider” perspective requires a reflexive approach, recognising the complexity of being both and neither the researcher and researched (Brannick & Coghlan, 2007). An insider perspective provided a head start on access to, as well as knowledge and understanding of, the existing formal and informal rules, norms, and behaviors, as well as “moments of chance” (Holmes et al, 2019) and the “hidden realities” (Chappell & Waylen, 2013) that are necessary to promote change through strong contextual understanding. To avoid simply following the “institutional script” (Holmes et al., 2019), continual critical self-reflection is required, to consider if the analysis has been controlled or limited in some way. It was through the process of recognizing inequality in the day-to-day moments of the organization, and partnership/agreement with leadership to initiate change, and support that inspired me to take on a new and additional role as researcher. As an insider the acceptance of researcher presence and engagement with the community was facilitated given a pre-existing relationship and corresponding high-level of trust.

Employing FPAR and an insider approach provides access to otherwise opaque and undocumented institutional processes.Organizational agents working on gender mainstreaming, sometimes called Femocrats, or “warriors within”, balance feminist values and advancing a change agenda within bureaucratic realities (Sandler, 2015). While femocrats can be instrumental for advancing gender mainstreaming internally, skeptics critique their limited potential for radical transformation, given the constraints of working within the institutional framework, and competing organizational priorities (Sawer, 2016; Gouws, 1996). This requires strategy at both macro and micro-political levels, building allies, and accepting trade-offs. As noted by Eisenstien (1989), “The struggle was always to extend the areas within which one’s gender experience and expertise were recognised by the men who continued, overall, to set the agenda”. These practitioners often function as “boundary spanners” bringing new information to help link and adopt this information to internal networks.
Tushman & Scanlan, 1981). As a femocrat working at international level on gender mainstreaming, there is potential to “cause a ripple effect” (Heijstra and Petursdottir, 2022), and encourage inter-organizational learning (Solheim & Moss, 2021). Combining Feminist institutionalism, IR, and FPAR provides a useful theoretical grounding to examine gendered power relations in an IGO, and consider the factors that contribute to the implementation of a change agenda towards greater gender equality.

3.2 Data and analysis

Feminist Participatory Action Research (FPAR) can be characterized by phases (Ely & Meyerson, 2000), and drawing on the phased approach of a feminist action research described by Ely & Meyerson (2000), a timeline of activities that contributed to recognizing institutional inequality and the initiation of a change agenda was analyzed within four phases, 1) problem identification & data collection, 2) Co-creation & awareness raising, 3) Create action plans & act, and 4) Evaluate & review outcomes, see figure 1.

Figure 1. Phases of feminist participatory action research adopted for the analysis.
In order to map the change process and understand how a feminist participatory action research approach was applied in an IGO, a mixed-method study design draws data from 1) ethnographic research log; 2) process documentation; 3) organizational documents; and; 4) online survey of the ICES community. The study takes a constructivist-interpretive approach to analysis recognising, that knowledge is shaped by social interactions, influenced by individual perspectives, and contingent upon specific contexts.

### 3.3 Method

Using critical feminist perspectives to reflect back on the FPAR process that led to the approval of a gender equality plan, a variety of specific contributions were identified, mapped to a timeline along the major stages of the research project, and categorized as a driver, data collection, co-creation through dialogue, or action.

The ethnographic research log was the main source of data used to construct the timeline of contributions. The log consists of field notes from the conduct of a feminist participatory action research project led by the author. The analysis drew on the research log maintained between November 2019 until April 2023. The field notes document the experiences of leading and facilitating meetings both online and in-person and sessions that engaged different parts of the ICES community to address gender equality, diversity, equity, and inclusion within the organisation. The field notes also recorded other interactions, emails, and correspondence that related to the implementation of the FPAR project. Internal process documentation, developed as part of regular organizational practice from sessions related to the FPAR project, was also reviewed. These include minutes of meetings and the reports of conference sessions that related to the FPAR project.

Specific versions of organizational documents - like the strategic plan and rules of procedure - are artifacts of practice that were also identified as relevant for inclusion to materials for analysis and the timeline as they were updated with more “gender aware” language, signaling a change in practice and institutional awareness of the need for change. Additional data sources including
interviews and an online survey questionnaire formed part of the analysis in the context of being specific contributions to the FPAR process, documenting ways of engaging and soliciting feedback at a range of scales.

Formal and informal contributions that stood out as contributing to change agenda were selected from the various data sources and set in a chronological timeline. FPAR phases and a theory of change (King, 2020) were then added to the timeline as presented in figure 1. The contributions were then assigned to different categories and coded to reflect the nature of the different types of contributions. “Driver” refers to the social, demographic, and economic developments which influence the institutional context and the gender equality agenda. “Data-collection” refers to the initiation of a spectrum of quantitative and qualitative data approaches that contributed to making inequality visible. “Co-creation through dialogue” refers to the events, sessions, and individual interactions that invited participatory engagement, feedback, and input to addressing gender inequality. “Actions” are specific interventions aimed at producing change.

Examples of resistance and acceptance of the FPAR project were also identified and analysed using the framework developed by Mergaert and Lombardo (2014).

Given the fluidity of FPAR methodology, by documenting specific contributions throughout an FPAR project, actions are made tangible, and an overview of the range of types of different activities that led to the initiation, acceptance, and resistance of gender equality initiatives in an IGO is constructed.

3.3.1 Online survey

An invitation to view the documentary film “Picture a Scientist” (Shattuck & Cheney, 2020), that depicts experiences of women working in the sciences, was shared widely with members of the ICES community, using the intranet, as well as direct emails to 539 members of the ICES community. There were 419 views of the film. Following the film screening, participants were sent an email
invitation to provide responses to a survey (see appendix 1). The anonymous survey was administered using the online tool Tyepform. There were 170 views of the questionnaire, resulting in 94 completed submissions, or a completion rate of 73.4%.

3.3.2 Interviews

The interview questions aimed to gather personal and institutional perspectives related to gender inequality in ICES and marine science workplaces. The interview guide is provided in annex 2. The responses identified potential barriers and solutions to inequality that linked to a range of issues in marine science workplaces.

Semi-structured interviews, ranging between 45 and 90 minutes, took place online between December 2021 and January 2023. Interviews were conducted with 22 individuals, predominantly women (21) with one identifying as non-binary, from 15 countries in the global North. Participants were selected purposively based on their affiliation with ICES. All were current or former members of the ICES marine scientific community, occupying various roles within the organization, predominantly as national representatives. Most participants were experienced professionals, with a few in early career stages (less than 10 years since graduation). Interviews were recorded and transcribed using otter.ai software, with the transcription later verified and corrected by the author. Transcripts were analysed and coded in NVIVO 14, using reflexive thematic analysis (Braun and Clarke, 2006). The detailed analysis of the interview transcripts is being prepared for publication in a forthcoming article.

3.3.1 Ethics

The research instruments were approved by the Research Ethics Committee of the World Maritime University prior to data collection. Participation in the survey questionnaire and interviews was voluntary, and responses were de-identified for publication purposes. Interview participants signed consent forms. In the broader FPAR context, the approach used was to be explicit with the ICES community about my dual role as researcher and insider, and highlight that the work was being used as part of a research project.
4.0 Results

The results of the analysis are presented by the FPAR phases, detailing how specific drivers, data collection, co-creation through dialogue, and actions contributed to the research process in an iterative manner over time. An overview of the process is presented in Figure 2. A specific analysis of instances of resistance and acceptance to change is also presented.
Problem Identification & Data Collection

Co-creation & Awareness Raising

Create Action plan & Act

Evaluate & Review outcomes

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Colour legend: Drivers | Data Collection | Actions | Co-creation through dialogue

Figure 2. A Feminist Participatory Action Research Process/ King (2020) Theory of Change mapped to the ICES process
4.1 Problem Identification and Data Collection

The first phase of this FPAR process “problem identification and data collection” (2011-2019). In this initial phase five major drivers of change were identified:

1) the appointment of the 1st female general secretary in the organization in 2011 2) A specific commitment to gender-balance in the 2019 strategic plan helped to build momentum and formalized institutional commitment to gender-change, effectively laying a platform to build on. 3) The participation of the General Secretary in the World Maritime University (WMU) Empowering Women Conference 2019 resulted in strengthening connection to the developing Empowering Women programme and catalyzed the first analysis of gender ratios across decision making levels of the organization. 4) The preparatory phase of the UN Ocean Decade, where funds were committed to the Empowering Women programme, with focus on gender inequality in ocean science and governance institutions. 5) A resource commitment allowing an organizational insider to take on a practitioner’s PhD as part of the Empowering Women Programme hosted by the Global Ocean Institute of the WMU.

In this phase three main sources of data collection were identified: 1) Make visible gendered decision-making power imbalances through quantitative overview 2) Initiation of systematic collection of self-identified gender disaggregated data for conference and event registration 3) Recording of ethnographic observations and researcher experiences logged.

