SCALE WELFARE

Philippines Farmed Fish Industry & Welfare Review

July-October 2025

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Executive Summary

Introduction to Scale Welfare

Scale Welfare's mission is to improve the welfare of farmed fish in Southeast Asia. Given that roughly 90% of the 100+ billion fish farmed annually are in Asia - and the Philippines ranks eighth globally by production, with aquaculture contributing 55% of national fish production by volume - there is significant opportunity for impactful, scalable work. While the field remains under-served in Asia, prior activity in the Philippines includes *Fish Welfare Initiative*'s 2020 scoping and Animal Kingdom Foundation's ongoing *Better Fish Tomorrow* campaign.

Scoping visit details

This report synthesizes insights from a three-week, exploratory scoping visit conducted in July 2025 across major milkfish and tilapia hubs and multiple production systems. The team engaged directly with smallholder farmers, cooperatives, market vendors, academic researchers, NGOs, and government bodies to build a picture of current aquaculture practices and welfare concerns.

The assessment combines primary field observations with desk research. Field access and openness were strongest among small-scale producers, who shared challenges candidly and expressed interest in future collaboration; engagement with larger farms was more limited due to permissions and access requirements.

During the scoping visit we conducted interviews with 20 farms and farmers while observing many additional operations. We also visited 3 research facilities, engaged with 3 government agencies, and toured multiple fish ports and markets.

Key welfare concerns

The report's findings will guide Scale Welfare's strategic decisions around welfare interventions to prioritize based on welfare improvement potential and feasibility in the local context. It also identifies key partners and research gaps to be followed up on to turn our early findings into actionable improvements for fish and farmers.

The next pages provide an overview of the key welfare concerns for farmed milkfish and tilapia in the Philippines throughout their lives.

Summary of Key Welfare Concerns

Our scoping visit and review of available information indicate several major welfare problems affecting farmed fish in the Philippines. While not exhaustive, the issues below appear to cause the greatest suffering based on both duration and intensity. This summary does not assess potential interventions.

Slaughter - Although brief in duration relative to other life stages, suffering at slaughter is likely intense. Stunning prior to slaughter is rarely practiced. Milkfish are typically processed via ice chilling. The benefits of this practice seem limited aside from reducing time to death. Tilapia experience varying end-of-life conditions depending on processing conditions. Chilled tilapia face deaths akin to milkfish, but tilapia sold live likely endure worse outcomes due to crowded transport, stressful market holding, and slaughter without stunning. Empirical stress data to compare these pathways are lacking.

Fish kill events - Sudden mass mortality events triggered by rapid environmental deterioration are a widespread, severe welfare concern across freshwater and marine systems. Farmers report these events as recurring annually, with mortality ranging from ~50% in Laguna Lake to up to 90% in cage farms on Talim Island.

High mortality in hatcheries and grow-out - Excessive mortality at multiple life stages signals pervasive welfare challenges. Some facilities report rates up to 70%. Early stages (larval-to-juvenile) are particularly prone to mortality with limited domestic fry supply driving overcrowding to meet output targets. Frequently, specific causes of death are unknown, underscoring systemic knowledge gaps in early stage fish health and husbandry. Nonetheless, high mortality rates are a clear indicator of compromised welfare conditions.

Water quality - Chronic suboptimal water quality causes sustained stress and poor health. Notably, 19% of tilapia and 39% of milkfish are raised in pens and cages in natural water bodies, where farmers cannot control water quality parameters and face challenges from industrial runoff, volcanic activity, and waste accumulation in densely populated areas. Pond operators also report issues, but monitoring is minimal: dissolved oxygen is sporadically checked, while other critical parameters (ammonia, nitrates, pH) likely remain problematic and largely unmeasured. Most farmers relied on visual indicators alone.

Introduction

Background & Context

Scale Welfare's Mission

To improve the welfare of farmed fish in the Philippines and Vietnam. We have been working towards this mission since April 2025.

Why farmed fish welfare?

When talking about fish welfare we are mostly referring to the individual experience of the fish. However, over approximately 130 billion fish are farmed and slaughtered worldwide every year.[1] This is more than twice the number for land-based farmed animals. Many of these fish live in suboptimal conditions and are inhumanely slaughtered. Strong evidence now exists to suggest that fish are sentient and experience suffering, meaning that the welfare of farmed fish should be a priority within animal welfare.

The welfare of farmed fish is highly neglected. Very few organisations are effectively working on improving their welfare in Asia. One of the most successful ones to date, the Fish Welfare Initiative (FWI), improves the lives of over one million fish in India per year. This is highly encouraging but represents less than 0.001% of the Asian farmed fish population.

Why the Philippines?

~90% of the 100+ billion fish farmed worldwide every year are in Asia. 8 of the top 10 fish-producing countries in the world are in Asia and the Philippines ranks 8th in worldwide production numbers.

The Philippines' Bureau of Fisheries & Aquaculture (BFAR) outlines improper aquaculture practices [high stocking densities and overfeeding] being the second most significant constraint in the development of the country's milkfish (the most farmed fish species) industry[2]. Furthermore, "disease problems" was quoted by the Department of Agriculture as one of the top threats to the country's tilapia (the second most farmed species) industry[3].

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[1] Fishcount. 2024. "Updated Farmed Fish & Crustacean Estimates."
[2] Bureau of Fisheries and Aquatic Resources. 2022. Philippine Milkfish Industry Roadmap 2021-2040.
[3] Bureau of Fisheries And Aquatic Resources. 2022. *National Tilapia Industry Roadmap 2022-2025*.

The Animal Kingdom Foundation (AKF), a leading animal welfare organisation in the Philippines, states that the aquaculture sector is significantly affected by poor water quality, improper handling and inhumane slaughter.

Scale Welfare's efforts are not the first in the Philippines to address improving the welfare of farmed fish. FWI conducted a scoping visit in 2020 before focusing its resources on Indian farmed fish welfare, despite identifying opportunities in the Philippines[4]. AKF has an ongoing campaign, Better Fish Tomorrow, focusing on improving farmed fish welfare through research and campaigns.

Objectives of the scoping visit

The primary objective was to develop a practical understanding of current aquaculture practices in the Philippines. Through direct engagement with stakeholders throughout the supply chain, including smallholder farmers, larger farming cooperatives, market vendors, academic researchers and experts, NGOs and government representatives, this ground research documented the challenges and opportunities in fish farming from a welfare perspective.

This supply chain approach was essential to understanding how welfare implications manifest at each stage of production, from hatchery operations to final market processing.

The scoping visit was an exploratory, learning-focused 3-week visit in July 2025 focusing on various production systems across multiple regions in the Philippines' major milkfish and tilapia farming hubs (the country's two most farmed species).

[4]FWI scoping report; accessible here

This scoping report

The report serves as a foundational assessment, based on desk and on-the-ground research, to inform Scale Welfare's strategic decision-making regarding potential programs and partnerships in the Philippines to improve the welfare of farmed fish. We hope it also serves as a useful information resource for other stakeholders interested in contributing to an aquaculture sector in the Philippines which more effectively addresses the welfare of fish.

The report includes primary and secondary information covering the following key areas:

- **Philippines Aquaculture Context** - Introduction to the country’s aquaculture sector, its economic importance, the socio-economic context, major species farmed and key stakeholders.
- **Life Cycle of a Farmed Fish** - Overview of a farmed fish’s life from hatchery through grow-out to harvesting and processing, including welfare implications at each stage.
- **Main Welfare Concerns** - Summary of the most significant welfare concerns for farmed fish in the Philippines that warrant further research.

Philippines Aquaculture Context

An overview of the aquaculture industry in the Philippines, focusing on farmed fish, based on secondary literature and field observations.

Industry Overview and Economic Importance

The Philippine fisheries industry is a vital economic and livelihood sector in an archipelagic nation of over 7,600 islands, surrounded by rich marine and freshwater ecosystems. Based on the number of fish slaughtered per year, the Philippines is the 8th largest fish-producing country globally.[5]

Total Fisheries Production

In 2024, total fisheries production reached 4.06 million metric tonnes, valued at PhP 305.45 billion (approx. 5.4 billion USD). This reflects a decline from the 4.26 million metric tonnes recorded in 2023. By production volume, aquaculture accounted for the largest share at 55%, while capture fisheries contributed the remaining 45%. However, in terms of value, the trend was reversed: capture fisheries contributed 62.2%, while aquaculture accounted for only 37.8%.[6]

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[5] Fishcount. 2024. "Updated Farmed Fish & Crustacean Estimates."
[6] Distribution of Fisheries Production Volume (PSA retrieved September 2025)

Table 01. Aquaculture Production Volume and Value by Region, 2024

Region	Volume (metric tonnes)	Volume (%)	Value ('000 PhP)
National Capital Region (NCR)	1,928.21	0.09	107,490.76
Cordillera Administrative Region (CAR)	3,215.01	0.14	381,604.38
Negros Island Region (NIR)	19,009.81	0.86	3,208,708.35
Region I (Ilocos Region)	159,852.50	7.2	21,527,253.90
Region II (Cagayan Valley)	14,856.72	0.67	2,565,294.16
Region III (Central Luzon)	300,329.46	13.52	42,302,264.30
Region IV-A (CALABARZON)	65,433.46	2.95	6,820,448.14
MIMAROPA Region	292,170.87	13.15	3,154,533.29
Region IX (Zamboanga Peninsula)	125,515.80	5.65	1,426,846.46
Region V (Bicol Region)	11,130.78	0.5	785,281.39
Region VI (Western Visayas)	187,156.31	8.43	11,261,570.20
Region VII (Central Visayas)	20,825.13	0.94	2,482,870.61
Region VIII (Eastern Visayas)	8,471.18	0.38	1,028,664.38
Region X (Northern Mindanao)	12,341.12	0.56	1,779,653.09
Region XI (Davao Region)	25,770.14	1.16	3,528,933.02
Region XII (SOCCSKSARGEN)	21,305.99	0.96	3,821,756.21
Region XIII (Caraga)	7,495.29	0.34	1,206,586.03
Bangsamoro Autonomous Region in Muslim Mindanao (BARMM)	944,530.44	42.52	8,067,852.22
TOTAL	**2,221,338.22**	**100**	**115,457,610.89**

Data Source: PSA Retrieved September 2025

Fisheries Export and Import

In 2023, the Philippine fisheries sector maintained a positive foreign trade position with a net surplus of 205.9 million USD, although this marked a 29.5% decline from the surplus recorded in 2022.

Total export value reached 1.14 billion USD, a 3.6% reduction, the lowest in five years. The major export commodities were tuna, seaweed, and eel. Together, these accounted for nearly 59% of export volume and 65% of export value. Tuna was the leader in exports, followed by seaweed.

On the import side, the Philippines brought in fishery products worth 938.3 million USD. 90% of these consisted of fish, crustaceans, molluscs, and processed products. The main sources of imports were China (35.6%), Vietnam (21.0%), and Papua New Guinea (11.3%).[7]

In the Philippines, both tilapia and milkfish are produced predominantly for domestic consumption[8], with only a modest share entering the export market. Milkfish exports in 2022 accounted for 2.4% of total production. Importantly, while the Philippines exports some value-added milkfish products, its fry industry is reliant on imports: about 1.4 billion milkfish fry were imported from Indonesia and Taiwan in 2024, as domestic hatcheries supplied only 1.1 billion fry, resulting in a self-sufficiency rate of 44%.[9]

Species Farmed and Distribution

Aquaculture Species

Aquaculture recorded a 6.83% decline in production in 2024 compared to the previous year, with a total output of 2.22 million metric tonnes. Seaweed remained the top contributor, accounting for 65.51% of total production volume.

