Accelerating Indonesia's Blue Food Economy

Qualitative Assessment

October 2024

Ministry of National Development Planning/Bappenas
Republic of Indonesia

MSC
MicroSave Consulting

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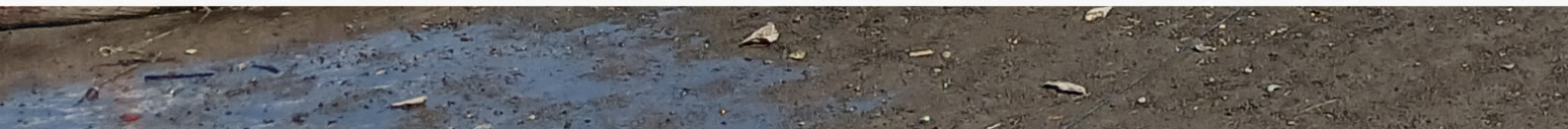

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List of Abbreviations

AMDAL	Analisis Mengenai Dampak Lingkungan (environmental impact assessments)
BFA	Blue Food Assessment
BAPPEDA	Badan Perencanaan Pembangunan Daerah (Regional Development Planning Agency)
BPAN	Bantuan Premi Asuransi Nelayan (Fishers Insurance Premium Assistance)
BPNT	Bantuan Pangan Non-Tunai (Non-cash Food Assistance)
BPOM	Badan Pengawas Obat dan Makanan (Indonesia's National Agency of Drug and Food Control)
COAST	Caribbean Ocean and Aquaculture Sustainability Facility
COVID-19	Coronavirus Disease 2019
DHA	Docosahexaenoic Acid
DKP	Dinas Kelautan dan Perikanan (Department of Fisheries)
EPA	Eicosapentaenoic Acid
FDA	Food and Drug Administration
FDS	Family Development Session
FGD	Focus Group Discussion
FishCORAL	Fisheries, Coastal Resources, and Livelihood
FLW	Food Loss and Waste
FSP	Financial Service Provider
GDP	Gross Domestic Product
GEMARIKAN	Gerakan Memasyarakatkan Makan Ikan (Indonesia's Eat More Fish Campaign)
GT	Gross Tonnage
HACCP	Hazard Analysis and Critical Control Points
IBEI	Indonesia Blue Economy Index
IDI	In-depth Interview
IDR	Indonesian Rupiah
IPAL	Instalasi Pengelolaan Air Limbah (waste water management installations)
JEEViKA	Bihar Rural Livelihoods Project, locally known as JEEViKA
JSPVAT	JEEViKA Special Purpose Vehicle for Agricultural Transformation
km	kilometer
KKP	Kementerian Kelautan dan Perikanan (Indonesia's Ministry of Maritime Affairs and Fisheries)

KUR	Kredit Usaha Rakyat (People's Business Credit)
KUSUKA	Kartu Pelaku Utama Sektor Kelautan dan Perikanan (Marine and Fisheries Sector Stakeholders Card)
LPMUKP	Lembaga Pengelola Modal Usaha Kelautan dan Perikanan (Indonesia's Agency for the Management of Maritime and Fisheries Business Funds)
MSC	MicroSave Consulting
MSME	Micro, Small, and Medium Enterprises
MT	Metric Ton
PIT	Penangkapan Ikan Terukur (measured fish capture)
PKH	Program Keluarga Harapan (Family Hope Program)
PNIPA	Peru National Program for Fisheries and Aquaculture Innovation
PNS	Pegawai Negeri Sipil (Civil Servant)
Posyandu	Pos Pelayanan Terpadu (community health post)
PPI	Pangkalan Pendaratan Ikan (fish landing bases)
PRODUCE	Ministerio de la Produccion (Peru's Ministry of Production)
PT PLN	Perusahaan Listrik Negara (Indonesia's State Electricity Company)
Puskesmas	Pusat Kesehatan Masyarakat (community health center)
R&D	Research and Development
SBCC	Social and Behavior Change Communication
SFA	Singapore Food Agency
SGD	Singaporean Dollar
SPBU	Stasiun Pengisian Bahan Bakar Umum (petrol station)
SPM	Small Fish Production, Processing, and Marketing
SSF	Small-scale Fisheries
SSFA	Small-scale Fisheries and Aquaculture
TPI	Tempat Pelelangan Ikan (fish auction sites)
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
USD	United States Dollar

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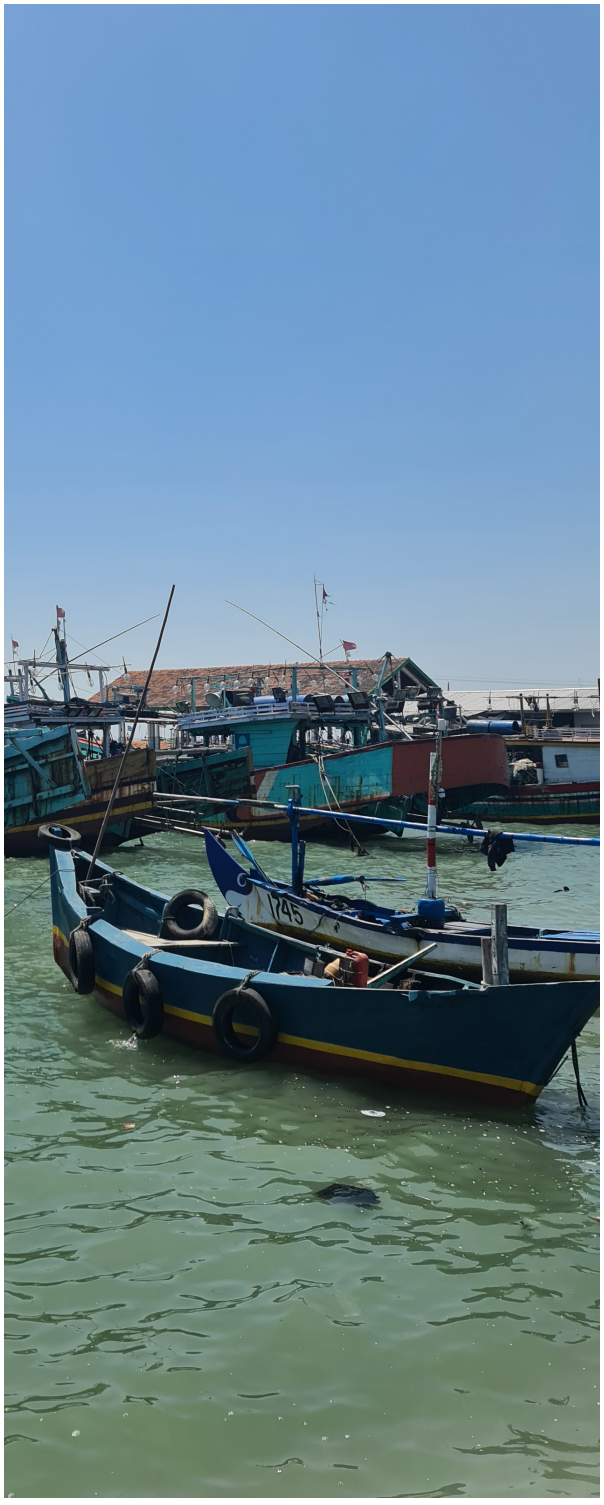
Executive Summary

Indonesia's blue economy is central to its strategy for economic transformation, leveraging its vast aquatic resources sustainably to foster growth and social development. With over 17,500 islands and a coastline of 108,000 kilometres, Indonesia has a rich potential in blue foods—derived from fisheries, aquaculture, and marine plants—that the nation aims to harness to drive economic prosperity and improve nutritional outcomes. The Indonesia Blue Economy Roadmap underscores the integration of blue foods into sustainable food systems to enhance value-added industries, reduce waste, and support a healthier, more equitable society. However, realizing this vision requires addressing complex challenges related to environmental sustainability, productivity, and equity in the sector.

The blue food sector plays a pivotal role in shaping Indonesia's economic and social landscape. It supports local food security and livelihoods, particularly through small-scale fisheries, which are integral to rural economies. However, these fisheries face significant barriers such as limited market access, outdated equipment, and structural inequalities that hinder growth. Women, essential yet often overlooked contributors to the post-harvest economy, face systemic challenges in accessing resources and opportunities. Concurrently, climate change, marine ecosystem degradation, and inefficient waste management exacerbate the sector's vulnerabilities, necessitating strategic interventions for sustainable growth and resilience.

The **Blue Food Assessment (BFA)** report offers an in-depth analysis of Indonesia's blue food sector, highlighting the contributions of small-scale fisheries to nutrition, economic development, and environmental health. The report identifies six key pillars that frame the sector's challenges and opportunities: nutrition, environment, justice, small-scale fisheries and aquaculture, value-added and productivity, and food loss and waste. Together, these pillars provide a comprehensive roadmap for unlocking the full potential of blue foods to foster economic development, promote social equity, and protect environmental health.



Key Insights

In many fishing communities, financial priorities often outweigh nutritional considerations, with households selling higher-value fish while consuming lower-quality species. Despite the prevalence of fish in local diets, limited awareness of its nutritional benefits hampers its potential to improve public health. Compounding this issue are environmental pressures such as industrial pollution, climate change, and poor wastewater management, which threaten aquatic ecosystems and increase aquaculture costs due to fluctuating conditions like water salinity.

Small-scale fisheries and aquaculture (SSFA) face structural challenges that limit their growth. Fisherfolk struggle with limited access to markets and are heavily reliant on intermediaries, while outdated equipment and inconsistent government support further constrain profitability. Traditional practices, local beliefs, and generational knowledge, while culturally significant, often impede adaptation to modern, more efficient methods. Gender disparities compound these challenges, as women, predominantly involved in post-harvest activities, remain excluded from many government programs and lack opportunities for advancing in the value chain. Value addition remains minimal, largely restricted to primary processing, which limits opportunities for small-scale processors to access international markets.

Food loss and waste present significant inefficiencies across the blue food value chain. Inefficient fishing methods, poor handling, and inadequate infrastructure lead to high post-harvest losses. In aquaculture, contamination and disease further reduce productivity. Emerging efforts to recycle byproducts and reduce waste offer promise, but challenges such as restaurant waste and market inefficiencies persist. Sustainable waste management and capacity-building initiatives can play critical roles in improving efficiency and reducing losses in the sector.

Recommendations

To improve nutrition outcomes, the government should incorporate blue foods into social assistance programs like **Bantuan Pangan Non-Tunai (BPNT)**, particularly in blue food production regions. Promoting fish-based options in school meal programs and advocating blue foods for pregnant and breastfeeding women through **Program Keluarga Harapan (PKH)** will further enhance nutritional benefits. Developing affordable, micronutrient-fortified fish products with local producers and implementing **Social and Behavior Change Communication (SBCC)** programs focused on nutrition literacy will bolster these efforts. Additionally, establishing a comprehensive national policy that positions blue foods as a cornerstone of nutrition strategies will help address malnutrition, especially among vulnerable populations.

To ensure environmental sustainability, the government must enforce independent **Environmental Impact Assessments (AMDAL)** for land conversion projects and incentivize sustainable fishing practices through tax breaks and green financing options. Limiting permits for companies lacking proper **Waste Water Management Installations (IPAL)** or AMDAL certifications will further mitigate environmental harm. Advanced technologies such as nano-satellites and hydroacoustic surveys should be employed for real-time fish stock monitoring, while investment in climate change adaptation research and disaster recovery programs, such as **Fisheries Insurance**, will enhance resilience.

For SSFA development, lessons from initiatives like the **Coastal Community Empowerment Program** can inform integrated livelihood diversification strategies. Expanding the coverage of KUSUKA cards through outreach and simplified registration will strengthen social protection for fisherfolk. Additionally, assessing the feasibility of minimum support prices or

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price stabilization funds for specific fish species will help stabilize incomes, especially if blue foods become part of national food subsidies.

To promote equity within the sector, outreach programs should educate fishing communities on zoning laws and co-management opportunities. Establishing a national network for women in fisheries can amplify their voices and improve access to resources. Women's collectives can also be leveraged to enhance livelihoods through targeted training and support. Co-management initiatives that blend local knowledge with government policies will promote sustainable resource use and protect fisherfolks' rights.

Efforts to increase value addition should prioritize expanding financial access for small processing units to improve product quality and meet export standards. Partnerships between the Ministry of Fisheries and Maritime Affairs and the Ministry of Cooperative and SMEs can foster the development of cooperative-run processing hubs. Public-private partnerships and research-driven innovation will further drive the creation of high-value blue food products and global branding strategies.

To tackle food loss and waste, investment in cold chains, community storage, and processing centers in high-catch regions is essential. Financial incentives for companies that convert fish by-products into valuable commodities can open new economic opportunities. Public awareness campaigns on waste reduction, coupled with a national policy setting measurable targets for reducing food loss, are crucial. Finally, promoting circular economy practices through research and development will help establish sustainable and efficient blue food value chains.

Indonesia's blue economy has the potential to drive sustainable growth, improve nutrition, and enhance social equity. To realize this, a strategic approach is needed that focuses on environmental sustainability, reducing food loss, supporting small-scale fisheries, and addressing gender disparities. We hope that evidence-gathering inputs such as those in this report will aid the government in framing policies that drive both growth and sustainability of the blue food economy in Indonesia, ensuring long-term prosperity and environmental protection.

Introduction to Blue Food

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Background & Context

Blue foods, which include aquatic foods from animals, plants, and algae cultivated or captured in freshwater and marine environments,[1] are among the most widely traded food products globally. They play a critical role in global food and nutrition security and support millions of people's livelihoods. Around 3 billion people depend on blue foods for nearly 20% of their animal protein intake, while 10-12% of the world's population rely on fish as their primary livelihood.[2]

Blue foods provide superior nutrition compared to beef and poultry, delivering essential nutrients and reducing micronutrient deficiencies. They offer high levels of DHA and EPA, which lower heart disease risk and support brain and eye health. Replacing red and processed meats with blue foods boosts health benefits. Environmentally, blue foods reduce the carbon footprint and help lower global greenhouse gas emissions. Blue foods provide vital employment opportunities, supporting millions of livelihoods globally across both large-scale industries and small-scale fisheries, particularly in rural and coastal communities.

[1] Golden, C. D., Koehn, J. Z., Shepon, A., Passarelli, S., Free, C. M., Viana, D. F., Matthey, H., Eurich, J. G., Gephart, J. A., Nyboer, E. A., Lynch, A. J., Kjellevold, M., Bromage, S., Charlebois, P., Barange, M., Vannuccini, S., Cao, L., Kleisner, K. M., Rimm, E. B., . . . Thilsted, S. H. (2021). Aquatic foods to nourish nations. Nature, 598(7880), 315-320. https://doi.org/10.1038/s41586-021-03917-1

[2] https://openknowledge.fao.org/server/api/core/bitstreams/170b89c1-7946-4f4d-914a-fc56e54769de/content

The importance of blue food economy in Indonesia

Indonesia, the world's largest archipelagic nation with extensive blue sector potentials

Comprises of **17,504** islands, **108,000 km** of coastline with **6.4 million km2** of seawater area

279 mn population

60% in coastal areas

The sector's tremendous potential remains untapped

Though the **second-largest** producer after China, the sector remains **underutilized**

	Potential	Production
Capture	**12.01** million tons	**7.8** million tons
Aquaculture	**>50** million tons	**15.3** million tons

The fishery sector's contribution to both national and global economies remains limited

2.65%

GDP contribution in 2023

3%

Shares in global seafood production

The fishery sector also plays a crucial socio-economic role, highlighting its importance for development

96% Are **small scale fishers** with low productivity

43% Workers in the fishery sector are **women**

21.5% Children are stunting despite high fish consumption

7-15 tons **Food loss and waste** generated by the fishery sector

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1. **Island nation with vast blue food potential:** As an archipelagic country, Indonesia's marine resources span two-thirds of its territory, making it a critical player in the global blue food supply chain. Despite producing 7.8 million tons[3] of fish annually and having the potential for over 50 million tons through aquaculture, Indonesia has yet to fully capitalize on its blue food potential. Strategic initiatives aimed at unlocking this vast USD 1,334 billion blue economy can significantly boost both national and global food security.

2. **Global economic growth:** Indonesia contributes 3% of the world's seafood market, valued at USD 4.8 billion, yet its fisheries sector accounts for less than 3% of national GDP[4]. With its rich marine biodiversity and strategic location, Indonesia has the potential to increase its global market share, enhancing its position as a key player in international trade. Expanding the blue food sector could unlock new economic growth and strengthen Indonesia's role in global seafood markets.

3. **Nutritional benefits:** Blue foods are a key source of high-quality protein, omega-3 fatty acids, and essential micronutrients like vitamins and minerals, which are vital for combating malnutrition and improving health outcomes. Indonesia's rising fish consumption, from 33.89 kg per capita in 2012 to 56.48 kg in 2022[5], reflects the growing recognition of the nutritional value of fish in boosting public health and supporting dietary diversity.

4. **Employment opportunity:** Over 10 million Indonesians are engaged in small-scale fisheries, with at least 5 million fishing primarily for household sustenance. Despite the prevalence of small-scale operations, they contribute only 20% of the national fish catch, highlighting underutilized potential[6]. With increased investment and productivity, these small-scale operations could drive economic resilience and improve livelihoods, especially in rural and coastal communities.

5. **Social indicators and inclusion:** Women make up 42% of the fisheries workforce[7] in Indonesia, yet their contributions are often overlooked. They play a crucial role in processing, marketing, and household food management. Empowering women and integrating their contributions more fully into the blue food value chain would not only promote gender inclusion but also improve food security and economic outcomes for households and communities.

The qualitative assessment of the blue food economy in Indonesia analyzes the blue food ecosystem to identify specific barriers and enablers that hinder or drive growth at various stages of the value chain, with a focus on small-scale fisheries and aquaculture. By recognizing these factors, we aim to offer actionable solutions that will unlock the full potential of Indonesia's blue food sector. These insights will foster sustainable development and strengthen Indonesia's position as a global leader in the blue economy.