Two specific actions are listed in this phase 1) In 2016, the (female) General Secretary had a photo gallery featuring headshots of all the (male) Presidents and General Secretaries that was displayed prominently in ICES headquarters replaced with a photo gallery featuring current photos of the ICES community at conferences and events. 2) In 2018, the Rules of Procedure were updated (among other changes) to include female pronouns, where previously there had only been reference to “he”.
The appointment of the 1st female General Secretary is identified as a major driver of change. Having a woman committed to advancing gender equality in the central leadership role meant there was a person in power with the ability, drive, and incentive to initiate change. Her experiences informed the inclusion of a specific commitment on gender and diversity and inclusion in the 2019 strategic plan. Identifying the need for change was a slow build process; from an affective diversity perspective, moments of “friction” can enact and signal the need for change (Dilger & Warstat, 2022). As noted by Meyerson and Hopkins-Stange, change is “most likely to be pursued by individuals or collectives where multiplicity and contradictions are most acute, such as when actors are disadvantaged by institutional arrangements or when they experience ongoing value conflicts” (Meyerson & Tompkins-Stange, 2007). Change is then initiated through “tempered radicalism” (Meyerson & Tompkins-Stange, 2007), the incremental and everyday tactics, such as that exemplified in the replacement of a prominently displayed male-only photo gallery with more inclusive reflections of the current ICES community, and insistence of reference to the need for gender balance in the strategic plan. In the words of Dr. Brusendorff, the 1st female General Secretary of ICES “There was initial resistance to the inclusion of language specific to gender, with comments that there was no issue within ICES, but we persisted and it is now in the high-level ICES Strategic plan” (Sun, et al., 2021, p.68). The need for the collection of gender disaggregated data to monitor inequality became evident, and began opportunistically for participants registering to participate in ICES conferences and events.

No instances of “Co-creation through dialogue” were identified in this initial problem identification & data collection phase. While FPAR approaches often frame community involvement at the problem identification phase to foster co-creative knowledge outcomes, here this phase focuses on how individual awareness became a catalyst for initiating participatory approaches to further explore and address inequality.

4.2 Co-creation and awareness raising
In this second phase “Co-creation & Awareness Raising” (2020-2022) greater understanding of the reality and extent of inequality in the organization was building and is characterized by having a gender researcher present in the organization, helping to advance the gender equality agenda, and culminating in the approval of a gender equality plan.

In this period, two additional drivers were identified 1) the COVID-19 pandemic and resulting shift to remote work revealed major sources of inequality in all parts of society and institutions. 2) A new requirement compelling all research partners to have an organizational gender equality plan was added to the main source of European research funding Horizon Europe.

Additional data collection in this period related to 1) collecting anonymous feedback via an online survey from the community about gendered experiences and perceptions working in ICES. 2) Collecting feedback on gender specific recommendations (among a package of recommendations to help facilitate the organizational response needed post-pandemic). 3) A specific study that made visible gendered power imbalances through quantitative analysis of annual science conferences & awards.

This phase was characterized by a strong emphasis on co-creation through dialogue and awareness raising, with six major contributions identified. 1) Formal and Informal discussions with leadership, colleagues, and external groups 2) Gender mainstreaming and adaptation of existing policies and practice 3) A specific session at the ICES Annual Science Conference that facilitated engagement with the wide international community that participates 4) Presentations and dialogue with key committees and groups, including decision-making bodies, and staff 5) Facilitation of sub-groups from different parts of the organization to develop solutions 6) Interviews with women and non-binary members of ICES and the wider community to collect institutional and personal experiences from members of the ICES community, and seeking to identify barriers, and recommend actions to create a more inclusive working environment that allows people of all genders to participate equally in ICES activities.
Five specific actions included 1) Screening the film “Picture a Scientist”\(^1\), making it broadly available for the ICES community and using this to frame a survey on gendered experiences of the ICES community 2) Gender mainstreaming in policy and processes 3) Provision of specific training to staff 4) Specific recommendation and resource commitment related to gender awareness for post-pandemic response 5) Development of the draft/interim gender equality plan.

Applying FPAR at international level and seeking change across a complicated, poly-centric network organization (Galaz et al., 2012), during a pandemic required creative and online approaches. However, this was also a benefit, as the switch to remote work meant the venues for discussion of gender equality and inclusion were more widely accessible to members of the ICES community. Co-creation was facilitated through dialogue, by presenting evidence and information on organizational inequality to different parts of the organization. Sessions were held with the organizational committees that structure and oversee the work in different areas, staff of the Secretariat, and a specific network session at the ICES annual science conference. Interaction with the community took place through online meetings, presenting information about the current state of equality in the organization and seeking feedback and input.

“I felt so encouraged after [meeting of Chairs of ICES groups]. Both men and women spoke up during the discussion. Asking how they could help, wanting to be part of the study. Suggesting this information be presented at Council, ACOM, and SCICOM. Suggesting that a direct message be sent to every member country”. (Extract from research log 28 January 2021)

A main feature of FPAR is the researcher working with the researched to define the problem and set the research agenda. By using a variety of approaches to engage participation with a broad science

\(^1\) “Picture a Scientist” is a film that documents the gendered and racial biases and harassment faced by women working in the sciences today. [https://www.pictureascientist.com/](https://www.pictureascientist.com/)
network, a range of inputs were collected that helped to shape the research, engagement, and actions.

![Figure 3. Visual representation of gender imbalance in the organizational hierarchy used to communicate and facilitate dialogue with the ICES community. This figure was developed inferring gender based on first name (limiting the gender overview to the binary).](image)

Dominant disciplinary thinking can influence organizational policy development (Safarty, 2012; Degnbol, 2006). The disciplinary focus of the organization/ICES, with many of the staff and experts in marine science, revealed that the meritocratic fallacy was deeply ingrained and learning to “talk their language” and present “evidence” was a critical part of achieving buy-in. Use of quantitative approaches was a critical component of communicating and making visible the inequality within the ICES scientific community. Feminist researchers must often play the role of “translator” to relate values and drive change that empowers women and other marginalized groups (Jenkins et al., 2019).

This was accomplished by documenting evidence of inequality in roles and processes, making visible gendered power imbalances through gender-disaggregated data, drawing on gender inference technologies where necessary, revealing that women represent around 20% of leadership roles.
(Figure 3), and were underrepresented in awards (Johannesen et al., 2023). While in this context, the importance of initiating data collection was found to be important to achieving buy-in for a change agenda, in other contexts the focus on data collection can distract from the culture change needed to achieve gender equality (Grzelec, 2024).

Following the virtual screening of the film, an online survey was sent to all those who had also received the invitation to see the film, encouraging and collecting anonymous responses regardless if the film had been viewed. Of the 94 Responses received, 68% were from Northern/Western Europe (68%). Respondents were 54% female, 45% male, 1% preferred not to say, 0 selected “prefer to self describe”. Nearly half (47%) of respondents had been working in ICES for 5-15 years. Approximately one-third (31%) of respondents reported experiencing gender-based harassment (defined broadly, inclusive of microaggressions) while working on ICES related activities. A majority (63%) of respondents reported that they did not have the impression that gender representation in ICES activities was equal. More than half (54%) of respondents reported that if they had witnessed or experienced harassment they would not know who to or how to register a complaint. There were also questions with free text response fields where respondents were prompted to share any additional details about their experiences and potential solutions. A range of experiences and viewpoints were shared. Some who had not experienced or witnessed gender or racial bias, and others who had. The majority of responses related to implicit bias and microaggressions, for example:

"Woman (although in minority) repeatedly selected by men to be the minute taker (although they did not volunteer for it)."

One response mentioned sexual harassment directly:

"After a meeting we had drinks and someone made unwanted advances towards me and would not stop. It was very uncomfortable and I left early with an escort because I was quite worried".
Examples of these anonymous responses were used in presentations to frame dialogue with key committees and groups, including major decision-making bodies, and staff. It was important to have evidence from the specific community, it made the existence of bias, discrimination, and harassment visible and tangible. Comments that insinuated that a lack of reports of these instances meant these behaviours happen in other organizations, or other science disciplines, were noted in survey responses, as well as informal exchanges, and documented in field notes.

“I’ve encountered this a few times – this idea that these things are happening in other places. I think of [name]’s feedback on “Picture a Scientist” where he seemed to think this was happening in other disciplines, but marine science is fine.” (Extract from research log 20 January 2022)

The results of the survey also spurred direct actions 1) with immediate effect to update introductory presentations at the start of all working group meetings with information about expectations of behavior, including information on how to report violations. 2) to initiate a renewal and streamlining of the professional expectations of behavior, which eventually became “the Code of Ethics and Professional Conduct”. These are examples of actions labeled “gender mainstreaming in policy and processes” in figure 2.

