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PERSPECTIVE

Designing gender-inclusive data systems in small-scale fisheries

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Abstract Gender equality is a ubiquitous national goal, yet sectoral gender data gaps to support this goal persist. These gaps are both structural and sexist, concealing women's contributions and impeding actions that would strengthen livelihoods and economic development, food security, and environmental sustainability. The small-scale fisheries sector offers a cogent example of this phenomenon. Building on lessons from the Illuminating Hidden Harvests initiative, we identify systemic changes and specific indicators needed to fill these gaps. This requires multiple data streams, many of which come from outside fisheries agencies, e.g., government statistical or census organizations, sourced from responsible agencies across multiple areas—economy and environment, governance and support services, and health and nutrition. Closing gender data gaps requires making the policy case and working across agencies to create an enabling institutional environment. Only then can data reflect and respond to the lives of the ~ 500 million people who depend on small-scale fisheries.

Keywords Data systems · Gender equity · Livelihoods · Small-scale fisheries · Sustainable development · Transformation

INTRODUCTION

Progress toward gender equality is varied but slowing around the world (England et al. 2020; World Economic Forum 2023). Advancements have been hindered by the COVID-19 pandemic, climate change, the rise of anti-egalitarian populist governments, and geopolitical conflicts, and in many contexts long-standing gender inequalities have been exacerbated (World Economic Forum 2021). While gender equality was projected as achievable within a century (Ibid.), the United Nations (UN) estimated 286 years to remove discriminatory laws and close legal gaps in gender protection (UN Women and UN DESA 2022). Amplified by and made visible through these contemporary developments, this reversal and slow pace result from unaddressed, underlying systemic causes of gender inequalities (Hepp et al. 2019). One increasingly recognized systemic cause is the persistence of gender data gaps within sectoral data systems, as these shape the direction of decision-making and investments throughout economies and societies (Criado Perez 2019; Mohamedou 2020). As countries around the world work toward their commitments to the Sustainable Development Goals (SDGs), SDG 5 (Gender equality) will continue to lag if actionable solutions to advance sectoral gender data are not put in place (Buvinic and Levine 2016; Hepp et al. 2019).

The small-scale fisheries (SSF) sector is a valuable example of human–nature relationships from which to generate lessons, illuminating both gender data gaps and potential ways forward to address these gaps. SSF are critical economic and food production systems that make

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important contributions to sustainable development. This sector is central to livelihood strategies and a vital source of food and nutrition, income, and/or cultural identity to one in every 12 people globally, nearly half of them women, altogether generating 44% (USD 77.2 billion) of total fisheries landed economic value, and over 90% of the fisheries workforce (FAO et al. 2023; Basurto et al. 2025). However, gender data gaps are persistent throughout national and international SSF data systems, which themselves suffer from data deficiencies. Insufficient gender-disaggregated data in SSF limit understandings of livelihoods, food consumption, sustainable practices, and ecological impacts, while also obscuring the full value of women's contributions and undermining the rights of women and gender minorities to participate in and benefit equitably from SSF. The broader implications of these limitations (i.e., knowing what gears, by whom, and for what goals fishing is taking place) have weakened fisheries management decisions and outcomes. Although improved data alone are not sufficient to transform embedded inequalities (Grzelec 2024), they are a necessary ingredient for generating the knowledge needed for policy and practice that lead to more effective and equitable outcomes for SSF, and sustainable development broadly.

Biased and incomplete data collection is underpinned by cultural and gender norms that uphold the long-held and self-reinforcing assumption that fisheries are a male domain (Kleiber et al. 2014; Salmi and Sonck-Rautio 2018; Gopal et al. 2020; Harper et al. 2020; Thomas et al. 2021). This results in data systems that are not representative of the SSF sector, leading to policies, procedures, programs, and products that are only relevant or beneficial to a narrow sub-section of the population (Criado Perez 2019; D'Ignazio and Klein 2020; Kreiger 2021). However, when primary and secondary commercial fisheries labor, across all nodes of the SSF value chain, are included alongside small-scale subsistence fishing activities, women have been estimated to make up 39.6% of total SSF labor (Harper et al. 2023: Table 6.2, p. 134; Supplementary Material Table S1). Examining the sector based on the broader definition of SSF labor provides data that enable the development of policies and extension programs that acknowledge women's central role.

In this perspective article, we take on the gender data gap by detailing a gender-inclusive data system for SSF to overcome the current structural and coverage biases. We take a feminist data approach to this framing (D'Ignazio and Klein 2020) by identifying how gender and other social biases lead to data that lack essential details and are therefore unable to address important sustainable development challenges. This approach then highlights opportunities for correcting such gaps by taking gender- and other socially disaggregated data collection seriously. We begin with identifying the problem by reviewing sources of the gender data gaps ("Background: SSF and gender data gaps" section), followed by the recent history of global efforts to assess the engagement of women in SSF by using patchy and unrepresentative data sets of gender-disaggregated data, and leading up to the recent release of the *Illuminating Hidden Harvests* (IHH) report (FAO et al. 2023) ("Recent history and the evolution of gender data" section). The IHH Gender Analysis draws on the efforts of 28 gender experts from around the world (FAO et al. 2023).[1] Heeding the extent of gender data gaps revealed by the report and subsequent meetings of these experts, we draw upon our collective knowledge about gender in SSF to propose a gender-inclusive data system for SSF ("Designing a stronger system: gender and SSF data needs and sources" section) and identify efforts necessary to promote and implement this system ("Next steps" section).

