

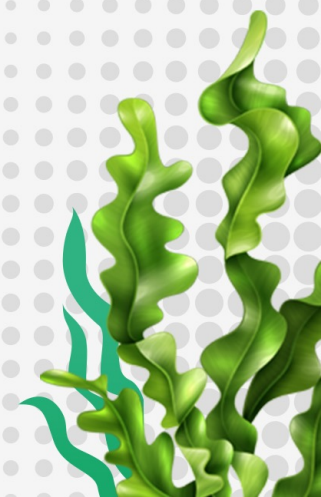


BOOKLET
SUMMARY

BLUE FOOD ASSESSMENT IN INDONESIA

MINISTRY OF NATIONAL DEVELOPMENT PLANNING/
NATIONAL DEVELOPMENT PLANNING AGENCY

OCTOBER 2024





Acknowledgement

The Blue Food Assessment in Indonesia is a result of collaboration between stakeholders in the Government, Development Partners, Universities, and Private Sector.



BAPPENAS

Kementerian Perencanaan Pembangunan Nasional/
Badan Perencanaan Pembangunan Nasional



Stanford
Center for
Ocean Solutions

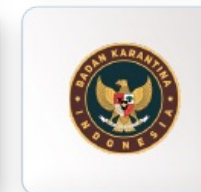




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Blue Food Definition



Aquatic Food (Blue Food) is derived from aquatic animals, plants, and algae that are cultivated and caught in freshwater and ocean.

Blue Food Is A Solution To Maintain Global Food Security

- Blue Food is integrated into the National Food System to achieve Indonesia Emas 2045 vision through food self-sufficiency.
- Blue Food includes production, consumption, marine and aquaculture, market expansion and access to the value chain, food resilient system, small-scale producers empowerment, sustainability certification and product competitiveness, innovation, and investment (Indonesia Blue Economy Roadmap, 2023)
- Blue Food development is part of sustainable, healthy, and resilient food system transformation based on local knowledge and resources. Blue Food integration is needed to provide sufficient, diverse, and balanced nutrition for healthy and safe food for all.



Global Blue Food Assessment



Blue foods provide much
more than protein

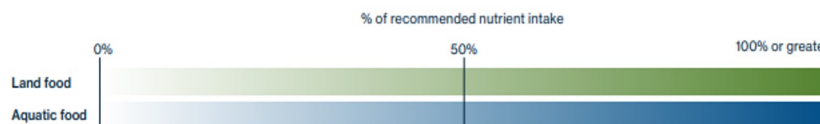
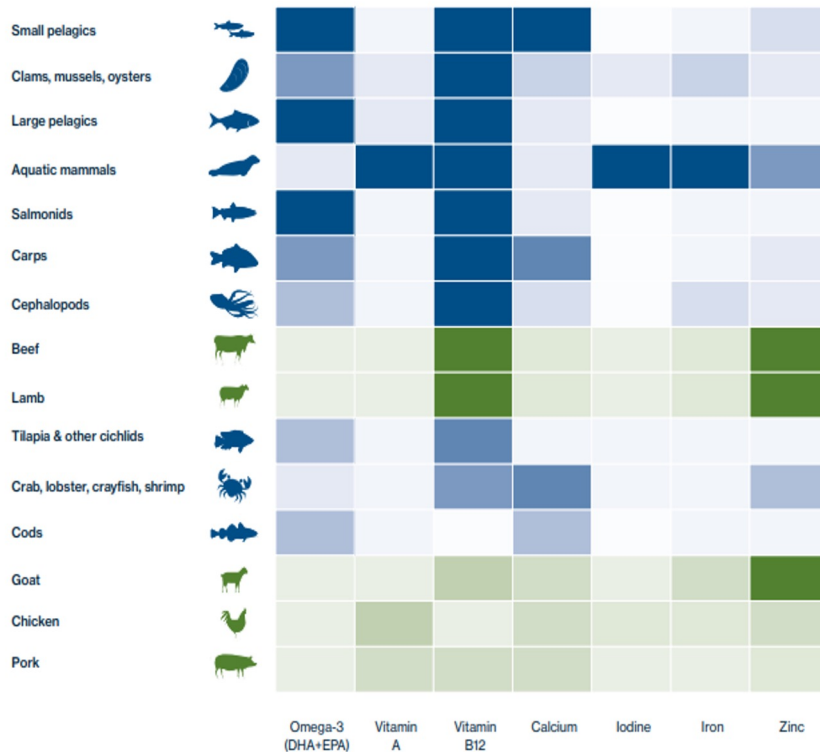