Milkfish ranked second overall and first among fish commodities, representing 16.1% of aquaculture production, a 1.38% increase from 2023. Other major contributors included tilapia (11.8% of production), *Penaeus vannamei* (2.2%), and oyster (1.7%). In terms of production value, milkfish remained the leading commodity, generating 38.8% of total value. This was followed by tilapia at 22.0% and P. vannamei at 11.48%.[11]

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[7] *Philippine Statistics Authority, Import and Export Volume 2023*
[8] *PCAARRD Milkfish Profile 2024*
[9] *SEAFDEC Milkfish Fry Sufficiency 2025*
[11] *Philippine Statistics Authority 2025. Fisheries Situation Report: January to December 2024*

Table 02. Top Ten Produced Commodities in Aquaculture in Terms of Production Volume, 2024

Commodity	Volume (metric tonnes)	Volume (%)	Value ('000 PhP)
Seaweed	1,455,218.32	65.51	10,476,762.13
Milkfish	357,878.90	16.11	44,787,282.26
Tilapia	260,964.34	11.75	25396260.93
P. Vannamei	48,115.37	2.17	13259748.89
Oyster	36,762.68	1.65	1076886.1
Tiger Prawn	22,855.34	1.03	12462069.63
Catfish	11,318.81	0.51	1177665.32
Mudcrab	9,401.51	0.42	5035134.83
Mussel	7,576.14	0.34	257637.46
Carp	6,157.87	0.28	203581.33
Others	5,088.95	0.23	1324582.01

Data Source: PSA Retrieved September 2025

The number of individuals farmed per species, which when talking about fish welfare is more relevant than volume, are provided in the table below:

Table 03. Number of individuals farmed per species in Philippines during 2024

Species	No. of individuals (midpoint estimate) in millions
Milkfish	1,400
Tilapia	1,280
Catfish	50

Data Source: Fishcount. 2024. "Updated Farmed Fish & Crustacean Estimates."

Aquaculture: Average Farmgate Price by Species

Farmgate prices in Philippine aquaculture during 2024 (Table 04) reveal significant variation among major commodities, reflecting differences in production scale, market demand, and the economic value of each species. Milkfish, a staple in the Filipino diet, has a moderate farmgate price averaging PhP 124.76 (approx. 2.3 USD) per kilogram, while tilapia fetches a slightly lower price at approximately PhP 96.09 (approx. 1.7 USD) per kilogram. Both are cultured predominantly for the domestic market. High-value species such as tiger prawn and mudcrab command premium prices, underscoring their export potential and specialized markets.[12]

Table 04. Top Aquaculture Commodity Average Farmgate Price, 2024

Aquaculture Commodity	Average Farmgate Price (PhP/Kg)
Milkfish	124.76
Tilapia	96.09
P. Vannamei	275.58
Oyster	29.4
Tiger prawn	544.01
Catfish	112.39
Mudcrab	487.05
Mussel	34.01
Carp	67.22

Data Source: PSA Retrieved September 2025

[12] Philippine Statistics Authority. 2025. Fisheries: Farmgate Price by Geolocation, Species, Year and Quarter

Socio-Economic Context

The fisheries sector supports an estimated 2.3 million registered fisherfolk engaged across capture fishing, aquaculture, gleaning (traditional harvesting by hand), processing, and marketing activities. Capture fishing constitutes the largest livelihood group (approximately 51% of registered fishers), followed by aquaculture (11%) and gleaning (11%). About 70% of the workforce is male, involved mainly in active fishing and farming, while women predominantly engage in gleaning, processing and vending.

Between 2023 and 2024, the Philippines' fishing and aquaculture subsector encountered a significant reduction in employment, losing approximately 173,000 workers, the third largest reduction among all major economic sectors.
This downward trend intensified in 2025, with an additional decline of 288,000 jobs between April and July, maintaining its position as the third-most impacted sub-sector during both periods. Such declines highlight the ongoing structural and economic challenges facing the fisheries sector in providing stable livelihoods amid fluctuating production and market conditions.[10]

[10]Philippine Statistics Authority, Labor Force Survey 2024

Organizational & Regulatory Framework

Organizational Framework

The Philippine fisheries sector operates within a complex framework of national agencies, regional offices, local government units (LGUs), and educational and research institutions, all coordinated under the Philippine National Government.

The Department of Agriculture (DA) serves as the primary executive department responsible for promoting agricultural and fisheries development. Under its supervision are several key bureaus that play distinct roles in the fisheries sector:[13]

- The Bureau of Animal Industry (BAI) handles the health and welfare of aquatic animals[14]
- The Bureau of Agricultural and Fisheries Engineering (BAFE) focuses on the engineering aspects of aquaculture and fisheries infrastructure[15]
- The Bureau of Agricultural and Fisheries Standards (BAFS) is crucial for setting quality and safety standards (e.g. the Philippine National Standards (PNS) for various aquaculture products, such as milkfish and tilapia)[16]

The Bureau of Fisheries and Aquatic Resources (BFAR) is the primary implementing agency of the DA for the development, management, and conservation of the country's fisheries and aquatic resources. BFAR has a hierarchical structure with a central office, and regional and provincial offices that handle local implementation. It also has specialized training and research centers, such as the National Fisheries Development Center (BFAR-NFDC), which focuses on technology transfer and training for stakeholders.[17]

Local government units (LGUs), under the supervision of the Department of the Interior and Local Government (DILG), have a significant role in managing municipal waters. They collaborate with DA-BFAR and other Departments to implement national policies, but LGUs hold regulatory and executive power within their jurisdictions. This is especially true for municipal waters, where they can regulate fishing and aquaculture activities, such as specifying zones for fish cages and prescribing minimum standards.[18] Although LGUs are the lowest form of government, with the barangay being the most basic political and administrative unit at the grassroots level, their executive power means they can be a potent force in shaping local fisheries policy.[19]

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[13] *Department of Agriculture. (2017). Citizens Charter.*
[14] *Bureau of Animal Industry. (2024). Citizens Charter.*
[15] *Bureau of Agricultural and Fisheries Engineering. (n.d.). Mandate and functions.*
[16] *Bureau of Agricultural and Fisheries Standards. (n.d.). Mission, vision & mandates.*
[17] *Bureau of Fisheries and Aquatic Resources. (n.d.). BFAR mandate. Department of Agriculture.*
[18] *House of Representatives of the Philippines. (2025). House Bill No. 02065.*
[19] *Carlos, C., Lalata, D., Despi, D., & Carlos, P. (2010). Democratic deficits in the Philippines: What is to be done?*

Aside from these, academic institutions such as the University of the Philippines Visayas and Central Luzon State University, recognized as Centers of Excellence in Fisheries Education, conduct vital fisheries and aquaculture research in collaboration with various government agencies and the private sector.

Regulatory Framework

The foundation of the country's fisheries and aquaculture sector is the Philippine Fisheries Code of 1998 (RA 8550), the core legislation that integrates all relevant laws on resource management, conservation, and utilization. This law outlines policies for sustainable development, management, and conservation of fishery resources, while also protecting the rights of fisherfolk. Chapter II, Article III (Sections 45-57) of RA 8850 specifically addresses aquaculture.

This section mandates BFAR to create a code of practice for the industry, which was led through FAO No. 214 (2001).[20] This FAO outlines principles for environmentally sound and sustainable aquaculture. Complementing this, the Bureau of Agriculture and Fisheries Standards (BAFS), a separate bureau under the DA, develops Philippine National Standards (PNS) for Good Aquaculture Practices (GAqP).[21] These standards are implemented by BFAR to ensure aquaculture operations are safe and compliant with national and international requirements.

The legality of many aquaculture farms remains a complex issue. While the Fisheries Code provides the framework for legal operations, many small-scale farms often operate without proper permits or exceed legal limits.[22]

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[20]FAO. 2025. Philippines. Spreij, M.. In: Fisheries and Aquaculture. Accessible here
[21]Department of Agriculture. 2001. *Code of Practice for Aguaculture*.
[22]Aquaculture in the Philippines: The Case of Fish Cage Farming Regulatory Review, 2024

Main Stakeholders

In addition to the key government stakeholders outlined above, the success and sustainability of the Philippine fisheries and aquaculture sectors depend on the collaborative efforts of various other stakeholders:

Academia

Academic institutions, such as the University of the Philippines Visayas (UPV) and Central Luzon State University (CLSU), are pivotal in the Philippine fisheries and aquaculture sectors, driving knowledge, skills, and innovation. They prepare future professionals through specialized programs with practical training, and lead research on climate change, sustainable feeds, and disease management, informing government policies and technological advances.

Additionally, the Technical Education and Skills Development Authority (TESDA) provides competency-based training and certifications, like "Aquaculture NC II," to equip individuals with job-ready skills for sustainable practices, particularly benefiting small-scale fishers. Together, academia and skill-building agencies ensure a skilled workforce and a scientific foundation for a sustainable and competitive fisheries sector.

Cooperatives

Cooperatives play a key role in pooling marine and fisheries resources to prevent hoarding and address the economic and social needs of small-scale fish farmers. They empower members through collective actions such as bulk purchasing and coordinated marketing to secure better prices. These cooperatives serve as a critical link between government agencies and individual fishers, facilitating efficient distribution of aid, program implementation, and training, thereby ensuring that government benefits reach the most marginalized.

Feed Companies

Proper nutrition is crucial for cultured species to enhance growth, survival, and reproduction, with well-formulated feeds boosting production and disease resistance, thereby increasing income for small-scale farmers with minimal environmental impact.[23] Feed companies develop specific feeds for the various growth stages of milkfish and tilapia, focusing on improved vitamin, mineral content, and essential fatty acids, while ensuring all feeds are natural and antibiotic-free.[24]

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[23]Coloso, R. 2015. Use of Plant Proteins in Aquaculture Feed for Top Five Commodities in ASEAN Member States.
[24]Feedmix Specialist, 2025

Both sinking and floating feeds for milkfish and tilapia are on offer. Their goal is to promote optimal growth and health, strengthen immune defenses, and ensure minimal environmental waste. *TATEH* Aquafeeds, under *SANTEH* Feeds Corporation, provides a comprehensive range of feeds for different growth stages of milkfish, tilapia, and other finfish species, along with feeds for shrimp and crabs, and specific feeds for species like eels, catfish, and seabass.

Insurance Companies

Insurance companies play a vital role in the Philippine fisheries sector by offering financial protection against unexpected losses, with the Philippine Crop Insurance Corporation (PCIC) as the primary provider. PCIC's fisheries insurance program covers fish farmers and fisherfolk against losses in unharvested crops or stocks due to natural calamities and unforeseen events, including production inputs and labor costs, from stocking to harvest.

Non-Government Organizations (NGOs)

- **Southeast Asian Fisheries Development Center (SEAFDEC):** An autonomous inter-governmental body established in 1967 with a mission “To promote and facilitate concerted actions among the Member Countries to ensure the sustainability of fisheries and aquaculture in Southeast Asia”.
- **Tambuyog Development Center:** Promotes community-based coastal resource management, tackling issues like sustainable fisheries, women's roles in fisheries, climate change, and sustainable aquaculture in Pangasinan.[25]
- **Animal Kingdom Foundation:** Advocates for the welfare of farmed animals across the Philippines and raises awareness on the environmental impacts of intensive farming, with campaigns like *Better Fish Tomorrow* aimed at improving aquaculture fish welfare.[26]

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[25] Tambuyog Development Center
[26] Farm Animal Coalition

Scoping Visit Methodology

This chapter outlines the methodology used during our scoping visit to assess milkfish and tilapia farming practices in the Philippines. It details the rationale for selecting specific regions and farms, the limitations encountered during fieldwork, and the data collection methods used.