BACKGROUND: SSF AND GENDER DATA GAPS

The lack of fisheries data on women has been lamented for decades (Chapman 1987; Williams 2001). The poor performance of national and international fisheries agencies in gathering and reporting gender-disaggregated data has been highlighted repeatedly (Weeratunge et al. 2010; Harper et al. 2013; Kleiber et al. 2015). These gender gaps in fisheries data are driven by a legacy of fisheries agencies focused on perceived higher value capture fisheries and formal economy actors, as well as siloed agency structures. This legacy is a typical outcome when data systems are designed, and data are collected and used, while ignoring underlying patterns of gender dispersion and dynamics (Brandusescu and Nakamura 2019).

The SSF domain comprises subsistence fisheries[2] and the value chains of small-scale commercial fisheries. For international data purposes, commercial fisheries are currently considered to encompass the primary sector (harvesting or fishing) and the secondary sector (pre- and post-harvest activities such as fish processing and trade). National and international agencies responsible for fisheries management and statistical collections focus mainly on the primary sector, where fishing activities are dominated by men who are emphasized as the main actors (Williams and Syddall 2022). This structural emphasis, combined with strong gender divisions of labor (Harper et al. 2023), leads to SSF gender data gaps at levels from the household to global.

[1] For more information on the methods used in the IHH study, please see the report (FAO et al. 2023).

[2] Subsistence fisheries labor estimates are not able to distinguish between harvesting, pre- and post-harvest activities.

Employment in the primary sector is often highlighted in reports and graphical presentations, e.g., FAO (2025: Ch 6) and FAO (2024: p. 114), appearing to represent the whole of fisheries. Since a higher proportion of women's fisheries' employment is in the secondary sector than is the case for men, this underestimates women's overall contribution. Women have been estimated to comprise 18.7% of the labor force of the SSF primary sector (Harper et al. 2023: Table 6.2, p. 134; Supplementary Material Table S1). However, primary sector data rarely include subsistence fishers. By definition, subsistence fishing is non-commercial and is thus not part of the UN System of National Accounts (FAO et al. 2023: p 264, 267). Subsistence data may be recorded in household surveys, but primary and secondary sector fisheries activities are indistinguishable within these surveys. Based on these estimates, women represent an estimated 45% of people engaged in subsistence fisheries activities worldwide (FAO et al. 2023; Supplementary Material Table S1), rising to 57% in Africa (Virdin et al. 2023).

Not only is subsistence activity often overlooked, but the data on labor in the formal economy often overlook women's labor that, in each node of the fisheries value chain, is more often unpaid, informal, or part time and unrecorded. Within the primary sector of SSF, women's fishing activities are often carried out on foot, with simple gear and in inshore and coastal, riverine, lacustrine, and wetland areas. These fisheries are rarely included in fisheries statistics (Fröcklin et al. 2014; Kleiber et al. 2014), resulting in undercounted harvests, household incomes, and food access for fishing communities (Torell et al. 2019).

Furthermore, household and reproductive labor that supports fishing operations and enterprises are seldom included in general statistics systems (UN 2009) and global fisheries policy-makers do not include these types of labor in fisheries data collections (e.g., FAO FishStat collection). Sampling designs that can lead to blind and/or biased data are also evident for other important identities (e.g., age, class, and ethnicity). As such, social inclusion necessitates further disaggregated data to enable analysis of intersectional hierarchies based on overlapping social identities, e.g., how gender inequities vary by race and social class (Ferguson 2021; Axelrod et al. 2022; Rice and Gondwe 2023; Oloko et al. 2025).

For the secondary sector, in the limited places where employment data do exist, these data are less rigorously collected and often lie outside the responsibility of fisheries agencies. The siloed nature of many government agencies exacerbates this as a limitation to comprehensive SSF data, while also leading to gaps in areas that are critical to understanding gendered (in)equality of opportunity in SSF. This includes data on fisheries governance and support services, and health and nutrition (Iannotti et al. 2021), disaggregated by gender. While these data are limited overall, irrespective of gender, they are critical to understanding gendered (in)equality of opportunity in SSF.

RECENT HISTORY AND THE EVOLUTION OF GENDER DATA

Upon completion of the IHH study, the gender experts reconvened in a workshop and a series of smaller meetings to examine the inclusion of gender in the IHH study process and outputs, and create a template for the next steps for gender data in SSF. The outcome of the workshop and subsequent follow-up meetings included a recent history of gender and SSF data, as described in this section.