[3] Ministry of Marine Affairs and Fisheries (2024), Implementasi Kebijakan Ekonomi Biru, Jakarta,Ministry of Marine Affairs and Fisheries

[4] Badan Pusat Statistik (2023), PDB per Lapangan Usaha 2023, Jakarta, BPS

[5] Pratiwi, F. S. (2023). Angka Konsumsi Ikan RI Naik Jadi 56,48 Kg/Kapita pada 2022. https://dataindonesia.id/sektor riil/detail/angka-konsumsi-ikan-ri-naik-jadi-5648-kgkapita-pada-2022

[6] Kurniawan and Aini (2022), Mapping of Changes in the Utilization of Marine Resources in the Small-Scale Fisheries Subsector in Indonesia, Jakarta, Universitas Gadjah Mada

[7] https://koral.info/id/perempuan-nelayan-di-pesisir-indonesia-masih-terpinggirkan/

Research Design & Methodological Framework

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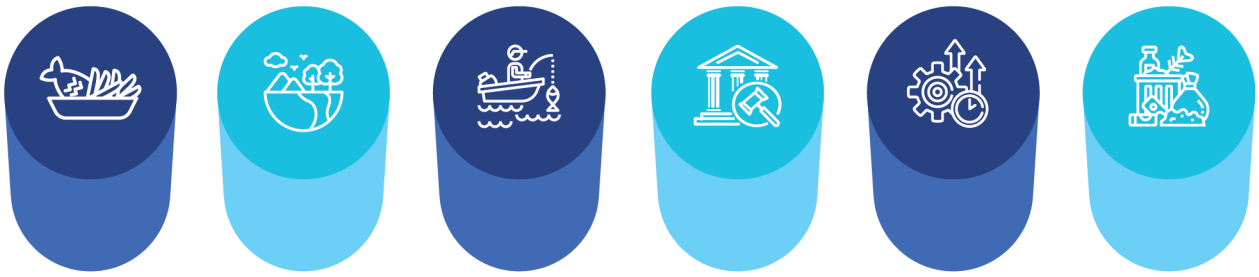
Approach & methodology

This report presents the results of a qualitative assessment of blue food in Indonesia, focusing on the perspectives of fisherfolks, aquaculture operators, policymakers, and other stakeholders in the blue food value chain. The study delves into the cultural, social, economic, and environmental factors that shape their experiences, offering a comprehensive understanding of their roles, challenges, and contributions. By exploring six key pillars—nutrition, environment, justice, small-scale fisheries and aquaculture, productivity, value creation and export, and food loss and waste—the study identifies critical themes that influence decision-making, practices, productivity, and sustainability efforts in the blue food sector.

Designed to complement the secondary research and quantitative studies conducted by BFA's collaborating organizations, this qualitative research provides rich, context-specific narratives. These insights enhance the interpretation of quantitative data and contribute to actionable recommendations for sustainable development in Indonesia's blue food sector. The study also draws on literature and regulatory reviews to provide further context for understanding the sector's dynamics.

Our approach focused on examining six key pillars that shape Indonesia's blue food sector: nutrition, environment, justice, small-scale fisheries and aquaculture, productivity, value creation and export, and food loss and waste.



*Additional pillar that will be studied specifically on the qualitative research

We engaged a diverse range of ecosystem stakeholders, including fisherfolks, aquaculture operators, policymakers, supply chain actors, and experts, to understand their roles and perspectives within the blue food value chain.

For **nutrition**, we analysed the role of blue foods in improving dietary outcomes by exploring consumption patterns, dietary habits, and the varieties of fish preferred by local communities. In the **environment** pillar, we explored the impact of blue food practices on marine ecosystems, emphasizing the sustainability measures necessary to protect these resources.

In the justice pillar, we investigated gender roles, equitable access to resources, and governance structures, with a focus on how women and marginalized groups participate and benefit from the blue food sector. In the **small-scale fisheries and aquaculture** pillar, we explored the operational practices of traditional capture fisheries and farmed fish production.

For **productivity, value creation, and export,** we assessed how innovation, market access, and value-added activities can enhance profitability and opportunities for blue food actors. Lastly, we explored **food loss and waste**, identifying

inefficiencies that reduce the availability and quality of blue foods across the value chain. Throughout the study, **access to finance** emerged as a critical cross-cutting theme that significantly influences the entire ecosystem. We identified it as both an enabler and a barrier, affecting opportunities and challenges in each pillar.

The methodological framework of this study is designed to explore the nuanced interplay between the blue food value chain and the six pillars central to the Blue Food Assessment (BFA). This qualitative research employed a multi-method approach, integrating **in-depth interviews (IDIs), focus group discussions (FGDs)**, and **participant observations** to enable a comprehensive understanding of the blue food ecosystem in Indonesia. The study employed **purposive sampling** to ensure the selection of respondents was deliberate and aligned with the research objectives, focusing on key actors embedded within the blue food value chain. These actors included government officials, small-scale fishers, fisherwomen, processing units, and other stakeholders influencing or impacted by the sector.

The conceptual framework we developed provided a structured guide for data collection and analysis, ensuring that the research maintained a rigorous focus on the six pillars. This framework enabled a multidimensional examination of how various factors within the blue food ecosystem interact, allowing for a holistic assessment of the sector's strengths, challenges, and opportunities.

Sampling strategy

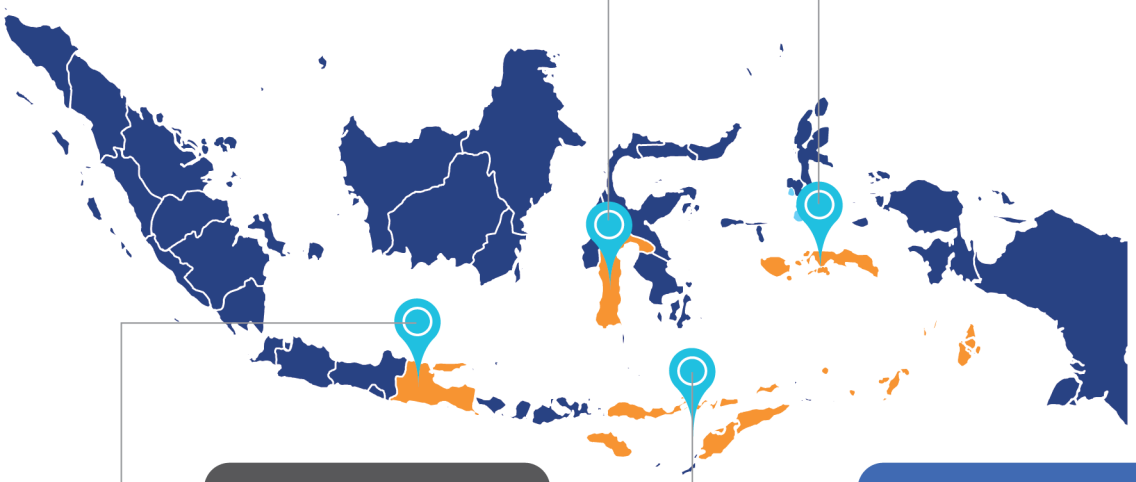
A **two-tiered screening process** was applied to select research locations. In the first stage, provinces were identified using a set of quantitative criteria, including the **Indonesia Blue Economy Index (IBEI)**, poverty rates, financial inclusion metrics, stunting rates, and gender inequality indices. These indicators were selected to ensure that the provinces captured for the study represented a broad spectrum of socioeconomic and environmental conditions relevant to the blue food value chain. In the second stage, regions within these provinces were further narrowed down using qualitative selection criteria. This included alignment with BFA's thematic pillars, potential for policy impact, and the presence of local social and logistical enablers. This approach enabled us to target diverse locations with unique characteristics that provide a robust representation of Indonesia's blue food landscape.

South Sulawesi - Pangkajene & islands, Makassar

Focus Group Discussions: **4**
In-depth Interviews: **6**

Maluku - Ambon City

Focus Group Discussions: **3**
In-depth Interviews: **7**



East Java - Surabaya, Lamongan

Focus Group Discussions: **4**
In-depth Interviews: **7**

East Nusa Tenggara - Kupang, West Manggarai

Focus Group Discussions: **4**
In-depth Interviews: **7**

27 IDIs **15 FGDs**

144 respondents

26	84	14	7	8	5
fisherwomen	fisherfolks (capture, aquaculture)	intermediaries	processing units	value chain actors (logistics, cold storage, FSPs)	government stakeholders

Data collection was carried out through **27 in-depth interviews (IDIs)** and **15 focus group discussions (FGDs)** across the four selected provinces, involving **144 respondents**. The IDIs were employed to capture detailed, individual perspectives, while the FGDs facilitated broader, communal insights and interactions among stakeholders. The inclusion of **participant observations** provided contextual depth, offering direct insights into real-world practices and the socio-cultural dynamics within the blue food value chain. This triangulation of data collection methods enhanced the reliability and validity of the findings.

To maintain ethical rigor, we applied stringent confidentiality measures, with respondents' names and affiliations anonymized using pseudonyms. This ethical consideration was critical to ensuring the integrity of the research process, allowing participants to share candid insights without concerns about privacy violations or potential repercussions.

Blue food profile of provinces included in the research

We selected the regencies of Lamongan in East Java, Pangkajene and Islands in South Sulawesi, West Manggarai in East Nusa Tenggara, and Ambon in Maluku, along with the capital cities of each province, to represent regions with significant blue food potential. In consultation with Bappenas, these locations were chosen to reflect diverse socioeconomic and geographical conditions, ensuring balanced geographical coverage across Indonesia.

We explored three key components within SSFA: capture fisheries, aquaculture, and seaweed farming, across the four provinces. This approach allowed us to gain insights into the different practices and challenges unique to each area.

- In **East Nusa Tenggara** and **Maluku**, capture fisheries, which involve the harvesting of wild fish from natural water bodies like seas, rivers, and lakes, were a dominant practice. Key species such as tuna, mackerel, and scad are targeted here, serving both local consumption and domestic markets.
- In **East Java** and **South Sulawesi**, we focused on aquaculture, which involves the controlled farming of species such as fish and crustaceans in ponds, cages, or tanks. This capital-intensive practice is critical in these regions, where inputs such as fish seed and feed drive productivity.
- Lastly, seaweed farming, an important alternative livelihood for many small-scale fishers, was a major focus in **East Nusa Tenggara**. This activity, primarily aimed at export markets, has gained traction as a key economic opportunity for the coastal communities.

Indicators	East Nusa Tenggara	East Java	South Sulawesi	Maluku
Population[8]	6.5 million	41.8 million	9.4 million	1.9 million
Income Per Capita (IDR)[9]	20.6 million	71.12 million	69.7 million	26.1 million
Blue Economy Index (2023)[10]	68.5	71.63	80.86	67.22
Fishers Households[11]	45,435	210,279	111,064	40,695
Fish Production (ton)[12]	139,066	595,779	434,805	518,614
Processing Units[13]	892 (Micro-Small)	10,737 (micro-small) 133 (medium-large)	1,211 (micro-small) 105 (medium-large)	1,184 (micro-small 20 (medium-large)
Export Volume (ton)[14]	3,909	352,237	173,650	11,941
Export Value (USD)[15]	9.7 million	1,982.7 million	612.0 million	79.8 million
Stunting Rate[16]	37.9%	17.7%	27.4%	28.4%
Capture Commodities[17]	Scads, Sardines, and Skipjacks	Indian oil sardine, Purple-spotted Bigeye, and Breadfin bream	Indian mackerel, Indian oil sardine, and Skipjack tuna	Skipjack tuna, Scads, and Indian mackerel
Aquaculture Commodities[18]	Seaweed, nile tilapia fish,	milkfish, vannamei shrimp, and catfish	seaweed, milkfish, and nile tilapia fish	Seaweed, Nile tilapia fish, and Grouper

[8] Badan Pusat Statistik (2024), Jumlah Penduduk menurut Provinsi 2023-2024, BPS: Jakarta

[9] Badan Pusat Statistik (2023),PDRB Per Kapita Atas Dasar Harga Berlaku Menurut Kabupaten/Kota 2022-2023

[10] Bappenas Background Paper (2023), Indonesia Blue Economy Index 2023, Bappenas: Jakarta

[11] Statistik-KKP (2024), Jumlah Rumah Tangga Perikanan menurut Provinsi 2022,KKP: Jakarta

[12] Statistik-KKP (2024), Volume Produksi Perikanan Tangkap menurut Provinsi 2022,KKP: Jakarta

[13] Statistik-KKP (2024), Unit Pengelolaan Ikan menurut Provinsi 2022,KKP: Jakarta

[14] Statistik-KKP (2024), Volume Ekspor Hasil Perikanan menurut Provinsi 2022,KKP: Jakarta

[15] Statistik-KKP (2024), Nilai Ekspor Hasil Perikanan menurut Provinsi 2022,KKP: Jakarta

[16] Ministry of Health Indonesia (2023), Survey Kesehatan Indonesia Tahun 2023, Kemenkes: Jakarta

[17] Badan Pusat Statistik (2020), Complete Enumeration Results of the 2023 Census of Agriculture: Fishery Individual Agricultural Holdings , BPS: NTT, East Java, South Sulawesi, Maluku

[18] Badan Pusat Statistik (2020), Complete Enumeration Results of the 2023 Census of Agriculture: Fishery Individual Agricultural Holdings , BPS: NTT, East Java, South Sulawesi, Maluku

Limitations of the study

The findings from this study are synthesized into in-depth analyses of each pillar, along with case studies that offer a closer examination of specific themes. However, readers are advised to consider the following limitations when interpreting the research results:

a. **Limited scope for generalization:** The research sample is restricted to four provinces chosen for their geographical characteristics and significance in Indonesia's blue food sector. As such, the findings may not fully represent the blue food landscape across the entire country, as certain insights are highly specific to local contexts.

b. **Response biases:** Respondents' answers during data collection may have been influenced by social desirability or misunderstandings of certain questions. We recognize the potential for such biases and took steps to mitigate them, such as assuring participants of confidentiality to encourage honest responses. Additionally, we cross-verified qualitative and quantitative findings with secondary research data to minimize any biases that could affect the conclusions.

c. **Time constraints:** Due to limited time, researchers were unable to fully immerse themselves in fieldwork or conduct extensive interviews and observations. While the insights obtained are valuable, they may not fully capture the breadth of experiences and contextual factors relevant to the topic. To supplement this, we explored emerging themes in greater detail through desk research and followed up with participants where necessary to gain additional clarity and a deeper understanding.

While these limitations should be considered when interpreting the findings, the report provides valuable insights into Indonesia's blue food sector. The analysis presented in the report offers a strong foundation for informed decision-making and policy development, while also highlighting areas for future research to deepen understanding and address remaining gaps.

Summary Insights & Recommendations

Ministry of National Development Planning/Bappenas
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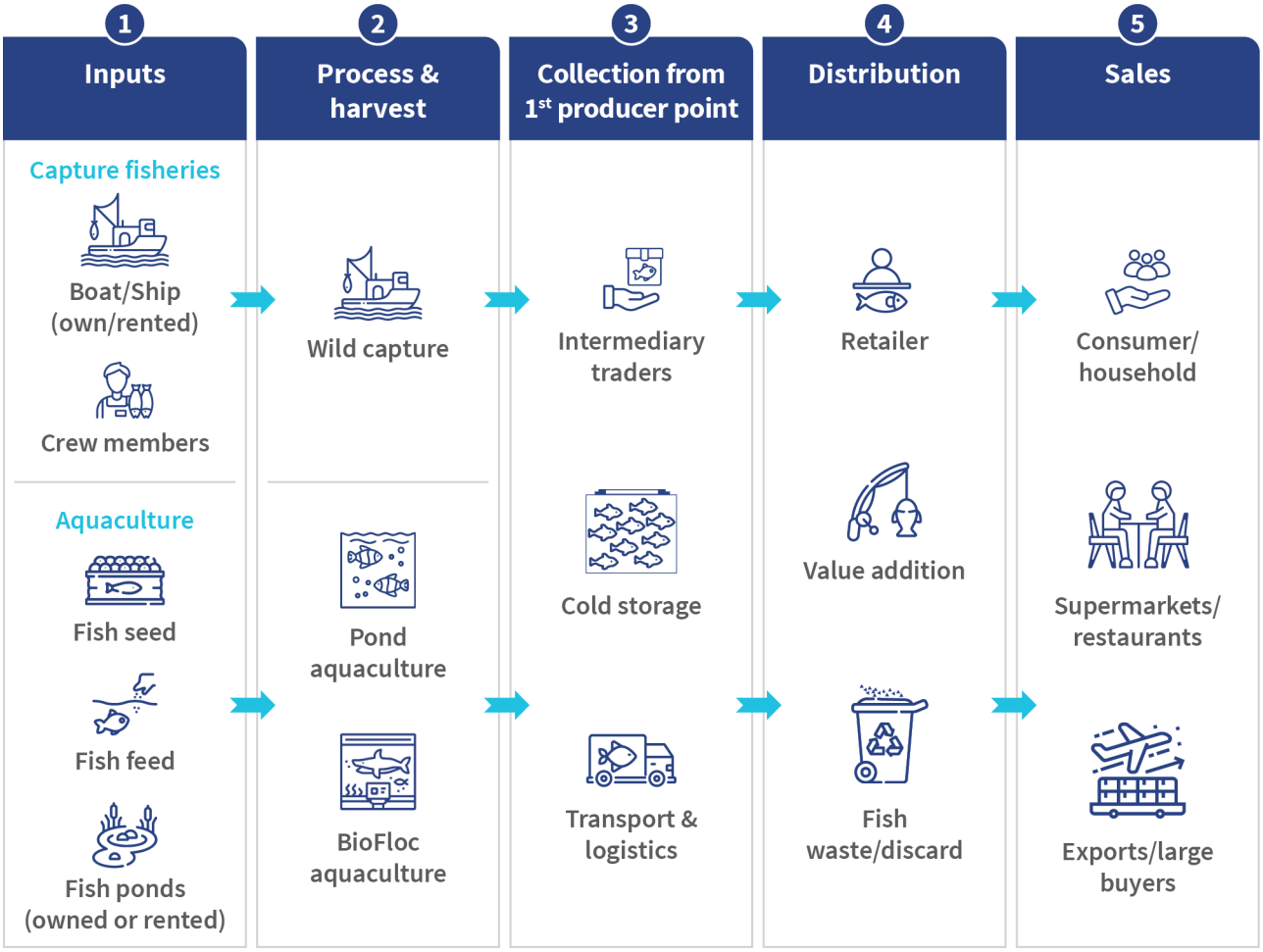
Indonesia's blue food value chain

In this section, we explore the roles of various actors across the capture fisheries and aquaculture value chains. While the post-capture or harvest stages share many similarities, aquaculture stands apart due to its intensive demand for inputs and labor over a longer duration. Unlike capture fisheries, which rely on natural ecosystems, aquaculture requires continuous management of feed, water quality, and farm infrastructure, which makes it far more resource-intensive throughout the production cycle.



