Aquaculture

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How many people are employed in aquaculture?

Introduction

Aquaculture has expanded from roughly **0.5 million tonnes in 1950 to 126 million tonnes in 2021,** transforming into a major economic and food production sector. Growth has been driven by a focus on **market oriented species, improved breeds, feeds, health and farming systems, and stronger food safety and environmental regulation,** including trade measures. As production systems mature, the sector must shift equal attention to the **people** who operate, sustain and add value to aquaculture.

Why employment data lags behind production

The sector's rapid evolution has outpaced the capacity of both private and public organisations to collect the right data. In the 1990s, observers warned that **"much aquaculture activity is inadequately recorded because most countries have been unable to establish the necessary institutions and tools for monitoring the structure of the aquaculture sector"** (Rana, 1997, p. 1). That warning remains relevant: production tonnages are now well documented, but the workforce that produces them is not.

Early definitional and measurement challenges

Part of the problem has been definitional. In the 1990s fisheries authorities were still debating what to include under aquaculture—**were cultured ornamental fish counted? Should restocked fish be recorded under capture fisheries or aquaculture?** (SEAFDEC, 1994). Those debates mattered because they shaped what national systems recorded and what they ignored. At the same time, experts urged states to collect **sex disaggregated** worker data and to provide substantive guidance on gender information needs in aquaculture (van der Mheen Sluijer & Sen, 1994; SEAFDEC, 1994). Without clear definitions and guidance, national statistics remained partial and inconsistent.

The Current Situation on Employment Data in Aquaculture: better production data, patchy people data

By 2023, global production statistics for aquaculture were far better specified. Yet **much less attention has been paid to the people** who make the aquaculture revolution work (Brugere et al., 2023). Core workforce

metrics—basic counts of people employed across the value chain, their employment status, and their working conditions—are still incomplete. As FAO notes, employment statistics remain a work in progress, even in some of the largest producing countries (FAO, 2025a, p. 55).

Employment data has long posed challenges in fisheries, yet recent developments have set fisheries and aquaculture on diverging paths—offering potential lessons for aquaculture. FAO has been a common force for progress in developing improved employment data in both aquaculture and fisheries, working diligently with countries and experts in this challenging space.

In fisheries, grassroots initiatives aimed at reversing the decline of small-scale fisheries have helped close critical data gaps (FAO et al., 2023; World Bank et al., 2012). Through these efforts, experts devised and applied methodologies that generated employment estimates across all scales of fisheries, including small-scale and subsistence fishworkers (see Table 1).

By contrast, aquaculture employment data remain fragmented and incomplete. Global statistics provide only rudimentary estimates for primary production—essentially "fish farmers" (FAO, 2025a, p. 157). Employment figures for other segments of the value chain, such as processing, trading, and input services, are absent. Even within primary production, data are limited to a handful of top aquaculture producing countries, with some sex-disaggregated figures available. Global totals are presented only in aggregate form, with underlying components withheld (FAO, 2025a, p. 192). Gendered data appear solely in bar charts (pp. 58–59), restricting deeper analysis.

Table 1: Illustration of global employment data currently available for fisheries and aquaculture. Green cells indicate areas where some data exist, while other colors highlight gaps. For fisheries, both small-scale (SSF) and large-scale (LSF) employment have been estimated globally (FAO et al., 2023). Aquaculture, however, is represented far more sparsely, with limited entries in FAO's annual *Fishery and Aquaculture Statistical Yearbooks (FAO, 2025a).*

This lack of granularity leaves fundamental questions unanswered in aquaculture:

- Who is employed across different nodes of the value chain?
- Under what conditions do they work?
- Are jobs rooted in rural communities, offering local opportunities, or dominated by external expertise?
- Who controls the capital—farm licenses, company shares, and other assets?
- How do employment patterns vary across scales of aquaculture and along the value chain?

Who Needs Employment Data in Aquaculture and Why?

The **Guidelines for Sustainable Aquaculture** (FAO, 2025b) highlight *decent work and employment opportunities* as central to sustainability. Employment is also critical to aquaculture's social licence to operate (Hishamunda et al., 2014; Olsen et al., 2024). Yet, responsibilities for collecting and using employment data vary across participants and observers, operating at different scales.

Two important elements are missing from the Guidelines:

- **Comprehensive employment data across the value chain.** This gap is explicitly addressed in the Shanghai Declaration (FAO et al., 2021, article J(1)), a participant statement from the 2020 Global Conference on Aquaculture.
- **Data on capital ownership.** Ownership structures shape enterprise operations, workforce size, employment types, and conditions. While some studies examine firm structures, ownership concentration, and performance impacts, comprehensive statistics remain unavailable. Resistance from powerful firms and coalitions often impedes transparency.

