ISSN: 2945-4387

NATIONAL MILKFISH INDUSTRY ROADMAP 2021-2040

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Masaganang Mataas na ANI KITA

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Published by:

BUREAU OF FISHERIES AND AQUATIC RESOURCES
Fisheries Building Complex, BPI Compound, Visayas Ave., Quezon City
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NATIONAL MILKFISH INDUSTRY ROADMAP 2021-2040

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MESSAGE

Roadmap development is one of the major thrusts of the Department of Agriculture (DA). And so, it is my delight to see the Philippine Milkfish Industry Roadmap (2021-2040) finally reached completion and come to reality. Thanks to the relentless and collective efforts of the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR), Philippine Council for Agriculture and Fisheries (PCAF) and of course, to the unwavering commitment of the private stakeholders that actively supported this endeavor. Indeed, this industry roadmap is a result of a fruitful partnership between the government and the private sector.

Milkfish is regarded as the national fish of the country because of its commercial and economical importance for the Filipinos. In fact, Philippines is recognized as the second largest producer of milkfish in the world with a total production of 416,315 metric tons (MT) in 2020. I believe this commendable production performance can still achieve more through the harmonized actionable plans, strategic priorities and developmental initiatives indicated in this industry roadmap.

Anchored to the DA Food Security Plan Framework and the One-DA Reform Agenda, the Philippine Milkfish Industry Roadmap (2021-2040) will serve as guide towards a more resilient, sustainable, and modern milkfish industry. With the roadmap in place, common industry goals and targets are now being seen clearer than before. This document will help enable the milkfish value chain players to effectively strategize and seriously elevate their game while significantly contributing to the milkfish industry development and to food security.

Truly, this endeavor shall be just one of the big steps of the Department of Agriculture through the Bureau of Fisheries and Aquatic Resources in improving fisheries productivity and empowering stakeholders towards inclusive growth, global competitiveness and climate change adaptation. May this roadmap rightly serve its purpose and catalyze for social and economic transformation creating a more food secure Philippines and prosperous Filipino fisherfolks.

Isang Masaganang Ani at Mataas na Kita para sa lahat. Mabuhay ang Sektor ng Pangisdaan!

WILLIAM D. DAR, Ph.D.
Secretary, Department of Agriculture

"A food-secure Philippines with prosperous Farmers and Fisherfolk"

Masaganang ANI Mataas na KITA

MESSAGE

Aptly regarded as the national fish of the Philippines, milkfish has become one of the most important fishes, economically and commercially for Filipinos. In 2020 alone, milkfish production shared 416,315 metric tons or 17.9% of the total fisheries production that contributed about Php 43.5 billion to the Gross Domestic Product of the country. Globally, the Philippines currently ranks second in milkfish production. It behooves us to repay this contribution by nurturing this thriving industry so that we may harness its fullest potential and sustain its performance.

We are proud to present this Philippine Milkfish Industry Roadmap (2021 – 2040) which is a product of extensive and participatory consultation among milkfish stakeholders across the milkfish value chain. The Philippine Milkfish Industry Roadmap (2021-2040) defines the short- (2021-2025), medium- (2026-2030) and long-term (2031-2040) plans for sustainable development of the Philippine milkfish industry. It also outlines the roles and responsibilities of various sectors including the government and non-governmental organizations, research and academic institutions, as well as the private sector in achieving the common goals and targets set for the industry.

This roadmap embodies that vision of milkfish stakeholders of a globally competitive, equitable, and sustainable milkfish industry that is modern, fry self-sufficient, market-oriented, and private sector-led with a strong government support promoting increased livelihood opportunities among its stakeholders. For this purpose, the roadmap mainly focuses on strengthening governance and investing on ecologically sound, industry-driven milkfish technologies and facilities.

The Department of Agriculture's Bureau of Fisheries and Aquatic Resources commits its full support in the implementation of this roadmap, towards creating a meaningful contribution for our shared vision of a food-secure Philippines, with prosperous fisherfolk, free from hunger and poverty.

Maraming salamat at Mabuhay ang ng Pangisdaan!

COMMODORE EDUARDO B GONGONA, PCG (Ret.)
BFAR National Director

MESSAGE

The milkfish industry was able to contribute 17.9% of total fishery production of 2020. About 43.5 billion pesos share to our economy that provided good food and good livelihood to millions. In spite of the challenges and issues still need to be settled within the industry, all of this was accomplished.

Imagine now that we have a Milkfish Industry Roadmap to guide us, one that the industry worked on together under the leadership of RD Wilfredo Cruz (BFAR Milkfish Commodity Focal), the more we can create inclusive livelihood to produce good food and nurture our God given natural resources.

More good food of a native species for our people and the world.

Mabuhay ang Industriya Ng Pangisdaan!

Food Security can only be achieved by producing beyond our needs, anything else is an illusion if not a lie...

NORBERTO O. CHINGCUANCO
Milkfish Roadmap Development Team Leader
Member, NFARMC
Member, Governing Board of NFRDI
Convenor, Tugon Kabuhayan
VP for Corporate Planning, Feedmix Specialists Inc. II


DEPARTMENT OF AGRICULTURE
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AAGR	Average Annual Growth Rate
AGR	Annual Growth Rate
ABC	Agribusiness Corridor
ABI	Agribusiness Incubator
ACPC	Agricultural Credit Policy Council
AFC	Automatic Fry Counter
AFF	Agriculture, Fishery and Forestry
ATI	Agricultural Training Institute
BA-SD	Barangay Assembler – Small Distributor
BA-LD	Barangay Assembler – Large Distributor
BACs	Bayanihan Agri Clusters
BAFS	Bureau of Agriculture and Fisheries Standards
BAI	Bureau of Animal Industry
BAP	Best Aquaculture Practices
BAR	Bureau of Agricultural Research
BARMM	Bangsamoro Autonomous Region for Muslim Mindanao
BAS	Bureau of Agricultural Statistics
BBSB	Big Brother-Small Brother
BCR	Benefit-Cost Ratio
BFAR	Bureau of Fisheries and Aquatic Resources
BFAR-FAO	BFAR Fisheries Administrative Order
BFAR-ROs	BFAR Regional Offices
BFRS	Brackishwater Fisheries Research Station
BOP	Buyers Outside the Province
CALABARZON	Cavite, Laguna, Batangas, Rizal, Quezon
CAR	Cordillera Autonomous Region
CDA	Cooperative Development Authority
COVID-19	Coronavirus Disease 2019
DA	Department of Agriculture

DA-BAR	Department of Agriculture-Bureau of Agriculture Resources
DA-PRDP	Department of Agriculture-Philippines Rural Development Project
DAR	Department of Agrarian Reform
DBP	Development Bank of the Philippines
DENR	Department of Environment and Natural Resources
DLSU	De La Salle University
DOF-BOC	Department of Finance-Bureau of Customs
DOH	Department of Health
DOLE	Department of Labor and Environment
DOST	Department of Science and Technology
DOST-PCAARRD	Department of Science and Technology -Philippines Council for Agriculture, Aquatic and Natural Resources Research Development
DRMM	Disaster Risk Reduction Management
DTI	Department of Trade and Industry
DTI-BOI	Department of Trade and Industry-Board of Investment
DTI-EMB	Department of Trade and Industry-Expert Marketing Bureau
ECC	Environmental Compliance Certificate
EU	European Union
FAO	Food and Agriculture Organization
FARMCs	Fisheries and Aquatic Resources Management Council
FC	Fish Cage
FCR	Feed Conversation Ratio
FDA	Food and Drugs Authority
FFRDC	Freshwater Fisheries Research and Development Center
FIQD	Fisheries Inspection and Quarantine Division
FIQS	Fisheries Inspection and Quarantine Services
FLA	Fishpond Lease Agreement
FMA	Fisheries Management Area
FNRI	Food and Nutrition Research and Institute
GAqP	Good Aquaculture Practices
GDP	Gross Domestic Product
GMP	Good Manufacturing Practices

GVA	Gross Value Added
HACCP	Hazard Analysis Critical Control Point
HDPE	High Density Polyethylene
IBH	Integrated Broodstock and Hatchery
IEC	Information and Education Campaign
IMTA	Integrated Multi-Trophic Aquaculture
IRA-LD	Interregional Assembler – Large Distributor
IRA-MD	Interregional Assembler – Medium Distributor
IRR	Internal Rate of Return
KG	Kilogram
KRAs	Key Result Areas
LBP	Landbank of the Philippines
LGU	Local Government Unit
LTP	Local Transport Permit
MA-LD	Municipal Assembler – Large Distributor
MA-SD	Municipal Assembler – Small Distributor
MIMAROPA	Occidental Mindoro, Oriental Mindoro, Marinduque, Romblon, and Palawan
MP	Mariculture Park
MT	Metric Ton
NAIA	Ninoy Aquino International Airport
NCR	National Capital Region
NEDA	National Economic Development Authority
NFLD	National Fisheries Laboratory Division
NFRDI	National Fisheries Research and Development Institute
NGAs	National Government Agency
NGO	Non-Government Organization
NIFTDC	National Integrated Fisheries Technology Development Center
NIPAS	National Integrated Protected Area System
OFWs	Overseas Filipino Workers
OIE	World Animal Health Organization
PA-MD	Provincial Assembler – Medium Distributor
PAFES	Provincial Agriculture and Fisheries Extensions Services

PCIC	Philippine Crop Insurance Corporation
PFOs	Provincial Fisheries Officers
PMIR-SC	Philippine Milkfish Industry Roadmap- Steering Committee
PP	Payback Period
PPP	Private Public Partnership
PRDP	Philippine Rural Development Project
PSA	Philippine Statistic Authority
PSPs	Policies, Strategies and Programs
R&D	Research and Development
RA-LD	Regional Assembler – Large Distributor
RDIs	Research and Development Institutions
RDT	Roadmap Development Team
ROI	Return of Investment
RSBSA	Registry System for Basic Sectors in Agriculture
SAPA	Special Use Agreement for Protected Areas
SCBLRF	Satellite Community-Based Larval Rearing Facilities
SEAFDEC/AQD	Southeast Asian Fisheries Development Center/Aquaculture Department
SEC	Security and Exchange Commission
SOCCKSARGEN	South Cotabato, Cotabato City, Sultan Kudarat, Sarangani, General Santos City
SOP	Seller Outside the Province
SRP	Suggested Retail Price
SSOP	Sanitation Standard Operating Procedure
SUCs	State Universities and Colleges
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TWG	Technical Working Group
UK	United Kingdom
UPV	University of the Philippines-Visayas
USA	United State of America
USD	US Dollars
VC	Value Chain
VCA	Value Chain Analysis

EXECUTIVE SUMMARY

The Philippine Milkfish Industry Roadmap defines the short- (2021-2025), medium- (2026-2030) and long-term (2031-2040) plans for sustainable development of the milkfish industry. It also outlines the roles and responsibilities of various sectors including the government and non-government agencies, research and academic institutions, as well as the private sector in achieving the common goals and targets set for the industry. The roadmap answers the general questions: Where are we? Where do we want to go? How do we get there?

The general objective of the roadmap is to gear up the Philippine Milkfish Industry towards global competitiveness and climate change resilience through setting up of priority policies, strategies and programs (PSPs) that will enhance and sustain milkfish production, accelerate local economy, increase job opportunities and income for milkfish farmers, and diversify value-added products.

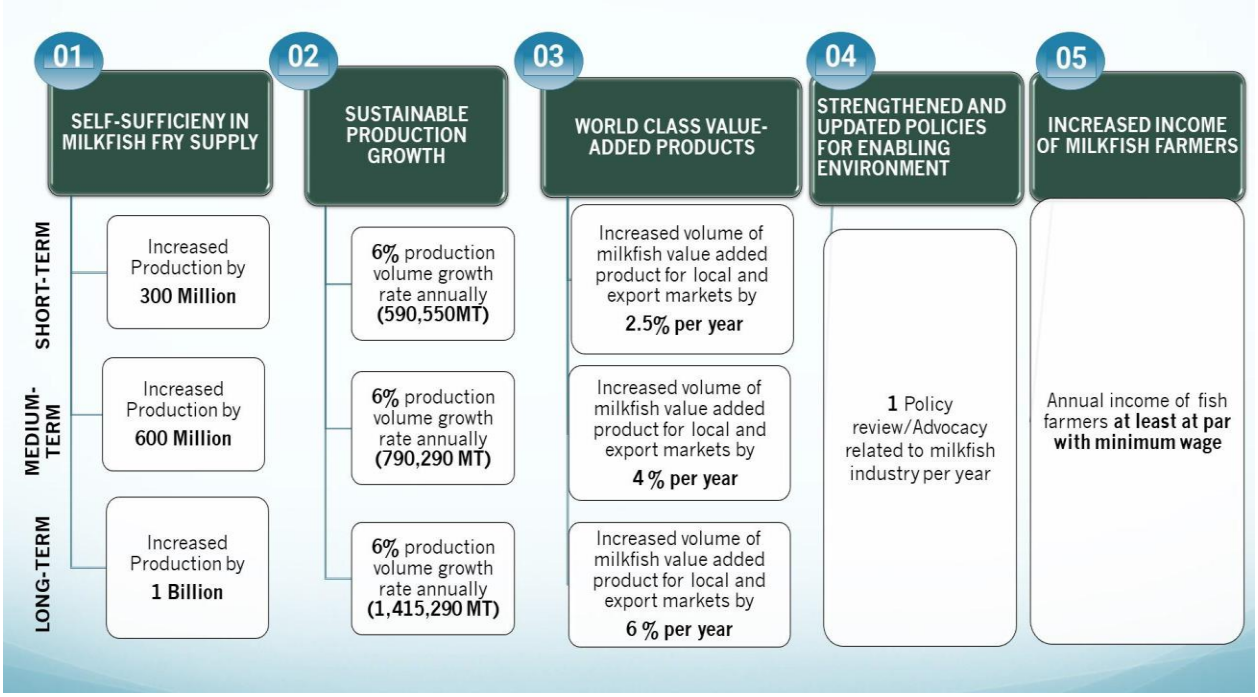
In crafting this Industry Roadmap, the value chain approach was used as the primary planning tool. Moreover, the roadmap is also aligned to the Food Security Plan Framework of the Department of Agriculture (DA) and with the One-DA Reform Agenda.

With the "new normal" situation due to COVID-19 pandemic, consultation-workshops and meetings with milkfish hatchery operators, farmers, processors, traders, research institutions, and Regional Milkfish Focal Persons were done online. Secondary data from Philippine Statistics Authority (PSA), Bureau of Agricultural Statistics (BAS), Bureau of Fisheries and Aquatic Resources (BFAR) Provincial/Regional Offices, DA) websites of international organizations like the Food and Agriculture Organization (FAO) Fisheries and Aquaculture Statistics and internet searches were also utilized.

In 2020, milkfish production contributed 17.9% to total fisheries production and Php 43.5 billion to the Gross Domestic Product (GDP). This is equivalent to about 2.5% to the country's Gross Value Added (GVA) on Agriculture, Fishery and Forestry (AFF). Moreover, the potential of milkfish culture to reduce poverty is closely linked to its ability to create jobs and self-employment in the communities. About 10% of the 36.8 kg of annual fish consumed by an average Filipino household is milkfish. In terms of market and trade, milkfish is one of the largest volumes of fish merchandized everyday in almost all public markets in the Philippines.

The milkfish stakeholders envision to produce quality and globally competitive milkfish for both Filipinos and foreign consumers in a sustainable way as indicated in its vision: "A globally competitive, equitable and sustainable milkfish industry that is modern, fry self-sufficient, market-oriented, and private sector-led with a strong government support promoting increased livelihood opportunities among its stakeholders."

The goals, objectives and targets for the industry within the planning period are depicted below:



Despite its significant contribution to the economy and food security, milkfish industry is challenged by several problems along its supply/value chain. The priority constraints and/or opportunities faced by the industry are as follows:

1) High dependence to imported fry;
2) Improper aquaculture practices resulting to siltation and mass fish kills;
3) Underutilized/underdeveloped fishponds and mariculture parks (MP);
4) Limited and seasonal supply of quality small milkfish as raw materials for processing limits the expansion of value-added milkfish products for the local and global market;
5) Product traceability and quality assurance issues;
6) Limited access to funding capital and financial programs for milkfish stakeholders;
7) Policy-related concerns (i.e., Difficulty in accessing permits, high cost of fees, contradicting public waters/land use plan implemented by national government agencies (NGAs) & local government units (LGUs) resulting to limited investments);
8) Weak linkage/networking between growers and processors/exporters;
9) Fragmented small-scale farmers resulting to less economies of scale and low income;
10) Inaccurate and inconsistent milkfish data on production and trade;
11) Limited number of milkfish technical experts and capacitated manpower;
12) Highly competitive global market coupled with limited acceptance of domestic market on milkfish products (limited to mostly Overseas Filipino Workers or OFWs); and,
13) Climate change, disasters and pandemic that affect and disrupt the production cycle.

To achieve the set goals, objectives and targets amidst the above challenges, the following were the agreed key result areas (KRAs) and corresponding PSPs:

Goal 1: Self-sufficiency in Milkfish Fry Supply

Key Result Area (KRA)	Priority Policies, Strategies and Programs (PSPs)
1. Sustainability of supply, quality and affordability of milkfish eggs and fry ensured	● DA-BFAR Bangus Fry Sufficiency Program (continues implementation) ✓Establishment of breeder cages for broodstock maintenance ✓Establishment of Satellite Community-Based Larval Rearing Facilities (SCBLRF) ✓Support for operationalization of legislated hatcheries ● Continuous breeding of private hatcheries ● Strengthen natural food production ✓Algal paste technology verification and commercial application ✓Continued Research and Development (R & D) on natural food production ● More public and private sector climate-resilient infrastructure investments to support fry production operations ✓Establishment of facilities within agribusiness corridors (ABCs) to spur vibrant agri-business operations such as: - Fry holding facility for wild caught fry - natural food production facility ✓Rehabilitation and upgrading of government hatcheries
2. Wild fry collection sustained	● Increase livelihood support for wild fry gatherers ✓Provision of fry collecting gears (fry dozer) and fry collection implements (basins, drum, dipper etc.) ✓Facilitate marketing assistance and linkage to buyers ● Development and implementation of wild fry resource assessment and management plan

Goal 2: Sustainable Production Growth

Key Result Area (KRA)	Priority Policies, Strategies and Programs (PSPs)
1. Farm output and productivity improved	● Adoption of Good Aquaculture Practices (GAqP) ✓cage density in accordance to area's carrying capacity ✓cost-efficient feeding management strategies ✓low-impact production systems ✓high technology support system ✓Other science-based farming techniques employing climate resiliency

	● Promote utilization of potential areas for farm expansion (e.g., offshore areas) ● Optimize and rationalize use of unutilized fishponds under Fishpond Lease Agreement (FLA) through transferring rights to capable and qualified investors ● Establishment of Agri-Business Corridors (ABCs) ✓mariculture parks as main hub ✓establishment of nursery banks to expand milkfish fingerlings production
2. Registration of milkfish aquafarms expanded	● Complete inventory and registration of milkfish aquafarms ✓Expand registration of aquafarms ✓IEC to encourage more milkfish farmers to register ✓Use of satellite and mapping technology to locate and inventory the nursery farms, grow-out farms, hatcheries, fish cages, fish pens, and other support facilities (Aqua-R application)
3. Available milkfish novel science-based technologies efficiently transferred to growers	● Promote available milkfish technology through technical trainings, technical assistance, and provision of IEC materials ● Establishment of techno-demo farms on climate-smart technologies ● Engagement in PPP (Public-Private Partnership) in the conduct of milkfish research and technology verification projects
4. Affordable alternative feeds formulated and made available for commercial use	● Strengthen R & D of low-cost alternative feeds using readily available local materials
5. Biosecurity measures and disease surveillance system to prevent, control and mitigate milkfish diseases strengthened	● Continuous enhancement/operation of existing BFAR regional laboratories ● Establishment and maintenance of regional/clustered quarantine facility for milkfish fry near entry points ● Regulation on fry importation specific to quality assurance and disease prevention measures ● Expand accreditation of milkfish hatcheries
6. Genetically improved milkfish strain through research on genomic**s** sustained, funded and supported	● Comprehensive Milkfish Breeding Program (with on-going initiatives) ✓ R &D on milkfish genomics

Goal 3: World-class Value-Added Products

Key Result Area (KRA)	Priority Policies, Strategies and Programs (PSPs)
1. Milkfish product traceability and quality assurance system enhanced and strengthened	● Expand farm registration under National Residue Control Program ● Promote GAqP among farmers ✓Intensify issuance of ladderized GAqP certificate among milkfish farms operators ✓Expand info-drive on GAqP ● Expand information and education campaign (IEC) on food safety and standards
2. Raw materials for processing and value adding made readily available	● Establishment of cold storage facilities in milkfish producing regions ● Promote farming of small-sized milkfish (100-300g)
3. More value-added milkfish products developed and made available in the market	● Continuous R & D on processing and packaging technologies ● Training on value-adding technologies and entrepreneurship ● Investment in post-harvest and processing technologies, equipment and facilities
4. Market linkages and networking strengthened	● Market-matching activities ● Sustained venue for information exchange (e.g., Industry Fora) ● Maximization of online or digital channels for transaction and delivery services of milkfish and milkfish products (e-market)
5. Support to marketing/ promotional efforts in the global market strengthened	● Facilitate attendance of exporters to International Seafood Exhibits/ Market Forum/Seafood Trade Fair ● Promote and facilitate the certification of processing establishments (Good Manufacturing Practice or GMP, Sanitation Standard Operating Procedure or SSOP, Hazard Analysis Critical Control Point or HACCP, and Halal) ● International market benchmarking ● Continuous market intelligence ● Marketing Plan for milkfish

Goal 4: Strengthened and Updated Enabling Policies

Key Result Area (KRA)	Priority Policies, Strategies and Programs (PSPs)
1. Accessible sound and reliable milkfish data for effective resource planning to attain sustainable growth in milkfish production	● Development and Maintenance of National Online Milkfish Database System ✓Coordinate with PSA on the enhancement of their methodology in data gathering and reporting ✓Monitor broodstock and fry supply ✓Profiling of milkfish producing areas
2. Polices reformed and strengthened	● Review and strengthen Fisheries Administrative Order No. 1971-1 ✓Rationalization of tenurial rights of unproductive FLA fishponds ✓Review monitoring schemes ● Regulatory framework for milkfish fry importation crafted ✓Standardize size and age of fry being imported ✓Quarantine/Disease prevention measures/Traceability ● Policy reviews on managing aquaculture feedmills ✓Review regulations on inclusion of toxic chemicals in fish feed ✓Allow importation of rendered meal for aquafeeds ● Ease in application for permits and other business transactions with the government ✓Review regulations for permits and licenses (e.g., high cost of fees, harmonization of fees collected by agencies etc.) ✓Develop online processing system for permits, licenses and streamlining of requirements
3. Provision of input subsidies, incentives and low-cost financial services for qualified milkfish industry players	● Provision of seedstocks and other farm inputs to Fish-R registered and qualified milkfish farmers ● Improve access to financial institutions for low-interest loan, crop insurance, and long-term funds ● Facilitate registration of investors to BOI for possible incentives and grants (incentives for local investors at least at par with foreign investors)
4. Well-managed coastal and marine resources	● Spatial planning and zoning of aqua farms ✓Long term exclusive permit for fish cages within Mariculture areas with a buffer distance (minimum of 0.5km, treating each farm as a critical area)

	● Strengthen real time environmental monitoring and reporting ✓Capacitate LGUs on water quality monitoring through provision of water quality test equipment ✓Conduct capacity building for LGUs on ecosystem-based aquaculture development, planning, implementation and monitoring ● Rehabilitation of aquaculture water systems
5. Manpower knowledge and technical capability enhanced	● Comprehensive Extension Program for Milkfish ✓OJT matching ✓Update training program and materials ✓Empower extension services

Goal 5: Income of Milkfish Farmers Increased

Key Result Area (KRA)	Priority Policies, Strategies and Programs (PSPs)
1. Refer to KRAs of Goal 1 and 2	● Refer to PSPs of Goal 1 and 2
2. Small milkfish growers empowered	● Cluster small farmers into federations/cooperatives to promote group farming ● Strengthen existing milkfish producers' associations ● Financial literacy and other entrepreneurial trainings ● Provision of reefer vans/trucks to fish farmer cooperatives for efficient transport to markets

To implement the priority PSPs, the investment requirement for the entire 20-year duration of this industry roadmap is estimated at Php 2.94 billion. Input provision will have the biggest share accounting for 56% of the total budgetary requirement. Post-harvest and processing and marketing combined together will cover up to 24% of the pie while farming and enabling environment will require an equal share of 10% each.

The implementation and monitoring of this Philippine Milkfish Industry Roadmap shall be guided by an inter-agency Steering Committee (PMIR-SC) with assistance from the DA-BFAR Technical Working Group (TWG).

I. INTRODUCTION

A. Rationale

Milkfish *(Chanos chanos Forsskal, 1775)* also locally known as "Bangus" is the prime fish commodity in the Philippines. It is the top fish commodity in terms of production and consumption. In 2020, milkfish production shared 416,315 metric tons (MT) or 17.9% of the total fisheries production that contributed about Php 43.5 billion to the Gross Domestic Product (GDP) of the country or approximately 2 to 3% of the country's Gross Value Added (GVA) for Agriculture, Fishery and Forestry (AFF). Volume of milkfish harvested has increased from 225, 337 MT in 2001 to 416,315 MT in 2020 recording about 84.5% production growth for the past 20 years. On the average, its production performance marked a 3.37% average growth rate increment per year (PSA, 2020). About 10% of the 36.8 kg of annual fish consumed by an average Filipino household is milkfish (BFAR Philippine Fisheries Profile, 2018).

Milkfish is the only species that belongs to family Chanidae. It has a fusiform shape and migratory nature; thus, comparable to tuna and salmon. It is widely distributed in Indo-Pacific region and abundantly collected in the Southeast Asian and West Pacific regions. It is cultured in freshwater, brackishwater, and marine environments. Milkfish is a desirable species for aquaculture for several reasons. Milkfish fry are hardy and easy to handle because of its high tolerance and adaptability to salinity change. It has higher growth rate compared to other herbivorous fish and can be polycultured with other finfishes and crustaceans. Its high resistance to diseases also adds to its advantage for aquaculture business.

The potential of milkfish culture to reduce poverty is closely linked to its ability to create jobs and self-employment in the communities (PRDP, 2016). Several economic activities are related to the milkfish culture which includes: fry gathering, hatchery, nursery operations, grow-out operations, processing, marketing, and other services, such as ice making and fish transport.

In terms of market and trade, milkfish is one of the largest volumes of fish merchandized everyday in almost all public markets in the Philippines. Most of the milkfish sold in local markets are in fresh chilled form either in whole or deboned. Nowadays, more of milkfish harvest is processed into value–added forms such as smoked, dried, marinated, fermented, canned or bottled. Some companies produce vacuum-packed milkfish value-added products and are exported to other countries like Canada, United States of America (USA), and the United Kingdom (UK). In 2019, about 32% or 132, 782 MT of milkfish produce are utilized for processing. Meanwhile, 5,870 MT milkfish were exported in the same year (PSA, 2020).

Despite its significant contribution to the economy and food security, milkfish industry is challenged by several problems along its supply/value chain. Shortage of good quality milkfish fry, expensive cost of production inputs and environmental degradation due to intensification of production are some of the major issues that impede the progress of milkfish farming. For post-harvest and marketing, availability of quality and suitable sizes of milkfish as well as fluctuating prices are the bottleneck for expansion. Furthermore, frequent typhoon occurrence and prolonged drought caused by climate change negatively affects milkfish production.

In order to identify solutions for the challenges besetting the industry, this Philippine Milkfish Industry Roadmap is crafted. The Philippine Milkfish Industry Roadmap shall be a document that will define the short- (2021-2025), medium- (2026-2030) and long-term (2031-2040) plans to sustain and improve each segment of milkfish value and supply chain from production, processing, trade and marketing taking into consideration the industry's current situation. This roadmap will also outline the roles and responsibilities of government agencies, research and academic institutions, as well as the private sector in achieving the common goals and targets set for the sustainable development of the milkfish industry.

B. Objectives

The general objective of the roadmap is to gear up the Philippine Milkfish Industry towards global competitiveness and climate change resiliency through setting plans and programs that will enhance and sustain milkfish production, accelerate local economy, increase job opportunities and diversify value-added products.

The specific objectives are to:

a) provide situational assessment of the Philippine Milkfish Industry;
b) identify milkfish product forms;
c) analyze the supply/value chain of the Philippine Milkfish Industry;
d) analyze the industry's competitiveness in terms of the volume of production, price and cost of production;
e) analyze market trends and prospects;
f) establish goals, objectives, targets and strategies to sustain and improve the Philippine Milkfish Industry in three planning periods – short-term, medium-term, and long-term; and
g) recommend action programs to improve the Philippine Milkfish Industry following the policy frameworks of the Department of Agriculture.

C. Methodology

In the crafting of this Milkfish Industry Roadmap, the value chain analysis (VCA) as a planning tool has been used order to understand and examine further the process involve in the industry along with the corresponding constraints and opportunities. The VCA can be defined as the method for accounting and presenting the value that is created in a product or service as it is transformed from raw materials to a final product. The performance and sustainability of the enterprise implementing supply/value chain system would depend on how well the key activities were performed, organized and managed to produce and deliver value to customers. The crafting of this industry roadmap is also in line with the One-DA Reform Agenda.

Amidst the new normal conditions brought about by the COVID-19 pandemic, a series of online consultations were conducted among the different stakeholders and enablers of the milkfish industry value chain nationwide. Table 1 shows the summary of stakeholders who participated during the online consultations via the zoom platform.

Table 1. Summary of Consulted Stakeholders, by VC Segment

Respondent	1st Consultation, 22 February 2021	2nd Consultation, 2 March 2021	3rd Consultation, 2 September 2021
Input Providers			
Male	4	2	1
Female	2	4	
Total	***6***	***6***	***1***
Farmers/Growers			
Male	5	2	10
Female	3	1	2
Total	***8***	***3***	***12***
Traders			
Male	2	2	
Female		1	1
Total	***2***	***3***	***1***
Processors			
Male		4	
Female	3	6	4
Total	***3***	***10***	***4***
Enablers			
Male	17	12	18
Female	14	26	16
Total	***31***	***38***	***34***
Grand Total	**50**	**60**	**52**

A Roadmap Development Team (RDT), which was led by the private sector, was likewise formed providing strategic guidance in the crafting of this industry roadmap.

D. Scope and Limitations

This industry roadmap covers both fresh and processed/value-added product forms of milkfish. Geographical scope is nationwide.

The mobility restrictions brought about the COVID-19 pandemic has constrained face-to-face movement on the ground to do data gathering. There was also an observed limited knowledge on VCA among the BFAR personnel, which also posed another challenge in the speedy completion of this report.

Other constraints pertain to inconsistencies of local production data reported by government authorities such that of PSA versus estimates of the private sector. Detailed comparative international benchmarks are not readily available such that supplemental studies maybe done in the future along with the annual monitoring of the progress of this Roadmap.

II. INDUSTRY SITUATION AND OUTLOOK

A. Structure

1. Industry Definition: Key Players and Functions

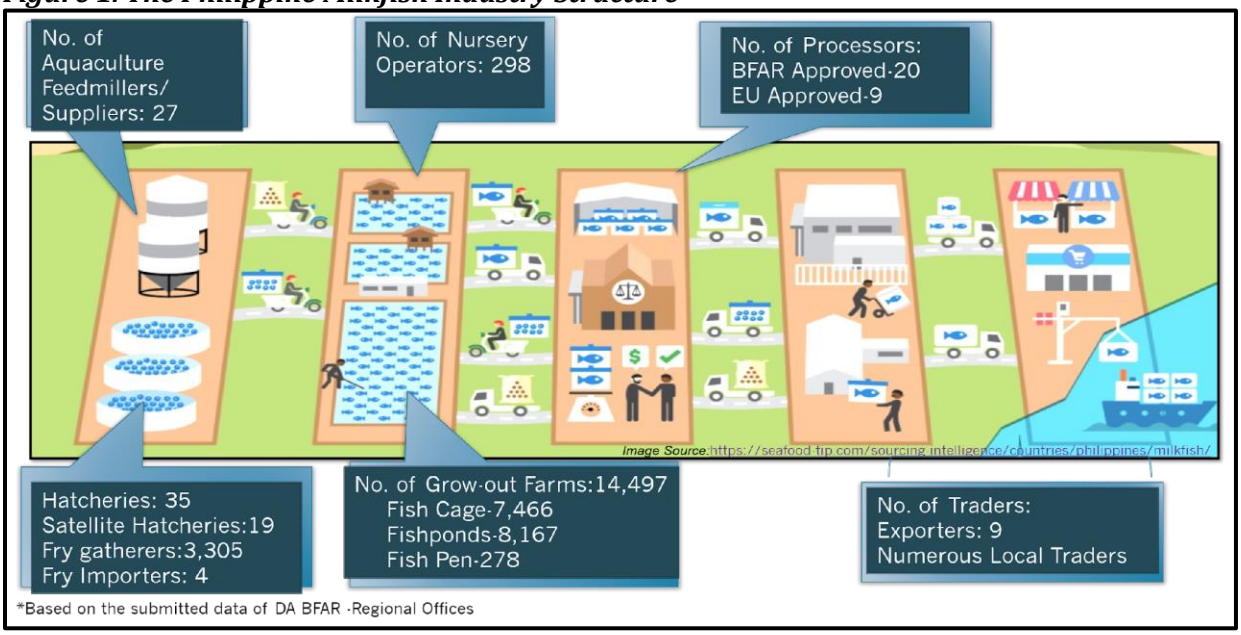
This section describes and characterizes the Philippine milkfish industry. Players or operators in each segment of the milkfish value chain segment are likewise identified and characterized here. Activities performed in each stage are also briefly discussed herein. The translation of this into the value chain maps can be found in Section VI.A.

Milkfish is considered as the national fish of the country and thus, an important seafood for Filipinos. It is grown in almost all regions of the country except in Cordillera Administrative Region (CAR). Milkfish farming is the oldest aquaculture venture in the Philippines. In fact, existing studies and literatures indicate that global milkfish farming started in the Philippines around 400-600 years ago and spread to Indonesia, Taiwan, and into the Pacific (FAO, 2009). Earliest milkfish fishponds in the country were brackishwater that traps and grow fry from incoming tidal waters and uses natural food or "lablab" as feed. Conventionally, milkfish can be cultured solely (monoculture) in a pond or be cultivated together with other species such as shrimp (polyculture).

In early 1970s, culture method expanded to cage culture in bamboo and net pens set in Laguna de Bay, the country's largest freshwater lake. Intensified milkfish farming happened in the mid-1970s as government agencies and fisheries institutions like the Southeast Asian Fisheries Development Center/Aquaculture Department (SEAFDEC/AQD) were involved in researching and developing milkfish culture techniques (Bagarinao, 1998). In support to the growing milkfish industry, large investments on infrastructure, research, credit and training have been made since 1970s. Establishment of ancillary industries and services such as feed milling also followed the trend to cater the needs of growing number of milkfish farms. In 1990s, milkfish cultivation in fish pens spread to shallow marine bays and estuaries, particularly in the Lingayen Gulf area located at Pangasinan. Milkfish culture soon spread to net cages which were fixed or floating in both freshwater and marine water.

Figure 1 summarizes the structure of the Philippine milkfish industry along with its key players in each segment of the VC.

Figure 1. The Philippine Milkfish Industry Structure



Source of basic data: BFAR Regional Offices
Processed by BFAR National Bangus Program

a) Input Providers

The input providers in this stage are the broodstock operators, hatcheries, fry collectors, as well as licensed dealers of agriculture and fishery supplies. Agri-fishery dealers of feeds and equipment are likewise included in this segment.

i. *Wild Fry Gathering*

Traditional milkfish farming industry is dependent on the wild-caught fry as seedstocks. Wild-caught fry are reared in nursery ponds to cultivate fingerlings that are then stocked in grow-out fishponds, cages and pens.

Milkfish fry gathering activity in coastal areas is a supplemental livelihood for fishermen especially during peak season (March to May). The most common gear for fry gathering is the push net or the sweepers. Some utilize fine-mesh seines and bag nets that are dragged at both ends to collect fry. According to interviews, a wild-caught fry is a hardier seedstock compared to hatchery-bred fry. One wild fry costs around 40 to 50 cents. High demand for wild-caught fry makes fry gathering an indispensable economic activity in the industry.

Based from DA-BFAR Regional and Provincial Offices' Local Transport Permits (LTPs) issued, the country recorded about 356 million wild fry collections in 2020. About 44% of wild fry production came from Western Visayas (Region 6). Central Visayas (Region 7) ranked second sharing 26.37% followed by Central Luzon (Region 3) with 14.89% contribution to total wild fry collection

(Table 2).

Table 2. Wild Fry Collection in the Philippines, 2020

Regions	No. of Fry Gatherers	No. of Wild Fry Collected (In million pcs)	Percent Share to National Wild Fry Production (%)
Region 1	934	15.57	4.37
Region 2	351	2.71	0.76
Region 3	79	53.03	14.89
Region 4A	11	8.82	2.48
Region 4B	213	0.61	0.17
Region 5	-	9.00	2.53
Region 6	1,314	157.78	44.29
Region 7	103	93.95	26.37
Region 8	-	-	-
Region 9	15	3.84	1.08
Region 10	9	5.00	1.40
Region 11	-	5.96	1.67
Region 12	-	-	-
Caraga	-	-	-
TOTAL	**3,029**	**356.26**	**100.00**

Source: *DA-BFAR Regional Offices Data*

ii. **Breeding Facilities**

These facilities play an important role of the milkfish industry to provide adequate and quality fry/fingerlings for stocking in the fishpond, fish pen and fish cages.

Broodstocks and Broodstock/Breeding Facilities

Under captive conditions, broodstock development involves stocking, feeding and maintaining large juvenile milkfish in protected covers or in large, deep, fully saline ponds until they reach sexual maturity with an average body of 1.5kg at the very least. There are also land-based broodstock facilities, which are entirely dependent on fresh pumped seawater supplies and are often integrated with a hatchery (PRDP Mindanao VCA on Processed Bangus, 2016).

Broodstocks usually reach maturity in five years' time. First spawning broodstocks tend to be smaller than adults caught from the wild. As a result, first-time spawners produce fewer eggs than wild adults. Larger and older broodstocks, however, produce as many eggs as wild adults of similar size. Broodstocks of about eight (8) years old and averaging six (6) kg can produce about 34 million eggs. Breeding milkfish in captive conditions and the mass production of fry, as practiced in the regions of Mindanao, is mostly dependent on natural spawning, which assures high survival rates[1].

With reference to the 2021 data provided by regional private and government hatchery operators, overall, there are 15,257 active milkfish breeders and about 14,544 broodstocks for development (Table 3). Region 12 accounted for 59% of the total functional breeders followed far

[1] Ibid

behind by Region 1 with 12. The private sector owned 84% of the functional breeders while government owned 97% of the total broodstocks for development.

Table 3. Inventory of Functional Milkfish Breeders and Broodstocks for Development, 2020

Region	Functional Breeders			Broodstock for Development		
	Private	Gov't	Total	Private	Gov't	Total
Region 1	2,000	180	**2,180**	-	80	**80**
Region 3	90		**90**	-	2,000	**2,000**
Region 4A	328	40	**368**	-	719	**719**
Region 4B	-	257	**257**	-	2,150	**2,150**
Region 5	-	85	**85**	-	500	**500**
Region 6	1,167		**1,167**	179		**179**
Region 7	-	631	**631**	-	1,720	**1,720**
Region 8	-	485	**485**	-	1,700	**1,700**
Region 9	-	-	**-**	-	290	**290**
Region 10	-	728	**728**	-	920	**920**
Region 11	166	100	**266**	300	2,800	**3,100**
Region 12	9,000	-	**9,000**	-		**-**
Caraga		-	**-**		1,186	**1,186**
TOTAL	12,751	2,506	**15,257**	479	14,065	**14,544**

Source: DA-BFAR Regional Offices

Hatcheries and Hatchery Operators

The PRDP Mindanao VCA on Processed Bangus (2016) describes milkfish hatchery and breeding operations as follows:

"Hatchery operations utilize either intensive (high stocking density, high volume tanks, daily feeding and water exchange) or semi-intensive (low stocking density, high volume tanks, minimal water exchange, feeding with mixed diet) systems, with an average survival rate of 30 percent (from stocked newly hatched larvae).

After hatching, the larvae are ideally kept at 15-30 ind/liter in hatchery tanks (either concrete, fiber glass, canvas or polypropylene earthen tanks) maintained with Chlorella and fed with rotifers during the early stages and later with copepods or brine shrimp for a total of 3 to 4 weeks. Following this, their size ranges between 2 to 3 cm and they are ready for transport to nurseries. Fry are sorted and counted, transported, and stored for different periods of time. They are highly vulnerable commodity and some of them die during gathering, storage, transport, nursery rearing and grow out due to stress.

The technologies for fry storage and transport are generally effective, although perhaps not yet optimized. Fry are stored in a cool place in plastic basins or clay pots at 100-500/liter, in water of 10-25%, which is renewed daily. Dealers may store fry for 17 days, depending on the demand.

Fry can be fed with wheat flour or cooked chicken egg yolk for 12 weeks. Recently, microencapsulated feeds have become commercially available for finfish but the cost compared to conventional live feeds is higher. Still, some growers prefer fry from the wild and others sourced their fry from Indonesia, which, according to them is much cheaper.

There are two types of milkfish hatcheries- complete and satellite hatchery (Roxas, et al n.d.). A complete hatchery, also known as an integrated broodstock facility, is a milkfish hatchery complete with spawning tanks and breeders. It breeds milkfish, produces eggs and rears up to fry stage. A satellite hatchery, on the other hand, does not have a breeding facility but has larval rearing and algal tanks. It acquires eggs/larvae from a complete hatchery or larvae from the wild and conducts the hatching and larval rearing until the market fry stage. Fry are sold at the age range of 18 to 25 days depending on environmental conditions and market demand.

To date, there is no strict/mandatory registration and/or accreditation of milkfish hatcheries and nurseries. Per 2020 inventory, there are 20 government and 15 private milkfish hatcheries in the Philippines with an estimated annual fry production capacity of 1.3 billion (Table 4).