Qualitative approaches to documenting inequality were critical in this phase. Having direct evidence of (anonymous) experiences of people working in the ICES community, including instances of gender based discrimination, bias, harassment and microaggressions was an important basis for progressing the change agenda, including development and dissemination of a Code of Ethics and professional conduct, and information about reporting, and garnering support for a permanent anonymous reporting tool.

Collecting and sharing quantitative and qualitative evidence of institutional inequality, including specific experiences helped to facilitate the co-creation of knowledge and outcomes, in line with FPAR. By working with the community to discuss the problems and potential actions to promote
change, awareness is raised. Balancing the scale of FPAR requires a trade-off, while engaging a wide
community remotely means the message is broadly disseminated, however online discussions have
limitations for meaningful engagement and may have limited impact on empowering women and
other underrepresented groups.

A turning point for institutional acceptance and executive level buy-in for the change agenda was
the EU requirement for all organizations receiving EU Horizon Europe research funding to have a
gender equality plan. The sudden urgency of the business case meant the change agenda was
prioritized. Community feedback and input, as well as “insider” knowledge was used to develop the
interim Gender Equality Plan, drawing on widely available resources\(^2\) and tailoring the plan to the
specific organizational context. The draft plan was discussed with committees and staff, input and
feedback was then incorporated into the interim plan, and at the October 2022 Council meeting,
adopted by the Council.

4.3 Create action plan & act

In this current phase, data collection continues with evidence of acceptance and change, as well as
resistance being logged through informal feedback, dialogue, and observations. Four specific actions
include: 1) Formal adoption of the Gender Equality Plan by member countries; 2) New code of ethics
and professional conduct adopted; and 3) Anonymous reporting tool launched.

“Actions” in action research and FPAR, needs to be broadly defined, and can take place at a range of
scales from individual to collective, and all of these have value and can contribute to broader scale
social or institutional change (Reid et al., 2006). A variety of “actions” emerged during the research
process, and many “small” pieces contributed to the approval of the Gender Equality Plan, and may
be helping to evolve the culture needed to advance equality.

4.4 Evaluate and Review outcomes

\(^2\) e.g. https://eige.europa.eu/
A future phase, using data collection that has been formalized as part of the gender equality plan will facilitate reporting and monitoring of progress through goals and targets. This data centric approach can help to identify additional actions needed, and facilitates a cyclic process aligned with action research. The Gender Equality Plan has a built-in-reporting mechanism that requires annual update assessment to monitor progress on gender equality through goals and targets. This is both data collection and an action, as it requires annual progress monitoring, and reporting. This action also facilitates the creation of a time-series to evaluate progress (or not) over time. Annual reporting to the Council will keep awareness of institutional inequality high on the agenda and allow member country representatives to reflect on their own contribution to the diversity of gender representation in the organization.

Engagement with representatives from multiple ICES member countries indicates that, having been confronted with the evidence of androcentric domination of their delegations in decision-making roles for at least the past 10 years, are reflecting on the selection criteria and acknowledging the need to increase the diversity of their delegations. These “small wins” (Benschop & Verloo, 2011) signal the FPAR process has started to raise awareness of the need to attend to the gendered nature of the organization and specifically attend to the unconscious bias that can influence nominations when operating in a gender-blind context.

4.5 Analysis of institutional acceptance, resistance, uptake and evidence of change

Feminist activist work took place throughout the project period, using incremental change processes to adapt the formal rules of the organization to be more gender sensitive (gender mainstreaming) with the aim to rectify ongoing gendered imbalances in the organization (e.g. in representation as keynote presenters/symposia guidelines; Johannesen et al., 2023).

"After the meeting, I worked with [colleagues] to revise DEI text in the merit award guidelines – some of the “gender mainstreaming” needed. We helped make what the merit award committee is already doing in terms of evaluating if the merit awards are unfairly
favoured towards one group over another, explicit in the guidelines.” (From the research log - 15 March 2023)

In an intergovernmental setting, nominations to the ICES work are the duty of member countries, and codified in the formal organizational documentation, such as the ICES Convention, and Rules of Procedure. Longer-term change processes are needed to change formalized nominations and election processes, limiting further disruption of gendered power relations at the highest levels of the organization. However, co-creation is ongoing by working through less formal channels, by for example the facilitation of a sub-group of Council representatives to discuss diversity, equity, and inclusion in nominations to ICES work. In this group, the informal processes needed to be more intentional in IGO representation are being addressed by providing a venue for member countries to share and exchange good practice, and self-assess how to address gender and other types of bias in national nominations. Ongoing analysis and critical reflection on the effectiveness of both formal and informal reforms to redistribute power within the organization will be needed.

4.5.1 Resistances

Change processes inevitably face resistance, and can manifest at individual and institutional levels both explicitly and implicitly (Mergaert and Lombardo, 2014). Documenting and acknowledging resistances, helps to reveal continued opposition, makes visible how institutional cultures are gendered, and can help identify where additional actions are needed to help support the change agenda (Mergaert and Lombardo, 2014). Resistance to change in support of gender equality in academic institutions explained by feminist institutionalism “…highlights the persistence of a gendered organizational culture that is deeply embedded, internalised and reflected in the gendering of careers and informal day-to-day interactions; one which may continue to spur resistance to change, even in the face of overwhelming evidence and popular support.” (Hodgins, O’Connor, and Buckley, 2022, p.16).
Examples of resistances at individual and institutional level encountered during the research process are presented in Table 2.

<table>
<thead>
<tr>
<th>Types of Resistance</th>
<th>Individual</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denial of existence of gendered inequalities</td>
<td>Messages, remarks, or responses that gendered inequalities/harassment/bias happen other places, but are unlikely or do not exist in this workplace/community/discipline Belief that it is a matter of “time”- and gender imbalance will solve itself.</td>
<td>Recruitment procedures not standardized across leadership roles, with some lacking publicly available vacancy announcements.</td>
</tr>
<tr>
<td>Competing agendas</td>
<td>Interventions during intersectional presentations on gender to highlight other types of inequality - Diversity, Equity, and Inclusion is ‘more than just gender’</td>
<td>Digital infrastructure developments needed to collect self-identified gender disaggregated and better document gender inequality not prioritized</td>
</tr>
<tr>
<td></td>
<td>Unwilling to present information on the newly adopted Gender Equality plan to &quot;clients&quot;. Gender Equality framed as an “internal” issue – unrelated to the “real” business/work</td>
<td></td>
</tr>
</tbody>
</table>
4.5.2 Acceptance

During the course of the research, there were instances of resistance, but also acceptance, and these should also be recognised. A major signal of institutional acceptance of the need to address inequality was the formal adoption of the ICES Gender Equality Plan by the Council of ICES member countries. While some committees did not allocate specific time on their agendas to accommodate consultation, others have made these issues a regular feature for discussion and action. While analyzing resistances may help us to reflect on and understand why realizing goals on gender equality may be slow, we must also consider the sites where acceptance takes place, and where the focus on gender equality has created positive impacts on individuals’ work through gender mainstreaming and women’s empowerment. For instance, the inclusion of a statement asking authors of ICES publications to consider gender equality when suggesting reviewers lead to an immediate increase (compared between years) in the number of women suggested to review internal ICES publications.

5. Summary and discussion

By analyzing and identifying contributions that lead to the initiation of a formal change agenda, this research highlights how FPAR approaches can be applied in the context of driving institutional change to address gender inequality in an intergovernmental marine science organization. Evidence
of how the coordination of international marine science is gendered was used to engage a science
community using participatory and collaborative approaches. The role of individuals also contributes
to the initiation and implementation of institutional and organizational change.

For meaningful change a structural organizational approach is needed but will also require constant
reinforcement. However, interventions that focus on individuals are often prioritized as they can be
more easily accepted and implemented (Hodgins, O’Conner, Buckley, 2022). While formal gender
equality plans signal positive intentions for change, they can lack effectiveness and can quickly
become merely aspirational if they are unable to effectively shift culture and create the conditions
to empower women and other underrepresented groups (Ojwala et al, 2022; Bosma et al, 2018).

While this analysis culminates in the approval of the ICES Gender Equality Plan, the evidence that
such plans can support meaningful change is lacking. Having a specific plan and documentation has
benefits, but it can also shift the focus from making changes to demonstrating what can be
measured (Ahmed, 2007). There can also be unintended consequences and shortcomings of Gender
Equality plans, if they overlook the intersectional nature of challenges that face women and can be
labor intensive – with the work and development disproportionately done by women, or becomes a
“box-ticking” exercise (Tzanakou & Pearce, 2019). And this has also been true in the ICES case,
where women have been disproportionately doing the work of leading, implementing, and
participating in the processes linked to the change agenda. Tzanakou (2019) recommends ways of
overcoming these issues: take an intersectional approach, collect qualitative data to understand
workplace culture, ensure there are sufficient resources and support for those conducting this work,
and allow for reporting that can help strengthen continual learning and progress towards gender
equality, and many actions that reflect these recommendations have been adopted in the ICES
Gender Equality Plan.