Species Focus

This report focuses on milkfish and tilapia, which are the most farmed fish by individuals in the Philippines. Below are brief profiles of these species for context:

Photo credit: Personal photos

Milkfish (*Chanos chanos*)

Milkfish, locally known as *bangus*, is the most farmed finfish species in the Philippines and the country's national fish. With an estimated 1.4 billion individuals produced annually. It is a euryhaline and eurythermal species, meaning it can tolerate a wide range of salinities (fresh, brackish, and marine water) and temperatures (10–40 °C). This adaptability makes milkfish highly suited to the country's diverse aquaculture systems, from brackish ponds and coastal pens to marine cages.

Tilapia (*Oreochromis spp.*)

Tilapia is the second most farmed finfish species in the Philippines, producing over a billion individuals annually. Often called the "aquatic chicken" for its versatility. In this report we refer to "tilapia" as a single species for simplicity, but in reality several species and strains are farmed in the Philippines — predominantly Nile tilapia (*Oreochromis niloticus*) and GIFT or GIFT-derived strains that grow faster and tolerate crowding better than earlier stocks.

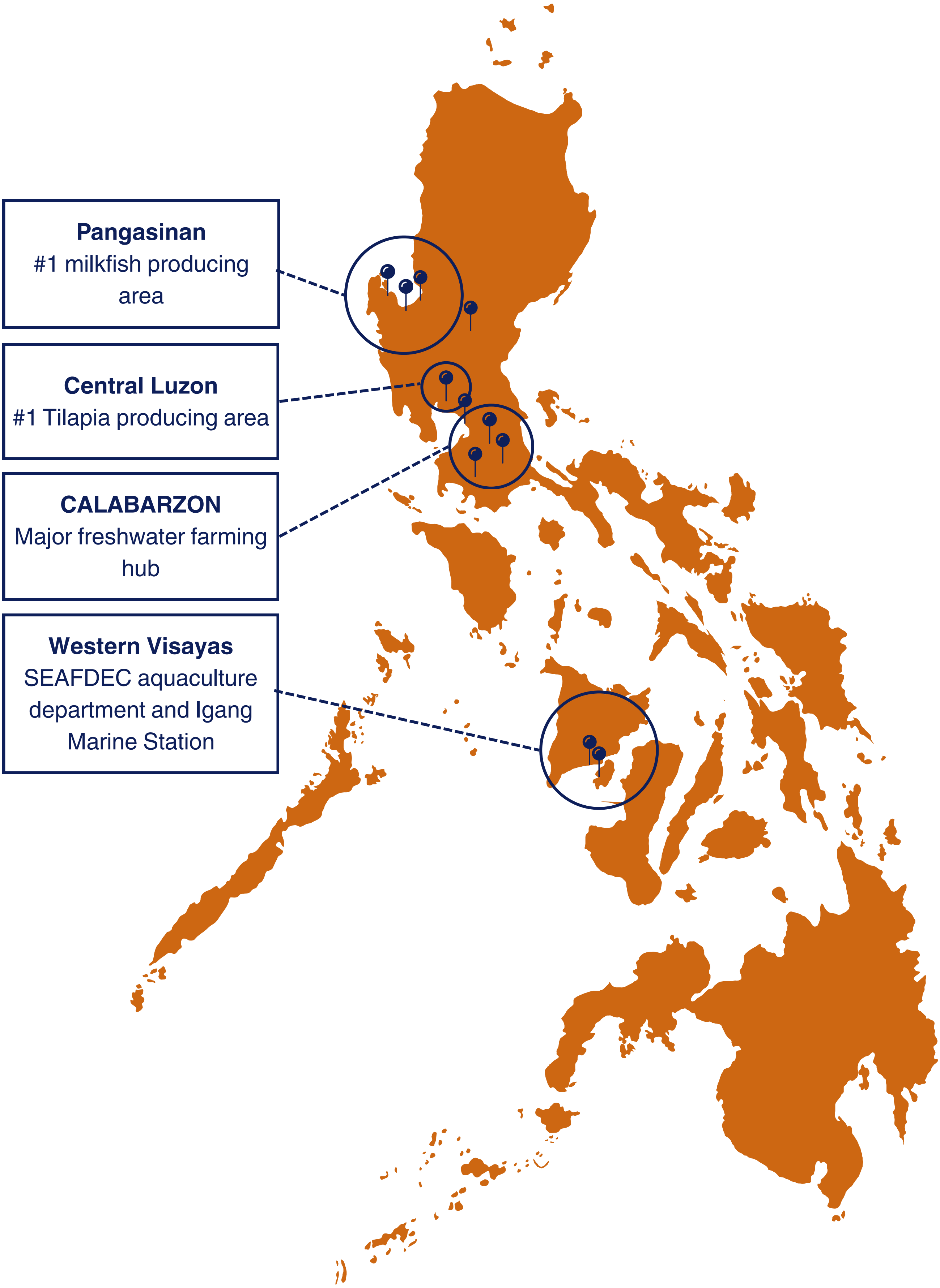
Geographical Focus and Areas Visited

Our objective was to gather as much useful information about milkfish and tilapia farming as possible within our three week scoping visit. Farming of both these species is widespread across the Philippines so we had to strategically select the regions we would visit (rationale outlined below). Priority was given to regions not covered in FWI's previous scoping visit to expand geographical understanding:

- **Pangasinan (Ilocos Region):** This province stands out as the top-producing area for milkfish in the Philippines. Pangasinan is also home to the BFAR National Fisheries Development Center (NFDC) and BFAR Regional Mariculture Technology Demonstration Center (RMaTDeC), making it a strategic location for observing both private and government aquaculture operations focused on milkfish.
- **Central Luzon** – Pampanga and Nueva Ecija: Pampanga leads tilapia production, and Nueva Ecija hosts CLSU and BFAR NFTC. Central Luzon is noteworthy for notable production of both tilapia and milkfish.
- **CALABARZON** – Batangas, Rizal, Laguna: CALABARZON ranks high in tilapia production and is also an important source of milkfish, especially through cage culture in Laguna Lake. Rizal and Laguna (including Laguna Lake, the seven lakes of San Pablo, and Calauan) are major sites for freshwater cage culture and hatchery operations, producing significant volumes of tilapia that supply both local and national markets.
- **Western Visayas:** The region is well-known for its marine aquaculture production. SEAFDEC Tigbauan serves as a national center for marine species research, including milkfish and tilapia culture. Visiting SEAFDEC Tigbauan allowed engagement with expert researchers and observation of advanced hatchery operations for marine and brackishwater species, providing valuable insights into applied research and fish welfare practices.

During the scoping visit we conducted interviews with 20 farms and farmers while observing many additional operations. We also visited 3 research facilities, engaged with 3 government agencies, and toured multiple fish ports and markets.

Map of Areas Visited



Process of identifying farms

Farms and stakeholders were identified through a multi-pronged approach to capture diverse perspectives. This included targeting local fish farm operators, both registered and unregistered, government agencies, key cooperatives involved in milkfish and tilapia production, research institutions, and academic centers.

Initial contacts with some registered operators were facilitated via BFAR and local government units, which assisted in identifying fisherfolk. Other operators were identified through local recommendations and existing connections. Scheduling was primarily coordinated via email, especially for academic and government stakeholders, with messaging platforms and phone calls used for other stakeholders.

Farmers generally showed openness in sharing information and transparently communicated challenges they faced, expressing interest in future collaboration.

Size of farms visited

We primarily visited small-scale farms as they were easier to gain access to than larger-scale farms that required special permission and were more difficult to contact.

Data Collection Methods

Data gathering combined several strategies to ensure comprehensive assessment of fish farm operations, welfare practices, and stakeholder perspectives:

- **Direct Observational Visits:** On-site inspections of hatchery and grow-out facilities documented daily practices, infrastructure, and environmental conditions, enabling verification of reported practices and identification of welfare concerns not evident in interviews.
- **Structured Interviews:** Standardized questionnaires guided discussions with farm operators, researchers and staff. The full questionnaire is available in appendix B.
- **Secondary Data Review:** Supplementary information was gathered from government records (e.g., BFAR, PSA), published institutional reports, and farm documentation to strengthen and validate primary observations and interview responses.

Additional Methods:

- Photo-documentation was conducted with full consent to systematically record environmental conditions, fish health, and management practices.
- Online interviews with industry experts accommodated scheduling constraints while enriching sector-wide understanding.
- Wet market visits assessed fish welfare in downstream supply chain segments, providing a complete production-to-market perspective on welfare issues.

Limitations and Areas Not Covered

Mindanao's Absence: A significant gap exists in excluding Mindanao, which contributes substantially to national tilapia and milkfish outputs. Farmers in Mindanao might face different challenges that were not captured by our current focus.

Limited Coverage Within Selected Regions: Even within visited regions, coverage was incomplete. In Laguna Lake, the study focused on Talim Island and Los Baños, excluding more urbanized and industrial areas. Of San Pablo's Seven Lakes, only Sampaloc and Bunot Lakes were surveyed based on cooperative responses, with practices in other lakes inferred rather than directly observed, potentially missing unique welfare issues.

Western Visayas Field Access: While the region was included, on-site activities were limited to SEAFDEC facilities (Tigbauan and Igang Station). No field visits to local farms took place, notably in Capiz which is noted for high milkfish production. Although a SEAFDEC farmer's forum provided valuable expert insights and regional perspectives on production practices and welfare challenges, direct observation of local farm operations was absent, potentially leaving some welfare and management issues underexplored.

Corporate Farm Exclusion: Complex administrative procedures prevented access to large-scale corporate aquaculture operations. This means findings primarily reflect small- to medium-scale practices, missing the different technological innovations and management systems employed by larger commercial farms - a crucial limitation given their growing influence in Philippine aquaculture.

A list of all locations visited during the scoping visit is included in appendix A.

Industry Overview

This chapter provides an overview of the main stages of milkfish and tilapia production in the Philippines. It summarizes how these species move through the cycle from hatchery to processing and highlights key practices, timelines, and systems at each stage.

By mapping the production process, this section helps contextualize the welfare issues described throughout.

Overview

Table 05 below outlines the typical production stages for milkfish and tilapia, with a brief description of each stage and the approximate duration under common farming conditions. These durations vary with management intensity, feeding practices, and target market size, but they reflect the ranges most frequently reported during field visits and in the literature.

Table 05. Typical production stages for milkfish and tilapia

Stage	Description (Milkfish & Tilapia)	Typical Duration – Milkfish	Typical Duration – Tilapia
Hatchery / Fry Production	Eggs hatch and larvae are reared until fry stage.	~21 days post-hatch to fry distribution	
Nursery	Fry grown in ponds or tanks to fingerling size for transfer to grow-out.	2–3 months	1–2 months (sometimes up to 2 months)
Grow-Out	Fingerlings stocked in ponds, pens, or cages and raised to market size.	~4–5 months in semi-intensive/intensive systems	~4–6 months in semi-intensive/intensive systems; up to 1–1.5 years in extensive systems
Harvest & Transport	Fish are crowded, harvested, and transported for market (live or chilled).	Hours to days depending on market route	

Early life stages

The early production stages in aquaculture encompass broodstock management, hatchery operations, and nursery rearing, all essential for producing healthy and viable seedstock.