Table 4. List of Milkfish Hatcheries in the Philippines, Type of Ownership and Estimated Annual Fry Production, 2020

Region/No.	Name of Hatchery	Location	Ownership Type	Estimated Annual Fry Production (In million pcs)
Region 1				
1	Star Bangus	Mangas, Bacquioen,Sual, Pangasinan	Private	30
2	BFAR-NIFTDC	Bonuan-Binloc, Dagupan City, Pangasinan	Government	4.7
3	Feedmix Hatchery	Infanta, Pangasinan	Private	65
Region 3				
4	CDO Hatchery	Iba, Zambales	Private	0.2
Region 4A				
5	Unisan Multi-species Finfish Hatchery	Brgy. Punta, Unisan, Quezon	Government	1.175

Region/No.	Name of Hatchery	Location	Ownership Type	Estimated Annual Fry Production (In million pcs)
6	San Jose Agro-Marine Development Corporation	Talao-Talao, Lucena City	Private	12
7	Rock Fin Fish Farm	Sitio Dayap, Brgy. Tanagan, Calatagan, Batangas	Private	8
8	Timmy Aquafarm	Talao-Talao, Lucena City	Private	ND
Region 4B				
9	Multi Species Marine Fish Hatchery	Labasan, Bongabong, Oriental Mindoro	Government	3.7
10	Brackishwater Fisheries Research Station (BFRS)	San Jose, Oriental Mindoro	Government	Broodstock Facility
11	Inland Sea Ranching Station	Bgy. Sta. Lucia, Puerto Princesa City, Palawan	Government	3.24
12	Marine Multi Species Fish Hatchery	Canduyong Odiongan Romblon	Government	2.1
Region 5				
13	National Bangus Breeding Farm	Bay-bay Tiwi, Albay	Government	1.2
14	Sagňay Multi-Species Hatchery	Patitinan, Sagňay, Camarines Sur	Government	2.25
Region 6				
15	RETCEM Hatchery	Dumangas, Iloilo	Private	100
16	SEAFDEC/AQD	Tigbauan, Iloilo	Private	66.11

Region/No.	Name of Hatchery	Location	Ownership Type	Estimated Annual Fry Production (In million pcs)
17	Maranon Hatchery	Escalante, Negros Occidental	Private	ND
Region 7				
18	Multi-Species Hatchery	Sinandigan, Ubay, Bohol	Government	1
19	Multi-species Hatchery	Kawit, Medellin, Cebu	Government	1
20	Central Milkfish Hatchery	Lawis, Pangangan, Calape, Bohol	Government	4.1
21	Municipal Milkfish Hatchery	Argao	Government	ND
22	Municipal Milkfish Hatchery	Bais City	Government	ND
23	Marcela Frontier Resources, Inc. (MFRI)	Lila, Bohol	Private	ND
24	Oversea Feeds Corporation (Cebu)	Tulay, Minglanilla, Cebu	Private	ND
Region 8				
25	Guiuan Marine Fisheries Development Center (Central Milkfish Hatchery)	Sto. Niño, Guiuan, Eastern Samar	Government	3.5
26	Laoang Multi Species Hatchery	Aruganga, Laoang, Northern Samar	Government	- (broodstock not yet spawning)
Region 10				
27	Sagay Multi Species Hatchery	Manuyog, Sagay, Camiguin	Government	6

Region/No.	Name of Hatchery	Location	Ownership Type	Estimated Annual Fry Production (In million pcs)
28	Benoni Experimental Station	Benoni, Mahinog, Camiguin	Government	Broodstock Facility (13 million egg production)
29	Mindanao State University at Naawan - Marine Fisheries Hatchery	Naawan, Misamis Oriental	Government	ND
Region 11				
30	BFAR 11 Multi-Species Hatchery	Lawis, Bato, Sta. Cruz, Davao del Sur	Government	2.5
31	ALT Hatchery & Aquaventure Inc.	Panabo City	Private	NO
32	Davao Oriental Bangus Hatchery	Brgy. Badas, Mati City, Davao Oriental	Private	23
Region 12				
33	Southern Mindanao Seafoods Hatcheries Incorporated	Brgy. Kawas, Alabel, Sarangani Province	Private	32
34	Finfish Hatchery Incorporated	Lun Masla Malapatan, Sarangani Province	Private	890
Caraga				
35	Burgos Cortes Multi Species Hatchery	Burgos, Cortes S.D. S	Government	1.0
TOTAL ESTIMATED ANNUAL FRY PRODUCTION				**1,263.78**

Source: DA-BFAR Regional Offices Data *ND- No Data* *NO-Not Operational*

In 2018, DA-BFAR launched the National Fry Sufficiency Program has focused on establishing Satellite Community-based Larval Rearing Facilities (SCBLRFs). A SCBLRF is a satellite type of hatchery that is awarded to and managed by Fisherfolk Cooperatives/Associations, Non-Government Organizations (NGOs), Overseas Filipino Workers (OFWs) and other private sector groups through

Public-Private Partnership (PPP) Scheme. This project aims not only to reduce the purchase of imported fry but also be a livelihood source for the beneficiaries, as they will become fry suppliers to local fish farms. To date, there are 18 SCBLRFs established while one (1) SCBLRF located in Agusan Del Norte is under construction (Table 5). These facilities are among the source of fry/fingerlings for use in aquaculture in the country.

Table 5. List of Satellite Community-Based Larval Rearing Facility (SCBLRF), per Region, 2020

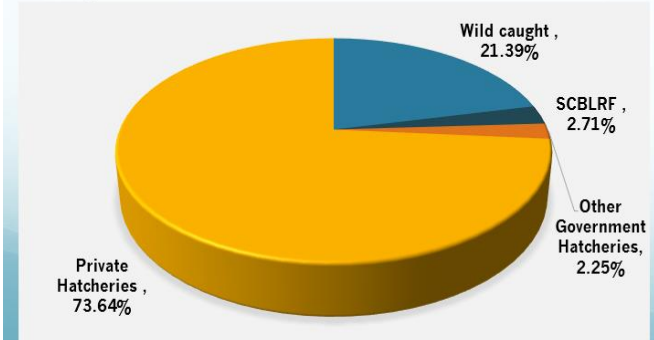
Region	No of SCBLRF	Location		Ownership Type	Estimated Annual Fry Production (in M)
		Municipality	Province		
Region 1	2	Lingayen	Pangasinan	Public Private Partnership (PPP)	1.68
		Aringay	La Union	Public Private Partnership (PPP)	1.68
Region 3	1	Masinloc	Zambales	Government	2
Region 4A	1	Batangas	Calatagan	Public Private Partnership (PPP)	1
Region 4B	1	Calapan	Oriental Mindoro	Government	1
Region 6	2	Batan	Aklan	Public Private Partnership (PPP)	5
		Concepcion	Iloilo	Public Private Partnership (PPP)	1
Region 7	5	Calape	Bohol	Government	2
		Lomboy	Bohol	Public Private Partnership (PPP)	0.84
		Tubigon	Bohol	Public Private Partnership (PPP)	1
		Candijay	Bohol	Public Private Partnership (PPP)	1
		Talibon	Bohol	Government	1.68
Region 8	1	San Roque	Northern Samar	Government	1.68
Region 10	3	Pedro Sa Baculio	El Salvador City	Public Private Partnership (PPP)	3.36
		Biasong	Lopez Jaena	Public Private Partnership (PPP)	3.36
		Misamis Oriental	Initao	Public Private Partnership (PPP)	3.36
Region 11	2	Sta. Cruz	Davao del Sur	Government	3.5
		Mati	Davao Oriental	Public Private Partnership (PPP)	10
Caraga	1	Nasipit	Agusan Del Norte	Government	
TOTAL ESTIMATED ANNUAL FRY PRODUCTION					**45.14**

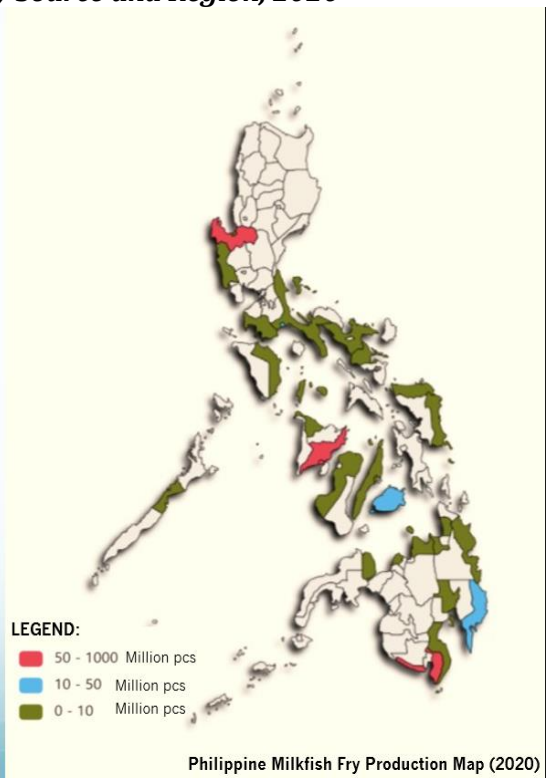
Source: DA-BFAR Regional Offices Data

The industry was able to produce 1.47 billion pieces of milkfish fry in 2020. Majority of fry produced in 2020 came from private hatcheries with 73.64% share to national production or equivalent to 1.08 billion pieces fry, thus, the milkfish fry production in the country is private sector driven (Figure 2). This was followed by 21.39% contribution from wild-caught fry gatherers with 356.26 million. The remaining 4% of domestic fry supply was contributed by the government-owned hatcheries including the SCBLRFs.

Figure 2. Milkfish Fry Production in the Philippines, by Source and Region, 2020

Region 12	55.37%
Region 6	19.81%
Region 1	7.12%
Region 7	6.40%
Region 3	3.32%
Region 11	2.70%
Region 4A	1.86%
Region 10	1.27%
Region 5	0.75%
Region 4B	0.64%
Region 8	0.31%
Region 9	0.23%
Region 2	0.16%
Caraga	0.06%





Source of basic data: DA-BFAR Regional Offices Data

The SOCCKSARGEN (Region 12) led the country in terms of milkfish fry production contributing 55.37% to the total fry production in 2020 (Table 6). This was followed by Western Visayas (Region 6) with 19.81% share, Ilocos Region (Region 1) with 7.12%, and Central Visayas (Region 7) with 6.40%.

Table 6. Regional Milkfish Fry Production (in million pieces), By Source of Fry, 2020

Region	Wild Caught	Private Hatchery	Gov't Hatchery	Total
Region 1	15.57	40.0	5.350	**60.92**
Region 2	2.71			**2.71**
Region 3	53.03	0.11		**53.14**
Region 4A	8.82	20.0	1.175	**29.995**
Region 4B	0.61		1.940	**2.55**
Region 5	9		0.7	**9.7**
Region 6	157.78	166.23		**324.01**
Region 7	93.95	42.40	13.73	**150.08**
Region 8			2.820	**2.82**
Region 9	3.84			**3.84**
Region 10	5		6.16	**11.16**
Region 11	5.96	4.6	0.212	**10.772**
Region 12		808.0		**808**
Caraga				
Total	**356.27**	**1,081**	**32.08**	**1,470**

Source of basic data: DA-BFAR Regional Offices Data

Based on the milkfish fry requirement analysis per region (Table 7), it is estimated that the country is deficit of about 1.2 billion which is 54% of the 2.7 billion country's total fry requirement. Among the regions, only Regions 12, 7 and 4B could be considered fry supply sufficient. Region 12 covers about half of the total fry supply in the country which comes from large scale private hatcheries namely- Finfish Hatchery Incorporated and Southern Mindanao Seafoods Hatcheries Incorporated. On the other hand, Region 7 has DA-BFAR managed Central Milkfish Hatchery in Calape, Bohol and Multi-species hatcheries in Medellin, Cebu and Ubay, Bobol that supplies egg/larvae to satellite and municipal hatcheries. Two medium to large scale hatcheries are also present in Region 7.

This data reveals that there is a need for a strong government intervention to invest on hatcheries and broodstock development particularly in regions with low local fry production in order to sustain the growth of milkfish industry in the country.

Table 7. Estimated Milkfish Fry Requirement Analysis per Region, 2020

Region	2020 MILKFISH PRODUCTION, *in MT* [a] (a)	2020 FRY REQUIREMENT, *in pcs* [b] (b)	2020 FRY PRODUCTION, *in pcs* [c] (c)	GAP, *in pcs* (d) *c – b*	SUFFICIENCY LEVEL (%) (e) *(c/b)*100*
NCR	680.94	4,410,947		-4,410,947	0.00
CAR	-	-		-	
Region 1	125,913	815,631,352	118,630,000	-697,001,352	14.54
Region 2	555	3,595,595	2,710,000	-885,595	75.37
Region 3	78,016	505,364,405	55,230,000	-450,134,405	10.93
Region 4A	43,338	280,733,150	30,995,000	-249,738,150	11.04
Region 4B	1,605	10,393,846	10,650,000	256,154	102.46
Region 5	3,291	21,315,304	12,450,000	-8,865,304	58.41
Region 6	98,327	636,935,061	329,890,000	-307,045,061	51.79
Region 7	6,287	40,726,931	106,570,000	65,843,069	261.67
Region 8	3,221	20,866,591	5,180,000	-15,686,591	24.82
Region 9	6,027	39,039,870	3,840,000	-35,199,870	9.84
Region 10	16,620	107,661,215	21,080,000	-86,581,215	19.58
Region 11	16,527	107,059,757	44,960,000	-62,099,757	42.00
Region 12	3,733	24,180,923	922,000,000	897,819,077	3,812.92
Caraga	4,840	31,351,579	1,000,000	-30,351,579	3.19
BARMM	7,337	47,526,154		-47,526,154	0.00
Philippines	**416,317**	**2,696,792,680**	**1,470,149,000**	**-1,226,643,680**	**54.51**

[a] Philippine Statistics Data, 2020

[b] Technical assumptions: Fry to fingerlings survival rate=65%; fingerlings to marketable size survival rate=95% at 4 pieces per kg

[c] DA-BFAR Regional Offices Data, 2020

To cope with the shortage of locally produced fry, milkfish growers resort into importation of fry from countries like Indonesia. Data on SPS import clearances issued from 2018-2020 by DA-BFAR shows that the importation of milkfish fry expanded almost ten-fold from year 2018 to 2020 that recorded about 386 million imported fry (Table 8).

Table 8. Importation of Milkfish Fry CY 2018-2020

Year	Quantity, pcs	Country of Source
2018	39,500,000	Indonesia
2019	62,425,000	
2020	386,000,000	

Source: DA-BFAR SPS Import Clearances issued from 2018-September 2020

According to consultations with stakeholders, though, the above record is still understated, as there is a growing expansion and intensification of milkfish grow-out culture. Such claim of the private sector is validated by the data on live importation of live milkfish fry for 2020 obtained from the Ninoy Aquino International Airport (NAIA) alone where total fry quantity stood at 1.433 billion pieces (Table 9). These fry are distributed to nurseries and grow-out farms in Pangasinan, Bulacan, Tacloban, Bacolod, Misamis Occidental, and General Santos City.

Table 9. Importation of Live Milkfish Fry, Landed at NAIA, 2020

Month	Quantity (No. of pcs)	Quantity (kgs)	Value (In USD)	Origin	Purpose
January	7,920,000	2,907	3,960	Indonesia	For Commercial Use
February	86,920,000	33,100	41,460	Indonesia	For Commercial Use
March	33,360,000	12,442	16,560	Indonesia	For Commercial Use
April	11,000,000	4,484	5,500	Indonesia	For Commercial Use
May	165,920,000	72,069	87,040	Indonesia	For Commercial Use
June	307,480,000	130, 051	214,600	Indonesia	For Commercial Use
July	194,160,000	84,010	124,080	Indonesia	For Commercial Use
August	97,200,000	43,144	58,160	Indonesia	For Commercial Use
September	232,480,000	96,181	278,660	Indonesia	For Commercial Use
October	130,040,000	59,569	194,400	Indonesia	For Commercial Use
November	110,200,000	48,229	86,680	Indonesia	For Commercial Use
December	55,960,000	24,958	38,570	Indonesia	For Commercial Use
TOTAL	**1,432,640,000**	**481,093**	**1,149,670**		

Source: Region 4-A Fisheries Inspection and Quarantine Services (FIQS)

Aside from those fry landed at NAIA, the Bangus focal person in MIMAROPA region also said that there are imported Indonesian fry landed at Cebu International Airport. These fry are then moved to a conditioning facility in Cebu before they are flown to Palawan.

There are four (4) accredited milkfish fry importers in the country which are based in Luzon (Table 10).

Table 10. List of Accredited Milkfish Fry Importers, 2020

Company	Address	Commodity
1. 1064 Euro Fish Trading	302 Ilang Ilang St. Lakeview Subd. Putatan, Muntinlupa City	Live Milkfish Fry
2. Charoen Pokphand Foods Philippines Corporation	Unit 1C-1D LSC Bldg. Lazatin Blvd. Dolores Homeste, Ext 2, City of San Fernando, Pampanga	Live Milkfish Fry
3. R4 Jet Aquatic Enterprises	66 Bunyi St. Bunting Pasig City	Live Milkfish Fry
4. Fiserv Resources Incorporated	2 Biglang Awa Street, Caloocan City	Live Milkfish Fry

Source: DA Online System (2020)

Fry survival depends on the proximity of source, size of fry, and transport methods. Indonesian milkfish fry has an average survival rate of 20-25% 30 days after stocking. Mortality is usually high likely because of the transport and handling stress as well as relatively smaller size of imported fry to reduce unit transport cost. In comparison, local hatchery-bred fry, has an average survival rate of 65% 30 days after stocking.

Nurseries and Nursery operators

Milkfish nursery operations are both practiced as integral part of the milkfish grow out culture system and as an enterprise for nursery operators. In the case where nurseries are integrated with grow out facilities, wild caught or hatchery-reared fry are first acclimated into nursery compartments which comprise 1/3-1/4 of the total area of the brackish water pond (PRDP Mindanao VCA on Processed Bangus, 2016).

Nursery rearing has also been carried out in hapa type suspended nylon nets installed in Brackish water ponds or lagoons and in freshwater lakes within the grow-out compartments, as practiced in Regions 9 and 13 in Mindanao. When natural food is becoming depleted, artificial feeds such as rice bran, corn bran, and stale bread or formulated feeds are provided. In about 46 weeks, the fry grows to 58 cm juveniles, which is the ideal size for releasing into grow-out ponds or pens. Depending on the desired grow-up period, juveniles or fingerling size milkfish are kept in nurseries or transition holding tanks up to the required stocking size of 30-50g (garungan). Nursery rearing from fry to fingerling size normally achieves 70% survival[2].

The milkfish nursery enterprise in the Philippines are subdivided into four (4) types by *Salayo et al.* (2021):

Type 1 Nursery: Fry to Fingerlings in 120 days (2 runs/year);

Type 2 Nursery: Fry to Hatirin (1g) in 45 days (intermediate product) to Fingerlings in 120 days (final product) (2 runs/year);

[2] Ibid

Type 3 Nursery: Fry to Hatirin (1g) in 45 days (4.5 runs/year); and,

Type 4 Nursery: Hatirin (1g) to Fingerlings in 75 days (3 runs/year).

Based on the analysis of Salayo et. al, 2021, the most profitable nursery enterprise is Type 4 with Return of Investment (ROI) of 324 %, next is Type 2 with ROI of 204%, then by Type 1 with ROI of 200% and finally by Type 3 with 47% ROI. This is on the assumption that all optimal environmental conditions are met.

Aside from hatchery-bred fry production, fingerlings production has emerged to be a milkfish sub-industry. It became a commercial enterprise given the increasing seedstock demand for operation of fish cages and pens which requires fingerlings of 4-5 inches in length. Intensive fingerlings nursery operation is being practiced in Regions with high density of fish cages like in Regions 1, 3, 11, and Caraga.

As of 2020, there were a total of 298 milkfish nursery farms in the country with a total area of 2,419.34.34 hectares (Table 11). Region 11 had the most number and hectarage of nursery farms at 37% and 43%, respectively.

Table 11. Inventory of Milkfish Nursery Farms, 2020

REGION	Number of Nursery Farms	Total Area (in has.)
Region 1	38	172.76
Region 2	1	1.5
Region 3	75	739.83
Region 4A	N/D	N/D
Region 4B	4	7.8
Region 5	N/A	N/A
Region 6	5	59
Region 7	7	29.8
Region 8	9	16.85
Region 9	12	59.5
Region 10	16	40.8
Region 11	110	928
Region 12	2	87.5
Region 13	19	276
TOTAL	**298**	**2,143.34**

Source: DA-BFAR Regional Offices Data *N/D – No data N/A – Not Applicable*

Constraints Affecting Breeding

Research on milkfish propagation and mass production of fry gained progress in 1990s to find solution on the shortage of fry. Research on milkfish propagation and mass production of fry by SEAFDEC/AQD started on 1978 to find solution on the shortage of fry. The first successful induced spawning of milkfish was on 1978 followed by natural spawning in 1981. In 1983, closed life cycle in captivity was perfected by the institution. The first National Bangus Breeding Program by the

government was institutionalized in 1982 to support the local milkfish fry production. Since then, the Philippines along with other countries of Indonesia and Taiwan acquire majority of the fry from hatcheries.

Despite the above developments, however, the fry sufficiency ratio for milkfish in the Philippines only stood at 54%.

On gathering of fry from the wild. Rigorous fry gathering activity over time as well as aquatic pollution, resulted into decline of fry availability. Moreover, seasonality and regional variation when it comes to collection of fry impeded the growing industry.

Wild fry gatherers also faced difficulty as some of their collection areas are now converted into resorts and other private purposes. The owners of these properties now restricted gathering of wild fry.

Problems faced by breeders. Gaps are identified to be on the: quality of maintained breeders that results into eggs with low hatching rate; seasonality of breeding; poor broodstock management practices; and, the limited number of breeders in ideal 2:1 female to male ratio per breeding facility. To address these gaps, there is a dire need to reinstate a comprehensive and well-funded National Comprehensive Milkfish Breeding Program that aims to enhance quality of breeders through advance research (genomics), improve breeding practices and increase number of active high-quality breeders. It should be noted that the previous breeding programs was discontinued due to lack of budgetary support.

Along with already started Fry Sufficiency Program, the proposed reinstatement of the comprehensive breeding program should take lessons from the previous program and be sustained in the long-term by establishing regional broodstock centers managed by milkfish technical experts. Clustered/Regional Broodstock Centers will serve as constant source of quality milkfish eggs/larvae that will be distributed to satellite or community based-hatcheries and nursery areas for fry/fingerling production. These facilities must be strategically located in areas that meets the environmental requirement of milkfish to reach spontaneous maturation and spawning with proximity to areas with high milkfish production.

Broodstock development needed strong government support as it is a high-investment and low-profit enterprise. For instance, while an integrated broodstock and hatchery (IBH) facility with a 20-year project duration showed a positive annual net income, its return on investments (ROI) is only 7% with a payback period (PP) of 7.9 years. “These economic indicators showed low coefficients primarily due to the high capital investments in IBH facilities amounting to PHP 14.4 million and consequently its high depreciation cost. The total annual operating costs is also high at PHP 5.63 million due to the cost of feeds and other inputs to maintain the breeders. IBH operations therefore showed low internal rate of return (IRR) at 13% and 1.06 benefit-cost ratio (BCR).” Nonetheless, it is a key aquaculture enterprise in the Philippine milkfish value chain wherein the industry has been besotted with milkfish and egg supply problems and has been relying on imports (Salayo *et. al,* 2021).

Problems faced by hatchery operators. The lack of efficient broodstocks, broodstock facilities, hatcheries and natural food production facilities to support milkfish seed production remain a challenge. For instance, most hatcheries in Luzon area are still challenged by issues on scarcity of egg supply brought about by limited supply of good quality seawater for operations, brought about by high density cages, and delayed spawning of breeders. In times of southwest monsoon season,

decrease in salinity of seawater supply and high-water turbidity due to river runoffs is experienced which negatively affects spawning and larval rearing. Problems on continuous propagation of green microalgae and rotifer as natural food also confront local hatcheries. Since natural food is delicate and prone to collapse due to environmental stress, it is difficult to maintain all throughout the year. This results into below industry standard survival rate of fry at harvest. In order to improve fry production and increase fry survival rate, existing facilities should be upgraded to provide year-round supply of good quality seawater. Technical capability of hatchery operators must be enhanced to improve natural food production and milkfish breeding. Moreover, conduct of industry-relevant researches like genomics, broodstock management, nutrition, among others must be prioritized.

Fry importation issues. Over dependence on imported milkfish fry, which has a relatively high mortality rate than that of locally produced fry (average survival rate: 17.5% viz 72.5%), to fill in the supply gap is a potential threat to the industry. It can cause loss of revenue for the government and loss of income as well as job opportunities for Filipinos. Moreover, unregulated importation of fry may cause potential transfer of pathogens that can pose detrimental impact to the Philippine milkfish industry (Bagarinao, 1997). Along this line, stakeholders are in consonance that there is a need to craft a milkfish fry importation regulatory framework that will balance the economic needs and biosecurity concerns of the industry. A thorough and wide consultation will likewise have to be done in the process.

Lack of adequate supply of fry also gives opportunity to some importers as well as other local fry producers to take advantage and escalate the price of fry. This scenario happens usually during fry off season and adds burden to small fish farmers according to interviews with milkfish farmers in Bulacan.

iii. Feed and fertilizer manufacturing industries

The feed and fertilizer manufacturing industries support the milkfish industry for the production of quality feeds and pesticides including biologics for the milkfish producers. Table 12 shows the list of milkfish feed producers and suppliers in the country.

Table 12. List of Milkfish Feed Producers and Suppliers, 2020

No.	Name	Location
1	B-meg (San Miguel Foods, Incorporated)	San Miguel Ave, Ortigas Center, Mandaluyong, 1554 Metro Manila; Pangasinan
2	Rich (First El Presidente Manufacturing, Incorporated)	F. Ortigas Jr. Rd., Ortigas Center, Pasig, Metro Manila
3	Excel (Philippine Foremost Milling Corporation)	Davao City, Davao Del Sur
4	Feedmix Specialist Inc. II	Dampol 2nd A, Pulilan, Bulacan
5	General (General Milling Corporation)	Legazpi Village, Makati City, Philippines
6	Hoc Po (Hoc Po Feeds Corporation)	Sta. Rita, Guiguinto, 3015 Bulacan
7	Moric (NuRich Vitameal Corporation)	Araneta Subd., Quezon City
8	Ocean (Ocean Feedmill Corporation)	Bacolod, 6100 Negros Occidental

No.	Name	Location
9	Oversea (Oversea Agri-Aqua International Development Corporation)	Plaridel St, Cebu City, 6000 Cebu
10	Popular (Popular Feedmill Corporation)	Lower Calajoan, Minglanilla, 6046 Cebu
11	Ram (Ram Aquafeed Corporation)	P Remedio Banilad, Mandaue City, Cebu
12	Robina Starfeeds (Universal Robina Corporation)	Pasig City, Metro Manila
13	Tateh (Santeh Feeds Corporation)	Sto. Niño, Calumpit, Bulacan
14	Vitarich (Vitarich Corporation)	Sta. Rosa 1, Marilao, Bulacan
15	Angeles Core Enterprises, Inc.	Bo. Pulung Cacutud, Angeles City
16	CJ Philippines, Inc.	Brgy. Sampaloc, San Rafael, Bulacan
17	Arowana Agriventures Corporation	Richmond Global, Silway 7, Polomolok, South Cotabato
18	Cargill Philippines, Inc.	Bo. Dampol 1st, Pulilan, Bulacan
19	Grobest Feeds Philippines, Inc.	Barangay Singat, Gerona, Tarlac
20	Unahco, Inc.	Mandaluyong, Metro Manila
21	Green Era Biotech Corporation	Calawitan, San Ildefonso, 3010 Bulakan
22	Ace Feeds Philippines (Angeles Core Enterprises)	E1, Pulong Cacutud, Angeles City, Pampanga
23	Charoen Pokphand Foods Phils. Corp	Km 111, Ramon Superhighway, Gugo, Samal, Bataan
24	Feedworld, Inc	Edson Farm, Manibaug Paralaya, Porac, Pampanga
25	New Hope Bulacan Agriculture, Inc.	0645 Tibag, Pulilan, Bulacan
26	Southeast Feeds Specialist (Prodigy)	688 Mercado St. Guiguinto, Bulacan
27	Texicon Agri Ventures Corporation	C. Mercado, Brgy. Panginay, Guiguinto, Bulacan

Source: BAI

iv. **Financing institutions**

These are both government and private financing institution to provide capital for the hatchery operators, producers, processors and traders.

v. **Construction firms**

They also play an important role for the industry to help for the construction of infrastructure support to the milkfish industry.

b) Grow-out Farms and Farmers /Growers

Grow-out Production. The grow-out production segment rears the fingerlings from the nursery to marketable-sized milkfish at 400-500g.

Milkfish culture in the Philippines include: pond culture; pen culture; and, fish cage culture. Table 13 shows a summary of the characterization of each culture system.

Table 13. Characterization of Milkfish Grow-out Farming Culture in the Philippines

Characterization	Pond	Pen	Cage
Stocking Density	✓ Depends on intensity of culture and availability of aeration ● Intensive with aeration: 8-10mt/ha ● Extensive with lablab: 2,000 juveniles/ha	✓ Depends on water quality, organic matter load, and frequency of changing nets ● Eutrophic Freshwater Lakes: 30,000 to 50,000 fingerlings/ha or 1 fish/m^3 ● Marine and Brackishwater: 6-12 fingerlings/m^2	✓ Stocking density depends on the carrying capacity of the cage and the environment • floating and stationary cages: 10-40pcs/m^3 ● Offshore cages: 40-100 pcs/m^3
Annual Production/ Carrying Capacity	✓ A well-prepared lablab pond can produce up to 500kg bangus/ha	✓ 20-40kg/cubic meter depending on the site and intensity of culture ● Eutrophic Freshwater Lakes:4,000-10,000kg/ha (250-300g in 4-8mos with 60-80% survival) ● Marine and Brackishwater: 1.5-6kg/m^2(250-275g in 4-5 months with 80-90% survival)	✓ floating and stationary cages: 3-20kg/m^3 (70-90% survival) ✓ Offshore cages: 20-35 kg/m^3 (350-500g at final harvest; partial harvest can be done when fish reach 200g average body weight or ABW to think the stock and realize midway cash inflow)
Culture Period	✓ Defined by fish harvest size	✓ Defined by fish harvest size	✓ Defined by fish harvest size
Feeding Requirement	✓ Mainly dependent on natural food “lablab” (algal mat and all microorganisms associated with it)	✓ Eutrophic Freshwater Lakes: planktons; supplementary feeding may be required especially when stocked at higher densities or natural food	✓ Feeding of complete formulated diet (27-31% protein) is essential from stocking of the fish to harvest

Characterization	Pond	Pen	Cage
		becomes depleted ✓ Marine and Brackishwater: Commercial formulated diet containing 27-31% protein is fed daily at 3-4 times a day starting from stocking until harvest	

Source: http://saranganifry.com/milkfish.html
Yap, et al. 2007
PRDP Mindanao Processed Bangus VCA, 2016

The establishment of mariculture parks –marine cages in the country in the early 2000s has really shifted the production of milkfish from inland brackishwater to marine waters. It also changed the paradigm of milkfish culture wherein most of the brackishwater ponds in regions with high density fish cages have been utilized to produced 300– 500 g table-size milkfish instead of the usual marketable size of 250 to 300 g.

With prohibition of the conversion of mangroves to fishponds and the non-renewal of the government fishpond lease agreement of abandoned and non-productive fishponds, it is expected that more of the milkfish production will come from farming milkfish in marine cages. However, prior to further mariculture expansion, government should have comprehensive plan for mariculture site identification and zonation.

Part of the grow-out operations are fertilization and feeding practices. Feeds usually take up a larger share of total variable production cost ranging from 60-70%. Reported feed conversions obtained with commercial pellets in extensive culture are generally below 1, and range from 1.2-1.6 and 1.5-2.0 within semi-intensive and intensive culture, respectively. Higher feed conversion ratios (FCRs) are generally obtained with smaller stocking sizes, higher stocking rates, and increasing harvest size (PRDP Mindanao Processed Bangus VCA, 2016).

Partial harvesting has been already practiced not only in fishponds but among cages as well to avoid market gluts. An oversupply in the market pulls prices down. Some growers now prefer contracted buyers as well.

The key players in this segment of the supply chain are the fish producers, workers, including the management team of the business.

- Fish producers are fisherfolk directly or personally and physically engaged in culturing fish and other fishery products.
- Fish workers are persons regularly or not regularly employed in fish cages, fish pens and fish pond.
- Management teams are group of individual personnel within the organization who are tasked to perform their designated authorities and responsibilities to achieve business profit

Table 14 shows the partial inventory of the aquafarms and number of milkfish growers in the country based on the data gathered by DA-BFAR Regional Offices and registered aquafarms by DA-BFAR. In 2020, there were a total of 9,337 milkfish farmers in the country. The same record shows that there is a total of 15,138 aquafarms wherein 51% are fishponds, 47% are fish cages and about 2% are fish pens.

Aquafarm registration is done by the National Residue Control Program of BFAR. As shown in the table, there were only 255 registered milkfish aquafarms, mostly coming from Region I, in the Philippines. These registered aquafarms comprised a meager 1.76% of total aquafarms. The main reason of operators for registration is to comply for traceability and be fit as supplier for processing plants as well as for export market.

Table 14. Inventory of Milkfish Aquafarms and Milkfish Growers in the Philippines, 2020

Regions	No of Aquafarm [a]				Total Number of Registered Aquafarms [b]	Total No of Milkfish Growers [a]
	Pond	Pen	Cage	Total		
NCR	N/D	N/D	N/D	N/D		
REGION 1	783	101	1, 408	884	82	500
REGION 2	891	-	299	1,190		1,015
REGION 3	3,300	60	452	3,812	38	3,812
REGION 4A	ND	28	140	168	9	28
REGION 4B	360	-	31	391	26	387
REGION 5	368	5	68	441	8	441
REGION 6	1,597	30	21	1,648	27	1,765
REGION 7	152	23	84	259	6	240
REGION 8	31	5	760	796	9	37
REGION 9	307	-	121	428	11	314
REGION 10	92	9	193	294	22	135
REGION 11	151	17	3465	3,633	9	606
REGION 12	135	-	92	227	2	57
Caraga	N/D	-	332	332	6	332
PHILIPPINES	**8,167**	**278**	**7,466**	**14,497**	**255**	**9,669**

Source: *[a] DA-BFAR Regional Offices* *N/D – No data*
[b] DA-BFAR Official Website (https://www.bfar.da.gov.ph/)

Constraints Affecting Farming/Growing

One pressing concern that besets the grow-out segment of the milkfish VC is the prevalence of improper aquaculture practices resulting to siltation and mass fish kills. Specifically, these were brought about by high density cages beyond the area's carrying capacity as well as overfeeding.

Because there is no strict observance of traceability in domestic market and no mandatory registration for aquafarms, about 98% of the aquafarms that deliver to domestic market remain unregistered. Currently, registration is only required for farms that supply to registered processors.

It should be noted also that many of the brackishwater farms operators are not usually the owners but are lessors. This can create further challenge in registration.

There is likewise an observation that small-scale farmers are fragmented resulting to less economies of scale and low income.

c) Post-harvest and Processing

In this roadmap, processing already embeds post-harvest, packaging and labeling. Post-harvest and processing here cover both the traditional (i.e., marinating, drying, smoking, deboning) and non-traditional (freezing, bottling, canning, and other value-adding) techniques.

Processors are fisherfolk who are engaged in processing fish and other fishery products. Support crew staff and equipment/packaging manufacturers are also concern here.

Based from partial data gathered by the DA-BFAR Regional Offices, there are 82 local processors of milkfish in the country (Table 15). Topping the list are Regions 3 (40%) and Region 1 (34%). Other regions had no data.

Table 15. Inventory of Domestic Milkfish Processors in the Philippines, 2020

No.	Name	Location of Facility	Type of Products Processed	Market Destination
Region 1				
1	RIC San Vicente	San Vicente, Urdaneta City, Pangasinan	smoked, marinated, steamed deboned	Local
2	D' Alarcio Womens Rural Improvement Club, INC.	D' Alarcio, Laoac, Pangasinan	smoked, deboned	Local
3	St. Hannibal Multipurpose Cooperative	Sampaloc, Bolinao, Pangasinan	deboned	Local
4	Gayaman Aqua Processors Association	Gayaman, Binmaley, Pangasinan	smoked deboned, marinated deboned, shanghai	Local

No.	Name	Location of Facility	Type of Products Processed	Market Destination
5	Rosales Tinapa and Vendors Association	Carmen West, Rosales, Pangasinan	smoked, marinated	Local
6	Pinablin Calasiao, RIC, Inc	Poblacion West, Calasiao, Pangasinan	smoked, deboned	Local
7	San Miguel farmers and Fisherfolk Association	San Miguel, Bani, Pangasinan	smoked	Local
8	Brgy. Maasin Fish Vendor Fisherfolk Assoc.,	Maasin, Mangaldan, Pangasinan	smoked, deboned	Local
9	Calapugan Agrarian Reform Co.,	Calapugan, Natividad, Pangasinan	smoked	Local
10	Binmaley Upward Christian Women In Community Development (BUCWCD)	Linoc, Binmaley, Pangasinan	longanisa, smoked, marinated, chicharon, shanghai	Local
11	Talogtog Fish Processors Association	Talogtog, Mangaldan, Pangasinan	smoked, deboned	Local
12	Baquioen Mangangalap Multi Purpose Coop	Baquioen, Sual, Pangasinan	deboned shanghai smoked	Local
13	Fighter Fishermen and Fisherfolk Association	San Jose, Labrador, Pangasinan	deboned, shanghai	Local
14	Cabayaoasan Livestock, Fisherfolk P4MP Inc.	Cabayaoasan, Labrador, Pangasinan	deboned	Local
15	Vita's Farmers Delicacies Food Products Manufacturing	Bañaga east, Bugallon, Pangasinan	smoked, marinated , shanghai	Local
16	Emars Enterprise	Maniboc West, Lingayen, Pangasinan	fresh frozen deboned (Plain, Different cuts, smoked, marinated, Relleno kit)	Local
17	Icthys JRK	Banauang, Calasio, Pangasinan	Frozen Whole Milkfish	Local
18	JB's Aquafarm and Seafood Products	Buenlag, Binmaley, Pangasinan	frozen deboned (in different variants) & value-added products	Local

No.	Name	Location of Facility	Type of Products Processed	Market Destination
19	JE's Bagoong	Lingayen,Pangasinan	fresh frozen deboned (Plain and marinated), frozen whole	Local
20	Haileys Food Processing Plant	Pandan, Bacnotan	Fresh Frozen Deboned Milkfish (Plain and marinated)	Local
21	Centro Damortis Dried Fish Association	Damortis, Sto. Tomas, La Union	deboned	Local
22	San Mariano RIC	Bantay, Ilocos Sur	smoked	Local
23	Villamar RIC	Caoayan, Ilocos Sur	bottled	Local
24	Fuerte Rosangis Assoc	Caoayan, Ilocos Sur	smoked, deboned	Local
25	Suksukit RIC	Sto. Domingo, Ilocos Sur	smoked, deboned	Local
26	BRIDGE TO PROGRESS RIC	San Miguel, Sarrat, Ilocos Norte	Deboned	Local
27	Zona Del Zol Fish Production RIC	Solsona, Ilocos Norte	shanghai	Local
28	Dumalneg RIC	Dumalneg, Ilocos Norte	smoked	Local
Region 2				
1	RIC Luttuad	Luttuad, Diffun, Quirino	marinated	Diffun Public Market
2	RIC Rizal	Rizal, Diffun, Quirino	marinated	Diffun Public Market
3	RIC San Leonardo	San Leonardo, Aglipay, Quirino	marinated	Aglipay, Public, Market
4	RIC Divisoria Sur	Divisoria Sur, Maddela, Quirino	marinated	Maddela, Public Maret
5	Cabiseras Farmers and Fisherfolk Association	Cabisera 20, Ilagan City, Isabela	smoked, deboned	Ilagan Public Market
6	RIC Motherhood Association	Centro 3, Luna, Isabela	smoked, deboned	Luna Public Market
7			smoked, deboned	San Mateo, Public Market
8	Bhasang Cuaresma Cervantes	Barangay 2, San Mateo, Isabela	smoked, deboned	San Mateo, Public Market
9	Mira Cuaresma	Barangay 2, San Mateo, Isabela	smoked, deboned	San Mateo, Public Market
10	RIC Sta. Lucia	Sta. Lucia, Bagabag, Nueva Vizcaya	smoked, deboned	Bagabag Public Market

No.	Name	Location of Facility	Type of Products Processed	Market Destination
11	RIC Qurino	Quirino, Solano, Nueva Vizcaya	smoked, deboned	Solano Public Market
12	Quirino Women's Association	Quirino, Solano, Bueva Vizcaya	smoked, deboned	Solano Public Market
Region 3				
1	Samahang Ugnayan ng mga Kababaihan Mag-iisda ng Paltic	Dingalan, Aurora	bottled and smoked	Aurora
2	ABR Fish Dealer	Bataan	deboned, bottled, smoked	Bataan / Manila/ Subic/ Zambales
3	Amanda's Marine Product	Bataan	smoked, bottled	
4	BSPPC Seafresh Fishline Products	Bulacan	bottled	Bulacan
5	D'Originals smoked Fish Processors Association	Bulacan	smoked	Malolos/ Guiguyinto/ Balagtas/ Bocaue/ Marilao/ Meycauayan/ Manila/ Valenzuela
6	Reynaldo Gregoria	Bulacan	smoked	Calumpit
7	Unang Ginang	Bulacan	smoked	Calumpit
8	Chloejazz smoked fish	Bulacan	smoked	Calumpit
9	Matilde Ronquillo	Bulacan	smoked	Paombong/ Malolos
10	Mariluz Calixto	Bulacan	smoked	Paombong/ Baliuag
11	Marcella Rodriguez	Bulacan	smoked	Paombong
12	Prudencio De Arce	Bulacan	smoked	Paombong
13	Bacayao 4H	Nueva Ecija	smoked	Guimba
14	RIC - Sto. Domingo	Nueva Ecija	smoked	Sto. Domingo/ Cuyapo
15	Chrisopher Hipolito	Tarlac	smoked	Capas/ San Fernando/ Mabalacat
16	Tinapang Talaga	Tarlac	smoked	Capas/ Angeles/ Mabalacat
17	Amucao Women's Organization	Tarlac	smoked	Tarlac City

No.	Name	Location of Facility	Type of Products Processed	Market Destination
18	Daisy V. Mabuti	Tarlac	smoked	Tarlac City
19	June H. Baluyut	Tarlac	smoked	Tarlac City/ Gerona
20	RIC Pulo Kabalutan Orani Bataan	Orion, Bataan	smoked, bottled	Local
21	Samahan at Ugnayan sa Pangisdaan ng Orion	Orion, Bataan	smoked, bottled	Local
22	Federated Fisherman's Association	Bagac, Bataan	smoked, bottled	Local
23	Samahan ng Regaton ng Panibatuhan	Morong, Bataan	smoked, bottled	Local
24	Calumpit Fisherman's Cooperative	Calumpit, Bulacan	smoked, bottled	Local
25	Hagonoy Fish Farmer's Producer's Cooperative	Hagonoy, Bulacan	smoked, bottled	Local
26	Obando Fisherfolks Associaton	Obando, Bulacan	smoked, bottled	Local
27	NASAMAPA	Paombong, Bulacan	smoked, bottled	Local
28	Pescodores Fisherfolks and Farmers Association	Candaba, Pampanga	smoked, bottled	Local
29	San Miguel Pundaquit Fisherfolks Association	San Antonio, Zambales	smoked, bottled	Local
30	La Paz Deep Sea Fishing Association	San Narciso, Zambales	smoked, bottled	Local
31	Bangkero Fisherfolks Association	Olongapo City, Zambales	smoked, bottled	Local
32	Liwanag ng Buhay Fisherfolks Association	Cabangan, Zambales	smoked, bottled	Local
33	Samahang Nagtutulungan ng mga Kababaihan ng Ermita Hills	Baler, Aurora	smoked	Local
Region 6				
1	Asia Pacific Aqua Marine, Inc.	Timpas, Panit-an, Capiz	Canned, smoked, fresh chilled	Local

No.	Name	Location of Facility	Type of Products Processed	Market Destination
Region 7				
1	SONAMCO (Southern Negros Oriental Agribusiness Multi-Purpose Cooperative)	Sumaliring, Siaton, Negros Oriental	deboned	Local (Negros, Manila)
2	Rachael Abapo	Cansojong, Talisay City, Cebu	bottled	Local
Region 8				
1	Lorenzo Robles	Brgy. South, San Jose, Northern Samar	Stuffed marinated deboned	Local
2	Benabaye Primary Multipurpose Cooperative	Acacia District, Merida, Leyte	Deboned	Local
3	Tiklos Kabuhian Han Kababayen-An Han San Antonio (Association)	San Antonio, Basey, Samar	Softboned Deboned	Local
4	Sta. Cruz Women Association	Sta. Cruz, Tanauan, Leyte	Softboned	Local
Region 9				
1	Godelia Napigkit	San Pedro, Dapitan City, Zamboanga Del Norte	deboned	Local
2	Febes Tacbaya	Banonong, Dapitan City, Zamboanga Del Norte	deboned	Local
3	Allan Icao	Polo, Dapitan City, Zamboanga Del Norte	deboned	Local
4	Ronald Cimafranca	Polo, Dapitan City, Zamboanga Del Norte	deboned	Local
5	Niña Obnimaga	Dawo, Dapitan City, Zamboanga Del Norte	deboned	Local
6	Dennis Gonzales	Liyang, Dapitan City, Zamboanga Del Norte	bottled	Local
7	Jocelyn Gazo	Polo, Dapitan City, Zamboanga Del Norte	bottled	Local
8	Alindahaw Rural Improvement Club/Womens Empowerment Movement Association	Alindahaw, Tukuran, Zamboanga Del Sur	bottled	Local
Region 10				

No.	Name	Location of Facility	Type of Products Processed	Market Destination
1	D'farm	Misom	bottled	Local
2	Centennial Gen Mdse	Catadman	bottled	Local

Source: DA-BFAR Regional Offices Data *Notes: N/D= No data*

Aside from the above local milkfish processors, there are 20 BFAR-registered fishery establishments that process milkfish product lines. These establishments are all HACCP compliant at the very least while nine (9) are European Union (EU) approved (Table 16).

