Subsection 5B

Chapter 6

Gender

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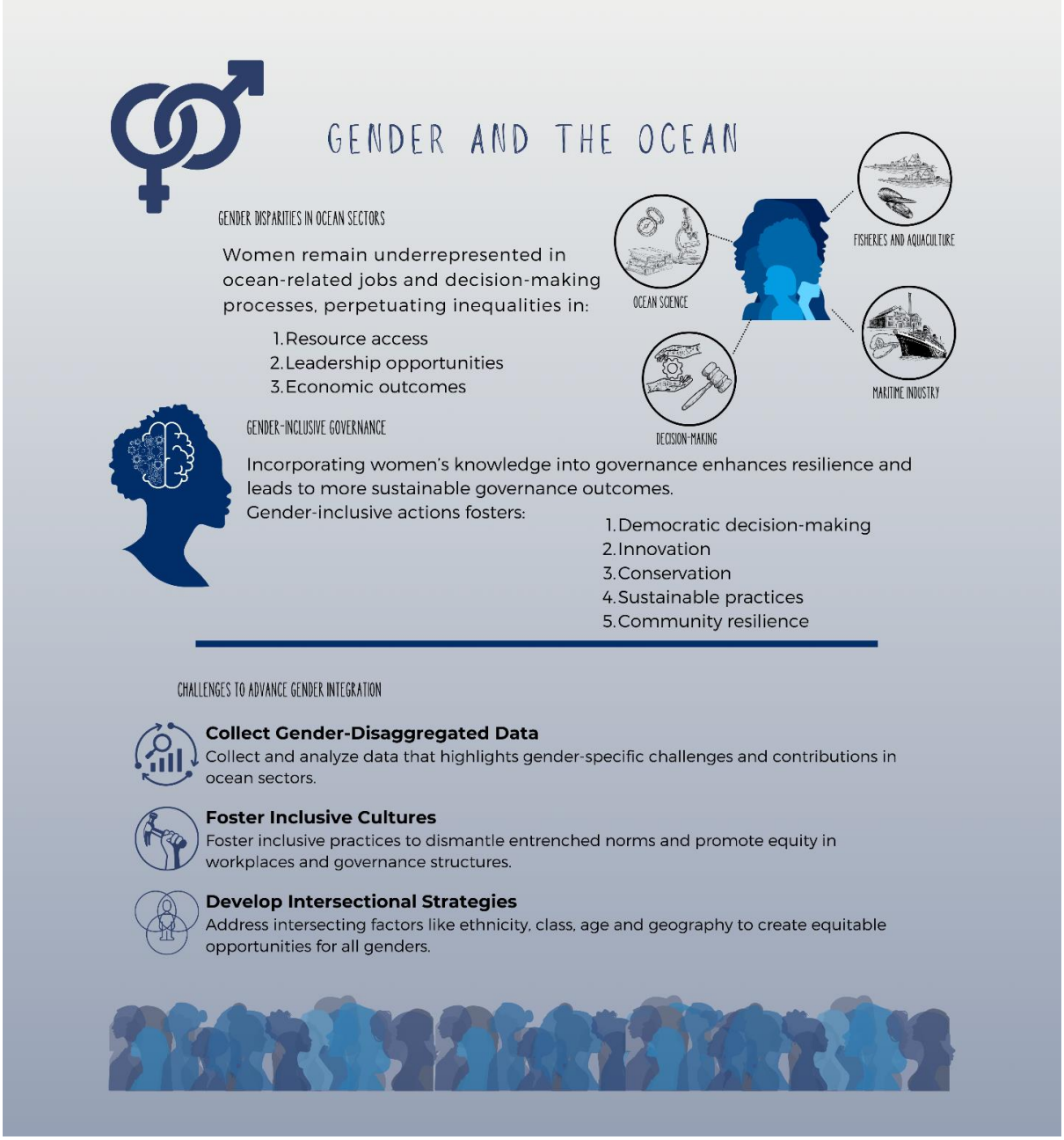
Key points

- Persistent gender disparities across ocean sectors: women remain underrepresented in ocean-related employment and decision-making processes. Traditional roles often restrict their participation in fisheries, aquaculture, maritime industry and marine sciences, perpetuating inequalities in resource access, leadership opportunities and economic outcomes (Crosman and others, 2022; Johannesen and others, 2022).
- Importance of gender-transformative governance: integrating gender perspectives into ocean governance enhances the resilience and effectiveness of conservation and management initiatives. Women's knowledge, particularly in small-scale fisheries and coastal communities, is an underutilized resource that can enrich governance frameworks and promote sustainable outcomes (Andrade and others, 2021; De la Torre-Castro and others, 2017) (see also subsect. 5A, subchap. 1B).
- Advances and gaps in gender integration: milestones such as the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction of 2023 demonstrate progress in recognizing gender in international frameworks. However, systemic challenges, including a lack of gender-disaggregated data and entrenched masculinized cultures, limit the implementation of gender-responsive policies (Kitada and Rodríguez-Chaves, 2024; Hornidge and others, 2023).
- Need for intersectional approaches: addressing gender issues in ocean governance requires intersectional strategies that take into account the ways in which factors such as ethnicity, class and geography intersect with gender. These approaches are vital to tackling systemic barriers and fostering equitable participation in ocean-related activities (Axelrod and others, 2022).
- Benefits of gender-transformative conservation: case studies show that gender-transformative approaches in marine conservation lead to more gender-equitable decision-making and innovative strategies. Promoting women's leadership in ocean science and governance is aligned with sustainable practices and strengthens community resilience (Giakoumi and others, 2021; Shellock and others, 2022).

Figure I

Gender and the ocean: overview of gender disparities in ocean-related sectors and the role of gender-inclusive governance in promoting sustainability, equity and resilience



Source: Prepared by the writing team.

1. Introduction

Gender plays a critical role in shaping ocean-related employment, activities and governance. However, systemic disparities continue to limit equitable access and representation in these sectors. Women are often underrepresented in leadership positions and decision-making processes, while traditional gender roles restrict their participation in fisheries, aquaculture and marine sciences (Crosman and others, 2022; Johannesen and others, 2022). Addressing these inequities is essential to fostering sustainable and inclusive ocean governance (Bennett, 2022).

Achieving the Sustainable Development Goals, particularly Goal 5, on gender equality, requires the integration of gender considerations into ocean policies and frameworks. A gender-responsive approach not only supports social justice, but also enhances the effectiveness of conservation and management initiatives by drawing on women's extensive, yet often underutilized, knowledge of marine ecosystems. This is especially relevant in small-scale fisheries and coastal communities (Andrade and others, 2021; De la Torre-Castro and others, 2017). Such an approach enriches governance systems, ensuring resilience and sustainability in the face of global challenges.