- **Broodstock**: These are the sexually mature fish conditioned and maintained for reproduction, serving as the foundational source of eggs and sperm for hatchery production. The quality and health of broodstock directly influence the quality and quantity of fry produced.[27]
- **Hatcheries**: Facilities where the controlled spawning and hatching of fish eggs occur, followed by the initial rearing of larvae into fry or fingerlings. Hatcheries provide a protected environment that optimizes survival and growth during these delicate early life stages.
- **Nurseries**: Intermediate rearing facilities where fry from hatcheries are further grown to a larger, more robust size (fingerlings or juveniles) before being transferred to grow-out ponds or cages. This stage enables increased survival rates in the more challenging grow-out environment.

Milkfish Reproduction and Hatchery Operations

Milkfish typically reach sexual maturity after 3-5 years under marine conditions and require specialized marine water systems in hatchery facilities.

Milkfish broodstock are commonly sourced from wild populations. Research institutions like SEAFDEC follow strict criteria for capturing and assessing wild broodstock to ensure their productivity in hatcheries. While this method helps maintain genetic diversity, it can be unpredictable due to the variable availability of wild fry.

When broodstock is not sourced from the wild, milkfish juveniles weighing 250-350g are obtained in brackishwater ponds or fish pens, where they are then transported to broodstock cages or tanks. In a 10m diameter circular tank, 100 juveniles can be stocked for three years until maturity is attained.[28]

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[27] Izquierdo, M. S., H. Fernández-Palacios, and A. G. J. Tacon. 2001. “Effect of Broodstock Nutrition on Reproductive Performance of Fish.” Aquaculture.
[28] A.C. Emata, C.L. Marte, L.Ma.B. Garcia. 1992. “Management of Milkfish Broodstock.” Preprint, December.

Once mature, spawning can be induced using hormone injections, and the resulting eggs are collected using fine mesh nets or specially designed collecting systems. They are then placed in larval rearing tanks and fed daily with rotifer.

Following the larval stage, a distinct nursery phase is common in milkfish production. Fry from hatcheries are typically reared in separate nursery ponds or pens by either the grow-out farm or specialized nursery operators before being transferred to grow-out facilities.

The Philippines currently cannot produce enough fry for its milkfish farms. In 2020, only 54% of fry was provided by domestic hatcheries, with the remainder being imported, mostly from Indonesia.[29]

Milkfish broodstock tanks at BFAR hatchery, Dagupan (personal photo)

[29] Bureau of Fisheries and Aquatic Resources. 2022. Philippine Milkfish Industry Roadmap 2021-2040.

Tilapia Reproduction and Hatchery Operations

Tilapia demonstrates remarkably rapid reproductive maturity, reaching sexual maturity within 3-6 months at lengths of 10-30cm. This species exhibits unique mouth-brooding behavior where females incubate eggs in their mouths for 5-7 days until hatching, with early juveniles remaining in the mouth until yolk sac absorption is complete. Reproduction occurs only when temperatures exceed 20°C, making tilapia well-suited to tropical conditions.

Tilapia broodstock is typically obtained from reputable hatcheries where different strains are developed and maintained. Compared to marine species, tilapia hatchery systems are simpler and less dependent on live feeds, as larvae and fry mainly rely on formulated diets with occasional supplemental natural food.

The tilapia hatchery setup offers considerable flexibility, ranging from small-scale backyard operations to commercial facilities. Healthy broodstock weighing 50-250g are sourced from reputable hatcheries and bred in concrete tanks using a ratio of 1 male to every 3 females, stocking 4 breeders per square meter. Fry typically appear after three weeks and can then be collected and transferred to rearing tanks.[30]

The nursery step often happens in close collaboration with the hatchery and takes place at special nurseries, or at the grow-out farm (on-site hapas/tanks).

An additional step that occurs for tilapia is sex reversal. Due to the relatively young sexual maturation of tilapia, farmers add hormones to their feed or water to create an all-male pond. This prevents issues during the later grow-out stage.

Tilapia fingerlings in a pond type hatchery (personal photo)

[30] Ledesma, Rossea H. 2011. "Tilapia Hatchery." SEAFDEC/AQD - Southeast Asian Fisheries Development Center | Aquaculture Department, August 15.

Transportation of fingerlings from nursery to grow-out

Fingerlings are transported between hatcheries, nurseries and grow-out farms once production facilities are ready for stocking. Both tilapia and milkfish fingerlings require pre-transport conditioning - tilapia are fed for 24 hours prior to transport, while milkfish fry are harvested 1-2 days before transport to allow adequate rest time. Transport typically occurs during cooler periods, either early morning or after sunset, to minimize stress.

For long-distance transport, oxygenated plastic bags are commonly used, with double-bagged systems containing water and oxygen. Short-distance transport may use transport boxes fitted in trucks with battery-operated aerators, while lake-based operations often employ specialized transport boats with compartments allowing free water flow.

Upon arrival at the destination, gradual acclimatization is essential - transport bags are floated to equalize water temperature, and cage water is slowly introduced to help fingerlings adjust to local conditions before final release.

Welfare Concerns during Early Production

Early production stages are critical for determining fish quality and health throughout the entire life cycle. Welfare concerns at these stages are frequently overlooked in favor of production efficiency, but ultimately affect productivity, fry quality, and long-term profitability.

Broodstock Handling and Reproductive Manipulation

Broodstock management involves numerous invasive procedures that cause significant stress and welfare concerns:

- **Manual sexing**: Physical restraint and manipulation of urogenital area to determine fish sex, involving removal from water, prolonged air exposure, and handling that can cause scale loss, tissue abrasions, and oxygen deprivation
- **Egg collection**: Forcible extraction of eggs from mouth-brooding tilapia females through manual stripping or mouth manipulation, often causing mouth injuries, stress-induced egg release, and disruption of natural brooding behavior
- **Transfer operations**: Netting, crowding, and moving fish between tanks or breeding systems, creating handling stress, potential physical injuries, and environmental shock from water parameter changes

- **Cannulation**: Surgical insertion of tubes into reproductive organs to extract gametes (sperm or egg), an invasive procedure requiring anesthesia and causing tissue trauma, infection risk, and recovery stress.

The above procedures involve handling, air exposure, and physical manipulation that trigger acute stress responses. They can cause tissue damage, immunosuppression, and increased disease susceptibility, while disrupting natural reproductive behaviors.

Stress is also induced in the following ways:

- **Environmental manipulation for induced spawning:** Temperature shocks, hormone injections, and photoperiod changes create both acute and chronic stress that can suppress immunity and reduce reproductive performance.
- **Reusing breeders with minimal rest periods (3-7 days or less):** Prevents physiological recovery, leading to suppressed immunity, reduced seed quality, and increased deformities in offspring
- **Absence of natural breeding substrates:** Prevents species like tilapia from performing essential nesting behaviors in intensive systems, causing chronic stress and reduced spawning success

Manual Sexing of Tilapia broodstock (Aure, 2021)

Cannulation of Pompano (Aure, 2025)

Fingerling Manual Counting before Transport (Aure, 2021)

Early Life Stage Vulnerability and Environmental Stressors

Larvae and fry face multiple welfare challenges during their most vulnerable developmental stages:

- **Poor water quality management:** Poses particular risks to developing fish - they are highly sensitive to fluctuations in dissolved oxygen, pH, ammonia, nitrite, temperature, and pollutants, with minor changes causing stress responses, distress behaviors like swirling, and compromised immune function leading to increased mortality and developmental abnormalities.
- **Handling:** During routine counting and transport operations, this process exposes young fish to air, temperature fluctuations, and physical stress that can cause rapid mortality spikes and weaken immune systems. Incomplete acclimation protocols that focus only on temperature while ignoring pH, salinity, and dissolved oxygen differences between environments lead to "water shock" and compromised survival.
- **Overcrowding in nursery systems:** Often practiced to compensate for anticipated mortality, this creates competition for resources, triggers aggressive behaviors and cannibalism, and increases disease susceptibility.
- **Exposure to predation in open systems:** Causes both direct mortality and chronic stress that reduces feeding efficiency and growth.

High-Density Tilapia Fingerling Grading and Harvest (Aure, 2021)

Grow-out Production

During the grow-out production phase, fingerlings obtained from hatcheries and nurseries are grown to marketable size, before being harvested and sold. Grow-out farms vary between species, locations and farm size. This section provides an overview of these variations built upon information obtained during one-on-one conversations with farmers in the Philippines.

Production systems

Grow-out systems can exist in different combinations of environment, farm type and feeding regime. One simplified way of understanding the different types of farms is as follows: ***Grow-out = Environment × Farm type × Feeding intensity***

Table 06. Description of farm characteristics

Environment:	*Freshwater*	*Brackish water (mix of fresh and saltwater)*	*Marine*
Farm type:	*Pond:* A land-based facility enclosed with earthen or stone materials to impound water for growing fish.	*Pen:* A fixed enclosure built within a natural water body using posts and netting; crucially, the bottom is the natural lake/sea bed (i.e. not netted).	*Cage:* An enclosure (floating or stationary) made of nets or screens on all sides including the bottom, held in place by frames/anchors/floats, allowing free water exchange.
Feeding intensity: [31]	*Extensive:* Natural food	*Semi-intensive:* Natural food + low-protein supplement	*Intensive:* Formulated feeds

Freshwater cages used for tilapia in Taal Lake (personal photo)

Small freshwater fish pond in Calauan Laguna (personal photo)

Large freshwater pen in Laguna Lake (personal photo)

[31] Food and Agriculture Organization of the United Nations. 1993. Cage and Pen Fish Farming: Carrying Capacity Models and Environmental Impact. Food & Agriculture Organization of the United Nations (FAO)

Duration

The duration of the grow-out stage varies considerably between farms. It depends not only on the farming system but also on the target market and feeding practices. Fish destined for filleting or larger-size markets are often grown longer, while those sold whole at smaller sizes are harvested earlier. Feeding regime also plays a major role: farms relying mainly on natural food typically have longer grow-out periods, whereas those using formulated feeds achieve faster growth and shorter cycles.

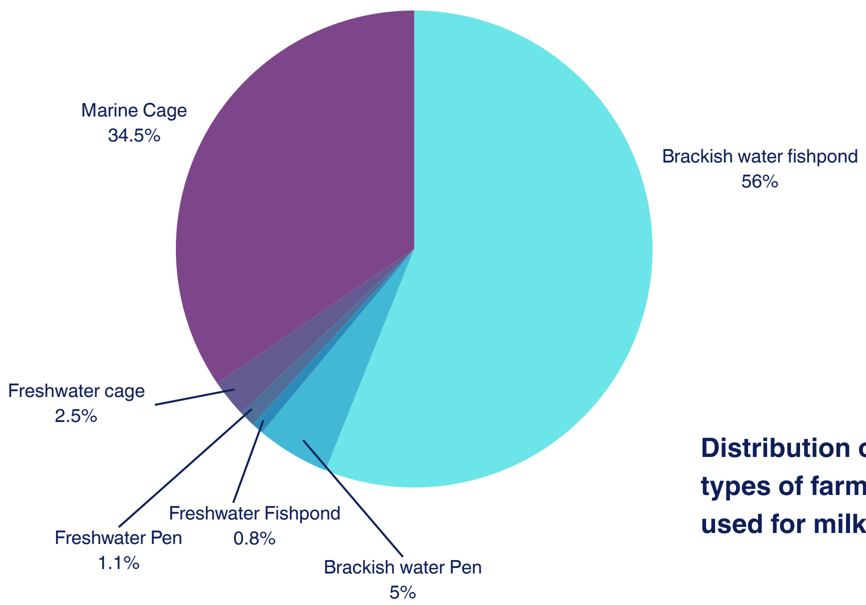
Table 07. Duration of grow out stage.