By visually analysing contributions along a timeline (figure 2), the drivers, data collection, co-creation
through dialogue, and actions reveal how stages of awareness, understanding, and action in a
gender equality change process overlap and are not discreet, actions can occur at a variety of scales, and that the doing and participatory engagement is the value in the process. While there are varying degrees of acceptance and resistance identified in the short-term, documentation can help to signal where additional attention is needed to continue to foster change in the longer run. The adoption of a Gender Equality Plan provides an important signal of institutional commitment and recognition of inequality, but further progress can only be expected if community engagement is ongoing.

6. Conclusion

Achieving greater equality requires concerted actions, and policy interventions that address both the measurable and immeasurable, formal and informal processes, cultures, values, and norms. Using feminist participatory action research approaches combined with feminist institutional perspectives can help to generate the context specific knowledge needed to develop transformative gender equality policies and drive organizational change, and create the enabling environment to support greater diversity in leadership positions.

Collecting quantitative and qualitative data can make visible institutional inequalities, inform relevant policy and through participatory approaches, foster awareness, and greater acceptance for changes needed to shift culture towards recognizing and valuing differences in pursuit of greater equality.

Following initiation of a change agenda and institutional commitment to gender equality, future phases of organizational change needs to ensure that the focus remains on transformation, through critical acts, broadening responsibility for socialization and further progress of the plan, and avoiding a focus on quantitative calculation of representation as a singular measure of gender equality.

While executive level support was critical to initiating the change agenda in ICES, participatory processes and community engagement can help foster the institutional and individual awareness needed to shift culture. Having an insider with the interest and understanding of how to drive change through formal and informal channels was important for the development and acceptance of
the gender equality plan. This analysis reflects my personal experience of leading and researching this process, which has been simultaneously deeply rewarding and challenging, encountering both acceptance and resistance to change along the way. Additional resources will be needed to continue to promote engagement and shift institutional practice to foster greater equality and ensure diverse perspectives and experiences are represented in the conduct and coordination of international marine science, as a matter of social justice, but also for even better science.

7.0 Credit authorship contribution statement

The author confirms sole responsibility for the research, study design, data collection, analysis and interpretation of results, and manuscript preparation.

8.0 Declaration of interest

The author declares that they were employed at ICES during the conduct of this research.

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Appendix 1. Survey questionnaire

Thanks for agreeing to give us some feedback.
This questionnaire should take approximately 10 minutes to complete.

Let's start press Enter »

"As part of an ICES initiative to promote diversity, equality, and inclusion, members of the ICES community were invited to see the documentary PICTURE A SCIENTIST.

This movie thoughtfully portrays experiences by women in the sciences today and identifies the importance of being active allies of gender equality.

We are now gathering anonymous feedback from the community about experiences, perceptions, as well as insights and ideas on how we can work together to discuss gender equality, diversity, inclusivity, and spaces free from harassment in the ICES community.

Even if you haven't seen the film, you are welcome to provide feedback.

Responses will also be used to inform an academic research project."
First a few questions about you

Where do you live?

- A North America
- B Northern Europe
- C Central Europe
- D Southern Europe
- E Eastern Europe
- F Western Europe
- G Other

OK ✅
2. What is your gender?

A. Female
B. Male
C. Prefer to self describe
D. Prefer not to say

OK ✓

3. How many years have you participated in ICES activities?

A. <5 years
B. 5-15 years
C. 15+ years
D. I've never participated in ICES activities

OK ✓

4. Did you have a chance to see the film "Picture a Scientist"?

Y. Yes
N. No
5. What was your main takeaway message from the film?

Type your answer here...

OK ✓

6. Did any of the situations and issues raised in “Picture a Scientist” (e.g. gender based discrimination, or harassment) seem familiar or relevant for your experience participating in the ICES activities? If yes, in a few words please describe which experiences were familiar?

Type your answer here...

OK ✓

7. Have you experienced any behaviours that you would consider as gender-based harassment while working on ICES related activities?

Examples of gender-based harassment:

- subtle exclusions
- being left off an email
- not being invited to collaborate
- vulgar name calling
- obscene gestures
- hostility
- Incivility - impolite or offensive comments
- passed over for promotions
- relentless pressure for dates
- remarks about bodies

Y Yes
N No
8 ➔ Would you like to share your experiences in a few words?

Description (optional)

Type your answer here...

Shift 9 - Enter ⌃ to make a line break

OK  press Enter ⌃

9 ➔ Have you **witnessed** any behaviours that you would consider as gender-based harassment while working on ICES related activities?

Examples of gender-based harassment:

- subtle exclusions
- being left off an email
- not being invited to collaborate
- vulgar name calling
- obscene gestures
- hostility
- Incivility - impolite or offensive comments
- passed over for promotions
- relentless pressure for dates
- remarks about bodies

Description (optional)
10. Would you like to share your experiences in a few words?
   Description (optional)

Type your answer here...

Shift 8 + Enter ^ to make a line break

11. If you witnessed or experienced harassment, would you know to who or how to register a complaint?
   Description (optional)

   Y Yes
   N No

12. Is it your impression that gender representation in ICES activities is equal?
   Description (optional)

   Y Yes
   N No

13. Could you suggest any actions to help empower women and other under-represented groups in ICES work?
   Description (optional)

Type your answer here...

Shift 8 + Enter ^ to make a line break

OK ✓ press Enter ^
Thank you for sharing your thoughts and experiences!

Expectations for behaviour when participating in ICES activities, as well as information on how to report incidents of harassment are provided in the document *ICES Meeting Etiquette*.

*Description (optional)*
Appendix 2. Interview guide

Warm-up questions:

- Who you are, where you work, main discipline, how long have you been part of the ICES community, and current role.
- Can you recall your first experience with the ICES community? How did you get involved?
- What does gender equality mean to you?

Personal questions:

- Can you think of a time when your gender influenced your career/participation in ICES work?
- In your career so far, what aspects of your work have been most important for your career progression? (Prompt: for example, participating in field work/surveys, technical training, publishing your research, networking opportunities etc?)
- Was there a time when you had caring responsibilities – and if so how did this impact on your ICES work?
- Can you describe instances where specific structures or actions could have better supported your participation?
- How has COVID-19 and the shift to remote work affected your work, and ability to participate in ICES work?
- Please describe the characteristics of people you see privileged and/or promoted in marine science/ICES?
- What values are most important to you as a leader?

Institutional questions:

- How does your country make nominations to ICES? Are the processes the same for members and chairs of expert groups, chairs of committees, and delegates?
- Does your institution have support structures for women scientists?
- Which obstacles/barriers/challenges to achieving gender equality do you think exist in your organisation/and ICES? And can you think of any solutions?
- Why do you think we have so few women represented in the decision-making bodies of ICES?
- What strategies would you support to empower more women to leadership roles, and why; e.g. quotas/term-lengths on committees to encourage greater rotation and opportunities/training/mentorship?
- Are you familiar with the UN Ocean Decade, and do you think it will present opportunities to help improve the gender balance in ocean/marine science? Why or why not?
- Do you have any other experiences or thoughts you would like to share with me?
Paper IV
Title: Beneath the Surface: Exploring Women’s Perspectives on Gender Equality paradoxes in a Marine Science Organization

Target journal: NORA - Nordic Journal of Feminist and Gender Research

Authors: Ellen Johannesen, Francis Neat, Susan Buckingham, Momoko Kitada

Key words: Gender, Paradox, Marine, Science, postfeminism

Abstract

This paper explores the perceptions and experiences with gender equality of women working in a marine scientific network. The interviews were analysed employing thematic coding to identify recurring patterns and themes in the qualitative data. The findings highlight perceptions of gender inequality, revealing paradoxical interpretations of individual and institutional experiences. Some perceptions revealed a postfeminist sensibility, where attachment to gender-neutrality and merit rationalised gender equality paradoxes in science organisations and workplaces. The subsequent analysis explores participants' views on barriers and solutions in addressing gender inequality in marine science, revealing a nuanced understanding of the issue across various scales, and illustrating the nested and interconnected nature. Inequality is seen as something that happened in the past or will soon be eliminated given the prevalence of women in the system. Acceptance of the formal rules that prescribe access to membership are accepted, though support for disruptive interventions such as quotas should be further explored. The findings emphasise the need for a multifaceted approach to addressing institutional gender inequality involving awareness, mentorship, structural changes, and societal shifts.

Introduction

The well-being, culture, economy, and ecosystems of Nordic regions rely on the health of their extensive coastlines and marine resources. Nordic societies prioritise gender equality, and are frequently recognised as world leaders in the advancement of this goal (EIGE, 2023). Marine science provides the evidence-base for decision-making regarding the utilisation of ocean and coastal resources. The field of marine science has only recently begun to acknowledge how gender shapes its
social system, and how traditional masculinist work approaches may marginalise women (Johannesen et al., 2023). Organisational cultures that operate, advance, and reward their staff on the basis of “merit”, without attending to how merit is defined and assessed, can generate a paradox between successful individual performance that is independent of gender, and systemic gender bias due to hidden factors not directly related to the working environment (Castilla & Bernard, 2010). Using an international marine science organisation as a focus, this study attempts to understand how women navigate continuing gender equality paradoxes.