Despite this recognition, progress remains limited. Differences in systematically collected, gender-disaggregated data represent a critical gap that hampers the design of targeted interventions aimed at achieving equitable access and participation in ocean sectors (Kitada and others, 2023). Research on the gender-ocean nexus has predominantly been focused on women's roles and has often overlooked the impacts of masculinities and the entrenched masculinized cultures that exclude women and other marginalized people (Hornidge and others, 2023). Addressing these dimensions is key to dismantling structural barriers and fostering inclusive policies.

Recently, there have been significant milestones in international ocean governance, such as the inclusion of gender-responsive language in the Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction. This Agreement, the first law of the sea instrument in which gender is explicitly addressed, reflects the cross-cutting importance of gender in sustainable ocean management (Kitada and Rodríguez-Chaves, 2024). Such progress is aligned with a growing recognition that gender perspectives must be integrated into global frameworks aimed at promoting equity and inclusivity across sectors (the dimensions of equity are further explored in subsect. 5B, chap. 5).

The intersection of gender and social, economic and environmental dimensions further underscores the need for a comprehensive approach. Traditional gender roles have historically influenced activities in marine environments, ranging from fishing (Mangubhai and others, 2022) and aquaculture (Kruijissen and others, 2018) to governance and research (Crosman and others, 2022; Johannesen and others, 2022). Through international initiatives, organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) are emphasizing the need for structural changes aimed at promoting gender diversity in marine science and technology in light of its importance for fostering innovation and addressing global challenges (IOC-UNESCO, 2020).

The present chapter is focused on the role of women in the context of ocean employment and activities, and provides an in-depth examination of gender-responsive approaches to ocean governance. Including these discussions in the *World Ocean Assessment* makes it possible to highlight the importance of gender awareness and inclusive policies. The chapter also provides actionable insights for embedding gender equality within global ocean governance frameworks, drawn from case studies.

Three case studies were deliberately selected because each project was supported by a prominent international organization that coordinates activities in its sphere of work, exemplifying how structured global collaboration can drive gender-responsive practices. While other sectors – such as offshore oil, gas, renewable energy, tourism, recreation, environmental protection and coastal management – also play critical roles in the ocean economy, focusing on these three cases facilitates an in-depth exploration of coordinated international efforts in promoting gender equality.

2. Gender and the Sustainable Development Goals

The Sustainable Development Goals of the 2030 Agenda for Sustainable Development build on the foundation of the Millennium Development Goals, which provided a framework for development and resulted in significant progress in several areas. However, the Millennium Development Goals had a limited scope and relatively few indicators, leading to uneven progress on some Goals; the Sustainable Development Goals were designed to complete what remained unachieved (see General Assembly resolution 70/1). The Sustainable Development Goals are grounded in frameworks such as the Beijing Declaration and Platform for Action and the Programme of Action of the International Conference on Population and Development, and contain an emphasis on the causal role of discriminatory laws, beliefs and practices in relation to ocean and gender disparities (Odera and Mulusa, 2020). The focus on gender is evident in Goal 5, "Achieve gender equality and empower all women and girls", and in the cross-cutting consideration of gender issues in other Goals (Fukuda-Parr, 2016; Leal Filho and others, 2023). Gender equality is thus recognized as critical for economic, social and environmental sustainability (United Nations, 2024), with direct impacts on the implementation of the 2030 Agenda.

Although Sustainable Development Goal 14 does not explicitly address gender, the interdependence of the Goals demands that gender considerations shape the conservation and sustainable use of ocean resources (Breuer and others, 2019; International Council for Science, 2017). Achievement of the targets under Goal 14 is significantly affected by gender disparities (Leal Filho and others, 2023). The intersection between Goals 5 and 14 illuminates the importance of integrated approaches that enhance gender equality and advance sustainable ocean management (Singh and others, 2018).

The targets under Goal 5 address key barriers to gender equality such as discrimination (5.1), violence (5.2) and harmful practices (5.3), while promoting access to sexual and reproductive health (5.6), equal decision-making (5.5) and economic rights (5.a). In contrast, the focus of Goal 14 is on conserving marine ecosystems and resources, including by reducing pollution (14.1), mitigating ocean acidification (14.3) and restoring fish stocks (14.4). Fisheries are essential to ocean economies and community resilience. Notably, target 14.7 is focused on economic benefits from marine resources for small-scale fishers, which should explicitly support equitable access for women and other people in marginalized situations in the ocean economy (Silva and others, 2020).

Women's involvement in ocean conservation is often underrecognized, despite their unique perspectives and roles in sustainable marine practices (Gissi and others, 2018; Shellock and Maltby, 2023). However, limited representation of women in decision-making jeopardizes progress towards goals on sustainable ocean practices by reinforcing inequalities in resource access and policy influence (Baker-Médard, 2017). For instance, promoting sustainable fisheries requires gender-safe environments both on land and at sea, as well as policies that address the economic barriers faced by women and ensure equal access to markets and marine resources (Becker-Weinberg, 2019).

Empowering women in ocean-related sectors also requires investment in capacity-building, technological access and research opportunities (Fitrianggraeni, 2019; Mahabir-Lee and Rambarath-Parasram, 2019). Engaging women in ocean science bolsters innovation for sustainable marine resource management, especially as women play key roles in community-based conservation and climate resilience initiatives (Loarne-Lemaire and others, 2021; Gicheru and others, 2024). Women working in grass-roots organizations, for instance, often lead efforts to reduce marine pollution and educate communities, thereby transforming gender norms and improving urban coastal conditions (Hanson, 2017).

Lastly, increasing women's representation in international ocean conservation agreements is essential to fostering gender-responsive policies. Historically, ocean affairs have been male-dominated (Kitada and others, 2015), with slow but growing acknowledgment of women's roles. Expanding women's participation in ocean conservation and management, research, and policy development will not only advance Goal 5 but will also accelerate progress towards Goal 14, which is one of the Sustainable Development Goals with the lowest rates of implementation (Sachs and others, 2024; United Nations Department of Economic and Social Affairs (UNDESA), 2024). Gender-responsive ocean policies and inclusive decision-making processes will be key in moving towards a more equitable and sustainable ocean future.

3. Gender issues in ocean science

Overview of gender disparities in ocean science and governance

Gender equity in ocean science is not only an ethical imperative but also a means to improve the quality, relevance and impact of the science itself (Nielsen and others, 2017). As ocean sciences tackle increasingly urgent global challenges, the full participation of diverse talent is required for producing the best possible research and policy advice. While evidence of gender disparities in science have diminished considerably over time, women still have to contend with discrimination, unequal pay and difficulty accessing funding (Shen, 2013).