Table 16. List of BFAR-Approved (HACCP Compliant) Processors with Milkfish Product Lines, 2020

No.	Region	Name of Establishment	Address	Products
1	1	Korea-Philippines Seafood Processing Complex (SPC)	BFAR-NIFTDC, Compound Bonuan Binloc, Dagupan City	Fresh Frozen Plain Deboned Milkfish Fresh Frozen Marinated Deboned Milkfish
2	3	Angel Farmers Gourmet Food Corporation	San Jose, Magalang, Pampanga	Fresh Frozen Milkfish (whole round Deboned Unseasoned and Marinated Milkfish)
3	3	Mica by the Sea	N4018 Centennial Road, Clark Freeport Zone Pampanga	Frozen Milkfish (whole and baby) Frozen Boneless Milkfish and belly, marinated baby, Deboned Milkfish (vacuum Packed) Frozen Marinated baby split milkfish (vacuum)
4	3	TGA Foods Corporation	N7179 cm. Recto Corner. Blue Diamond St., Clark, Special Economic Zone	Fresh Frozen Deboned Milkfish Fresh Frozen Whole and Belly Milkfish
5	NCR	Eoana Canning and Food Processing Corporation	Navotas Fish Port Complex, Navotas, Metro Manila	Frozen Marinated Deboned Milkfish Frozen Whole Milkfish (eviscerated and uneviscerated)
6	NCR	Philprawns and Seafood Corporation	14-A SCPI Bldg., Veterans Road, Veterans Center, Western Bicutan, Taguig	Fresh Frozen Milkfish
7	NCR	Tiger Marine Products	L6 B5, Greenland Street, Topland, Subd., San Isidro, Paranaque City	Fresh Chilled Milkfish

No.	Region	Name of Establishment	Address	Products
8	4A	CARM Foods Enterprise, Incorporated	Don Basilio St., Ligtong, Rosario, Cavite	Dried Bangus Smoked Bangus
9	4A	Ipil Oriental Food Export & Consolidator	#1 First St., Virginia Summerville Subd., Phase 1, Mambugan, Antipolo City	Fresh Frozen Deboned Milkfish (Plain & Marinated)
10	4A	Ocean Glory Seafood Dealer	B3 L11 Eloisa St., Casimiro Baytown Village Habay 1, Bacoor City, Cavite	Fresh Chilled Milkfish
11	11	Anderlude Seafood Corporation	Davao Fish Port Complex, Toril, Davao City	Fresh Frozen Whole Milkfish Fresh Frozen Deboned Milkfish and Milkfish Belly Cuts

Source: DA-BFAR Fisheries Inspection and Quarantine Division

Table 17. List of EU-Approved Processors with Milkfish Product Lines, 2020

No.	Region	Name of Establishment	Address	Products
1	1	Anjo Farms Incorporated	Brgy. Sabangan, San Fabian, Pangasinan	Frozen Deboned Milkfish (smoked, plain, marinated & different cuts) Frozen Deboned Milkfish Value Added Products (adobo, teriyaki, barbeque, curry, sisig, spring roll, native sausage, relleno kit)
2	3	Fisher Farms Incorporated	Dampol 2nd A. Pulilan, Bulacan	Fresh Frozen Milkfish (whole round, baby split, whole deboned, deboned marinated belly (bistek,& adobo marinated), deboned marinated, deboned spicy marinated, deboned marinated baby split, deboned spicy marinated baby split, deli products (fish hotdog/cheesedog, fish frankfurter sausage, fish hungarian sausage, fish longaniza (garlic, spicy, skinless), natural fish sausages (kielbasa, Italian,frankfurter and german)vacuum-packed, Frozen Vacuum packed hot smoked deboned milkfish Frozen ground meat Fresh Frozen Deboned Marinated Milkfish Loins (Asian curry, Mexican glaze, garlic and herbs, marinated steak, roasted garlic, summer onion & tandoori masala) Fresh Frozen sinigang sliced/ cut/ descaled/ and gill gutted scaled on/off milkfish

				Frozen steamed deboned milkfish loins Crispy Bangus-(Danaing Marinade, Sili Anghang Marinade, Inasal Marinade (Breaded marinated deboned milkfish) Fresh Chilled Whole Round Milkfish Fresh Frozen Deboned Smoked Milkfish Frozen Deboned Cooked Milkfish Loins
3	NCR	Superb Catch, Incorporated	46 Maria Clara St., Acacia, Malabon City	Boneless Milkfish Unseasoned Boneless Milkfish Marinated Boneless Milkfish Marinated hot Boneless Milkfish Belly, Back fillet, head and tail Frozen Milkfish (Barbeque, Steak Ala Pobre and Inasal) Frozen Smoked Milkfish Frozen Milkfish Meat, Milkfish Bits (Bangus Sisig), Milkfish Roll (rellenong bangus) and Milkfish Spring Roll
4	12	Alsons Aquaculture Corporation	Alabel, Saranggani Province	Fresh Frozen Whole Milkfish Fresh Frozen Baby Whole Milkfish Fresh Frozen Deboned Milkfish Frozen Smoked Deboned Milkfish Frozen Smoked Deboned Baby Milkfish Fresh Frozen Deboned Milkfish Belly Fresh Frozen Deboned Milkfish Fillet Fresh Frozen Gutted Gilled Sliced Milkfish Fresh Frozen Gutted Gilled Descaled Scale Milkfish Fresh Frozen Deboned Milkfish Loafkit Fresh Frozen Deboned Marinated Milkfish Fresh Frozen Deboned Marinated Milkfish-Spicy Fresh Frozen Baby Split Marinated Milkfish Fresh Frozen Baby Split Marinated Milkfish-Spicy Frozen Milkfish Embutido Frozen Cooked Stuff Milkfish Frozen Milkfish Fillet tapa Frozen Milkfish Fillet Sisig Frozen Milkfish Tocino Fresh Frozen Deboned Marinated-Classic Daing, Milkfish-in-Tomato Sauce (MTS), Milkfish-in-Oil
5	12	General Tuna Canning Corporation	Tambler, General Santos City	Canned Milkfish (gourmet bangus, fillet in oil with tausi, Spanish style in oil and in chili sauce)
6	12	General Tuna Canning	SAFI Compound 2,	Fresh Frozen Whole milkfish, Fresh Frozen Deboned Milkfish (Plain and marinated)

		Corporation (SAFI II Plant)	Brgy. Tambler, General Santos City	Fresh Frozen Belly (unseasoned and marinated) Fresh Frozen Milkfish (bangus) (whole round/ deboned milkfish/baby classic/deboned marinated/hot & spicy/ home style classic/belly marinated/tapa/tocino & deboned fillets) Fresh Frozen Milkfish (Fish Fingers and Katsu Nuggets)
7	12	RDEX Food International Phils., Incorporated	Calumpang, General Santos City	Frozen Milkfish (Whole Round, Whole Gilled and Gutted Milkfish, boneless plain, boneless fillet, baby split marinated classic, barbeque and adobo flavor products milkfish)
8	12	Rell and Renn Seafood Sphere Corporation	Tambler, General Santos City	Frozen Milkfish (whole, gilled and gutted, baby Split (150-250 grams) Frozen plain deboned Milkfish
9	12	Malalag Bay Aquaculture & Processing Corporation (former - Sta. Cruz Seafoods, Incorporated)	General Santos Fish Port Complex, Tambler, General Santos City	Fresh Chilled whole round milkfish Fresh Frozen Milkfish (whole, gilled and gutted, plain deboned and marinated, sinigang cut, belly cut, deboned and baby split plain marinated and minced, smoked deboned milkfish

Source: DA-BFAR Fisheries Inspection and Quarantine Division

Constraints Affecting Post-harvest and Processing

Processors raised their concern on the limited and seasonal supply of quality small bangus as raw materials for processing. This, in turn, limits the expansion of value-added milkfish products for the local and global market. Meanwhile, milkfish growers are apprehensive to venture on harvesting small size bangus citing concerns on profitability, stocking rate change, and strict quality standards.

This segment of the milkfish VC is also embedded with value adding activities involving cold storage and logistics. Logistics services include transport service, storage and warehousing. Transport industries offer service for the distribution the products to designated markets.

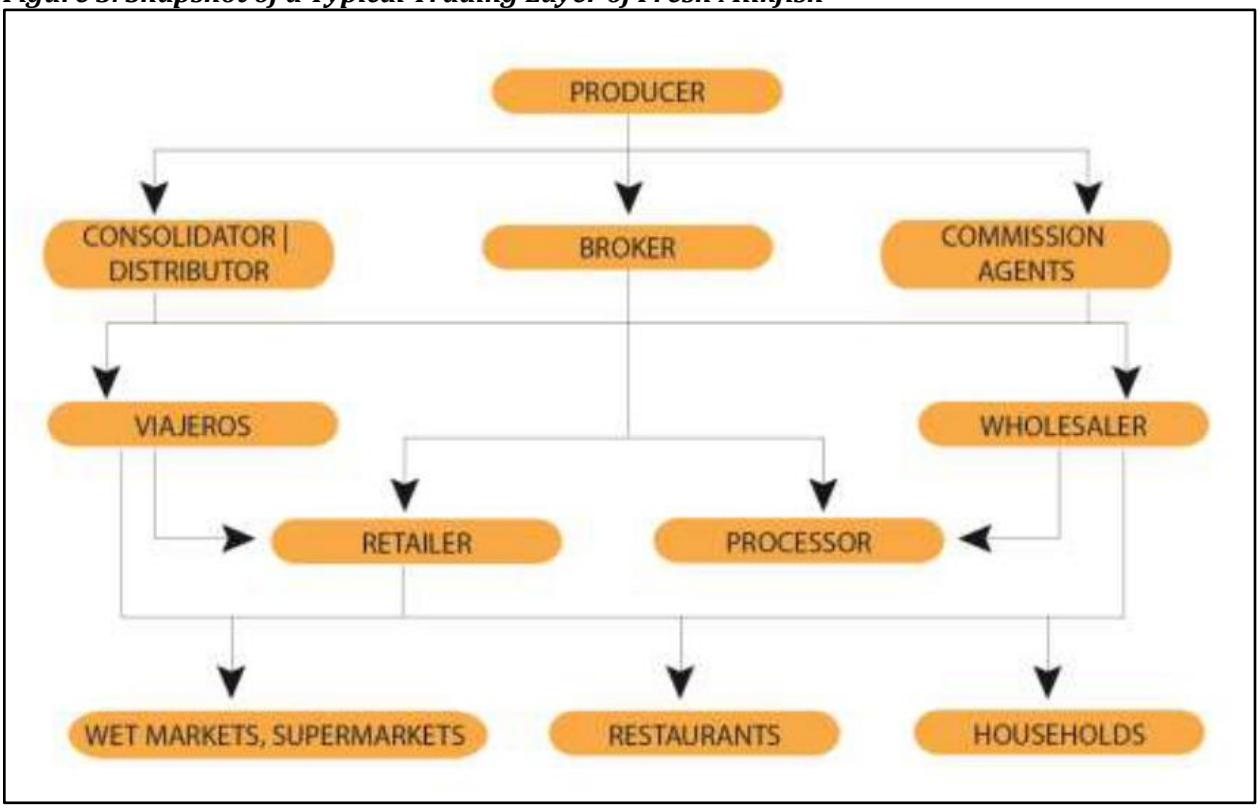
There are numerous domestic traders involve in the bangus industry while the nine (9) EU-approved processors are likewise the exporters themselves.

Marketing Channels

Domestic trading of milkfish follows a multilevel distribution channel before it reaches the end consumer. While a few milkfish farmers/growers sell their produce direct to the consumers or processors, a greater number of them don't. Harvests are instead passed through consolidators, brokers, dealers, or agents.

Generally, milkfish and other fish products are sold through marketing layers-from producers to brokers, *consignacions* or consolidators and agents to viajeros and wholesalers and then to retailers and processors before the product reaches the consumers and institutional buyers. Figure 3 shows a snapshot of a typical trading layer of fresh milkfish in Mindanao.

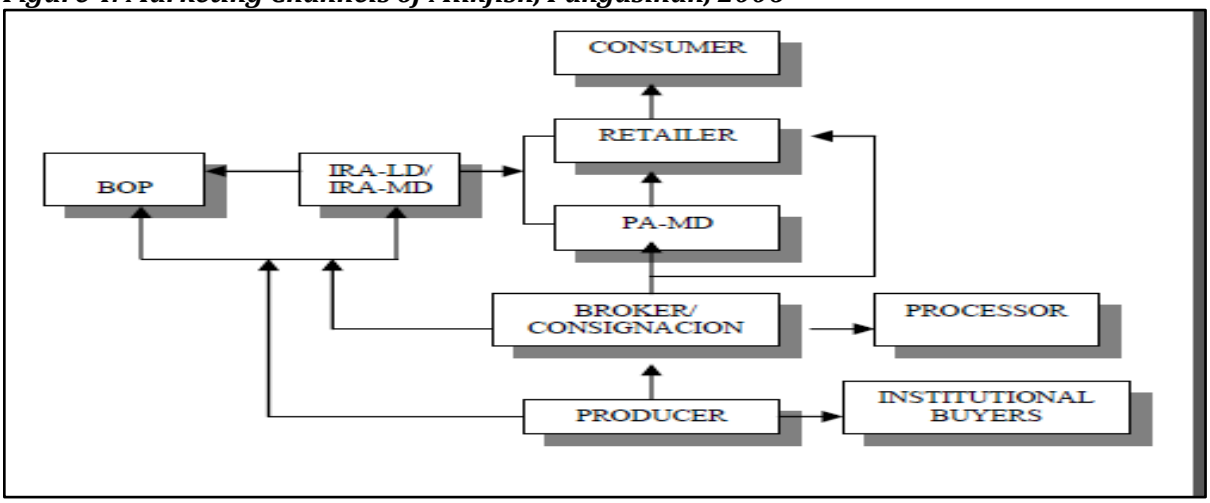
Figure 3. Snapshot of a Typical Trading Layer of Fresh Milkfish



Source: PRDP Mindanao Processed Bangus VCA, 2016

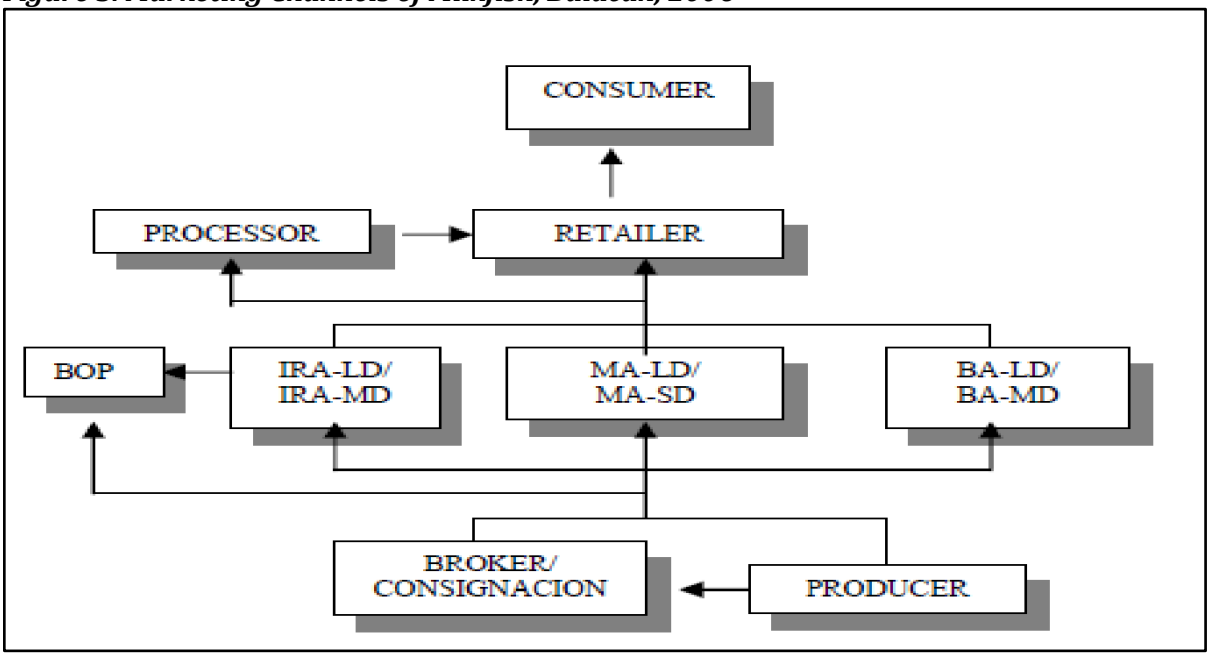
In 2007, the BAS, which is now under the PSA, released a paper on Marketing Costs Structure of Milkfish and shows four localized marketing channels among the top 10 milkfish producing provinces particularly that Pangasinan, Bulacan, Capiz and Iloilo (Figures 4 to 7). These figures still send the same message of how multi-layered are the marketing channels for milkfish which remains true up to the current times.

Figure 4. Marketing Channels of Milkfish, Pangasinan, 2006



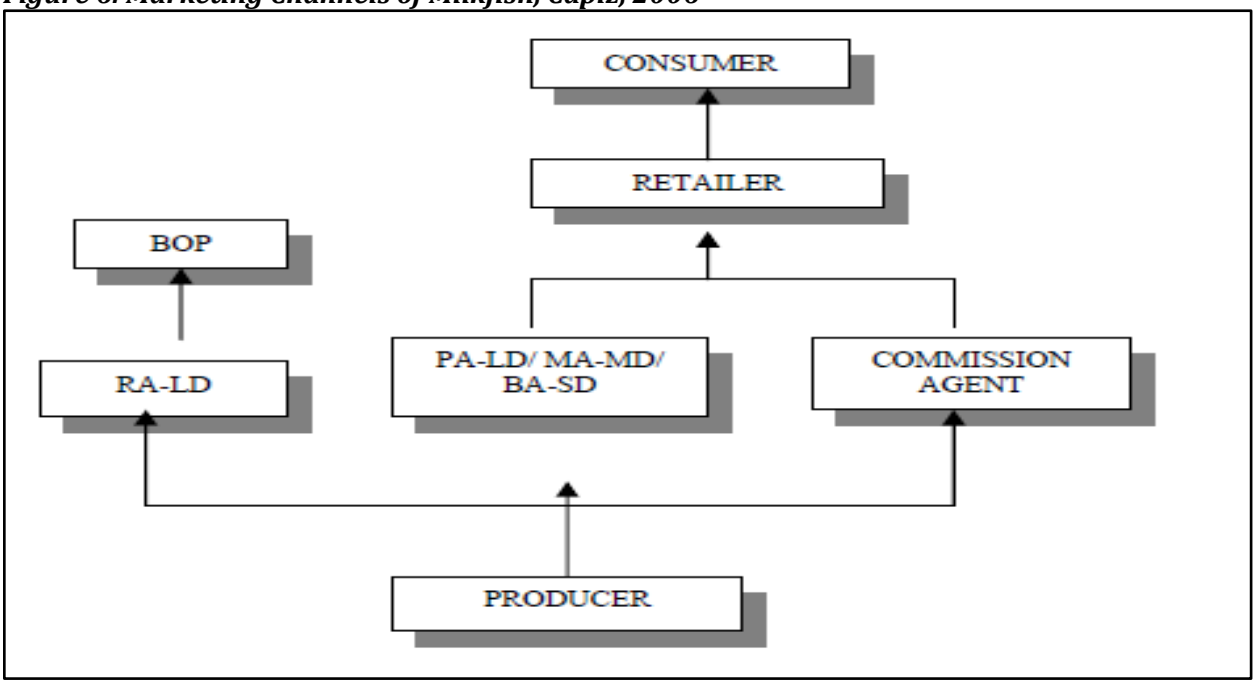
Source: BAS 2007
BOP=Buyers Outside the Province; PA-MD = Provincial Assembler – Medium Distributor
IRA-LD = Interregional Assembler – Large Distributor; IRA-MD= Interregional Assembler – Medium Distributor

Figure 5. Marketing Channels of Milkfish, Bulacan, 2006



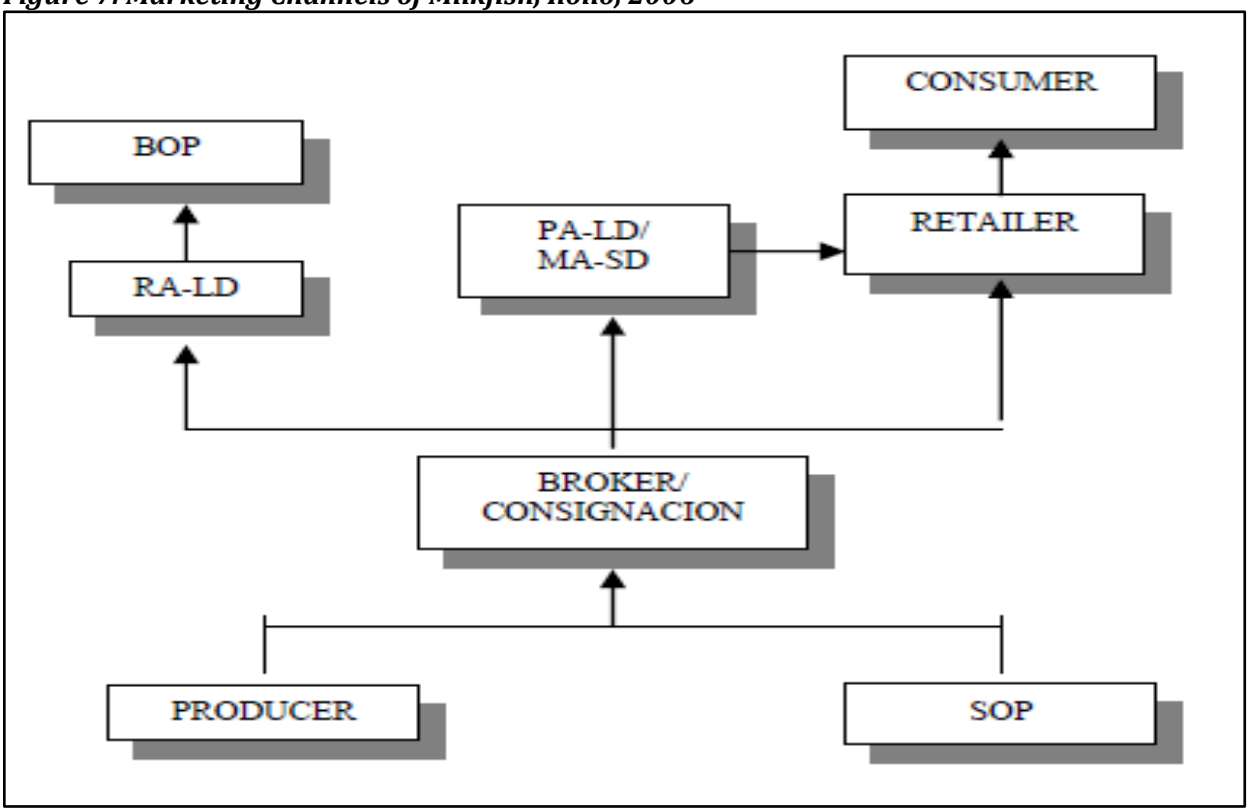
Source: BAS 2007
MA-LD = Municipal Assembler – Large Distributor; MA-SD = Municipal Assembler – Small Distributor;
BA-LD = Barangay Assembler – Large Distributor; BA-SD = Barangay Assembler – Small Distributor

Figure 6. Marketing Channels of Milkfish, Capiz, 2006



Source: BAS 2007
RA-LD = Regional Assembler – Large Distributor

Figure 7. Marketing Channels of Milkfish, Iloilo, 2006



Source: BAS 2007 *SOP = Seller Outside the Province*

Navotas and Malabon markets are the biggest consignment markets in the country. Marketed milkfish are fresh, chilled or frozen forms. The price and volume of milkfish is usually dictated by the *consignacion*. The bulk of fish unloading from these markets is sold in Metro Manila and nearby provinces. Only a small percentage is sold to fish exporters and small-scale processors based in Metro Manila.

Constraints Affecting Trading

The multi-level and multi-layered market distribution channel of milkfish fish products are an indication of a weak linkage/network between growers and processors/exporters. Oftentimes, due to many marketing layers, prices are manipulated resulting to high retail price of milkfish but farm gate price still the same.

One of the challenges identified by exporters during the consultations conducted is the limited international market for milkfish. Unlike carps and tilapia, milkfish is not globally recognized by other countries due to its spiny characteristics. Consumers of exported milkfish are usually Filipino communities abroad in USA, Middle East, Canada, Europe and Australia. Hence, processors have expanded their product lines to easier to eat milkfish-based items to increase competitiveness and widen their market reach. Most of the exporters innovated various deli products, explored different flavors for marinated milkfish and produced choice cuts or ground meat instead of selling it in whole gutted.

Product traceability and quality assurance are also concerns in relation to the export market.

2. Product Forms

Milkfish is placed relatively lower in food chain. It eats primarily plant materials and detritus but will readily eat rice bran, trash fish, and formulated diet when natural food becomes scarce. It can exploit food found from the surface of the water up to the bottom. It is also a benthic feeder which browses on complex benthic organisms (lablab), filamentous algae, and detritus on the bottom. Due to its diet, the flesh of milkfish has a distinct mild flavor unlike most of white fishes which have neutral bland taste.

Almost 90% of milkfish produced in the Philippines are sold in fresh chilled form in the domestic market; either in various product forms such as whole or in prime cuts, bellies, backs, heads and tail (FISH, 2005). Milkfish has about 196-214 spines. The unique characteristic of having numerous spines limits the marketability of milkfish. Thus, to reach a wide-range of consumers, deboned milkfish is one of the most popular product forms in local and a number of international markets.

Deboned milkfish or "boneless milkfish" is the most popular value-added milkfish product in the local market particularly in Luzon areas (PRDP, 2016). These are sold fresh-chilled, smoked, marinated and chilled, or individually packed and frozen. Trimmings and the small pieces of flesh from the production of "boneless milkfish" are further made into other value-added products such as fishballs, quekiam, embutido, etc. Other milkfish products produced in Luzon regions include the split-salted dried milkfish (*daing na milkfish*), fillets, smoked milkfish (tinapa), marinated milkfish, frozen premium cuts (belly), stuffed milkfish (relleno), and bottled milkfish.

Milkfish belly-based products are the most profitable as it commands the highest price. However, profitability depends on a significant extent to the size of the fish. To have a good recovery and meet requirement of buyers of belly products, one would need at the minimum a 450-gram fish. Most processors use the excess flesh after cutting the belly into production of surimi products. A large segment of the country's exported milkfish consists of fresh frozen whole, split, sliced, or deboned milkfish in a variety of forms such as marinated, smoked, dried and vacuum-packed.

To address the concern of the export market, processors have expanded their product lines to easier to eat milkfish-based items to increase competitiveness and widen their market reach. Most of the exporters innovated various deli products, explored different flavors for marinated milkfish and produced choice cuts or ground meat instead of selling it in whole gutted.

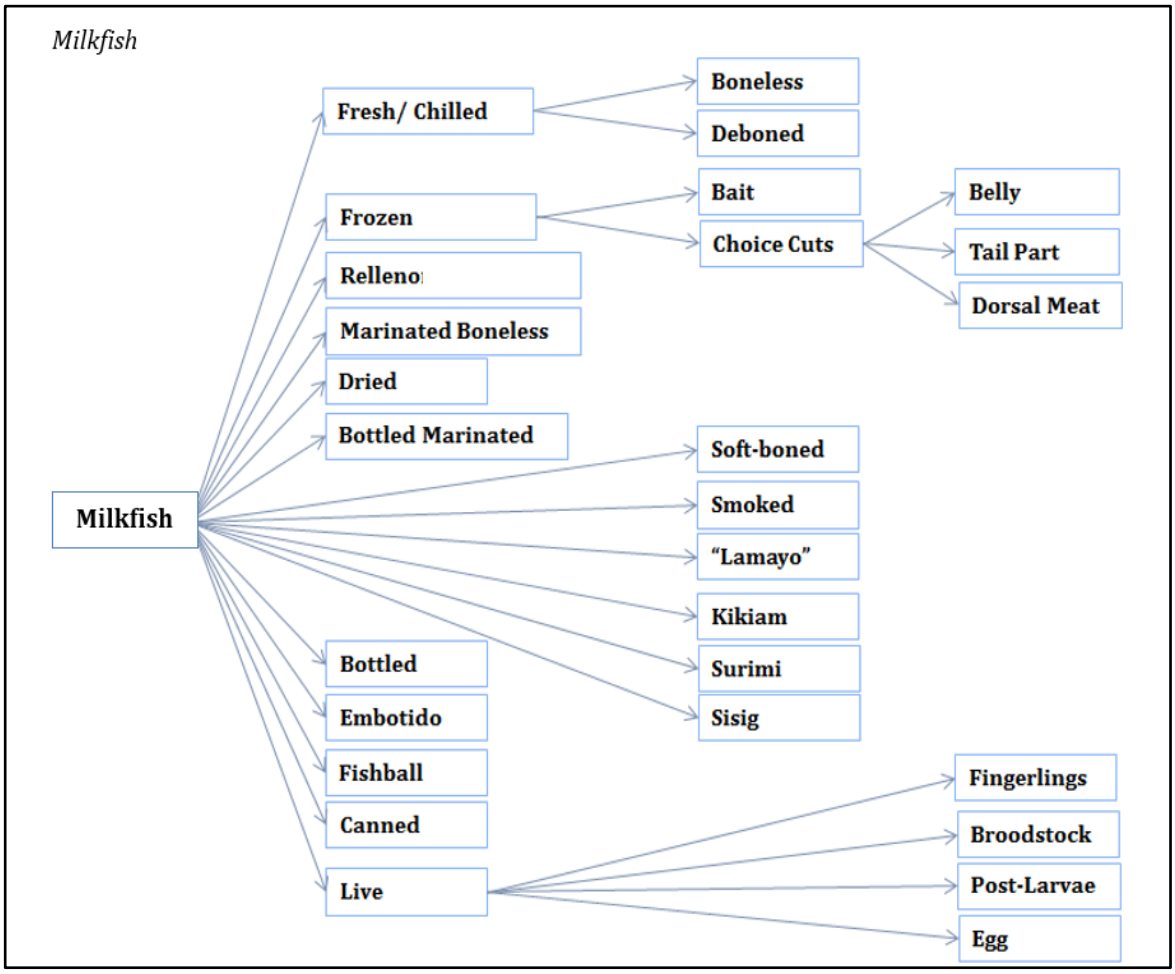
About 94% of the exported milkfish products are in frozen/chilled forms while the remaining 6% are in other value-added product forms.

Milkfish can also be used alternatively as bait for tuna. In Davao Region, a growing number of longline vessels are using live milkfish fingerlings (5 to 6 inches) as bait instead of fish from the wild which has negative implications on fisheries population. Live milkfish have been mainly used by Taiwanese vessels. Live milkfish are often transported in sealed plastic bags filled with water and oxygen. The decision to use live milkfish over alternative bait is dependent on the following factors:

- Attitude and experience of the vessel captain with live baits;
- Capability of vessel to hold live bait;
- Consistent availability of live milkfish;
- Quality of the live milkfish (size, health, pre-acclimated to saltwater); and
- Price of the live milkfish compared to other alternative baits.

Figure 8. Different Milkfish Product Forms

Figure 9. Milkfish Product Forms



B. Industry Performance and Outlook

1. Production

World Aquaculture and Milkfish Production

In 2018, world aquaculture fish production reached 82.1 million tons (FAO). This contribution of world aquaculture was 46% out of the total 179 million tons global fish production in the same year. China has remained a major fish producer, accounting for 35% of global fish production in 2018. Excluding China, a significant share of production in 2018 came from Asia (34%), followed by the Americas (14%) Europe (10%), Africa (7%) and Oceania (1%).

Among aquaculture commodities, finfishes wherein milkfish is included, dominated the aquaculture sector. In 2018, it contributed about 47-54.3 million tons for inland aquaculture and 7.3 million tons for marine and coastal aquaculture (FAO). As for the top finfishes cultivated, Carp species (Grass carp, Silver Carp, Common Carp and Bighead Carp) and Nile Tilapia dominated the

global finfish production (Table 18). Milkfish ranked 12th among the finfish species cultured in the world. It shared about 2.4% in the total finfish production.

Table 18. Major Finfish Species Produced in World Aquaculture, 2018

Finfish species	C.Y 2018 (Thousand MT)	% Share to Global Finfish Production (percentage)
1. Grass Carp	5,704	10.5
2. Silver Carp	4,788.50	8.8
3. Nile Tilapia	4,525.40	8.3
4. Common Carp	4,189.50	7.7
5. Big Head Carp	3,143.70	5.8
6. Catla	3,041.30	5.6
7. Carassius spp.	2,772.30	5.1
8. Freshwater Fishes	2,545.10	4.7
9. Atlantic Salmon	2,435.90	4.5
10. Striped Catfish	2,359.50	4.3
11. Rohol labeo	2,016.80	3.7
12. Milkfish	1,327.20	2.4
13. Torpedo-shaped catfishes	1,245.30	2.3
14. Tilapia spp.	1,030	1.9
15. Rainbow trout	848.1	1.6
16. Wuchang bream	783.5	1.4
17. Marine Fishes	767.5	1.4
18. Black Carp	691.5	1.3
19. Cyprinids	654.1	1.2
20. Yellow Catfish	509.6	0.9
21. Other finfishes	8,900.20	16.4
TOTAL	**54,279.00**	**100**

Source: *UN-FAO Fisheries and Aquaculture Statistics, 2018*

Milkfish farming is being practiced only in the three regions of the world- Asia, Oceana, and Africa. Asia remained to be the largest contributor for global milkfish production in 2018 accounting for 99.97% of overall production (Table20).

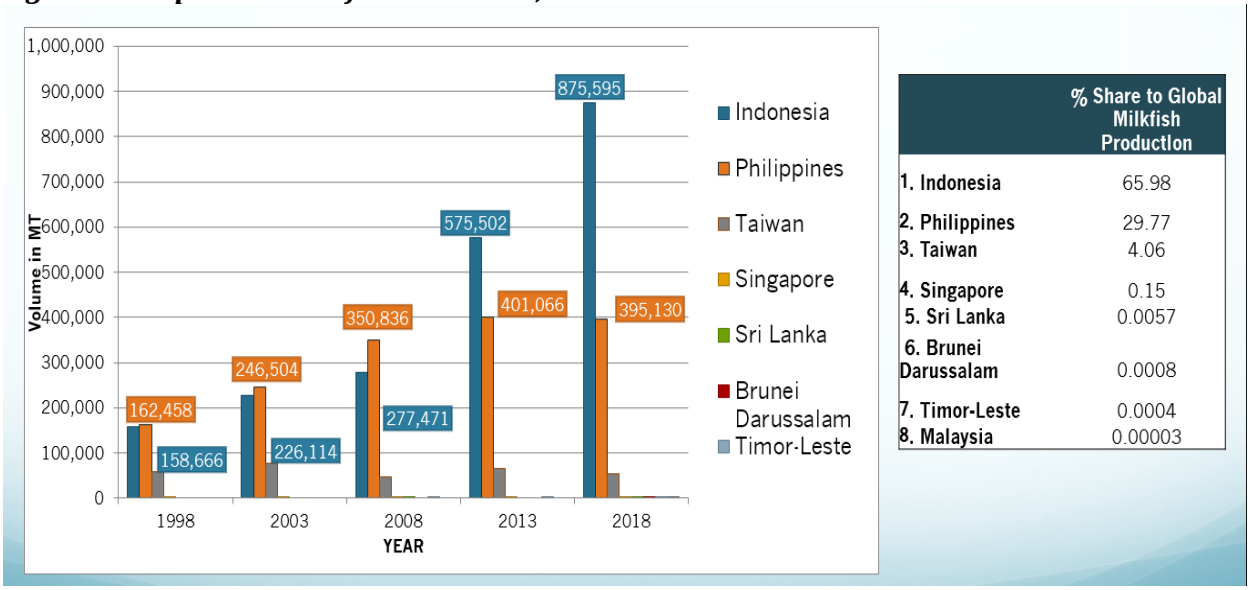
Table 19. Global Milkfish Production per Region in MT, 1998-2018

	Year				
	1998	**2003**	**2008**	**2013**	**2018**
World	**379,650**	**552,083**	**676,236**	**1,044,179.00**	**1,327,153.00**
Asia	379,621	552,009	676,163	1,043,903.70	1,326,746.30
Africa	0	0	2	209.77	355.70
Oceania	29	74	70.64	65.3	51.1

Source: Food and Agriculture Organization of the United Nations-Fisheries and Aquaculture Statistics, 2018

In 2018, top milkfish producing country is Indonesia which shared 66% of the total milkfish volume in the world. Philippines comes next with 29.77% contribution followed by Taiwan with 4% portion of the total global milkfish production (Figure 10). It should be noted that the Philippines used to take the lead in terms of milkfish production from 1998 to 2008. In 2013, however, milkfish production growth in the Philippines slowed down due to occurrence of typhoons and fish kills. Though there is an increase in production per year, Philippines' growth in production became relatively stagnant compared to Indonesia. Indonesia finally edged off the Philippines in 2013. Indonesia was able to double its milkfish production from 277 MT in 2008 to 575 MT in 2013 recording about 107.41% growth in five years. Indonesia consistently expanded its production and continued to gain lead in production.