Blue foods have lower environmental
footprints than land-based foods



Blue food systems are a cornerstone
of many rural and national economies

*The diversity of blue food systems
offers opportunities to simultaneously
work toward multiple goals, including
delivering better nutrition, leaving a
lighter environmental footprint,
improving livelihoods and increasing
the equity of the distribution of
benefits.*



Aquatic mammals are important sources of nutrition and have strong cultural values for some local and Indigenous communities. However, they often have a highly threatened conservation status. The BFA does not recommend consuming aquatic mammals except in the case of local or Indigenous communities that have been granted access rights to take and consume them.



More than 2,500 species
or species groups

of fish, invertebrates and aquatic plants
are wild caught or cultivated for food.



More than
800 million people

depend on blue food systems for their livelihoods,
mostly in small-scale fisheries and aquaculture.



Over 3 billion people

get 20% of their animal protein from blue foods, along
with essential nutrients like Vitamin A, Vitamin B-12,
calcium, iodine, iron, zinc and omega-3 fatty acids.



Global demand
for blue foods

is expected to double in live weight by 2050.



Small-scale fisheries
and aquaculture

produce more than half of the global fish catch
and over two-thirds of blue foods for
human consumption.



Blue foods vary in their
environmental footprint

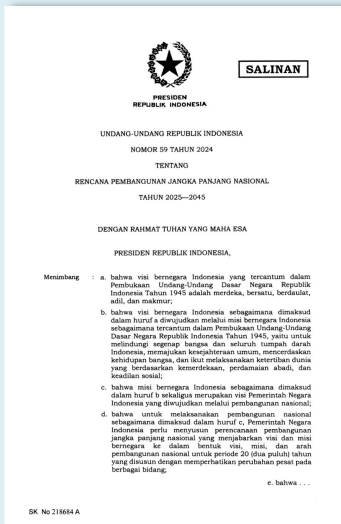
but most provide animal-source protein with relatively
low greenhouse gas emissions and biodiversity impacts
compared to land-based animal-source foods.



Blue Food Assessment Objectives and Scopes

National Long-Term Development Plan 2025-2045

The integration of aquatic food as part of the food system to provide sufficient, diverse, balanced, nutritious, healthy, and safe food is one of the policy directions to achieve Energy, Water, and Food Independence Resilience.



Indonesia Blue Economy Roadmap

Blue food (fisheries) is one of the priority sectors in the development of blue economy as a new source of growth.

Enhancing existing sectors will provide a stronger boost to optimize development and achieve the expected outcomes.



Blue Food Assessment Objectives



Identify and map the current condition of aquatic food to be further outlined in strategic steps to achieve the target of aquatic food development as stated in the Blue Economy Roadmap.



Strengthening the role of aquatic food in the food system towards a blue transformation, which is a more efficient, inclusive, resilient, and sustainable food system for better production, better nutrition, a better environment, and a better life.

Blue Food Assessment Dimensions



Nutrition



Environment



Small-Scale Fisheries & Aquaculture



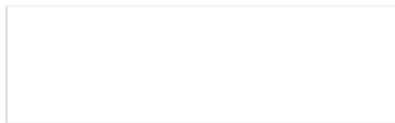
Justice



Productivity, Value Creation, and Export



Blue Food Assessment Methodology in Indonesia





Blue Food Assessment Methodology In Indonesia

Primary Analysis



Micro-level Survey

- Blue Food Survey to get primary data on existing conditions in 12 provinces.
- Descriptive analysis and contextual analysis of the regional area
- Results of identification and mapping of Indonesia's blue food conditions
- Recommendations for Indonesian blue food development policies in achieving blue transformation.

Qualitative Survey

- In-depth qualitative study of primary data survey results in 4 provinces.
- Thematic case studies based on qualitative survey analysis covering nutrition, gender, and Financial Inclusion.
- Effective and contextual roadmap from the local perspective and strategic blueprint for progress on the six pillars.

Secondary Analysis



1. Literature Review

- Identifying initial conditions.
- Descriptive analysis using secondary data.
- Secondary Data Assessment based on 5 BFA dimensions.



2. Regulation Review

- Identify regulations and policies related to Blue Food.
- Identify institutional gap factors.
- Identify policies to develop intervention programs to address small-scale fisheries issues in the context of Blue Food.