Species	Farming Type / System	Typical Duration to Market Size
Milkfish	Semi-intensive / intensive ponds or cages	~4–5 months [32]
Tilapia	Semi-intensive / intensive ponds or cages	~4–6 months [33]
	Extensive systems (e.g., Talim Island lake cages relying on natural feed)	~1–1.5 years

Common Farm Types

Milkfish farms

Milkfish are grown mainly in marine cages and brackish water ponds, which account for ~89% of national production. Mariculture parks (marine cages) with HDPE cages, often foreign-funded, employ intensive feeding and high stocking densities. Brackish water ponds, especially in Regions VI and III, use semi-intensive feeding.

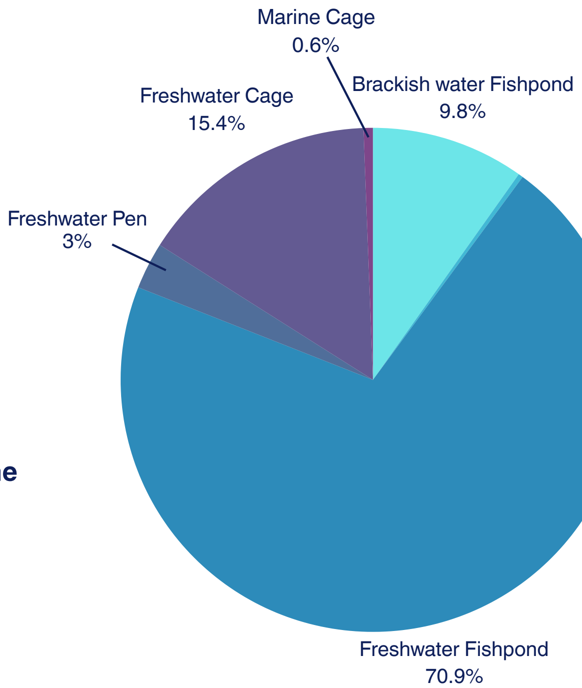


Distribution of the types of farms used for milkfish

[32]Bureau of Fisheries and Aquatic Resources. 2022. Philippine Milkfish Industry Roadmap 2021-2040.
[33]Bureau of Fisheries And Aquatic Resources. 2022. *National Tilapia Industry Roadmap 2022-2025.*

Tilapia farms

Tilapia are mainly farmed in freshwater ponds in Regions I and III. Pampanga is a major hub, with semi-intensive and intensive operations fed by natural rivers.



Distribution of the types of farms used for tilapia

This large difference in type of farm can based on the local environment, whether the farm is operated by a smallholder or by a large corporation, and what regulations allow. Data for the above charts were provided by PSA.

Common Management Practices

Management practices during the grow-out stage vary significantly depending on the farm type and intensity. For example, intensive operations require daily feeding schedules and constant monitoring, while extensive cage farms operate with minimal intervention - farmers typically inspect their cages only once or twice weekly to ensure net integrity.

Some of the more common management practices occurring in different types of fish farms, including observations from our visits, are as follows:

Pond Preparation (specific to earthen ponds)

Before stocking, ponds should typically be drained, levelled, and dried. The soil is tilled and treated with lime and/or tea seed to remove unwanted species and improve soil quality. Basal fertilizers (organic manure and/or inorganic fertilizers, such as urea or 16-20-0) are applied to enhance natural food production. The pond is then filled with clear water.

Pond preparation is not always practiced consistently. In flood-prone areas like Pampanga, farmers often limit pond preparation to the summer season, as they lack the means to fully drain their ponds due to frequent flooding and a high water table.

Feeding Management

Farms can be based on different types of feeding regimes, the type of regime mainly influences whether fish receive supplementary feeding or not. Other farming operations also differ between these different regimes:

Table 08. Desciption of feeding regimes.

System	Feeding	Farmer visits
Extensive	Natural food (lab-lab, plankton); no pellets. In Laguna de Bay, several pen operators told us they rely on natural feed or cheap supplements like bread, rather than pellets.	Weekly net checks only
Semi-intensive	Natural food + occasional pellets; “feed when needed”	More frequent visits
Intensive	Formulated pellets multiple times/day; 27–31% protein	Daily visits, high feed cost (60–70% of variable cost)

In semi-intensive or intensive aquaculture operations feeding operations are required. Guidelines provide methods to determine the amount of feed required, with the advised feed being a percentage of the average fish weight. Multiple farmers reported basing the amount of feed on the response of the fish, meaning they keep feeding as long as they eat. Feed is usually provided manually from shore.

Water Quality Management

Water quality is crucial for both productivity and fish welfare. Since milkfish and tilapia thrive in different environments, water characteristics significantly influence growth rates across species and breeds. Table 09 provides an overview of recommended water quality parameters for tilapia and milkfish grow-out culture.

Table 09. Water quality paramaters as recommended by various sources

Water Parameters	Tilapia[34]	Tilapia (growth optimum)[35]	Milkfish (general)[36]	Milkfish (cage culture)[37]
Salinity (ppt)	0-36 (depending on species and breed)	Up to 19	30-35	15-34
Dissolved Oxygen (mg/L)	>0.1	>3	>5	>4
Temperature (°C)	8-42	22-29	28-32	27-31
pH	3.7-11	7-9	7-8.5	6.5-8.5
Ammonia (mg/L)	Up to 7.1	<0.05	-	<0.5

Maintaining these recommended water quality parameters proves challenging in practice. Most farmers were unaware of their water quality parameters, with only basic knowledge of temperature and dissolved oxygen (DO) level, if anything at all. Even when farmers recognized problems with these parameters, they often lacked the means to address them.

While manuals recommend equipment like paddle wheels to maintain DO levels, only two farmers in our study actually used such devices. Larger associations and corporate farms typically have the expertise and resources for regular water quality testing, but most small- and medium-scale operations lack systematic monitoring of these parameters. This challenge is particularly acute in natural lake environments, where farmers have virtually no control over water quality conditions.

In lake environments, BFAR and the LLDA (for Laguna Lake) conduct monthly water quality assessments. Despite this official monitoring, farmers primarily rely on observing fish behavior during feeding to gauge DO levels.

[34] Maria Rowena R. Romana-Eguia, Ruel V. Eguia, Rolando V. Pakingking, Jr. 2020. *Tilapia Culture - The Basics*. Southeast Asian Fisheries Development Center.
[35] Standards, Fisheries. 2025. "PNS/BAFS 196:2025: Milkfish and Tilapia — Good Aquaculture Practices (GAqP) — Code of Practice." Preprint.
[36] Heti Herawati, is Rostini. 2022. WATER QUALITY MANAGEMENT OF MILK FISH (Chanos Chanos) AT THE SOUTH AREA AND SEA FISHERIES CENTER PANGANDARAN.
[37] Albert G. Gaitan, Joebert D. Toledo Margarita T. Arnaiz, Evelyn Grace DJ. Ayson Jon P. Altamirano, Renato F. Agbayani Nerissa D. Salayo, Clarissa L. Marte. 2014. *Milkfish Chanos Chanos Cage Culture Operations*. Southeast Asian Fisheries Development Center

Some feed company technicians measure water quality during farm visits, though this monitoring tends to be irregular and linked to feed sales or technical support rather than routine farm management. It is not regular.

Stocking Density

Stocking density substantially affects fish welfare and is a relatively straightforward parameter to improve. SEAFDEC and BFAR provide guidelines on appropriate stocking rates, recommending that milkfish density should be based on the carrying capacity of the cage and environment. However, field interviews revealed that farmers often do not follow these recommendations and only have rough knowledge of the stocking densities on their farms.

Table 10. Stocking density recommendations for various holding systems.

Species	Pond	Pen	Cage
Milkfish[38 39]	Intensive with aeration: 8-10mt/ha; Extensive with lablab: 2,000 juvelines/ha	Eutrophic Freshwater Lakes: 30,000 to 50,000 fingerlings/ha or 1 fish/m3; Marine and Brackish water: 6-12 fingerlings/m2	Floating and stationary cages in shallow water: 5-300pcs/m3; Floating cages in deep lakes and bays: 30-20 pcs/m3; Offshore cages: 40-100 pcs/m3
Tilapia[40 41]	Extensive: 1-2 per m2 Semi-intensive: 3-4/m2; Intensive: 5-10/m2	-	10-15 pieces/m3 for a 10x20x2,5 m cage; Higher densities may be used, as high as 50-200/m3 in intensive settings

The precise relationship between stocking densities and the welfare of milkfish and tilapia is not well understood by farmers. While producers have an incentive to avoid stressing fish to the point that it harms growth or survival, the stocking densities recommended for optimal production may still be higher than those that minimize stress and maximize welfare.

[38]Bureau of Fisheries and Aquatic Resources. 2022. Philippine Milkfish Industry Roadmap 2021-2040.
[39]Standards, Fisheries. 2025. "PNS/BAFS 196:2025: Milkfish and Tilapia — Good Aquaculture Practices (GAqP) — Code of Practice." Preprint
[40]Maria Rowena R. Romana-Eguia, Ruel V. Eguia, Rolando V. Pakingking, Jr. 2020. Tilapia Culture - The Basics. Southeast Asian Fisheries Development Center.
[41]Standards, Fisheries. 2025. "PNS/BAFS 196:2025: Milkfish and Tilapia — Good Aquaculture Practices (GAqP) — Code of Practice." Preprint

Health Management

Aquaculture operations typically face numerous fish health challenges during grow-out, including viruses, diseases, and parasites that can cause fish mortality, physical injuries, and potential human health risks. However, according to farmers, milkfish and tilapia farming in the Philippines appears relatively free from serious health issues.

Similarly, parasites pose minimal concern in Philippine milkfish and tilapia culture. Farmers rarely identify parasitism as a significant problem, and while literature acknowledges the presence of some parasites in these species, none are characterized as major threats. Disease pressure is similarly low. Milkfish farming encounters few disease-related issues, while tilapia operations face only occasional cases of Tilapia Lake Virus, which farmers do not consider problematic.

Despite the availability of laboratory analysis services through BFAR for fish health monitoring (including disease identification), only a small fraction of farmers actually utilize these services due to associated costs. This low uptake of health monitoring services suggests either that disease pressure is genuinely minimal, or that farmers may be underreporting health issues due to limited diagnostic capacity and financial constraints.

Weather Management

The Philippine fisheries and aquaculture sectors experience major losses during typhoons and extreme weather conditions. To cope with these weather-related challenges, cage and pond operators have adopted various strategies, but difficulties remain significant.

- Cage farmers typically cover their cages with nets to prevent fish escapes caused by strong winds and water currents. Despite these efforts, strong storms frequently cause fish to be washed ashore. Faced with this risk, many farmers resort to forced or early harvests, selling their produce at significantly reduced prices before the fish reach marketable size.
- Earthen pond operators face different challenges during typhoons, primarily involving overflow and breaching of dykes. In Pampanga, a major tilapia-producing province, typhoon-induced flooding frequently inundates ponds, causing massive stock losses and sediment runoffs that degrade water quality.[42]

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[42] *Lansangan, E. and Tubal, J. (2023) Impacts of Climate Change on Economic Performance of Tilapia Pond Operations in Minalin, Pampanga: A Case of Intensive Large-Scale Pond Culture. Open Journal of Ecology, 13, 516-523. doi: 10.4236/oje.2023.137031.*

Examples of Grow-out Facilities in the Philippines

Pampanga Ponds (Region III - Central Luzon)

The province of Pampanga represents a vast freshwater tilapia production area covering approximately 2,000 hectares, characterized by individual pond ownership rather than corporate operations. Most farms operate on a scale of 4-5 hectares, with pond ownership typically consisting of ancestral lands that make large-scale corporate acquisition difficult.