Figure 10. Top Global Milkfish Producers, 1998-2018



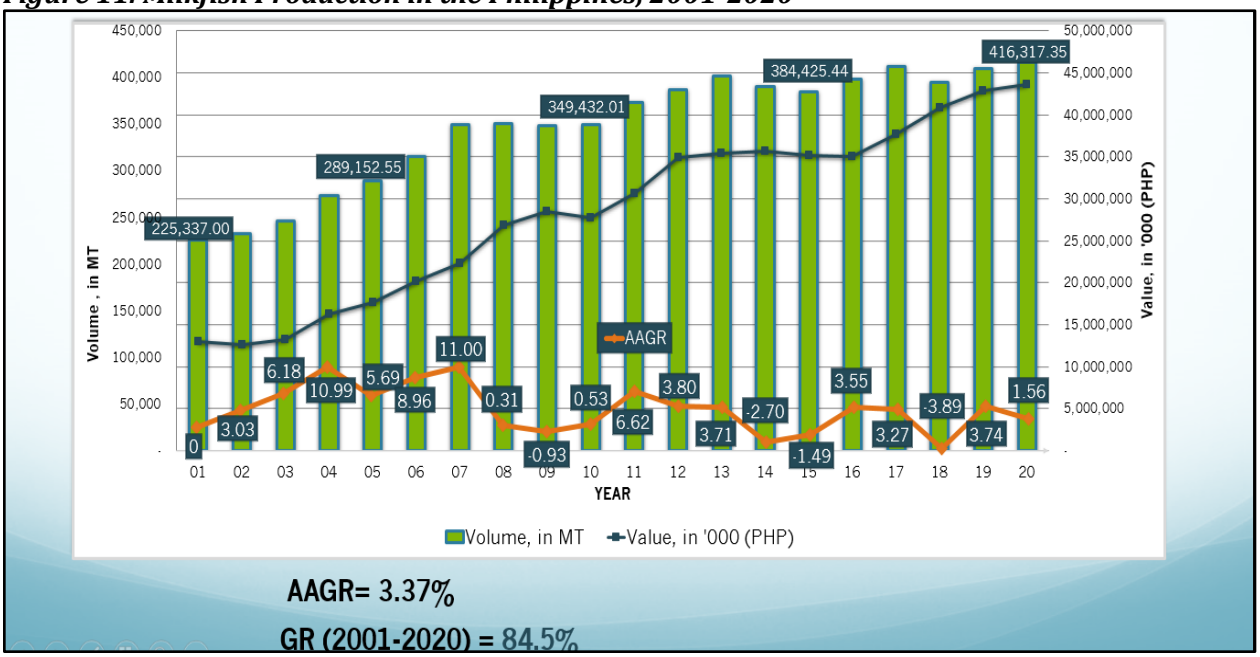
	% Share to Global Milkfish Production
1. Indonesia	65.98
2. Philippines	29.77
3. Taiwan	4.06
4. Singapore	0.15
5. Sri Lanka	0.0057
6. Brunei Darussalam	0.0008
7. Timor-Leste	0.0004
8. Malaysia	0.00003

Source: UN-FAO, 2018

Philippines Milkfish Production

Volume of milkfish harvested in the Philippines increased by 84.5% over the past 20 years, that is, from 225,337 MT in 2001 to 416, 315 MT in 2020 (Figure 11). During the same period, production has an increasing trend and recorded an average annual growth rate (AAGR) of 3.37%. In 2020, milkfish contributed 17.9% to total national aquaculture production. Though there is a continuous growth documented, milkfish production in the country fluctuated in 2009, 2014 to 2015 and 2018. This can be accounted to series of typhoon occurrences that devastated milkfish farms during these periods. Inadequate seedstocks and decreased investment on milkfish farming due to shifting to high value species such as shrimp were the other contributory factors.

Figure 11. Milkfish Production in the Philippines, 2001-2020



Source of basic data: Philippine Statistics Authority, 2021

BFAR Alternative Estimate of Milkfish Production for 2020

In response to the clamor of the private on observed inaccurate production data reported by the concerned authorities such that of the PSA, the BFAR National Bangus Program came up with an estimate of the 2020 production. The setting up of the assumptions and parameters was in consultation with the Milkfish Roadmap RDT and other stakeholders. The resulting figures are reflected in Tables 21 and 22. The National Bangus Program's production estimate turned to be around 32,000 MT higher that of PSA's.

Table 20. BFAR-National Bangus Program Local Production Estimate for Milkfish, 2020

Parameters	Fishpond			Fish Cage (Circular)		Fishpen
	Extensive	Semi-Extensive	Intensive			
	1 ha	1 ha	1 ha	10-15 diameter	18-20 diameter	1 ha
Ave. Stocking Density per hectare/unit, pcs	3,000	12,000	20,000	25,000	55,000	15,000
Ave. Survival Rate at Harvest, %	85	85	85	90	90	85
No of Crop per year	2	2	2	2	2	2
Ave. Body Weight at Harvest (kg)	0.33	0.33	0.45	0.55	0.55	0.5
Ave. Yield per Crop (kg)	842	3,366	7,650	12,375	27,225	6,375

Parameters	Fishpond			Fish Cage (Circular)		Fishpen
	Extensive	Semi-Extensive	Intensive			
	1 ha	1 ha	1 ha	10-15 diameter	18-20 diameter	1 ha
Ave Yield in a Year (kg)	1,431	5,722	13,005	24,750	54,450	12,750
Total Hectarage/No of Units	11,269	32,229	197	5,470	1,952	278
Ave Yield in a year (kg)	16,121,353	184,420,144	2,559,774	135,382,500	106,286,400	3,544,500
Ave Yield in a year (ton)	**16,121**	**184,420**	**2,560**	**135,383**	**106,286**	**3,545**

Source of basic assumptions: Industry
Processed by BFAR National Bangus Program

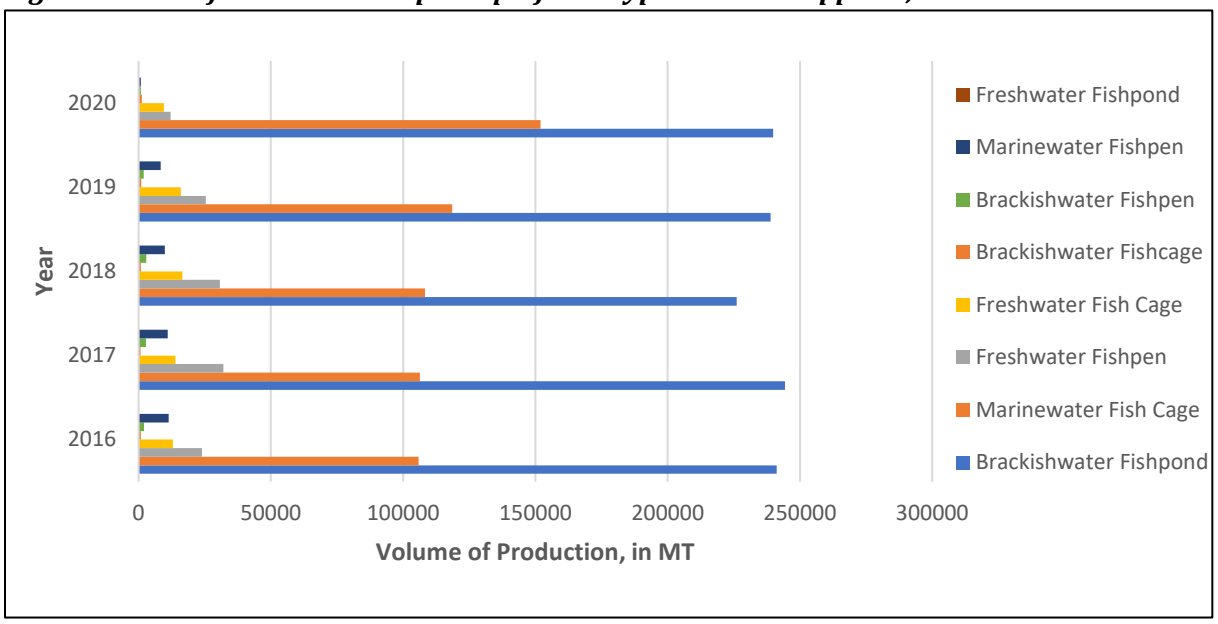
Table 21. BFAR-National Bangus Program Local Production Estimate versus PSA Data, 2020

Source	Production Volume (in MT)
BFAR National Bangus Program Production Estimate	448,314.67
PSA Estimate	416,317.99
Difference	**31,997.67**

By Aquafarm Type

Milkfish production in the Philippines is derived almost all from aquaculture. Figure 12 shows that the majority source of farmed milkfish is from the brackishwater fish ponds (59%), followed by marine fish cages (27.2%) and then by freshwater fish pen (6.8%). From 2016-2020, marine cages production showed the most significant increase. It grew from 105,848.35 MT in 2016 to 151,931.58 MT in 2020 with an AGR of 9.98% per year. This can be accounted to more private and government investments on mariculture. Meanwhile for brackishwater fishpond, production is increasing from 2015 to 2017 however on 2018 there is a slight decline by about 2%. Nonetheless, it is still the major source of farmed milkfish.

Figure 12. Milkfish Production per Aquafarm Type in the Philippines, 2016-2020



Source of basic data: Philippine Statistics Authority, 2021

By Region

Based on PSA data in 2020 (Table 22), Region 1 has the most abundant harvest of 125,913.09 MT milkfish majority from marine fish cages and brackishwater fishponds which is about 30% out of the total 416,317.35 MT national milkfish production. This was followed by Region 6 with 98,326.85 MT wherein brackishwater ponds was their major source. It contributed about 24% of total production. Production from brackishwater fishponds and marine cages made Region 3 the third leading milkfish producer with 78,015.63 MT or 19% contribution to the milkfish production. Most of the production came from brackishwater ponds which are mostly present in Regions 6, 3, 1, 4A and 10. It accounted for 57.6% of the total milkfish harvest in 2020. Likewise, significant contribution was seen from marine fish cages located in Regions 1, 3, 9, Caraga, and 10. Marine fish cages production contributed about 36.5% of the total milkfish produce. In terms of milkfish freshwater aquaculture, Region 4A led among the regions with its freshwater fish pen and cages in Taal Lake. The region contributed about 5% of the total milkfish production.

Table 22. Milkfish Production by Culture Environment and Region, 2020 (in MT)

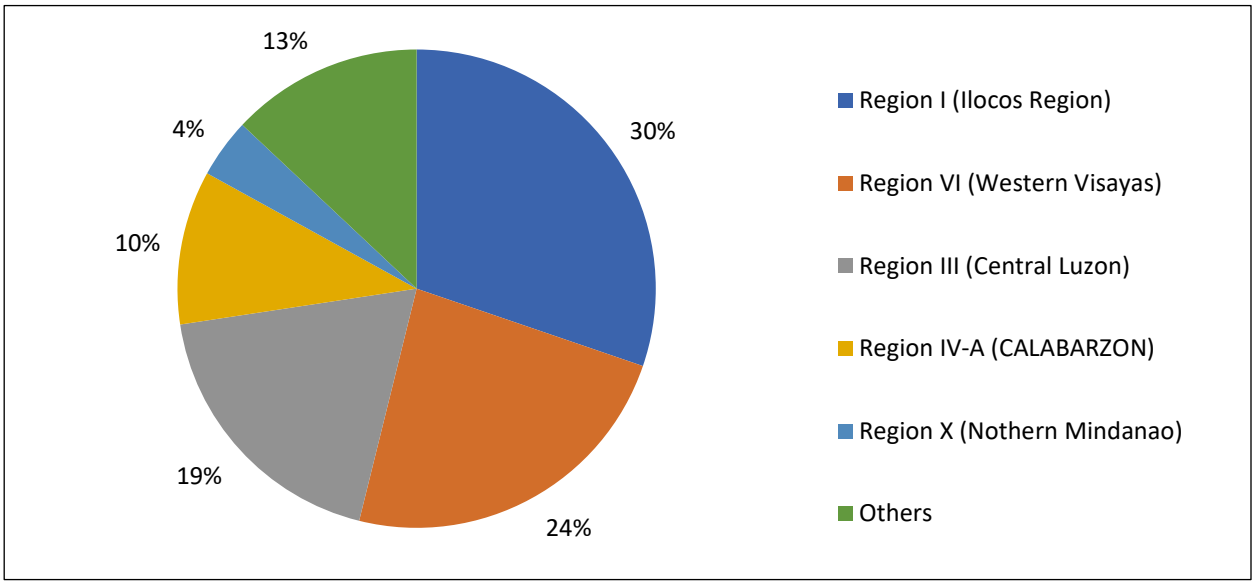
Regions	Total Production (MT)	Brackishwater			Freshwater			Marine Water		Rice Fish	Small Farm Reservoir
		Fishpond	Fishpen	Fish Cage	Fishpond	Fishpen	Fish Cage	Fishpen	Fish Cage		
NCR	680.94	2.00	..	..	0.50	655.81	22.63	..	..	..	..
CAR	0.00										
Region 1	125,913.09	23,251.31	228.31	117.78	8.23	4.35	28.03	309.07	101,966.01	..	..
Region 2	555.07	553.55	..	1.52	..	..	..	..	..	..	..
Region 3	78,015.63	51,008.24	1.42	0.05	..	..	..	..	27,005.92	..	..
Region 4a	43,338.18	24,068.77	..	0.10	..	9,557.86	9,367.07	0.38	344.00	..	..
Region 4b	1,604.55	1,603.39	..	0.22	0.24	..	..	..	0.70	..	..
Region 5	3,290.55	3,202.27	0.55	-	0.32	..	..	85.66	1.75	..	..
Region 6	98,326.85	97,577.99	67.36	5.61	39.42	..	..	196.68	439.79	..	..
Region 7	6,287.22	5,717.39	..	9.89	..	..	..	12.67	547.27	..	..
Region 8	3,221.28	3,068.41	9.75	17.10	20.20	1.70	..	2.44	101.66	..	0.02
Region 9	6,026.78	5,894.08	..	3.58	1.56	..	..	..	127.56	..	..
Region 10	16,620.20	12,750.61	16.13	..	..	..	..	79.91	3,773.55	..	..
Region 11	16,527.35	2,168.24	17.98	232.02	0.64	..	..	120.49	13,987.98	..	..
Region 12	3,732.93	2,254.82	..	..	0.25	..	..	..	1,477.86	..	..
Caraga	4,839.90	1,783.09	21.77	793.77	36.24	..	22.10	25.38	2,157.55	..	..
BARMM	7,336.85	4971.49	488.34	..	..	1,819.64	45.46	..	..	..	11.92
Philippines	**416,317.35**	**239,875.64**	**851.61**	**1,181.64**	**107.60**	**12,039.37**	**9,485.29**	**832.68**	**151,931.58**	**..**	**11.94**

Source: Philippine Statistics Authority, 2021

2. Area

In 2020, across regions, Ilocos Region was the top producer of milkfish. It contributed 30% followed by Western Visayas at 24 %, Central Luzon at 19 %, CALABARZON at 10% and Northern Mindanao at 4 % (Figure 13).

Figure 13. Major Milkfish Producers, 2020

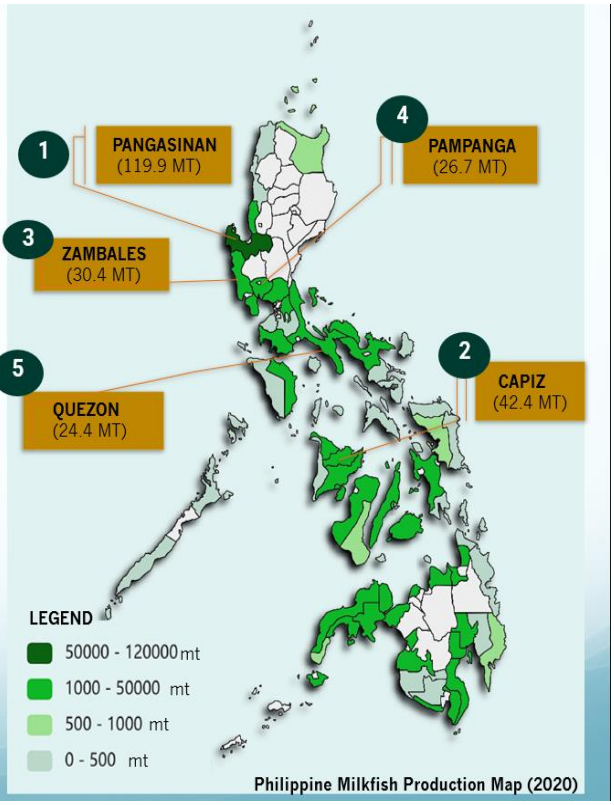


Source of basic data: Philippine Statistics Authority, 2021

Meanwhile, the country's top five milkfish producing provinces are Pangasinan, Capiz, Zambales, Pampanga, and Quezon (Figure 14). While Pangasinan had the biggest share of the production at 28.8%, Capiz, comes next contributing about 10.19% and then Zambales accounting for about 7.31%. Ranked fourth is the province of Pampanga with 6.40 % followed by Quezon with 5.86% contribution to total milkfish production in 2020.

Figure 14. Major Milkfish Producing Provinces, 2020

TOP 20 Producing Provinces	2020 Annual Production, in MT	% Share to National Production
Philippines	**416,317.35**	**100**
1. Pangasinan	119,899.42	28.80
2. Capiz	42,414.42	10.19
3. Zambales	30,420.85	7.31
4. Pampanga	26,653.97	6.40
5. Quezon	24,410.38	5.86
6. Negros Occidental	23,451.47	5.63
7. Aklan	15,342.50	3.69
8. Iloilo	14,731.79	3.54
9. Bulacan	13,296.74	3.19
10. Rizal	9,536.92	2.29
11. Batangas	9,369.07	2.25
12. Misamis Occidental	8,157.61	1.96
13. Bataan	7,644.06	1.84
14. Davao Occidental	6,638.93	1.59
15. La Union	5,748.69	1.38
16. Maguindanao	5,613.15	1.35
17. Lanao del Norte	4,896.27	1.18
18. Davao del Sur	3,768.71	0.91
19. Misamis Oriental	3,563.18	0.86
20. Sarangani	3,548.18	0.85



Source of basic data: PSA 2021

Potential Areas for Expansion

The country has a total of 90 mariculture parks (MPs) established and 17 more are proposed to be established. These MPs cover a total of 36,234 hectares. The 38 non-operational and 17 more proposed MPs provide an opportunity for potential areas for expansion for milkfish cages and pens.

Table 23. Inventory of BFAR Mariculture Parks, 2019

REGION	Number of BFAR MPs			Total Area (in Has.)
	Operational	Non-Operational	Proposed	
Region 1	3	2		571.00
Region 2		1		100.00
Region 3		1		321.60
Region 4A	1	1		1,662.00
Region 4B	5	5		3,203.00
Region 5	1	5		1,405.00
Region 6			8	54.00
Region 7	4			976.73
Region 8	8	8		4,750.00

REGION	Number of BFAR MPs			Total Area (in Has.)
	Operational	Non-Operational	Proposed	
Region 9	4	2		1,647.00
Region 10	4	7		1,890.96
Region 11	15	2		3,219.50
Region 12			4	231.00
Caraga	5		5	1,533.21
BARMM	2	4		14,669.00
Total	**52**	**38**	**17**	**36,234.00**

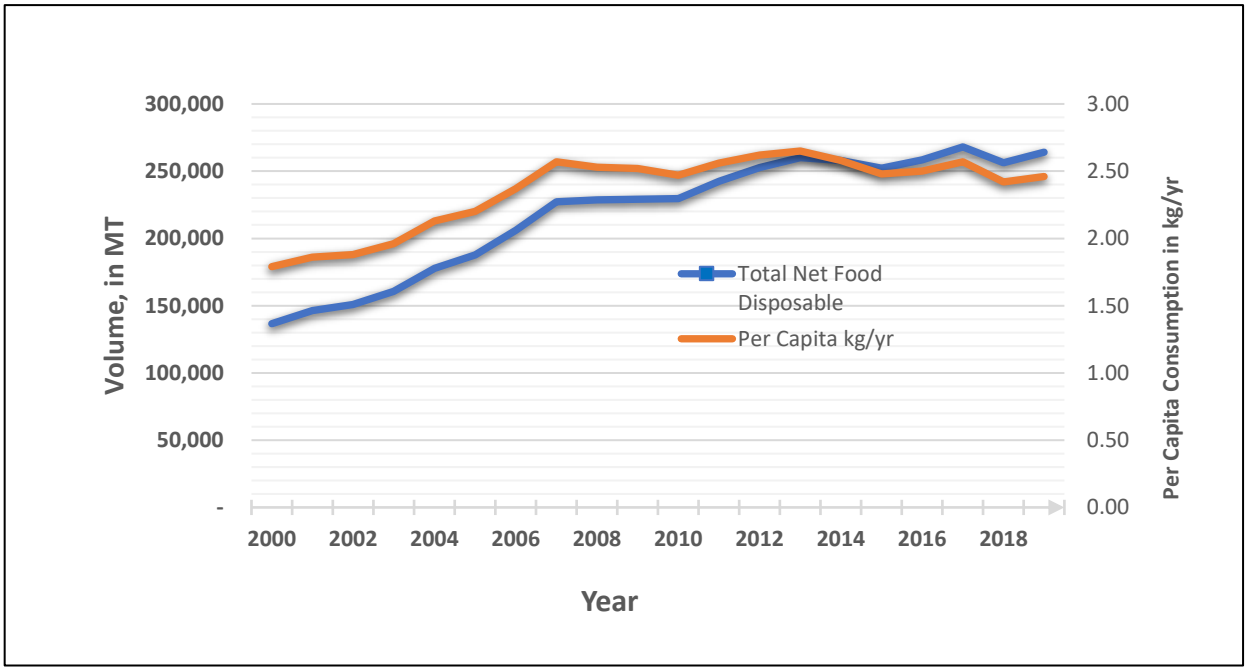
Source: BFAR-NMC

3. Consumption

About 98.6% of the total milkfish produced in the country are consumed domestically while the remaining 1.4% is exported. In 2019, about 132,782 MT or 32% of total production were being processed.

The local consumption of milkfish had expanded by an average of 3.61% per year from 136,593 MT in 2000 to 264,162 MT in 2019. In terms of per capita consumption, it increased from 1.89 kg per year to 2.46 kg per year during the same period (Figure 15). As of 2019, milkfish covered 9.8% of the 36.8 kg annual per capital consumption of fish among Filipinos.

Figure 15. Milkfish Consumption, 2000-2019



Source: Philippine Statistics Authority, 2021

Supply and Demand

Table 24 shows the milkfish supply and demand from 2010 to 2019. The total supply of milkfish in 2019 reached 415.26T MT, about 16% higher than the volume in 2010. About 99.9% of the total supply was produced locally while about 0.1% came from imports.

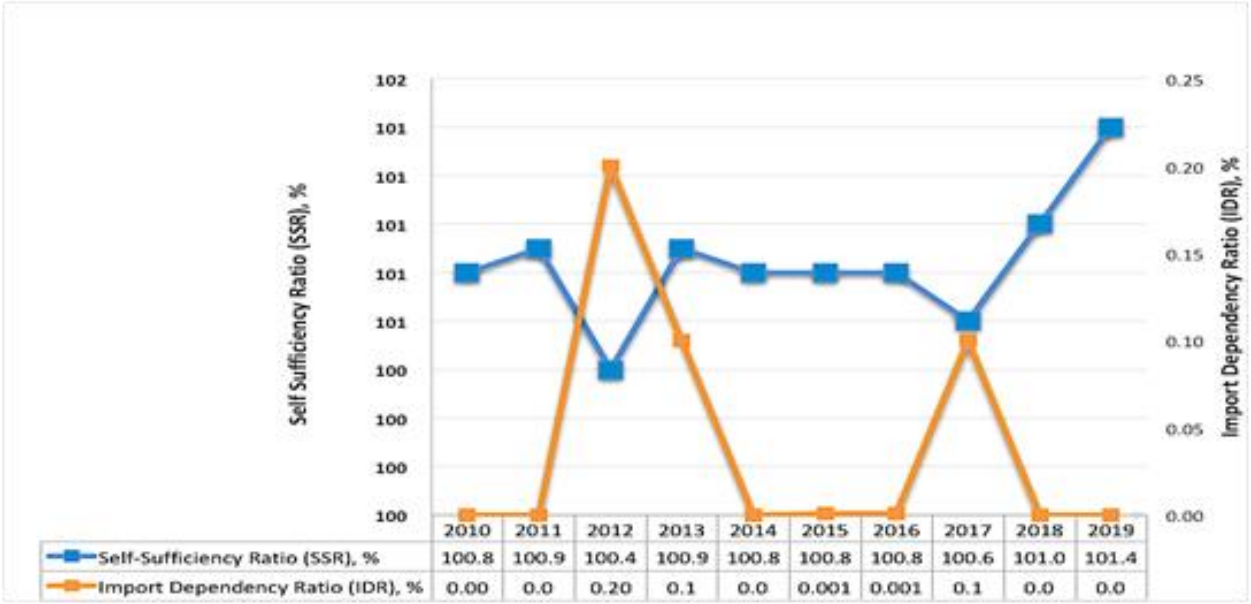
Table 24. National Milkfish Supply and Demand, 2010-2019 ('000 in MT)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Production	357.92	378.30	391.33	405.78	401.98	392.74	402.66	416.36	400.12	414.94
Imports	0.04	0.16	0.74	0.46	0.11	0.11	0.01	0.45	-	0.32
Gross Supply (Production + Imports)	357.96	378.46	392.07	406.24	402.09	392.84	402.66	416.81	400.12	415.26
Exports	2.98	3.47	2.30	4.12	3.42	3.22	3.31	3.04	3.88	5.87
Human Consumption	229.71	242.59	252.81	260.10	257.98	252.17	258.43	268.05	256.20	264.16
Other use (Feeds and Wastes; Processing)	125.27	132.41	136.97	142.02	140.69	137.46	140.93	145.73	140.04	145.23
Total Domestic Consumption	354.98	374.99	389.78	402.12	398.67	389.62	399.36	413.77	396.24	409.39
Total Use (Domestic Consumption+ Export)	357.96	378.46	392.07	406.24	402.09	392.84	402.66	416.81	400.12	415.26
Ending Stocks (Supply-Consumption)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Per Capita (kg/yr)	2.47	2.56	2.62	2.65	2.58	2.48	2.50	2.57	2.42	2.46

Source: Philippine Statistics Authority, 2021

Self-sufficient ratio of milkfish was consistently above 100% for the past ten years based from PSA data and thus, importation of marketable size milkfish is minimal (Figure 16).

Figure 16. Milkfish Self Sufficiency Ratio (SSR) and Import Dependency Ratio (IDR), Philippines, 2010-2019



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Self-Sufficiency Ratio (SSR), %	100.8	100.9	100.4	100.9	100.8	100.8	100.8	100.6	101.0	101.4
Import Dependency Ratio (IDR), %	0.00	0.0	0.20	0.1	0.0	0.001	0.001	0.1	0.0	0.0

Source: *Philippine Statistics Authority, 2021*

The total use (i.e., calculated as domestic consumption + export) also went up by around 16%, from 357.96T MT in 2010 to 415.26T MT in 2019. Domestic consumption accounted to 98.6% while the remaining 1.4% were exports.

Moreover, per capita consumption for milkfish for the period of 2010-2019 ranges from 2.42kgs. to 2.65 kgs. Least per capita consumption is recorded in 2018 and the greatest in 2012. Per capita consumption of milkfish slightly decreased from 2.47 kgs in 2010 to 2.46 kgs in 2019.

Based on the fish-eating population estimated for 2021 and per capita consumption of 2.46 kg of milkfish measured in 2019, analysis of supply and demand per region (Table 25) shows that the country has a surplus production of 191,055 MT by 2021. Six regions which include Region 1, 3, 6, 10 and 11 have reached sufficiency level while the rest of the regions are deficient in production.

Table 25. Projected Milkfish Supply and Demand Analysis by Region for 2021

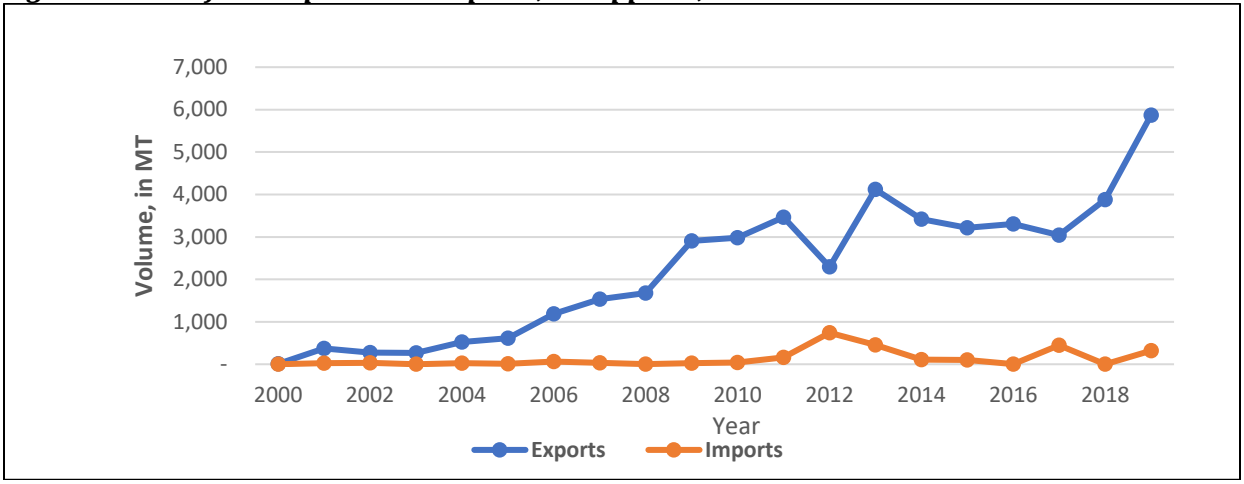
Region	Fish Eating Population *(Total Population less 9 Years Old and Below)*	Total Milkfish Supply 2020 (in MT)	Requirement Per Year (in MT)	Gap (in MT)	Sufficiency Level (%)
NCR	11,545,139	680.94	29,555.56	-28,874.62	2.30
CAR	1,459,928	-	3,737.42	-3,737.42	-
Region 1	4,289,435	125,913.09	10,980.95	114,932.14	1,146.65
Region 2	2,968,300	555.07	7,598.85	-7,043.78	7.30
Region 3	10,219,764	78,015.63	26,162.60	51,853.03	298.20
Region 4-A	13,282,562	43,338.18	34,003.36	9,334.82	127.45
Region 4-B	2,465,360	1,604.55	6,311.32	-4,706.77	25.42
Region 5	4,756,052	3,290.55	12,175.49	-8,884.94	27.03
Region 6	6,421,512	98,326.85	16,439.07	81,887.78	598.13
Region 7	6,427,134	6,287.22	16,453.46	-10,166.24	38.21
Region 8	3,732,185	3,221.28	9,554.39	-6,333.11	33.72
Region 9	2,982,453	6,026.78	7,635.08	-1,608.30	78.94
Region 10	4,016,462	16,620.20	10,282.14	6,338.06	161.64
Region 11	4,252,571	16,527.35	10,886.58	5,640.77	151.81
Region 12	3,903,231	3,732.93	9,992.27	-6,259.34	37.36
Caraga	2,153,542	4,839.90	5,513.07	-673.17	87.79
BARMM	3,117,461	7,336.85	7,980.70	-643.85	91.93
Philippines	**87,993,091**	**416,317.37**	**225,262.31**	**191,055.06**	**184.81**

Based on 2019 per capita consumption of 2.46 kg. The fish-eating population is estimated based on the population projection of the Philippine Statistics Authority for 2021.

4. Trade (Import and Export)

More of the milkfish harvest is processed into value-added forms such as smoked, marinated (brined, sweetened), fermented with rice, and canned or bottled in various styles (salmon style, sardine style, Spanish style, smoked in oil, etc.) for the domestic and export markets. Some companies in the Philippines now produce frozen prime cuts of milkfish bellies and backs including heads and tails. Exports of milkfish increased from 9 MT in 2000 to 5,870 MT in 2019. In 2012, exports dropped dramatically with the decline in main markets such as Canada and USA. About 81% of the total exports were frozen milkfish excluding livers and roes. Other exported products included canned, dried and smoked (Figure 17). Meanwhile, imports were erratic during the period from 23 tons in 2001 to 319 tons in 2019. Imports were mostly frozen milkfish in fillet forms

Figure 17. Milkfish: Imports and Exports, Philippines, 2000-2019



Source of basic data: Philippine Statistics Authority, 2021

Target consumers in the international markets are the Filipino communities abroad. Table 26 shows that frozen milkfish (excluding fish fillets and other fish meat) remained to be the top export product form in 2019 with USA and Canada as the top major markets still.

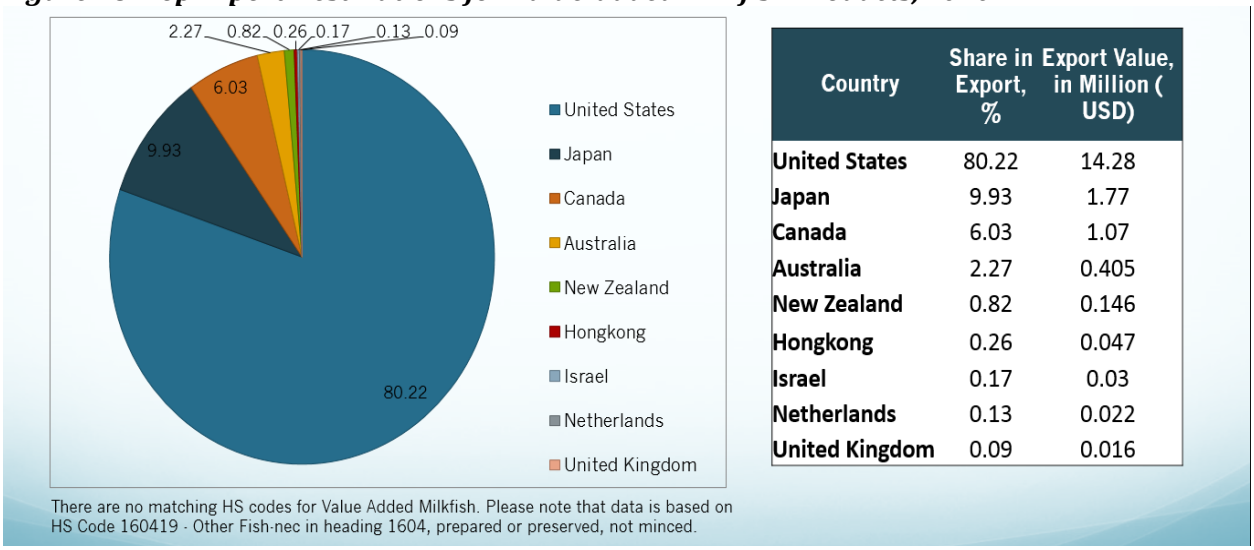
Table 26. Philippine Milkfish Exports, Product Forms and Major Markets, 2019

Product Form	Volume (MT)	Value (Php million)	Major Markets
Milkfish, frozen (excluding fish fillets and other fish meat)	5,603.75	1,326.38	USA – 61.1% Canada – 20.2%
Milkfish, prepared or preserved, in airtight container	250.43	78.40	Canada – 50.1% Thailand – 16.9% USA – 15.3%
Milkfish, Fresh or chilled	175.71	34.02	UAE, NES – 42.9% Qatar – 27.1% USA – 25.6%
Milkfish, fillets, frozen	90.85	6.24	Bahrain – 35.8% USA – 30.7% Saudi Arabia – 11.7% New Zealand – 11.5%
Milkfish fillets, dried, salted or in brine, but not smoked	7.31	2.03	USA – 55.1% Republic of Korea – 19.2% Australia – 15.8%
Milkfish, salted not dried or smoked and in brine	1.84	0.249	Australia – 100%

Source: PSA 2019 Commodity Factsheets

For 2020, the top export market destinations are the USA (80.22%), Japan (9.93%), Canada (6.03%) and Australia (2.27%).

Figure 18. Top Export Destinations for Value-added Milkfish Products, 2020



Country	Share in Export, %	Export Value, in Million (USD)
United States	80.22	14.28
Japan	9.93	1.77
Canada	6.03	1.07
Australia	2.27	0.405
New Zealand	0.82	0.146
Hongkong	0.26	0.047
Israel	0.17	0.03
Netherlands	0.13	0.022
United Kingdom	0.09	0.016

Source of basic data: https://www.tridge.com/intelligences/canned-milkfish/PH/export

In one of the stakeholders' consultations, it was reported that export to UAE was stopped up to this time since UAE imposed a stricter requirement which the Philippine government, thru the Food and Drugs Authority, is still complying. The UAE used to be to the top export market of fresh or chilled milkfish, the product form that ranked third in terms of volume and value in 2019.

In 2019, the Philippines imported frozen milkfish to the tune of 313.66MT valued at Php 18.27 million. Indonesia and Denmark were the only suppliers.

Table 27. Philippine Milkfish Imports, Product Form and Major Supplier, 2019

Product Form	Volume (MT)	Value (Php million)	Major Supplier
Milkfish, frozen (excluding fish fillets and other fish meat)	313.66	18.27	Indonesia – 91.7% Denmark – 8.3%

Source: PSA 2019 Commodity Factsheets

5. Prices

Export

Table 28 indicates the derived prices of the exported milkfish product forms. Prepared and preserved milkfish products in airtight containers turned to be priced the highest, followed by those which are in fillet, dried, salted or in brine, but not smoked. Milkfish frozen fillets are the priced the lowest.

Table 28. Derived Export Prices of Value-added Milkfish Products, 2019

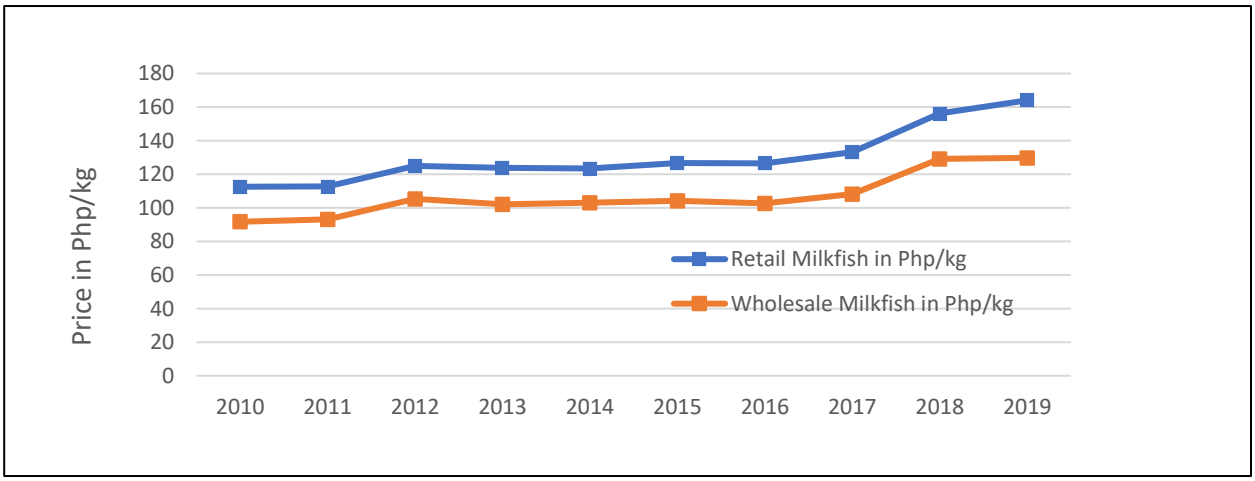
Product Form	Estimated Price Per Kilo
Milkfish, prepared or preserved, in airtight container	313.06
Milkfish fillets, dried, salted or in brine, but not smoked	277.70
Milkfish, frozen (excluding fish fillets and other fish meat)	236.70
Milkfish, Fresh or chilled	193.61
Milkfish, salted not dried or smoked and in brine	135.33
Milkfish, fillets, frozen	68.68

Source of basic data: PSA 2019 Commodity Factsheets

Domestic

Figure 19 shows the comparative prices of wholesale and retail milkfish. Movement in average annual prices of wholesale and retailed milkfish followed a similar trend. From 2010-2019, milkfish wholesale prices grew by 41.5% from Php 91.72 per kg in 2010 to Php 129.78 per kg in 2019. Same with the wholesale price, retail price increased sharply from Php 112.56 per kg in 2010 to Php 164.00 per kg in 2019 accounting for a 45.7% increment. Average annual growth of wholesale and retail prices were 4.16% and 4.42 %, respectively. There are significant differences in the gaps between segments of the supply-value chain such that the calculated average gap from the wholesale to retail prices was around PhP22.30 per kg.

Figure 19. Domestic Milkfish Prices: Wholesale and Retail, 2010-2019



Source: *Philippine Statistics Authority, 2021*

III. ANALYSIS OF THE MILKFISH INDUSTRY

A. Value Chain Map

Figures 20-22 portray the VC maps of fresh and processed milkfish products, respectively. The VCP map on processed milkfish products has two sub-sets. The first one has processors directly sourcing their materials from growers while the other one has processors sourcing their raw materials from consolidators/agents/brokers.