The value chain within the blue food ecosystem encompasses diverse actors who play vital roles to enhance its efficiency and sustainability. Primary actors include small-scale fishers, intermediaries, and processing units. They drive the production and distribution processes. In contrast, supporting actors include input suppliers, feed providers, logistics companies, financial service providers, and government regulators. They offer essential infrastructure and resources. Collectively, these key actors collaborate to uphold the value chain's integrity and functionality, while individually, each contributes to the industry's overall advancement. However, in their operations, they also encounter challenges that impact their ability to optimize the value chain.

Stakeholders must understand the roles and challenges of these actors concerning key pillars of blue food if they are to develop policies and strategies that strengthen the blue food ecosystem and ensure its long-term resilience. The key challenges of each actor within the value chain are summarized as follows:

Actors	Key challenges
Small-scale fisheries (SSF)	• Limited access to formal credit and financial products • Dependence on intermediaries for financing • Inadequate access to modern equipment and technology • Food loss due to lack of proper storage and waste management facilities • High cost of inputs (feed, seeds, etc.) for aquaculture • Vulnerability to climate change and environmental conditions • Gender-based barriers for women in access to resources, training, and opportunities
Input suppliers (seed, feed, fuel, boats, and equipment)	• Price monopoly of inputs • Scarcity and fluctuations of input supplies • Lack of affordable and accessible input alternatives
Intermediaries	• Price fluctuations and market instability • Limited financial resources for investment in storage and transportation • Food loss due to poor handling and lack of cold storage
Processors and Value Addition	• Inconsistent fish supply due to seasonality and weather • High operational costs to maintain quality standards • Management of food loss and waste in processing • Limited access to export markets due to stringent standards
Exporters	• Compliance with international standards and certification requirements • Challenges in maintaining supply chain efficiency • Vulnerability to global market fluctuations
Logistics partners	• High operational costs and reliance on consistent power supply • Limited infrastructure in remote areas • Regulatory challenges in transporting perishable goods
Financial service providers (FSPs)	• High risk associated with lending to SSF due to seasonality • Lack of collateral among fishers • Limited financial products tailored to the fisheries sector

Nutrition

Key Insights:

- Fisherfolk communities often prioritize selling higher-value fish to generate income, leaving lower-quality fish for household consumption.
- Fisherfolk primarily rely on their own catch for daily consumption, but when their catch is insufficient, they turn to local markets to purchase fish.
- Repetitive diet and traditional fish preservation practices limit nutritional variety and intake.
- Children are introduced fish quite early, but preference shifts to costlier alternatives like chicken and eggs.
- Dietary choices in fisherfolk communities are often driven by affordability and availability rather than nutritional value.
- Despite frequent fish consumption, fisherfolk communities have limited awareness of the specific nutritional benefits of the seafood they consume.
- For many households, the choice of fish to consume is based on market value rather than nutritional quality.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
1.	Integrate blue foods into existing social assistance programs, such as Bantuan Pangan Non-Tunai (BPNT), which provides monthly food staples to vulnerable families, particularly in provinces with significant blue food production. Additionally, promote blue foods among pregnant and breastfeeding women through the Family Development Session (FDS) of the Program Keluarga Harapan (PKH) to enhance nutrition and health outcomes.	Programmatic changes	High	Short-term	**Government:** program development, funding, implementation **Community health workers:** community outreach and engagement	The Pantawid Pamilyang Pilipino Program (4Ps) in the Philippines has implemented innovative strategies to incorporate fish and other aquatic products into its social assistance framework, particularly targeting coastal and malnutrition-prone areas
2.	Inclusion of fish-based meals in government's proposed school meal program.	Policy changes, programmatic changes	High	Short-term	**Government:** program development, funding, implementation	Timor-Leste has incorporated tilapia into weekly school lunches as part of the national school feeding program.
3.	Develop and promote affordable fish-based products fortified with essential micronutrients in collaboration with local food producers.	Programmatic change, private sector enablement	High	Medium-term	**Government:** Program development **Processing units:** Product development, production **Research institutions:** research	Myanmar and Zambia have managed to develop local fish-based solutions through Small Fish Production, Processing, and Marketing (SPM) programs

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
4.	Position blue food as the cornerstone of nutrition through Social and Behavior Change Communication Program (SBCC) to enhance national nutrition literacy among local producers, distributors, and consumers-particularly for pregnant and lactating women.	Programmatic changes	Medium	Short-term	**Government:** program development **Community health workers:** community outreach and engagement	USAID's initiative SPRING Project has managed to improve maternal and child nutrition through SBCC
5.	Develop a comprehensive policy to make blue foods a cornerstone of national nutrition strategies, emphasizing their role in improving public health and addressing malnutrition, especially among vulnerable populations.	Policy & regulatory change	Medium	Long-term	**Government:** Policy development **Development partners, research institutions:** advisory, research	Norway has a comprehensive integrated long-term nutrition strategy that includes a strong focus on blue foods.
6.	Conduct a comprehensive micronutrient deficiency assessment across all provinces to identify the specific nutritional gaps within communities. Based on the findings, develop a tailored aquaculture and fisheries plan that prioritizes species rich in the most deficient nutrients for each province.	Programmatic changes, policy changes	Medium	Medium	**Government:** Program development, policies, resource commitments **Research institutions:** research and policy insights **International development organizations:** Technical assistance and funding	n/a

Environment

Key Insights:

- Land use conversion for aquaculture is a common practice, but mangrove conversion was not reported by the research respondents.
- Inadequate wastewater management and industrial pollution threaten aquatic ecosystems.
- Illegal fishing methods persist despite environmental consequences and regulations.
- Climate change Is disrupting fisheries and aquaculture through unpredictable weather and rising temperatures.
- Changes in rainfall and salinity are increasing operational costs and reducing aquaculture productivity.

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No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
1.	Promote the enforcement of a comprehensive independent Environmental Impact Assessment (AMDAL) before converting land, including mangrove forests and rice fields, into aquaculture ponds.	Programmatic changes	High	Short term	**Government:** Implementation	South Africa mandates that projects undergo regular post-approval audits to ensure that environmental management plans are implemented, with penalties for non-compliance.
2.	Provide tax incentives and credit for companies that implement or transition to sustainable fishing practices and mandate financial service providers to increase green funding for fisheries.	Private sector enablement	High	Medium term	**Government:** Policy development, funding **Financial Services Authority:** Policy development **Industry associations:** Advocacy **Financial Service Providers:** Implementation	UNDP provided a 75% loan guarantee to Verde Ventures, which issued loans to a fishing cooperative in Mexico. The cooperative had voluntarily established no-take zones within the secure fishing areas it was granted for harvesting spiny lobsters.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
3.	Strengthen oversight by restricting operational permits for companies lacking adequate Waste Water Management Installations (IPAL) and those that have not completed their Environmental Impact Assessments (AMDAL).	Institutional and governance reforms	High	Short term	**Government:** Implementation **Industry associations:** Advocacy **Processing units and exporters:** Compliance	China has implemented a real-time environmental monitoring system that tracks pollution levels from factories, including wastewater discharge. Factories and industrial facilities are required to install sensors that automatically report wastewater and air pollution levels to a centralized system.
4.	Promote the adoption of technologies like nano-satellites, hydroacoustic surveys, and statistical modeling for real-time fish stock measurement and sustainable fishing quota determination, moving away from reliance on post-production data recorded at ports.	Programmatic changes	Medium	Medium term	**Government:** Program development, funding **Development partners, research institutions:** Technical assistance, collaboration, research	In Chile, the Ministry of Environment is supporting the ARClim project that develops climate change risk maps for aquaculture to generate science-based harmful algal bloom warnings to help reduce farmed salmon mortality.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
5.	Invest in research and development to adapt to climate change impacts, such as establishing early warning systems for extreme weather, while also promoting sustainable fishing and aquaculture practices using the latest technology.	Programmatic changes	Medium	Long term	**Government:** Program development, funding **Development partners, research institutions:** Technical assistance, collaboration, research **Local community organizations:** Training and capacity building	China has implemented hydroacoustic and remote sensing surveys in Yangjiang coastal waters to assess fish populations in the Three Gorges Reservoir utilizing advanced echosounders to measure fish density, distribution, and biomass.
6.	Re-implement and expand the Fisheries Insurance for Small Fish Farmers (APPIK) and Fishers Insurance Premium Assistance (BPAN) for climate insurance, disaster recovery, and ecosystem rehabilitation for fisherfolks and aquaculture farmers affected by climate change.	Policy changes	Medium	Short term	**Government:** Policy development, funding **Financial Services Authority:** Policy development **Financial Service Providers:** Implementation	The Caribbean Ocean and Aquaculture Sustainability faciliTy (COAST) unlocks insurance pay-outs to a pre-determined list of people and organizations involved in the fishing industry if an extreme weather event occurs and causes a set of environmental indicators such as wave height, rainfall, wind speed and storm surge to exceed pre-set thresholds.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
7.	Revitalize and promote community-driven ecosystem restoration (locally led adaptation approaches) and environmental stewardship by leveraging indigenous practices.	Programmatic changes	Medium	Medium term	**Government:** Program development **Development partners:** Technical assistance, networking and collaboration **Local community organizations:** Advocacy, implementation, training and capacity building	Environment Investment Fund's Empower to Adapt initiative has a locally led climate monitoring system that informs dynamic climate change planning and adaptive management.

Small Scale Fisheries and Aquaculture (SSFA)

Key Insights:

- Small-scale fisherfolk often engage in a limited set of activities both within and outside the fishing sector to diversify their income.
- Fisherfolk and aquaculture farmers' economic conditions differ based on the type of species they catch or cultivate, which also directly influences the markets they serve.
- Small-scale fisherfolk across capture fisheries, aquaculture, and seaweed farming often face restricted market access, heavily depending on intermediaries to sell their products.
- Many capture fisherfolk come from families that have relied on fishing for generations, inheriting their knowledge and skills through hands-on experience passed down over time.
- Aquaculture farmers struggle with limited access to affordable, reliable seeds, feed, and fertilizers, along with insufficient resources and training, which hampers their ability to optimize production and maintain sustainable operations.
- In addition, small-scale capture fisherfolk often rely on outdated or rented equipment, which restricts their access to more productive fishing grounds and reduces profitability.Traditional beliefs and local wisdom play a key role in governing fisheries in some communities.
- The majority of fisherfolks are small-scale, and the lack of younger fisherfolks poses a threat to the sustainability of the community, as most are part of an aging population.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices
1.	Draw on the lessons from the Coastal Community Empowerment Program (PMP-PPK) and design comprehensive and integrated livelihoods diversification programs for the SSFA community in partnership with other related government agencies.	Programmatic and policy changes, private sector enablement	High	Short	**Government:** Program design, policy development and implementation **Development partners and civil society organizations:** Implementation support, technical assistance	JEEViKA program in India specifically focusses on livelihood promotion and diversification for women in fisheries sector.
2.	Strengthen social protection for SSFA community by improving coverage of KUSUKA cards which is still low - build public outreach programs and simplify the registration process to make these cards more accessible.	Programmatic changes	High	Short	**Government:** policy changes, outreach and awareness initiatives **Civil society organizations:** implementation support **Development partners:** technical assistance and evaluation support for design and implementation	N/A

3.	Expand access to affordable, high-quality inputs for small-scale aquaculture by improving subsidy program for fish feed, seeds, and fertilizers targeted at vulnerable farmers, facilitating local production, and supporting bulk purchasing for fishing cooperatives.	Programmatic and policy changes	High	Medium	**Government:** Program design, subsidy allocation **Private sector:** Engage in local production and bulk purchasing **Development partners:** technical assistance, monitoring and evaluation support	The Pradhan Mantri Matsya Sampada Yojana (PMMSY) under India's Blue Revolution scheme promotes sustainable aquaculture by providing subsidies and encouraging cooperatives to lower input costs for small-scale fish farmers.
4.	Develop a structured succession planning strategy to attract younger generations to the fisheries sector through a youth-focused program. This initiative should provide capacity building, youth-specific financial services, and leverage digitalization.	Programmatic and policy changes	Medium	Long	**Government:** Program design, policy development, pilot testing and implementation **Development partners:** Evidence gathering researches for policy and program design, evaluation support	In Nigeria, the International Institute of Tropical Agriculture's (IITA) Youth Agripreneurs program provides financial support for equipment and business incubation in aquaculture ventures.

Justice

Key Insights:

- The traditional gender roles within Indonesia's fishing communities highlight a clear divide in participation across different phases of the fishing process.
- Women play a key role in post-harvest activities and financial management of the household.
- The role of women in fishing remains largely underrecognized limiting their access to resources and government assistance.
- Small-scale fisherfolk face critical barriers in accessing essential resources, which jeopardize the sustainability of their livelihoods.
- The degradation of marine ecosystems due to pollution and industrial activities poses a significant threat to the livelihoods of small-scale fisherfolk.
- Zoning regulations in conservation areas initially caused conflicts but have led to adaptation as fishing community starts to realize benefits through alternative livelihood sources.
- Fisherfolk lack awareness regarding government policies and zoning laws as it relates to protecting their interests.
- Conflicts between small-scale and larger fisherfolk over limited fishing grounds highlight the need for better regulation and resource-sharing practices.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
1.	Invest in building awareness on zoning laws amongst fishing community and involve community in co-management of fisheries resources.	Programmatic changes	High	Short term	**Government:** Program development **Civil society organizations, local community organizations:** Program implementation	Environmental Justice Foundation and Hen Mpoano are working to educate communities on fisheries laws, policies and tenure rights.
2.	Establish a national network for women in fisheries in Indonesia to strengthen women's voices and access to resources in the blue food value chain, through gender-sensitive advocacy, capacity-building initiatives, and regular forums for sharing knowledge and best practices.	Private sector enablement	Medium	Medium term	**Government:** Networking and collaboration **Civil society organizations, industry associations, development partners, fishing cooperatives:** Advocacy, networking and collaboration, training and capacity building	The National Network on Women in Fisheries in the Philippines, Inc. (WINFISH) is a network of individuals and professionals interested in improving the status of women especially in the fisheries sector.
3.	Develop comprehensive outreach and education programs to raise awareness among fisherfolk about government policies and zoning laws, ensuring they understand how these regulations protect their rights and livelihoods.	Programmatic changes	Medium	Short term	**Government:** Program development **Civil society organizations, local community organizations, fishing cooperatives:** Advocacy, training and capacity building	The Philippines has implemented various community-based awareness programs as part of the Fisheries Code to inform fisherfolk of marine protected areas (MPAs) and fisheries management zones.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
4.	Establish a national or provincial level programs to establish and promote women collectives in fisheries sector for livelihood activities through targeted aquaculture training, skills development, financial support, and access to resources.	Institutional and governance reforms	Medium	Medium term	**Government:** Program development **Civil society organizations, local community organizations, fishing cooperatives:** Advocacy, networking and collaboration, training and capacity building	JEEViKA Special Purpose Vehicle for Agriculture Transformation (JSPVAT) program in India targets women's self-help groups (SHGs) and female smallholders to improve women's nutrition, livelihoods, and empowerment in aquaculture and fisheries.