Gender disparities in representation across career stages reflect the persistent gender bias and multiple barriers that women face in ocean science (Giakoumi and others, 2021; Brooks and Déniz-González, 2021). In many areas, while gender balance has been achieved at the PhD student and recent graduate levels, women remain significantly underrepresented in higher-level academic and leadership positions. This pattern reflects the well-documented "leaky pipeline", a metaphor used to describe the underrepresentation of women at leadership levels of science and academia (Berryman and Rockefeller Foundation, New York, 1983; UNESCO, 2015).

Women face a range of gendered challenges in marine science workplaces, including harassment, stereotyping and unequal distribution of power, that require systemic, institutional and network changes in order to create conditions that allow a greater variety of leaders to advance to leadership roles (Shellock and others, 2022). Family-friendly institutional arrangements and gender-neutral parental leave can prevent mothers and fathers from being penalized in their science careers (Powell, 2021).

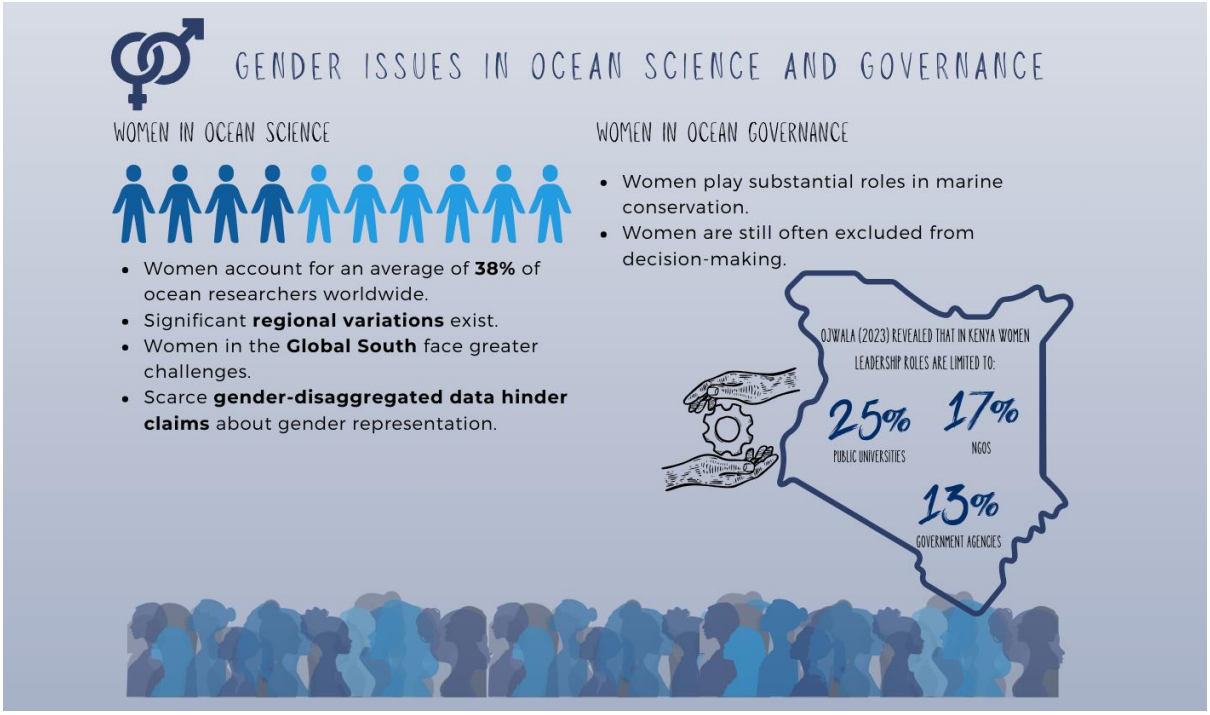
According to the best available data, women account for 38% of ocean researchers worldwide, with significant regional variations – from 4% in Mauritania to 62% in Croatia (Intergovernmental Oceanographic Commission (IOC-UNESCO), 2020). While the Global Ocean Science Report provides critical insights, data quality and reliability remain a challenge (Kitada and others, 2023; Ojwala, 2023).

Johannesen (2024) highlights the lack of standardized, gender-disaggregated data, which makes global claims about gender representation difficult to validate.

Although women have substantial roles in marine conservation and governance, they are often excluded from decision-making (Ojwala and others, 2022). For instance, data from Kenyan ocean science institutions reveal that women hold just 25% of leadership roles in public universities, 17% in non-governmental organizations and 13% in government agencies (Ojwala, 2023). Gender equality is crucial to achieving the objectives of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030), including through the integration of gender perspectives into ocean policies (IOC-UNESCO, 2020; Sun and others, 2021).