Who Needs the Data?

- **Policymakers and public managers** require reliable employment data to design policies, target interventions,

Table 1: Illustration of global employment data

FISHERIES				AQUACULTURE	
VC node	**SSF**	**LSF**	**Total**	**Value Chain Segment (all scales)**	**Status**
Pre-harvest				Pre-harvest and farming services	n/av
Harvesting				Farming	
Subsistence (pre-, post-harvest, harvesting)		n/app		Subsistence farming	n/av
Post-Harvest Processing				Post-Harvest Processing	n/av
Post-harvest Trading				Post-Harvest Trading	n/av

VC = value chain; n/app = not applicable; n/av = not available

and coordinate across agencies (aquaculture, fisheries, labour, welfare, statistics). Fragmented responsibilities across value chains hinder comprehensive collection.

- **Private sector actors** use employment data for investment, planning, and benchmarking against industry or national averages. Enterprises often reduce staff through automation or adjust workforce skills to meet technical needs. In downturns, they may seek state support based on local employment figures.
- **Workers and communities** need recognition in economic statistics to claim rights. Emerging collective action, such as trade unions, pressures firms and policymakers to improve reporting, including occupational health and safety (Nuruzzaman, 2017; Watterson et al., 2020).
- **Advocacy groups**—environmental, animal welfare, human rights, women's equality, food safety, and industry associations—depend on employment data to track patterns and trends.
- **Women's groups and gender advocates** stress sex-disaggregated data across value chains (Harper et al., 2025). A gendered approach must also account for unpaid care and community work, disproportionately carried out by women, without which aquaculture cannot function.
- **Researchers** face major data gaps. In their absence, they reconstruct employment estimates through case studies or sampling, as in Phillips et al. (2016), which used nine country case studies to estimate global aquaculture employment.
- **Consumers and citizens** increasingly demand transparency on employment conditions. Certification schemes, however, remain weak on social data, outsourcing human elements and slowing progress.

Why It Matters

Employment data must go beyond primary production. Focusing only on farming obscures the broader workforce engaged across value chains. Shocks—whether disease outbreaks, climate disasters, or trade disruptions—affect workers at every stage. Conversely, technological advances or production leaps ripple through employment systems.

Accurate, reliable time-series data are essential to:

- Understand the diversity and scale of people engaged.
- Track conditions of work and how they evolve.
- Anticipate impacts of crises or innovations across the value chain.

Challenges

Improving employment data faces persistent obstacles:

- Historical neglect of social statistics.
- High costs and technical difficulties in system design.
- Social barriers, especially in reaching small-scale and under-recognised workers.
- Political resistance from powerful interests unwilling to expose questionable employment practices.

Global employment data estimates

The first global estimates of aquaculture employment appeared 15 years ago in the FAO Director General's statement to the 5th meeting of the Committee on Fisheries Sub-Committee on Aquaculture (Table 2). In the *FAO Yearbook of Fish Statistics 2015* (published 2017), farmer numbers were reported from major producing countries and extrapolated globally.

The 2017 Yearbook also provided estimates for 1995–2015 at five year intervals. Subsequent editions revised historic figures, generally upward, as more data became available through FAO's leadership, with Table 2 presenting the latest estimates.

Scale of operations highlights the complexity of aquaculture employment data. The Big Numbers study on small-scale aquaculture (Phillips et al., 2016) found that farming, including hatcheries, employed more people than all other value chain segments combined. This contrasts with Bartley (2022), underscoring the need to address scale-related complexities—similar to those tackled in fisheries by Hidden Harvests and Illuminating Hidden Harvests (FAO et al., 2023; World Bank et al., 2012).

Sex and gender disaggregation adds another layer of complexity. For aquaculture, only 60% of employment data reported to FAO is disaggregated by sex, compared to 78% for fisheries. Women account for roughly a quarter of employees (~27% aquaculture, 24% fisheries) (FAO, 2025a, p. 55). FAO cautions, however, that regional gender patterns vary widely. Case studies by Hishamunda et al. (2014), Phillips et al. (2016), and Kruijssen et al. (2018, Table 1) confirm that women's employment differs significantly by industry, country, enterprise type, and value chain segment.

Employment is also vulnerable to shocks, particularly for small-scale operators and women. Maal (2013) documented "nearly jobless growth" in Norwegian salmon farming, where women's share fell from 20% in 1990 to 9% in 2010. Ownership changes and policy shifts transformed the sector from locally owned to large, industrialised, vertically and horizontally integrated companies. While economies of scale delivered profits, they severely reduced women's employment—a trend unchanged despite repeated recommendations for action (Karlsdóttir & Guðmundsdóttir, 2024).