Ocean health is critical for human well-being and ecosystem stability, and is currently threatened by multiple stressors (Fleming et al., 2019). Improved gender representation in marine science decision-making organisations is needed from an ethical standpoint, but also to ensure a broad range of perspectives contribute to developing science that responds to the full range of societal needs, and the improvement of ocean health (Shellock & Maltby, 2023; United Nations Environment Programme and Gender and Water Alliance, 2019). In the North Atlantic Ocean, the importance of international cooperation to inform management of human activities has been long recognized and coordinated by the intergovernmental (IGO) marine science organisation, the International Council for the Exploration of the Seas (ICES), founded in 1902 by agreement between eight countries1 (Rozwadowski, 2002). In over 100 years, ICES has grown to twenty member countries and a network of over 6000 scientists, supported by a Secretariat based in Copenhagen, Denmark. While the number of women involved in ICES has increased in recent years and its first female General Secretary served from 2011–2021, it still falls far short of parity especially in senior roles (Johannesen, forthcoming).

As part of a broader feminist participatory action research project, ICES was selected as a case study examining the extent to which the under-representation of women in leadership roles indicates organisational gender inequality (See Johannesen et al., 2023; Johannesen, forthcoming). We were especially interested in the challenges and opportunities for greater gender equality in the marine

1 Denmark, Finland, Germany, the Netherlands, Norway, Sweden, Russia, United Kingdom
science system from the perspective of women working in and connected to the ICES network. This paper aims to answer two questions, 1) What are the perceived barriers and potential solutions to greater female recruitment and participation in the decision-making levels of a marine science organisation, and 2) How do perceptions of gender inequality vary within female or gender diverse members of the organisation?

Perceptions of inequality

Understanding and managing perceptions is essential for addressing gender inequality and fostering positive change that can help promote equality in marine and oceans sectors, as well as other STEM disciplines. Perceptions inform and shape individual and collective behaviours, thereby influencing policy decisions and impacting social dynamics. Research has shown that a person’s experience of inequality will influence perceptions of how important it is to act. García-González et al. (2019) demonstrated variations in the perception of inequality in research organisations across genders, with men perceiving greater gender equality than women, independent of country, discipline, seniority level, or institution type. Eslen-Ziya and Yıldırım (2022) found that women academics’ perceptions (based on a survey of 200 academics) of gender equality was linked to perceiving strong hierarchy at work, with perceptions of greater gender inequality linked to perceptions of strong hierarchy in higher education institutions. Handley et al. (2015) concluded in their study that men were more likely to be critical of research that provides evidence of gender bias than women. In Earth and Space science, Popp et al. (2019) found gendered differences in perceptions of bias, with awareness of gender inequality lower among men, who were also less likely to support disruptive interventions, such as quotas. Evidence of a meta-bias against research on gender bias compared to research on other types of discrimination has also been documented (Cislak et al., 2018).

Gender equality in marine science

While the often-cited figure of women comprising 38% of the ocean science workforce may indicate that gender representation in ocean science is approaching parity (Brooks & Déniz-González, 2021)
simplistic counting of representation is not a sufficient measure of gender equality in itself (Liebowitz & Zwingel, 2014). The continued existence of gender bias in ocean and marine science has been documented across diverse measures including representation in career stages, leadership, as well as in academic outputs like authorship in peer-reviewed articles and funding (Giakoumi et al., 2021). While quantitative analysis can help make inequality visible, qualitative research is needed to provide in-depth understanding of context and complexity of gendered power-relations in marine and ocean science. Shellock et al. (2022) conducted in-depth qualitative research into the barriers faced by woman leaders in interdisciplinary marine science, as perceived by woman leaders, and identified potential actions to address these barriers. They found that “the majority of women have experienced a wide range of additional barriers and challenges owing to their gender” (Shellock et al., 2022, p. 12), but 40% of their respondents “stated that they had not faced any specific gender-based challenges or were unable to identify them” (Shellock et al., 2022, p. 12). Given the substantial evidence of gender inequality in marine science it is relevant to consider what factors contribute not only to the perception of barriers, but also why these barriers are perceived differently by some.

Descriptions of barriers and potential solutions, and calls to action for greater equality across STEM fields, including marine and ocean science (see Giakoumi et al., 2021; Shellock et al., 2022) are making inequality visible, and identifying pathways to change. However, with leadership in marine science continuing to be dominated by men, and men reluctant to acknowledge gender bias, the institutional actions needed for change may be slow to advance. Finding effective ways to communicate inequality challenges is one strategy to promote understanding and action.

**Metaphors in gender research**

Gender research often employs metaphors to clarify complex concepts and convey meaning. The 'leaky pipeline' metaphor (Berryman, 1983), depicting the diminishing presence of women in senior academia and research roles, remains prevalent. Metaphors are needed that can reflect the dynamic and evolving nature of cultural and institutional contributions to gender equality. Communicating
identified barriers in a way that can be understood and overcome from a system perspective has also been explained using a firewall as a metaphor. A ‘firewall’, like that which restricts access to secure computer networks, is suggested as a metaphor that captures the complexities of discrimination in organisations, given its focus on process (Andersson et al., 2022). In this metaphor, progression through an organisation is facilitated or hindered by accessing specific codes to pass through the firewall (Andersson et al., 2022). Because formal and informal barriers require understanding and connection to pass through, the metaphor illustrates both how individuals construct pathways for access to progression in an organisation, as well as how the systems themselves create barriers. This metaphor also aligns with an intersectional perspective, where some “codes” may be more difficult to access for some social identities than others.

Data collection

Perceptions of gender bias in marine science are explored through data collected as part of a wider participatory action research project aimed at initiating change in Intergovernmental Organizations (IGOs). Taking ICES as a case study, the project was conducted from an insider perspective, with the lead author taking a dual role as Secretariat staff member and gender researcher. ICES is a network organisation, with members nominated based on their expertise. National representatives and expert members are not paid by ICES for their work, nor considered members of staff. Responses reflected participants’ experiences at both their “home” institution and within ICES, a network organisation.

This study is based on interviews with 22 individuals, 21 identifying as women, and one identifying as non-binary, originating from 15 countries in the global North. Participants were identified through a purposive sampling method, linked to their connection to ICES. All participants were current or past members of the ICES marine scientific community, participating in a number of roles, at different levels of the organisation, with the majority nominated as national representatives. Most participants were mid-to-late career stage professionals, though 4 participants were at an early career stage (i.e. 10 years or less since graduation). Data were not collected or volunteered on ethnicity, but the group
appeared racially homogenous (white), and working in countries of Europe and North America, where ICES member countries are represented. Fifteen participants identified as mothers, while 6 participants reported not having children.

This study was approved by the Research Ethics Committee of the World Maritime University. Participation was voluntary, and responses have been de-identified for use in this article. The interview questions aimed to gather personal and institutional perspectives related to gender inequality in ICES and marine science workplaces. The responses identified potential barriers and solutions to inequality that linked to a range of issues in marine science workplaces.

Semi-structured interviews, ranging between 45 and 90 minutes, took place online between December 2021 and January 2023. Interviews were recorded and transcribed using otter.ai software, with the transcription later verified and corrected by the author.

Data analysis

Transcripts were analysed and coded in NVIVO 14, using reflexive thematic analysis (Braun and Clarke, 2006). The underlying assumptions of the coding approach used for this analysis acknowledge that coding is a creative process and that the results are reliant on the intersection of the researcher skills, dataset (participants’ input), and analytic assumptions. In coding the data, a constructivist approach was adopted where the interpretation of meaning and experience is based on understanding that social production of the ICES network occurs through individual and shared perceptions of reality (Byrne, 2021). A dominantly inductive approach was used to develop codes, taking a “data-driven” approach, aiming to emphasise respondents’ meanings and minimise researcher biases. However, deductive analysis was also used to form themes that would help to answer the research questions.

Contradictions in the responses of participants were noted, for example in how they perceived their own individual experience of gender (in)equality, as well as organisational gender inequality, and marine science overall. Britton (2017) also noted resistance to the acknowledgement of the role of
gender in the working lives of women academics, finding that contradictions in recognizing inequality are related to how gender intersects with work both in systemic and interactional ways. These types of contradictions have also been understood as a coping mechanism, and “pragmatic postfeminism” has been used as a framework to understand these contradictions as a way women rationalise ongoing inequality in a variety of contexts (Kelan, 2009; Gill, et al., 2016; Keisu and Brodin, 2022; Lamberg, 2023), including STEM (Nash and Moore, 2018). The qualifier “pragmatic” refers to a practical approach to understanding gender equality paradoxes. Postfeminism is a concept characterised by the idea that feminism has already achieved significant equality and that its goals have been largely accomplished, leading to a focus on individual empowerment and choice. Gill et al. (2016) developed a “postfeminist sensibility” to signal postfeminism as a critical object of study (Banet-Weiser et al., 2020), and this perspective is adopted for analysing and understanding the responses of participants.

