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Gender equity in Maine's aquaculture industry: navigating data gaps to build gender responsive programming and networks

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Introduction

Over the past decade, Maine's aquaculture sector has grown in value, volume, and size of the workforce (Sadusky et al., 2022; Maine Department of Marine Resources, 2024) (Figure 1). In fact, in 2019, an estimated 12,700 people were employed in the seafood production sector as fishers and aquaculturists, and an additional 23,846 people were employed in the combined seafood processing, retail, wholesale, and logistics sectors (SEA Maine, 2024). Aquaculture is an opportunity to restore and enhance aquatic food production, increase seafood consumption, diversify marine resource-dependent livelihoods, and provide ecosystem services (Brugere et al., 2023; Cleaver et al., 2024). However, social objectives for sustainable development cannot be met until equity becomes an integral focus of development efforts (Bennett et al., 2025; Brugere et al., 2023; Cisneros-Montemayor et al., 2019). This is in line with the United Nations Sustainable Development Goals, where equity, particularly gender equity, outlined in Goal 5, is essential to prosperity.

While efforts have been made to increase attention on equity in Maine's aquaculture industry, including action items related to increasing diversity within Goal 4 of the Maine Aquaculture Roadmap, initiatives are limited by the lack of demographic data on aquaculture industry members. Currently, there is no systematic data collection process across state or federal agencies in the U.S. that captures demographic data, or even data related to number of farms in operation, species grown, production volumes, and sales, making data-driven management decisions challenging (Kleiber et al., 2024; Froehlich et al., 2022). Barriers to demographic data collection include institutional policies that require research clearance and confidentiality safeguards, which may delay project timelines, as well as expertise in social science research design. Funding for social science research is also a barrier to data collection. To date, aquaculture research and development in Maine has focused primarily on market expansion and new species husbandry, with social dimensions and policy research largely overlooked for funded research (Cleaver et al., 2023). As a result, little is known about how existing aquaculture development is serving to enhance or inhibit gender equity within the aquaculture industry and associated social objectives, such as human agency and wellbeing. This is a major challenge, as it is impossible to measure progress without reliable baseline data (Bennett et al., 2025; Rice et al., 2024). It is also challenging to design effective strategies to enhance gender diversity in the industry without a clear understanding of women's contributions.