Productivity, value creation, and export

Key Insights:

- Value addition presents a powerful solution to boost fisheries productivity amidst environmental and overfishing challenges.
- Unlocking the potential of underutilized species through innovative processing faces significant challenges in expanding market reach and capacity.
- Small-scale processing units in Indonesia often face significant market limitations, as their products are typically restricted to local food items.
- For those who are exporting, value creation is currently limited to basic (primary) processing activities.
- Only a small portion of SSFA is involved in exporting due to the stringent processing quality standards required for international markets and the challenges of managing the diversity and quantity of fish captured.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
1.	Improve financial access for small processing units to help them expand their businesses, including investments in tools and machinery that can improve product quality and meet export standards.	Programmatic change	High	Short-term	**Government:** Program development, funding **Financial service providers:** Funding **Processing units:** Implementation	The Pradhan Mantri Matsya Sampada Yojana (PMMSY) scheme in India promotes financial institutions to extend tailored credit to small-scale fish processing units, providing subsidies and grants to boost competitiveness while improving infrastructure and supporting value-added product development.
2.	Provide support to processing units in navigating export requirements and connecting to broader markets. Simplify export procedures by reducing bureaucratic red tape and streamlining certification processes for small-scale producers.	Programmatic change	High	Short-term	**Government:** Program development; funding **Processing units:** Implementation	Under the Aquaculture Act, Norway adopted a one-stop service system. This allows industry players to submit their applications to a single authority (the Directorate of Fisheries), which then coordinates with other relevant agencies, streamlining the process for obtaining the necessary licenses and approvals.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
3.	Strengthen branding and marketing strategies for positioning Indonesian blue food products in the global market, assess product strengths and market dynamics, and execute trade missions to forge partnerships and secure access to international markets.	Programmatic change	High	Medium-term	**Government:** Program development, funding **Processing units:** Implementation	The Norwegian Seafood Council, a state-owned entity, promotes the Norwegian blue food industry by enhancing its global market value and advising the Ministry of Trade, Industry, and Fisheries on seafood exports.
4.	Partnership between Ministry of Fisheries and Maritime Affairs and Ministry of Cooperative and SMEs to establish small, cooperative-run processing hubs with access to shared equipment (e.g., dryers, freezers, packaging machines) to process fish into higher-value products.	Programmatic change	High	Short term	**Government:** Program development, funding **Bank Indonesia MSME development program:** Funding and technical assistance support **Civil society organization:** Mobilization and implementation support	Some of the existing Kelompok Usaha Bersama (KUBs) in fisheries sector or even BUMDES could be good starting point for receiving such support.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
5.	Strengthen blue food processing hubs in Indonesia's regions through public-private partnerships to enhance capacity and technology for value-added blue food.	Private sector enablement	Medium	Medium-term	**Government:** Program development, funding **Private sector:** Investment, implementation **Fishing cooperatives:** Networking and collaboration **Development partners:** Technical assistance, training and capacity building	Thailand's shrimp processing industry is an example where partnerships between the government and private companies helped develop value-added shrimp products like cooked and peeled shrimp for export.
6.	Support innovation in developing value-added blue food products through research and development, along with capacity building for processors.	Programmatic change	Medium	Long-term	**Government:** Program development, funding **Research institutions:** Research, technical assistance, implementation **Development partners:** Technical assistance, training and capacity building	The ICAR research and program has empowered fisherwomen by enhancing their skills in producing value-added fish products. Beginning with market research which identified consumer preferences, enabling fisherwomen to tailor their products to market needs. The program also offers training in hygienic processing, marketing, and entrepreneurship

Food loss and wastage

Key Insights:

- Inefficiencies in fishing methods and inadequate storage leads to significant losses in capture fisheries.
- Aquaculture faces losses due to contamination, disease, and improper practices.
- Post-harvest, fish quality degrades due to poor handling during transport and long transit periods.
- Processing and packaging generate significant waste, but some efforts to recycle byproducts are emerging.
- Market and restaurant waste remains largely unaddressed.
- Waste management and infrastructure challenges at ports undermine cleanliness and sustainability efforts.
- Logistics service providers adopt waste minimization practices and explore innovative solutions for food loss management.
- Government-led training programs have shown positive outcomes to promote sustainable waste management practices.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
1.	Invest in cold chains, community storage, and processing centers, especially in high-catch regions, to reduce post-harvest losses and maintain product quality for domestic and export markets.	Programmatic changes	High	Medium term	**Government:** Program development, funding **Processing units and exporters:** Implementation, compliance **Fishing cooperatives:** Networking and collaboration	The Government of India supports the development of post-harvest and cold chain infrastructure in the fisheries sector to reduce food loss and improve quality for domestic markets.
2.	Provide financial incentives for companies investing in technologies that transform fish by-products into valuable commodities such as animal feed, fertilizers, and cosmetics, thereby reducing waste and creating new economic opportunities.	Private sector enablement	High	Medium term	**Government:** Policy development, funding **Processing units:** product development, technology adoption, investment **Financial Service Providers:** Funding **Research institutions:** Research, technical assistance	In Chile, the government provides financial support, such as tax credits and research grants, for companies investing in fish by-product technologies.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
3.	Promote public awareness campaigns in local fish markets and food courts on practices and techniques to minimize food waste.	Programmatic changes	High	Short term	**Government:** Program development, funding, networking and collaboration **Fisheries extension workers, civil society organizations, local community organizations, fishing cooperatives:** public outreach and engagement	In Japan, existing laws require national and local governments to educate consumers and businesses about reducing and recycling food waste through public campaigns.
4.	Develop a national policy aimed and measurable targets at significantly reducing food loss and waste including in the blue food value chain over.	Policy changes	Medium	Long term	**Government:** Policy development **Development partners, research institutions:** advisory, research **Industry associations:** networking and collaboration	Japan passed the Act on promotion of food loss and waste reduction in 2019, and previously the Food recycling act in 2001 aiming to reduce and recycle food waste across the entire food value chain, including fisheries and aquaculture.

No.	Recommendation	Type	Priority levels	Timeframe	Actors and their roles	Global best practices, if any
5.	Promote research and development focused on circular economy practices across the blue food sector.	Programmatic changes	Low	Long term	**Government:** Program development **Development partners, research institutions:** research, technical assistance **Industry associations:** networking and collaboration	Norway has created a state-owned limited company, FHF, under the Ministry of Trade, Industry, and Fisheries to facilitate research and development in the blue food industry to enhance value creation.

Detailed Insights on Thematic Pillars of the Research

Ministry of National Development Planning/Bappenas
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Nutrition

Nutrition is a key focus of the blue food assessment, as most of Indonesia's population heavily relies on fish as a primary dietary staple. Fish consumption in Indonesia has steadily increased, from 47.34 kg per capita annually in 2017 to 57.27 kg in 2022[19] highlights the growing reliance on aquatic foods. Despite this growth, malnutrition among children and widespread micronutrient deficiencies persists. The root of these issues lies in factors such as poor fish quality, inadequate preparation methods, limited dietary diversity, and economic barriers, all of which diminish the nutritional value gained from fish. Addressing these nutritional gaps is essential for improving public health and ensuring that the blue food economy can contribute to the well-being of not only the consumers but also the producers of blue food.

Key insights on nutrition are highlighted below:

1. Blue food availability and affordability

Fisherfolk communities often prioritize selling higher-value fish to generate income, leaving lower-quality fish for household consumption

This practice and economic constraints limit access to nutrient-dense seafood and affects their overall diet. Many households consume unsellable fish or crabs that are too small to market. This pattern is typical because higher-value species are sold, particularly during lean seasons when families rely on less nutritious foods like instant noodles.

> We eat fish every day, but the fish we consume is cheaper and comes from the market, not from our own catch. The fish from our catch is reserved for sale, usually to restaurants.
>
> **- Fisherwoman, Ambon, Maluku**

Fisherfolk primarily rely on their own catch for daily consumption, but when their catch is insufficient, they turn to local markets to purchase fish

In these situations, they tend to choose cheaper species such as catfish or milkfish, which limits the diversity in their diet. Additionally, fisherfolk often buy fish from their neighbors—who are also fisherfolk—particularly those with unsold lower-quality fish. Even fisherfolk who regularly catch high-value species like snapper, grouper, or squid will opt for more affordable, lower-quality fish when buying for personal consumption. This reliance on less diverse and lower-quality fish sources reduces the variety of nutrients they obtain from their diet.

Repetitive diet and traditional fish preservation practices limit nutritional variety and intake

In terms of food preparation, fish is most commonly grilled, fried, or stewed, while nutrient-preserving methods such as steaming and baking are rarely used. Many fisherfolks noted

[19] Kementerian Kelautan dan Perikanan. Statistic KKP. Accessed December 23, 2023. Statistik KKP

that despite fish being a staple in their diet, their meals often consist of just fish, rice, and sambal (chili paste), with little thought given to including vegetables or other nutrient-dense ingredients. Fisherfolks also use traditional preservation methods like salting and drying, especially for storing fish during lean seasons or to increase the market value of low-quality fish. While these techniques are practical for extending the shelf life of fish, they can reduce the nutritional value, particularly by lowering the content of essential fatty acids and vitamins. These preservation methods are important for the community's survival during periods when fresh fish is scarce, but they also mean that fisherfolks and their families may not be getting the full nutritional benefits of the fish they consume.

2. Dietary practices and preferences

Children are introduced fish quite early, but preference shifts to costlier alternatives like chicken and eggs

Children in fishing communities are introduced to fish at an early age, with some in East Java beginning to consume fish as young as seven months old. However, as they grow older, many children develop a preference for other protein sources, such as chicken and eggs. Despite this shift in preference, the higher cost of these alternatives makes them difficult for families to afford on a regular basis. Eggs are often used as a more affordable substitute when fish is either unavailable or less preferred, but financial constraints prevent families from providing these foods consistently. This lack of dietary diversity and limited access to preferred protein sources can impact children's ability to achieve optimal nutrition.

> The stunting is high in Labuan Bajo. While we eat fish every day, vegetables and fruits are not part of our daily diet. Children also prefer chicken when it's available, and they want to eat fish in snack form or fish sambal with rice, which causes it to lose some nutritional value. This lack of balanced nutrition, especially in the first 1,000 days of life, is the main cause of stunting in our children.
>
> **- Fisherwoman and Midwife (bidan), Labua Bajo, East Nusa Tenggara**

Dietary choices driven by affordability and preference, not nutrition

Dietary choices in fisherfolk communities are often driven by affordability and availability rather than nutritional value. Cheaper, more accessible fish are consumed daily, while higher-value, nutrient-rich fish are sold for income or reserved for special occasions. This focus on cost over nutrition leads to missed opportunities to improve dietary quality and health outcomes. Similarly, in the Ambon community, the highly nutritious "laor" worm, harvested once a year during the Timba Laor Festival, is a rich source of protein but lacks a preservation method, limiting its availability. These practices underscore how traditional knowledge and seasonal limitations contribute to the nutritional gaps in these communities, highlighting the need for better preservation techniques and more nutrition-focused dietary practices.

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> The local wisdom of the Ambon community is called 'timba laor,' referring to a type of worm found in the Latuhala region, which comes from coral reefs. It is a highly rich source of protein and is usually saved by fishermen for young children, as it only appears once a year in April. There's even a festival dedicated to it, the Timba Laor Festival. It can only be found on beaches with long stretches of coral. Laor is usually prepared as curry or fritters, but a suitable preservation method has not yet been discovered. To catch laor, fishermen use nets and lights, as the worms are drawn to the light.
>
> **- A government official in Ambon, Maluku**

3. Nutritional awareness and literacy

Despite frequent fish consumption, fisherfolk communities have limited awareness of the specific nutritional benefits of the seafood they consume

Most fisherfolk eat fish out of habit and availability, rather than for its health benefits. While some believe that fish helps them feel vital and energized, this perception isn't connected to a deeper understanding of essential nutrients like omega-3 fatty acids, vitamins, and minerals found in fish. As a result, their choices regarding fish selection and preparation often do not optimize its nutritional value, with practices like frying or salting potentially diminishing the health benefits. Educating these communities about the nutritional value of different fish species and healthier cooking methods could greatly enhance their dietary outcomes.

In places like Ambon, fish consumption is linked to maintaining energy and strength for daily work. However, there is little awareness of how the specific nutrients in fish contribute to health, especially for vulnerable groups like pregnant and lactating women. This knowledge gap, combined with economic factors, shapes their dietary choices and practices in ways that do not always support optimal health outcomes.

> Fish is a staple food for the Ambonese. When we eat fish, we feel strong and energized, ready to take on more activities.
>
> **- Fish farmer, Ambon, Maluku**

For many households, the choice of fish to consume is based on market value rather than nutritional quality

Higher-value fish like tuna or trevally are sold for profit, and the lower-value fish kept for household consumption may not provide sufficient nutritional benefits. Economic conditions further shape these practices. For instance, fisherfolk in Kupang, East Nusa Tenggara, who catch high-quality fish like tuna and skipjack, often consume the best fish themselves while selling the rest. In contrast, fisherfolk in West Manggarai, who have smaller operations and catch lower-value species, tend to sell their best catch and eat what is left over or unsold, highlighting the influence of economic status on dietary choices.

> Usually, we sell the fish first and then keep the remaining ones for ourselves if there's any left. It just feels wrong; it's better to sell the fish to earn money.
>
> **- Mr.I, Marine capture fisherfolk, West Manggarai, East Nusa Tenggara**

Case study: Enhancing nutrition literacy and dietary practices through local fish festivals – A missed opportunity

The Festival Ikan Kerapu (Grouper Fish Festival) in Labuan Village, East Java, is organized by local grouper farmers in partnership with the local government and the Department of Marine and Fisheries. This annual event highlights grouper's economic significance while celebrating its cultural importance to the community. A key attraction is a cooking competition, where women's groups prepare creative grouper dishes, promoting local culinary traditions and sustainable aquaculture practices. Such festivals are common across East Java, but they predominantly focus on economic promotion and cultural celebration.

Opportunity for nutritional awareness

Although these festivals celebrate fish's economic and cultural roles, they currently miss a key opportunity to raise awareness about fish's nutritional value. Integrating educational elements like workshops on the health benefits of fish, cooking demonstrations showcasing nutrient-preserving methods, and distributing healthy recipe booklets could turn these festivals into powerful tools for improving public nutrition literacy.

Potential role of government in enhancing nutrition education

Government agencies, particularly the Department of Marine and Fisheries, can play a crucial role in utilizing these community festivals to promote nutrition awareness. By collaborating with health and nutrition experts, these agencies can ensure that the festivals also emphasize how to maximize fish's nutritional benefits through proper preparation and cooking techniques. This approach would help communities appreciate both the economic and health value of fish, leading to healthier dietary practices and better overall nutrition.

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Environment

The environmental ecosystem of the fisheries sector is increasingly under pressure from a range of interconnected challenges. Climate change, with its rising temperatures and unpredictable weather patterns, has significantly disrupted both capture fisheries and aquaculture, affecting fish productivity and altering marine ecosystems. Small-scale fishers, who form the backbone of many coastal communities, are particularly vulnerable as they often lack the resources to adapt to these shifts. In addition, environmental degradation from pollution, improper waste management, and unsustainable fishing practices exacerbates the problem, leading to further declines in fish stocks and escalating operational costs. Addressing these environmental challenges is crucial to ensuring the long-term sustainability of fisheries and safeguarding the livelihoods of vulnerable communities.

The following insights from the field research highlight specific environmental issues impacting fisheries and aquaculture in Indonesia:

1. Environmental and resource management challenges

Land use conversion for aquaculture is a common practice, but mangrove conversion was not reported by the research respondents

While there are no significant insights on mangrove conversion into ponds, land conversion for aquaculture is prevalent in areas like South Sulawesi. Farmers frequently alter land use, modifying brackish water ponds to accommodate freshwater species or converting former rice paddies into brackish water ponds to cultivate high-demand commodities like milkfish and shrimp. This flexibility in land conversion indicates adaptability among farmers, but it raises environmental concerns, such as soil degradation and potential impacts on local ecosystems.

> Nowadays, most of the ponds we have used to be rice fields, which we call 'marginal ponds.' Back in President Habibie's time, when shrimp prices shot up, a lot of rice fields were transformed into shrimp farms. Because of that, we now get our water from bore wells, and the quality is definitely different. Only one person among us has access to seawater because their location is pretty good. To create brackish water, we have to mix freshwater with saltwater first. This shift in land use has caused ongoing effects that we're still dealing with today.
>
> **- A brackishwater aquaculture farmer, Pangkep, South Sulawesi**

Inadequate wastewater management and industrial pollution threaten aquatic ecosystems

Wastewater management practices in small-scale fish processors and aquaculture operations are often inadequate, with many processors discharging untreated wastewater directly into the sea or local sewer systems. This is particularly concerning as the use of chemicals to treat pond water is common, yet no wastewater treatment practices are employed. Additionally, industrial pollution from sources such as power plants and overflowing landfills is contributing to water contamination. For example, seaweed farmers in East Nusa Tenggara have reported a significant decline in production due to pollution from nearby power plants, and an aquaculture farmer in East Java had to install a water filter and biofloc pond to maintain water quality due to contamination.

> Rice pests (wereng) interfere with milkfish. The pests thrive in stagnant or salty water. The water becomes like this because the soil is not fertile, leading to increased salinity. This allows the pests to thrive and consume the oxygen needed for the fish. To eliminate the pests, chemicals are used. The price of these chemicals has skyrocketed; a bottle that used to cost Rp 50,000 now costs around Rp 100,000. One plot requires about two bottles, and treatments are done twice a year. However, chemical pesticides are not recommended. Natural pesticides are suggested, but the problem is that these natural pesticides also kill shrimp and tilapia. This situation is essentially an accumulation of using chemical fertilizers and pesticides. However, it's a dilemma: what should we do if we don't use chemicals?
>
> **- A freshwater & brackishwater aquaculture farmer, Pangkep, South Sulawesi**

2. Sustainability and regulatory challenges

Illegal fishing methods persist despite environmental consequences and regulatory prohibitions

Despite awareness of their environmental impacts, fisherfolks continue to use banned, harmful fishing methods like tiger trawls (pukat harimau) and seine nets (cantrang) due to their efficiency in catching large quantities of fish. Overfishing, particularly in the northern sea of Java, has led to severely depleted fish stocks, leaving fishing community struggling to sustain their livelihoods. In South Sulawesi, conflicts arise among fishers over the use of illegal methods such as explosives, which damage marine habitats. These disputes are typically resolved by local government authorities, but the persistence of these practices underscores the lack of accessible, sustainable alternatives for fisherfolks. Stronger enforcement of fishing regulations and the promotion of eco-friendly fishing techniques are critical to curbing the environmental damage caused by illegal methods.

> We know that the use of tiger trawl for fishing is forbidden. Several times the government officers remind us about it. However, we are only boat crews which rely on the boat owners. Such reminders should be conveyed to them, instead of to us. In addition, this is also related to our livelihood. We do expect that the government can support us to not use the tiger trawl, by providing fishing gears which have similar effectiveness with tiger trawl but more environment-friendly.
>
> **- A fisherman, Lamongan East Java**

3. Impact of climate change on fisheries and aquaculture

Climate change is disrupting fisheries and aquaculture through unpredictable weather and rising temperatures

Climate change has made weather patterns increasingly erratic, negatively impacting both capture fisheries and aquaculture. Fisherfolks in regions like Kupang and West Manggarai (East Nusa Tenggara) have reported decreased catches since the 2021 Seroja cyclone, with fishing activities becoming more unpredictable over time. Rising sea temperatures have particularly affected aquaculture, where longer harvest periods and increased disease outbreaks

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are causing significant losses. In South Sulawesi, milkfish production has dropped due to soil quality degradation, while shrimp and grouper farmers in Pangkep and Lamongan are experiencing higher mortality rates due to diseases exacerbated by heat.