Figure II.A

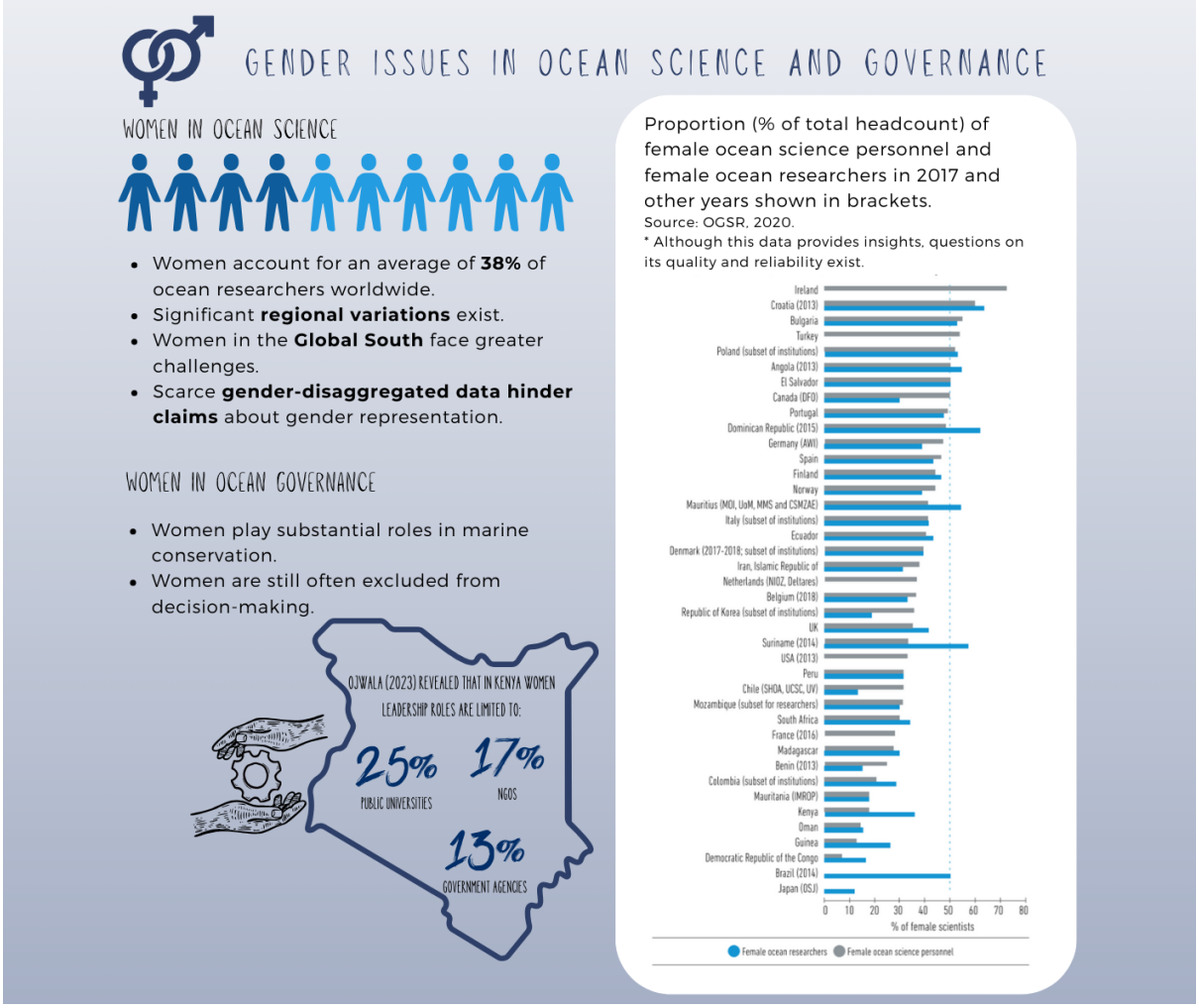
Gender issues in ocean science and governance



Source: Prepared by the writing team.

Figure II.B

Gender issues in ocean science and governance



Source: Prepared by the writing team.

Challenges faced by women in fieldwork

Fieldwork in ocean science often demands extended periods in remote environments, posing unique challenges for women. Traditional male-biased workplace norms, caregiving obligations, safety concerns and physical demands related to ship design exacerbate these challenges (Johannesen and others, 2022). Sexual harassment remains pervasive, impacting women's professional and personal lives (St. Clair, 2021). Creating pathways to safe working environments is necessary to allow for greater inclusion of a broader range of social identities in ocean science (Amon and others, 2022).

Implicit biases also perpetuate inequalities, influencing hiring, funding and publication decisions (Calaza and others, 2021). For example, such biases create divides between knowledge systems, impeding collaborative efforts for ocean sustainability (Hägele and Hornidge, 2024). Addressing these biases is critical to fostering equity and inclusivity in the field (see subsect. 5B, chap. 5).

Initiatives and policies that promote gender equality in ocean science

Gender equality plans offer actionable steps for fostering inclusivity. In 2022, the European Union linked Horizon Europe research funding to gender equality plans, highlighting the importance of diversity in scientific teams. Similarly, through the "Empowering Women for the United Nations Decade of Ocean Science" programme, a high-level gender equality plan to guide organizations was produced (Sun and others, 2022; Rodríguez-Chaves and others, 2024). However, evidence from Kenyan ocean science institutions suggests that plans alone are insufficient: they must be systemically implemented (Ojwala and others, 2022; Johannesen, 2025).

Programmes such as Baltic Gender; Women in Ocean Science; "Empowering Women for the United Nations Decade of Ocean Science"; "Empowering Women in Hydrography," of the International Hydrographic Organization; and the International Seabed Authority (ISA) “S.H.E. See Her Exceed” mentoring programme are examples of regional and international efforts to enhance gender inclusivity. Mentorship programmes, representation in outreach initiatives and policies, such as conference quotas and leadership targets, contribute to fostering a more balanced ocean science community.

Gender-transformative policies not only promote equal rights for women and men in terms of employment, professional development and working conditions, but also ensure equal representation in leadership, decision-making and research teams. This, in turn, improves resilience and sustainability in ocean governance (Ojwala and others, 2022). In contrast, gender-neutral policies – often termed “gender-blind” – fail to advance true gender equality, as they are based on the assumption that women and men face the same challenges, and do not address the unique barriers that hinder inclusivity and equity.

Integration of gender considerations into ocean science

Gender issues have increasingly been addressed in marine social science, highlighting power dynamics in sea-related practices. However, the focus has largely been on gender roles rather than on how dominant systems in science, policy and society are gendered (Pauwelussen and Lau, 2023). A systematic literature review reveals that marine social science largely treats gender as an object of study, with limited focus on researcher positionality and knowledge production. Expanding to gender-as-subject and gender-as-epistemology fosters intersectional, reflexive approaches. A gender-as-political-project perspective strengthens ocean equity by addressing structural inequalities, power dynamics and epistemological biases in marine research (Pauwelussen and Lau, 2023). Gender significantly influences access to and interaction with marine resources. In many regions of the global South, gender-specific restrictions, such as taboos and traditional practices, affect resource use and management (Jones and others, 2008; Oloko and others, 2024). Gender analysis is needed to improve coastal management and inform marine spatial planning (De la Torre-Castro and others, 2017). Inclusive management strategies enhance socioecological outcomes, uphold human rights and foster equitable governance systems (Bennet and others, 2021).

Challenges and opportunities in promoting gender equality

Promoting gender equity in traditionally male-dominated ocean science is essential for fostering diversity, innovation and human rights (Shellock and others, 2022). Despite their contributions, women in these fields continue to face systemic barriers, including underrepresentation, isolation, stereotyping and unsafe working environments (Shellock and others, 2022; Johannesen, 2025). For Black women and other women from minority groups, these challenges are further compounded by financial and structural

obstacles that hinder their progress in ocean science programmes, from education to career advancement (Isma and others, 2023; Ojwala, 2024). High tuition costs, limited funding opportunities, limited access to career opportunities and wage disparities create significant roadblocks. A study by Isma and others (2023) revealed that over 60% of Black women in ocean science in the United States of America identified funding as a critical barrier to achieving their career goals. In addition, more than 40% of surveyed individuals had to take unpaid internships, while over 90% worked multiple jobs to support themselves due to lower wages for women. These financial constraints, combined with systemic discrimination and limited access to resources, create an uneven playing field that prevents talented individuals from fully participating in and contributing to ocean science.