In 2012, the FAO's flagship biennial report, the State of World Fisheries and Aquaculture (SOFIA), included for the first time the percentage of women in fisheries value chain segments (15% in the primary and up to 90% in the secondary fisheries segments) (FAO 2012). This coincided with the first Hidden Harvest report, where women were estimated to make up 46% of the total small-scale and large-scale fisheries sectors (World Bank et al. 2012). These early statistical reports also dovetailed with the negotiations of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines; FAO 2015), which included references to gender equity. The 2018 State of World Fisheries and Aquaculture report is one of the few that provided a time series of numbers of women in the primary sector (fishing), but contained data from only seven countries (FAO 2018). This and other State of World Fisheries and Aquaculture reports have presented boxes explaining the gender data gap and stressing the case for better data, but the issue has not yet progressed to the stage of being adequately addressed on the policy agendas of FAO's Committee on Fisheries and in the member countries that supply the data to FAO for global compilation.

To augment the core work of FAO and member countries in encouraging the collection and publication of gender-disaggregated fisheries data, the IHH study used approaches that tapped wider sources of data than typical national and international fisheries statistical sources and gathered greater participation of experts on particular geographies and themes, including gender. FAO now has a full-time gender focal point in the fisheries and aquaculture division, and some fisheries agencies around the world are paying more attention to gender in the sector (FAO 2023).

The IHH employment and subsistence fishing data went beyond previous estimates in terms of geographic coverage, while also providing estimates disaggregated by value chain segment and for subsistence fishing activities.

However, overall gender-disaggregated data were limited for many countries. Fewer than half of the IHH 58 country case studies reported sufficient quantitative data for gender analysis. Additional data sources were sought to estimate, for example, the scope and scale of employment in SSF using labor force and household income and expenditure surveys (Harper et al. 2023: Table 6.1). While these datasets provided standardized sources of geographically expansive data, the ways in which these types of surveys capture context-specific complexities, for example, around what is considered "work" in SSF and who can do that work, may continue to misrepresent women's contributions.

With more sources than previous estimates and greater granularity of data, the IHH report (FAO et al. 2023; Virdin et al. 2023) provides a revised overall estimate that women make up 39% of the total SSF workforce, with considerable variation globally (Fig. 1). Women's participation in small-scale and subsistence fisheries varied by nodes of the workforce, comprising 15% of pre-harvest workers; 19% of commercial harvest; 48.7% of processing workers and 50.2% of traders; and 45% of people engaged in subsistence fishing activities (Supplementary Table S1). The estimate of subsistence fishing, which includes harvesting and processing activities for home consumption, is an improvement over previous fisheries datasets, where unpaid fisheries labor (largely by women) was not accounted for (Virdin et al. 2023). Yet, because the estimates for the number of people engaged in subsistence fishing activities cannot be easily disaggregated into harvesting and processing, this continues to obscure who participates in SSF and how.

The characterization of SSF in the IHH study included specific estimates of foot fisheries[3] catches, a category of fishing usually done by women that is often overlooked in data collection. While these data were not disaggregated by gender, this represents efforts toward gathering data that are more inclusive of women, as women's harvesting activities, in many contexts, focus on shoreline and near-shore harvesting (Macho et al. 2013; Kleiber et al. 2015; Thomas et al. 2021; Chuku et al. 2022). The study estimated that 1.4% of the total marine SSF catch and 13.9% of total freshwater SSF catch globally were from non-vessel based harvesting such as foot fisheries, including gleaning. However, women make many other contributions in SSF—such as reproductive labor, food preparation, and gear preparation—that are unpaid but facilitate and are essential to fishing effort. These contributions are not always understood as SSF work and therefore may not be captured in existing data (Szaboova et al. 2022).

The inclusion of women in SSF is rooted in the principles of equity and justice, recognizing their inherent right to participate equally in and benefit from the sector—this also leads to more sustainable and equitable management of fisheries. Where the fisheries activities of women are not included in subsistence and SSF data, these data gaps can impact economies, fisheries governance and sustainability, food and nutrition security, safety nets against poverty, and social justice (Supplementary Table S2). The gender data gap reinforces the social and economic marginalization of women in SSF and may also prevent the development of value chain improvements and extension programs aiming to sustainably grow women-led fishing activities, limiting the opportunities for women's economic empowerment in the sector, which in turn hampers the overall societal economic growth potential.

The IHH study lifted a veil and provided a glimpse into where to look for or cultivate improved gendered data. In reflecting on this—both the process and product—here, we identify opportunities for broader explorations into what good quality, quantitative and comprehensive SSF gender data would look like and who might be responsible for collecting, analyzing, and using it.

DESIGNING A STRONGER SYSTEM: GENDER AND SSF DATA NEEDS AND SOURCES

A comprehensive set of indicators and responsible institutions

To illustrate what a SSF gender data system could look like, we first outline what fisheries *gender data* are needed, followed by *where it might come from*. The IHH report presented four thematic areas (economics, environment, nutrition, and governance), which we have restructured into three key themes: (1) economy and environment; (2) governance and support services; and (3) health and nutrition, with a total of 17 indicators (Table 1). Taking a feminist data approach, and based on the practical experiences of the co-authors who have worked extensively with and for national statistical systems and in research, we expand on the IHH study to develop a list of indicators that are broadly relevant to SSF, but also designed to be gender inclusive, and meant to be collected using gender-disaggregated sampling techniques.