Findings

The outcomes of discussions were more nuanced than expected, with some paradoxical responses. The first section highlights these conflicting messages and makes use of a postfeminist analytic framework to consider how and why individuals may refute gender inequality. Thereafter, the analysis of participants' perceptions of barriers and solutions for tackling gender inequality in ICES and marine science identified by respondents and exploration of how these relate to a postfeminist sensibility are presented.

There were conflicting messages from interviewees about how gender influenced their career and ICES work. A number of participants did not feel that gender had influenced either their career, or ICES work, but could recognise gender inequality in science and in ICES, and discussed barriers and solutions to tackling gender inequality. These findings are analysed through the lens of postfeminist sensibility resulting from an attachment to a belief in meritocracy.

Gill et al., (2016) use the concept of postfeminism as an analytic tool to understand the repudiation of gender inequality at workplaces and in organisations. They identify four main features of post feminist
rejection of gender inequality: 1) inequality happened in the past 2) happens in other places 3) being female in the workplace is seen as an advantage 4) acceptance of status quo – that relies on individuals to just work hard to get ahead. Examples of all four of these features can be found in the responses.

1) Inequality happened in the past

The code “Generational change and matter of time” (n=12) grouped participants’ references to inequality as something that happened in the past, or that change is in progress. As noted by Gill et al., “the trope of generational change is frequently evoked in the portrayal of gender inequalities as passé” (Gill et al., 2016, p. 11), which was echoed by one participant:

“Since we have women in marine sciences with a lot of merit. Good professionals, good researchers, for sure that will still keep on changing and being more balanced, because the old ones will go away, they will get retired. So, there is a change of a new cohort coming in. So, I think that’s good, I think I’m positive about that, I’m sure within 10 years we will have much more representation of women in ICES work.” (Participant 17)

The “old boys club” was also mentioned by several participants (n=9) as something that exists in the past, and present. The term “old boys club” is often used to describe informal networks of men, primarily linked through professional connections, which are used for mutual advantage, and may wield collective influence and decision-making in ways that impact others. ICES as a network organisation has a long history of male dominated participation. An historical account of its development refers to its inception as evolving from a “gentlemen’s agreement” (Rozwadowski, 2002). At the highest levels of decision-making in the organisation, men continue to occupy 80% of positions (Johannesen, forthcoming). As mentioned by Participant 16 when describing a warning about the informal culture she received from a mentor prior to joining the network, as “not a nice place for young women to be”, she also framed this as in the past:
“So, you probably heard that people have been reflecting on the fact that it has always been old men in lead and admiring each other and so on. I think it's improved over time. So that leadership is completely different. So I don’t think it’s an issue anymore.” (Participant 16)

While the informal culture of the ICES network may have progressed, and there have been increasing numbers of women in the network, inequality in representation at leadership and decision-making levels persist.

2) Inequality happens in other places

Some participants did not see gender as something that influenced their work in ICES or career, or one and not the other. In this sense, inequality is seen as something that happens in other places:

“Most of my experience with ICES has not been influenced by any views on gender issues, or I haven’t felt limited as a female in ICES at all. Actually, more at [name of workplace] than in ICES”. (Participant 18)

There were also perceived differences in gender equality between ICES member countries where Nordic countries were discussed as having greater levels of gender equality, compared to other ICES member countries, for example:

“We’re lucky I think in [name of Nordic country] because the opportunities are so equal for the genders in connection with maternity leave, because that’s really a problem I see in the other countries that it’s so difficult to have children and get them into daycare when they are small and have the time off without ruining your career […] So, it's been really good here, but I can tell that it's different in other countries. So, I think that’s a large part of gender equality to me.” (Participant 3)

3) Being female in the workplace seen as an advantage

While there were few participants who expressly described being female as an advantage, compared to the position of men, one participant referred to a “micro-benefit”: 
“I would say in some ways there’s been little sort of micro benefits. I can think of, for example, when we would do our fieldwork on ships, people offering to carry things for you and stuff like that.” (Participant 21)

Another participant highlighted how women may be better suited to the stressful work associated with delivering time-sensitive science advice:

“...there’s a lot of multitasking going on. It seems to be easier for the women than the men....I actually think that women are probably better suited, and we should probably soon start worrying about a bias in the opposite direction from what we have now.” (Participant 3)

In this example, the potential that women become over-represented in the network in future is seen as an issue to prepare for.

4) Acceptance of status quo

The structure of ICES means there are formal rules about nomination of experts to participate in the organisation. Many respondents expressed how the nominations process for appointing experts is based on existing rules and the expertise and skills available:

“We can’t mandate the way that member countries assign people, for instance, to the groups but I think we also here have the opportunity to raise awareness among our member countries, because not all of them have it on the agendas as much as [some countries] you know, so it’s also an opportunity for our platform to raise this issue” (Participant 14)

In this example, the firewall metaphor (Andersson et al., 2022) is useful to apply, where the layers of access are regulated by the formal rules, but is also mediated through informal processes in member countries, where the nominations are designated by specific persons and their knowledge of available skills and expertise.
In marine science, career paths are conceived as progressing from junior to senior researchers, with more responsibilities taken on over time, with a variety of factors contributing to women leaving as conveyed by the “leaky pipeline” metaphor. Multiple respondents were keen to signal the importance of “merit”, “competence”, or “abilities” as an important factor in what should be valued for progression.

“*I think it’s hard to de-correlate gender and personality and sensitivity and your skills. Because we are in an environment where you’re really judged by your skills, I think, mostly, at least when you say, in sciences.*” (Participant 10)

This response demonstrates a belief of science as a gender-neutral institution, without critical reflection on which skills are valued, and who defines those values. The idea of merit as central to advancement in science is described as a “myth”, given that individual accomplishments are affected by so many factors. A meritocracy appeals to those benefiting from it by suggesting that their achievements result solely from personal merit (Criado-Perez, 2019). The idea of “merit” is used to legitimise inequality (Kunovich and Slomczynski, 2007), with persons with advanced education and high income having stronger beliefs in merit. One participant expressed a critical view of merit, noting that it is a potential obstacle to greater equality.

“I *think one obstacle is that people who are privileged don’t recognize their privileges as such. It’s the whole, there’s a term for it. Is it meritocracy? Yeah, the people that say that, if people just work hard enough, they get high positions. Which is bull shit. And I think if people don’t recognize that, I mean, that holds true for every other discipline as well. That is definitely an obstacle.*” (Participant 8)

Feminist theorists have shown how inequalities are regular features of merit-focused systems that claim to convey excellence free from bias and subjectivity. Critical examination of the achievement of individual “excellence” reveals gendered processes where professional and individual qualifications are assessed, for example on publication records, can be affected by implicit bias, and
network connections, where women are less likely to benefit in male dominated networks (Brink & Benschop, 2012).

This finding of emphasis on merit may also reflect a limitation of the study, based on the sample that included women who had, in some ways, “made it”. Only one interviewee had left the network. The participants had in many ways, therefore, accessed the “codes” needed to pass through the “firewall” to access the network, advance in their careers, and the organisation. Given the inherent difficulty in identifying participants who may have been excluded from the network, it is difficult to evaluate all the barriers to access that may exist.

**Gender inequality barriers and solutions**

Participants identified a range of barriers that can have influence on the progression and representation of women at senior levels of marine science in national institutes, as well as in the specific IGO context. Themes emerged that demonstrate how gender issues are perceived at a variety of scales, and how they are nested and interrelated. A conceptual diagram of the identified themes, relation between barriers and solutions, and scales is presented in figure 1. [Insert Figure 1. here].

**Barriers**

At the individual level, many participants (n=20) discussed the role of gender and social dynamics. There was mention of a general lack of awareness of gendered issues in marine science workplaces, as well as reference to unconscious bias or “hidden” structures in science, and microaggressions, that challenge women and underrepresented groups. Gendered microaggressions refer to the subtle, often unintentional verbal or behavioural actions that convey negative or derogatory slights based on a person’s gender, and often experienced by women (Kim and Meister, 2023). Tokenism was also discussed, related to the additional burden of women who work in organisations where they are underrepresented and, therefore, are recruited to bring gender balance to different committees and processes. In some experiences, little effort was made to involve them...
substantively, or in another case, a male colleague assumed that a woman would be interested to work on institutional gender equality work, based on her gender:

“There’s this odd game there. You’re running around trying to avoid evaluating professors and all kinds of things at different places. Yeah, being the token woman on the board.” (Participant 3)

Some participants (n=7) also recognised the challenges linked to different intersections of identity which contribute to career progression, communicating awareness of inequality across different categories of identity that need to be attended to:

“I think we as a community are pretty darn privileged. But I also think we as a community are pretty darn white. I don’t think we’re a very racially diverse group.” (Participant 12)

The role of confidence and ‘imposter syndrome’ was also mentioned by multiple participants (n=9), both with reference to personal experience, but also many referring to confidence as an important quality in leadership.