Women also hold a mere 13–24% of senior leadership positions in European Union research institutions, with very few leading them. In publication, women account for only 18–22% of authors in top journals, with a significant gap in senior authorship. Funding data show a larger success rate for women in early grants, but their representation drops significantly in advanced funding stages (Giakoumi and others, 2021).

International actions, such as expanding funding opportunities, creating inclusive mentorship programmes and dismantling structural biases, are required to address these disparities and challenges. By breaking down these barriers, the ocean science community can harness the full potential of diverse perspectives, ultimately leading to more equitable and innovative solutions to marine challenges.

The absence of comprehensive gender-disaggregated data hampers efforts to assess and address disparities in ocean science education, employment and leadership (Ojwala, 2023; Johannesen and others, 2023). Such data are essential to understanding participation and contributions across genders, and provide insights into gaps in access to resources and career progression (Ojwala and others, 2022). Policymakers can use these insights to promote inclusivity and equitable governance, ensuring that ocean science efforts align with sustainability goals (Gissi and others, 2018). Addressing data gaps will enable more inclusive decision-making and support global progress in women's representation in ocean science and governance frameworks.

As the Ocean Decade neared its halfway mark, the Intergovernmental Oceanographic Commission of UNESCO initiated a process called Vision 2030 to refine the direction of future action under the Ocean Decade and further strengthen engagement and impact in the period up to 2030 and beyond. This process led to the identification of the need to "continue to enhance diversity, inclusivity, and equity in the Ocean Decade, and systematically identify and remove barriers to generational, geographic, and gender diversity" (UNESCO-IOC, 2024). An Ocean Decade gender working group has been established to oversee development of a road map and action plan for enhancing gender equality in the Ocean Decade.

4. Incorporating a gender lens in fisheries and aquaculture

Overview of gender dynamics in fisheries and aquaculture

In 2022, approximately 62 million people were employed in the primary sectors of commercial fisheries and aquaculture, with women playing key roles across these "blue" food sectors by participating in organizations, administration, consulting and research (Food and Agriculture Organization of the United Nations (FAO), 2024; Frangoudes and others, 2020). These sectors are essential for nutrition, livelihoods and food security in rural coastal communities (Quimby and others, 2023; Thomas and others,

2021; Weeratunge and others, 2010). Women are active throughout fisheries and aquaculture value chains, particularly in processing, trading and marketing (Elias and others, 2024; Gopal and others, 2020). However, entrenched beliefs, norms and regulatory practices often define which activities are "feminized" or "masculinized", reinforcing a rigid gender division of labour (Kruijssen and others, 2018; Weeratunge and others, 2010). These dynamics highlight the fact that power, equity and equality within fisheries cannot be fully understood through a gender lens alone: intersecting social dimensions, such as age, class, ethnicity, ability and marital status, also shape women's roles and access to opportunities (McDougall and others, 2022).

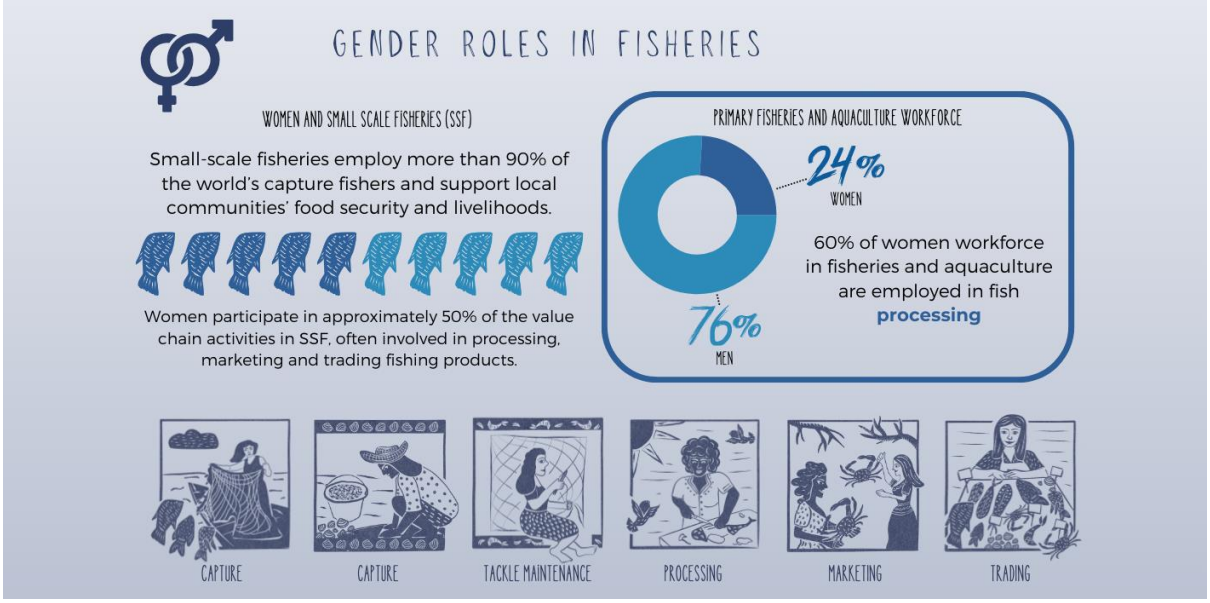
Gender equality is imperative for diversifying seafood value chains and achieving "blue justice" within the sector (McClenachan and Moulton, 2022). However, women's contributions are often underrepresented in data, with limited gender-disaggregated information restricting understanding of their participation (Merayo, Vakhitova and Carlson, 2024). This lack of documentation marginalizes women and slows the development of gender-sensitive policies in fisheries and aquaculture, perpetuating inequality (Szymkowiak and Rhodes-Reese, 2020; Kruijssen and others, 2018).

Representation and contributions of women in fisheries and aquaculture

Gender roles in fisheries and aquaculture differ globally, influenced by cultural, economic, political and ecological factors (Adam and others, 2024). Globally, women accounted for 24% of the primary fisheries and aquaculture workforce in 2022, with about 60% employed in fish processing (FAO, 2024). Women's roles are especially prominent in small-scale fisheries, where they participate in approximately 50% of value chain activities, often in roles related to processing, trading and marketing (FAO, Duke University and WorldFish, 2023; Weeratunge and others, 2010). In aquaculture, women's involvement in production, processing and marketing may surpass their involvement in that work in fisheries, contributing significantly to coastal community resilience (Kruijssen and others, 2018; Szaboova and others, 2022) (see also subsect. 5A, subchap. 1B).