**Policy Recommendation for
Mid-Term National Development Plan 2025-2029**

Stanford
Center for Ocean Solutions &
Center on Food Security and
the Environment





Surveys and Respondents (1/2)

Survey Location Characteristics

North Sumatra,
West Java, East
Java, North
Kalimantan, and
South Sulawesi

Riau Islands,
Bangka Belitung,
West Nusa
Tenggara, East
Nusa Tenggara,
North Sulawesi,
Maluku, and
North Maluku

5 (five) provinces based
on their significant
production of capture
fisheries, aquaculture,
marine-based
manufacturing, seaweed,
and marine tourism

7 (seven) provinces
based on their
archipelagic
characteristics

Primary Data Survey (N=4,000)



1500
Fishermen



1000
Fisheries Processing
Enterprise



1000
Fisheries
Cultivator



500
Fisheries Value
Chain Actors

Qualitative Data Survey (N=144)



26 Fisherwomen



7 processing units



85 Fisherfolks



8 value chain actors



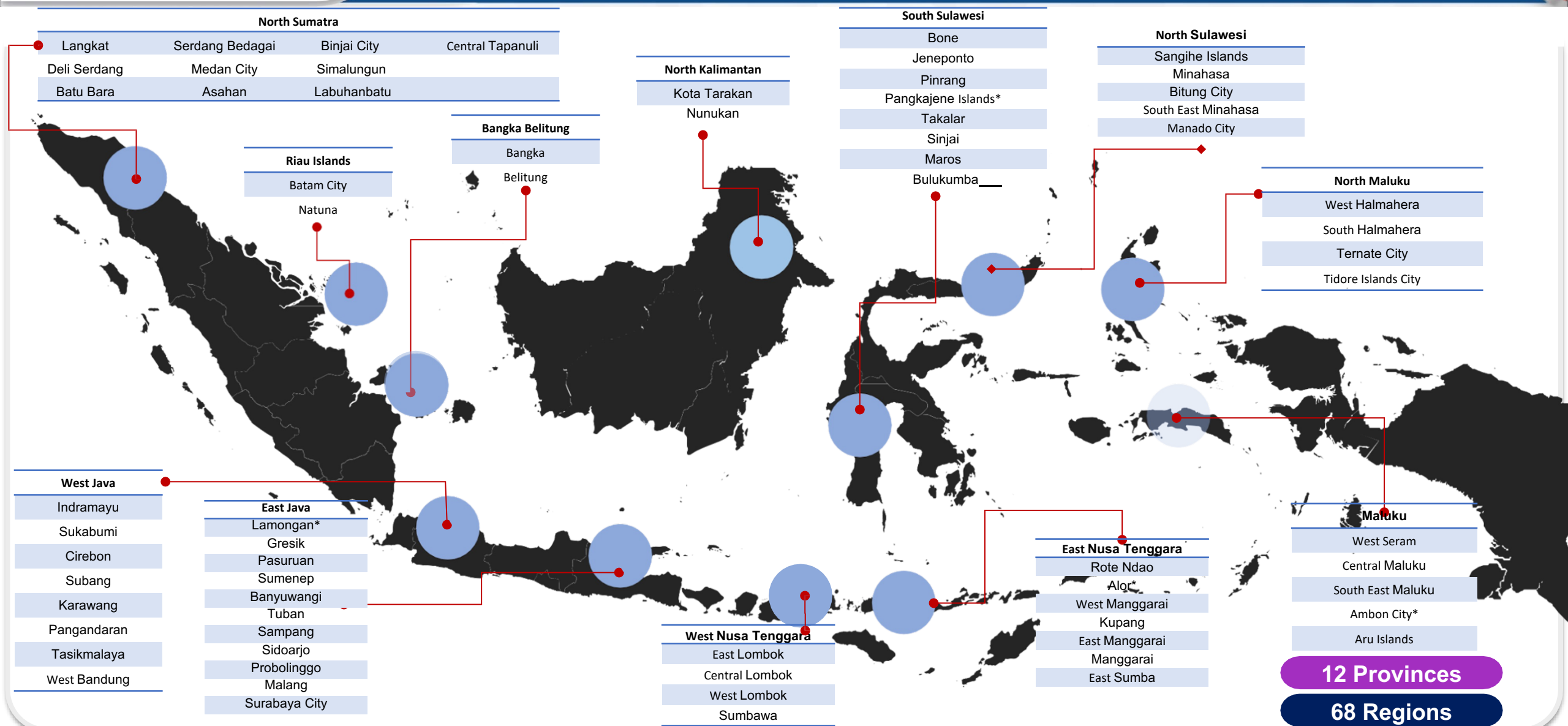
14 Intermediaries



5 government actors



Surveys and Respondents (2/2)