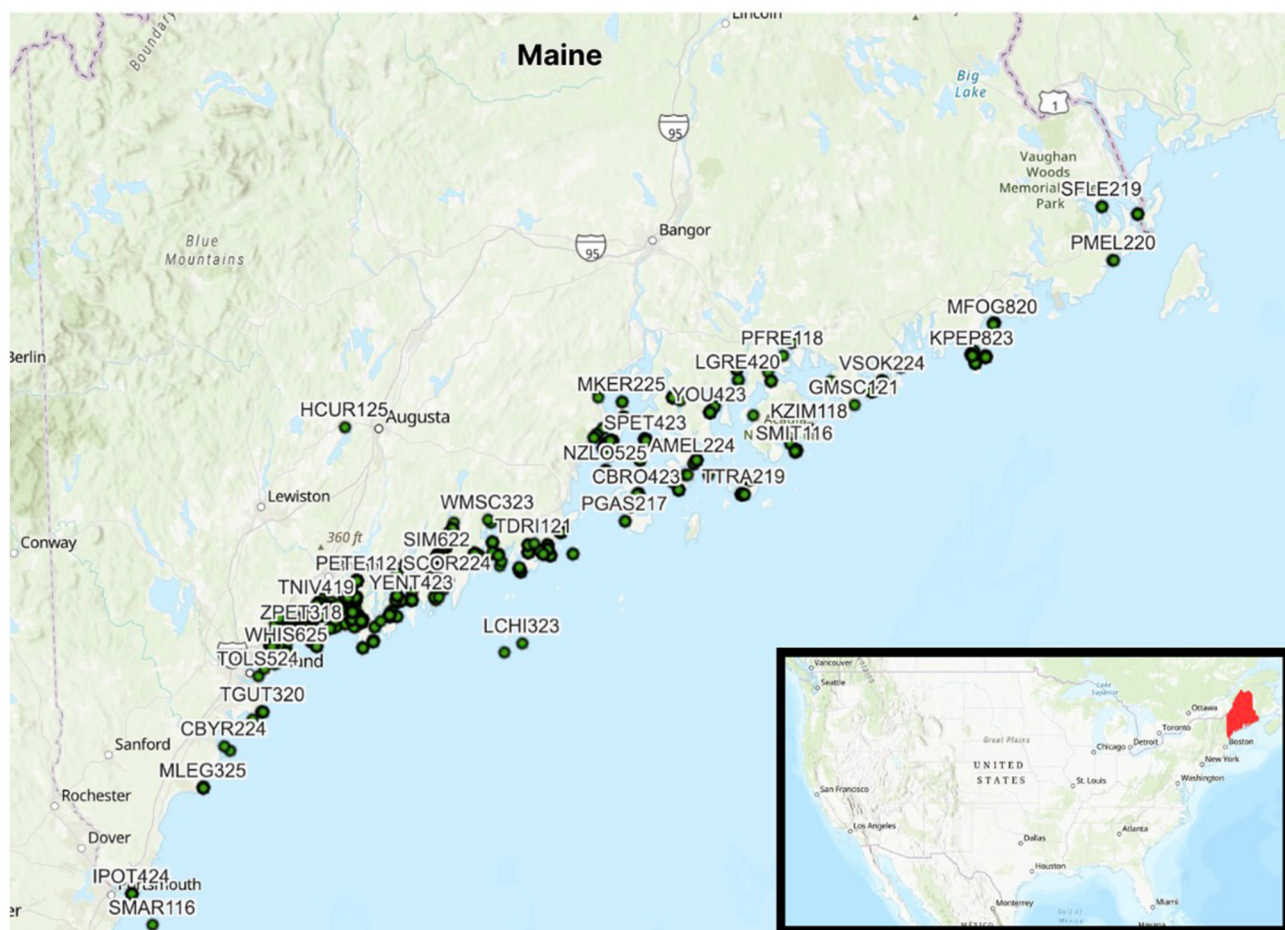


FIGURE 1
Active aquaculture leases in the state of Maine, USA (Maine Department of Marine Resources, 2025b).

Women's participation in Maine aquaculture

Women are involved in every aspect of the aquaculture value chain in Maine—from selling gear, drafting lease applications, and producing kelp and shellfish seed, to owning and operating farms, harvesting, processing, and distributing seafood products. Off the water, women hold positions in organizations that support aquaculture development as researchers, extension agents, educators, communications specialists, and workforce development professionals. Women are overrepresented in industry leadership and media roles (McClenachan and Moulton, 2022). For example, 77% of staff within the Maine Department of Marine Resources (DMR) Bureau of Public Health—the state agency office overseeing aquaculture—are women, including the two top leadership positions (Maine Department of Marine Resources, 2025a).

However, among Maine industry members, there is also evidence that women are underrepresented as aquaculture lease and license holders, particularly among standard leaseholders. McClenachan and Moulton (2022) assessed women's participation in lobster fishing, bivalve farming, and seaweed aquaculture via

an analysis of 2020 lease and license holders and interview methodology. The research was funded by the F. Russell Cole Student Research Fellows program in Environmental Studies at Colby College. In 2020, women held only 23.4% of all aquaculture leases and licenses. The seaweed sector included more women lease and license holders overall (37.8%), compared to bivalve farming (19.6%). Participation also varied based on license type, with a higher proportion of women holding temporary Limited Purpose Aquaculture (LPA) licenses compared to tenured standard leases (McClenachan and Moulton, 2022). LPAs are limited to 400 square feet and must be renewed annually, but have fewer regulatory requirements and are the lowest cost license option in Maine (Maine Department of Marine Resources, 2022).

Women were underrepresented in shellfish and seaweed aquaculture; however, women's participation was still four times higher than Maine's lobster fishery, where only 4.8% of lobster fishing licenses were held by women (McClenachan and Moulton, 2022). Importantly, the percentage of female license holders by sector (lobsters, bivalve, seaweed) was inversely related to the value of the species—i.e., women's participation decreases as species value increases. Participants described more flexible working hours and greater reliance on marketing and social media promotion

as unique aspects of aquaculture that conferred greater access for women than the lobster fishery (McClenachan and Moulton, 2022).