[3] Foot fisheries are SSF where access to the resource is by hand and on foot, rather than from a vessel. These fisheries occur around the world, typically in shallow waters (e.g., swamps, streams and lakes, estuaries, beaches, tidal flats, and coral reefs). Activities include gleaning (collecting aquatic animals and plants) or fishing using such gear as cast nets, box or fence traps, hook and line, and spears. These activities may be occasional, undertaken as part of other daily routines, or seasonal (i.e., when there is an abundance of aquatic resources), such as during spring tides, flood recessions, and seasonal migrations (FAO et al. 2023).

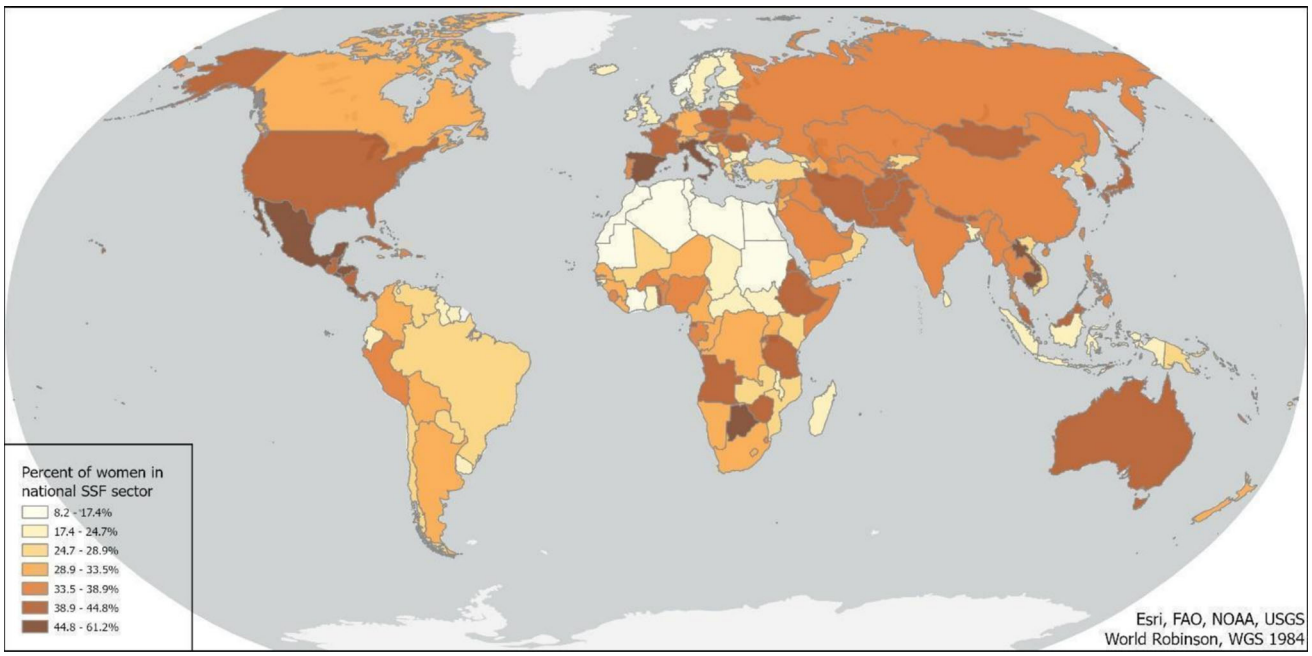

Fig. 1 Proportion of women in the small-scale fisheries sector by country

We also identify the likely data sources and responsible agencies for collecting these gender-inclusive SSF indicators (see Supplementary Information Table S3). Using synthesized categories of data sources ($n = 5$) and responsible agency types ($n = 4$), we map out the information ecosystem that could supply the identified SSF data needs (Fig. 2).

From design to implementation

Several key insights emerged from the review of the IHH process and the data mapping exercise (Table 1, Table S3, Fig. 2). The first is that national government agencies, followed by international agencies, bear the greatest responsibility for inclusive data production, as many of the indicators rely on data typically found in government regulatory statistics (Fig. 2). However, these data sources are also supported by research and surveys, broadening the responsibility of data collection to research agencies and nonprofit organizations (Fig. 2).

The second insight, drawn from the IHH process, is that while data from national fisheries agencies often have the correct scale for management of specific fisheries, these are rarely gender disaggregated and often overlook key components of the fisheries. For example, data for formal fishing (but not post-harvest and trading) are held in fisheries agencies, but it is infrequently disaggregated by gender (but see Gerrard and Kleiber 2019). Hence, one important avenue to more inclusive data is improving data collection capacity and scope within fisheries institutions.