Figure III

Gender roles in fisheries



Source: Prepared by the writing team.

Note: This overview of gendered participation in fisheries highlights women's central roles in small-scale fisheries and along the value chain, particularly in processing, marketing and trading, alongside disparities in the primary fisheries and aquaculture workforce.

Despite women's contributions in activities such as net-making, gear repair and bait acquisition, traditional definitions of "fishing" typically exclude these pre-harvest roles, meaning that women's labour and contributions are undervalued (FAO, Duke University and WorldFish, 2023). Men are more visible in data due to their engagement in offshore, boat-based fishing, while women's inshore activities, like gleaning for shellfish in intertidal zones, are less documented (Thomas and others, 2021; Weeratunge and others, 2010). This exclusion leads to an underestimation of fishing effort and catch volumes, affecting fisheries management decisions on local, national and international levels (Kleiber and others, 2015).

Challenges faced by women in fisheries and aquaculture

Women in fisheries face challenges that vary across sectors and regions but often include limited recognition, lower wages and unpaid labour (Elias and others, 2024). Women involved in processing in small-scale fisheries frequently receive lower or no pay, as their work is perceived as an extension of household duties, such as cooking and cleaning (Merayo, Vakhitova and Carlson, 2024). Meanwhile, men dominate more lucrative fishing sectors, resulting in stark income disparities (Cho, 2024). In aquaculture, women are often relegated to less profitable tasks and receive lower pay for the same work, hindered by traditional gender norms that limit their economic roles (Kruijssen and others, 2018; St. Louis and Oliveira, 2022).

Access to resources remains a significant barrier, with women facing challenges in securing financial support, owning property and participating in decision-making (Merayo, Vakhitova and Carlson, 2024). Limited access to financial instruments like loans prevents women from investing in essential

equipment and land resources, further marginalizing them in fisheries and aquaculture (St. Louis and Oliveira, 2022). Traditional norms, such as those restricting asset inheritance or property ownership, also limit women's involvement and autonomy in these industries (Kruijssen and others, 2018) (see also subsect. 5A, subchap. 1C).

Gender-specific impacts of overfishing and environmental changes

Climate-driven changes to marine ecosystems pose severe challenges for aquatic food systems, especially in low- and middle-income coastal areas (Cochrane and others, 2023; Mitra and Barua, 2023). Climate change affects fish availability and trade, disrupts local food security and heightens coastal communities' vulnerability to extreme weather events, with women often disproportionately impacted (Nyasimi and Jakarasi, 2024; Barange and others, 2018). As fishing becomes increasingly dangerous, female fishers and processors, whose livelihoods depend heavily on fish harvests, are bearing the brunt of the economic consequences (Siles and others, 2019; Riviwanto and Basuki, 2019).

Gendered divisions of labour mean that men and women are exposed to different risks and stressors associated with climate change and overfishing. For example, when extreme weather prevents men from fishing, women who process and sell fish products may lose income sources, destabilizing entire households and communities (Shaffril and others, 2024; Almeida de Carvalho and others, 2023). Similarly, overexploitation of fish resources, particularly in shallow coastal waters (Ding and others, 2017), affects female workers primarily engaged in processing and trading (FAO, Duke University and WorldFish, 2023) for low-profit fisheries (McClanahan and Abunge, 2017), resulting in livelihood losses and an increase in gendered food insecurity. Beyond economic hardship, unsustainable fisheries practices, such as overfishing, may also amplify the risk of sexual violence for female processors and traders (Nyasimi and Jakarasi, 2024).

Policies and initiatives promoting gender equality

Over the past decade, global fisheries policies have demonstrated increasing recognition of the role of women and contained a greater emphasis on gender equality (Mangubhai and Lawless, 2021). In its *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (2015), FAO formally acknowledges the importance of gender mainstreaming for small-scale fisheries' development strategies. The Illuminating Hidden Harvests initiative (FAO, Duke University and WorldFish, 2023) supports the implementation of the *Guidelines*, and aims to close the gender data gap by highlighting both men's and women's contributions (see also subsect. 5A, subchap. 1B).

Despite these advances, fisheries policies often remain gender-blind in practice, with many practitioners lacking the training and knowledge necessary to implement gender-sensitive strategies (Mangubhai and others, 2022). Even in contexts with advanced fisheries policies, like Norway, the male-dominated ownership of fishing quotas underscores the need for additional gender-aware policies (Gerrard and Kleiber, 2019). Misunderstandings around gender equality also hinder implementation, as seen in Pacific tuna fisheries where perceived progress has not matched on-the-ground realities (Barclay and others, 2021).

In this context, mechanisms for scaling up successful gender-transformative initiatives and ensuring their integration into local governance frameworks would strengthen the link between policy and practice. Connecting female leadership to generational transition in this sector is essential.

Successful examples of integrating a gender lens in fisheries management

In many countries, women play a vital role in shellfish industries. For instance, in West Africa, women are integral to the harvesting, processing and marketing of shellfish in estuarine and mangrove ecosystems (Chuku and others, 2022). The oyster fishery in the Densu delta in Ghana has seen declining populations due to overfishing and habitat loss. In response, the United States Agency for International Development, through its Sustainable Fisheries Management Project, partnered with the Development Action Association and the Ghana Fisheries Commission to address the issue by establishing the Densu Estuary Women's Oyster Pickers Association (Agbekpornu and others, 2021; Torell and others, 2019).

The approximately 200 members of the Association work to restore oyster habitats and implement sustainable management practices. These women have increased their skills with training in leadership, oyster ecology and water quality monitoring, meaning that they are able to contribute to a more sustainable fishery (Chuku and others, 2022). The project's peer-to-peer learning programmes have fostered greater confidence among participants, allowing the Association's model to serve as a scalable example of community-driven, women-led fisheries co-management (Agbekpornu and others, 2021).

The Association demonstrates how women's contributions to resource management can be harnessed for effective fisheries governance. By empowering fisherwomen in Ghana, the programme has strengthened their roles as stewards of local biodiversity while promoting sustainable livelihoods. Initiatives like this one underscore the potential for similar models in other regions, where empowering women through training, leadership development and community-based management can enhance the sustainability of fisheries and aquaculture (Torell and others, 2019; Crawford and others, 2022).