“I’ve often heard that men have more self-confidence than women. I don’t know if that’s true. And in that sense, that could influence who’s favoured because if you’re self-confident, you’re going to look brighter, just sound brighter.” (Participant 10)

‘Imposter syndrome’ is the term used to describe feelings of inadequacy and self-doubt despite high levels of achievement (Clance & Imes, 1978). Critiques of ‘imposter syndrome’ as a concept identify that the term focuses on the individual and does not account for the dynamic and systemic nature of discrimination. It also pathologizes feelings of self-doubt through the use of the word ‘syndrome’ (Tulshyan & Burey, 2021). Gill & Orgad (2017) highlight how confidence culture narratives put focus on individuals and make them responsible not only for building confidence to achieve individual success, but also for advancing the overarching objectives of social equality and diversity, contributing to promoting a postfeminist sensibility. This focus on the identification of ‘imposter
syndrome’ by multiple participants highlights how aspects of a postfeminist sensibility operates to put focus on individual over institutional or systemic gender equality actions.

Many participants (n=20) discussed issues related to how science work at the national level is structured in a way that is disadvantageous for those with caring responsibilities, most of whom are women. Interviewees also noted a high overall workload, where long hours are often expected or required for career progression. Individual researchers often have to work across multiple projects resulting in an additional burden through task switching, as well as administrative and coordination roles that are often “invisible” work that is not recognised or valued. National level institutional requirements for workplace advancement to higher researcher roles are limited by policy and finance, and/or major administrative effort, and decisive evaluations can be conducted in subjective ways, as highlighted in the response below (e.g. advancement controlled by a single ‘gatekeeper’).

“I thought that if your fate or the evaluation of what you’re capable of doing only depended on one person, that was not fair because if this person had something against you, that was the end of you. Or in the other way. If you’re the only one deciding on what someone you manage should do, you have all the power on helping or pushing this person towards a new direction or preventing him or her from moving forward. And I don’t think that’s good.” (Participant 10)

The role of established networks was also mentioned by several (n=7) participants. Within the academic system, in national institutes, and at the IGO level, opportunities were described as being accessed through informal networks that can be difficult for early-career researchers, women, or other underrepresented groups to tap into.

“But there is a lot of hidden structures, or specifically traditions and male dominated networks and so on, that I still think is important and challenging for females.” (Participant 18)

The gendered nature of networks in knowledge-intensive organisations, and especially academia has been theorised and documented from various perspectives (See Cecchini et al., 2019). The strength
of network connections are also related to perceptions of research excellence and where individuals
often are biased by a preference for similarity in social connections, with gendered consequences
(Brink & Benschop, 2012).

“So, what would be bad in ICES is if there’s a lot of bias in the working groups, and I haven’t seen
that. […] but then maybe I’m just not picking up on it. […] It matters a lot who you are, what your
social skills are, and who your friends are, is very, very important. But I don’t think it matters as
much what their gender is. So, I haven’t really seen a lot of bias in the ICES groups and you’re very
dependent on who people are sending there. So, that’s sort of the open, the more obvious stuff you
could do something about” (Participant 3)

In the above response there is a repudiation of any gender issues in the science network, it is the
individual independent of gender and informal social connections, or “who your friends are” which
are emphasised as very important. Here the “status quo” is both rationalised by claiming that there
is no evidence of gender bias, while also acknowledging that the IGO nominations procedures mean
each member country is responsible for sending people and that is where actions could be relevant.
Belief that science is not gendered contributes to an ideological dilemma that acquiesces to male
organisational domination, but is a coping strategy for surviving in male dominated environments
(Nash and Moore, 2018).

As the focus of the case study, issues specific to this IGO were discussed by a majority of participants
(n=17). Informal culture plays a significant role in shaping gender dynamics within an organisation,
and was also discussed by participants (n=6).

“I do think that the tone we have in the groups, and the way we involve the non-dominating, I’m on
the dominating side I should say. So, it’s not because I think that other people talk more than me, but
the way we include the people who are less sure of themselves. I think that would help because
there’s a lot of women that I know that think it’s really painful to be in a working group with these
Workplace incivility, disrespectful communication or behaviour, can have negative consequences for women’s workplace engagement, and should be addressed through specific actions to improve the working climate (Saxena et al., 2019).

Addressing institutional barriers is an important part of creating the enabling conditions for equality, and is often addressed through policies or plans for change. The limitations of gender equality plans were mentioned by some participants (n=8), as well as instances of discrimination, some of which are difficult to document or report.

“...it was probably more subtle, negative influences, very hard to document. I feel that, some of the senior male managers at the time, were very paternalistic, they may have thought they were being supportive, but for the wrong reasons, I don’t know how to really put this into words, but it’s just sort of an impression I have that, as long as you went along with what they wanted to do, it’s fine. But I wasn’t being listened to as an independent thinker.” (Participant 6)

Ambiguous gender discrimination is a regular feature of the lives of professional women that is very difficult to address, and is often not reported, with women responding by changing their own workplace behaviours (Doering et al., 2023).

When asked to reflect on the potential for an organisational gender equality plan to make change, one participant reflected on the plan at her national institute:

“No, they can’t make any change. Maybe it’s a small step forward to a bigger plan. Really, like with this plan nobody is monitoring how that plan is progressing.” (Participant 20)

Another participant summed up her perception of gender equality initiatives in her workplace as “A helluva lot of talk” (Participant 13). In other words, this participant did not see initiatives as translating into action.
At the societal-level, broad social and science challenges were discussed (n=21) in terms of the gender roles and stereotypes, as well as perceived vertical and horizontal gender segregation that persists in marine science disciplines. Several participants remarked that continuing inequality was likely related to structural realities of women and mid-career levels and likely, this is a “matter of time” before women reach the top-levels. Horizontal segregation was also viewed as a preference among women for laboratory work, where caring responsibilities could be more easily catered for.

“So, if you go to the biological working laboratory, there was almost dominance from women. But still nowadays, I think that's the case [...] because we started on biology when we spoke about fisheries biology, that could still be true, because it's a lot of work to be done in a laboratory. But then you have in fisheries biology and stock assessment, and in general, working in marine sciences, there is still a great chance probably that you need to go abroad, or on board a research vessel, or a commercial vessel, and that could be an impediment for some women.” (Participant 17)

Potential solutions, strategies, and experiences with addressing gender inequality in marine science were also discussed by participants, these responses were similarly grouped thematically and at the different scales to which they are relevant.

At the scale of the individual, gender and social dynamics was frequently discussed (n=20), many described raising awareness (n=10), especially among leaders(n=7) as an important strategy:

“we just need to have a focus on it, and talk about it, and challenge ourselves. So, I don't think you can change that with any gender balance plans. It's a cultural thing. You need to change the culture and the way to change culture is, I guess, to be conscious, and to be open, and to discuss these issues and to bring them up again and again and again.” (Participant 18)
Training, peer support, and mentorship were also strongly favoured strategies. Mentorship was discussed by a majority (n=15), and for many participants, having a mentor or sponsor (of any gender) was a central factor in progression, as well as access to the ICES network:

“I think mentorship is key and maybe that’s just because it’s helped me so much over the years.” (Participant 12)

Not all participants found mentorship to be a perfect strategy. The support mechanism was described by one participant as “mysterious”, others noted the challenges of not having a mentor.

Voice and opportunity was also a strong theme (n=11), with participants discussing the experience of having voice, and being listened to as an important part of their success and career progression, and linked this to access to opportunities:

“I think having an opportunity to do different things, having a varied experience. Having the ability to try something on for a few years that’s vastly different than what you were doing a few years previous. I think to be successful in that type of change, and constant change, you need to both have confidence obviously in yourself, but you know, a confidence in yourself is driven by others, also feeling like they have confidence in your abilities.” (Participant 2)

Changes to the structure of work can enable participation and career progression. Structure refers to the allocation of power along lines of authority, encompassing both formal institutional policies with written documentation and informal, unwritten rules that prescribe normative practices (Britton, 2017). Attending to workplace atmosphere is needed to address informal culture that can result in raised voices, meeting stress, and pressure from deadlines. In this theme a variety of issues was highlighted including the importance of family friendly working environments (n=13); supportive leaders (n=8); teamwork and collaboration (n=10); as well as balanced and fair recruitment processes that are sensitive to a diversity of candidates, including those with caring responsibilities (n=5); and networking (n=18). Teamwork and collaboration were highlighted as important for being successful
in obtaining research grants, and publications, which are both metrics often used to measure individual success in science. However, science is inherently a team effort as highlighted in this response:

“I didn’t have the ambition of being a lead researcher, but I wanted to put people together and build the team to propose new projects. And I think that helped people acknowledge the fact that I had that added value for them, because maybe I was not the best scientist in the team, but I was the one putting everybody together. And I think I’m pretty proud of that. Because that was satisfactory for everybody - actually for my colleagues and for myself, and even as a team leader now, I still believe in that, in collective work, collective intelligence...I believe in that and helping everybody speak their mind. And participate in building new proposals, new ideas, and concepts.”