Beyond gender disaggregation within the fisheries data already collected, fisheries population surveys should expand to capture informal fisheries work and reproductive labor in all fisheries sectors. The third insight is that because of the data limitations from fisheries agencies, the indicators will often require other responsible agencies and likely multiple data streams (Fig. 2 and Supplementary Table S4). Formal fishing labor, informal fishing labor, and reproductive labor require data from multiple sources and responsible agencies. These data sources may also be a mix of fisheries-specific, labor-specific, or population-wide data, all at multiple scales. For example, fisheries industry sources include specific monitoring statistics and regulatory databases, while other industry sources (e.g., for processing and trading data) may be entangled with similar data from other industries, such as agriculture, forestry, and manufacturing. Population-wide sources including household and population surveys, and business and community service databases, could also be tapped to cover current data gaps. This use of multiple data sources can run into data sharing barriers, related to both data ownership and compatibility issues across different datasets (different formats, scales, etc. for different measures). The IHH study engaged gender-disaggregated data from labor force surveys and household income and expenditure surveys to estimate employment. These data also contained a considerable amount of intersectional information, such as age, education, household details, and migrant status, allowing for more nuanced assessment and a broader connection to social justice concerns in SSF. Responsible lead agencies

Table 1 A schema of potential small-scale fisheries indicators, disaggregated by gender, and grouped by thematic area. The indicators would be quantitative, selected from the list given, and tailored to suit the fisheries concerned

Thematic areas	Indicators
Economy and environment	
Labor force (productive)	Number of workers by labor categories: fishing subsistence, small-scale formal, small-scale informal, processing, trading, support work
	Other disaggregation: major fishery types (gear, species, fishing grounds, markets, products)
Entrepreneurs	Entrepreneurs by value chain category
Labor force (reproductive and care)	Numbers of people by care category: households of fishers, community, environmental
Labor force in fisheries research and management	Numbers by work category: government fisheries agencies, fisheries development agencies, Marine Stewardship Council, research, extension; NGOs focusing on fisheries, conservation
	Other disaggregation: level of work category (management, supervision, workplace)
Fisheries resource access entitlements	Numbers by fishing licenses, vessel licenses, spatial and seasonal access by area, species, gear
Fisheries resource use	Catch volume, value by fisheries (gear, species, fishing grounds)
Fisheries technology	Ownership of or access to (rental, use rights) key technologies: fishing, fish processing, trading
Finance and investment	Numbers of people accessing financial services and programs, insurance schemes, grants, subsidies
Education and skills	Education levels, training program attendance, mentorships
Governance and support services	
Resource governance bodies	Participation and leadership in fisheries organizations, cooperatives, and other fisheries decision-making, by role
Fisheries and related policies	Policies specifying equality, property ownership, access to subsidies, rights to organize for collective action, bargaining
Support organizations	Participation in supporting social networks, extension services, cooperatives, legal services
Health and nutrition	
Physical health	Prevalence or incidence of major disease and disorder categories; gender-based violence; alcohol, drug usage
	Nutritional status (Body Mass Index categories, macro- and micro-nutrient intakes), exposure to toxins/pollutants in food, including aquatic food
Mental health	Prevalence or incidence: mental health; gender-based violence
Accidents and injuries	Incidence of work-related accidents and injuries
Occupational factors	Prevalence of occupational exposures: pollutants, weather and climate, unsafe and stressful work practices
Access to healthcare	Availability by location, type (including women's health)

for SSF may need to petition other agencies (e.g., government statistical organizations) to better identify fisheries households by more clearly showing in which sectors respondents work, undertake periodic fisheries-oriented household surveys, and/or improve their coverage/capture of gendered fisheries data. Non-fisheries sources could be strengthened in recognizing fisheries activity, while adhering to the International Labour Organization (ILO) standards for recording work (ILO 2013, 2023). One remedy at the country level would be to have fisheries experts included in the development and potentially the deployment of HH surveys to make them relevant to SSF communities.

The final insight is that creating bridges across responsible agencies is a key component of developing inclusive SSF data sets. Beyond labor data, a more inclusive and holistic approach to SSF data includes indicators that are relatively novel to fisheries management, such as health, governance, reproductive labor, and gender-based violence (Table 1). Effective integration of these indicators would require building bridges with other government and NGO institutions that focus on these areas, such as institutes for health and gender. Linkages and partnerships across agencies will help to break down some of the silos that have previously hindered inclusive data collection. The IHH study (FAO et al. 2023) and earlier researchers (Béné et al. 2012; Fluet-Chouinard et al. 2018) opened up possibilities for sourcing data from household surveys such as population censuses, labor force surveys, and household income and expenditure surveys. If better linkages existed across responsible agencies and others as potential data sources, these latter agencies could be canvassed as vehicles for future data collection, on a routine or, more likely, periodic basis. For example, Kiribati is collecting and