Atlantic salmon have been raised in net pen systems in Maine state waters since the 1970s (Bricknell et al., 2021). The sector leads state aquaculture sales (Cole et al., 2017), and today it is managed entirely by Cooke Aquaculture, which is the only salmon aquaculture company operating in marine waters in the U.S. (Stoll et al., 2019). Similar to other aquaculture sectors, there are no sex disaggregated data collected. There has yet to be research focused on the gender dimensions of salmon aquaculture production in the state, or the broader U.S.; this may be due to confidentiality and privacy challenges arising from the industry's concentration of ownership. Future research may contribute to the growing body of literature on gender and salmon fisheries and aquaculture (Kruijssen et al., 2018; Gerrard and Kleiber, 2019; Szymkowiak, 2020). More recently, the 2022 Census of Agriculture by the National Agricultural Statistics Service reported that 94 aquaculture farms in Maine had at least one female producer out of 261 farms in 2022 (National Agricultural Statistics Service, 2022). While aquaculture presents one potential avenue for women to gain rights and entry into seafood production and livelihoods, the aquaculture industry in Maine still has work to do to expand access for women and other marginalized groups.

Equity for aquaculture development cannot be achieved without an analysis of intersectional participation among marginalized communities, specifically women, people of color, and indigenous peoples (Bennett, 2022; Brugere et al., 2023; Rice et al., 2024). Given the lack of demographic data collected across the broader U.S. seafood system (Kleiber et al., 2024), an intersectional approach to research is challenging. However, the 2022 USDA Census of Agriculture provides some insight into the racial demographics of aquaculture producers in Maine (National Agricultural Statistics Service, 2022), an overwhelming majority of aquaculture farms reported producers that identify as white ($n = 156$), while few farms reported producers that identify as American Indian or Alaska Native ($n = 1$), Asian ($n = 3$), Black or African American ($n = 1$), and Hispanic, Latino, or Spanish ($n = 6$) (National Agricultural Statistics Service, 2022). The 2022 USDA Census of Agriculture reported ($n = 94$) farms with women as aquaculture producers (National Agricultural Statistics Service, 2022). More context-specific research is needed to understand participant demographics across seafood value chains and the ways in which aquaculture development impacts minority and indigenous access to aquatic foods and livelihoods more broadly. Existing literature, largely from outside of the U.S., demonstrates a gender division of labor in seafood value chains, with women disproportionately represented in the shore-based sectors (Kleiber et al., 2015; Kruijssen et al., 2018; Weeratunge et al., 2010). Examining intersectional demographics across the entire seafood supply chain is a critical area for future attention, given how post-harvest activities like processing and distribution have previously been ignored in fisheries and food systems research, especially in the U.S. seafood context (Stoll et al., 2015; Simmance et al., 2021; Kleiber et al., 2015; Bennett et al., 2021).

In addition to the limited quantitative data available, two qualitative case studies exist that provide insight into the experiences of women in aquaculture in Maine, focusing on

gendered barriers and challenges (Lord, 2022; Veo, 2024). Lord (2022) used a mixed-methods approach, combining a survey of aquaculture leaseholders and a participatory action methodology, photovoice, to explore gender specific barriers for women oyster farmers, while Veo (2024) conducted 32 interviews with women who had previously taken aquaculture training courses and analyzed the data using thematic analysis. Both research projects were funded by state Sea Grant programs at the University of New Hampshire and the University of Maine. Perceived barriers to women's participation include stereotypical gender norms, sexual harassment while working on farm sites, gear and farm designs that do not fit their body, inheritance patterns of knowledge and assets that favor men, financial capital needed for limited-entry fishing licenses, social capital tied to previous experience in fisheries, discrimination, exclusion, and access to funding and relevant training opportunities (McClenachan and Moulton, 2022; Lord, 2022; Veo, 2024). To overcome gender-specific challenges of the industry, aquaculture participants have cultivated social networks primarily made up of other women, and have exhibited interest in expanding network opportunities for further support and collaboration (Lord, 2022; Veo, 2024). This research has informed the development of two gender-responsive programs by aquaculture organizations in the state: the Women in Aquaculture Series offered in partnership with Aquaculture in Shared Waters and a network for women and gender nonconforming aquaculturists hosted by the Maine Aquaculture Innovation Center (MAIC).