Figure 20. Fresh Milkfish Value Chain Map

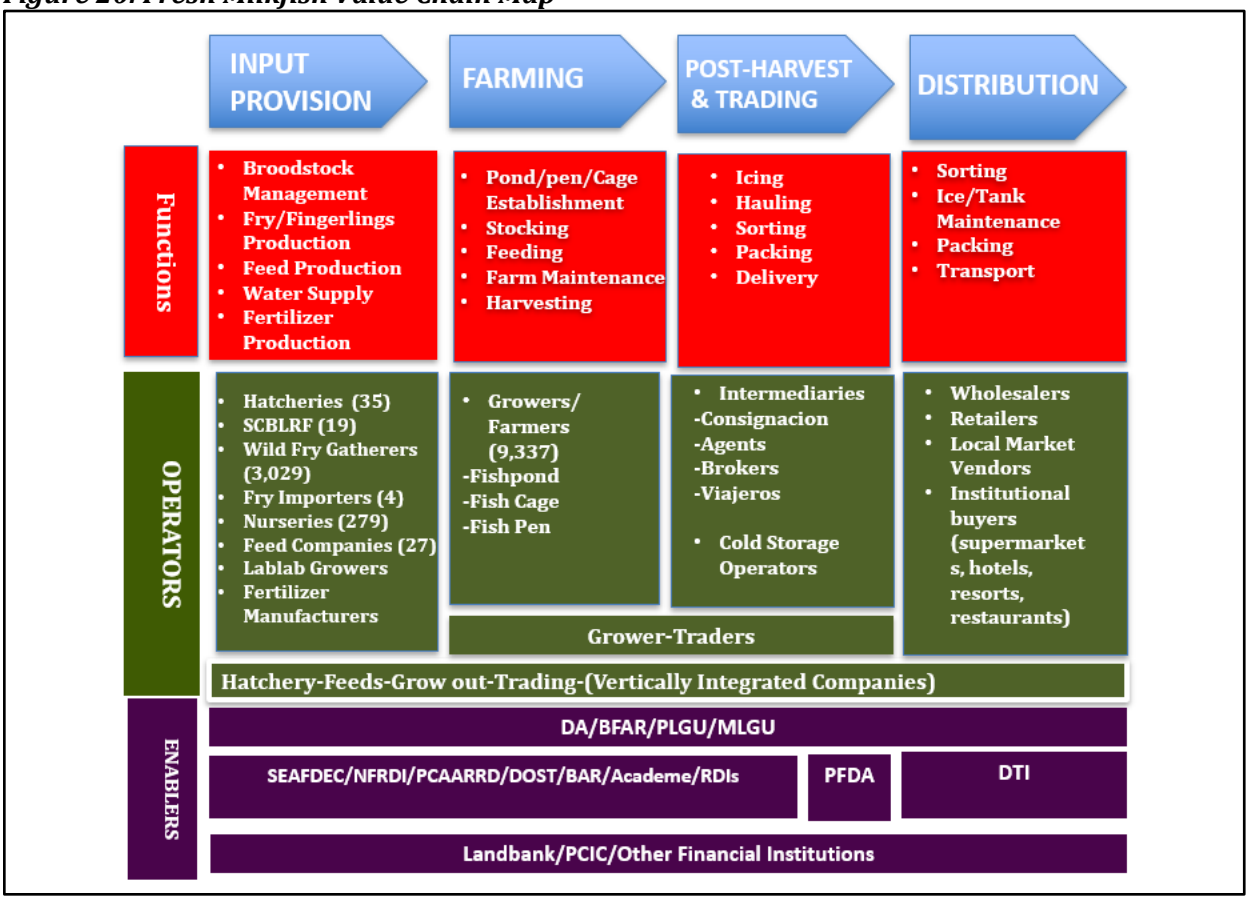


Figure 21. Processed Milkfish Value Chain Map (direct source from the farm)

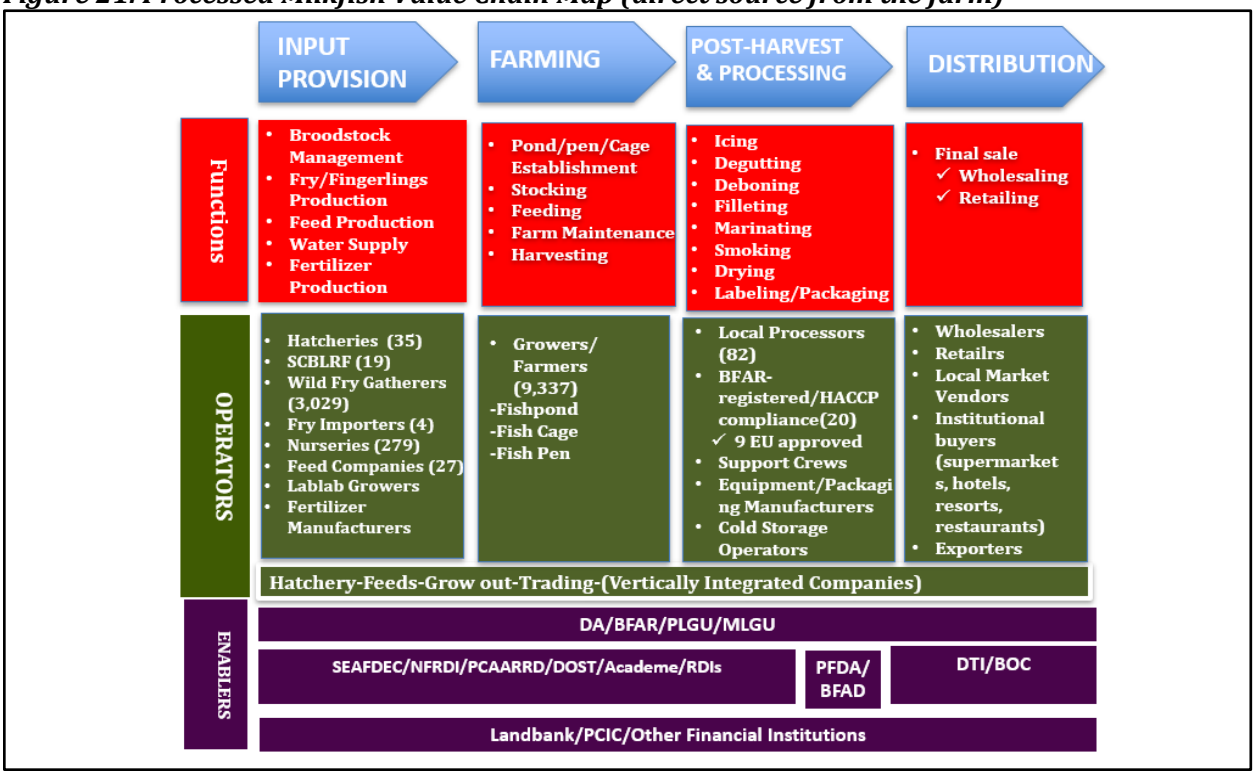
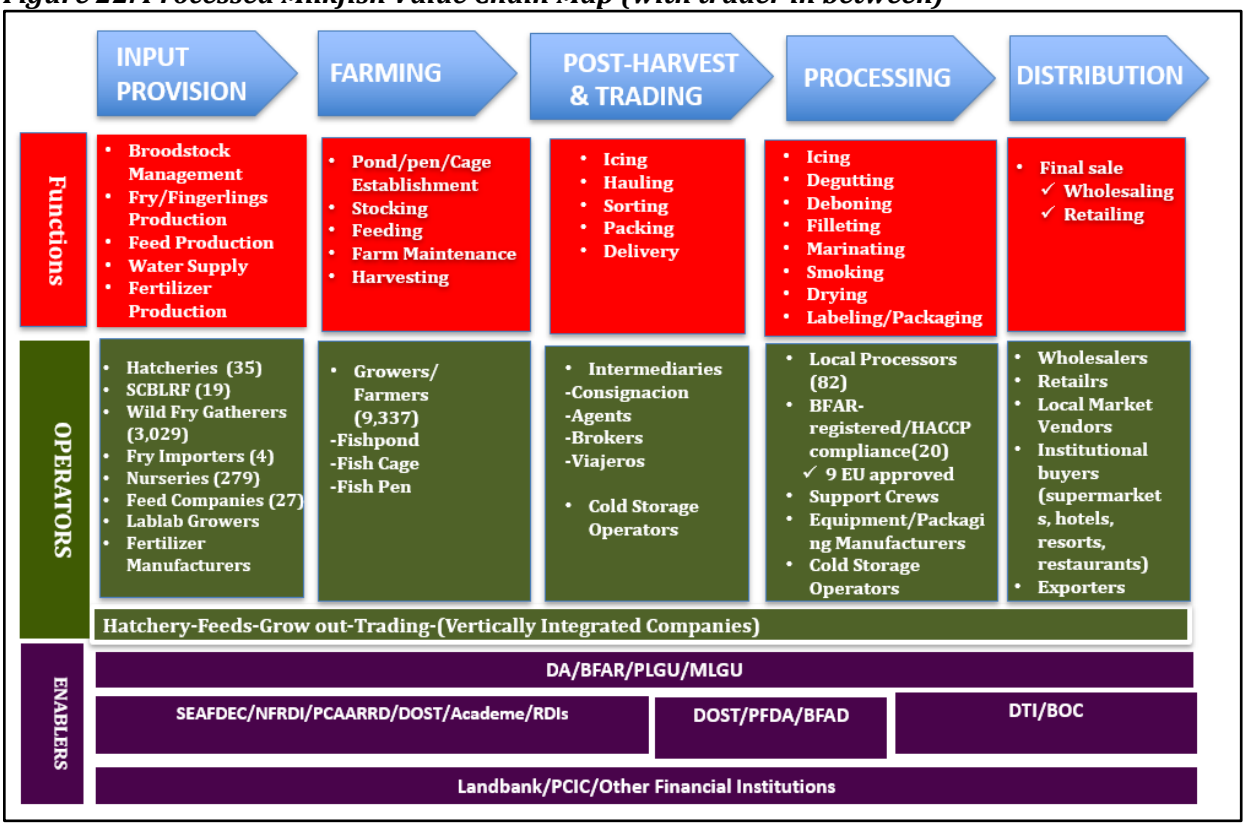


Figure 22. Processed Milkfish Value Chain Map (with trader in between)



Commodity Maps

Shown on Figures 23-27 are the spatial distribution of hatcheries, nursery farms, milkfish feed mills manufacturers, registered aquafarms, and the location of the BFAR-approved processors and EU-accredited exporters.

Figure 23. Distribution of Milkfish SCLRFs, Hatcheries and Wild Fry Grounds, 2020

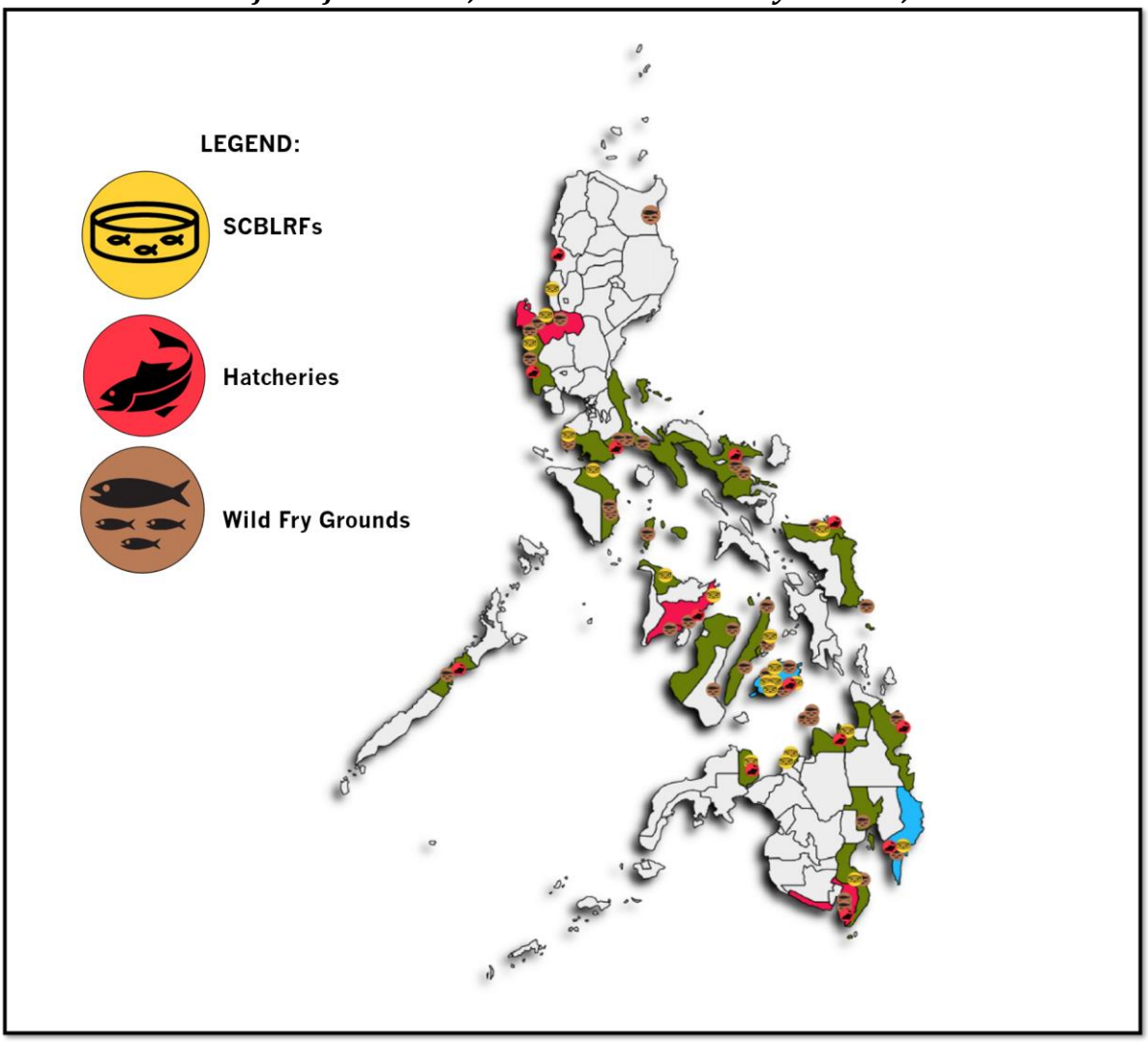


Figure 24. Distribution of Milkfish Nursery Farms, 2020

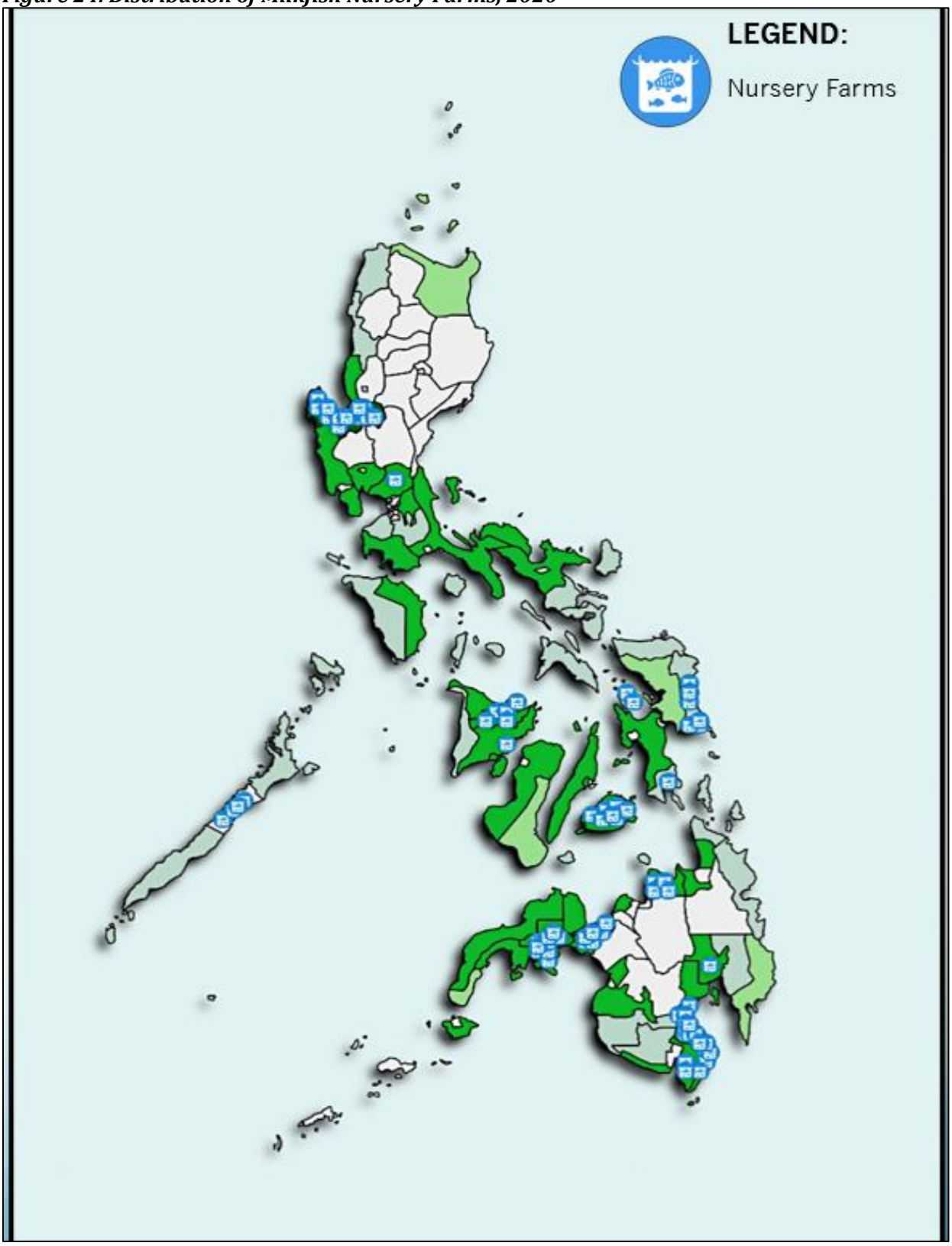


Figure 25. Distribution of Milkfish Aquafeed Manufacturers, 2020

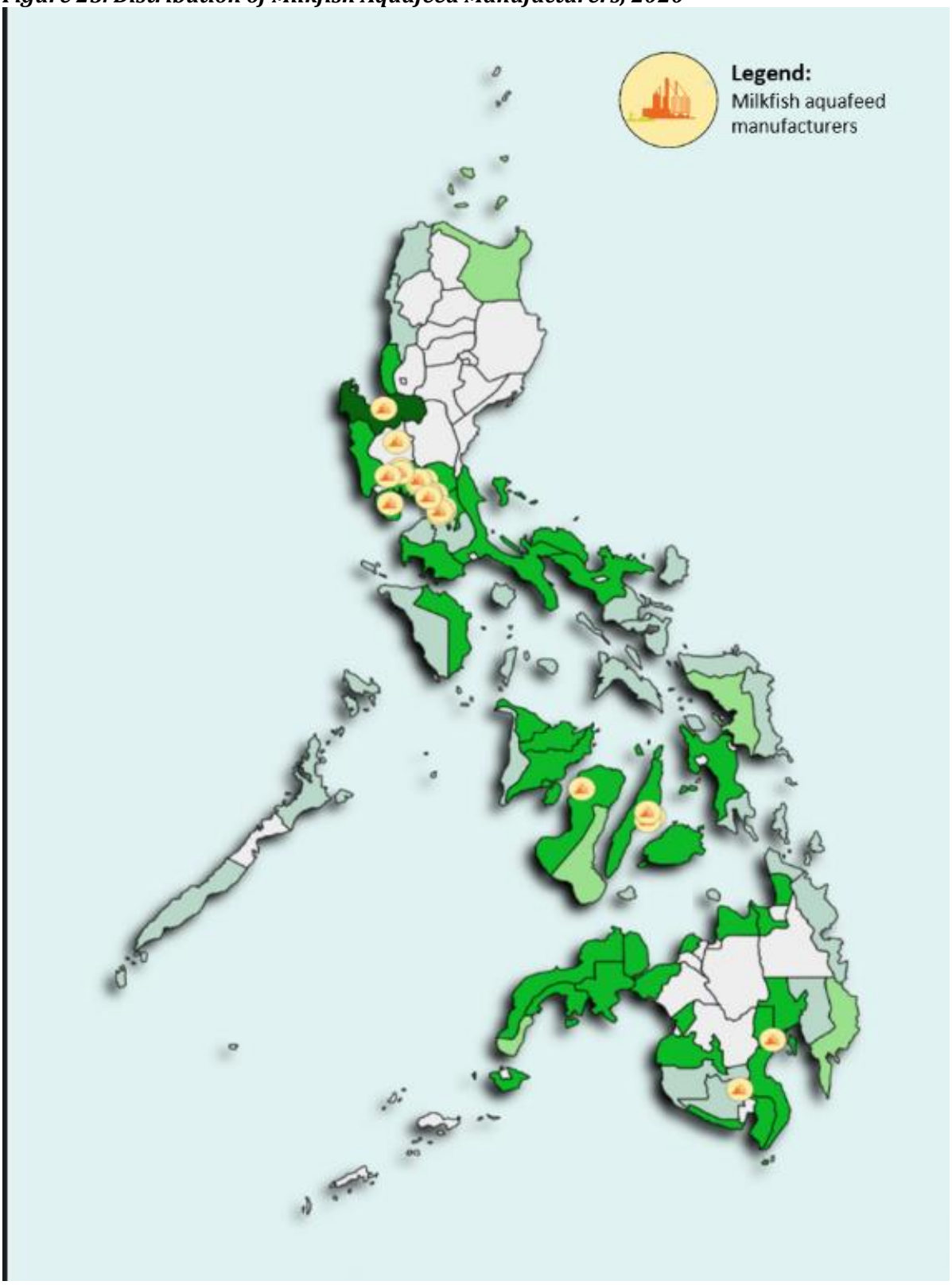


Figure 26. Distribution of Registered Milkfish Aquafarms, 2020

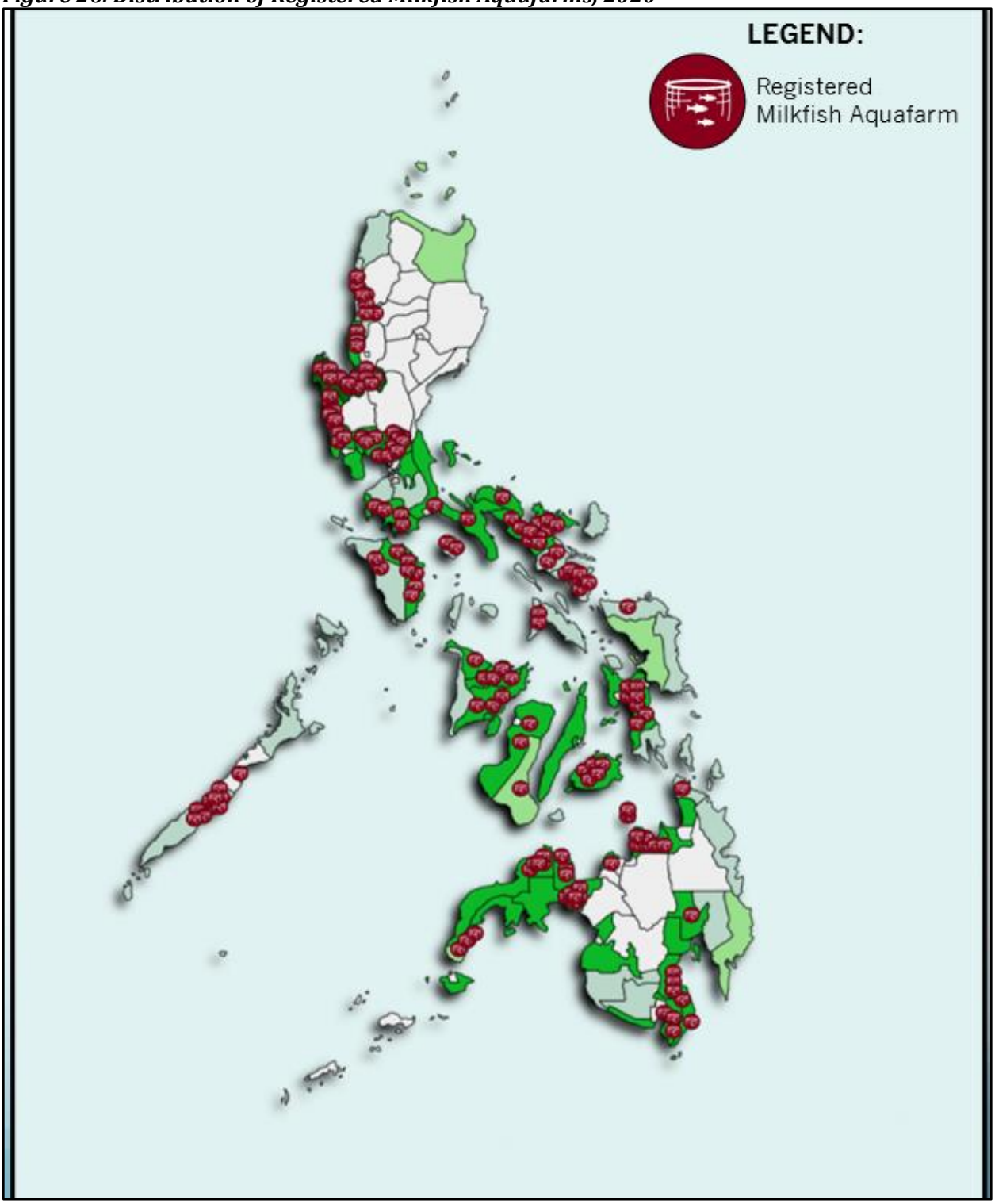
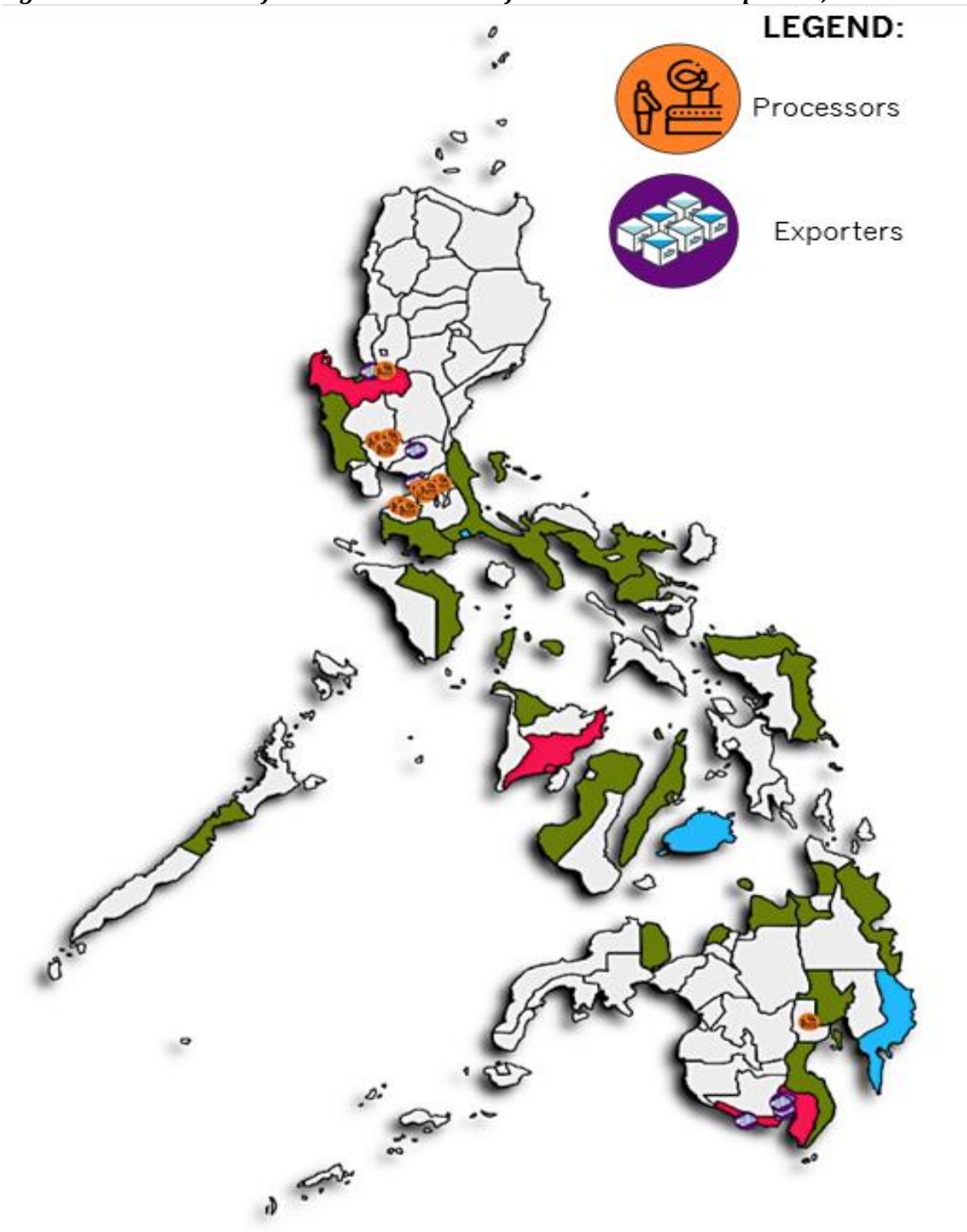


Figure 27. Distribution of BFAR-Accredited Milkfish Processors and Exporters, 2020



Key Institutions and Programs: The Enablers

The key institutions that support the milkfish industry are the DA-BFAR, Department of Trade and Industry (DTI), Department of Environment and Natural Resources (DENR), National Fisheries and Research Institute (NFRDI), Department of Science and Technology (DOST) and DOST- Philippines Council for Agriculture, Aquatic and Natural Resources Research Development (DOST-PCAARRD), Southeast Asian Fisheries Southeast Asian Fisheries Development Center/Aquaculture Department (SEAFDEC/AQD), Bureau of Agricultural Research (BAR), FDA (formerly BFAD), PSA, Philippine Crop Insurance Corporation (PCIC), State Colleges and Universities (SUCs), LGUs, and other key institutions.

Table 29. Key Institutions of the Milkfish Industry in the Philippines

Key Institution	Functional Objectives
DA-BFAR	To help promote the production, processing, marketing and distribution of milkfish.
SEAFDEC/AQD/ NFRDI/ DOST/DOST-PCAARRD	To generate science-based aquaculture technologies
DOST/DTI	To assist in product value adding/processing, packaging and labeling.
FDA	To ensure adherence to food safety requirements and standards.
DTI	To help promote export of milkfish.
DOST	To help in the processing of lease agreements and environmental compliance certificates.
PCIC	To provide crop insurance to milkfish aquaculture
SUCs	To conduct research and development activities for milkfish.
BAR	To fund research program of various institutions and state colleges and universities.
PSA	To account milkfish production, area harvested and prices.
LGUs	To fund enhancement project related to the production of milkfish.

B. SWOT Analysis, by Segment and Cross Cutting Concerns

The SWOT Analysis involves, scanning the internal and external environment of the milkfish industry to identify factors that may affect or contribute to the success or failure of the business.

Strengths are internal to the organization, like resources and capabilities that can be used to its advantage. Weaknesses are also internal to the organization. They are factors that need to be improved. Opportunities are current or future external factors that can be advantageous to the milkfish industry, which can be new opportunities for growth and business profitability. Threats are current or future external factors, including unfavorable changes in the environment that can negatively affect the industry.

The SWOT analysis presented below is the output that resulted from the Online National Consultation-Workshop for Milkfish Industry Roadmap Updating conducted on February 22 and March 2, 2021. The said workshops were participated by milkfish regional focal persons, milkfish farmers, milkfish processors, exporters, fish cage operators, academic institutions, and representatives from research institutions like SEAFDEC/AQD and NFRDI. Strengths, Weaknesses, Opportunities and Threats to the milkfish industry were identified based on the knowledge and experiences of the stakeholders.

Table 30. **Milkfish Industry SWOT Analysis, by Value Chain Segment**

Strengths	Weaknesses	Opportunities	Threats
Input Provision			
• Availability of Government and Private Hatcheries that produces milkfish fry • Availability of wild fry resource • Availability of breeders • Available science-based breeding/ natural food production technologies • Existing feed mills for feed production	• Scarcity of quality milkfish fry • Limited number of milkfish hatcheries to cater needs of the grow-out sector • Limited use of technology that address seasonality of breeding • High operating (e.g., electricity) and Maintenance cost of hatcheries • Inadequate supply of Broodstock	• Availability of wild fry • Business opportunities for ancillary industries (eg. Feed millers) • Available technology and R&D on milkfish breeding	• Over reliance to imported milkfish fry • Market competition between locally produced fry and Indo-fry • If Indonesia will stop fry exportation, they can solely dominate in exporting marketable milkfish • Occurrence of diseases and

Strengths	Weaknesses	Opportunities	Threats
● Available government support on the conduct of technical trainings on natural food production and hatchery as nursery operations ● Existing Research Institutions like SEAFDEC/AQD, BAR, DOST, NFRDI, and SUCs that conduct research on broodstock enhancement and other science-based breeding/farming technologies ● Capability to upgrade/rehabilitate the existing hatchery facilities and availability of funds to establish legislated hatcheries ● Availability of fishponds that can be utilized for intensive production of fingerlings	● Unabated price increase of feeds and other farm inputs ● Limited supply of feeds/absence of feed producer/miller in some milkfish producing regions ● Absence of holding facility for wild caught fry ● Limited use of advanced natural food production technology (eg. algal paste) ● Monopoly of private enterprise in terms of milkfish fry production ● Unregulated importation of milkfish fry		climate change threats ● High investment capital to establish hatchery/nursery facilities

Strengths	Weaknesses	Opportunities	Threats
Farm Production			
● Availability of natural resources ● Available potential areas (fishponds/ mariculture sites) and players for the intensification of grow-out culture ● Existing Research Institutions like SEAFDEC/AQD, BAR, DOST, NFRDI, and SUCs that conduct research on technologies on nutrition (broodstock diets) and grow-out culture ● Presence of BFAR laboratories to perform antibiotic drug testing of milkfish	● Fragmented small-scale production ● Underutilized/Underdeveloped fishponds and mariculture parks ● Few number of milkfish farms/ mariculture are compliant with Good Aquaculture Practices (GAqP) ● Need for more industry-relevant researches from the part of Research Institutions and Academe. ● High production cost due to unabated prices of feeds and farm inputs ● Lack of intensified law enforcement against polluters	● Available credit facilities and programs ● Business Opportunities for Ancillary Industries ● Innovations in Milkfish Aquaculture (Mechanization, Digitization) ● Available science-based culture technologies for dissemination to milkfish growers	● Climate change and Natural Calamites ● Aquatic Pollution and environmental degradation due to improper farm practices ● Mortalities caused by diseases / aflatoxin in feeds, and environmental degradation ● Unreasonable/ unnecessary importation of raw materials (e.g., feedstuffs, farm inputs) that are produced locally
Post-harvest and Processing			
● Availability of technology on the different techniques of post-harvest/value-adding ● Skilled workforce to debone fish ● Presence of European Union	● Weak cost competitiveness compared to other species in international market ● Instability of raw materials supply and prices	● Investment opportunities on grow-out farming producing smaller sizes required by export processors	● Sharing of deboning skills/technology to other countries may trigger competition in international market

Strengths	Weaknesses	Opportunities	Threats
(EU) Approved Fishery Establishments ● Existing milkfish processors and exporters ● Existing Cold Storage and Post-Harvest Facilities	● Low quality raw materials for processing resulting to price fluctuation ● Limited supply of required size for processing ● Limited number of supplier farm for export market due to few registered and accredited grow-out farms ● Lack of interest on the part of fish farmers to invest/engage in post-harvest activities due to insufficient capital ● Limited number of common post-harvest facilities	● Value adding creates opportunity for alternative livelihood and employment for fish farmers who may be engaged/employed in processing plants	● Possible negative environmental impact if the processing plants will not be regulated ● Public health hazards brought about by unsanitized/unregulated small-scale post-harvest activities undertaken by the small-time processors
Trading			
● General acceptance from the local market ● Presence of local traders and exporters	● Acceptance to export market is limited to Filipino communities abroad ● Milkfish is not a popular food fish globally	● Kosher and Halal Markets ● Healthier products attract more consumers	● Strict technical regulations of importing countries ● Logistical constraints due to the pandemic ● Multi-layered Marketing system that contributes to the unabated prices
Cross-Cutting (Enabling Environment)			
● Existing Government System and Policies	● Limited farmer capability to access trainings,	● Available network of RDIs and pool	● Climate change and natural

Strengths	Weaknesses	Opportunities	Threats
on accreditation and certification ● Extension support (Technical assistance and training) from Government Institutions ● Available skilled personnel for aquaculture ● Existing government credit and financing programs	workshops, and other types of assistance ● Declining number of workforces ● High cost of user's fee/SAPA (Special Use Agreement for Protected Areas) by DENR ● Difficulty in securing government permit for operation ● Limited crop insurance coverage / Government insurance scheme	of experts on milkfish	calamities, pandemics

C. Farm Income / Cost and Return Analysis

The costs, margins and value added along the fresh milkfish value chain are estimated from key informant interviews of chain players as well as from existing literatures.

Table 31. Cost Structure of Milkfish in Fishcages (FC) in Key Milkfish Producing Regions, 2020

Particulars	Marinewater		Freshwater
	Region 1	Region 11 (Panabo, Davao Del Norte)	Region 4A (Taal Lake)
Production			
Cost of Inputs	94.46	109.66	106.73
Operating Expenses	18.22		6.86
Total Investment Cost	3.13		10.43
Margin	17.37	16.44	18.03
Sub-total	133.18	126.1	142.62
Consignacion (Trading)			
Margin	6.66	6.3	7.13
Sub-total	139.84	132.4	149.75
Buyer and Sellers (Marketing)			
Add-on-charges	2.74	1.5	1.71
Margin	5.69	11.89	15.146
Sub-total	148.27	145.79	166.61
Viajeros (Logistics)			
Add-on-charges	2.74	1.5	1.71
Margin	6.11	5.86	8.42
Sub-total	157.12	153.15	176.74
Retailers (Market)			
Add-on charges	0.35	0.5	0.44
Margin	8.13	7.18	8.86
Suggested Retail Price (SRP)	165.6	160.83	186.04
Notes:			
Marketable Size	500/2pcs/kg	5:2 (80%),3:1 (9%),4:1 (6%),5.1 (5%)	500/2pcs/kg
Feed Conversion Ratio (FCR)	2.3:1	2.2:1	2.59:1
PRODUCTION, kg/year	56,980	13,000	11,200

Source of data: Key Informants DA-BFAR Regional Offices Data
Note: With assumption that there are no typhoons or any disaster experienced that may affect production during the culture period.

The culture method from brackishwater fishpond ranges from extensive to polyculture to semi-intensive. The leading producers are Capiz, Aklan, Negros Occidental, Pampanga and Quezon. Based from the production data gathered by the concerned BFAR regional offices, the average

milkfish yields in brackishwater ponds is 2,189 kg / ha / year. Table 32 shows the cost and return analysis of milkfish production from brackishwater ponds. The leading provincial producers like Capiz has an average yield of 3,168 kg / ha / year. In 2020, the average gross income from brackishwater fishponds is Php 291,620.00 from an average farmgate price of Php 107.50. The total costs in producing milkfish from brackishwater ponds is Php 207,375.00: 55.3% on feeds; 33.83% on fertilization and other daily pond inputs; 2.37% on fry cost and 8.5% on labor and other expenses.

Table 32. Cost and Return Analysis for Brackishwater Fishpond

Particulars	**Region 6**		**Region 10**	
	Area 1	**Area 2**	**Area 3**	**Area 4**
Total Area	1 hectare	1 hectare	1 hectare	1 hectare
1.Total Capital Investment Cost	30,000	151,500	228,000	190,000
Fry			50,000	
Feeds			114,000	
Fertilizers / Pond preparation			24,000	
Caretaker			40,000	
Total Assets				
Fixed Capital Investment (Depreciation Cost)	10,000	15,000	40,000	15,000
Administrative Cost	15,000	20,000	35,000	20,000
Licenses and permits	-	-	10,000	-
Rent	15,000	5,000	25,000	5,000
Production (kg) 2 cycles	1,200	2,200	3,900	3,168
Selling Price (P/kg)	90	110	120	110
Total Investment Cost	70,000	191,500	338,000	230,000
Gross Sales	108,000	242,000	468,000	348,480
Net Income	38,000	50,500	130,000	118,480
Income before tax				
Return of Investment (%)	54.29	26.37	38.46	51.51
Payback period (years)	1.84	3.79	2.60	1.94

Source: Interview with key informants in Region 6, 10

Note: With assumption that there are no typhoons or any disaster experienced that may affect production during the culture period.

Milkfish production from marine cages contributed 42% to the total milkfish production from brackishwater ponds and marine cages combined. The highest producing province for marine cage production is Pangasinan, followed by Zambales, Davao Occidental and Misamis Oriental. The contribution of marine cages to production increased by 147% since 2005 up to 2020.

The average production of milkfish from marine cage culture is 28,625 kg per 18m-diameter cage (6 to 8 m depth) per year. The average gross sales from this type of operation are Php 3,959,666.67 annually with an average net income of Php 889,480.00 per year.

In cage aquaculture of milkfish, feeds account for about 40% to 65% of the total operational expenses while the requirement for fingerlings accounts for about 9% to 20%. Although fingerlings requirement account for only 9% to 20%, the quality of the fingerlings used will determine the success of the cage operations. This maybe the factor on why the different producing regions have different productivity rates despite similar stocking densities.

The return of investment for marine cage operations ranges from 27% to 44% and the payback period has an average of 2.98 years. The average payback period from the different mariculture areas has a shorter recovery time than the payback period when the marine cage culture started way back in the early 2000s. Table 33 shows the cost and returns analysis of milkfish production from marine cages.

Table 33. Cost and Return Analysis for Milkfish Production in Fish Cages in Key Producing Regions, 2020

Particulars	**Region 1**	**Region 11 (Panabo, Davao Del Norte)**	**Region 10 (Misamis Oriental)**	**Region 3 (Masinloc, Zambales)**	**Region 4A (Taal Lake)**
	Marinewater				**Freshwater**
Fish Cage Size	18x18x8m	15m-diameter Circular Cage		18m diameter x 15m (depth); Circular Cage	
Operational Cost	5,636,400	1,228,100	4,701,960	2,785,500	1,195,500
Fingerlings	569,800	240,000	850,000	132,500	140,000
Feeds	4,719,600	880,000	3,732,960	2,415,000	962,800
Caretaker	72,000	60,000	70,000	108,000	78,000
Overhead Cost	21,000	14,000	14,000	80,000	14,700
Selling Expenses	254,000	34,100	35,000	50,000	
Total Assets					76,832
Fixed Capital Investment (Depreciation Cost)	178,600	133,000	145,000	145,000	116,816

Licenses and permits	28,000	10,000	10,000	10,000	10,930
Administrative Cost	64,000	12,000	15,000	15,000	30,000
Rent / Loan Interest	52,000				
Production (kg) 2 cycles	56,980	15,000	50,500	29,400	14,400
Selling Price (P/kg)	133		125	125	143
Total Investment Cost	5,815,000	1,383,100	4,871,960	2,955,500	1,430,078
Gross Sales	7,578,340	1,891,500	6,312,500	3,675,000	2,053,728
Net Income	1,763,340	508,400	1,440,540	719,500	623,650
Income before tax					
Return of Investment (%)	30.32	36.76	29.57	24.34	43.61
Payback period (years)	3.30	2.72	3.38	4.11	2.29

Source: Interview with key informants in Regions 3, 4A, 11, and 10
Note: With assumption that there are no typhoons or any disaster experienced that may affect production during the culture period.

Aside from the data collated from regions, existing research studies conducted by NFRDI-Freshwater Fisheries Research and Development Center (FFRDC) were also the source for farm income/ cost and return analysis for milkfish production in this paper.

Based on the data shown in Table 34, milkfish hatchery operations in Lucena City, Quezon requires PhP 82,855.00/cycle for the total costs. Variable costs include the larva of milkfish, fertilizers (21-0-0, 16-20-0, and urea), Japonicus #0 and #1, eggs, fry booster, electricity, water, and hired labor (skilled technician, helpers), which amounted to PhP 64,985.00/cycle. On the other hand, fixed costs include the larval rearing tanks and natural food tanks, which amounted to PhP 1,039,980.00 with its depreciation costs of PhP 17,900.00/cycle. Gross sales of harvested fry are PhP 120,000.00 for 300,000 pieces fry with a unit price of PhP 0.4. Computed ROI is 3.57%, which indicates the total cost for the operations exceeded the total income of the hatchery farm.