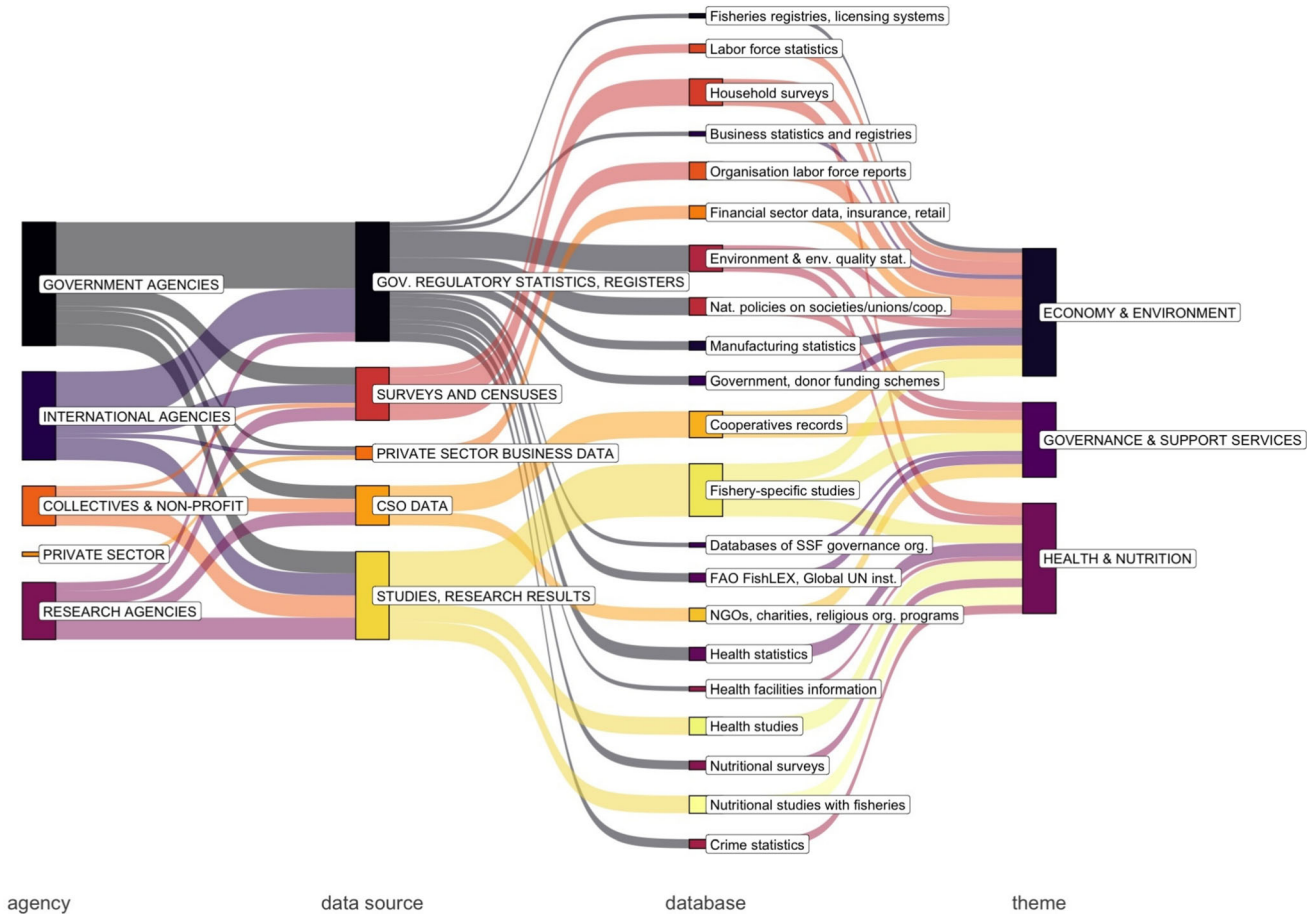

Fig. 2 Derived from the schema for gender-disaggregated indicators for small-scale fisheries, this diagram shows the flow of data from types of agencies responsible through the sources that collect, store, or could collect such data, examples of databases in which the data would be found or stored, and the associated thematic category (Table 1). Responsible agencies may work in the fisheries sector or other sectors. For example, government agencies may be responsible for fisheries at the local or national level, or have responsibilities such as collecting national statistics, managing industry, trade, welfare, infrastructure, health, education, or research

reporting gender-disaggregated data for fisheries as part of its national household income and expenditure surveys (Kiribati National Statistics Office 2021). Outside of government agencies, private data sources (e.g., cooperatives, small business organizations, non-governmental organizations) could also be leveraged, as well as the development of cross-sectoral or multi-country partnerships and networks such as the Southeast Asian Fisheries Development Center (SEAFDEC) that comprises 11 Southeast Asian member countries and Japan (SEAFDEC 2019), Pacific Island region that comprises of 22 Pacific Island countries and territories (Barclay et al. 2021), the Commission on small-scale, artisanal and aquaculture for Latin America and the Caribbean (FAO, n.d.) and Europe (Gustavsson 2020). These bridges could also address issues that arise from collection of data in silos such as mismatches between datasets. For example, in India, gender or livelihood data are often collected from different groups of participants and levels of analysis than catch (Gopal et al. 2022; Swathi Lekshmi et al. 2022), effort, and price data, limiting the use of such data to inform policies. When experts, including policy-makers, seek SSF data, they start with sources in government fisheries agencies. Fisheries agencies will have to be visionary and proactive in petitioning non-fisheries agencies and shaping the data gathering by, for example, government statistical offices and women's ministries.