The production system faces significant challenges from climate change, particularly high temperatures that prevent tilapia breeders from reproducing above 34°C. Farmers also struggle with water management issues, including inability to drain ponds due to high river water levels and increasing salinity in water sources. These environmental stressors contribute to poor growth performance, with tilapia achieving only 3-4g/day compared to 8g/day in optimal rearing conditions.

Laguna Lake (Region IV-A - CALABARZON)

Laguna Lake represents the Philippines' largest freshwater area, featuring an estimated 3,000+ cages operated by small-scale farmers and numerous large pens (typically 1 hectare) run by bigger organizations. Both require permits from the Laguna Lake Development Authority (LLDA), though illegal structures proliferate due to weak enforcement and operators exploiting registration loopholes.

Cages are typically 10x10x4 meters, fully submerged and stocked with 5,000-7,000 fingerlings. High commercial feed costs, combined with LLDA's ban on commercial feeds to preserve water quality, drive most farmers to rely entirely on natural feeding, which extends grow-out periods to 1-1.5 years. Despite the feed ban, enforcement challenges persist as some farmers continue using inappropriate feeds. Overcapacity is severe, with LLDA declaring saturation even as new cage developments continue unchecked.

Sual Cages (Region I - Ilocos Region)

The coastal area close to Sual hosts many intensive fish cages. These intensive marine cages are primarily owned by large corporations and often set up using foreign investments. Operations in these mariculture parks are often better developed and of a higher standard, however secondary sources mentioned that these farms operate with high stocking densities (200-300k fish per cage) which leads to a wide range of welfare concerns. The coastal area itself faces severe overcrowding that exceeds natural carrying capacity, leading to environmental degradation from waste buildup and reduced water quality.

Welfare Concerns during Grow-out

With the grow-out stage being the longest life stage of fish it is essential that practices do not interfere with fish welfare to an unreasonable extent. Based on the literature and interviews with farmers, multiple welfare concerns were identified:

Water quality issues

Any deviations from the optimal water quality ranges can compromise the health and welfare of fish. To assess whether this is a large problem within the Philippines, farmers and academics were asked about their current understanding of water quality, and what efforts already exist to improve the water quality. There were three main findings on this topic:

1. Many fish are being kept in farm types that make influencing water quality difficult.

A large share of fish, 19% for tilapia and 39% of milkfish, are kept in pens or cages in natural bodies of water, either larger lakes or coastal areas with a free flowing exchange of water. Whilst some lakes did have centralized water quality readings, conducted by local authorities or farmer associations, there is little possibility to influence water quality on the farm level. These farms still had problems with water quality, with farms in the Seven Lakes area and Taal Lake being influenced by volcanic activity, farms in Laguna Lake being influenced by run-off of from large-scale industry and drinking water facilities near Manila, and the overcrowding of large mariculture parks leading to waste collection on the seabed.

2. Water quality knowledge of farmers is limited, with only basic understanding on the common parameters.

Interviewed farmers were not aware of most water quality parameters in their farms. Only basic knowledge of some water quality parameters, mostly dissolved oxygen (DO), was present. Two farmers had pumps installed, while other farmers use visual indicators of low oxygen (response to feeding).

One association of farmers conducts their own water quality measurements. One problem mentioned was the influence of climate change on water quality, which in some areas leads to higher water levels due to increased quantity and occurrences of rainfall, making it difficult for farmers to drain their ponds. And when possible the water was often too saline. These findings correspond with those reported by FWI in their scoping report.

3. Water degradation caused by feeds.

Sinking feeds, which remain common in Philippine aquaculture, influence water quality by increasing organic load and sedimentation when uneaten pellets accumulate at the bottom of ponds or cages. This accumulation exacerbates water quality issues such as increased total suspended solids, reduced dissolved oxygen, and nutrient enrichment, potentially triggering harmful algal blooms, fish stress, and disease outbreaks.[43] Floating feeds are beneficial for aquaculture operations and the surrounding environment.

In response to concerns about water quality degradation, agencies and LGUs have banned the use of commercial sinking feeds and all types of feeds in sensitive areas such as Taal Lake and Laguna Lake[44]. Despite these bans, some farmers resort to alternative feed sources like stale bread, which are not species-specific and contribute to pollution.

Completely banning commercial feeds has its downsides, as farmers often substitute with unsuitable human foods instead of using nutritionally-balanced, species-specific formulated feeds designed to support optimal fish health and environmental sustainability.

Mortality

Mortality rates on grow-out farms seem to vary, with rates ranging from 2% to as high as 70%. The exact cause of mortality is not apparent however some farmers mentioned water quality problems as the cause. According to fisheries experts, the timing of mortality following handling events provides clues to the cause: if mortality occurs within two weeks post-handling, handling stress is likely responsible. However, if mortality arises more than three weeks after handling, environmental factors such as water quality deterioration, temperature fluctuations, or disease are usually the main causes.

Fish kill events

Multiple farmers mentioned the occurrence of frequent fish kill events, which mostly seem to occur across freshwater lakes and mariculture sites. They are typically triggered by abrupt dissolved-oxygen crashes after heavy rains and temperature shifts. Harmful algal blooms (HABs) were also mentioned as a possible source of fish kill events, and seem to be a source of compromised fish health in general.

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[43] *Food and Agriculture Organization of the United Nations (FAO). (2020). National aquaculture sector overview: Philippines.*
[44] *Laguna Lake Development Authority (LLDA). (2021). Memorandum Circular No. 2021-01.*

Farmers in Laguna Lake mentioned having a 50% mortality rate due to these fish kill events. They reported that after these events the dead fish are buried or thrown into open water. Another farmer, based on Taalim Island, reported that these events occur every year, they notice them because their cages, which are fully submerged, start to become more buoyant and release bad odors, due to the rotting fish. One farmer mentioned a 90% mortality rate due to these fish kill events. Researchers at SEAFDEC describe these fish kill events as associated with eutrophic conditions—nutrient-rich environments prone to oxygen depletion—and note that these events are challenging to prevent. They are actively researching causes.

Fish health and diseases

Disease prevalence across visited sites appeared relatively low, with farmers reporting few infectious disease or parasitic problems. This observation was corroborated by discussions with government officials and academic researchers. Milkfish farmers reported no significant parasite or disease issues, while tilapia producers mentioned only Tilapia Lake Virus, though this was not identified as a major concern.

However, the apparent low disease incidence may reflect limited disease monitoring rather than genuine absence of health issues. Several factors suggest potential underreporting:

- **Limited diagnostic capacity:** While BFAR offers laboratory analysis services for fish health diagnostics, utilization by farmers remains limited. Many farmers are not aware of the diagnostic protocols or lack sufficient information on fish health management. Larger commercial farms and corporations often use private laboratories for advanced diagnostics like PCR, histology, and microbial tests, with some even having their own facilities, but these practices are rare among small- and medium-scale farmers due to cost and technical limitations.
- **Inadequate health screening:** At consignment points, fish are not systematically examined for external health problems, allowing diseased fish to potentially enter the supply chain undetected.
- **Observable health issues:** During harvest observations, fish displayed concerning symptoms including bacterial infections, missing eyes, and scale damage - indicators of potential disease.

Stocking Density

It is unclear how the stocking densities recommendations referred to in Table 10 relate to the welfare of milkfish and tilapia. Whilst it is in the interest of the industry to not overstress fish to an extent to which production is significantly affected, it might well be the case that the optimal stocking density for welfare is lower than that recommended for optimal production.

It is expected that stocking density is not a big problem for extensive or semi-intensive farms. However for intensive farms this is likely to be one of the larger welfare concerns. One secondary source mentioned that stocking densities in mariculture parks can be extremely high, also mentioning high mortality rates and fish kill events.

Harvest and Processing

Harvesting refers to the planned capture and removal of market-size fish from aquaculture systems for commercial sale. While procedures vary by species, farm type, and scale of operation, most harvest processes follow a standardized sequence:

1. **Pre-harvest fasting (12-24 hours)**
2. **Crowding and capture**
3. **Size grading and selection for market categories**
4. **Transport via chilled or live pathways**

The choice of processing pathway - live sales versus chilled processing - significantly influences handling methods and has substantial welfare implications for harvested fish.

Timing of Harvest

Harvest timing at visited farms was primarily market- and risk-driven. Farmers aim to meet buyer demand and preferred size grades (counts-per-kilo), often doing partial, selective harvests so marketable fish are sold while smaller fish continue growing.

- Milkfish harvesting similarly follows size and market demand. While a recommended market size is 400–500g, several interviewed farmers reported selling at smaller sizes (200–300g) when prices or cash-flow needs justify it.
- Tilapia are generally harvested once they reach buyer-preferred size grades; local wet markets often favour smaller fish (around 3–5 fish/kg, “pan-size”). Some producers noted that growing to larger sizes could be more efficient biologically but is constrained by demand. Some farmers also wait additional weeks to target better prices.

Once a farmer decides to (partially) harvest one of their farms the first step is feed withdrawal.

Pre-harvest Fasting

In all operations observed that actively supplemented feed, mandatory feed withdrawal was implemented 12-24 hours before harvest. This practice serves multiple stated purposes:

- Gut evacuation to prevent water quality deterioration during crowding
- Reduced fecal contamination during transport

- Perceived improvement in product quality when combined with post-harvest chilling

Extended fasting represents a significant stressor for fish, though farmers prioritize operational benefits over welfare considerations.

Crowding

Crowding methods vary across different types of farms. Multiple approaches are used to harvest milkfish or tilapia from ponds and pens. One common method observed was partial harvesting with a seine net: a group of workers, often contractors or friends of the farmer, slowly sweep a net from one side of the pond to the other, concentrating the fish in one corner. Another method used in pond-type farms involves draining the pond to crowd fish near the outlet.

In cage farms, existing nets are sometimes used to crowd fish into one section of the cage. Some farms employ extended crowding periods as part of their harvest strategy. Fish are transferred into much smaller crowding cages, also called conditioning nets, which serve dual purposes: facilitating transport to shore and inducing stress that farmers believe helps empty the fish's digestive system. This stress-induced evacuation is considered beneficial by farmers as it reduces the risk of fecal contamination during subsequent handling and transport. Two farmers reported keeping fish in these nets for roughly 4–5 hours.

Farm workers using a net to crowd and transport fish from a bamboo cage into a towable steel holding net (personal photo)

The duration of the crowding stage varies widely between farms. Some farmers reported that moving fish from the grow-out area into the smaller holding net took only about 30 minutes, while others described procedures lasting up to four hours.

Transport Pathways

After crowding, processes start to differ significantly depending on the type of farm and how the fish are to be sold. Almost all milkfish and a portion of tilapia harvested in the Philippines are transported and sold on ice, while the remaining share of tilapia are sold alive.

Chilled fish pathway

In a milkfish harvest, the fish are ideally transferred into crates immediately. SEAFDEC suggests chilling the fish in an ice water mixture using a 4:1 ratio (four standard size ice blocks per 1,000 kg of fish). However, the methods for this are not standardized and seem to vary from farm to farm. One farmer mentioned that their milkfish die from asphyxiation after roughly 2 minutes, after which they transfer them to boxes with ice. Another farmer mentioned transferring them directly into an ice slurry, which killed the fish after 5-10 minutes. Whether the fish were actually dead after the reported time intervals is uncertain, it is likely that this is only when they ceased moving.

Similar to milkfish, there does not seem to be a standardized method to harvest tilapia that end up being sold chilled. Tilapia appear more resistant to asphyxiation, with one farmer mentioning that they could stay alive outside of water for up to 1.5 hours. At one location, Taal Lake, a batch of tilapia destined to be sold chilled were transferred from the cages to a boat where multiple workers stored the tilapia in iced crates. Once the boat arrived at shore, the crates were moved onto a large transport truck headed for Manila. It is unclear how long the process from being taken out of the fish cage until death took, the tilapia stored in chilled crates being moved onto the truck were still moving.