Table 34. Cost and Return Analysis of Milkfish Hatchery Farm, Lucena City, Quezon

Item	Unit	Quantity	Price	Amount
RETURNS/INCOME				
Cash Returns/Income				
Harvested Fry	pieces	300,000	0.4	120,000.00
TOTAL CASH RETURNS				120,000.00
TOTAL RETURNS				**120,000.00**
COSTS				
Variable Costs				
Milkfish Larva	pieces	600,000	0.008	4,800.00
Fertilizer 21-0-0	kg	5	13	65
Fertilizer 16-20-0	kg	5	20	100
Urea	kg	5	26	130
Japo #0	packs	3	1100	3,300.00
Japo #1	packs	3	1100	3,300.00
Eggs	trays	6	150	900
Fry booster	kg	10	55	550
Skilled tech		1		16,500.00
Helper		1		13,500.00
Helper		1		11,000.00
Laborer		1		4,840.00
Electricity		1		4,500.00
Water		1		1,500.00
TOTAL VARIABLE COSTS				**64,985.00**
Fixed Costs				
Larval Rearing Tanks (Depreciation cost)	units	2		4,900.00
Natural food tank (Depreciation cost)	units	5		13,000.00
TOTAL FIXED COSTS				**17,900.00**
TOTAL COSTS				**82,885.00**
NET INCOME				**37,115.00**
Return on Investment (ROI)				**3.57%**

Source: NFRDI-FFRDC 2021. Enhanced Fingerling Production through Outscaling of Improved Milkfish (Chanos chanos) Hatchery and Nursery Protocol in Quezon Province (On-going project of NFRDI funded by BAR)

Note: With assumption that there are no typhoons or any disaster experienced that may affect production during the culture period.

** Per cycle using 2 larval rearing tanks (6 m x 4 m x 1.7 m each)*

On the other hand, milkfish nursery operations in Unisan, Quezon require PhP 141,916.67.00/cycle for the total costs (Table 35). Variable costs include the milkfish fry, fertilizers (16-20-0 and urea), teaseed, fry booster, fine meshed net, hired labor for pond preparation and harvesting, which amounted to PhP 120,650.00. On the other hand, fixed costs include the rent for the ponds, and depreciation cost for the ponds and fine meshed net, which amounted to PhP 21,266.67.00. Gross sales of harvested milkfish fingerlings is PhP 160,000.00 for 40,000 pieces fry with a unit price of PhP 4.00. Computed ROI is 22.60%.

Table 35. Cost and Return Analysis Milkfish Fishpond Nursery Farm, Unisan, Quezon

Item	Unit	Quantity	Price	Amount
RETURNS/INCOME				
Cash Returns/Income				
Harvested Fingerlings	pieces	40,000	4	160,000.00
TOTAL CASH RETURNS				160,000.00
TOTAL RETURNS				**160,000.00**
COSTS				
Variable Costs				
Milkfish fry	pieces	200,000	0.4	80,000.00
Fertilizer Urea	bag	2	1500	3,000.00
Fertilizer 16-20-0	bag	3	1500	4,500.00
Teaseed	bag	1	3800	3,800.00
Fry booster	bag	21	550	11,550.00
Fine meshed net	roll	1	800	800
Labor cost for pond preparation and harvesting				17,000
TOTAL VARIABLE COSTS				**120,650.00**
Fixed Costs				
Rent				20,000.00
Dep cost (Pond Development 2 HA)				1,000.00
Dep. Cost (Fine Meshed net)				266.67
TOTAL FIXED COSTS				**21,266.67**
TOTAL COSTS				**141,916.67**
NET INCOME				**18,083.33**
Return on Investment (ROI)				**22.60%**

Source: NFRDI-FFRDC 2021. Enhanced Fingerling Production through Outscaling of Improved Milkfish (Chanos chanos) Hatchery and Nursery Protocol in Quezon Province (On-going project of NFRDI funded by BAR)

Note: With assumption that there are no typhoons or any disaster experienced that may affect production during the culture period.

** Per cycle for a 2-ha milkfish fishpond*

For the milkfish grow-out operations in Igang, Guimaras, it requires PhP 252,332.56/cycle for the total costs (Table 36). Variable costs include the milkfish fingerlings, feeds, and labor for repair and maintenance, and harvesting which amounted to PhP 240,77.00. The fixed cost was

composed of depreciation cost and payments for business license and permits, which amounted to PhP 11,555.56. Investment cost for the cage construction amounted to PhP 95,000.00. Gross sales of harvested milkfish amounted to PhP 235, 241.00 with a unit price of PhP 90-120/kg. Computed ROI is -0.18% that indicates that the total cost greatly exceeded the income of the grow-out operations for the first cycle.

Table 36. Cost and Return Analysis of Milkfish Cage Grow-Out in Igang, Guimaras

Item	Unit	Quantity	Price	Amount
RETURNS/INCOME				
Harvested Milkfish	Kgs		90-120.00	**235,241.00**
COSTS				
Variable Costs				
Fingerlings	Pcs	7,500.00	6	45000
Feed cost	Kg	5,419.00	33	178,827.00
Labor	man/day	10,000.00		10,000
Maintenance and Repairs		950		950
Harvesting cost				6,000.00
TOTAL VARIABLE COST				**240,777.00**
Fixed Cost				
Depreciation cost				10,555.56
Business license and other permits		1000		1,000.00
TOTAL FIXED COST				**11,555.56**
TOTAL COST				**252,332.56**
NET INCOME				**-17,091.56**
Investment cost (Cage Construction Materials and Labor)				**95,000.00**
ROI				-0.18

Source: NFRDI-FFRDC. 2020. Technology verification of cost-efficient diet for milkfish grow-out culture- commercial feeds (On-going project of NFRDI with SEAFDEC/AQD).
** Per cycle for three (5 x 5 x 3 m) cages*

Lastly, for the milkfish grow-out operations in Guiuan, Eastern Samar, it required PhP 115,818.45/cycle for the total costs (Table 37). Variable costs include the milkfish fingerlings, feeds, and labor for repair and maintenance, which amounted to PhP 105,057.23. For the fixed cost, it was composed of the depreciation cost and payments for business license and permits, which amounted to PhP 10,761.22. Investment cost for the cage construction amounted to PhP 87,851.00. Gross sales of harvested milkfish amounted to PhP 130,749.60 for 1,089.58 kg with a unit price of PhP 120/kg. Computed ROI is 0.17, indicating that the total cost exceeded the income of the grow-out operations.

Table 37. Cost and Return Analysis of Milkfish Cage Grow-Out in Guiuan, Eastern Samar

Item	Unit	Quantity	Price	Amount
RETURNS/INCOME				
Harvested Milkfish	Kgs	1089.58	120	**130,749.60**
COSTS				
Variable Costs				
Fingerlings	Pcs	2,880	8	23,040.00
Feed cost	Kgs	2,146.61	33.14	71,138.72
Labor	Man/day	10,000.00		10,000.00
Maintenance and Repairs		878.51		878.51
TOTAL VARIABLE COST				**105,057.23**
Fixed Cost				
Depreciation cost				9,761.22
Business license and other permits		1,000.00		1,000.00
TOTAL FIXED COST				**10,761.22**
TOTAL COST				**115,818.45**
NET INCOME				**14,913.15**
Investment cost (Cage Construction Materials and Labor)'				**87,851.00**
ROI				0.17

Source: NFRDI-FFRDC Milkfish Grow-out Project
** Per cycle for three (4 x 4 x 3 m) cages*

In terms of fingerling production, based on the existing cost and return analysis and cost structures from the different regional offices survey, the major inputs for this component are fertilization scheme used and feeding regimen employed by the milkfish fingerlings producers. The average cost of producing bangus fingerling with an average size of 4 inches and weighing 30 to 50 grams is Php 4.93. Feeding and fertilization strategy, which plays an important role in achieving cost efficient fingerling production, accounts for 45% and 10% of the total costs. Fry costs and other expenses like maintenance, segregation activities and other daily activities accounts for 7% and 38%, respectively.

A paper by Salayo et al (2021) came up with a comparative financial analysis of 10 different milkfish enterprises along the backward linkage of the milkfish VC and ranked such enterprise investments accordingly based on the following financial indicators: capital investment, costs, income as well as profitability indictors including ROI, PP, IRR, and BCR (Figure 28). The result showed that the top five most viable and profitable enterprises are: Type 4 nursery; Type 1 nursery; small scale hatchery; Type 2 nursery; and, 4-cage polyculture operation. Interestingly, among the bottom enterprise is an integrated breeding and hatchery facility. This supports the initial observation that this type of service is better provided by the government.

Figure 28. Comparative Financial Analysis of Different Milkfish Enterprises

Technical information, capital investments, costs, incomes and profitability indicators of milkfish production, enterprises, Philippines, 2016.

	Integrated breeding & hatchery facility[a]	Small-scale hatchery	Type 1 Nursery	Type 2 Nursery	Type 3 Nursery	Type 4 Nursery	Cage Monoculture[b]		Cage Polyculture[c]	
							1-cage operation	4-cage operation	1-cage operation	4-cage operation
Project duration, years	20	10	5	5	5	5	5	5	5	5
Number of crops/year	10	10	2	2	4.5	3	2	2	2	2
Survival rate,%	80	30	65	65	65	65	95	95	95	95
Stocking rate	15–25 larvae/liter	15–25 larvae/liter	154,000/2-ha pond	154,000/2-ha pond	154,000/2-ha pond	154,000/2-ha pond	15,000/cage (15x15 × 5m)	15,000/cage (15x15 × 5m)	15,000/cage (15x15 × 5m)	15,000/cage (15x15 × 5m)
Capital investment	14,444,900	851,000	250,400	250,400	250,400	250,400	148,000	575,100	148,000	575,100
Variable cost	2,976,775	598,000	432,859	1,161,346	1,466,717	644,291	1,033,062	3,958,740	1,049,062	4,046,518
Fixed cost	3,042,046	433,463	116,226	137,300	117,057	116,906	75,384	295,730	78,704	297,704
Total cost	6,018,821	1,010,538	549,085	1,298,646	1,583,774	761,197	1,108,446	4,254,470	1,127,766	4,344,222
Gross income	8,240,898	1,746,000	1,048,648	1,810,200	1,702,350	1,571,400	1,128,600	4,514,400	1,225,200	4,900,800
Net income, excluding depreciation	2,222,077	711,943	499,562	511,554	118,576	810,203	20,154	259,932	97,434	556,578
Break-even price, PHP	18,270/million larvae 0.15/fry	0.17/fry	3.14/finger-ling	0.98/hate-rin; 3.06/finger-ling	0.93/hate-rin	2.91/finger-ling	88.39/kg milkfish	84.82	84.51	81.38
ROI	15.4%	86%	200%	204%	47%	324%	14%	68%	66%	148%
Payback period, years	4.69	0.96	0.45	0.44	1.46	0.29	2.16	1.06	1.01	0.77
IRR	23%	105%	222%	227%	67%	347%	30%	68%	91%	125%
BCR	1.25	1.88	1.87	1.39	1.07	2.04	1.02	1.06	1.09	1.13
Investment Rank	9	3	2	4	7	1	10	8	6	5

[a] IBH facility: for the breeding component, capital cost = PHP 5,525,900, variable cost = PHP 1,409,095; Fixed cost = PHP 1,221,744 and total cost = PHP 6,630,839. Meanwhile, for the hatchery component, the capital cost = PHP 8,919,000, variable cost = PHP 1,567,680, fixed cost = PHP 1,820,302 and total cost = PHP 3,387,982.

[b] Of the 600 cage units (10x10 × 5m) to be supplied with fingerlings emanating from 112 million eggs produced in 1 IBH, 120 units of cages are assumed to operate with 1 cage per operator, and 480 units are under 4-cage operation which benefit from economies of scale.

[c] These 600 cages may opt for monoculture of milkfish or polyculture with siganids using similar levels of inputs and culture procedures. Without additional feed inputs, polyculture optimizes feed utilization and increases profit levels.

Source: Salayo, et al. 2021

D. Benchmark Analysis

1. Local

There are a number of existing local best practices, researches, and technologies related to milkfish production. A few are enumerated herein.

Thermal Manipulation for all-year round egg production

Milkfish farmers suffer from shortage of fry mostly during the colder months of the year (November-February) because of the seasonality in breeding. Data from the SEAFDEC/AQD hatchery show that milkfish breeders normally only spawn between March and October when the weather, and consequently the water, is warmer. In order to address this pressing concern, SEAFDEC/AQD has introduced a technology that involves thermal manipulation to stimulate breeding despite off-season.

According to SEAFDEC/AQD Chief Dr. Baliao in the article "*Heated tanks lead to productive milkfish spawning in cold months*" posted on the SEAFDEC/AQD website on the second quarter of 2021, the technology involves the installation of water heaters in a 500-ton tank housing over 100

milkfish breeders, raising the temperature to at least 29 degrees Celsius from November to February. With this new "thermal manipulation" technology, the research institution was able to collect about 2.9 million good eggs from which almost 1.7 million normal larvae were hatched in a time that is normally considered off-season by milkfish hatcheries from Nov. 2020 to Jan. 2021.

Availability of milkfish fry all throughout the year is a big leap for the industry to address the inadequate fry supply. Herewith, the fishponds and mariculture areas can be operated even during fry off-season thereby contributing more to production and food security.

Philippines University Develops Fry Counter for Small-Scale Hatcheries

An automated fish fry counting machine has been developed by the College of Fisheries and Ocean Sciences of the University of the Philippines-Visayas (UPV). It aims to increase the speed and accuracy of fry counting compared to the common practice; thus, minimizing stress on the fry. The research team also sought to make the model very affordable as well with small-scale milkfish fry hatcheries in mind. The device is appropriately called Automatic Fry Counter (AFC).

The AFC is relatively low in operational cost when compared to employing manual labor for fry counting. The research stated that, "The significant feature of the R&D product is the relatively lower cost which is certainly affordable and an attractive alternative to the laborious manual counting of fry." The AFC, which costs below the market price of P20, 000 (USin US Dollars386), consists of a counting channel, laser as a light source, phototransistor as receptor mechanism and a small processor. It has a capacity of counting 12 milkfish fry per second or over 43,000 pieces an hour, at 95% accuracy. The speed exponentially contributes to the hatchery's productivity. Manual counting is about 10,000 pieces an hour. It is a tedious and time-consuming method, prone to human error and creates an environment that could put stress on the fry.

Genomic stock structure of Philippine milkfish breeders

In the recent paper of Romana-Eguia, M., et. al., (2018) titled "*Genetic assessment of milkfish (Chanos chanos Forsskal) stocks based on novel short tandem repeats for marker-aided broodstock management*", baseline data on genetic stock structure of wild- and hatchery- bred Philippine milkfish breeders were determined. The general objective of the study was to characterize and assess the genetic variation in hatchery-bred milkfish spawners for potential formulation of effective broodstock management scheme employing genetic markers. Specifically, it aims to determine which broodstocks has high genetic variability and has potentially better economic traits for milkfish production.

The experiment investigated on eight wild-bred Philippine stocks sourced from provinces of Claveria (Region 2), Currimao (Region 1), Camiguin (Region 10), Guimaras (Region 6), Dumangas (Region 6), Palawan (Region MIMAROPA) and Zambales (Region 3); four hatchery-bred stocks from SEAFDEC/AQD hatcheries in Igang and Dumangas (Region 6), BFAR Bohol (Region 7), and CDO hatchery in Zambales (Region 3); two farm stocks of known mixed lineages from Sual Pangasinan Hatchery (Region 1) and BFAR Dagupan Hatchery (Region 1); and one Indonesian hatchery-bred stock from West Java Hatchery. Total genomic DNA was extracted from the fin samples of each stock and was analyzed using genetic tools.

Results showed that in terms of mean allelic richness, wild-bred stocks registered the highest (9.5) while hatchery-bred spawners were the lowest (9.1). Wild-bred stocks were also identified to be slightly higher (0.67) among the others in terms of mean expected heterozygosities. This only

indicates that among local-sourced broodstocks, stocks from the wild are more preferable than the hatchery-bred or farm stocks with mixed lineages. As for genetic variability indices, it was noted that Indonesia stock was similar to local wild-bred stocks. Meaning, it is likely that broodstocks utilized in Indonesia, which is perceived to be superior, is genetically comparable and has the same fitness traits with the wild-bred broodstocks in the Philippines.

Furthermore, the study showed that domesticated first-generation stocks have reduced mean allelic richness compared to their founder stock. Thus, it is recommended that in developing good quality broodstock, it is best to use parental broodstock on grown from original wild stock for seed production purposes. Romana-Eguia, M., et. al., (2018) also suggested that, it is advantageous to perform periodic recruitment and development of wild fry into broodstock than to continuously develop breeders in the hatchery.

Genetic characterization of potential active breeding stocks in aquaculture is an important pre-requisite to hatchery stock management especially for long-term use (Romana-Eguia, et. al., 2018). This study benchmarks the genetic exploration on Philippine milkfish stocks. It is envisioned that through enhanced genetics, improved growth, nutrition, disease resistance, and climate resilience in Philippine milkfish stocks can be realized.

Milkfish Genomics Research and Development Roadmap

In support to the DA-BFAR's Bangus Fry Sufficiency Program 2020-2025, which aims to bolster the needed infrastructure-based milkfish seedstock production program, a complementary R&D initiative on milkfish genomics has been proposed. Headways were already made from the preliminary researches on the development and application of molecular markers (mtDNA, microsatellite markers) in determining the genetic diversity of wild and hatchery stocks of milkfish as well as the Philippine participated ongoing FAO project that documents current milkfish genetic resources used as breeding stocks in government and private milkfish seed production facilities.

Specifically, the proposed long-term Milkfish Genomics Research and Development Roadmap came about as an inter-agency collaborative effort involving the DA-BFAR, NFRDI, Feedmix Inc., UP, and the De La Salle University (DLSU). Among the major key activities to be undertaken: marker development; genetic monitoring and profiling of milkfish stocks; genetic linkage map development; and selective breeding.

R&D undertakings of this kind will need strong support from both the public and private sector and are better done via the network of research and development of institutions (RDIs) and experts.

Farming practices to improve income and reduce the environmental impact of milkfish culture in the Philippines

The continuously growing demand for seafood drives the uprising trend for intensive milkfish cage culture in marine environment in the country. The practice uses high stocking densities, with significantly greater inputs of artificial feeds which more often than not, have led to excessive feeding and consequently excessive nutrient loading in receiving waters, exacerbating problems with pollution which results into occurrence of fish kills (de Jesus-Ayson, E.G.T., & Borski, R.J., 2012).

In the technical report of de Jesus-Ayson, E.G.T., & Borski, R.J. (2012), cost-effective feeding practices and application of Integrated Multi-Trophic Aquaculture (IMTA) were discussed and

suggested to achieve improved income and reduction of ecological footprint of milkfish culture in the Philippines.

The study initially conducted production comparison of milkfish fed on alternate days versus those raised on daily feeding in marine cage culture. The experiment aimed to evaluate whether feed ration reduction can demonstrate significant cost savings without compromising the production efficiency. In the study, survival rates (~ 90%) were comparable between the control fish fed daily and groups fed on alternate days in marine cages. Similarly, total harvested biomass of fish in the alternate day and daily feeding groups was similar as was the harvest value, although fish on the alternate day feeding scheme grew slightly less. Feed conversion ratio (FCR) was lower in the alternate-day fed group (FCR = 2.46) relative to stocks fed daily (FCR = 3.59). Overall, the results demonstrate that feed costs can be reduced by around 32% in stocks fed on alternate days, which yields an estimated 20-25% improvement in production efficiency relative to raising animals on a daily feeding protocol. Hence, a significant costs savings with reduced impact of nutrient loading in the environment is likely to be realized for farmers who adopt an alternate day feeding scheme in raising milkfish in marine cages (de Jesus-Ayson, E.G.T., & Borski, R.J., 2012).

The paper also explored the application of IMTA. IMTA is the culture of aquatic organisms employing the concept of complementary trophic roles of each organism being cultured in recycling nutrients and energy during the production cycle. With this premise, applying IMTA in intensive aquaculture systems will lessen its negative impact to the environment (de Jesus-Ayson, E.G.T., & Borski, R.J., 2012).

The study integrated the culture of sea cucumber, seaweed gracilaria (as biofilter) and milkfish in brackishwater fishponds. The experiment aimed to investigate whether these commodities can be cultured together and may affect growth of each other. Researchers found that milkfish and sea cucumber can be cultured together however presence of sea cucumber did not have any effect on the growth of milkfish in both weight and length. Survival of sea cucumber was very good (78-86%). Thus, sea cucumber can be produced as a value-added product in brackishwater pond production of milkfish that can result into additional income for fish farmers. As for gracilaria grown in canals between ponds, it initially showed good growth but later died off after alternating days of intense heat followed by days of heavy rains, which lowered the salinity in the pond below 25 ppt.

For the trial in marine cages, the seaweed *Kappaphycus alvarezii* is used as biofilter. Milkfish fingerlings were randomly stocked in 6 units 5x5x3m cages at a density of 35 fish/m3. Sea cucumbers were stocked under three of the cages. However, 100% mortality was observed during the 1st sampling (2 weeks). Trials on sulfide tolerance of sea cucumbers show that sea cucumbers cannot withstand the high sulfide environment under cages especially if the site has been used for mariculture operations for extended periods. Although the feasibility of co-culture of milkfish and seaweeds in cages could not be determined due to outbreak of ice-ice disease resulting in mortalities in the seaweeds, K*appaphycus alvarezii* grown in cages adjacent to the fish cages generally show good growth with increasing biomass of the cultured stocks. This suggests that integrated culture of milkfish and seaweeds is feasible (de Jesus-Ayson, E.G.T., & Borski, R.J., 2012).

Vertically and Horizontally Integrated Companies

It is a common practice for feed manufacturers and processors of milkfish to vertically or horizontally integrates to attain competitiveness. An example of which is in Feedmix Specialist Inc.

and its affiliate Fisherfarms, Inc. that is vertically integrated in all aspects of the supply value chain. SANTEH Corporation also has vertically integrated into marketing by supplying to institutional buyers and also has horizontally integrated into other fish and fishery products to fill in the requirement that a single supplier is required to source all fish and fishery product needs of the buyer.

Feed millers that either integrate into marketing or processing usually starts on marketing assistance to clients which then usually expands to other aspects of the business-like processing and/or marketing of related products. This is also true for grow out operators which vertically integrate into processing to expand markets beyond the typical wet markets. Processed products expand markets to institutional buyers and supply certain niches that can only be served by introduction of value-added products. ALSONs Corporation is good example of this to which the company has integrated into processing and hatchery operation and attains competitiveness attributes such as cost, quality and supply reliability.

Vertical integration helps a lot in maintaining cost low. As per interview, vertically integrated farm can release large milkfish (2 pcs. per kg) at P 110/kg when its farm gate price in the regular buying stations is at P 140-150/kg. Processors also claim that price fluctuations are steady in the regular wholesale markets, which make milkfish processing less profitable if supply is not produced internally. Supply from milkfish trading areas is inconsistent to which fish bought in these areas may not be enough to attain break even production of the processing facility.

Quality aspects of raw material may be easier to control if the firm is vertically integrated in operation. The most common of these concerns is the presence of antibiotic residues that is a primary concern of export markets. That if feed manufacturing is not integrated into the operation, a processing company may not be assured that the fish are antibiotics free.

2. International/Global

Taiwan: Selective Breeding Benchmark

Since the successful completion of larval rearing technology in 1984, fry production has increased significantly, which has not only provided milkfish farmers in Taiwan with ample supply but also opened an export market to neighboring countries.

Taiwan, however, has recently developed an improved strain of milkfish through selective breeding process resulting in a golden coloured F1 pioneered by a private farmer. This would accordingly command a better price than the original silvery coloured strain, once introduced in the market. Current practice of commercial hatchery and nursery productions are integrated enterprises. Milkfish fry are generally grown in either earthen ponds or elevated canvas or concrete tanks at intensive stocking densities of >2 000/litre. However, production has been limited since these are marketed and consumed locally with a few exports concentrated on processing and value-added products to other countries like USA. Although, there is still continuous research and development for milkfish in Taiwan, diversification of species remains the priority and has paved the way for prioritizing other high valued commercial marine species of fish, which has affected the growth of the milkfish industry. Fish processing plants are located in several fishing ports around Taiwan. The two major fish processing centres are Suao on the east coast and Pindong near Kaohsiung.

Indonesia: Broodstock Development Benchmark

Broodstock development in Indonesia is shouldered by the Government to which the several fish production centers like the one in Gondol collect fry from different parts of the country. Broodstocks are grown in ponds for a year or two prior to distribution to private and government hatcheries. Broodstock are chosen from the fast-growing milkfish and termed labeled as G1 broodstock. Commercial feeds are supplemented with various needed vitamins and nutrients specifically for broodstock development.

Broodstock are stocked in rectangular tanks for breeding and egg collection. These eggs are transported to smaller facilities for hatching. Most notable practice of these small hatcheries is their specialization in the growth of natural food which is essential for the survival of fry. It was noted by some of the industry practitioners in the Philippines that occurrences of mortalities are encountered between the 7th to the 9th day of hatching to which it is a practice in Indonesian hatcheries to increase the amount of natural food being fed to the fry to reduce fry mortalities. This practice is documented to have increased survival by 42%.

During the propagation of natural food there are also some techniques being done to add supplements to the natural food during production prior to feeding them to the fry which allows the introduction of needed nutrients and vitamins. Since these small facilities areas aware of the importance of the natural food, a lot of tanks in these hatcheries are just used for natural food production. As compared to the hatchery practices in the Philippines wherein the natural food provided to the fry is limited.

Well established backyard-type nursery is used in Indonesia that consists of series of elevated canvas or concrete 1-2 tons tanks. Similar stocking densities to those used in Taiwan are employed. Because of this system of support for the production of milkfish, Indonesia has strengthened its export of hatchery-reared seedstock to the rest of the Asia-Pacific region for tuna bait and for grow-out.

In Indonesia and Taiwan, production of milkfish specifically for the tuna bait market is one of the important segments of the industry. Based on published studies, this niche is dominated by Indonesia.

Table 38. Size Requirement for Tuna Bait

Type of Bait	Acceptable Size Range	Application for Species of Tuna
Live Milkfish	40-60 grams/piece	Mainly Yellowfin Used as secondary bait for bigeye In shallow sets, it can be used for albacore
Frozen Milkfish	100-200 grams/piece	Yellowfin, bigeye, albacore

Source: FitzGerald/ Secretariat of the Pacific Community

The Philippines' milkfish production is only 80% of that of Indonesia. The country is next to Indonesia in terms of global milkfish production. For CY 2018, the country produced 395,130 MT of milkfish. The 2018 annual growth rate in production was -3.89%. Average annual growth rate for the past ten years is 1.5%. On the other hand, Indonesia's milkfish production in CY 2018 was 875, 595 MT. Indonesia maintained a two-digit growth of 24.8% in 2018. Its average growth rate for the past ten years is 12.7%. This could be attributed by the huge resources of Indonesia – large area for

brackishwater aquaculture, huge supply of hatchery-produced milkfish fry, and the support of the Indonesian government to aquaculture, tax exemption on feeds importation, subsidy on aquatic feeds, and food security credit scheme to fish farmers.

Turkey: Policy for Mariculture Development Benchmark

Development and improved aquaculture in Turkey started in the year 2003 marking the policy changes in increasing government support to aquaculture investment purposely to increase production by increasing productivity, diversity and quality at the same time taking into consideration the sustainable use of resources. Subsidies were provided to aquaculture farmers farming trout, gilthead, seabream and seabass in the form of fry support and other production support provided by the government. From an aquaculture production of 79,943MT in 2003, Turkey's production from aquaculture rose to 253,395 MT in 2016 marking a 30% increase in production.

Various incentive and support were also provided to farms implementing EU standards and good fish culture practices with the government targeting to increase exports by increasing both quality and volume production. Support programs were in accordance to the farm capacity and decreased over time as incremental production targets have been reached. To avail of such support, farmers were required to satisfy several requirements such as Fisheries Aquaculture Document Certification, registration with the aquaculture registry system, join associations or cooperatives related to aquaculture production, as well as submit documents of fry and feed purchase and sales documents relative to harvest.

This program of farm support played a major role in preventing unregistered production, creation of a competitive aquaculture sector and development environment friendly and sustainable production techniques. Growth gained from aquaculture support increased the capacity of farms and establish momentum to introducing new farming technologies. This in addition to the introduction of inspection mechanisms which have avoided informal sales and allowed the aquaculture industry to achieve price stability.

Farmer registration was up to 95% from 10% in 2003 when various product subsidies where introduced. Cooperatives were provided with investment and operating loans establishing aquaculture facilities. This allowed the shifting of production towards aquaculture to which capture fisheries growth will remain stagnant thus allowing aquaculture a bigger role in food security.

All of the above product support programs played an important role in the application of modern and advanced technologies. It further encouraged offshore aquaculture and allowed ease in access to better equipment. In 2016, the government of Turkey preached production incremental targets and started reducing support to allow the industry to stand on its own.

Vietnam: Marketing and Competitive Strategy Benchmark

The model for international competitive strategy is from Vietnam that was used for Pangasius that started out as a virtual unknown to the export market. Vietnam incentivized aggressive approaches in production and marketing that led to Pangasius as one of the most traded fish and fishery products in the world. Vietnam already has competitive advantage over Pangasius since it is native to the country with natural breeding primarily found in the river Mekong in which unique characteristic somehow triggers natural spawning.

Vietnam's aggressive approach in supporting research allowed the fast development of Pangasius starting with the selective breeding to which other countries are unable to duplicate. Same strategy is being applied to other species like *Macrobrachium* wherein selective breeding experiments included cutting off the eyes of broodstocks to reduce the aggressive behavior of the species during mating season just to reduce injury to broodstock to make them more productive. Vietnam likewise invested in broodstock selection - growing and observing characteristics of collected potential broostock that were selected for growth disease resistance and other characteristics that are useful for both breeding and culture.

This aggressive stance in production and marketing was backed up by the Vietnam government providing support such as supply chain restructuring, enhancement of cooperative roles in the dissemination of technology, gradual improvement and application of VietGAP standards to increase compatibility to international standards, improvement of information systems and provision of timely updates in market requirements. The implementation of these strategies along with strong investment and financial support allow some Vietnamese firms to aggressively pursue production and marketing.

A study conducted by Vietnamese researcher in 2016 presented in IIFET 2016 Scotland Conference showed how the Vietnamese firms, in partnership with the government, adapted to issues like changes in exchange rates, interest rates, product standards and product rejection which posed as the primary threats to Vietnamese international trade. Foreign exchange changes were solved by strategies of exporters. They employ forward contracting to hedge against exchange rate risks. However, it is not easy to organize a large number of small producers to engage in forward contracts. Another possible adaptive measure is vertical coordination and integration. About 80% of the surveyed larger exporting firms are engaged in vertically integrated firms.

Product standards compliance was improved by the Vietnamese government by the issuance of issued Decree No. 36/2014/ND-CP on April 29, 2014. The decree outlined a number of specific requirements for producers, processors and exporters. Two notable requirements for producers were that "The breeds, feeds, veterinary medicine, bio-products, microorganisms and chemicals used must be consistent with the law," and "By December 31, 2015, every commercial Pangasius farm must obtain the Certificate of Good Aquaculture Practice according to VietGAP or an international certificate that is consistent with Vietnam's law."

The Deputy Chair of Vietnam's Association of Seafood Exporters recently stated that roughly 50% of farmers have attained compliance with certification requirements (Lutz, 2016). Pangasius processors are obligated to comply with the demands of the decree and with a number of requirements. These requirements include tracing the origins of processed Pangasius products, and applying a quality control system. Technical regulations and standards for food safety and hygiene during manufacture and sale of aquaculture products must be followed. Producers and processors must obtain a certificate of food-safety facility issued by a competent authority and ensure the announced quality of Pangasius products, carry out inspections and take responsibility for the announced quality, and label goods in accordance with the law Lutz, 2016).

Vietnamese firms have been classified into three: those that employ the aggressive or proactive approach; those that employ the reactive offensive approach; and, those, which use the reactive and defensive approach. Firms with the longest experience in the export market generally practiced the offensive and aggressive approach showing more labor employment reaching figures

of more than 2,000 personnel employed. The proactive and aggressive firms also were more aggressive in adapting to the stricter regulations of the EU and had more success in maintaining markets especially when the Vietnamese Pangasius market was tainted with several product returns in 2014.

E. Competitive Analysis

Competitive Analysis was described as a process an entity defining and understanding its industry, identifying its competitors, as well as their weakness and strengths and predicting their future plans (Zahra and Chaples, 1993). It involves collecting data from the said competitors to help it position itself in the industry and understand the market process (Oxenfeldt and Schwartz, 1981).

1. Local

Table 39. Ten-Year Price and Production Data for Milkfish in the Philippines, 2010-2019

Year	Price/kg (retail)	Wholesale	Milkfish Production (MT)
2010	112.56	90.69	349,432.01
2011	112.86	92.32	372,580.80
2012	125.01	104.49	386,728.94
2013	123.84	100.46	401,066.40
2014	123.51	101.47	390,232.53
2015	126.75	104.88	384,425
2016	126.47	104.47	398,088
2017	133.12	107.48	411,103
2018	156.18	128.48	303,402
2019	164.00	-	409,906.56

Source: Philippine Fisheries Profile, BFAR (2010-2019)

In terms of average price, milkfish places 9th in terms of highest value in price among fishery commodities. (PSA, 2020), with an average price of Php 104.51/kg. Suggested retail price for cage cultured milkfish by the Department of Agriculture (DA) is at Php 169.00/kg (Gomez, 2020). While prevailing prices for milkfish for Dec 2020 ranged from Php 120-220 for medium sized bangus at 3-4 pcs/kg in Metro Manila Markets (DA, 2020).

Based on the weekly pricing of fishery commodities by BFAR, wholesale milkfish market in Navotas Fish Port Complex has been subdivided into 3 categories such as small (6 pcs and above/kg), medium (3-5 pcs/kg) and large (1-2 pcs/kg). Milkfish marketed as small usually costs 100 Php/kg and is usually sourced from Laguna, while medium-sized bangus are at Php 130-150/kg and is usually sourced from Pangasinan and Bulacan.

Among regions, Regions 1 and 5 obtained the highest prices in milkfish while Region 13 obtained the lowest pricing in milkfish in January (BFAR Monthly National Consolidated Price Monitoring Report, January 2020) while on November, CAR Region obtained the highest prices in milkfish while region 9 obtained the lowest pricing. Regional prices that are collected and presented for milkfish can be used as a tool on the relative pricing among regions (BFAR NCPMR, November 2020).

2. International/Global

The Philippines recorded an export of over 17,040 kg of milkfish products to the EU in 2002, valued at USD 58 000. While Taiwan concentrates on processed and value-added products for export to the USA while Indonesia has strengthened its export of hatchery-reared seedstock to the rest of the Asia-Pacific region for tuna bait and for grow-out.

IV. MARKET TRENDS AND PROSPECTS

A. Key Demand Drivers

Marketing of milkfish products contribute a lot to the sustainability of the industry in the major milkfish producing countries - Indonesia with its seed production exports, Taiwan with value-added milkfish products and the Philippines with whole fresh and processed products both for domestic and export markets.

Milkfish production value in the Philippines obtained the highest value among other aquaculture species amounting at Php 42, 879.6 million (BAS, 2020). Aside from this, the market of milkfish products in the Philippines has contributed greatly to the economy, these are milkfish products in the form of whole fresh milkfish and other processed products for domestic and export markets.

Small milkfish producers have become the major souce of milkfish for the Philippine domestic market. Milkfish exporters on the other hand, have been composed of few large Filipino-owned companies with enough facilities to produce, process and export their produce on their own. In doing these, these companies have been able to reduce their production costs, they are also able to successfully ensure the traceability and quality requirements set by the export countries like the EU. Popular milkfish export products include frozen fillets and frozen whole milkfish (Seafood TIP, n.d.).

Investing in reducing feed costs was also recommended as well as following the proper techniques in feeding requirement computations and post-harvest facilities. Lastly, shorter farm to table milkfish production segment with direct market to producers/cooperatives to retailers is encouraged.

B. Market Prospects

1. Local

Price manipulation is said to exist in the milkfish industry and in order to solve this, industry leaders suggested the use of" tienda" to bring the fish to low-milkfish supply areas. The suggestion of establishing strategic trading posts across the country and the push in the usage of e-commerce to make the milkfish pricing more transparent was also championed. The usage of e-commerce could also shorten the segment in milkfish value chain

Debunking the myth among Filipinos that shy away from buying frozen fish in the markets as it has already been stored long with reduced freshness, was also pushed as the use of cold storage facilities in freezing and storing the newly harvested fish ensures its freshness, quality, and safety.

Prospects of leveling up the milkfish industry, wherein choice cuts to market milkfish similar to market of poultry and pork was also supported (Lena, 2018).

In terms of production, further improvements in cage-culture technology that enabled Region 1 to overtake Region VI in Western Visayas in milkfish production as Western Visayas' milkfish is mostly in ponds (PNA, 2018). Marine cages can also amplify milkfish production due to increased stocking density when compared to brackishwater ponds (Formoso, 2018). As mariculture parks are

also established in Region 1. Slightly better taste was also said to be obtained in marine cage-cultured milkfish because of the presence of salt in seawater with (Seafood Tip, n.d.).

A push for more value-added milkfish products such as deboned smoked, dried, marinated (brined, sweetened), fermented with rice, and canned or bottled in various styles (salmon style, sardine style, Spanish style, smoked in oil, etc.) can be good strategy to encourage an increase in the local consumption of milkfish. This is in view of the observed consumption trend in the Visayas and Mindanao areas wherein local consumers seem to prefer marine fishes over milkfish or tilapia. One contributory factor could be the bony nature of milkfish.

2. International/Global

As noted, the main drivers of Philippine milkfish exports are the OFWs abroad including those in the USA. This has been also the case with Canada, Hong Kong, Korea and Guam with OFW as the main consumer of the milkfish export market. Other milkfish-consumers from the UK were also immigrants and workers hailing from Indonesian, Bangladeshi and Pakistani origin (Seafood TIP, 2021).

Nonetheless, apart from the OFWs, there is strategic need to increase the export market base. Marketing strategies will have to be undertaken to attract more foreign consumers to also patronize Philippine milkfish products. And the way to go is for the milkfish value added products to be competitive in the global market. This would require compliance to stringent traceability and food safety requirements.

The impositions of stricter protocols in EU and US markets have made a considerable impact on the market of milkfish products, even with the implementation of HACCP system in the processing segments. The General Agreement on Tariffs and Trade (GATT/WTO) trade restrictions and the EU/US bio-safety and quality control standards are foreseen to be an added burden among production costs. Although HACCP from farm to product processing are now strictly observed (for both domestic and export markets), farmers and processors view this as another trade barrier that has been set by the importing industrialized countries.

Philippines is currently the only country that markets and produces boneless milkfish. In order to further expand and improve the market for milkfish, FAO recommended to include the expansion of local and international market for boneless milkfish. This includes the improvement of distribution of boneless milkfish in local markets.

The UAE market can be likewise revived following compliance of the said market's requirement via the Philippine FDA.

V. PRIORITY CONSTRAINTS AND OPPORTUNITIES

The constraints and opportunities from the SWOT analysis were ranked accordingly by the stakeholders in accordance to its degree of severity and importance.

Table 40. Priority Ranking of Constraints/Opportunities Affecting the Philippine Milkfish Industry

Rank	Constraint/Opportunity	Applicable Value Chain Segment
1	High dependence to imported fry - Low survival rate, ave. 17.5% (resulting to low farm productivity) viz local survival rate at 72.5% - Lack of efficient broodstocks, broodstock facilities, hatcheries and natural food production facilities to support milkfish seed production	Input Provision
2	Improper aquaculture practices resulting to siltation and mass fish kills - high density cages beyond the area's carrying capacity - overfeeding	Farming
3	Underutilized/underdeveloped fishponds (FLAs) and Mariculture Parks (MP) - 38 of 90 MPs are non-operational (2019) - 17 proposed (2019)	Farming
4	Limited and seasonal supply of quality small milkfish as raw materials for processing limits the expansion of value-added milkfish products for the local and global market - Farmers are apprehensive to venture on harvesting small size bangus: profitability, stocking rate change, strict quality standards	Post-harvest and Processing
5	Product traceability and quality assurance issues	Post-harvest and Processing, Trading
6	Limited access to funding capital and financial programs for milkfish stakeholders - High cost of farm inputs (seedstock, feeds, fertilizers, etc.), raw materials for processing, logistics and distribution	All segments

7	Difficulty in accessing permits, high cost of fees, contradicting public waters/land use plan implemented by NGAs & LGUs resulting to limited investments	All segments
8	Weak linkage/networking between growers and processors/exporters - multi-level and multi-layered market distribution channel (High retail price of milkfish due to many marketing layers and price manipulation but farm gate price still the same)	Trading, Processing
9	Fragmented small-scale farmers resulting to less economies of scale and low income	Farming
10	Inaccurate and inconsistent milkfish data on production and trade - for more efficient governance over milkfish industry	All segments
11	Limited number of milkfish technical experts and capacitated manpower	All segments
12	Highly competitive global market - Limited acceptance of domestic market on milkfish products (limited to mostly Filipino OFWs)	Trading
13	Climate Change, Disasters and Pandemic that affect and disrupt the production cycle	All segments

VI. TARGET SETTING

A. Vision

"A globally competitive, equitable and sustainable milkfish industry that is modern, fry self-sufficient, market-oriented, and private sector-led with a strong government support promoting increased livelihood opportunities among its stakeholders."