(Participant 10)

Regarding ICES specific issues that can help support women and other underrepresented groups, ten participants noted the importance of access to international experience to their career progression, for example:

“there are intangible benefits from the network, you hear about jobs before they get posted. You also get to learn how to be professional in these environments by being surrounded by mentors. You can corner people and ask for advice.” (Participant 4)

International research collaboration is gendered, with women less likely to participate. Respondents recognised that barriers or as noted in the literature “glass fences”, exist that continue to reinforce male domination of science collaboration at the international level (Uhly et al., 2017). The above quote highlights how after accessing the network there are many benefits, but the informal access to these benefits are not evenly accessible.
Institutional issues were discussed both at the international IGO level and at national institute level with mentions of existing practice. Many existing interventions were described including the need to understand barriers to gender equality, and design context specific strategies.

Participants communicated support for quotas, targets, and positive discrimination interventions. Seventeen participants discussed quotas, with four expressing negative reactions, but all with caveats, and description of in what conditions they would not work. This is an important finding given that two important papers at the intersection of gender and marine science have either discounted or excluded quotas as a potential intervention to resolve continuing gendered imbalances in marine and ocean science. Based on a survey of 764 responses (75% women) Giakoumi et al. (2021) found that positive discrimination measures were consistently ranked low, and that “European women ranked gender quota as a lower priority than men did” (Giakoumi et al, 2021, p. 5). They point out that institutional transformation cannot come solely from changes in representation and conclude “Instead, promoting critical gender awareness in institutions considering contextual (institutional and family-related) factors and non-contextual factors (including individuals’ attitudes and beliefs) should be prioritized” (Giakoumi et al, 2021, p. 5). However, it is not clear why these are constructed as an either/or.

Similarly, Shellock et al., (2022) note that the actions they recommend to support women in early career stages are aimed at creating “an equitable platform” (Shellock, et al., 2022, p.59), acknowledging that positive discrimination is often discussed in the literature, but is not lawful in some contexts, and therefore chose to exclude them from their guide. Others have suggested that positive discrimination has the potential to strengthen the appointment of qualified candidates by counteracting effects of unconscious bias (Manfredi, 2017).

The disavowal of gender inequalities linked to a postfeminist sensibility restricts and limits support for disruptive mechanisms, such as quotas or other types of positive discrimination (Gill at al., 2016). These findings highlight that gender specific actions such as positive discrimination in marine science
should not be rejected among a range of tools, given their potential to disrupt the status quo and increase the representation of women in decision-making roles in marine science organisations.

Participants' perceptions of decision-making bodies and leadership processes in the IGO provided reflection on motivation as well as what aspects of senior leadership roles and representation on decision-making committees were not attractive. Multiple respondents mentioned they were not motivated by certain types of roles, potentially related to how they understand the importance of those roles, as exemplified in the quote below:

“I think it comes to the personalities. The ambitions perhaps. I'm not sure, you know, who would sit down and say, I want to be President of ICES? Not me.” (Participant 6)

Another participant was motivated to leadership based on an imbalance of gender representation and said:

“In one way I'm not very focused on gender issues at work. But at the same time, gender issues have been a very important factor for me, when taking decisions, for instance going into positions with more responsibility and more power. Like this [leadership title] it was a very important aspect for me, that we had so few female leaders at [name of national institute]. And I think if it wasn't for that aspect I wouldn't have taken that position. Because I wasn't sure if I wanted to deal with all that responsibility, I was really happy as a scientist, but it was an interesting position as well. And I think maybe this gender issue was kind of the balance that kind of switched over to saying yes to that position.” (Participant 18)

This response also demonstrates a desire to refute the influence of gender on her career, while paradoxically acknowledging that greater gender equality is needed in leadership roles.

Role models and balanced gender representation were mentioned (n=12) as important factors for tackling inequality in science culture:
“I have a Professor colleague in my institute that actually thinks that we should go public at the moment and say that we don’t think that gender diversity is an issue that should be focused on, because it’s not important whether you’re a man or a woman, what is important is that people think differently. And you know, I couldn’t agree with him more. But we’re a public institution. Where over half of our students are women. We have 18 professors, where only one, by the way, the oldest is a woman, and you know... we just can’t not have role models for these people.” (Participant 13)

This response highlights a postfeminist pragmatism, where the participant wants to support the gender-neutral approach of her male colleague, but simultaneously recognises the importance of gender in representation.

By reflecting on personal experiences to identify perceived barriers and solutions to address gender inequality, members of an international marine science network contribute to demonstrating that inequality is experienced and needs to be addressed at a variety of scales. Solutions provided are evidence of how individuals who have been able to advance in the network have been able to rationalise their success in a system where few women advance to decision-making roles.

**Conclusion**

Contradictory responses in perceptions in a network organisation highlight the complexity of addressing gender inequality in marine science. Multiple paradoxes were identified, highlighting that women perceive gender inequality intersecting with working in marine science as occurring at a variety of scales: at the individual level, organisational and/or institutional level, as well as in the broader societal and science culture context. Recognising paradoxes can help us to see the world beyond a binary either/or conception. Instead, there are multiple challenges and multiple strategies that should be embraced to reform network structures and improve accessibility for women, and other underrepresented groups.
By building on traditional approaches to understanding gender equality that have focused on solutions and barriers, this analysis has focused on how a postfeminist sensibility contributes to paradoxical responses. Participants identified a range of barriers across different levels and also related experiences that were the “codes” or solutions that enabled their own advancement through the formal and informal barriers of the organisation. The findings emphasise the need for a multifaceted approach involving awareness, mentorship, structural changes, and societal shifts to address gender inequality. Perceptions were often linked to a postfeminist sensibility, where attachment to gender-neutrality and merit rationalised gender equality paradoxes in science organisations and workplaces. Inequality is seen as something that happened in the past, or that inequality will soon be eliminated given the prevalence of women in the system. Acceptance of the formal rules that prescribe access to membership are accepted, though support for disruptive interventions such as quotas should be further explored.

Changing gendered institutional and organisational cultures is complex and requires understanding of perceptions of people of all genders to influence meaningful change (Acker, 2006). This research has shown how the firewall metaphor and “codes” needed to help women progress to decision-making roles can be useful for understanding how individuals are able to progress through a complex marine science IGO. Recognising the role of informal processes to progression and leadership is critical for addressing gender inequality in network organisations. Future research could consider how to evaluate the views and perceptions of those “excluded” from the network, though sampling may be a challenge. This work has also documented how postfeminist sensibility contributes to the perception of both barriers and solutions, that can facilitate critical reflection needed to challenge the perceptions that continue to prevent transformational change in marine science, and in the intergovernmental context.

Declaration of Interest

The first author declares that she was employed at ICES during the conduct of this research.
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Figure 1. Overview of interconnected challenges and solutions to gender equality.
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Appendix 1. Interview guide

Warm-up questions:

- Who you are, where you work, main discipline, how long have you been part of the ICES community, and current role.
- Can you recall your first experience with the ICES community? How did you get involved?
- What does gender equality mean to you?

Personal questions:

- Can you think of a time when your gender influenced your career/participation in ICES work?
- In your career so far, what aspects of your work have been most important for your career progression? (Prompt: for example, participating in field work/surveys, technical training, publishing your research, networking opportunities etc?)
- Was there a time when you had caring responsibilities – and if so how did this impact on your ICES work?
- Can you describe instances where specific structures or actions could have better supported your participation?
- How has COVID-19 and the shift to remote work affected your work, and ability to participate in ICES work?
- Please describe the characteristics of people you see privileged and/or promoted in marine science/ICES?
- What values are most important to you as a leader?

Institutional questions:

- How does your country make nominations to ICES? Are the processes the same for members and chairs of expert groups, chairs of committees, and delegates?
- Does your institution have support structures for women scientists?
- Which obstacles/barriers/challenges to achieving gender equality do you think exist in your organisation/and ICES? And can you think of any solutions?
- Why do you think we have so few women represented in the decision-making bodies of ICES?
- What strategies would you support to empower more women to leadership roles, and why; e.g. quotas/ term-lengths on committees to encourage greater rotation and opportunities/training/mentorship
- Are you familiar with the UN Ocean Decade, and do you think it will present opportunities to help improve the gender balance in ocean/marine science? Why or why not?
- Do you have any other experiences or thoughts you would like to share with me?
Flag State Performance and the Implementation of Port State Control in the European Union

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