NEXT STEPS

While "Designing a stronger system: gender and SSF data needs and sources" section provides a zero draft for a comprehensive set of indicators, substantial effort will be needed to adapt these to different contexts. Gender data gaps will not be closed under present practices. In this section, we outline some key areas for action within and between the organizations responsible for data and

reporting, including how to persuade different institutions to prioritize gender-inclusive data, internal capacity changes to fisheries institutions, building bridges to other responsible institutions, and the sticky question of how to resource this need.

Strengthening the policy case for gender data

To gain support for inclusive data collection by responsible institutions, the policy case for gender data must be understood and communicated. The policy case will also need to account for different goals of the responsible institutions. In SSF contexts, these goals can range from ecological (e.g., biodiversity, stock size) to social (e.g., gender equity, human rights), with many institutions located somewhere in the middle (Lawless et al. 2022). For institutions with social goals, showcasing how inclusive data can highlight areas of inequality or illuminate linkages between different types of inequality could be persuasive. For example, collecting gendered productive labor force data can produce an evidence base elucidating women's economic situation and contributions. Combining this with reproductive and care labor indicators specific to the fisheries sector may reveal dimensions of social and economic inequality (including health and wealth inequality), thereby informing inclusive policy and action that can be replicated in other sectors as well. For institutions with ecological goals, data that highlight more instrumental outcomes related to biodiversity or resource conservation outcomes could be more persuasive for the prioritization of gender-inclusive data. For example, gender-inclusive fisheries resource use data that would reveal a more comprehensive understanding of the extent of human interactions in marine ecosystems and the ecological stresses that may be exacerbated or moderated by previously hidden livelihoods and nutritional choices. For institutions with economic objectives, the integration of gender-inclusive data significantly enhances macroeconomic forecasting. This enhancement enables informed decision-making that aligns with ecological and social goals, thereby fostering sustainable development. Gendered approaches to resource governance could bring greater equity in decision-making and bring new skills and knowledge into governance. Community input and buy-in to fisheries policies would increase. Additional data requests, however, will need to confront agencies' resistance to change by demonstrating the necessity of this information for better achieving agency management goals, such as social justice or nutritional security.

Bolstering capacity for gender-inclusive data collection within fisheries institutions

Many of the IHH country case studies had no gender-disaggregated indicators, and several had limited data only. This lack of gender-disaggregated data may in large part be due to data limitations from national fisheries and aquatic agencies that were the first source of IHH data. These agencies are often built to serve national biological and economic goals. Data systems to support these goals prioritize biological resources, national-scale fishing operations, and trade. These data priorities are in turn supported by a staff of mainly biologists, ecologists, economists, lawyers, managers, and administrative workers. This system prioritizes data collection systems and management models, goals, principles, and approaches such as stock assessment models to achieve maximum sustainable yield (e.g., Cooper 2006). Unless political issues arise, it does not favor data systems that can monitor the impacts of fisheries management and policy on the full diversity of people directly engaged in fisheries.

Social goals have begun to be integrated into some fisheries and marine conservation institutions. Hence, one area of action would be to build capacity for gender-inclusive data systems within fisheries institutions. The advantage of this approach would be enhancing a data system that is already focused on fisheries. Internal capacity building would require expanding institutional goals to include equity, hiring staff with the expertise to collect, analyze, and maintain gender-inclusive and intersectional data systems (Ferguson 2021; Axelrod et al. 2022; Rice and Gondwe 2023), and putting staff in positions with sufficient decision-making power within the agency as not to be easily tokenized (Harrison 2019).

However, there are barriers to developing gender-inclusive data systems within fisheries agencies, including a lack of incentive and active internal resistance. While some fisheries agencies are aware of the gendered aspects of fisheries, most currently approach gender matters, including the need to collect gender-disaggregated data, with indifference or to ensure instrumental gains only (Mangubhai et al. 2022), such as increased productivity of a fishery, without reference to social justice (Lawless et al. 2021). This status quo is reinforced by sectoral barriers and approaches, e.g., working by species, functional groups, or ecosystems, and focusing on the primary production segment of the value chain, which hinders integration of gender data. Furthermore, within government departments, gender relevant issues are often siloed within the Ministry of Women (if one exists), not fisheries (Mangubhai et al. 2022).

Building bridges across disciplines and institutions

Disciplinary diversity will introduce more methodological diversity into data collection and analysis. Interdisciplinarity, that is, the interaction among individuals with different disciplinary backgrounds that results in the creation of synergistic new approaches that are more than the sum of their parts, is now more embraced in research. In fisheries, however, this has yet to gain widespread traction except in some universities. Interdisciplinarity and diversity of members (gender, geography, etc.) in data collection, synthesis, and analysis teams, as highlighted by the composition of the IHH study team (Harper et al. 2023), are necessary to support the collection of data that represent the diversity and complexity of fisheries systems and community contexts. Moreover, qualitative research may be necessary to establish the appropriate data points to collect in a particular context. For example, data collectors must first identify the types of women's involvement in a particular fishery without imposing external expectations, and then, the quantitative frequency of these activities can be identified through surveys asking about those specific activities. Qualitative data are also crucial for gaining the full picture of gender roles in SSF, given the challenge of quantifying power relations (Haraway 1999). The application of diverse methods is much more likely to bring into focus activities that are otherwise not on the radar of those designing data collections. Many SSF activities that women engage in are overlooked because of the small number of women engaged or the dispersed nature of these activities (FAO et al. 2023).