B. Mission

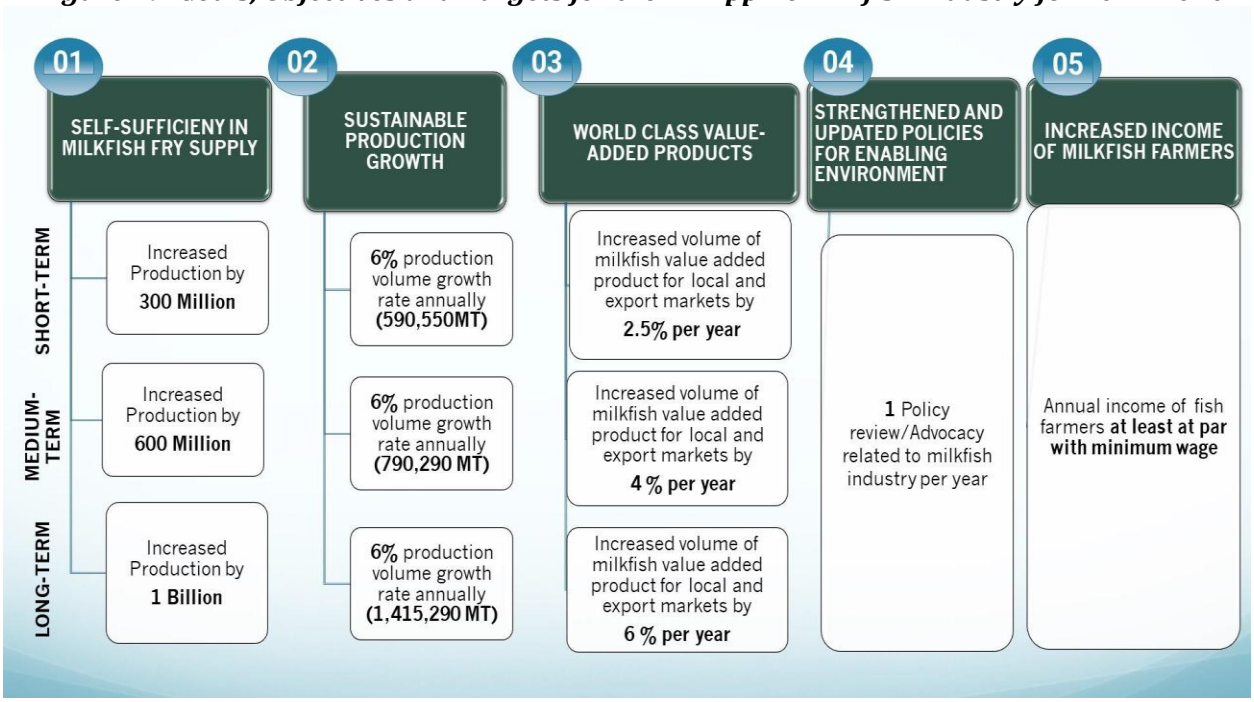
"To strengthen governance and invest on ecologically sound industry-driven milkfish technologies and facilities promoting generation of sustainable livelihood opportunities towards an empowered and globally competitive Philippine Milkfish Industry"

C. Tagline

"Quality bangus (milkfish) for the Filipinos and the world."

D. Goals, Objectives, and Targets

Figure 29. Goals, Objectives and Targets for the Philippine Milkfish Industry for 2021-2040



VII. RECOMMENDATIONS FOR POLICIES, STRATEGIES AND PROGRAMS

Goal 1: Self-sufficiency in Milkfish Fry Supply

Increasing domestic fry produce as import substitution is the key solution identified to attain self-sufficiency in milkfish fry production. Government through its legislative support must capitalize on aquaculture support infrastructures such as milkfish broodstock facility, SCBLRF, wild fry holding facility, and natural food production facility.

It is recommended that broodstock maintenance, being costly (due to long gestation period of milkfish) and yet least lucrative segment of the chain, should need full government intervention, support, and subsidy (Salayo ND *et al.* 2021). On the other hand, satellite hatcheries and nurseries would need private and public partnerships, wherein private investors should take the chunk in operations, as it is the most profitable for growth. These public investments will be put in ABC in qualified Fisheries Management Areas (FMAs) to maximize socio-economic benefits and integrate players within the milkfish value chain.

Another is, rehabilitation and upgrading existing breeding and hatchery facilities. Application of the latest aquaculture technologies and integrating it to hatcheries particularly those producing below its egg and fry capacity is needed to improve their performance. Strategic networking between big private and small fry producers through Big Brother-Small Brother (BBSB) concept is likewise a priority to allow sharing of technologies, experience and resources to help starting investors.

To complement infrastructure establishment efforts, comprehensive training program in collaboration with SEAFDEC/AQD and commercial hatcheries for fishery technicians will be implemented. It is suggested that to attain effective technology transfer and sustainability in operation, candidates for training will agree to sign a contract for a return service of at least five years after training. Contract with a provision that trained technicians will not be transferred to other stations/office during return service.

It was recognized that during the times of pandemic when fry importation was restricted, wild fry gathering help sustain fry supply in the country. Hence, fry gathering activity will be given full support under this plan. Fry collection gears and paraphernalia will be provided as input subsidies for collectors. Fry holding facilities in wild fry hotspots are to be established for efficient collection and improved survival rates. Fry holding facilities are designed similarly to that of SCBLRF. With these facilities accessible to fry gatherers, they can have better appreciation of larval rearing activities and will be taught of backyard hatchery operations through extension services of DA-BFAR. It is envisioned that this intervention can catalyze fry gatherers conversion into backyard hatchery operators and sustainably contribute to target increase in fry production. This program can serve as livelihood opportunity not only for men fisherfolks but also for their wives and the youth in coastal areas.

Although promoted, it is acknowledged that wild fry gathering should be done with caution due to by-catch of important high-value species and declining stocks. Thus, there is a need for massive information drive regarding responsible fry collection methods. For long-term sustainability, updated wild fry resource assessment and management plan should be put in place.

As long-term strategy, milkfish genomics research and development program shall be pursued as national initiative to increase Philippine milkfish production efficiency and realize long-term security. Advanced genetic technologies will benefit improved growth, nutrition, disease resistance and climate resilience in milkfish. It is envisioned that through this proposed state-funded program, Philippine milkfish industry shall be the first among the known milkfish producing countries, to have a genetically improved milkfish strain. The Philippines can, as well, become a country of large scale and small hold aquaculture that is commercially profitable, equitable and sustainable, and playing a key role in the sustainability of the global aquaculture gene pool.

Goal 2: Sustainable Production Growth

Investment on industry-relevant technologies and use of renewable energy sources (e.g., solar power systems, wind turbines) to mechanize and modernize aquafarms will be initiated to help reduce operating costs, boost competitiveness and profitability. Effective technology transfer to growers will also be done to complement the efforts of technology research and development. Appropriate extension services such as trainings, technical assistance and technology demonstrations will be conducted to provide fish farmers with technical know-how on new farming practices. Sharing techniques on natural food culture will be given emphasis during trainings as this technology plays a big role to the success of any aquaculture system. Extending this knowledge and making every farmer skillful on this field will capacitate them towards improving their farm's yield efficiency.

Maintaining balance between increasing production and the need to conserve the environment is an important premise for sustainability. With this principle, strategies will mainly focus on harnessing science-based milkfish technologies to improve farming practices while implementing ecologically sound policies to promote culture operations within the ecosystem carrying capacity.

Goal 3: World-class Value-Added Products

PSPs under this goal should revolve around: enhancing and strengthening product traceability and quality assurance system; ensuring readily available raw materials; market linkaging and networking; and strengthening Philippine positioning in the global market. Under this goal, series of post-harvest and entrepreneurial trainings to capacitate processors including women and youth will be conducted.

Goal 4: Strengthened and Updated Enabling Policies

It is strongly recommended that government should amplify its support to the industry in terms of subsidy (e.g., fingerlings, feeds, farm inputs etc.), grants (e.g., 50% financial support for tools/equipment in aquaculture facilities and for other aquaculture activities), and accessible low-cost financial services (e.g., credit programs, coverage insurance). Government must develop reward system policies (e.g., tax incentives) and recognize top contributors. In this way, stakeholders are empowered to contribute efficiently to the target production increment annually while good investment climate is maintained.

Proper management of coastal and marine resources marks a sustainable fish farming. Involving community to manage resources is one of the schemes to be implemented as new policy

under this roadmap. Establishment of well-defined rights, aquaculture zones, and responsibilities for aquaculturists must pursue to let firms take obligations in resource management within their reach. Allowing firms to have demarcated area with appropriate distance to the next firm can give them space to expand at the same time make liable to any aquatic pollution their culture system may bring. This will also help in identification of farms not compliant to rules of good aquaculture practices; hence strengthening law enforcement.

Overall productivity of the sector can likewise be enhanced if there is a good foundation of realistic baseline data. Proper resource inventory, integration of spatial mapping technologies and transparent database system will direct government as well as industry players to make data-driven decisions that are aligned with the roadmap's targets. With known resources, government can correspondingly optimize use of public owned fishponds (fishponds under FLA) and other potential culture areas (offshore mariculture) to expand farming.

Goal 5: Income of Milkfish Farmers Increased

Consolidation of small farms into bigger farm is advantageous in terms of achieving economies of scale. Small milkfish producers capacitated into cooperatives/federations can work as "Collective Enterpreneurs". As a group, the cooperative can plan, program, and manage the production to ensure year-round production. The organization can also facilitate consolidated procurement and marketing giving competitive advantages through economies of scale procurement of inputs and increased supplier power having vertically integrated into trading. Thus, improving individual farmer's income.

Large producers particularly those engaged in fish cage operations can easily increase their production by 10%, 20% or even 30% so long as the market can absorb the harvest and sell it in acceptable value. However, uncertainty for market hinders farmers to harvest more and limit the potential for increased production. Thus, contract-farming scheme is highly recommended. Contract farming is to assure milkfish produce is bought after harvest in reasonable fixed price. Affordable milkfish in the market will also be perceived as farmers are linked with retailers or cooperatives that in turn sell to direct consumers. Farmers may not get to maximize gross profit from fixed price but can earn better as they keep selling in big volumes continuously. This innovative mechanism will urge farmers to produce more, earn more and contribute to food security.

Milkfish farmers should also be provided with modern technologies to increase production efficiency. Equipment that utilizes renewable sources such solar system can help lessen cost of production and increased profitability of fish farm.

The complete list of priority PSPs per goal with its corresponding targets, budgetary requirements and responsible institutions can be found in Table 41.

Table 41. Priority Policies, Strategies and Programs, Short Term – Long Term (2021-2040)

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
GOAL 1: SELF-SUFFICIENCY IN MILKFISH FRY PRODUCTION (INPUT PROVISION SEGMENT) – Total Budgetary Requirements: Php 1,636,300										
High dependence to imported fry (due to insufficient local fry production)	Infrastru cture Investme nts/ PAFES/ BACs/Di gital Agricultu re/Agric ulture Career System	Sustainability of supply, quality and affordability of milkfish eggs and fry ensured	Bangus Fry Sufficiency Program continues implementation	Number of programs implemented	1	1	1	9,000	DA-BFAR	LGUs, Private Sector
			-Establishment of breeder cage for broodstock maintenance	Number of cages established	75			77,000	DA-BFAR	LGUs, DENR
			-Establishment of Satellite Community-Based Larval Rearing Facilities in strategically located areas	Number of established Satellite Community-Based Larval Rearing Facilities	45	6	5	210,00 0	DA-BFAR	SEAFDEC / AQD, LGUs, Private Sector (investor s)

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			(eg. near mariculture parks, areas with high fish cage operation)							
			-Support for operationalizatio n of legislated multi-species hatcheries (broodstock maintenance, operations)	Number of operated legislated multi-species hatcheries	19	28	38	425,00 0	DA-BFAR	SEAFDEC / AQD, LGUs, Private Sector (investor s)
			Continuous breeding of private hatcheries	Number of private hatcheries operational					Private Sector (Hatcheri es)	DA-BFAR
			Strengthen natural food production							
			-Algal paste technology verification and	Number of technology	3			3,000	NFRDI	DA-BFAR, LGUs,

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			commercial application to hatcheries	verification conducted						Private Sector (hatcheri es)
			-Continued R & D on natural food production (Alternative production of rotifer aside from algal paste such as pond-based rotifer production and production of rotifer using bakers' yeast)	Number of R & D conducted	1 R & D	1 R & D	1 R & D	15,000	NFRDI, DOST, BAR, SEAFDEC / AQD, Academi c institutio ns/ SUCs, RDIs	DA-BFAR, LGUs, Private Sector
			More public and private sector climate-resilient infrastructure investments within ABCs to spur vibrant							

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			business operations							
			-Establishment of natural food production facilities	Number of established natural food laboratory	7	2	1	130,000	DA-BFAR	NFRDI, DOST, SEAFDEC / AQD, LGUs, Private Sector
				Number of constructed natural food tanks for mass production in hatcheries	42	20	10	10,800	DA-BFAR	
			-Establishment and Operation of Regional/Clustered Broodstock Centers	Number of established and operated Regional Broodstock Centers	10	2	1	480,000	DA-BFAR	SEAFDEC /AQD, LGUs, Academic Institutions/SUCs,

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
										NFRDI, DOST, Private Sector
			-Rehabilitation and upgrading of government hatcheries (improvement of facilities, provision of water test kits, upgrading of equipment)	Number of rehabilitated and upgraded government hatcheries/ Percentage increase in fry production	10	10		132,00 0	DA-BFAR	DOST, LGUs, Private Sector
				Percentage increase in fry production	at least 50% increase in fry producti on target per rehabilit ated/upg raded hatchery	at least 50% increa se in fry produ ction target per rehabi litated				

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
						/upgr aded hatch ery				
		Wild fry collection sustained	Increase livelihood support for wild fry gatherers							
			-Provision of fry collecting gears (fry dozer) and fry collection implements (basins, drum, dipper etc.)	Number of fry collecting gears and fry collection implements distributed	at least 50 distribut ed (per year)	at least 50 distri buted (per year)	50 distribu ted (per year)	52,500	DA-BFAR	LGUs
			-Establishment of fry holding facility for wild caught fry in coastal areas	Number of established fry holding facility	14 establish ed	3 establ ished	2 establis hed	80,500	DA-BFAR	DENR, LGUs
			-Facilitate marketing assistance and	Number of fry gatherers assisted	at least 1 group	at least 1 group	at least 1 group	1,500	DA-BFAR	LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			linkage to buyers		(per year)	(per year)	(per year)			
			-Development and implementation of wild fry resource assessment and management plan	Number of management plan developed and implemented	1 manage ment plan develope d and impleme nted	1 mana geme nt plan devel oped and imple mente d	1 manage ment plan develop ed and implem ented	10,000	NFRDI	DA-BFAR, DENR, LGUs, Private Sector (wild fry gatherers)
GOAL 2: SUSTAINABLE PRODUCTION GROWTH (FARM PRODUCTION SEGMENT) - Total Budgetary Requirements: Php 299,500										
Underutilize d/ underdevel oped fishponds and mariculture parks for	Bayaniha n Agri Clusters (BACs) /Provinc e-led Agricultu	Improved farm output and productivity	Optimize and rationalize use of unutilized fishponds under Fishpond Lease Agreement	Percentage of fishponds under FLA utilized	30% utilized	60% utilize d	100% utilized	1,500	DA, DA-BFAR	LGUs, Private Investors

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
milkfish production	re and Fisheries Extensio n System (PAFES)/ Digital Agricultu re/Clima te Change Adaptati on and Mitigatio n Measures /Digital Agricultu re/Strate gic Commun ication Support Credit Support		(FLA) - harmonize apparent conflicting policies of DA-BFAR, DENR, DILG, and LGUs relating to underutilized and underdeveloed fishponds - transfer rights to capable and qualified investors							
			Improvement and adoption of cost-efficient feeding management strategies, low-impact	Number of R & D conducted	1 R & D	1 R & D	1 R & D	30,000	NFRDI, DOST, BAR, SEAFDEC / AQD, Academi c	DA-BFAR, LGUs, Private Sector

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			production systems, high technology support system using renewable energy and climate-smart technologies (e.g., offshore/cage structure technology)						institutio ns/ SUCs	
				Number of technologies developed	2	2	2	30,000	DOST-BAFE, PhilMech	DA-BFAR, Academi c Institutio ns/ SUCs, Private Sectors
			-Distribution of modern fishery equipment and machineries to fish farmer organizations	Number of fishery equipment /machineries distributed	at least 2 (per year)	at least 2 (per year)	at least 2 (per year)	10,000	PhilMech , LGUs, BFAR	PhilMech , NFRDI, SEAFDEC / AQD, DOST, BAR
			Establishment of Agri-Business Corridors (ABCs) wherein markiculture parks are the main hub	Number of ABC established	1 establish ed	3 establ ished	2 establis hed	60,000	DA-BFAR	LGUs, DENR, Private Sector (Investor s)

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			-Expand milkfish fingerlings production through establishment of nursery banks	Number of nursery bank established	20	35	1	18,000	DA-BFAR	Private Sector
		Registration of milkfish aquafarms expanded	Complete inventory and registration to DA Registry System for Basic Sectors in Agriculture (RSBSA) of milkfish farms for easy identification of unutilized farms that can be assisted	Percent of registered milkfish aquafarms	30% of total milkfish farms are registere d	60% of total milkfi sh farms are regist ered	100% of total milkfis h farms are register ed	6,000	LGUs	DA-BFAR
			-Conduct IEC to encourage more milkfish farmers to register							

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			-Use of satellite and mapping technology to locate and inventory the nursery farms, grow-out farms, hatcheries, fish cages, fish pens, and other support facilities (Aqua-R application)							
		Available milkfish novel science-based technologies that are efficiently transferred to growers	Intensive Information Education Campaign (IEC) on available novel science-based milkfish aquaculture technologies through distribution of IEC Materials	Number of conducted training and distribution of IEC Materials	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,0 00	DA-BFAR, DA-ATI, SEAFDEC / AQD	LGUs, Academi c Institutio ns/ SUCs, Private Sectors

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			and conduct of technical trainings (Face to Face/through online)							
			Establishment of technology demonstration on milkfish production technology	Number of technology demonstratio ns established	1 establish ed	1 establ ished	1 establis hed	1,500	DA-BFAR	NFRDI, SEAFDEC /AQD, DOST, BAR, SUCs, LGUs, Private Sectors
			Engage in PPP (public-private partnerships) in the conduct of milkfish research and technology verification projects	Number of adoptors for milkfish production technology	5 establish ed (per year)	5 establ ished (per year)	5 establis hed (per year)	5,000	DA-BFAR, LGUs, Private Sector	NFRDI, SEAFDEC /AQD, Academi c Institutio ns/ SUCs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
High cost of feeds		Affordable alternative feeds formulated and made avaiable for commercial use	Strengthen R & D of low-cost alternative feeds using readily available local materials	Number of R & D conducted	1 R & D	1 R & D	1 R & D	15,000	NFRDI	SEAFDEC / AQD, DOST, BAR, Academi c institutio ns/SUCs, DA-BFAR, LGUs, Private Sector-Feedmill ers
Occurrence of diseases and possible emergence there of	Food Safety and Regulatio ns/ Infrastru cture Investme nts	Biosecurity measures and disease surveillance system to prevent, control and mitigate	Establishment and Maintenance of Regional/ Clustered Quarantine Facility for milkfish fry (Fry banks) near entry points	Number of quarantine facility established and maintained	1	3	1	17,500	DA-BFAR	LGUs, SUCs, SEAFDEC / AQD, NFRDI

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
		milkfish diseases strengthened	Review/formula te regulation on fry importation specific to quality assurance and disease prevention measures	Number of Policy reviewed/for mulated	1 policy formulat ed/revie wed	1 policy formu lated/ revie wed	1 policy formula ted/rev iewed	20,000	DA-BFAR	LGUs
			Accreditation of aquafarms including hatcheries	Percent of accredited milkfish hatcheries and aquafarms	30% of total hatcherie s registere d and accredite d	60% of total hatch eries regist ered and accred ited	100% of total hatcher ies register ed and accredit ed	6,000	DA-BFAR	LGUs
Challenges on broodstock late maturation, seasonal	Infrastru cture Investme nts/ Province-led	Genetically Improved Milkfish Strain through research on	Comprehensive Milkfish Breeding Program (with on-going initiatives)	Number of R & D conducted	1 R & D conducte d	4 R & D condu cted	2 R & D conduct ed	75,000	DOST-PCAARR D, NFRDI, Academi c	DA-BFAR, LGUs, Private Sector

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
peaks in breeding, unreliable broodstock developmen t and managemen t technology, sub-optimal culture systems, inefficient feed and feeding regimens and low resilience to environmen tal stressors (oxygen depletion caused by algal blooms,	Agricultu re and Fisheries Extensio n System (PAFES)/ Bayaniha n Agri Clusters (BACs	genomics sustained, funded and supported	applying Milkfish Genomics -Conduct of research on milkfish genomic resources and markers (Short Term) - Application of markers and available genomic resources developed for various traits (Medium Term) -Conduct of Selective Breeding for Milkfish (Long Term)						Institutio ns/ SUCs, RDIs, BAR	

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
pollution etc.)										
GOAL 3: WORLD CLASS VALUE-ADDED PRODUCTS (PROCESSING SEGMENT) – Total Budgetary Requirements: Php 692,000										
Product traceability and quality assurance issues	Post-harvest, Processi ng, Logistics, and Marketin g Support/ Food Safety and Regulatio ns Agri-Industria l Business Corridor	Milkfish product traceability and quality assurance system enhanced and strengthened	Expand farm registration under National Residue Control Program	Percent of farm registered under National Residue Control Program	30% of total farms registere d	60% of total farms regist ered	100% of total farms register ed	6,000	DA-BFAR	LGUs
			Promote Good Aquaculture Practices (GAqP) among grow-out farms							
			-Conduct of trainings and intensive IEC on GAqP	Number of trainings conducted	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,000	DA-BFAR, ATI	LGUs, Academi c Institutio ns/ SUCs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
	s (ABCs)/ Digital Agricultu re /Post-harvest, Processi ng, Logistics, and Marketin g Support		-Intensify issuance of GAqP certificate among milkfish farms operators	Percentage of GAqP accredited milkfish aquafarms	30% of total milkfish farms are accredite d	60% of total milkfi sh farms are accred ited	`100% of total milkfis h farms are accredit ed	2,000	DA-BFAR	LGUs
			Conduct IEC on food safety and standards	Number of trainings conducted	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,000	BFAD/F DA	DA-BFAR, LGUs, Private Sector
Limited and seasonal supply of quality small bangus as raw		Raw materials for processing and value adding made readily available	Establishment of cold storage facility in key markets to avoid post-harvest losses in case of over supply	Number of cold storage facility established	2 establish ed	5 establ ished	2 establis hed	270,00 0	DA-BFAR, PFDA	LGUs, Private Sector

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
materials for processing limits the expansion of value-added milkfish products for the local and global market (Farmers are apprehensiv e to venture on harvesting small size bangus: profitability, stocking rate change,			Conduct IEC on business opportunities with regards to grow-out farming of small-size milkfish	Number of trainings conducted	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,000	DA-BFAR, DTI, DA-ATI	LGUs, Private Sectors
		More value-added milkfish products developed and made available in the market	Investment in post-harvest and processing technologies, equipment and facilities							
			-Provision of fish processing kits and processing equipment	Number of beneficiaries served	5 groups (per year)	10 group s (per year)	5 groups (per year)	5,000	DA-BFAR	LGUs
			-Establishment of large processing plants in key producing regions	Number of Processing Facility established	3 establish ed	4 establ ished	2 establis hed	300,00 0	DA-BFAR, PFDA	LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
strict quality standards)			Conduct of research and development on processing and packaging technologies	Number of R and D conducted	1 R & D conducte d	1 R & D condu cted	1 R & D conduct ed	30,000	NFRDI, SEAFDEC / AQD DOST, BAR, Academi c institutio ns/SUCs	DA-BFAR, LGUs
			Conduct post-harvest trainings (e.g, GMP, SSOP, HACCP, proper labeling/packagi ng and value-added technologies)	Number of trainings conducted	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,000	DA- ATI, DA-BFAR, DTI,	LGUs
Weak linkage/net working between growers and processors/ exporters;		Market linkages and networking strengthened	Sustained venue for information exchange (e.g., Industry Fora)	Number of industry fora conducted	1 conducte d (per year)	1 condu cted (per year)	1 conduct ed (per year)	3,000	DA-BFAR	LGUs
			Facilitate market matching between	Number of market-	at least 1 group	at least 1 group	at least 1 group	1,000	DA-BFAR, DTI	LGU, Private Sectors

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
multi-level and multi-layered market distribution channel (High retail price of milkfish due to many marketing layers and price manipulatio n but farm gate price still the same)			processors/expo rters and growers - Application of well-managed contract-farming scheme (continuous implementation of Oplan ISDA)	matching facilitated	(per year)	(per year)	(per year)			
			Establishment and Maintenance of online or digital channels for transaction and delivery services of milkfish and milkfish products (e-market)	Number of established and maintained e-market system	1 establish ed and maintain ed	1 maint ained	1 maintai ned	10,000	DA-BFAR	DTI

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			Conduct of regular price monitoring in key markets and facilitate the implementation of Suggested Retail Price (SRP) for Milkfish through the Local Price Coordinating Councils (LPCCS) in coordination with the concerned NGAs	Number of price monitoring conducted	240 conducte d	240 condu cted	240 conduct ed	5,000	DA-BFAR	
			Establishment of Central Seafood Market Complex (common trading post) in key producing regions to avoid fish farmers to engage with	Number of Central Seafood Market Complex established	1 establish ed	1 establ ished	1 establis hed	30,000	PFDA, LGUs	

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			unscrupulous trading manipulations							
Limited support to marketing/ promotional efforts in the highly competitive global market		Support to marketing/ promotional efforts in the global market strengthened	Facilitate attendance of exporters to International Seafood Exhibits/ Market Forum/Seafood Trade Fair	Number of Exhibit/ Forum attended	1 facilitate d	1 facilit ated	1 facilitat ed	3,000	DA-BFAR, DTI	Private Sector
			Facilitate the Certification of processing Establishment (GMP, SSOP, HACCP), inlcuding HALAL certification	Number of certifications facilitated	10 facilitate d	5 facilit ated	5 facilitat ed	1,000	DA-BFAR	BFAD/F DA
			International market benchmarking (continuous market intelligence)	Number of international market benchmarkin g conducted	1 conducte d	1 condu cted	1 conduct ed	5,000	DTI	DA-BFAR

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medium term)	2030-2040 (long-term)	('000)	Lead	Support
			Development and implementation of Marketing Plan for milkfish	Number of plans developed and implemented		1 developed and implemented	1 developed and implemented	5,000	DTI	DA-BFAR
GOAL 4: STRENGTHENED AND UPDATED POLICIES FOR ENABLING ENVIRONMENT (ALL SEGMENTS) Total Budgetary Requirements: Php 253,625										
Inaccurate and inconsistent milkfish data on production and trade for more efficient governance over milkfish industry	Digital Agriculture	Accessible sound and reliable milkfish data for effective resource planning to attain sustainable growth in milkfish production	Development and Maintenance of National Online Milkfish Database System (Coordinate with PSA on the enhancement of their methodology in data gathering and reporting, Monitor broodstock and	Number of developed online information database and monitoring system	1 developed	1 developed and maintained	1 developed and maintained	20,000	DA-BFAR, NFRDI	LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			fry supply, Profiling of milkfish producing areas)							
Difficulty in accessing permits, high cost of fees, contradictin g public waters/land use plan implemente d by NGAs & LGUs	Ease of Doing Business and Transpar ent Procure ment	Polices reformed and strengthened	Review and strengthen FAO No. 1971-1 (Rationalization - assessment and withdrawal of tenurial rights of unproductive FLA fishponds, Review monitoring schemes)	Number of policies reviewed snd implemented	1 policy reviewed	1 policy imple mente d	1 policy implem ented	10,000	DA	DA-BFAR, LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
resulting to limited investments			Formulate regulatory framework for milkfish fry importation crafted (Standardize size and age of fry being imported Quarantine/Dise ase prevention measures/ Traceability)	Number of regulations formulated and implemented	1 regulatio n formulat ed	1 regula tion imple mente d	1 regulati on implem ented	10,000	DA-BFAR	LGUs
			Review/Implem ent policy on managing aquaculture feedmills (Review regulations on inclusion of toxic chemicals in fish feed; Allow	Number of policies reviewed snd implemented	1 policy reviewed	1 policy imple mente d	1 policy implem ented	10,000	DA	DA-BFAR, LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			importation of rendered meal for aquafeeds)							
			Review/Implem ent Policy on Milkfish Aquafarm Registration and Accreditation	Number of policies reviewed snd implemented	1 policy reviewed	1 policy imple mente d	1 policy implem ented	10,000	DA-BFAR	
			Harmonization of apparent conflicting policies of DA-BFAR, DENR, DILG, and LGUs relating to regulations for issuance of permits, conflicting land	Number of regulations reviewed and implemented	1 reviewed and impleme nted	1 revie wed and imple mente d	1 reviewe d and implem ented	5,000		

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			use plans, and fees to facilitate and encourage investments							
			-Develop online processing system for permits, licenses and streamlining of requirements	Number of online systems developed and maintained	1 develope d and maintain ed	1main tained	1 maintai ned	30,000		
Limited access to funding capital and financial programs		Provision of input subsidies, incentives and low-cost financial services for qualified milkfish industry players	Provision of farm inputs (e.g fry, feeds etc.) for growers that will shift into fingerlings production	Number of adoptors for milkfish fingerlings production technology	10 adoptors (per year)	10 adopt ors (per year)	5 adoptor s (per year)	8,125	DA-BFAR	LGUs
			Provision of seedstocks and other farm inputs to fish farmers registered in Fish-R	Number of beneficiaries served	100 individua ls (per year)	200 indivi duals (per year)	200 individ uals (per year)	12,500	DA-BFAR, LGUs	

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			Improve access to financial institutions for low-interest loan, crop insurance, and long-term funds							
			- Review/Formula te Policy on tax exemption /tax holiday for imported raw materials for feed and other aquaculture farm inputs (eg. Fertilizers) as well as to equipment and machineries) Provide tax incentives to aquaculture ancillary	Number of policy reviewed/for mulated	1 policy formulat ed/ reviewed	1 policy formu lated/ revie wed	1 policy formula ted/ reviewe d	10,000	DA-BFAR	

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			industries to reduce farm input production cost)							
			Facilitate registration of investors to BOI for possible incentives and grants (incentives for local investors at least at par with foreign investors)	Number of stakeholders facilitated	10 facilitate d	40 facilit ated	20 facilitat ed	50,000	LBP and other financial institutio ns	DA-BFAR, LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
Improper aquaculture practices resulting to siltation and mass fish kills (high density cages beyond the area's carrying capacity; overfeeding)		Well-managed coastal and marine resources	Review National Guidelines/Polic ies on establishment of milkfish cages and pens in consideration to GAqP (Long term exclusive permit for fish cages within Mariculture areas with a buffer distance (minimum of 0.5km, treating each farm as a critical area)	Number of Guidelines/ Policy Reviewed	1 policy formulat ed/revie wed	1 policy formu lated/ revie wed	1 policy formula ted/rev iewed	10,000	DA-BFAR, DENR	LGUs, Private Sector-Fish cage and pen operator s
			Encourage and promote the crafting of LGU ordinances on zonation and carrying capacity for	Number of meetings conducted	at least 5 meetings conducte d	at least 5 meeti ngs condu cted	at least 5 meetin gs conduct ed	1,000	DA-BFAR/LG Us/DEN R	Private Sector-Fish cage and pen operator s

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			establishment of cages and pen in mariculture sites							
			Regular water quality monitoring in highly productive areas (mariculture areas) to obtain baseline data over the years	Number of water quality monitoring conducted	4 conducte d (per year)	4 condu cted (per year)	4 conduct ed (per year)	3,000	DA-BFAR	LGUs
			Capacitate LGUs on water quality monitoring and through provision of water quality test kits	Number of LGUs capacitated	at least 10 capacitat ed (per year)	at least 10 capaci tated (per year)	at least 10 capacit ated (per year)	9,000	DA-BFAR	LGUs
			Rehabilitation of aquaculture water systems	Number of aquaculture water system rehabilitated	3 rehabilit ated	2 rehabi litated	1 rehabili tated	30,000	LGUs	DA-BFAR

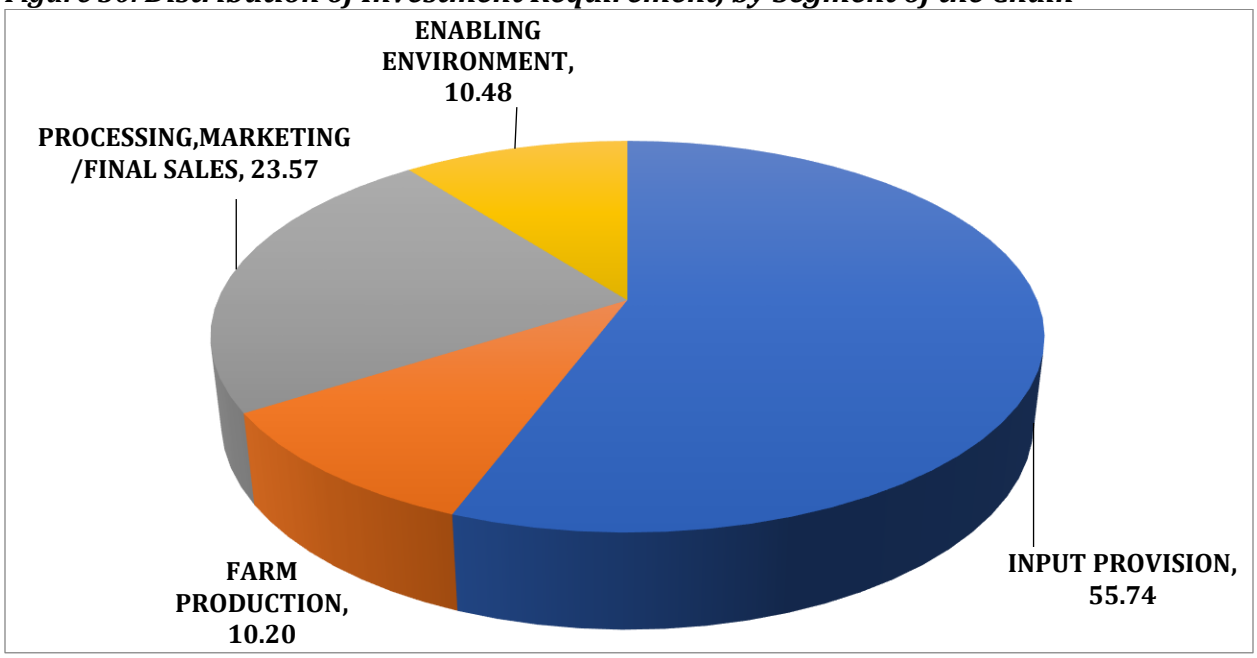
Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
Climate Change, Disasters and Pandemic that affect and disrupt the production cycle	Climate Change Adaptati on and Mitigatio n Measures /Digital Agricultu re	Strengthen information disseminatio n prior on dam discharge, flood warning operations, and typhoon advisory to prevent big loss in revenue by fish farmers	Create an efficient information system between NGAs, LGUs and fish farmers	Number of efficient information system developed and implemented	1 develope d	1 imple mente d	1 implem ented	5,000	NIA, DOST, PAG-ASA	
Limited number of milkfish technical experts and capacitated manpower	Agricultu re Career System	Manpower knowledge and technical capacity enhanced	Implementation of Comprehensive Extension Program for Fishery Technicians (OJT matching; pooling of experts, update training	Number of Comprehensi ve Extension Program developed and implemented	1 develope d and impleme nted	1 imple mente d	1 implem ented	20,000	DA-BFAR, DA-ATI, SEAFDEC / AQD,	Academi c Institutio ns/SUCs, NFRDI, DOST, Private Sector/T ESDA

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
			program and materials Empower extension services)							
GOAL 5: INCOME OF MILKFISH FARMERS INCREASED (ALL SEGMENTS) Total Budgetary Requirements: Php 54,000										
Fragmented small-scale farmers resulting to less economies of scale and low income	Farm Clustering/Bayanihan Agri Clusters (BACs)/ Mobilization and Empowerment of Partners /Province-led	Refer to KRAs of Goal 1 and 2	Refer to PSPs of Goal 1 and 2							
		Empowered small-scale growers through clustering and consolidating them into federations/cooperatives	Promotion/Facilitate the consolidation of small-scale growers into federation/ cooperatives	Percentage of small-scale growers included into federation/cooperatives	30% of total small-scale growers	60% of total small-scale growers	100% of total small-scale growers	6,000	CDA, DOLE DA-BFAR	LGUs

Issues/ Problems	One DA Key Strategy	Action Plans/ Key Result Areas (KRAs)	Priority Policies, Strategies, and Programs (PSPs)	Success Indicators	Physical Target			Budge-tary Requir ement	Responsible Institution	
					2021-2025 (short term)	2026-2030 (medi um term)	2030-2040 (long-term)	('000)	Lead	Support
	Agricultu re and Fisheries Extensio n System (PAFES)		Strengthening of existing milkfish producers' associations throguh conduct of capability trainings (e.g., cooperative management)	Number of trainings conducted	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,000	DA-BFAR, DTI, DA-ATI	LGUs, Private Sectors
			Conduct of enterpreneurial trainings	Number of enterpreneur al trainings conducted	2 conducte d (per year)	2 condu cted (per year)	2 conduct ed (per year)	4,000	DA-BFAR, DTI, DA-ATI	LGUs, Private Sectors
			Provision of reefer vans/trucks to fish farmer cooperatives for efficient transport to markets	Number of reefer vans/trucks provided	5 provided	6 provi ded	5 provide d	40,000	DA-BFAR	
Grand Total								**2,935, 425**		

Figure 30 summarizes the estimated investment requirement for the entire planning period which stood at P2.94 billion. Input provision will have the biggest share accounting for 56% of the total budgetary requirement. Post-harvest and processing and marketing combined together will eat up 24% of the pie while farming and enabling environment will require an equal share of 10% each.

Figure 30. Distribution of Investment Requirement, by Segment of the Chain



VIII. INDUSTRY CLUSTER GOVERNANCE NETWORK

Table 42. Institutions, Agencies and Groups for the Implementation of the Philippine Milkfish Industry Roadmap

Role	Actors	Responsibilities
Oversight and Advisory	Philippine Milkfish Roadmap Steering Committee (PMR-SC) - Representatives from DA-BFAR, NFRDI, SEAFDEC/AQD, DTI, DOST, DENR, NEDA, Philmech, FDA, CDA, BAI, PCIC, LBP, DOLE, TESDA, DA-ATI, DA-PCAF, LGUs, Academic Institutions/SUCs, BAR, PSA, FARMCs, Regional Milkfish Industry Stakeholders Group	1. Advocate, promote, and coordinate with the national agencies on nationwide supportive policies and programs for the milkfish industry
		2. Validate and consolidate plans and proposal of the provinces/regions on milkfish development
		3. Act as top advisory body of the Philippine Milkfish Roadmap Master Plan Implementation
		4. Monitor and Update the Philippine Milkfish Roadmap Master Plan
		5. Liaison with the national policy makers on the milkfish development programs needed legislative support
		6. Represent the milkfish industry in International Conferences
		7. Conduct national and regional milkfish congresses and conferences
		8. Solicit funding support for the implementation of the Philippine Milkfish Roadmap Master Plan
		9. Assist in the formation of the provincial/regional implementing teams

Role	Actors	Responsibilities
National Secretariat and Coordinator	National Technical Working Group composed of representatives from DA-BFAR National Milkfish Program Focal Team, Planning, Monitoring and Evaluation Division, Inland Fisheries and Aquaculture Division	Shall act as the secretariat to consolidate specific policies and directives from PMR-SC
Regional Coordinator	Regional Milkfish Focal Persons (NCR, CAR REGION 1-12, MIMAROPA, Caraga, BARMM)	Shall act upon the policies and directives from PMR-SC in regional level; To monitor the strict implementation of activities and programs indicated in the Philippine Milkfish Roadmap Master Plan; Shall act as report officer that consolidate accomplished activities within the region; Shall ensure the implementation of programs in the regional level
Regional Technical Working Group	Representatives from DA-BFAR (Planning, Monitoring and Evaluation Section, Post-harvest and Marketing Division, Fisheries Production Division, Fish Health and Laboratory Division and Regional Training and Fisherfolks Coordination Division)	Shall assist the Regional Coordinators in monitoring and strict implementation of activities and programs indicated in the Philippine Milkfish Roadmap Master Plan
Provincial Coordinators	PLGU Provincial Agriculturists, DA-BFAR Provincial Fisheries Officers	Assist project implementation team; Shall ensure the implementation of programs and activities in provincial level
Project Implementing Team: Input Supply and farm production activities	Representatives from DA-BFAR (lead); PhilMech, Academic Institutions/SUCs, DOST, LGUs milkfish farmers, feed millers, farm input providers, concerned private sector	Responsible on implementing programs and activities of the Philippine Milkfish Roadmap relative to input supply and farm production
Project Implementing Team: Post-Harvest and Processing Activities	Representatives from DA-BFAR Regional Offices (lead); DTI, Philmech, Academic Institutions/SUCs, DOST, LGUs milkfish farmers, processors, feed millers, farm input providers, concerned private sector	Responsible on implementing programs and activities of the Philippine Milkfish Roadmap relative to post-harvest and processing

Role	Actors	Responsibilities
Project Implementing Team: Logistics supports and marketing activities	Representatives from DA-BFAR Regional Offices (lead), DTI, FDA, PCIC, LBP, LGUs, concerned private sector	Responsible on implementing programs and activities of the Philippine Milkfish Roadmap relative to logistics and marketing
Project Implementing Team: Research and Development	Representatives from NFRDI (Lead), SEAFDEC/AQD, DOST, LGUs, Academic Institutions/SUCs, BAR, DA-BFAR Regional Offices, concerned private sector	Responsible on implementing programs and activities of the Philippine Milkfish Roadmap relative to research and development
Project Implementing Team: Fisherfolk Training and Organization/ Consolidation of Fish Farmers	Representatives from DA-BFAR Regional Offices (lead), NFRDI, SEAFDEC/AQD, CDA, DOLE, TESDA, ATI, LGUs, milkfish stakeholders	Responsible on implementing programs and activities of the Philippine Milkfish Roadmap relative to Organization and Consolidation of Fish Farmers

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APPENDIX 1: VISION, MISSION, GOALS, OBJECTIVES AND TARGETS

1. Vision

A globally competitive and sustainable milkfish industry that is modern, fry supply-sufficient, market-oriented, and private sector-led with a strong government support promoting increased profit among its stakeholders.