Tilapia stored in transport box, tilapia were still gasping for air when picture taken.(personal photo)

Loading of boxes with chilled tilapia from boat to truck in Taal Lake (personal photo)

Live fish pathway

The other large share of tilapia are sold alive, commanding a premium of 20-30 PHP (0.35-0.53 USD) per kilogram over chilled fish. This pathway requires careful handling to maintain fish viability throughout the supply chain. Fish are transported in aerated water trucks or smaller vehicles to markets, where they are kept in shallow basins that allow consumers to verify the fish are still alive. The live presentation is strongly preferred by consumers who associate it with freshness. According to one source, this preference for living fish is a remnant from when China imported large amounts of low quality fish and meat into the Philippines, all product coming from China was frozen, whilst the higher quality product from the Philippines was still alive.

At the point of sale, **market vendors process the fish while they remain conscious**. This process includes cutting fins and tails, de-scaling, evisceration, making gill cuts, and finally beheading. Fish appear to remain conscious throughout most of this process, likely only losing consciousness after being beheaded and cut into pieces. Vendors clubbed the head of tilapia to immobilize them for easier cleaning and preparation, though this is often done without targeting specific parts of the fish, resulting in fish that are temporarily immobilized (often not even the case) but not fully rendered unconscious.

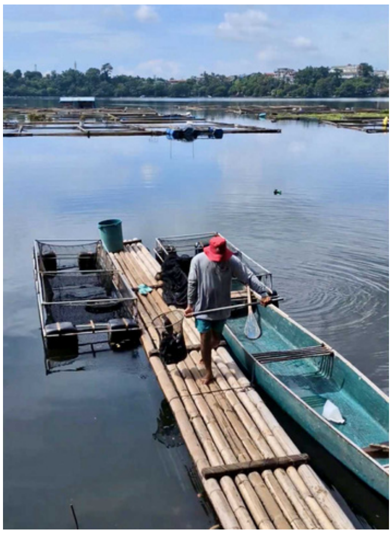
Tilapia kept in shallow market basins to be sold at San Pablo market (personal photo)

Tilapia being de-scaled whilst still alive, after having just had their fins cut off with scissors (personal photo)

Sampaloc Lake Example

One operation visited was a harvest happening at Sampaloc lake. Observations started when tilapia were being transferred from a holding net onto land. The tilapia had previously been moved from a cage farm in the lake to a smaller towing cage that was transported to a pier where the fish could be taken out using brailer nets (a large, bag-shaped scoop net for transferring live fish). The tilapia were kept in this smaller towing cage for 4 hours with the purpose of stressing them out, a method often used to get the fish to empty their guts.

On shore, a team member was sorting the tilapia into different tubs based on size. From the moment that the tilapia were taken out of the towing cage until they arrived at the market, the fish were left in open air. It was estimated that this entire process took around 30-45 minutes. Invasive species that were also caught in the harvest were removed and left to suffocate on the side. After sorting by size, the fish were weighed (with the weights noted by the buyer), after which the tubs were stacked onto a tricycle. This tricycle was transporting the tilapia to a San Pablo market, a local market, roughly 10-20 minutes away.



Fish being transferred from towing to shore using brailer nets (personal photo).

Fish being weighed and sorted in tubs (personal photo)

Tubs stacked in tricycle (personal photo)

Pampanga Example

In Pampanga, just north of Manila, small boats arrived filled with tilapia, with transport between the farm and port reported to take around 30 minutes. The tilapia were then transferred to the floor of the consignment area, where buyers used scales to weigh the fish. During the visit, a pile of tilapia was left on the floor, clearly still alive.

After being sold, the tilapia were transported using specially built tricycles equipped with aeration systems. While the destination was not known, the small volume of fish and means of transport suggested they were likely headed to a local market, similar to San Pablo market, to be sold alive. One person at the market reported that around 90% of tilapia traded at this port were sold alive. Chilling was only used for batches that farmers were unable to sell the same day as harvesting.

Pampanga also supplies tilapia to Manila. Large aerated trucks were observed transporting live tilapia to larger cities, primarily Manila. These trucks would arrive at Manila markets early in the morning, suggesting that fish were kept in transport conditions for multiple hours, where the fish would be sold at local markets. The exact conditions at Manila markets were difficult to observe due to the specific time window during which the fish were sold.

Tilapia being transported by boat from farm to consigment (personal photo)

Aerated trucks used for transport of live tilapia between Pampanga and Manila (personal photo)

Consignment Process

Before reaching their final destination, most fish pass through a consignment system where farmers sell to middlemen, who in turn sell to retailers or markets. Not all fish go through this consignment step, some larger-scale farmers mentioned having direct contracts with local restaurants or retailers. However, the majority of fish end up being sold to the highest bidder at the consignment lot.

During this consignment stage, fish are often left to suffocate on the ground regardless of whether they are destined for chilled or live sale pathways. Consigners interviewed only seemed to evaluate the quantity and size of the fish; they did not inspect for diseases, injuries or other quality aspects. However, farmers did mention that in some cases a diseased batch of fish could lead to a lower selling price.

It should be noted that the process between farm and consumer is more complex than just one consignment step—this process depends on the location, with some areas having additional parties involved.

The following sections detail the specific handling and transport methods for each pathway, beginning from the point fish are removed from crowding nets:

Post-harvest Processing

A selection of fish that have been harvested are not chilled or sold live, these go through additional processing steps that can include: deboning, gutting, marinating, smoking and drying. This part of the process was not researched in as much detail because as far as currently known the fish are dead when they arrive at this stage, making it less relevant from a welfare perspective.

Welfare Concerns during Harvest and Transport

Whilst the entire harvesting process is likely extremely stressful for the fish there are a couple of stages that stand out.

Live selling pathway

Fish that die through asphyxiation or die on ice have a long and stressful end of their life, however it is expected that the fish that get sold live have an even worse end due to the additional transport, which can range from 30 minutes to multiple hours or even a day, and having fins and tails cut off, de-scaling, evisceration, making gill cuts, and finally beheading.

Crowding

Crowding practices during harvest and pre-transport can pose significant welfare risks for milkfish and tilapia. When fish are packed too densely, whether in seine nets, conditioning nets, or smaller holding cages, oxygen levels can drop quickly, movement is restricted, and stress hormones rise. Prolonged or repeated crowding may lead to exhaustion, suppressed immune function, and increased susceptibility to disease.

Physical injuries are also common during crowding. Nets used to confine fish can cause abrasions, scale loss, torn fins, and eye damage as fish rub against the mesh or collide with each other. These effects were evident in our observations: at landing sites, many fish arrived with missing scales and some with missing eyes, indicating substantial handling-related injuries during crowding and transport. Such injuries not only compromise welfare but can also reduce product quality and shelf life.

Tilapia Aquatic Surface Respiration caused by overcrowding and low DO (personal photo)

Overview of Farmed Fish Welfare Concerns in the Philippines

The scoping visit and review of external sources have brought to light several welfare issues that occur in aquaculture settings in the Philippines. In this section we provide a list of the problems that seem to cause the most suffering to farmed fish in the Philippines. The main factors that go into this are the duration and the intensity of suffering experienced by the individual fish. This does not yet incorporate possible interventions to improve welfare, as that is outside the scope of this report.

This list is not conclusive and there are likely more welfare problems that did not come to light during our scoping visit.

1. Slaughter

Although limited in duration compared to problems that occur during other life stages, the suffering intensity is likely high. Aquatic animal slaughter is a significant problem worldwide, with most industries not incorporating any equipment to render animals unconscious before being killed. Harvesting methods used for milkfish in the Philippines seem similar to how species in the Mediterranean or India would be processed (ice chilling), whilst there might be solutions for this in the long term, for now there do not seem to be clear solutions to improve this process, besides trying to reduce the time duration.

For tilapia the extent of suffering involved in the journey from farm to consumer depends on the way it is to be sold. Whilst chilled tilapia undergo a similar death to milkfish, increased welfare concerns seem to be involved for tilapia that are sold alive. Whilst there are no studies looking into the stress involved in this process, it seems likely that crowded transport, holding in markets, and unstunned processing make for a worse end to a fish’s life.

2. Fish Kill Events

Fish kill events are sudden, mass mortality occurrences where large numbers of fish die simultaneously due to rapidly deteriorating environmental conditions. These events represent a significant welfare concern affecting both freshwater and marine aquaculture operations across the Philippines.

Multiple farmers reported these events as recurring annual occurrences, with devastating mortality rates ranging from 50% in Laguna Lake operations to as high as 90% reported by cage farmers on Talim Island.

3. High Mortality in Hatcheries and Grow-out

Excessive mortality rates throughout the production cycle represent a major welfare concern, indicating widespread fish suffering across Philippine aquaculture operations. Mortality levels vary dramatically between facilities, with some farms reporting mortality rates up to 70%.

Early life stages are particularly vulnerable, with substantial losses occurring during the critical larval-to-juvenile transition in hatcheries. The shortage of domestic fry production compounds these issues, forcing operators to overcrowd facilities to maximize output from limited hatchery capacity.

High mortality rates provide clear evidence of compromised welfare conditions, as healthy fish in appropriate environments should experience relatively low natural death rates. The exact cause for these mortalities is often not known.

4. Water Quality

Poor water quality represents a widespread welfare concern across Philippine aquaculture, creating chronic stress conditions that compromise fish health throughout their production cycle. A substantial proportion of fish - 19% of tilapia and 39% of milkfish - are raised in pens or cages within natural water bodies where farmers cannot directly influence water quality parameters, facing external contamination from industrial runoff, volcanic activity, and waste accumulation in overcrowded areas.

Pond operations also reported significant water quality problems, though farmer knowledge remains extremely limited. Most operators rely on basic visual indicators, with dissolved oxygen being the only parameter some farmers mentioned monitoring. However, it is likely that other critical parameters such as ammonia, nitrates, and pH are also problematic but simply go unrecognized and unmeasured.

Next Steps

The information included in this report forms the basis for our future work in the Philippines. Scale Welfare will use these findings to:

Prioritize Interventions: Analyze the welfare concerns identified to determine which issues affect the most animals, cause the most severe suffering, and offer the greatest potential for practical improvement.

Develop Targeted Programs: Create solutions tailored to the local context, production systems, and farmer constraints documented throughout this study.

Build Strategic Partnerships: Work with the cooperatives, research institutions, and government agencies contacted during this research to implement welfare improvements at scale.

Expand Research Coverage: Address the limitations identified in this scoping by engaging with additional stakeholders and production systems not covered in the initial assessment.

Scale Welfare's next phase of work will translate these research findings into actionable welfare improvements that benefit both fish and farmers across the Philippine aquaculture industry.

Acknowledgments

We extend our sincere gratitude to the Bureau of Fisheries and Aquatic Resources (BFAR) - National Fisheries Development Center (NFDC), Samahan ng mga Magbabangus ng Pangasinan Agriculture Cooperative (SAMAPA), Regional Mariculture Technology Demonstration Center (RMaTDEC), BFAR IV-A Regional Office, Los Baños MFARMC, Sampalok Lake Fisherfolk Agriculture Cooperative (SLFAC), Taal Lake Aquaculture Alliance Inc. (TLAAI), Philippine Tilapia Stakeholders Association, Central Luzon State University College of Fisheries, BFAR National Freshwater Technology Center (NFTC), SEAFDEC Binangonan Freshwater Station, SEAFDEC Aquaculture Department, and SEAFDEC Igang Marine Station for their valuable assistance and cooperation during our scoping visit. We also thank all the individual hatchery and farm operators who generously shared their time and insights with us. Their knowledge and openness were essential to this research.