> During El Niño periods, fish deaths are common. If the fish float to the surface in the pond, we eat them ourselves. If they stay submerged, we leave them to become natural fertilizer to enrich the soil. If the dead fish still have some market value, they are sold, though at a lower price. The same goes for shrimp. Shrimp are prone to dying from viruses, even though they are easy to manage but also quick to die. Dead shrimp usually turn red and float. Shrimp infected with viruses are often hard to detect, so they are left in the pond. If some can be saved, they are harvested immediately using traps.
>
> **- A brackish water aquaculture farmer, Pangkep, South Sulawesi**

Case Study: The impact of overfishing and climate change on fishing community in the Paloh Village, East Java

Declining fish stocks and abandoned purse seine boats in Paloh Village

Paloh Village, East Java, has long depended on fishing as its economic lifeblood, with generations of fisherfolks relying on the purse seine fleet to catch valuable pelagic species like tuna and mackerel. Each boat once employed 15 to 30 crew members, supporting entire families and contributing to the prosperity of the community. However, overfishing in the northern sea of Java, compounded by illegal tiger trawling, has drastically reduced fish stocks in recent years. Despite the known environmental damage and a ban on these harmful methods, illegal fishing continues to exacerbate the situation.

As fish stocks have plummeted, the operational costs of running purse seine boats have become unsustainable. This has led to the complete shutdown of these once-thriving fishing operations, leaving many boats abandoned. The shift has rippled through the local economy, forcing fisherfolks to rely on whatever limited catch is available, often at the expense of lower incomes and the broader fishing sector. Intermediaries like Pak Amir have had to scale down their operations significantly, working with fewer fisherfolks and handling reduced volumes of fish.

The abandoned purse seine boats alongside the currently used small boats in Paloh village, East Java

Cultural and generational shifts in Paloh's fishing community

The economic hardship has triggered a cultural shift in Paloh. Many fisherfolks, once proud of their profession, no longer want their children to follow in their footsteps due to the growing instability and dwindling resources. Comparing the bountiful catches of their youth with the uncertainty they face today, they question the long-term sustainability of fishing as a livelihood. This change in attitude reflects the broader challenges faced by fishing communities, where the combined effects of overfishing and environmental changes are not only reshaping livelihoods but also altering generational perspectives on the future of the profession.

"We used to be proud to be fishers, and life wasn't hard. Now, there are no more fish, the boats are just sitting idle because we can't afford to operate them, and no one's buying either. Sometimes we go out to sea and only catch enough fish to eat for the day, not even enough to sell. It's very different from when I was young. My child will definitely not follow in his father's footsteps; he better work on land instead of sea." **– A fisher at Paloh Village, East Java.**

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Changes in rainfall and salinity are increasing operational costs and reducing aquaculture productivity

Shifting rainfall patterns and rising ocean salinity are further complicating aquaculture operations, increasing costs and reducing productivity. For example, aquaculture farmers are facing the challenge of managing water salinity levels and ensuring optimal pond conditions, which requires additional investments in water treatment and management systems. These changes not only increase operational costs but also reduce output, as altered environmental conditions negatively impact fish growth and health. This is particularly problematic for small-scale farmers who have limited resources to adapt to these changes.

Small-Scale Fisheries and Aquaculture (SSFA)

Indonesia's small-scale fisheries can be broadly categorized into three main types: capture fisheries, aquaculture (fish farming), and seaweed farming. Each of these sectors plays a crucial role in supporting the livelihoods of coastal communities across the country, with unique operational practices and challenges. However, despite their differences, these fisheries share common characteristics that impact their engagement with markets, access to inputs, management practices, and specialization within the broader blue economy.

The following insights from the field research highlight specific issues impacting small scale fisheries and aquaculture in Indonesia:

1. Specialization

Small-scale fisherfolk often engage in a limited set of activities both within and outside the fishing sector to diversify their income

Within the sector, some fisherfolk have taken more roles apart from fishing but it is typically limited in simple post-production activities such as primary intermediaries or simple processing activities such as drying, smoking, and salting. The seasonal nature of capture fisheries also forces many fisherfolk to seek alternative employment during the off-season, usually limited to manual labor, such as construction work. In areas like West Manggarai in East Nusa Tenggara, where tourism has grown, some fisherfolk have expanded their roles within the sector, taking advantage of increased demand for local seafood or branching into tourism-related businesses. This diversification helps mitigate the economic instability associated with seasonal fishing and creates additional income opportunities. However, these efforts are often constrained by external factors such as limited access to markets, skills, or financial capital, which restrict the full potential of their ventures. Expanding their livelihood opportunities beyond simple processing and manual labor is essential for mitigating economic instability and unlocking the full potential of small-scale fisheries.

Fisherfolk and aquaculture farmers economic conditions differ based on the type of species they catch or cultivate, which also directly influences the markets they serve

Fisherfolk and aquaculture farmers have distinct characteristics based on the type of fish they catch or cultivate, as well as the markets they serve. The nature of their catch—whether it be mixed fish, specific species, or seaweed—directly influences the type of market they supply. For example, high-value fish such as snapper, grouper, and tuna are typically destined for the global market, while species like sardine (lemuru),indian mackerel (kembung), and scad (layang) are more commonly sold in local markets. This differentiation not only determines the market served but also impacts the fisherfolk' economic well-being. For instance, in East Nusa Tenggara, fisherfolk in Kupang who primarily catch high-value export species like tuna, skipjack (cakalang), and mackerel (tenggiri) have relatively better economic conditions than those in West Manggarai, where fisherfolk tend to catch smaller, mixed species that cater to local markets.

2. Engagement with market and demands

Small-scale fisherfolk across capture fisheries, aquaculture, and seaweed farming often face restricted market access, heavily depending on intermediaries to sell their products

The role of intermediaries varies, with some fisherfolk benefiting from their presence, as they bridge the gap between small-scale fisherfolk and larger markets, facilitating access and distribution. However, in other cases, intermediaries negatively affect profitability by exerting price control and extending the supply chain, which can reduce the fisher's earnings. In many situations, several layers of intermediaries are involved before the fish reach the final consumer, further eroding potential profits.

For example, in more competitive markets, such as grouper fishing in East Java, prices offered by intermediaries tend to be transparent, and fisherfolk generally accept these terms without issue. On the other hand, in less saturated markets, such as seaweed farming in East Nusa Tenggara, intermediaries often monopolize pricing, setting lower prices that leave fisherfolk with little bargaining power and reduced income. This stark difference highlights how market conditions and the role of intermediaries can significantly impact the livelihoods of small-scale fisherfolk.

> We don't have any problems with the intermediary. We all know the prices here, and if they try to manipulate the price a little, we can just go elsewhere. In fact, having Mr. H (the intermediary) is really helpful because if I need money, I often ask him to sell my harvest.
>
> **- Grouper aquaculture farmers in Labuan village, East Java**

> Back then, the price of seaweed could reach 60,000 per kilo, but now it's dropped drastically to just 15,000. That's because the intermediaries manipulate the price. But we have no other choice—if we don't sell to them, who else can we sell to?
>
> **- Seaweed farmers in Bolok village, East Nusa Tenggara**

3. Inputs and Assets

Many capture fisherfolk come from families that have relied on fishing for generations, inheriting their knowledge and skills through hands-on experience passed down over time

In aquaculture, many farmers either come from fishing backgrounds or have some connection to the fishing industry, even if they are newer to the trade. However, formal training is rare in both cases. Fisherfolk typically rely on generational knowledge or informal sharing of techniques within their communities.

Despite their deep-rooted experience, most fisherfolk lack the ability to expand their networks beyond the fishing community, as they remain dependent on intermediaries to access markets. This dependency is reinforced by a belief that each actor in the supply chain has a fixed role, with fisherfolk seeing themselves only as those who catch the fish, leaving marketing and sales to intermediaries. This mindset limits their ability to scale their operations or connect with broader markets.

> In my opinion, everyone has their own role and share of fortune. Let us fisherfolk catch the fish, and the rest of the process can be handled by others.
>
> **- Marine capture fisher in Ambon, Maluku**

> We have difficulties in obtaining high-quality seeds because our supplier in Situbondo prioritizes exporting quality seeds at higher prices
>
> **- Grouper farmers in Lamongan, East Java**

Aquaculture farmers struggle with limited access to affordable, reliable seeds, feed, and fertilizers, along with insufficient resources and training, which hampers their ability to optimize production and maintain sustainable operations.

Input management in aquaculture is crucial for ensuring the productivity and sustainability of the sector. Fish farmers frequently face challenges related to seed availability, high costs, and declining seed quality, which threaten their profitability and production stability. Similarly, they struggle with unreliable feed supplies due to seasonal and weather dependencies, price fluctuations, and a lack of alternative feed sources. This unpredictability, along with the increasing costs of seeds and feed, hinders farmers' ability to sustain operations and maintain growth. Many farmers lack access to resources, training, and capital to produce their own seeds or feed, adding pressure to an already strained aquaculture system. In places like South Sulawesi, lobster farming faces particular difficulties due to feed scarcity, highlighting the need for innovation and support in securing these essential inputs. Without improvements in seed and feed management, Indonesia's aquaculture sector, despite its potential for growth, faces significant operational risks and challenges in achieving long-term sustainability.

> We mostly use fish head flour, which comes from rejected fish, as feed. The problem is that the availability and price of this feed depend on the seasonal harvest of capture fisheries, making it hard to predict when we'll have enough feed.
>
> **- A milkfish farmer, Pangkajene and Islands Regency, South Sulawesi**

In addition, small-scale capture fisherfolk often rely on outdated or rented equipment, which restricts their access to more productive fishing grounds and reduces profitability

The quality of fishing gear and skill levels also affect their ability to catch higher-value fish, which directly impacts their economic situation. In the face of challenges like climate change and overfishing, fisherfolk need to adapt their techniques and equipment to stay competitive. Access to technology such as radar, GPS, and cameras could significantly improve their capacity to locate fish and mitigate the risks of scarcity.

Similar challenges are faced in aquaculture. In East Java, for instance, grouper farmers have noted that relying on outdated fuel-powered aerators significantly raises their operational costs, with fuel prices being a major burden. They estimate that access to electric aerators could reduce costs by up to 60%, highlighting the urgent need for better financing, modern equipment, and training to help both capture fisherfolk and aquaculture farmers enhance their operations and livelihoods. This demonstrates how critical it is to address these constraints in order to improve productivity and economic resilience in the sector.

> In my opinion, small-scale fisherfolk find it hard to export because of their lack of skills and proper equipment. For example, catching fish like snapper needs to be done one by one, and fisherfolk without the right skills often can't do that.
>
> **- Export cold storage owner in West Manggarai, East Nusa Tenggara**

> Nowadays, fish are becoming harder to find, so we often cast our nets and end up catching nothing all day. If we had technology like GPS or radar, it would be easier for us to know where to go to catch fish, saving time and making sure we don't come back empty-handed.
>
> **- Capture fisher in Warloka village, East Nusa Tenggara**

4. Management and Institutions

Traditional beliefs and local wisdom play a key role in governing fisheries in some communities

In Maluku, some villages (negeri) are led by tribal chiefs (raja). They adhere to local wisdom and practices unique to their village, including traditions that aim to preserve the environment, such as sasi. This tradition is fully supported by the government of Maluku, demonstrating that indigenous efforts to protect the environment can coexist with the development agenda. The sasi tradition is a prohibition against harvesting natural resources, whether from agriculture or the sea, before a specified time. This practice ensures that the community can utilize the resources equitably while protecting species and ensuring their sustainability. Even when resources are abundant, sasi should not be disregarded. The start and end of the sasi period are determined by the raja, and when the period concludes, a traditional ceremony is usually held in celebration. Each region has its own form of sasi depending on the local area. For example, sasi in Rutong applies to lobsters and sea cucumbers, while in Haruku, it applies to lompa fish (a type of mackerel). This practice exemplifies how local wisdom and traditions continue to influence the management of natural resources, demonstrating that informal governance can coexist with formal regulations to ensure resource sustainability.

The majority of fisherfolks are small-scale, and the lack of younger fisherfolks poses a threat to the sustainability of the community, as most are part of an aging population.

The existing small-scale fishing workforce is mostly aging, and many young people from fishing families are increasingly uninterested in or discouraged from pursuing a livelihood in fishing. Instead, they prefer to find jobs in the city, where opportunities may seem more promising. The combination of limited

economic prospects in fishing, environmental degradation, and competition with larger, more advanced vessels makes the industry less appealing. Without a new generation to take over, the continuity and sustainability of small-scale fishing is at significant risk, threatening the future of this livelihood. A group of seaweed farmers in East Nusa Tenggara, most of whom are over 50 years old, admitted that their children are no longer interested in continuing their seaweed farming business

> Our children prefer to work in the city and in an office job. They are even afraid their skin will darken if they continue as seaweed farmers.
>
> **- A seaweed farmer couple in Bolok village, East Nusa Tenggara**

Justice

The blue food economy in Indonesia represents a vital component of the nation's sustainable development, intertwining the health of marine ecosystems with the livelihoods of communities dependent on ocean resources. Central to this assessment is the principle of justice, which underscores the necessity of addressing maritime property rights and the equitable use of sea spaces. Inclusive governance mechanisms that actively involve women and marginalized groups are essential in promoting fairness and resilience in this sector. However, the challenges faced in the fisheries sector are exacerbated by existing gender disparities, inequitable access to resources, and increasing environmental threats, all of which require a focused and collaborative approach to ensure a balanced and just blue economy that serves all stakeholders.

The key insights are can be classified into three sub-categories:

1. Gender roles and participation in fisheries

The traditional gender roles within Indonesia's fishing communities highlight a clear divide in participation across different phases of the fishing process

While women predominantly engage in pre-harvest activities—such as preparing fishing gear and provisions for their husbands—their direct involvement in capture fisheries is limited. This trend contrasts with the more balanced gender roles observed in aquaculture, where women tend to participate more actively in both production and management aspects. This disparity suggests that societal norms and expectations significantly influence women's access and participation in various fishing sectors, revealing the need to challenge these norms to enhance gender equity and empower women in marine resource management.

Women play a key role in post-harvest activities and financial management of the household

In the post-harvest stage, women emerge as critical contributors to the fisheries economy, taking on roles that encompass sorting, selling, and buying fish, as well as engaging in gear repair. Their active participation in these value-adding processes illustrates their vital role in sustaining their households and supporting the local economy. Furthermore, regardless of their involvement in fishing, women often retain control over household finances, which underscores their influence in economic decision-making. However, the extent of their control over business finances is closely linked to their direct participation in fishing activities. This dual role not only empowers women economically but also enhances their capacity to impact community resilience and development, making it essential to support their involvement in both fisheries and related business activities.

The role of women in fishing remains largely underrecognized limiting their access to resources and government assistance

Women who participate directly in fishing at sea often struggle to establish their identity as fishers and face societal undermining. Moreover, the definition of "fisher" needs to be adequately socialized amongst key stakeholders such as extension workers and village heads. For instance, government initiatives like KUSUKA (Kartu Pelaku Utama Sektor Kelautan dan Perikanan), which aim to formalize key players in the marine and fisheries sectors, including fishers, aquaculture workers, and fish processors, often fail to account for women's contributions. Although those involved in pre- and post-harvest activities, many of whom are women, are technically eligible for the KUSUKA scheme, in practice it remains largely inaccessible to them. To obtain the KUSUKA

card, a recommendation letter from a local official, such as the fisheries extension workers (*penyuluh)* or village head, is required. However, women often struggle to get the necessary approval due to societal norms on traditional gender roles and the lack of recognition of their status as fishers, making it difficult for them to fully benefit from the scheme.

> In the past, I wasn't recognized as a fisherwoman because I am female. Even though I went out to sea and owned a boat, the fisheries extension workers (penyuluh) didn't register me for the KUSUKA card. As a result, it was difficult for me to access social assistance. But now, my situation has changed. Since I have the KUSUKA card, I can finally receive support from the government, such as assistance for boats. In fact, I often serve as a model for other women fishers now.
>
> **- A marine capture fisher, Pangkep, South Sulawesi**

Case study: Breaking the barriers as a fisherwoman in a male-dominated industry

The role of equitable access and a supportive environment

Marina, a 23-year-old fisherwoman from Ambon, Maluku, is a rare example of a woman successfully navigating the male-dominated world of capture fisheries. Her passion for fishing began at the age of seven when her father, a fisherman, started taking her to sea. By the time she was 15, she was fishing independently—something uncommon for women in her community. When her father left to work in Jakarta, Marina took on the responsibility of fishing to support her family, becoming the only family member still involved in the trade. Her work not only sustains her family's livelihood but also funds her university education, as she aspires to become a nurse. Marina has impressively balanced her roles as both a fisher and a student, breaking gender norms along the way.

Despite her success and the support from her community, Marina faces challenges in accessing government aid for fishers. Since her father is officially recognized as the fisher in the family, she often receives assistance through his connections rather than directly. However, her participation in local fisherfolk groups has been instrumental in gaining limited access to government support. This case highlights the need to address gender disparities in the blue food sector. By creating more

inclusive systems and ensuring that women like Marina receive the resources and recognition they deserve, communities like Ambon can build a more equitable and diverse workforce that benefits everyone involved.

"I give the same to the men, because Mama said, yes, women can go to sea, so men also have the task of doing household chores. They can take turns cooking and cleaning the house"

- Marina, fisherwoman, Ambon, Maluku

2. Resource access and sustainability challenges

Small-scale fishers face critical barriers in accessing essential resources, which jeopardize the sustainability of their livelihoods

Small-scale fishers face critical barriers in accessing essential resources, which jeopardize the sustainability of their livelihoods. In regions such as West Manggarai, capture fishers experience significant challenges in securing fuel, a vital resource for their daily operations. Due to financial constraints, many fishers rely on third-party resellers who provide upfront fuel and flexible payment options, but these arrangements are often exploitative, leading to cycles of dependency and debt. This limited access to affordable fuel not only increases operational costs but also reduces the capacity for fishers to remain competitive and sustainable.