The Way Forward on Aquaculture Employment Data

Without reliable data on employment, future aquaculture will not achieve its aspirations on decent work and employment opportunities, nor assure its social licence to operate. With the maturing of the aquaculture sector and the continuing dynamism in employment, now is the time to upgrade the data on employment. The global stimulus for this upgrade could be the Guidelines for Sustainable Aquaculture (2025), recently approved by the members of the FAO Committee on Fisheries and Aquaculture, alongside expert guidance and non-government commitments such as the Shanghai Declaration (2021).

Aquaculture has long focused on production data, while employment outcomes—who is engaged, under what conditions, and with what social impacts—remain poorly documented. Without attention to these dimensions, aquaculture risks repeating the trajectory

Table 2: Global estimates of employment in aquaculture, with sources.

Year	Estimates (millions of people)			Sources, notes
	Total Employment	On-Farm, Farmers, Primary Production	Off farm	
1995	n/av	11.17	n/av	FAO (2025a)
2000	n/av	13.40	n/av	As above
2005	n/av	16.17	n/av	As above
2010	n/av	19.90	n/av	As above
2010	30	21	9	DG's rep's statement to COFI-SCA#05 (Report, p. 69); fulltime equivalents
2015	n/av	22.04	n/av	Figures as cited in FAO (2025a)
2016	56.7	41.4	15.3	Phillips et al. (2016)
2018	59.51	20.53	38.98	Bartley (2022) citing FAO (2020)
2019	n/av	22.04	n/av	FAO (2025a)
2023	n/av	22.99	n/av	FAO (2025a)

of other industrial sectors, including fisheries, where growth in production masked labour losses alongside some opportunities, gender inequities, and exploitation. To avoid this trap, aquaculture must now build robust institutional data systems that capture employment characteristics alongside production.

Next Steps

Step 1: Obtaining Technical Agreement

- Secure broad, depoliticised consensus that employment data are essential.
- Stimulate global technical work to define aims and methodologies for setting up and maintaining the data systems at appropriate levels.
- Recognise challenges: entrenched legacy systems, resistance from stakeholders, and the inertia of long-standing data practices.
- Address the "two-edged sword" of data (Krieger, 2021): absence of data leads to neglect, while biased or incomplete data misguide action. Gender-disaggregated employment data exemplify this problem.

Step 2: Developing and Testing Methodologies

- Build on FAO and related work in aquaculture and fisheries employment data.
- Use participatory approaches and new information technologies to design inclusive systems.
- Draw lessons from studies such as Illuminating Hidden Harvests (FAO et al., 2023) and Harper et al. (2025) on gender-inclusive data systems.
- Determine levels of detail required: national vs. industry-specific, enterprise scale, sex-disaggregated, and intersectional categories (e.g., migrant status, part-time/full-time work).

Step 3: Reaching Political Agreement

- Present demonstrated approaches to political bodies such as COFI, COFI-SCA, ILO, UNIDO, and UN Women.
- Recognise that employment data responsibilities extend beyond aquaculture agencies to national statistical offices, private sector actors, NGOs, and government registries (health, welfare, labour, etc.).
- Build bridges across institutional silos, leveraging integrative frameworks such as the Blue Economy and agrifood systems approaches.

Step 4: Implementation

- Roll out systems across countries, ensuring consistency

for comparison and aggregation.

• Mentor and train a new generation of experts to sustain progress, recognising that building robust social data systems may take decades, but aquaculture's dynamism could accelerate convergence.

• Link employment data to organisational objectives, education, and training to create demand and ensure uptake.

Call to Action

Aquaculture has reached a turning point. Production growth has been extraordinary, but without robust employment data, the sector risks undermining its own sustainability and social licence to operate. The evidence is clear: we cannot continue to measure tonnes of fish while leaving the people behind.

To move forward, all stakeholders must act:

• **Governments and policymakers** must commit to building comprehensive employment data systems that capture the full value chain, including gendered and community-level dimensions.

• **Industry leaders** must embrace transparency, reporting workforce figures alongside production metrics, and recognising that decent work is integral to long-term profitability.

• **Workers and communities** must be empowered to demand recognition, fair conditions, and inclusion in economic statistics that shape policy and investment.

• **Researchers and advocates** must continue to innovate methodologies, ensuring that employment data reflect the realities of diverse aquaculture systems and scales.

• **International organisations** must coordinate efforts, with FAO's leadership, linking aquaculture employment data to global frameworks on sustainability, labour rights, and food security.

The time for fragmented, partial statistics is over. Reliable, inclusive, and transparent employment data are not optional—they are essential. By acting now, aquaculture can secure its future as a sector that not only feeds the world but also sustains livelihoods, empowers communities, and delivers on the promise of decent work.

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