To handle this pattern of women's engagement, national census data collection efforts would need to be adapted, or sector-specific surveys and data systems established, to include SSF-specific questions with emphasis on a gender-disaggregated format. National Health/Nutrition and labor questionnaires, for example, can, with minimal resources, be adapted to identify the demographics of fishing communities and thereby produce results valuable for fisheries gender analysis. Given their SSF responsibilities, fisheries ministers and senior fisheries agency officials would need to make the case for this kind of collaboration with their counterparts in other agencies, such as government statistical offices, industry, women's welfare, labor, and health agencies. Participation by these agencies can be encouraged, in part, by highlighting the co-benefits of better understanding overall impacts on livelihood and food security.

For data to be used in advocating for and informing policies and programs that support gender equality and the empowerment of women, data generated must be accessible and compatible with other data. However, while making data accessible is important, this must be done with attention to data ownership/sovereignty, access, and privacy considerations, preferably outlined in data use and sharing protocols. If sufficiently addressing individual, corporate, and organizational privacy concerns about data misuse, it would be ideal if the data is vested with national agencies, thus giving it a degree of authenticity and further being reported to international agencies like FAO, ILO, and UN Women.

Resourcing the system

While strong commitments at the policy level are required for bringing gender issues onto the main agenda, adequate funding is critical to achieving targets, with processes in place to measure progress against the initial baseline regularly. This necessitates a clear understanding at the policy level as to who, how, and what gender data can be generated and reported on to support national level objectives and commitments. Existing systems and technology for data generation can be leveraged to minimize costs and optimize sustainability.

Inclusive SSF data will require additional budget, even with the best efforts in efficient and collaborative data collection. Identifying the costs of the new data requirements will be a critical early step in obtaining sufficient new support. Again, a well-constructed case for the data system should be brought in to support budgetary requests. Depending on the context, securing the necessary financial and other resources may be able to reference national commitments to gender budgeting and specific national and international policies inside fisheries or more generally, as well as the co-benefits of more complete livelihood and food/nutrition information.[4]

CONCLUSION

SSF communities, researchers, and policy-makers need gender-disaggregated data to enable gender aware work. Without these the options are: (1) ignore gender, leading to gender blind solutions; (2) collecting primary data, which requires considerable resources and time (e.g., Kleiber et al. 2014) and rarely leads to time series that can assess change; or (3) engaging scarce academic labor to source, extract and/or synthesize secondary data (e.g., Harper et al. 2020, 2023; Szymkowiak 2020; Szymkowiak and Rhodes-Reese 2020). By contrast, where binary sex-disaggregated data are available, gendered studies require much less preparatory work, such as the Norway study on the impacts of harvest quotas on women (Gerrard and Kleiber 2019).

[4] https://www.nature.com/immersive/d42859-025-00024-3/index.html#section-T16tV4Who0.

There is movement toward this effort, such as FAO's increased encouragement to member countries to provide sex-disaggregated data (FAO 2024).

Bringing women in the SSF sector into sectoral consideration by including more comprehensive gender data[5] is necessary, although not sufficient, for advancing and assessing the gains from SSF toward sustainable development. The IHH study results, though far from complete, highlight the major role played by women and sketch out their contributions. One key message is that SSF cannot be understood unless women are included and accounted for in the sector's data. The IHH study also revealed the paucity of gender data.

Gender data gaps can conceal the contributions and status of women in the SSF sector, preventing the design and implementation of policies and interventions that improve equitable and sustainable development benefits from fisheries to all of society, and blocking the monitoring of positive and negative trends. The economic potential of the SSF at the individual and societal level will not be fully realized unless there are data to support the design of extension programs targeting sustainable growth of women-dominated areas of SSF. Lack of data related to low value species and ecosystems accessed by foot fishers also reduces the holisticness and efficacy of ecosystem approaches to fisheries management. Data gaps are a pivotal cause of women's low status and recognition in SSF. Gender data gaps originate in different ways, but the consequence is that these data gaps not only conceal the inequalities experienced by women but also constitute a major source of underestimation of the extent and importance of SSF as a sector.

The *Illuminating Hidden Harvests* study revealed highly significant gender data gaps at the state level. Using the experiences from this study, the present perspective goes a step further. We constructed a more comprehensive set of thematic indicators and offered actionable approaches for responsible agencies on how to collect these data. However, to re-imagine SSF data systems to be gender inclusive—closing the gender data gap—requires much more. Realizing an inclusive SSF data system at each level requires making the jurisdiction-specific case for why these data are needed, while also creating an enabling environment for their collection that involves overcoming cultural and operational barriers.

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[5] Comprehensive gender data consist not only of data that are disaggregated and inclusive, but also going beyond the binary categories of women and men to include people with other gender identities including non-binary people.

Declarations

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