In aquaculture, the situation is equally challenging. Fisherfolks struggle with limited access to high-quality seeds, as much of the available stock is exported at higher prices, leaving local fisherfolks with inferior options. This impacts both productivity and profitability, leading many to rely on waste fish for feed. However, the availability and cost of this feed are heavily influenced by the seasonal nature of fish harvesting. The lack of viable feed

alternatives hinders the potential for scaling operations, especially during lean fishing periods when aquaculture is anticipated to offer more stability than capture fishing. However, due to the reliance on feed from capture fisheries, the productivity of aquaculture remains tied to the seasonality of fishing. Additionally, government recommendations to reduce the use of chemical fertilizers clash with current practices, creating a disconnect between policy and the practical realities of small-scale aquaculture. The lack of affordable, high-quality resources places significant strain on the economic viability of small-scale fishers, highlighting the need for better access to resources and more alignment between government policies and local practices.

> Because we get our feed from fishers, when the fish season is lean, we all end up competing to buy fish heads from them. During times like that, the fishers can set extremely high prices as they please. But we don't have any other choice.
>
> **- Grouper aquaculture farmers, Labuan Village, East Java**

The degradation of marine ecosystems due to pollution and industrial activities, such as coal-fired power plants, poses a significant threat to the livelihoods of small-scale fishers

Environmental degradation not only reduces fish stocks but also disrupts the broader ecosystem that sustains fishing communities. Compounding these environmental challenges are weak regulatory frameworks and overlapping government responsibilities, which create enforcement gaps that hinder the implementation of safety and sustainable fishing practices. Without stronger governance and better coordination between local and national authorities, small-scale fishers remain vulnerable to economic and environmental shocks, leaving them with limited protection and few options for recourse.

> Sometimes when we're out at sea, black dust sticks to us, covering our bodies. If it touches our skin while we're paddling, it causes intense itching. We've raised concerns about this, but the power plant claims their waste isn't a problem. If that's true, why we can feel the hot steam from their plant reach our farm area every morning?
>
> **- Ms. F, Seaweed farmers in Bolok village, East Nusa Tenggara**

3. Governance, conflicts, and regulatory and policy awareness

Zoning regulations in conservation areas initially caused conflicts but have led to adaptation as fishing community starts to realize benefits through alternative livelihood sources

The implementation of zoning regulations as part of conservation and tourism efforts, such as the creation of Komodo Park in Bajo, has led to initial conflicts between fisherfolks and the government. Previously productive fishing areas were designated as conservation zones, resulting in protests from local fishers who felt their livelihoods were being threatened. However, over time, fishers have adapted to these changes and begun to see some benefits from the growth of tourism in the area. The income generated from tourism has brought new opportunities, providing a supplementary source of income to communities that once relied solely on fishing. This adaptive response highlights a critical dynamic: while zoning can initially cause tension and reduce access to traditional fishing grounds,

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it can also lead to long-term benefits when paired with complementary economic activities like ecotourism. The case demonstrates that zoning regulations, when managed properly, can balance conservation goals with the livelihoods of local fishing communities, but only after careful negotiation and adaptation by affected stakeholders.

> At first, when the zoning regulations were introduced, we all protested because we used to be able to fish there, but now it's a conservation and tourism area, so we can't anymore. However, over time, we've realized that tourism has actually benefited us as well. Now we can rent out boats, and many restaurants and hotels are buying fish from us.
>
> **- Mr. I, Marine capture fisher, Warloka Village, East Nusa Tenggara**

Fisherfolks lack awareness regarding government policies and zoning laws as it relates to protecting their interests

Many small-scale fishers lack adequate knowledge of government policies and zoning regulations, particularly regarding provisions meant to protect their interests. This knowledge gap prevents them from effectively advocating for their rights and engaging in policy discussions that directly affect their livelihoods. As zoning regulations often restrict access to traditional fishing grounds, fisherfolks who are unaware of the legal frameworks and protective measures may find themselves disadvantaged, unable to challenge decisions or negotiate for fair treatment. Improving awareness and education on zoning laws could empower fisherfolks to better navigate regulatory changes and safeguard their economic and resource access rights.

Conflicts between small-scale and larger fishers over limited fishing grounds highlight the need for better regulation and resource-sharing practices

In regions where fishing resources are limited, conflicts frequently arise between small-scale fishers and larger fishing vessels from other regions, such as Bali or West Nusa Tenggara. Small-scale fishers often struggle to compete with the larger boats, which have more advanced technology and greater reach, allowing them to claim key fishing spots. These disputes are exacerbated by the disparity in boat size, with larger vessels sometimes displacing smaller fishers from their traditional fishing areas, forcing them to relocate. This competition over scarce resources can also lead to violations of local fishing agreements, such as using illegal methods like explosives. The informal agreements that exist between small-scale fishers, such as designated times for lifting traps (bubu), further highlight the tension and the need for mediation, often provided by government authorities like Polairud (Water and Air Police). The recurrence of these conflicts underscores the pressing need for stronger regulations, better enforcement, and equitable resource-sharing practices between different fishing groups to mitigate tensions and ensure fair access to fishing grounds.

> Conflicts among fisherfolks usually occur on the islands, rarely in the city. The conflicts are related to violations of fishing regulations, such as the use of explosives. Resolutions are typically facilitated by the government.
>
> **- Capture fisherman (boat crew), Makassar, South Sulawesi**

Productivity, value creation, and export

Indonesia's fisheries sector faces significant challenges in productivity, market reach, and value creation. Value addition has become a key solution to boost productivity, especially in the face of environmental and overfishing pressures. However, many small-scale processors struggle with limited market access and export challenges, as their operations are often restricted to basic processing like filleting and cleaning. Additionally, only a small portion of small-scale fisheries and aquaculture (SSFA) are involved in exporting, due to stringent international quality standards and difficulties in managing fish diversity and volume.

Key insights for productivity, value creation, and export are summarized below:

1. Barriers to domestic market development

Value addition presents a powerful solution to boost fisheries productivity amidst environmental and overfishing challenges

In all provinces, the fisherfolk reported experiencing a decline in their catch and productivity. In regions affected by overfishing, where fisherfolk face declining stocks, moving beyond the sale of raw fish and incorporating value-added activities like drying, smoking, or marinating, able to increase the per-unit value of their catch, compensating for reduced fish availability while ensuring sustainable use of resources. In East Nusa Tenggara for instance, many women salt and dry their unsellable fish to enhance its market value. In South Sulawesi, environmental factors like soil degradation and unpredictable weather are some of the main challenges that reduce aquaculture yields such as milkfish and shrimp. However, by focusing on value-added products—such as processing shrimp into dried snacks or fish into fillets—fisherfolk and farmers can generate higher profits from lower volumes, offsetting the drop in raw production.

> There is an NGO who trained us to process the fish to be fish sambal. The training includes how to package the final product. The NGO also gave us the cooking appliances like you saw in our kitchen. Currently, we sell the products only to visitors coming to our village and if there were some exhibition events which we were invited by the government. But such an event was very rare. We don't have any idea how to expand our market.
>
> **- Leader of fish processing group, Labuan Bajo, NTT**

Unlocking the potential of underutilized species through innovative processing faces significant challenges in expanding market reach and capacity

In regions like East Nusa Tenggara, processors have successfully transformed underutilized species, such as crocodile fish, into local delicacies, increasing their market value. This innovation allows processors to make profitable use of species that were previously overlooked. However, scaling this approach remains a challenge due to limited market reach and processing capacity. Expanding domestic and international market connections for these products could drive growth in value creation for underutilized species.

> As mothers, we felt it was a shame to see fish being thrown away, so we tried it out—at least it helped us save money, and who knows, it could turn into a business. And it's true, now not only has the fish floss become our village specialty, but the crocodile fish also has started to gain value in the market.
>
> **- Fisherwomen, head of micro processing unit, East Nusa Tenggara**

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Case Study: Women's empowerment and value creation in Warloka Village, West Manggarai

Warloka, a fishing village in West Manggarai, East Nusa Tenggara, has a long history of male-dominated fishing practices, with women typically managing the household. One day, the wives of six fishermen noticed that fisherfolk regularly discarded crocodile fish (*ikan buaya*) due to its unattractive, crocodile-like appearance, which made it unmarketable. Seeing potential in the underutilized fish, the group of women conducted their own research using internet services they accessed through hourly-paid Wi-Fi. They learned that crocodile fish is indeed safe to consume and sought ways to transform its appearance and make it more appealing.

The women began experimenting with processing the fish into fish floss (*abon ikan*). Initially, the fisherfolk were happy to give them the discarded fish for free, and what started as a household effort quickly became popular in the village. Encouraged by the local demand, the women formalized their operation into a small business. They received cooking equipment as a grant (*hibah*) from a social organization and benefited from packaging designs created by university students conducting a community service project (KKN) in the village. With additional support from the Department of Marine and Fisheries, the women participated in several bazaars in West Manggarai, further expanding their reach. Currently, they also have expanded their business by producing other types of fish floss and fish chili paste.

This initiative not only empowered the women of Warloka by providing them with new economic opportunities but also demonstrated the potential for value creation through fish processing. By transforming a previously discarded fish into a marketable product, the women increased the overall value of local fisheries and contributed to reducing waste. Their business serves as an example of how innovation and entrepreneurship can improve livelihoods and enhance resource utilization in fishing communities.

Small-scale processing units in Indonesia often face significant market limitations, as their products are typically restricted to local food items

Most micro and small processing units focus on producing goods such as sambal (chili paste), fish crackers, or fish floss, which cater to local tastes and preferences. This narrow focus limits their market reach to domestic consumers and creates saturation in the market, driving down the value of these products. In Paloh Village, East Java, for example, nearly all women produce fish crackers, leading to an oversupply that makes the product difficult to sell. Additionally, the lack of proper certifications, such as BPOM or HACCP, hampers their ability to expand beyond local markets, further constraining their growth potential.

> I want to export my sambal products but I have to get a HACCP license. Currently, I couldn't apply it yet as my business kitchen is still connected with my household kitchen. The regulation is the business kitchen should be separated from the main house. I still need to prepare for the capital to build such a kitchen.
>
> **- Owner of fish processing unit, Labuan Bajo**

2. Barriers to international market access

For those who are exporting, value creation is currently limited to basic processing activities

In Indonesia's fisheries sector, value creation for export markets remains predominantly focused on basic processing activities such as filleting and cleaning. Even within medium to large-scale processing units, which are often export-oriented, the added value generated from fish products is limited to these preliminary steps. This approach restricts the potential for higher profitability, as more advanced processing techniques—such as transforming fish into ready-to-eat meals, nutraceuticals, or specialty products—are not widely adopted. While filleting and cleaning are essential for preparing fish for export, the limited scope of these activities prevents the sector from capturing greater market value or diversifying into higher-end products that could cater to more lucrative international demands.

> The procedure for domestic shipping is simpler. For example, there is no need for sampling tests, as sampling tests are only required for products sent abroad. However, there is still visual inspection, even though laboratory testing is not necessary. In contrast, export shipments have more complicated requirements.
>
> **- A representative of a cold storage facility, Makassar, South Sulawesi**

Only a small portion of SSFA is involved in exporting due to the stringent processing quality standards required for international markets and the challenges of managing the diversity and quantity of fish captured

In terms of exports, small-scale fisheries and aquaculture (SSFA) operations face even greater hurdles. These issues are closely linked to the availability of supporting gear and infrastructure. For instance, fisherfolks in East Nusa Tenggara report that to catch high-value export species like snapper, they must travel farther out to sea and use fishing rods instead of nets—an investment that requires

larger boats and more advanced equipment. Moreover, export buyers often require contract certainty, something SSFA operators find difficult to guarantee. Despite these challenges, some success stories exist, such as PT JM in East Nusa Tenggara, a processing unit that exports tuna loins abroad. By partnering with small-scale fisherfolk and providing them with necessary capital, PT JM helps bridge the gap between small-scale operations and export markets.

Food Loss and Wastage

Food loss and waste (FLW) in Indonesia's fisheries sector is a major contributor to the nation's nutrition challenges. Between 2000 and 2019, Indonesia produced an estimated 23–48 million tons of FLW annually, with around 30% coming from the fisheries sector. The majority of this waste occurs at the consumption level, with households accounting for 80% and the remaining 20% coming from non-household sectors[20]. Alarmingly, approximately 44% of the discarded food is classified as edible, representing a significant loss of valuable nutrients. This lost potential could otherwise play a critical role in combating malnutrition, reducing stunting, and enhancing food security in the country.

Key insights on food loss and waste in Indonesia's fisheries sector are outlined below:

1. Production and harvest related losses

Inefficiencies in fishing methods and inadequate storage leads to significant losses in capture fisheries

In capture fisheries, fish loss is primarily caused by issues with the fishing method and inadequate storage during long trips. Fishers in areas like Bajo and Kupang report that fish caught early in the net and exposed to rough sea currents often become damaged or spoiled due to lack of proper cold storage, especially on trips lasting up to 20 days. Up to 10 kg of fish per harvest may be discarded due to spoilage. Mitigation strategies include selling damaged fish to middlemen at lower prices, salting, drying, or smoking fish for local sale or personal use, though these methods are not always sufficient to prevent loss.

Aquaculture faces losses due to contamination, disease, and improper practices

Aquaculture operations are plagued by fish loss due to contamination, viral outbreaks, and feeding errors. For example, East Javan catfish farmers report improper feeding as a major cause of fish loss, while seaweed and grouper farmers in regions like NTT and East Java mention virus outbreaks are the primary reasons for loss. In some cases, such as with groupers in East Java, up to 40% of fish may be lost during peak seasons. Farmers attempt to mitigate these losses by selling affected fish at lower prices, however, dead fishes can be sold to feed suppliers, used as natural fertilizer (as observed in South Sulawesi), consumed by the farmers themselves, or, if beyond salvage, disposed of by burying, burning, or given to pets like cats.

[20] Bappenas (2023), BAPPENAS Study Report: Food Loss and Waste in Indonesia supporting the implementation of Circular Economy and Low Carbon Development, Jakarta, Bappenas

2. Post-harvest, processing, and market waste

Post-harvest and transportation challenges contribute to fish deterioration and waste

Post-harvest, fish quality degrades due to poor handling during transport and long transit periods. In regions like Maluku, fish often spoil during transportation, especially when moving over long distances. This results in lower prices for damaged fish and, in extreme cases, complete disposal of unsellable fish into the sea.

Processing and packaging generate significant waste, but some efforts to recycle byproducts are emerging

During the processing phase, fish parts such as tails, bones, skin, and fins are commonly discarded, along with infected or low-quality products. However, there are emerging efforts to recycle this waste. Some companies collaborate with middlemen to sell fish waste for use in other industries. Some processors are also being trained to convert waste into animal feed, compost, or soap, though limited resources hinder broader adoption of these practices. However, in efforts to reduce food waste, processors in rural areas face significant challenges due to inadequate infrastructure and limited access to markets for byproducts. These issues are particularly pronounced in regions like East Nusa Tenggara, where processing units struggle to manage fish waste due to a lack of appropriate equipment and insufficient demand for fish byproducts. As a result, valuable fish parts are often discarded, leading to unnecessary waste and a missed opportunity to utilize these resources.

Case Study: Food loss and waste management at PT JM – Byproduct utilization and waste minimization

Repurposing low-quality fish for sustainable practices

PT JM, a major fish processing company in East Java, exports a wide range of products, including demersal and pelagic species such as Anggoli, Leather Jacket, Grouper, and octopus. Their processed items vary from Whole Gilled Gutted Scaled (WGGS) fish to fillets and whole fish. However, the processing operations produce a considerable amount of byproduct waste, including fillet scraps, fish heads, skins, and innards, which are not typically part of their export products. Recognizing the potential value of these byproducts, PT JM has developed strategies to minimize waste by finding alternative uses for these materials.

Low-quality fish that turned into fish feeds

Through industry connections, PT JM established partnerships to repurpose their byproducts effectively. Fillet scraps are used to make fish nuggets, fish heads are sold to Padang restaurants, and fish innards are provided to catfish farmers as feed. Additionally, fish scales are dried and sold for use in the cosmetics industry. PT JM collaborates with intermediaries who actively seek these byproducts to supply other companies or restaurants, ensuring minimal waste. Low-quality fish from suppliers is returned and repurposed into fish feed, while any products found to be contaminated or diseased are destroyed to maintain food safety standards.

This comprehensive approach not only reduces waste but also generates additional revenue streams and promotes sustainable practices. PT JM's initiative serves as a model for waste management in the fisheries sector, turning potential waste into valuable resources.

"Here, no part of the fish is wasted, except for what's truly contaminated, which we destroy. For the other parts like the head, gills, skin, and so on, there's always someone who needs them, as long as there's a will to find the right channels to repurpose the waste."

– Mr. D, Head of Data and Export Division, East Java.

Market and restaurant waste remains largely unaddressed

In traditional markets and restaurants, unsellable fish and unconsumed food contribute to waste. In traditional markets, fish parts like heads, fins, and tails are discarded during the cleaning process. Although some of the salvageable fish are given away to neighbors or consumed by sellers themselves, around 5%-10% of the fish in a traditional market is usually goes as waste and disposed. At restaurants, poor-quality fish from suppliers and unappealing cooked fish are also discarded, though staff may consume some of the unpresentable cooked fish. Currently, there are no significant efforts to reduce the waste generated from bad-quality fish or uneaten portions, presenting an area for potential improvement.

3. Waste management and infrastructure challenges

Waste management and infrastructure challenges at ports undermine cleanliness and sustainability efforts

Ports face challenges in waste management and maintaining cleanliness due to its small size, heavy congestion, and improper waste segregation. Fish waste, mixed with household waste from nearby residential areas, is often poorly managed, with some of it being transported to cattle farms where livestock inadvertently consume plastics. Despite proposed waste management programs by the local government, implementation has been slow. Additionally, the port's limited space and constant high activity make regular cleaning efforts difficult, particularly on weekends when vehicle access is restricted.