Gender responsive programming and networks in Maine

Aquaculture in Shared Waters (AQSW) started in 2013 and is one of multiple aquaculture training programs in Maine. The course is offered through an interdisciplinary group of collaborating aquaculture organizations including the University of Maine, Maine Sea Grant, Maine Aquaculture Association, Maine Aquaculture Innovation Center, and Coastal Enterprises Incorporated. Between 2013 and 2023, students in the course were overwhelmingly male, with only 31% of participants in course surveys identifying themselves as women. Though many students viewed the course favorably, and women have been increasing in participation over time, some former AQSW students described their perception that AQSW was not meeting the needs of women in aquaculture (Johnson and Veo, 2023). Similarly, in Lord's (2022) study of women oyster farmers in the region, some participants shared that they felt alienated in aquaculture training programs. The Maine Aquaculture Roadmap declared expansion of DEI efforts within aquaculture training programs as an industry goal to ensure triple bottom-line sustainability, which requires environmental, economic, and social sustainability (Sadusky et al., 2022). This report launched an effort to better understand how training programs can meet the needs of women in aquaculture (Veo, 2024).

Preliminary research with women AQSW participants informed the development of the 2024 Women in Aquaculture Series (WAS). The course was an affinity training program limited

to women and gender minorities in Maine. WAS crafted gender-responsive programming, including topics spanning women in business, ergonomics, strategies to confront microaggressions, and maritime skills. The course intended to foster a sense of community amongst women working in aquaculture and those wishing to join (Veio, 2024), and to facilitate the informal social networks women in male-dominated industries rely upon (Lord, 2022).

After WAS concluded, the Women and Non-Binary in Aquaculture Network was established by MAIC and AQSW partners (Maine Aquaculture Innovation Center, 2025), with funding support from The Nature Conservancy. The goal of the project was to co-create a grassroots level networking group for aquaculturists in Maine where women and non-binary farmers could build relationships, share knowledge, and foster a strong and active presence in the industry. To date, the network has over 70 industry members across the state, with six in-person gatherings and numerous virtual meetings. Project leaders organized a newsletter that promotes women and non-binary-led events and industry opportunities, and members are developing plans for a state-wide all day event in 2026 as well as a pathway forward so the network continues to grow.

Network participants have voiced the value of engaging with other women and non-binary people in the industry. Programs like these are necessary to build an equitable industry—they provide targeted support for gender specific challenges that otherwise are not recognized. Participation in these programs is, in part, a result of being data-driven and informed by industry stakeholder experiences. Working toward gender equity is an iterative process. More research is needed to track progress over time and establish baselines that ensure future programming is relevant and inclusive for marginalized populations.

Concluding remarks

From the perspective of community members, researchers, oyster farmers, and industry leaders involved in Maine's evolving aquaculture sector, this opinion piece highlights the state of exploratory gender equity research and programming in the Maine aquaculture industry, the unique opportunities and barriers that women and gender non-binary individuals experience, and future research pathways. Women have carved out opportunities for themselves through innovative business models, gender inclusive programming, and collaborative social networks, but still face numerous obstacles. Advancing gender equity for Maine's aquaculture industry will require a nuanced understanding and application of substantive equity in all its shapes and forms. New

research could examine gendered differences in farm operations and economics, agency, wellbeing, and the distribution of socio-economic risks and benefits across seafood value chains, including wild capture fisheries and finfish aquaculture. Research progress will require baseline data to recognize women's contributions to the industry. Social data may help inform targeted policy, programming, and funding opportunities that create resources for underserved populations. Ultimately, research must move toward exploring how the aquaculture industry can best serve women, other marginalized groups, and the broader community.

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