2. Mission

To strengthen governance and invest on science-based ecologically sound industry-driven milkfish technologies and facilities promoting generation of sustainable livelihood opportunities towards an empowered and globally competitive Philippine Milkfish Industry

3. GOALS, OBJECTIVES, TARGETS (2021-2025)

Goal	Objectives	Targets
		Short Term (2021-2025)
1. Self-sufficiency in milkfish fry	To increase local production of milkfish fry.	300 million increase in local milkfish fry production
2. Sustainable production growth	To improve farming practices and develop milkfish technologies that will contribute to the increase efficiency in milkfish production.	6% production volume growth rate annually (590,550MT)
3. World-class value-added products	To improve traceability and food safety that will contribute to an increased quality and quantity of value-added products.	2.5% per year increase in the volume of processed products for local and export markets
4. Strengthened and updated policies for enabling environment	To review and update existing fishery regulations and implement new policies necessary to capacitate the industry.	1 policy review/advocacy related to milkfish industry per year
5. Increased income of milkfish farmers	To organize and cluster milkfish famers into cooperatives to work as "Collective Enterpreneurs".	Annual income of milkfish farmers at least at par with the minimum wage rate per region

APPENDIX 2: RESPONSIBILITY MATRIX (FIVE YEAR IMPLEMENTATION PLAN)

Program Activity/Project	Success Indicators	PHYSICAL TARGET (SHORT-TERM)	PHYSICAL TARGET					BUDGET (PhP '000)						Responsible Institution	
			2021	2022	2023	2024	2025	2021	2022	2023	2024	2025	Total	Lead	Support
GOAL 1: SELF-SUFFICIENCY IN MILKFISH FRY PRODUCTION (INPUT PROVISION SEGMENT)													**820,386**		
Bangus Fry Sufficiency Program continues implementation	Number of programs implemented	1 implemented	1	1	1	1	1	1,000	1,000	1,000	1,000	1,000	5,000	DA-BFAR	LGUs, Private Sector
- Establishment of breeder cage for broodstock maintenance	Number of cages established	75 established (Reg. 4A-10 units, Reg. 5-3 units, Reg. Reg. 8-35 units, Reg. 10-3 units, Reg. 11-3 units, Reg. 3-4units, Reg. MIMARO	15	25	25	5	5	10,500	17,500	17,500	3,500	3,500	52,500	DA-BFAR	LGUs, DENR

		PA-7 units, Reg. 7-10 units)												
- Establishment of Satellite Community-Based Larval Rearing Facilities in strategically located areas (eg. near mariculure parks, areas with high fish cage operation)	Number of established Satellite Community-Based Larval Rearing Facilities	45 Established (Reg. MIMAROPA- 5 units, Reg. 1-6 units, Reg. 3- 3 units, Reg. 6- 9 units, Reg. 8-20 units, Reg. 12-1 unit)		6	15	14	10	-	21,000	52,500	49,000	35,000	157,500	DA-BFAR	SEAFDEC/ AQD, LGUs, Private Sector (investors)
-Support for operationalization of legislated multi-species hatcheries (broodstock maintenance, operations)	Number of operated legislated multi-species hatcheries	19 operated		5	5	5	4		25,000	25,000	25,000	20,000	95,000	DA-BFAR	SEAFDEC/ AQD, LGUs, Private Sector (investors)

Strengthen natural food production															
-Algal paste technology verification and commercial application to hatcheries	Number of technology verification conducted	3 conducted		1	1	1		-	1,000	1,000	1,000	-	3,000	NFRDI	DA-BFAR, LGUs, Private Sector (hatcheries)
-Continued R & D on natural food production	Number of R & D conducted	1 R & D conducted		1	1	1	1	-	750	750	750	750	3,000	NFRDI, DOST, BAR, SEAFDEC/ AQD, Academic institutions/ SUCs, RDIs	DA-BFAR, LGUs, Private Sector
More public and private sector climate-resilient infrastructure investments within ABCs to spur															

vibrant business operations															
- Establishment of natural food production facilities	Number of established/upgraded natural food laboratory	10 established/upgraded (Reg 1- 1 unit, Region 3- 1 unit, Reg. MIMAROPA- 1 unit, Reg. 4A-I- unit, Reg. 8-3-unit, Reg. 10- 1 unit, Reg. 11- 1 unit, Reg. 12- 1 unit)		2	4	3	1	-	20,000	40,000	30,000	10,000	100,000	DA-BFAR	NFRDI, DOST, SEAFDEC/AQD, LGUs, Private Sector
	Number of constructed natural food tanks for mass	42 constructed (ISRS, Palawan -12 units, BFAR 7 Central		21	20			-	3,150	3,000	-	-	6,150	DA-BFAR	

	production in hatcheries	Hatchery - 30 units)													
- Establishment and Operation of Regional/Clustered Broodstock Centers/ Facility	Number of established and operated Regional/ Clustered Broodstock Centers/Facility	10 established/operated (Oriental Mindoro- 1 unit; Barotac Viejo, Iloilo- 1 unit; Carles, Iloilo- 1 unit; Talisay, Negros Occidental-1 unit; Diit, Tacloban City-1 unit, Guiuan, Eastern Samar- 1 unit, Lao-ang, N. Samar- 1		3	3	3	1	-	90,000	90,000	90,000	30,000	300,000	DA-BFAR	SEAFDEC/ AQD, LGUs, Academic Institutions/SUCs, Private Sector

		unit, Lopez Jaena Misamis Occidental - 1 unit, Sultan Kudarat - 1 unit, Sarangani Province - 1 unit)													
- Rehabilitation and upgrading of government hatcheries (improvement of facilities, provision of water test kits, upgrading of equipment)	Number of rehabilitated and upgraded government hatcheries/ Percentage increase in fry production	10 rehabilitated /upgraded	2	2	2	2	2	8,000	8,000	8,000	8,000	8,000	40,000	DA-BFAR	DOST, LGUs
Increase livelihood support for wild fry gatherers															

-Provision of fry collecting gears (fry dozer) and fry collection implements (basins, drum, dipper etc.)	Number of fry collecting gears and fry collection implements distributed	at least 50 distributed (per year)	176	50	50	50	50	2,338	1,287	1,287	1,287	1,287	7,486	DA-BFAR	LGUs
- Establishment of fry holding facility for wild caught fry in coastal areas	Number of established fry holding facility	14 established (Reg 1-3 units, Reg 2-1 unit, Reg 3-4 units, Reg.6 -2 units, Reg. MIMAROPA-2, Reg.8-2 units)	1	5	3	3	2	2,500	17,500	10,500	10,500	7,000	48,000	DA-BFAR	DENR, LGUs, Private Sector (Investor)
-Facilitate marketing assistance and linkage to buyers	Number of fry gatherers assisted	at least 1 group (per year)	1	1	1	1	1	50	50	50	50	50	250	DA-BFAR	LGUs
Development and implementation of wild fry	Number of management plan develope	1 management plan develope		1	1	1	1		1,000	500	500	500	2,500	NFRDI	DA-BFAR, DENR, LGUs, Private Sector

resource assessment and management plan	d and implemented	d and implemented													(wild fry gatherers)
GOAL 2: SUSTAINABLE PRODUCTION GROWTH (FARM PRODUCTION SEGMENT)													**75,850**		
Optimize and rationalize use of unutilized fishponds under Fishpond Lease Agreement (FLA) through transferring rights to capable and qualified investors	Percentage of fishponds under FLA utilized	30% utilized		1	1	1	1		250	250	250	250	1,000	DA, DA-BFAR	LGUs, Private Investors
Improvement and adoption of cost-efficient feeding management strategies, low-impact production	Number of R & D conducted	1 R & D conducted		1	1	1	1		3,000	3,000	2,000	2,000	10,000	NFRDI, DOST, BAR, SEAFDEC/ AQD, Academic institu	DA-BFAR, LGUs, Private Sector

systems, high technology support system using renewable energy and climate-smart technologies (e.g.offshore/ cage structure technology)														tions/ SUCs	
	Number of technologies developed	2 technologies developed		1	1				5,000	5,000			10,000	DOST-BAFE, PhilMech	DA-BFAR, Academic Institutions/ SUCs, Private Sectors
- Distribution of modern fishery equipment and machineries to fish farmer organizations	Number of fishery equipment /machineries distributed	at least 2 (per year)		2	2	2	2		500	500	500	500	2,000	DA-BFAR	LGUs
Establishment of Agri-Business Corridors (ABCs) wherein markiculture parks are the main hub	Number of ABC established	1 established		1						10,000			10,000	DA-BFAR	LGUs, DENR, Private Sector (Investors)

-Expand milkfish fingerlings production through establishment of nursery banks	Number of nursery bank established	20 established (Reg. 1- 1 unit, Reg. 2 -2 units, Reg 5- 2 units, Reg. 4A- 6 units, Reg. 6- 2 units, Reg. MIMAROPA-4 units, Reg. 3- 3 units)		3	7	8	2		630	1,470	1,680	420	4,200	DA-BFAR	Private Sector
Complete inventory of milkfish farms for easy identification of unutilized farms that can be assisted	Percent of registered milkfish aquafarms	30% of total milkfish farms are registered	1	1	1	1	1	250	250	250	250	250	1,250	LGUs	DA-BFAR
-Conduct IEC to encourage more milkfish farmers to register															

-Use of satellite and mapping technology to locate and inventory the nursery farms, grow-out farms, hatcheries, fish cages, fish pens, and other support facilities (Aqua-R application)															
Intensive Information Education Campaign (IEC) on available novel science-based milkfish aquaculture technologies through distribution of IEC Materials and conduct of technical	Number of conducted training and distribution of IEC Materials	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DA-BFAR, DA-ATI, SEAFDEC/ AQD	LGUs, Academic Institutions/ SUCs, Private Sectors

trainings (Face to Face/through online)														
Establishment of technology demonstration on milkfish production technology	Number of technology demonstrations established	1 established		4	4	4	4		150	150	150	150	600	DA-BFAR	NFRDI, SEAFDEC/AQD, DOST, BAR,SUCs, LGUs, Private Sectors
Engage in PPP (pubic-private partnerships) in the conduct of milkfish research and technology verification projects	Number of adoptors for milkfish production technology	5 established (per year)		5	5	5	5		450	450	450	450	1,800	DA-BFAR, LGUs, Private Sector	NFRDI, SEAFDEC/AQD, Academic Institutions/ SUCs
Strengthen R & D of low-cost alternative feeds using readily	Number of R & D conducted	1 R & D conducted		1	1	1	1		1,000	1,000	500	500	3,000	NFRDI	SEAFDEC/AQD, DOST, BAR, Academic institution

available local materials															s/SUCsDA-BFAR, LGUs, Private Sector-Feedmillers
Establishment and Maintenance of Regional/ Clustered Quarantine Facility for milkfish fry (Fry banks) near entry points	Number of quarantine facility established and maintained	1 established		1					1,500				1,500	DA-BFAR	LGUs, SUCs, SEAFDEC/ AQD, NFRDI
Review/formulate regulation on fry importation specific to quality assurance and disease prevention measures	Number of Policy reviewed /formulated	1 policy formulated/reviewed		1	1				1,500	1,500			3,000	DA-BFAR	LGUs
Accreditation of aquafarms including hatcheries	Percent of accredited milkfish hatcheries and	30% of total hatcheries registere	1	1	1	1	1	250	250	250	250	250	1,250	DA-BFAR	LGUs

	aquafarms	d and accredited												
Comprehensive Milkfish Breeding Program (with on-going initiatives) applying Milkfish Genomics	Number of R & D conducted	1 R & D conducted		1	1	1	1		12,500	6,250	3,125	3,125	25,000	DOST-PCAARRD, NFRDI, Academic Institutions/ SUCs, RDIs, BAR	DA-BFAR, LGUs, Private Sector
GOAL 3: WORLD CLASS VALUE-ADDED PRODUCTS (PROCESSING SEGMENT)													**188,150**		
Expand farm registration under National Residue Control Program	Percent of farm registered under National Residue Control Program	30% of total farms registered	1	1	1	1	1	250	250	250	250	250	1,250	DA-BFAR	LGUs
Promote Good Aquaculture Practices (GAqP) among grow-out farms															

- Conduct of trainings and intensive IEC on GAqP	Number of trainings conducted	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DA-BFAR, DA-ATI	LGUs, Academic Institutions/ SUCs
- Intensify issuance of GAqP certificate among milkfish farms operators	Percentage of GAqP accredited milkfish aquafarms	30% of total milkfish farms are accredited		1	1	1	1		250	250	250	250	1,000	DA-BFAR	LGUs
Conduct IEC on food safety and standards	Number of trainings conducted	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DTI,BFAD	DA-BFAR, LGUs, Private Sector
Establishment of cold storage facility in key markets to avoid post-harvest losses in case of over supply	Number of cold storage facility established	2 established			1	1				30,000	30,000		60,000	PFDA	DA-BFAR, LGUs, Private Sector
Conduct IEC on business opportunities with regards to grow-out	Number of trainings conducted	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DA-BFAR, DTI, DA-ATI	LGUs, Private Sectors

farming of small-size milkfish															
Investment in post-harvest and processing technologies, equipment and facilities															
- Provision of fish processing kits and processing equipment	Number of beneficaries served	5 groups (per year)		5	5	5	5		250	250	250	250	1,000	DA-BFAR	LGUs
- Establishment of large processing plants in key producing regions	Number of Processing Facility established	3 established		1	1	1				30,000	30,000	30,000	90,000	DA-BFAR, PFDA	LGUs
Conduct of research and development on processing and packaging technologies	Number of R and D conducted	1 R & D conducted	1	1					5,000	5,000			10,000	NFRDI, SEAFDEC/AQD DOST, BAR, Academic	DA-BFAR, LGUs

													institutions/ SUCs	
Conduct post-harvest trainings (e.g, GMP, SSOP, HACCP, proper labeling/packaging and value-added technologies)	Number of trainings conducted	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DA-ATI, DA-BFAR, DTI,	LGUs
Sustained venue for information exchange (e.g., Industry Fora)	Number of industry fora conducted	1 conducted (per year)		1	1	1	1		500	500	500	500	2,000	DA-BFAR	LGUs
Facilitate market matching between processors/exporters and growers	Number of market-matching facilitated	at least 1 group (per year)	1	1	1	1	1	50	50	50	50	50	250	DA-BFAR, DTI	LGU, Private Sectors
Establishment and Maintenance of online or digital channels for	Number of established and maintained e-	1 established and maintained		1	1	1	1		500	500	500	500	2,000	DTI	DA-BFAR, LGU, Private Sectors

transaction and delivery services of milkfish and milkfish products (e-market)	market system													
Conduct of regular price monitoring in key markets and facilitate the implementation of Suggested Retail Price (SRP) for Milkfish through the Local Price Coordinating Councils (LPCCS) in coordination with the concerned NGAs	Number of price monitoring conducted	240 conducted	48	48	48	48	48	50	50	50	50	50	250	DA-BFAR	LGUs
Establishment of Central Seafood Market Complex in key	Number of Central Seafood Market Complex established	1 established				1						10,000	10,000	LGUs	BFAR

producing regions															
Facilitate attendance of exporters to International Seafood Exhibits/ Market Forum/Seafood Trade Fair	Number of Exhibit/Forum attended	1 facilitated					1					1,000	1,000	DA-BFAR, DTI	Private Sector
Facilitate the Certification of processing Establishment (GMP, SSOP, HACCP), inlcuding HALAL certification	Number of certifications facilitated	10 facilitated		2	3	3	2		80	120	120	80	400	DA-BFAR	BFAD
International market benchmarking (continuous market intelligence)	Number of international market benchmarking conducted	1 conducted				1					2,000		2,000	DTI	DA-BFAR

Development and implementation of Marketing Plan for milkfish	Number of plans developed and implemented					1					2,000		2,000	DTI	DA-BFAR
GOAL 4: STRENGTHENED AND UPDATED POLICIES FOR ENABLING ENVIRONMENT (ALL SEGMENTS)													**118,075**		
Development and Maintenance of National Online Milkfish Database System (Coordinate with PSA on the enhancement of their methodology in data gathering and reporting, Monitor broodstock and fry supply, Profiling of	Number of developed online information database and monitoring system	1 developed			1	1	1			2,500	2,000	1,000	5,500	DA-BFAR, NFRDI	LGUs

milkfish producing areas)															
Review and strengthen FAO No. 1971-1 (Rationalization - assessment and withdrawal of tenurial rights of unproductive FLA fishponds, Review monitoring schemes)	Number of policies reviewed snd implemented	1 policy reviewed	1	1				1,500	1,500				3,000	DA	DA-BFAR, LGUs

Formulate regulatory framework for milkfish fry importation crafted (Standardize size and age of fry being imported Quarantine/ Disease prevention measures/Traceability)	Number of regulations formulated and implemented	1 regulation formulated	1	1				1,500	1,500				3,000	DA-BFAR	LGUs
Review/Implement policy on managing aquaculture feedmills (Review regulations on inclusion of toxic chemicals in fish feed; Allow importation of rendered meal for aquafeeds)	Number of policies reviewed snd implemented	1 policy reviewed	1	1				1,500	1,500				3,000	DA	DA-BFAR, LGUs

Review/Implement Policy on Milkfish Aquafarm Registration and Accreditation	Number of policies reviewed snd implemented	1 policy reviewed	1	1				1,500	1,500				3,000	DA-BFAR	LGUs, DENR
Review regulations for permits and licenses (e.g., high cost of fees, harmonization of fees collected by agencies etc.)	Number of regulations reviewed and implemented	1 reviewed and implemented	1	1				1,500	1,500				3,000	DA-BFAR	DENR, DTI, LGUs
-Develop online processing system for permits, licenses and streamlining of requirements	Number of online systems developed and maintained	1 developed and maintained		1	1	1	1		2,500	2,500	2,500	2,500	10,000	DA-BFAR	DENR, DTI,LGUs
Provision of farm inputs (e.g fry, feeds etc.) for growers that will shift into fingerlings production	Number of adoptors for milkfish fingerlings productio	10 adoptors (per year)	10	10	10	10		400	400	400	400	1,600	3,200	DA-BFAR	LGUs

	n technology														
Provision of seedstocks and other farm inputs to fish farmers registered in Fish-R	Number of beneficiaries served	100 individuals (per year)	100	100	100	100	1,000	1,000	1,000	1,000	1,000	5,000	9,000	DA-BFAR	LGUs
Improve access to financial institutions for low-interest loan, crop insurance, and long-term funds	Number of stakeholders facilitated	10 facilitated	3	3	3	1		3,000	3,000	3,000	1,000	-	10,000	LBP and other financial institutions	DA-BFAR, LGUs
Review/Formulate Policy on tax exemption /tax holiday for imported raw materials for feed and other aquaculture farm inputs	Number of policy reviewed /formulated	1 policy formulated/reviewed	1	1				1,500	1,500				3,000	BOI, DTI	DA-BFAR

(eg. Fertilizers) as well as to equipment and machineries) Provide tax incentives to aquaculture ancillary industries to reduce farm input production cost)															
Facilitate registration of investors to BOI for possible incentives and grants (incentives for local investors at least at par with foreign investors)	Number of stakeholders facilitated	10 facilitated	3	3	3	1		3,000	3,000	3,000	1,000	-	10,000	BOI	LBP and other financial institutions, DA-BFAR, LGUs

Review National Guidelines/Policies on establishment of milkfish cages and pens in consideration to GAqP (Long term exclusive permit for fish cages within Mariculture areas with a buffer distance (minimum of 0.5km, treating each farm as a critical area)	Number of Guidelines/Policy Reviewed	1 policy formulated/reviewed	1	1				1,500	1,500				3,000	DA-BFAR, DENR	LGUs, Private Sector-Fish cage and pen operators
Encourage and promote the crafting of LGU ordinances on zonation and carrying capacity for establishment of cages and pen in	Number of ordinances passed	at least 1 ordinance passed	1	1	1	1	1	75	75	75	75	75	375	DA-BFAR/ LGUs/ DENR	Private Sector-Fish cage and pen operators

mariculture sites														
Regular water quality monitoring in highly productive areas (mariculture areas) to obtain baseline data over the years	Number of water quality monitoring conducted	4 conducted (per year)	4	4	4	4	4	200	200	200	200	200	1,000	DA-BFAR	LGUs
Capacitate LGUs on water quality monitoring and through provision of water quality test kits	Number of LGUs capacitated	at least 10 capacitated (per year)	10	10	10	10	10	1,000	1,000	1,000	1,000	1,000	5,000	DA-BFAR	LGUs
Rehabilitation of aquaculture water systems	Number of aquaculture water system rehabilitated	3 rehabilitated (Reg. 1)		3						30,000			30,000	LGUs	DA-BFAR

Create an efficient information system between NGAs, LGUs and fish farmers	Number of efficient information system developed and implemented	1 developed		1	1			2,500	2,500	-	-		5,000	NIA, DOST, PAG-ASA	DA-BFAR, LGUS
Implementation of Comprehensive Extension Program for Fishery Technicians (OJT matching; pooling of experts, update training program and materials Empower extension services)	Number of Comprehensive Extension Program developed and implemented	1 developed and implemented		1	1	1	1	-	2,000	2,000	2,000	2,000	8,000	DA-BFAR, DA-ATI, SEAFDEC/ AQD,	Academic Institutions/SUCs, NFRDI, DOST, Private Sector/TESDA
GOAL 5: INCOME OF MILKFISH FARMERS INCREASED (ALL SEGMENTS)													**16,250**		
Refer to PSPs of Goal 1 and 2													-		

Promotion/Facilitate the consolidation of small-scale growers into federation/ cooperatives	Percentage of small-scale growers included into federation/cooperatives	30% of total small-scale growers	1	1	1	1	1	250	250	250	250	250	1,250	CDA, DOLE DA-BFAR	LGUs
Strengthening of existing milkfish producers' associations through conduct of capability trainings (e.g., cooperative management)	Number of trainings conducted	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DA-BFAR, DTI, DA-ATI	LGUs, Private Sectors
Conduct of entrepreneurial trainings	Number of entrepreneurial trainings conducted	2 conducted (per year)	2	2	2	2	2	250	250	250	250	250	1,250	DA-BFAR, DTI, DA-ATI	LGUs, Private Sectors
Provision of reefer vans/trucks to fish farmer	Number of reefer vans/truc	5 provided	2	2	1			5,000	5,000	2,500	-	-	12,500	DA-BFAR	

cooperatives for efficient transport to markets	ks provided														
													TOTAL	**1,218,711**	

APPENDIX 3: INSTITUTIONAL ARRANGEMENT

Institution	Role/Duties
Department of Agriculture-Bureau of Fisheries and Aquatic Resources	To help promote the production, processing, marketing and distribution of milkfish.
Aquaculture Department, Southeast Asian Fisheries Development Center/ National Fisheries and Research Development Institute/ Department of Science and Technology	To generate science-based aquaculture technologies
Department of Trade and Industry	To help promote export of milkfish.
Department of Environment and Natural Resources	To help in the processing of lease agreements and environmental compliance certificates.
Philippine Crop Insurance Corporation	To provide crop insurance to milkfish aquaculture
Land Bank of the Philippines and Other Financing Institution	To extend credit facility programs
Department of Labor and Employment/ Cooperative Development Authority	To assist in organizing fish farmers association and cooperatives
Department of Agriculture Agricultural Training Institute/ Technological Education and Skills Development Authority	To assist in the conduct of capability building and tranings for milkfish farmers, LGUs, and technical personnel
Philippine Center for Postharvest Development and Mechanization	To develop and generate fishery post-harvest and mechanization technologies, practices and systems for adoptation of milkfish farmers and processors
Bureau of Animal Industry	To assist in the registration/approval of feeds employed for milkfish; help in the review of policies on aquaculture feedmills
Food and Drugs Administration	To help assess and accredit processors and fishery establishments
National Economic Development Authority	To help in socioeconomic planning for development of milkfish commodity
State Universities and Colleges	To conduct research and development activities for milkfish.

Bureau of Agricultural Research	To fund research program of various institutions and state colleges and universities.
Philippine Statistical Authority	To account milkfish production, area harvested and prices.
Local Government Units	To fund enhancement project related to the production of milkfish.

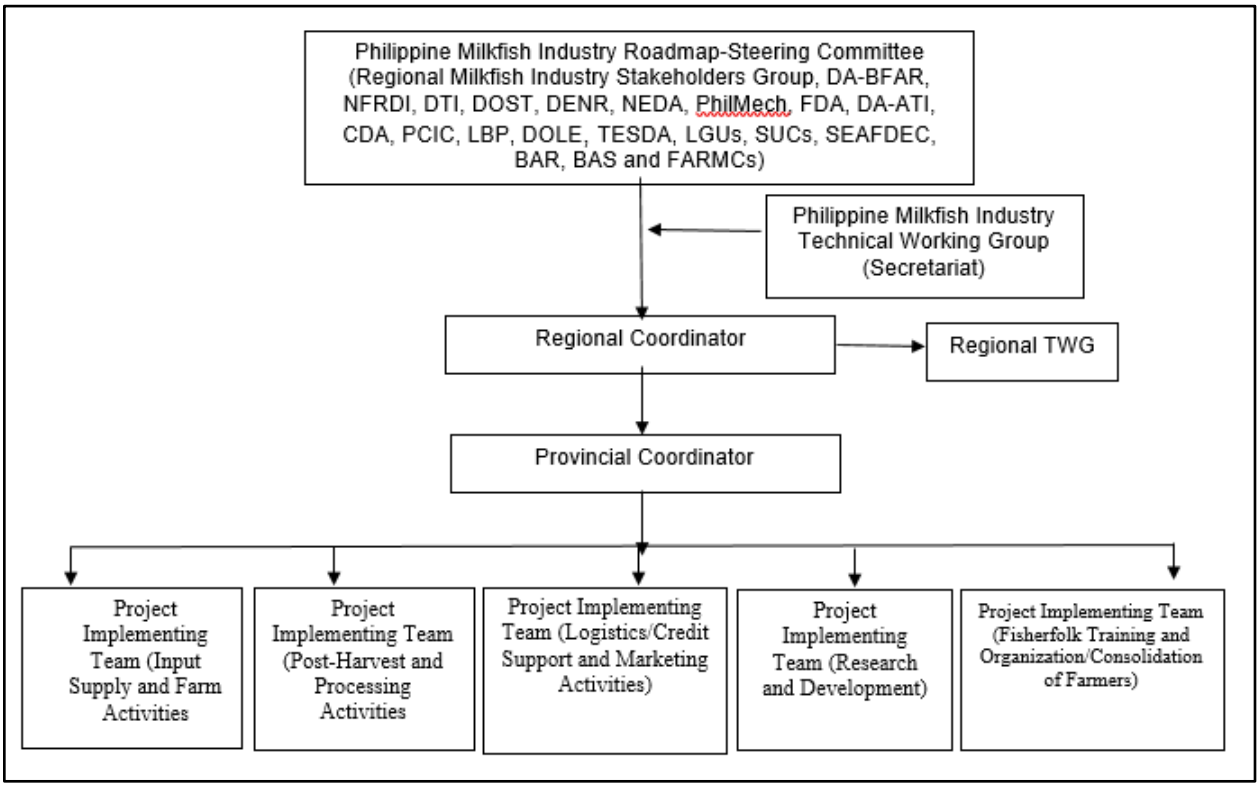
APPENDIX 4: MONITORING AND EVALUATION

The implementation of this Philippine Milkfish Industry Roadmap, shall be guided by a Steering Committee and shall be composed of one member from the following: Regional Milkfish Industry Stakeholders Group, DA- BFAR, NFRDI DTI, DOST, DENR, NEDA, PhilMech, FDA, CDA, PCIC, LBP, DOLE, TESDA, DA-ATI, LGUs, SUCs, SEAFDEC/AQD, BAR, PSA, and FARMCs. The organizational structure is shown in Figure 13.

The Philippine Milkfish Industry Roadmap-Steering Committee (PMIR-SC) shall have the following roles and responsibilities:

- Promote investment in milkfish development programs as indicated in the roadmap,
- Advocate, promote and coordinate with the national agencies on nationwide supportive policies and programs for the milkfish industry,
- Validate and consolidate plans and proposals of the provinces/regions on milkfish development,
- Act as top advisory body of the Philippine Milkfish Industry Roadmap Master Plan implementation,
- Monitor and update the Philippine Milkfish Industry Roadmap Master Plan,
- Liason with the national policy makers on the milkfish industry,
- Represent the milkfish industry in international conferences,
- Promote value-adding activities in milkfish production,
- Conduct national and regional milkfish congresses and conferences
- Solicit funding support for the implementation of the Philippine Milkfish Industry Roadmap Master Plan, and
- Assist in the formation of the provincial/regional implementing teams

Proposed Philippine Milkfish Industry Roadmap Master Plan Implementation Structure



The Philippine Milkfish Industry Roadmap – Steering Committee (PMR-SC) shall be chaired by a private sector with BFAR as its Co-Chair. Milkfish Producers Group shall be organized by region. This proposal is subject for review by the future organization.

The Technical Working Group (TWG) which is spearheaded by DA-BFAR National Bangus Program team shall act as the secretariat to consolidate specific policies and directives from the PMIR-SC, for action by the Regional Coordinators. The Regional Coordinators shall be assisted by the Regional TWG.

The Project Implementation Team shall be created at the provincial level to be responsible for, a) inputs supply and farm production activities, b) post-harvest and processing activities, c) logistics supports and marketing activities.

The designated Point Person at the National Level for Fisheries shall monitor the Philippine Milkfish Industry Roadmap Master Plan accomplishments at planned interval agreed with the PMR-SC.

The monitoring and evaluation shall be done by the BFAR at the Regional Level together with the members of the Technical Working Group (TWG), and the Office of the Provincial Agriculturist at the Provincial Level.

The finalization of the Philippine Milkfish Industry Roadmap Master Plan will determine the major terms of reference of the Plan.

APPENDIX 5: PROPOSED MILKFISH GENOMICS ROADMAP (OBJECTIVES, TIMELINES, AND ACTIVITIES)

Note: This proposal is an output during the series of online meetings on Milkfish Genomics Roadmap spearheaded by University of the Philippines (UP) and De La Salle University (DLSU) and was participated by National Fisheries Research and Development Institute (NFRDI), Department of Agriculture- Bureau of Fisheries and Aquatic Resources (DA-BFAR), and Feedmix Specialist Inc. representatives.

Milkfish genomics for enhanced growth, nutrition, disease resistance, and climate resilience

Timeline	Objectives	Activities	Research teams involved	Government Funding	Support Needed*
0-3 years	**Marker development** To develop genomic resources and genetic markers for: 1. Fast Growth 2. Sex identification	Determine putative genes associated with growth performance - this will be useful for management/breeding programs later that would select for faster growth. Early sex determination - this would optimize sex ratio among breeders and reduce the cost of developing and rearing the breeders.	UPD (MSI, IB)	Current DOST-PCAARRD project	Specimen collection (breeders, fry) Monitoring and data collection
4-8 years	**Genetic monitoring and profiling of milkfish stocks** To identify best practices by relating hatchery conditions with performance and genetic data	Genetic assessment in fish samples and collection of operational data - Ensure that high genetic diversity (low inbreeding) among stocks. High genetic diversity is associated with increased ability to cope with environmental change. Inbreeding may result to low fitness (susceptibility to diseases or other environmental stressors). - Application of sex markers produced in the	Academic institutions (e.g., SUCs and private HEIs with capability to do fish genetics/genomics work), RDIs (SEAFDEC/AQD, NFRDI)	Through DA (e.g., DA BAR, DA Biotech, DA NFRDI), DOST (and other agencies)	Access to facilities Monitoring and data collection

		previous study. This would ensure that the optimal sex ratio is maintained in the breeding facilities. - Apply parentage/sibship analysis to determine the transmission pattern of genetic markers among related individuals. The impact of domestication will also be assessed			
	Marker development To develop genetic markers for the following traits: - Nutrition - Immunity - Development To examine how performance is affected by the interaction between genotype and environment - Local Adaptation - Metagenomics	Nutrition - Determine the gene expression profile in relation to protein absorption. This will later help in increasing the feeding efficiency Immunity - Determine immunostimulant/immunomodulatory effects of extracted compounds. This would keep the fishes healthy despite the presence of pathogens. Development - Examine the genetic basis for fry abnormality. This would later help minimize losses due to such abnormalities Local Adaptation - Examine genotypic variation among milkfish broodstock from different biogeographic regions for signatures of selection. The overall performance (relative fitness) of the milkfish stocks may reflect	Academic institutions (e.g. SUCs and private HEIs with capability to do fish genetics/genomics work), RDIs (SEAFDEC/AQD, NFRDI)	Through DA (e.g. DA BAR, DA Biotech, DA NFRDI), DOST (and other agencies)	Access to facilities Monitoring and data collection

		adaptations to varying environmental conditions Metagenomics - Environmental detection of pathogens; Examine antibiotic resistance in microbe community; effect of physicochemical parameters and microbiome on performance			
	Establish a facility that would serve as a repository for milkfish resources - Gene banking - Genomics database	The gene bank would serve as a repository for various genetic variants detected and developed for milkfish. This, along with the genomics database, which will store for all genomic resources to be generated in the program, would greatly facilitate current and future research activities.	Academic institutions (e.g. SUCs and private HEIs with capability to do fish genetics/genomics work), RDIs (SEAFDEC/AQD, NFRDI); multiple agencies shall help populate the database and help in the gene banking; Genebank to be hosted by DA (through NFRDI)	Multi-agency	Infrastructure development
9-15 years	**Linkage mapping** To establish mapping populations To generate linkage maps to examine association of	Breeders and offspring characterized and monitored in the previous years will be used Validation/Application of markers for performance traits that were developed in the previous years	Academic institutions (e.g. SUCs and private HEIs with capability to do fish genetics/genomics work), RDIs	Multi-agency	Infrastructure development

	phenotypes/traits with genotype		(SEAFDEC/AQD, NFRDI)		
15++ years	**Selective Breeding** To breed milkfish with enhanced growth, nutrition, disease resistance, and climate resilience	Identify the best genotype-environment association that would produce milkfish with the desired traits - genotypes will be determined based on the genetic markers developed - environment will be determined based on monitoring data generated over the years	Academic Institutions (e.g. SUCs and private HEIs with capability to do fish genetics/genomics work), RDIs (SEAFDEC/AQD, NFRDI)	Multi-agency Legislated budget	Research center

** From industry (private and government hatchery operators*

APPENDIX 6: TARGET LOCATION FOR MILKFISH COMMODITY INFRASTRUCTURE DEVELOPMENT PROJECTS

Infrastructure Projects	Purpose	Number of Infrastructure to be established	Target Location
Milkfish Broodstock Center/ Facility	-To develop and maintain good quality milkfish broodstock (either in cages or tanks) that will support the egg and larvae requirements of milkfish satellite hatcheries and multi species hatcheries under RA 10861 - To conduct R and D on broodstock development and maintenance.	2	Region 1 - RMaTDeC - HINP Satellite Station, Cariaz Island, Hundred Islands National Park - Casantaan Satellite Station, Sto. Tomas, La Union
		1	Region 2
		2	Region 4A -Calatagan, Batangas -Padre Burgos, Mariculture Zone
		1	Region MIMAROPA -San Jose 1, Naujan, Oriental Mindoro
		3	Region 6 - Barotac Viejo, Iloilo - Carles, Iloilo - Talisay, Negros Occidental
		3	Region 8 - Diit, Tacloban City - Guiuan, Eastern Samar - Lao-ang, N. Samar
		1	**Region 10** **-** Lopez Jaena Mariculture Park, Lopez Jaena Misamis Occidental
	TOTAL	**13**	
Broodstock Cages (To be maintained at existing BFAR Technology	-To increase capacity of existing multi-species hatcheries on the development and maintenance of bangus broodstock	10	**Region 3**
		10	**Region 4A**
		7	**Region MIMAROPA**
		5	**Region 5**
		3	**Region 6**
		10	**Region 7**

outreach Stations)		10	**Region 8**
		4	**Region 9**
		3	**Region 10**
		3	**Region 11**
		10	**Region 13**
	TOTAL	**75**	
Satellite Community-Based Larval Rearing Facility	-Satellite Community-Based Larval Rearing Facility (SCBLRF) is a small-scale facility where milkfish eggs from either wild or hatchery source will be hatched and be reared up to marketable fry stage of 18 to 21 days. -The program will encourage the community to venture on bangus fry production and become local milkfish fry suppliers. SCBLRF will be awarded and managed by identified and capable Fisherfolk Cooperatives/Associations, NGOs, OFWs and other private groups -SCBLRF aims to sustainably increase local fry production through Public Private Partnership	6	**Region 1** -Ilocos Sur -Ilocos Norte -Pangasinan -La Union
		10	**Region 3** **-Aurora**
		3	**Region 4A** **-** Calatagan, Batangas
		5	**Region MIMAROPA** - Roxas, Oriental Mindoro - San Jose, Occidental Mindoro - Mamburao, Occidental Mindoro - Northern Palawan - Southern Palawan
		2	**Region 5**
		9	**Region 6** - Batan, Aklan - Concepcion, Iloilo
		20	**Region 8** - Eastern Samar (Guiuan, Quinapondan, Hernani, Arteche, Oras) - Leyte (Diit, Abuyog, Bato, Matalom, Merida) - Southern Leyte (Malitbog, Tomas Opos, Macrohon, San Juan) - Biliran - Northern Samar (San Roque, Mapanas, Gamay, San Jose) - Samar (Basey)
		1	**Region 12**
	TOTAL	**56**	
Fry Holding Facility	common use facility with larval rearing tanks that temporarily houses collected wild fry	3	**Region 1** **-Ilocos Norte** **-Ilocos Sur**
		4	**Region 3** **-Zambales**

	that are not Immediately sold or transported to nursery farms. This establishment would help extend the survival of collected wild fry prior to its transport to nursery farms or buyers.		**-Aurora** **-Bataan**
		3	**Region 4A** -Infanta, Quezon -Lobo, Batangas -Calatagan, Batangas
		2	**Region MIMAROPA** **-**Bongabong, Oriental Mindoro
		2	**Region 5**
		2	**Region 6** **-** Antique
		3	**Region 8** **-**Samar (Jiabong) -Northern Samar (Lavezares) -Leyte
TOTAL		**19**	
Fry Banks/Nursery Ponds	-the operation of the Bangus fry bank will generate fingerlings supply for fish cage culture and fishpond grow-out operations	1	**Region 1** **-**RMATDEC-Lucap and HINP Cariaz Satellite Station
		4	**Region 3** **-Zambales** **-Aurora**
		6	**Region 4A** -Brgy. Binunuan, Infanta, Quezon- 6 has -Brgy. Bungian, Infanta, Quezon-2 has. -Brgy. Ulo-ulo, Lobo, Batangas -Brgy. Tanagan (1ha), Brgy. Sta. Ana (1ha), Brgy. Balibago (1ha), Calatagan, Batangas -Brgy. Calubcob 1 (1ha), Brgy. Calubcob 2 (1ha), San Juan, Batangas
		2	**Region 6** **-**Hamtic, Antique Himamaylan, Negros Occidental
		50	**Region 8** -Samar: Sta Margarita, Calbayog, Catbalogan, Calbiga, Jiabong, Pinabacdao,

			Pagsangjan, Sta Rita, San Sebastian, Motiong, Gandara -N. Samar: Allen, Boboin, Capul, Lavezares, Lao-ang, Palapag, Rosario, San Jose, San Isidro, San Roque, San Antonio, Victoria -Eastern Samar: Salcedo, Sulat, San Julian; Biliran: Biliran, Naval KAwayan -Leyte: Abuyog, Babatngon, Barugo, Baybay, Carigara, Hilongos, Hindang, Inopacan, Isabel, Leyte, Matalom, Palo, Palompon, San Miguel, Tabango, Tanauan and Tacloban -S. Leyte: Maasin, Macrohon, P. Burgos
	TOTAL	**63**	
Establishment and Operation of Natural Food Production Laboratory	- the laboratory serves as the "Seed Bank" of microalgae starters for research and commercial purposes. This will support hatchery operations for increased fry production	1	**Region 1**
		1	**Region 3**
		1	**Region 4A**
		1	**Region MIMAROPA**
		1	**Region 7**
		7	**Region 8** -Eastern Samar (Guiuan, Arteche, Quinapondan) - Northern Samar (Laoang, San Roque) -Leyte (Diit) -Southern Leyte (Macrohon)
	TOTAL	**11**	
Rehabilitation and Upgrading of Existing Broodstock and Hatchery Facilities (Private and Government)	-to improve existing hatchery facilities including other support facilities for improved egg and fry production - To construct additional tanks for mass production of natural food	2	**Region 1** -Satellite Hatchery, Lingayen, Pangasinan -Satellite Hatchery, La Union
		1	**Region 2** -BFAR pond facility
		1	**Region 3** **-** TOSMW, Masinloc, Zambales
		2	**Region MIMAROPA** **-**Multi-Species Marine Fish Hatchery, Labasan, Bongabong and Brackishwater Fisheries

			Research Station, San Jose 1, Naujan, Oriental Mindoro -BFAR-ISRS Inland Sea Ranching Station, Sta. Lucia, Puerto Princesa City, Palawan
		8	**Region 7** -Satellite Hatcheries in Calape, Tubigon, Talibon Candijay, Bohol (5) - Central Hatcheries in Sinandigan, Ubay and Calape Bohol (3)
		2	**Region 10** - Sagay Multi Species Hatchery, Manuyog, Sagay, Camiguin - Taguines Lagoon, Benoni, Mahinog, Camiguin
		1	**Region 11** **-** TOSMB, Sta, Cruz, Davao del Sur
		2	**Region 12** -Paril, Kalamansig, Sultan Kudarat (Finfish Hatchery) -Sapu Masla, Malapatan, Sarangani Province
		1	**Region 13** **-** Masao Technology Outreach Station; Placer Outreach Station
TOTAL		**20**	
Cold Storage Facilities	-used for freezing and storing harvested fish to ensure its freshness, quality, and safety - to avoid post-harvest losses in case of over supply	1	**Region 1**
		1	**Region 3**
		1	**Region 4A**
		1	**Region MIMAROPA**
		1	**Region 6**
		1	**Region 7**
		1	**Region 8**
		1	**Region 12**
		1	**Region 13**
TOTAL		**9**	
Post-Harvest and Processing Facilities	-for processing fresh milkfish into value-added products	1	**Region 1**
		1	**Region 3**
		1	**Region 4A**
		1	**Region MIMAROPA**
		1	**Region 6**
		1	**Region 7**

		1	**Region 8**
		1	**Region 10**
		1	**Region 13**
TOTAL		**9**	
Central Seafood Market Complex	-to serve as common trading post in key producing regions	**3**	**Key Producing Regions (Region 1, 6, 3)**
TOTAL		**3**	

APPENDIX 7: MILKFISH INDUSTRY ROADMAP DEVELOPMENT TEAM

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