> Overstocking fish has become a problem, especially when there are fewer buyers, causing prices to drop. Therefore, the government has built cold storage facilities to accommodate fish during times of overproduction. If fisherfolks need cold storage, they can use a rental system. Currently, there are cold storage facilities whose roofs have started to deteriorate and leak. We need a budget to repair these cold storage facilities.
>
> **- Head of Paotere Port, Makassar, South Sulawesi**

4. Innovative practices in waste reduction

Logistics service providers adopt waste minimization practices and explore innovative solutions for food loss management

Many logistics providers in the fisheries sector have implemented practices to minimize food waste by repurposing non-standard fish parts into marketable products. For instance, at PT AB, fish parts that don't meet standard export requirements are turned into products like fish balls, while PT HS converts fish trimmings into side products and sells fish bones for further processing elsewhere. Additionally, some locations, such as Morotai, have developed fish mills to process fish bones into fish meal for animal feed, reflecting a forward-thinking approach to waste management. However, this innovation has not yet been widely adopted, highlighting an opportunity for broader implementation across the industry to enhance sustainable waste practices.

Government-led training programs foster sustainable waste management practices

Government and community support, especially through training programs, have played a critical role in promoting sustainable waste management among processors. For instance, in East Nusa Tenggara, the Poklasar group has benefited from government-led training initiatives focused on repurposing fish waste. These programs equip processors with the knowledge and tools to reduce waste, repurpose byproducts, and improve operational efficiency. Such initiatives are vital for empowering local communities to adopt more sustainable practices and contribute to broader efforts to reduce food loss and waste in the fisheries sector.

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Access to finance

Access to finance is a significant challenge for small-scale fishers and aquaculture operators (SSFAs), limiting their ability to upgrade equipment, expand operations, or invest in sustainable practices. These financial barriers often trap SSFAs in subsistence activities, preventing them from engaging in value-added processes that could enhance their incomes and boost Indonesia's export potential. Many SSFAs prefer informal loans over institutional financing due to a lack of trust in formal lenders, though some use programs like KUR. Middlemen, ranging from small to medium and large-scale, play a key role in facilitating access to finance for SSFAs. Blue food processing units often rely on personal savings to start but remain hesitant to seek formal loans as their capital needs grow, highlighting the broader financial constraints within the sector. This passage delves into the complexities of financial access for SSFAs, middlemen, and processing units.

The key insights can be classified into three sub-categories:

1. SSFA's access to finance

Although SSFAs have access to formal financial institutions a large majority still prefer informal loans from intermediaries and other value chain actors

SSFA activities are mostly carried out at sea or in coastal areas, whether in rural regions or cities, and sometimes in remote islands. Due to this, SSFAs often lack everyday access to FSPs, even if they have accounts. For example, female SSFAs living on small islands must take boat trips to reach the nearest ATM or bank branch, with only a bank agent available in their village. Meanwhile, their husbands spend most of their time at sea and have little time to manage banking matters. As a result, many feel more comfortable using informal financial products, with the closest sources of informal finance often being middlemen or fish seed sellers (*penggelondong*).

> We, fishers, don't like to go to the bank. First, the bank is only for the have while we struggle to meet our daily needs. Second, we're not comfortable to enter the office, as you see us right now, our clothes are dirty and shabby, and smell of fish. We feel that people in the bank, including the bank staff, tend to humiliate us because of our clothes. And three, we prefer to go fishing to earn money rather than queuing at the bank, it is wasting our time.
>
> **- A capture fisherman in Kupang**

Middlemen are sometimes preferred over banks for several reasons. First, they don't require collateral, which banks typically do, nor do they demand administrative requirements like a KTP or KUSUKA card. Second, SSFAs need more flexibility in repayment, as their income is often seasonal, making standard bank repayment schedules difficult to follow. Third, the relationship between SSFAs and middlemen is deeply rooted in cultural ties, resembling a patron-client relationship based on trust. SSFAs feel more comfortable dealing with people they know and trust, as they can negotiate repayment terms if they face difficulties. While this system addresses short-term financial needs, it may also perpetuate dependency on middlemen and inhibit SSFAs' participation in higher-value market segments.

> Less than IDR 1 billion in loans from the Ministry of Maritime Affairs and Fisheries has been disbursed. The fishing community remains hesitant to engage with formal financial institutions due to the collateral requirements, which act as a significant barrier to accessing these loans.
>
> **- Representative of Depart of Fisheries, City of Ambon**

When it comes to formal and semi-formal sources, KUR loans are most preferred, however, for a large majority of fisherfolks who cannot qualify for it, loans from microfinance institutions are more popular to meet short-term working capital and consumption needs of SSFAs

KUR from state-owned banks might be the most popular formal loan product among SSFAs who have the collateral and means to qualify for it. The staff from state-owned banks are also diligent in conducting outreach, making the community more aware about the KUR loans. Additionally, for those living far from banks, KUR from state-owned banks is more convenient because they can make payments through state-owned bank agents in their villages, which are often the only last mile banking touch points available in those areas. However, other products are also gaining prominence, such as loans from cooperatives, microfinance institutions like PNM, and tech companies like e-Fishery. These loans although small are easily accessible and serve the working capital needs of SSFAs. While they use these loans for productive needs—such as purchasing vessels, buying feed, or developing processing units—they also tend to use some of the loan funds for personal expenses.

Case study: Navigating the tides: How financial access is transforming Indonesia's small-scale fishers

In the coastal towns of East Nusa Tenggara, the daily grind of small-scale fishers is as unpredictable as the ocean itself. For Asrul, a 47-year-old fisherman from Kupang, the waves of financial instability are as constant as the tides. His story, like that of many others, reveals the deep challenges faced by fishers who rely on the sea for their livelihood, yet struggle to access the financial services that could secure their future.

The struggles of a traditional fisherman

Asrul has spent his entire life navigating the waters of Kupang, honing skills passed down through generations of his Bugis ancestry. Despite his expertise, he faces a reality that many small-scale fisherfolks in Indonesia know all too well, the lack of access to formal financial services. Without capital, even basic upgrades to his 30 GT boat are out of reach. Fishing trips are costly, with fuel, supplies, and crew wages eating into the IDR 1 million needed daily to keep his boat afloat. His wife manages their household on a tight budget, often needing IDR 200,000 a day to cover expenses.

In an effort to make ends meet, Asrul has turned to middlemen and informal lenders. The loans come without interest but at a high cost, as he is forced to sell his catch at lower rates. This arrangement significantly impacts his potential earnings.

A neighbour's alternative path: The impact of formal finance

Just a few kilometres away, another fisherman embarked on a different journey. Seven years ago, Melki, 55 years old, took out his first loan from a state-owned bank, borrowing IDR 20 million to purchase a second-hand boat. Using his motorcycle registration as collateral, the process was surprisingly straightforward, and the investment quickly paid off. As his business grew, so did his ambitions. A year later, he took out a second loan for IDR 50 million to upgrade his boat's engine, increasing his efficiency and, in turn, his income.

The transformative power of these loans was clear. Not only did they allow him to fish more effectively, but they also provided him with financial security. When his health began to fail, preventing him from going out to sea, his income didn't stop. As the boat owner, he still earned a share of the profits from the catch. The crew might do the physical work, but his investment in the boat allowed him to maintain a steady stream of income.

What sets these two fishermen apart is access to formal finance. For Asrul, the road to financial inclusion remains challenging, hindered by a lack of financial literacy and social barriers. Melki's experience, on the other hand, shows how the right loan at the right time can change everything.

2. Middlemen and other value chain actor's access to finance

Middlemen and intermediaries are usually able to access KUR funding as well as informal loans from value chain actors. In many cases they use that funding to also on-lend to fisherfolks

Middlemen and intermediaries, often embedded within the fishing communities, act as the first point of sale for SSFAs. While they face similar challenges related to seasonal income fluctuations, their access to greater resources and financial literacy allows them to secure formal funding, such as KUR loans. They not only use these funds for their own operations but also lend to fisherfolks.

In addition to formal funding, they often borrow from larger intermediaries or informal sources to fulfil their financial needs. They then extend credit to fisherfolks, sometimes offering interest-free loans on the condition that the fisherfolks agree to sell their catch at lower prices. These intermediaries, in turn, maintain strong ties with larger actors in the value chain, ensuring both financial backing and a steady buyer for the products they collect.

This system reflects the intricate dynamics of the fishing value chain, where intermediaries serve as important links between fisherfolks and larger markets. Their role contributes to the sustainability of fishing operations but can also shape the financial decisions of fisherfolks based on the terms set by intermediaries. While they provide support, intermediaries also significantly influence the pricing and distribution of fish.

> My monthly income is below Rp 1 million. The fisherfolks who supply crabs to me know me well. I choose them based on mutual trust. I also provide them with capital, usually because they need funds to repair broken engines or faulty lights. I have a KUR loan because I need additional capital, as the funds from the 'boss' are insufficient. Although I prefer borrowing from the boss because it is more flexible and based on trust, whereas with the bank, I have to repay on time.
>
> **- A middlewoman in Salemo Island, South Sulawesi**

Logistics providers such as cold storages also facilitate formal loans for fisherfolks using their services

Established operators, for instance, cold storage facilities also provide loans to fisherfolk who use their services. The purpose of these loans can vary and does not have to be directly related to fishing activities. However, they also sometimes facilitate KUR applications for fisherfolk by collaborating with banks for account openings and KUR registration.

> Bank BRI, Mandiri, and BCA collaborate with our cold storage for opening accounts or KUR funding. We facilitate the registration of fisherfolks for KUR at BRI. For loans outside of KUR, fisherfolks go directly to the boss; these loans can be for Umrah or weddings. The repayment is made through deductions from invoices (fish invoices), with the amount of deduction based on mutual agreement. Some fisherfolks also channel loans from us to other fisherfolks. Currently, there are over Rp 20 billion in non-performing loans among fisherfolks, such as fisherfolks gone missing or switching companies. Some loans have also been written off.
>
> **- Cold storage manager in Makassar, South Sulawesi**

On the other hand, companies like e-Fishery are beginning to enter the market by providing digital loans for fish feed products, allowing borrowers to repay the loans at harvest time, which is convenient for fisherfolk who rely on seasonal income. Although the company has digital processes, they still have field officers who serve as important last mile link to market loans and complete the paperwork with the loan recipients.

MSMEs usually rely on their own savings and government's capacity building support to start their business

Micro and small processing units typically rely on personal capital to start their businesses, driven by the potential of blue food products. Many owners transition from other professions, using savings from previous jobs, while others continue family-run businesses. Due to limited capital, these businesses often start small, but access to local government training and information helps improve their capacity. This support offers ideas for scaling operations, and many entrepreneurs are now exploring ways to enhance their products and access broader markets.

> I work as a civil servant (PNS), but I also run a side business in fish smoking. I got into this because I have a degree in fisheries, and it's something I genuinely enjoy. My father used to work at the port, so I've been able to use his advice and network to help the business. It's run by my family and a helper at home. My supervisor is okay with it as long as it doesn't interfere with my main job.
>
> **- Smoke fish entrepreneur in Makassar, South Sulawesi**

As MSMEs scale their business, they are still hesitant to take formal loans due to uncertain market conditions

Most blue food processing entrepreneurs start small, limiting their reach to local markets, often within their own city. As a result, their products typically require simpler processing and packaging. However, when they aim to expand

to markets outside their city or province, or even into export markets, their primary concern becomes maintaining product quality during transportation. Ensuring compliance with safety and packaging standards for exports is also crucial. Expanding operations usually requires investing in additional tools and machinery, which can be expensive. Despite this need, many entrepreneurs are hesitant to take out loans due to concerns about repayment, especially given the competitive nature of external markets. Instead, they often seek local government support to obtain the necessary equipment, avoiding the financial risks of loans.

> We actually tried exporting once, but it didn't work out. The customer asked if our milkfish could last at room temperature. We do have an eye for the machines, including one for sterilization, but they're super expensive. The fisheries department even tried to help me get that machine, but so far, no luck. My other option is to take out a KUR loan, but I'm still hesitant about that.
>
> **- A milkfish processing unit entrepreneur in Pangkep, South Sulawesi**

Conclusion

The Blue Food Assessment underscores Indonesia's immense potential to harness small-scale fisheries as a driver of nutrition, sustainability, and economic prosperity. Despite facing considerable challenges in the value chain, environmental sustainability, and financial accessibility, the government has demonstrated a strong commitment to addressing these issues. The report identifies areas where targeted interventions and reforms can have a significant impact, stressing the importance of collaboration among stakeholders—including policymakers, industry players, and local communities—to overcome barriers and unlock opportunities.

With blue food playing a pivotal role in Indonesia's economy and livelihoods, the country is not only poised to achieve substantial domestic benefits but also to emerge as a global leader in sustainable fisheries management. By leveraging the blue food sector's potential, Indonesia can set a benchmark for other nations, transforming its challenges into a case study for innovation and resilience. The insights and recommendations provided in this assessment offer a roadmap for policies and initiatives that strengthen fishing communities, enhance food security, and promote sustainable development. It serves as a strategic resource for guiding reforms that foster resilience and sustainable growth, ensuring long-term benefits for the environment and future generations.

Annexures

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Annex 1: International Best Practices

Environment | Productivity, value creation, and export

1. Pioneering sustainable aquaculture: How Norway transformed declining wild salmon stocks into global leadership in salmon exports through Innovation

Norway has transformed into a global leader in sustainable seafood exports, particularly in salmon, with production now reaching 30 million annually. This success was driven by the decline in wild salmon stocks during the 1970s, prompting the development of a more sustainable and innovative approach to aquaculture.

Central to Norway's transformation was the use of floating cages for controlled salmon farming, reducing pressure on wild populations and ensuring steady production. Over time, Norway adopted automated breeding techniques, which improved efficiency, reduced feed costs by 15%, and minimized environmental impact, especially ocean pollution. Norway's focus on research and development (R&D) in areas like sustainable feed, disease prevention, and eco-friendly infrastructure further solidified its leadership in responsible fish farming.

Norway's success also lies in its strong regulatory framework. The Aquaculture Act set clear guidelines for sustainable production, licensing, and fair competition. In 2013, the Green Licenses Scheme provided incentives for companies adopting environmentally friendly practices by offering reduced fees and prioritized licenses. This scheme supported smaller firms' entry into the market, ensuring balanced competition while maintaining sustainability across the industry.

Key outcomes

Norway's aquaculture industry has seen significant improvements in production efficiency and sustainability. Innovations like floating cages and automated breeding have boosted production while minimizing environmental harm. The Green Licenses Scheme has fostered fair competition and ensured that sustainability is at the core of industry practices. Norway's model is now recognized globally as a benchmark for sustainable aquaculture.

Lessons for Indonesia

Indonesia can draw lessons from Norway's approach by investing in resource-efficient technologies like floating cages and automated breeding systems to boost productivity while minimizing environmental impact. Developing a robust regulatory framework that encourages sustainability—through incentives such as the Green Licenses Scheme—can promote both industry growth and environmental responsibility. Additionally, prioritizing R&D in sustainable feed alternatives and disease prevention will help Indonesia build a more resilient and sustainable aquaculture sector.

Sources: YouTube: Farm Life; Afewerky et al, 2023; C Osmundsen et al, 2022; Norwegian Ministry of Fisheries and Coastal Affairs, 2006

Nutrition

2. Elevating nutritional security through small fish production: How Myanmar and Zambia are addressing malnutrition

Myanmar and Zambia face significant malnutrition challenges, particularly among children and women. To combat this, the Small Fish Production, Processing, and Marketing (SPM) program was introduced to enhance the availability of nutrient-rich aquatic products and improve food security.

The SPM program focuses on the production of dried fish powder, a nutrient-dense product that fortifies local foods. By using locally sourced small fish, the program maximizes both nutritional benefits and sustainability within local fisheries. This approach supports vulnerable groups by improving nutrition while boosting local economies.

Success in the SPM program is driven by partnerships between government bodies, civil society, and private companies. WorldFish coordinates production and distribution, while workshops educate communities, particularly women, on the nutritional benefits of fish-based foods. The program also builds local capacity in processing and marketing, ensuring long-term sustainability.

Key outcomes

The SPM program has significantly improved nutritional outcomes by making fish-based products accessible to vulnerable populations. It supports the local economy by utilizing underused small fish and promotes long-term food security and community resilience through capacity building and sustainable practices.

Lessons for Indonesia

Indonesia can apply lessons from the SPM program by focusing on local fish production to tackle malnutrition, especially in rural and vulnerable communities. Developing nutrient-rich fish products, like dried fish powder, can help address food security while supporting local fisheries. By fostering collaboration among stakeholders—government, private sector, and civil society—Indonesia can ensure a coordinated approach, integrating education and capacity building to sustain these initiatives. Investing in processing and marketing skills for small-scale producers will ensure long-term economic and nutritional benefits.

Sources: SPM Program, World Fish

Food Loss and Waste

3. Transforming food waste into sustainable fishmeal alternatives in Singapore

To address the challenges of fishmeal replacement in the aquaculture industry, Singapore is pioneering innovative solutions that focus on natural waste reduction and insect farming. Led by Blue Aqua, an aquaculture service provider, in collaboration with the Singapore government, this initiative is committed to developing sustainable protein sources that are economically viable, land-efficient, and aligned with the nutritional needs of aquatic animals.

At the heart of this initiative is a patented farming system that emphasizes energy efficiency and green recirculation, enabling multi-species growth. This technology allows for low-cost farm operations without compromising yield, making it an attractive option for aquaculture producers. In a pilot project, food waste is being repurposed to feed black soldier flies, which are then processed into high-quality protein. This protein is blended with algae to create a sustainable fishmeal alternative, enriched with essential nutrients for aquatic species.

This project is particularly important for Singapore, where less than 20% of food waste is currently recycled. By utilizing bioconversion techniques, Singapore is addressing both environmental and economic challenges in the food industry. The combination of waste reduction and sustainable protein production presents a scalable solution for the broader global aquaculture sector, positioning Singapore as a leader in eco-friendly food production practices.

Key outcomes

This innovative approach has the potential to revolutionize aquaculture by offering a sustainable alternative to traditional fishmeal. The use of food waste to produce insect-based protein contributes to both waste reduction and resource efficiency. Singapore's focus on sustainability not only enhances environmental responsibility but also promotes economic viability for the aquaculture industry, setting a benchmark for future food production practices.