5. Incorporating a gender lens in the maritime industry

The maritime industry is a capital-intensive business that serves as an economic backbone for many countries. The industry involves heavy ship and port infrastructure, where women are underrepresented. Of 1.9 million seafarers worldwide, women seafarers are estimated to account for only 1.28% (Baltic and International Maritime Council (BIMCO) and International Chamber of Shipping (ICS), 2021). In ports, women occupy management or administrative positions, but they comprise only 17% of the overall port workforce, according to the United Nations Conference on Trade and Development (UNCTAD) (2022), which investigated 58 port entities in 2021. In the same year, a survey conducted by the International Maritime Organization (IMO) and the Women's International Shipping and Trading Association revealed that 39% of women who worked in companies were in mid-management, 28% were in technical roles and 48% were in administrative and support roles. Women made up around 20% of the workforce in maritime authorities (IMO and Women's International Shipping and Trading Association, 2021) (see also subsect. 5A, chap. 6).

Generally, the maritime industry is characterized by both horizontal and vertical gender segregation, which makes it hard to attract and retain women (Kitada, 2022; IMO and Women's International Shipping and Trading Association, 2021). Traditionally masculine attributes, such as physical strength, technical and engineering experience, and certain leadership styles are also valued in

the work culture. That culture is also seen in maritime education, and fewer women take maritime-related courses, especially technical and engineering subjects. In Europe, approximately 13.5% of students enrolled in nautical courses are women, and an average of 6.3% of marine engineering students are women (Barahona-Fuentes and others, 2020). While women seafarers have historically been disadvantaged in terms of finding employment and accessing on-board practical training, recent initiatives have the potential to address these inequalities, leading to a gradual increase in their participation in the sector (World Maritime University (WMU), 2023).

Recently, there has been awareness-raising in the maritime industry, which has made it possible to discuss gender and diversity in relation to well-being and occupational safety and health. Inspired by the World Maritime Day theme for 2019, "Empowering women in the maritime community", the States members of IMO adopted resolution A.1147, entitled "Preserving the legacy of the world maritime theme for 2019 and achieving a barrier-free working environment for women in the maritime sector", in December 2019 (IMO, 2019). In response to a number of reported and unreported cases of sexual harassment and bullying of female crew members (Carballo Piñeiro and Kitada, 2020), in February 2024 the International Labour Organization (ILO) and IMO convened the Joint ILO/IMO Tripartite Working Group to identify and address seafarers′ issues, with a focus on violence and harassment, including sexual harassment, bullying and sexual assault (IMO and ILO, 2024). There is an urgent need for the maritime industry to ensure a safe working environment. One of the solutions under discussion at IMO is to make training on violence and harassment, as well as psychological safety, mandatory under the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers. Several States members of IMO have also stressed the importance of incorporating the perspectives of other gender minorities, such as lesbian, gay, bisexual, transgender, intersex and queer persons, into the design of a safe working environment at sea (IMO, 2023) (see also subsect, 5A, chap. 6).

In addition to the human dimension of gender equality, the concept of gender equality has recently become a factor in a just and equitable transition in the maritime industry. In 2022, the Maritime Just Transition Task Force was established by United Nations agencies and industry stakeholders with the aim of promoting smarter and greener shipping in a just and equitable manner (Maritime Just Transition Task Force, 2022). Today, gender equality is recognized as the top priority in the industry, although there is still a long way to go to remove all the barriers to women and people with diverse gender identities in order to achieve diversity and inclusion in the industry (see also subsect. 5A, chaps. 6 and 7).

6. Strengthening science-based approaches

Integrating gender perspectives into science-based marine solutions makes practices more equitable and enhances innovation, participation and sustainability (Alexander and others, 2021). Several successful initiatives demonstrate how gender-transformative approaches lead to improved research outcomes, reduce inequalities and strengthen community resilience.

For instance, the Gendered Innovations project of Stanford University highlights case studies that showcase how gender perspectives have contributed to improved outcomes in marine research. Studies included designing gender-sensitive equipment that enables both men and women to participate effectively in marine fieldwork and developing policies that address gender disparities in research funding and opportunities (Gendered Innovations, 2023). Such examples illustrate that when technology and

innovation are designed to be inclusive, they not only accommodate a broader range of users, but also enhance research quality and engagement.

In the Baltic region, Baltic Gender has pioneered the GenderWave tool, which supports the incorporation of gender perspectives into marine research and innovation. This tool supports research institutions in analysing and addressing gender imbalances across scientific disciplines and organizational structures (Baltic Gender, 2020). By fostering gender-aware practices in research, the GenderWave tool promotes a more equitable research environment and sets a model for other regions seeking to balance gender representation in science.

Collaboration between researchers, policymakers and local communities is essential to addressing gender disparities in ocean-related activities. Effective partnerships amplify marginalized voices, especially those of women in the fishing and extractive industries, thereby ensuring that policies reflect the diverse experiences and needs of those communities.

A notable example is the network of women from extractive and fishing communities in southern Bahia, Brazil. In a region heavily impacted by environmental degradation, predatory fishing and real estate pressures, local communities mobilized to protect their livelihoods through the Canavieiras Extractive Reserve, established in 2006 (Carmo and others, 2016). Recognizing the male dominance in the management of the Reserve, women fishers and shellfish gatherers formed the network of women from extractive and fishing communities in southern Bahia in 2009 (Ettinger, 2013; Figueiredo, 2015).

The network aims to empower women, promote gender equity and advocate policies that address women's unique challenges in extractive activities. Through it, women have gained the skills and confidence to participate actively in management discussions, advocate for their rights and take on leadership roles within their communities (Ettinger and others, 2016). Training sessions and forums organized by the network cover a range of topics, from technical skills to economic autonomy and legal rights, allowing women to build capacities that extend beyond their work in extractive industries (Ettinger, 2013; Carmo and others, 2016).

The network's impact is multifaceted: not only has it enhanced women's economic empowerment, but it has also fostered a sustainable management approach that aligns local traditions with environmental preservation. By engaging in sustainable fishing practices and educating communities on ecosystem protection, the network has contributed to safeguarding biodiversity and promoting long-term food security (Figueiredo, 2015). This community-driven model exemplifies how collective action rooted in gender equality can drive social, economic and environmental change.

In fisheries and aquaculture, access to gender-transformative technology has empowered women to participate in new ways. A powerful example of this is in the seaweed farming sector in Zanzibar, United Republic of Tanzania. Initially introduced as a means of economic empowerment for women, seaweed farming in Zanzibar has faced challenges, including declining productivity due to climate change and insufficient access to appropriate technology. In response, through the SeaPoWer project, tubular net technology for seaweed farming has been introduced, enabling women to shift their operations to deeper waters. This helps to mitigate climate-related declines in coastal yields, enabling more sustainable cultivation (Brugere and others, 2020). This initiative has not only provided women with essential skills in boat handling and environmental monitoring, but has also created pathways for women's leadership in aquaculture innovation (Brugere and others, 2019; Gopal and others, 2020). Gender-sensitive

technological interventions like these transform blue economy sectors by enhancing productivity, expanding livelihood opportunities and creating a more inclusive industry (see also subsect. 5A, chap. 6).