We are grateful to Alathea Faye Cendana and Reynaly Shen Javier for their assistance with organizing our visit, and to Rae Phillips-Smith for her help with the design of this report.

Any errors or omissions in this report remain our responsibility.

Appendix A - Locations visited

Region	Province	Facility Type	Aquafarm Type	Species Cultured	Stage of Culture
Ilocos Region (Region I)	Pangasinan	Private Farms (5)	Earthen Pond (4); Cages (1)	Milkfish	Grow-out, Hatchery
		Government Institution (2)	Concrete Tanks (1); Marine Cages (1)	Milkfish, Molobicus Tilapia, Freshwater Prawn, Catfish, Oyster Seabass, Pompano	Hatchery
CALABARZON (Region IV-A)	Laguna	Private Farms / Individuals (11)	Cages (5), Pens (2), Earthen Pond (4)	Tilapia, Milkfish, Catfish, Pangasius	Grow-out, Hatchery
		Wet Market		-	-
	Batangas	Private Farms / Individuals (3)	Earthen Pond (1); Cage (2)	Tilapia, Milkfish,	Grow-out, Hatchery
	Rizal	Research Institution (NGO) (1)	Concrete Tank (1)	Ayungin, Freshwater Prawn, Eel	Hatchery
		Consignment (1)	-	-	-
Central Luzon	Nueva Ecija	Academe (1)	Concrete Tanks; Earthen Pond	Tilapia, Catfish	Hatchery, Grow-out
		Government Institution (1)	Modified Hatchery; Earthen Pond	Tilapia	Hatchery, Nursery
	Pampanga	Private Farms / Individuals (1)	Earthen Pond	Tilapia	Grow-out
		Consignment (1)	-	-	-
Western Visayas	Iloilo	Research Institution (NGO) (2)	Concrete Tanks; Marine Cages	Milkfish, Tilapia, Mangrove	Hatchery, Grow-out
NCR	Navotas	Fishport	-	-	-
	Cubao	Farmers' Market	-	-	-

Appendix B

Scale Welfare Field Survey Form

Company/Institution/Organisation Name

Location

Farm Operator/Contact Person

Email

Phone

Viber

Facebook

Section 1: Farm Profile

1. Q: What kind of facility do you run? (earthen pond, cage, tank, etc.)
Tagalog: Anong uri ng pasilidad ang pinapatakbo ninyo?

2. Q: How big is your farm and what is your water source?
Tagalog: Gaano kalaki ang inyong bukirin at saan nanggagaling ang tubig?

3. Q: Can you describe your pond setup?
Tagalog: Maari nyo bang ilarawan ang inyong disenyo o estruktura ng palaisdaan?

4. Q: Surface area and average depth?
Tagalog: Gaano kalawak at gaano kalalim ang palaisdaan?

5. Q: Liner or natural soil bottom?
Tagalog: May lining ba ito o natural na lupa ang ilalim?

6. Q: What species do you farm?
Tagalog: Anong mga uri ng isda o hayop sa tubig ang inaalagaan ninyo?

7. Q: Why did you choose to farm this species or strain?
Tagalog: Bakit ito ang napiling uri ng isda

8. Q: Which life stages do you usually keep on-site? (fry, fingerlings, grow-out, market size)
Tagalog: Anong yugto ng buhay ng isda ang karaniwang nasa palaisdaan? (larva, fingerling, palakihin, market size)

9. Q: What is your stocking density?
Tagalog: Ilan ang inilalagay ninyong isda kada unit ng espasyo?

10. Q: What is the usual volume of your harvest? (pieces / kilo)
Tagalog: Gaano kadami ang karaniwang inaaani? (piraso kilo)

Section 2: Farm and Feeding Management

1. Q: Where did you learn aquaculture practices?
Tagalog: Saan po kayo natuto ng pagpapalaki ng isda?

2. Q. Describe a typical farm operation.
Tagalog: Ilarawan ang tipikal na araw sa palaisdaan?

3. Q: What kind of feed do you use? (brand, on-farm mix, by-products)
Tagalog: Anong uri ng pakain ang inyong ginagamit?

4. Q: How often do you feed your stock?
Tagalog: Gaano kadalas kayo nagpapakain?

5. Q: Do you monitor feed consumption?
Tagalog: Minomonitor ba ninyo kung gaano karami ang nakakain ng isda?

6. Q: How much per day, and how many times do you feed?
Tagalog: Gaano karami kada araw at ilang beses kayo nagpapakain?

7. Q: Do you check for left-over feeds?
Tagalog: Tinitingnan n'yo ba kung may natirang pakain?

Section 3: Water Quality

1. Q: Do you monitor water quality? If yes, how? (kits, lab, visual cues)
Tagalog: Minomonitor niyo ba ang kalidad ng tubig? Kung oo, paano? (kits, lab, visual na obserbasyon)

2. Q: How often do you take readings?
Tagalog: Gaano kadalas kayo sumusukat?

3. Q: Which parameters do you track most? (DO, pH, temp, ammonia, salinity…)
Tagalog: Anong mga parametro ang kadalasang sinusukat? (DO, pH, temperatura, ammonia, alat, atbp.)

4. Q: Which parameters lead to the most problems?
Tagalog: Aling mga parametro ang karaniwang nagdudulot ng problema?

5. Q: Does anyone else in the chain test your water or fish?
Tagalog: May iba pa bang sumusuri sa tubig o isda? (hal. vet, technician, feed rep)

Section 4: Harvest Practices

1. Q: What is your production cycle duration?
Tagalog: Gaano katagal ang isang cycle ng pagpapalaki hanggang anihan?

2. Q: Walk us through a typical harvest day—how are the fish collected and handled?
Tagalog: Ikuwento ninyo ang isang tipikal na araw ng anihan—paano kinokolekta at hinahawakan ang isda?

3. Q: Who leads the harvest—your team or the buyer's crew?
Tagalog: Sino ang nangunguna sa anihan—kayo o ang grupo ng mamimili?

4. Q: Once a fish leaves the water, how long before it stops moving?
Tagalog: Pagkaalis ng isda sa tubig, gaano katagal bago ito tumigil sa paggalaw?

5. Q: How many people do you bring in for harvest?
Tagalog: Ilang tao ang karaniwang kasali sa anihan?

6. Q: Do you prep the pond in the week before? (grading, fasting, lowering water, etc.)
Tagalog: Pinaghahandaan niyo ba ang palaisdaan bago ang anihan? (grading, puyat, pagbaba ng tubig, atbp.)

Section 5: Supply Chain

1. Q: Who buys your fish? (trader, wholesaler, processor, direct retail)
Tagalog: Sino ang bumibili ng inyong isda? (trader, wholesaler, processor, direct retail)

2. Q: Are they sold in the Philippines or exported?
Tagalog: Ibinebenta ba ito sa Pilipinas o ine-export?

3. Q: What mainly sets the price you get? (size, season, buyer specs, certification, etc.)
Tagalog: Ano ang pangunahing batayan ng presyo ng isda? (laki, panahon, specs ng buyer, sertipikasyon, atbp.)

4. Q: Where do you source fingerlings/fry?
Tagalog: Saan kayo kumukuha ng fingerlings o larva?

5. Q: Do you get any government support or subsidies? If yes, what form does it take?
Tagalog: May nakukuha ba kayong suporta o subsidiya mula sa gobyerno? Kung oo, anong uri ito?

6. Q: In what form do you sell the fish?
Tagalog: Sa anong anyo ninyo ibinebenta ang isda?

7. Q: Live, whole on ice, gutted, filleted, etc.?
Tagalog: Buhay, buo na may yelo, tanggal ang laman-loob, hiwa-hiwa, atbp.?

8. Q: Any special packaging?
Tagalog: May espesyal bang pagbalot?

9. Q: Do buyers or end-consumers know where the fish came from?
Tagalog: Alam ba ng mga mamimili kung saan galing ang isda?

10. Q: What happens to the fish between your gate and the final customer?
Tagalog: Ano ang nangyayari sa isda mula sa inyo hanggang sa huling mamimili?

Section 6: Problems Encountered in Aquaculture

1. Q: What are the most common problems you face in your farm?
Tagalog: Ano ang mga karaniwang problema na inyong nararanasan sa bukirin?

2. Q: Have you experienced high mortality rates? If yes, when and why?
Tagalog: Naranasan n'yo na ba ang mataas na dami ng namamatay na isda? Kung oo, kailan at bakit?

3. Do you encounter frequent disease outbreaks?
Tagalog: Nakakaranas ba kayo ng madalas na pagkalat ng sakit?

4. What are the common diseases or parasites in your area?
Tagalog: Ano ang karaniwang sakit o parasito sa inyong lugar?

5. Do you have access to reliable veterinary or diagnostic services?
Tagalog: May access ba kayo sa maaasahang serbisyo ng beterinaryo o diagnostic lab?

6. Have you experienced water quality issues? (e.g., low DO, high ammonia)
Tagalog: Naranasan n'yo na ba ang mga problema sa kalidad ng tubig? (hal. mababang DO, mataas na ammonia)

7. Do you have problems with feed availability or quality?
Tagalog: May problema ba kayo sa pagkakaroon o kalidad ng pakain?

8. Q: Are you affected by changes in climate or weather?
Tagalog: Apektado ba kayo ng pagbabago ng klima o panahon?

9. Q: Do you experience poaching, theft, or predator attacks (e.g., birds, snakes)?
Tagalog: Nakakaranas ba kayo ng pagnanakaw o paninila ng mga hayop (hal. ibon, ahas)?

10. Q: What challenges do you face in marketing or selling your fish?
Tagalog: Anong mga hamon ang inyong nararanasan sa pagbebenta ng isda?

11. Q: Do middlemen or buyers affect your income negatively?
Tagalog: Nakakaapekto ba nang masama sa kita ninyo ang mga middleman o mamimili?

12. Q: Do you receive enough training or technical advice?
Tagalog: Nakakatanggap ba kayo ng sapat na pagsasanay o teknikal na gabay?

13. Q: What improvements would help you solve these challenges?
Tagalog: Anong mga pagbabago ang makakatulong upang malutas ang mga problemang ito?

Section 7: Technologies and Interventions in Aquaculture

1. Q: Do you use antibiotics or other meds? If yes, when and why?
Tagalog: Gumagamit ba kayo ng antibiotics o gamot? Kung oo, kailan at bakit?

2. Q: Have you adopted any modern technology on your farm?
Tagalog: Nagamit n'yo na ba ang makabagong teknolohiya sa inyong bukirin?

3. Q: What type of technology have you tried? (e.g., aerators, sensors, RAS, automatic feeders)
Tagalog: Anong klaseng teknolohiya na ang inyong nasubukan? (hal. aerators, sensors, RAS, automatic feeders)

4. Q: What improvements did you notice after using technology?
Tagalog: Anong mga pagbabago ang inyong napansin matapos gumamit ng teknolohiya?

5. Q: If you haven't adopted any modern technology, have you considered investing in equipment? What would encourage you to try it?
Tagalog: Kung hindi pa gumagamit ng makabagong teknolohiya, naisipan niyo na bang gumamit? Ano ang maghihikayat sa inyo na subukan ito?

6. Q: What prevents you from using more advanced equipment or systems?
Tagalog: Ano ang pumipigil sa inyo para gumamit ng mas modernong kagamitan o sistema?

7. Q: Would you be open to trying new technologies if support or training is provided?
Tagalog: Bukas ba kayo sa pagsubok ng bagong teknolohiya kung may kasamang suporta o pagsasanay?

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