Lessons for Indonesia

Indonesia can learn from Singapore's innovative use of food waste in producing sustainable fishmeal alternatives. By adopting bioconversion techniques, Indonesia can tackle its food waste problem while contributing to sustainable aquaculture. Investing in insect farming and other resource-efficient technologies can help Indonesia reduce its reliance on traditional fishmeal and improve environmental outcomes. Additionally, focusing on waste reduction in the broader food industry will promote economic and environmental sustainability, contributing to a more resilient blue economy.

Sources: Reports from Blue Aqua

Environment | Productivity, value creation, and export

4. Transforming fisheries through innovation: Peru's National Program for Fisheries and Aquaculture Innovation (PNIPA)

Launched in 2017 by Peru's Ministry of Production, the National Program for Fisheries and Aquaculture Innovation (PNIPA) aims to enhance the sustainability and competitiveness of the fisheries sector through research, innovation, and capacity building. Supported by the World Bank and FAO, PNIPA promotes responsible fishing and aquaculture practices while improving productivity, positioning Peru as a leader in fisheries innovation.

PNIPA's core strategy involves a competitive grant system that funds projects focusing on increasing productivity, enhancing traceability, and adopting sustainable practices. This approach has led to advancements in aquaculture techniques, particularly for species like jumbo squid and trout, boosting production while ensuring environmental responsibility. PNIPA also strengthens partnerships between local fishers, research institutions, and government bodies, fostering collaboration that helps small-scale producers access markets and adopt advanced technologies.

A key feature of PNIPA is its emphasis on capacity building. The program offers training and workshops to fishers and farmers, equipping them with skills to implement sustainable practices. By integrating ancestral knowledge with modern technologies, PNIPA ensures that communities manage resources efficiently while preserving cultural traditions. Governance reforms further support sustainability by aligning policy with environmental goals and enhancing the profitability of local fisheries.

Key Outcomes

PNIPA has significantly improved the sustainability and productivity of Peru's fisheries. The adoption of eco-friendly practices has strengthened resource management and climate resilience. Economically, the program has empowered local communities, especially women, by increasing market access and the value of fishery products. PNIPA's blend of traditional and modern approaches has fostered innovation, while capacity building ensures long-term benefits for both the economy and the environment.

Lessons for Indonesia

Indonesia can draw from PNIPA's approach by investing in research and innovation to drive sustainable fisheries practices. Combining traditional knowledge with modern techniques can enhance resource management, while capacity building and partnerships with research institutions can help local communities adopt sustainable practices. These strategies will support Indonesia's long-term goals for a resilient and productive blue economy.

Environment | Productivity, value creation, and export

5. Singapore's Sustainable Aquaculture Plan: Transforming food production through Innovation

Launched by the Singapore Food Agency (SFA) in 2022, the Singapore Aquaculture Plan aims to boost the country's local food production as part of its "30 by 30" vision—producing 30% of its nutritional needs locally by 2030. This ambitious initiative focuses on technological innovation, sustainability, and strategic partnerships to create a highly productive, climate-resilient aquaculture industry.

Central to Singapore's plan is the AquaPolis initiative, which fosters collaboration between research institutes, universities, and industry stakeholders to develop sustainable aquaculture technologies. One key innovation is the Closed Containment Aquaculture System (CCAS), which minimizes water usage and environmental impact by reducing waste in fish farming. Additionally, real-time water quality monitoring systems have been deployed, enabling farmers to track marine health and take preventive measures when environmental conditions fluctuate. Through the Agri-Food Cluster Transformation (ACT) Fund, Singapore encourages the adoption of resource-efficient technologies, such as eco-friendly feed made from food by-products, further reducing the environmental footprint of its aquaculture operations. This fund also supports fish farmers in making long-term investments that enhance production efficiency.

The Singapore Aquaculture Plan focuses not only on production but also on fostering market linkages. By creating partnerships between local farmers and private companies, the plan has strengthened the domestic market for locally farmed fish, ensuring stable demand. Singapore's strategic focus on capacity building also ensures that fish farmers receive training in sustainable practices, further promoting innovation and resilience in the industry.

Key Outcomes

Singapore's aquaculture sector has benefited significantly from this initiative. Innovations such as the CCAS have improved resource efficiency, reduced environmental impact, and contributed to increased production levels. The use of eco-friendly feed and real-time monitoring technologies has further enhanced sustainability. Additionally, local partnerships have created stable market opportunities for fish farmers, contributing to Singapore's food security goals.

Lessons for Indonesia

Indonesia can adopt key aspects of Singapore's approach to enhance its own aquaculture sector. Investing in resource-efficient technologies such as closed containment systems can help Indonesia increase productivity while reducing environmental harm. Additionally, promoting market linkages through partnerships with private companies and government agencies can create stable demand for locally farmed products. Finally, capacity-building initiatives that equip farmers with the skills to adopt innovative practices will be crucial in ensuring long-term sustainability in Indonesia's blue economy.

Small-scale fishers and aquaculture (SSFA) | Justice

6. Philippines' FishCORAL project: enhancing financial access for coastal communities

The Fisheries, Coastal Resources, and Livelihood (FishCORAL) Project in the Philippines, in partnership with IFAD, addresses the challenges faced by small-scale fishers who are vulnerable to income volatility due to fluctuating fish stocks, market prices, and climate change. By enhancing financial access and promoting sustainable fisheries management, FishCORAL helps stabilize livelihoods and foster resilience in coastal communities.

A core element of FishCORAL is financial inclusion, achieved through partnerships with institutions like Land Bank.The project provides loans that enable fishers to invest in essential equipment like boats and fishing gear, boosting productivity. This is particularly important in remote areas where access to banking services is limited. Additionally, FishCORAL offers disaster resilience financing through the Climate Resilient Agriculture Financing Program, helping fishers recover from natural disasters and climate impacts.

FishCORAL works with DA-BFAR to provide training on sustainable fishing practices, improving the skills and knowledge of local fishers. The project also helps fishers access better markets, both domestic and international, through the Commercial Fishing Vessel Financial Program, launched in 2020.

Key Outcomes

FishCORAL has significantly improved the livelihoods of small-scale fishers by increasing access to capital, which has enhanced productivity and income stability. The integration of disaster resilience measures has further strengthened the ability of coastal communities to cope with climate-related challenges.

Lessons for Indonesia

Indonesia can learn from FishCORAL by prioritizing financial inclusion through local banks and microfinance institutions, enabling small-scale fisherfolk to access tailored credit for business growth. Introducing disaster resilience financing/insurance and coupling it with capacity-building programs will support sustainable fishing practices and improve productivity, fostering long-term resilience in coastal economies.

Sources: Reports from the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR), 2020 and LAND BANK.

Small-scale fishers and aquaculture (SSFA) | Justice

7. Social Protection for Small-Scale Fishers in Morocco

Morocco's extension of social protection to small-scale fishers (SSF) represents a well-rounded approach to ensuring financial inclusivity and enhancing economic resilience for one of the most vulnerable sectors. Recognizing the seasonal and unpredictable income patterns in fisheries, Morocco has introduced innovative financial mechanisms to provide fishers with crucial social and financial services, focusing on access to funding, social inclusion, and economic sustainability

At the core of Morocco's social protection framework is a cross-subsidization model. In this system, higher-income workers contribute more to subsidize small-scale fishers' social protection contributions. This enables fishers, with their irregular incomes, to participate in social services like healthcare and unemployment insurance. By lowering entry barriers to these services, Morocco ensures that SSF workers gain financial security, particularly during off-peak fishing seasons.

To further support fishers, microfinance schemes and subsidized loans have been introduced. These loans allow fishers to invest in essential equipment such as boats and nets, ensuring better productivity and operational continuity. Flexible repayment terms have been tailored to fit the irregular income streams characteristic of small-scale fisheries.

In addition to financial loans, small-scale fishers in Morocco also benefit from weather-related insurance, offering protection against natural disasters and poor fishing seasons. This insurance mechanism ensures fishers are financially supported when environmental conditions hinder their ability to fish.

Morocco has also connected small-scale fishers with public procurement processes, ensuring a stable market for their catches. By securing contracts with public institutions, fishers can rely on a steady income, even during low-demand periods. This boosts both economic stability and food security within the sector.

Key Outcomes

Morocco's social protection initiatives have improved access to healthcare and insurance for small-scale fishers. Microfinance and market access have empowered fishers to reduce poverty and promote sustainable practices, ensuring financial support even in lean periods.

Lessons for Indonesia

Indonesia can learn from Morocco's approach by implementing a cross-subsidization model that provides financial inclusivity for small-scale fishers. Offering subsidized loans, insurance schemes, and facilitating market access through public procurement could support Indonesia's vulnerable fishers, ensuring greater economic stability and poverty reduction.

Annex 2: Existing policies and initiatives for fisheries in Indonesia

Existing policy initiatives	Description	Benefits	Insights from the field
Quota-Based Measured Fishing Policy, Ministry of Fisheries and Marine Affairs	This policy is a part of the nation's Blue Economy Initiative. It regulates the total allowable catch (TAC) for commercial species. The policy includes three types of quotas: for industrial fishers, local fishers, and non-commercial purposes like research and training	The policy intends to balance economic benefits and ecological sustainability by preserving fish stocks and reducing overfishing.	The policy's full implementation has been delayed until 2025 to ensure all necessary infrastructure is fully developed and that effective communication with key stakeholders, including local fishers is achieved. In West Manggarai, NTT, the government's zoning regulations, which re-designated former fishing grounds as part of conservation areas like Komodo National Park, initially faced resistance from local fishers. However, over time, the integration of these areas into tourism initiatives has provided new economic opportunities, particularly through tourism-related jobs, which has led to more acceptance from local communities.
GEMARIKAN program, Ministry of Fisheries and Marine Affairs	The campaign program promotes the consumption of fish, especially among children, pregnant women, and other vulnerable groups.	The awareness of the health benefits of fish is hoped to boost its consumption. The end goal of this movement is to reduce the stunting rate.	In NTT, the GEMARIKAN program plays a crucial role in tackling malnutrition and stunting, which are ongoing concerns in the region. The program engages community leaders and local fishers to increase participation from vulnerable groups, particularly in rural and underdeveloped areas. However, limited infrastructure in NTT can sometimes hinder its effectiveness, as access to fresh fish, especially in inland areas, remains a challenge.

Existing policy initiatives	Description	Benefits	Insights from the field
The Modern Fishing Village, Ministry of Fisheries and Marine Affairs	The program intends to revitalize fishing villages by improving their infrastructure and facilities and providing capacity-building opportunities for fishers and their families.	The program's goal is to create well-organized, clean, and healthy fishing communities that enhance the productivity and well-being of fishers and their families.	In Warloka Village, West Manggarai, one of the pilot locations for the project, residents have begun to receive various forms of support, which include: • Improvements to road access, reducing travel time to the city from a 2.5-hour boat trip to just 30 minutes; • The establishment of fisher groups, along with training programs for both fishers and their wives; • The construction of new facilities aimed at boosting fisher productivity and fostering a supportive ecosystem for their work.
Solar subsidy program for fishers, Ministry of Energy and Mineral Resources	Fishers with boats 30 GT and below are eligible to get subsidized diesel once they have been verified. They need to get a letter recommendation from the Harbor Master or Head of Regional Work Unit (SKPD) to avail the subsidy.	The subsidy enables small-scale fishers to access more affordable fuel, significantly reducing their operational costs. The verification process ensures that subsidies are distributed accurately, targeting those who genuinely need financial support. This initiative enhances the sustainability of small-scale fishing operations, contributing to the welfare of fishers.	While the program has delivered clear benefits, several challenges have emerged that policymakers should address: • The program only applies to fishers who own boats, whereas some fishers who rent boats and have to purchase their own fuel are not eligible for it. • Some fishers struggle to generate the capital needed to buy fuel. Due to limited financial resources, they often turn to intermediaries who offer fuel at higher prices but with a "buy now, pay later" arrangement. • In remote areas, access to fuel stations (SPBU) remains difficult.

Existing policy initiatives	Description	Benefits	Insights from the field
The electrifying marine program, PT PLN Persero, Ministry of Fisheries and Marine Affairs	PT PLN Persero provides services to meet the electricity needs of the marine and fisheries sectors, including powering ships at ports, supplying electricity to mini cold storage facilities, and fulfilling energy demands at piers, fish landing bases (PPI), and fish auction sites (TPI) across Indonesia.	With increased electrification, key players in the marine and fisheries sectors are expected to reduce their reliance on fuel. Electrification cuts the high cost of fuel and also brings environmental benefits and operational efficiency. Reliable electricity at ports and fish auction sites can enhance productivity by ensuring that cold storage and other key infrastructure operate efficiently.	The government, PT PLN Persero, and other relevant stakeholders need to raise awareness of this program, particularly among fishers. For example, in Lamongan, aquaculture farmers expressed their hope for access to electricity in their pond areas. Currently, they rely on diesel fuel to power pumps and aerators, but they have calculated that switching to electricity could cut their costs by up to 60%. However, they only became aware of this program during the interview, after learning about it from a representative of the Department of Marine Affairs and Fisheries.
KUSUKA Card, Ministry of Fisheries and Marine Affairs	The KUSUKA card serves as a unique identity for key players in the marine and fisheries sectors, such as fishers, aquaculture, salt farmers, fish processors, and fish marketers.	The KUSUKA card is a primary requirement for beneficiaries to receive government assistance, which is typically distributed through fisher groups.	Although around 69% of fishers now have a KUSUKA card, many report experiencing limited direct benefits from it. The card is primarily used as a tool for receiving government aid, which is distributed through fisher groups. However, these groups are often underutilized, mainly functioning as distribution channels rather than active community platforms. This limits their potential for collaboration, training, and resource-sharing, which could maximize the card's value for fishers.

Existing policy initiatives	Description	Benefits	Insights from the field
Marine and Fisheries Business Capital Management Agency (LPMUKP), Ministry of Fisheries and Marine Affairs	LPMUKP is an institution under the Ministry of Fisheries and Marine Affairs, created to manage working capital assistance for fishery sector actors, both in the form of cash and in-kind support.	Through LPMUKP, fishery sector actors can access low-interest capital and financing.	While some fishers rely on formal financial assistance, such as loans from banks or other financial institutions, their use of the LPMUKP program remains very low. This could be due to a lack of awareness or limited access to the program. Therefore, LPMUKP must enhance its visibility and accessibility, particularly for small-scale fishers.

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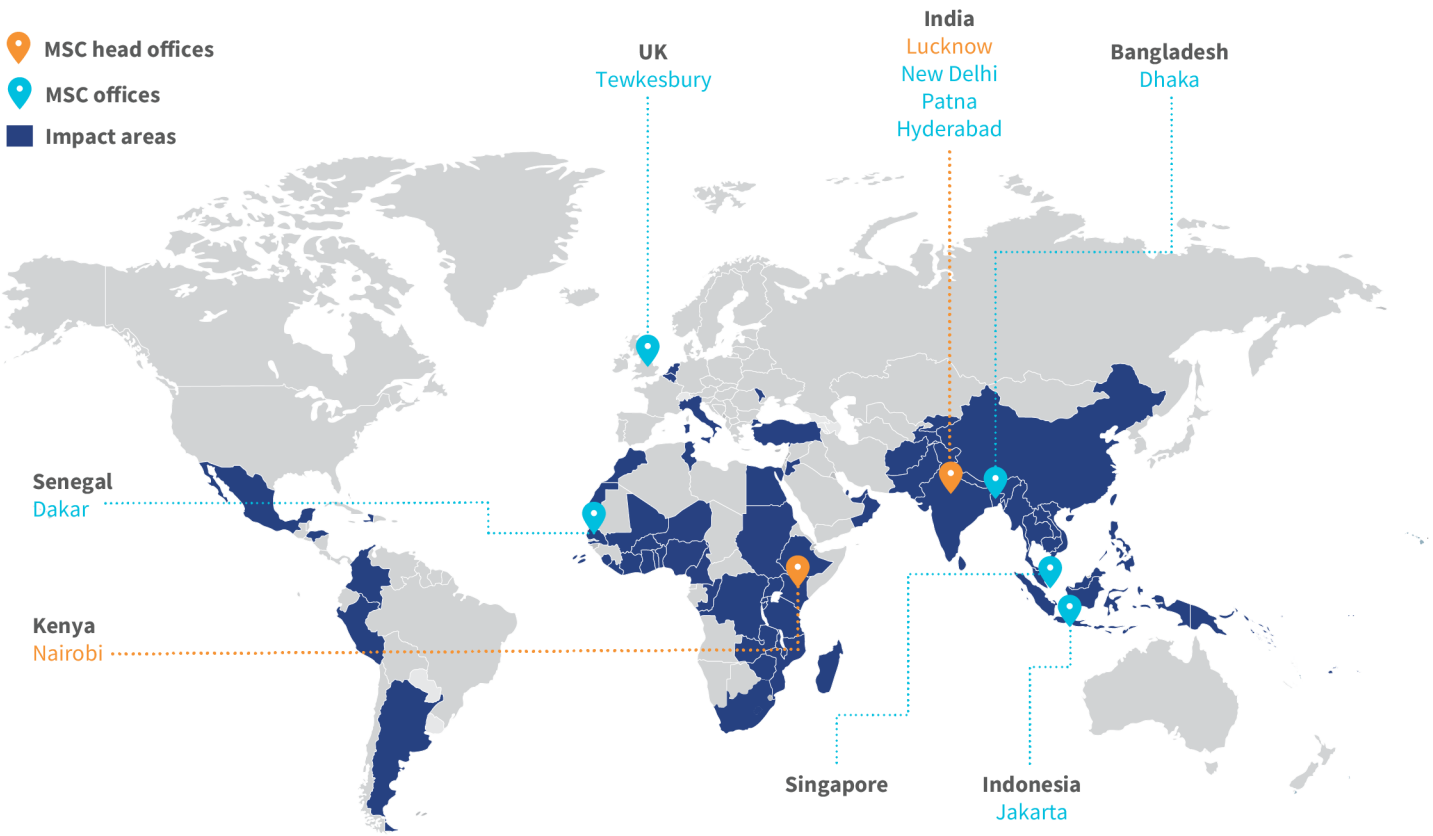

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