Gender-transformative technology is essential to advancing ocean science by ensuring that innovations are accessible, equitable and beneficial to people of all genders involved in marine research, management and conservation. Integrating gender perspectives into technology development entails consideration of the specific needs, experiences and constraints of women and other marginalized people, and thus promotes greater inclusivity, participation and innovation. For instance, area-based management tools like the Western Indian Ocean Symphony support ecosystem-based marine spatial planning, providing data-driven solutions that respond to diverse stakeholder needs (Nairobi Convention and Swedish Agency for Marine and Water Management (SwAM), 2021). Such gender-responsive technologies are needed to empower a wider range of users and to enhance the contributions of women to ocean scientific research and governance.

Incorporating gender perspectives into science-based approaches for ocean-related sectors like fisheries, aquaculture and marine conservation leads to more inclusive, sustainable and effective outcomes (see also subsect. 5A, subchap. 1C). Success stories from projects like SeaPoWer in Zanzibar and the women's network in southern Bahia demonstrate how gender-sensitive initiatives empower women, enhance resource sustainability and promote community resilience. Collaborative efforts between researchers, policymakers and communities are essential to addressing gender disparities in ocean sectors and implementing meaningful change. The integration of gender into ocean science makes it possible to adopt a more inclusive and resilient approach to marine conservation that is capable of addressing the diverse challenges of a rapidly changing world.

Ultimately, gender-transformative strategies in science-based solutions pave the way for sustainable development in marine and coastal environments. Gender equity must be central to our efforts, in the light of the invaluable roles that women play in marine stewardship and community resilience. By fostering innovation, collaboration and gender-sensitive policies, we can work towards a future where marine resources are managed sustainably and equitably for the benefit of all (see also subsect. 5B, chap. 5).

7. Conclusion

In the present chapter, the role of gender equality in ocean science and governance has been explored, and the ways in which a gender perspective can enhance the effectiveness, inclusivity and sustainability of ocean-related activities have been highlighted. Important strides in addressing gender disparities, including the Sustainable Development Goals and recent international agreements, such as the Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction, were emphasized. A gender lens allows for a more holistic view of marine sectors and the acknowledgment of the unique contributions of women, especially in fisheries, aquaculture, climate adaptation and marine conservation.

Gender disparities remain significant in these fields, with barriers for women ranging from limited access to leadership positions to systemic biases that result in the undervaluation of their roles and contributions. Women's roles in marine and coastal communities, often in areas like processing, trading and local conservation, underscore women's importance in the socioecological resilience of those communities. However, persistent structural challenges limit their involvement in decision-making and leadership. Studies reveal that gender-diverse teams and inclusive governance structures bring a broader range of perspectives and more innovative solutions to marine conservation and governance challenges.

Initiatives like the Gendered Innovations project and the Baltic Gender project, and local efforts, including the SeaPoWer project in Zanzibar and the network of women from extractive and fishing communities in southern Bahia, illustrate how gender-transformative approaches can lead to more sustainable and impactful marine management and conservation practices.

Promoting gender equality in ocean science and governance is not merely an ethical imperative: it is essential for effective and adaptive marine resource management. As has been demonstrated in the present chapter, fostering inclusivity through gender-sensitive policies, training and research contributes to healthier marine ecosystems and more resilient coastal communities. Integrating women's knowledge and leadership into ocean science makes it possible to address pressing environmental issues with greater nuance and cultural awareness.

A call to action, aimed at expanding and deepening gender equality efforts across ocean-related sectors, is therefore warranted. First, governments and international organizations must prioritize gender equality in policy frameworks and integrate gender-focused objectives into marine conservation and resource management initiatives. Also, funding bodies should provide targeted resources to support gender-sensitive research and training, particularly in regions where gender disparities are most pronounced.

Ocean governance institutions can play a pivotal role by establishing leadership programmes and mentorship opportunities for women, particularly those from underrepresented backgrounds, including women of colour, Indigenous women and lesbian, gay, bisexual, transgender, intersex and queer individuals. Gender-disaggregated data collection must also be prioritized, as data gaps remain a major barrier to the visibility of gender inequalities in these fields, and to accurate assessments and responses. Increasing awareness through gender training, as seen in projects like the "Empowering Women" initiative, under the United Nations Ocean Decade, can help to dismantle biases and foster a culture of inclusion and respect in ocean science.

As the field of ocean science and governance continues to evolve, future research must focus on several key areas to ensure that gender equality is fully integrated into marine resource management. One potential area is the intersectionality of gender and other social factors, such as ethnicity, class and geography. Future studies can investigate how these intersections affect women's access to resources, decision-making power and roles in marine sectors, allowing for a more nuanced understanding of the barriers and opportunities within these industries.

Another critical direction is the development and assessment of gender-sensitive technology in marine science. Technological innovations, particularly in remote sensing, marine biology and climate monitoring, can benefit from inclusive design principles that make them accessible and relevant to diverse user groups. Researchers can explore how such technology may empower women in ocean-related fields, particularly by reducing physical barriers in activities like data collection and fieldwork.

The impacts of climate change on gender disparities in ocean science and coastal management are also worthy of further study. As climate-induced shifts affect fishery resources, coastal habitats and marine biodiversity, an understanding of the gender-specific impacts on livelihoods and resilience can guide the formulation of adaptive policies that support both ecological and social resilience. In addition, future research could be focused on how women in local communities are adapting to climate pressures

through community-led conservation initiatives and sustainable resource management, which could provide valuable insights for scaling these practices globally.

Lastly, expanding research into the economic contributions of women in fisheries, aquaculture and conservation can bring visibility to their roles and contributions. Quantifying these economic impacts would help to correct the long-standing undervaluation of women's labour and encourage policymakers to allocate resources to and support programmes that enhance women's economic empowerment in marine sectors (see also subsect. 5A, subchap. 1C).

Promoting gender equality in ocean science and governance is integral to creating more sustainable, resilient and equitable marine ecosystems. Acknowledging and addressing gender disparities enables more effective and inclusive stewardship of marine resources. As the present chapter has shown, diverse voices and perspectives enrich conservation and governance practices, making them more adaptable and better suited to meet the challenges of a changing world.

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