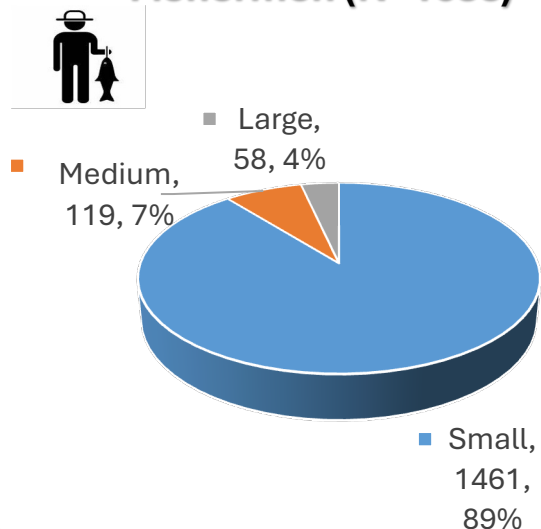
Key Findings of Blue Food Assessment in Indonesia



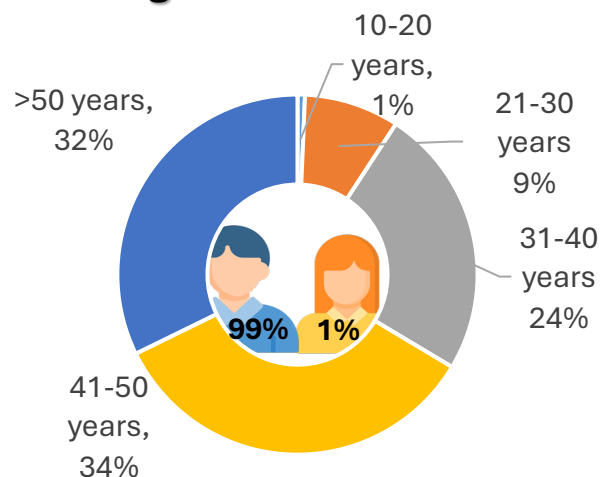
Fishermen

In Indonesia, the capture fisheries sector is predominantly composed of small-scale fishermen, who constitute approximately 89% of the total fishing population. The vast majority of these fishermen are male (99%), with about 66% being over 40 years old. Additionally, many Indonesian fishermen prefer to work individually and without formal contracts.

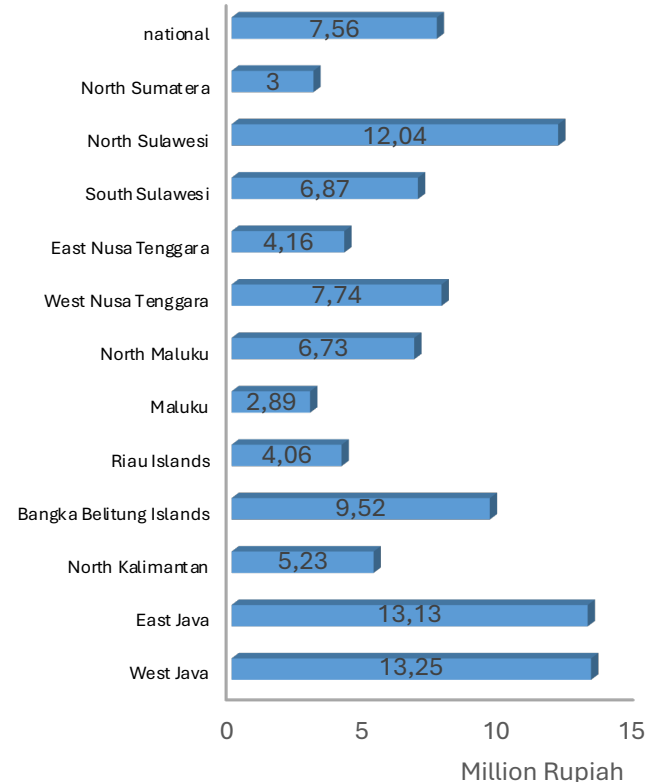
Fishermen (N=1638)



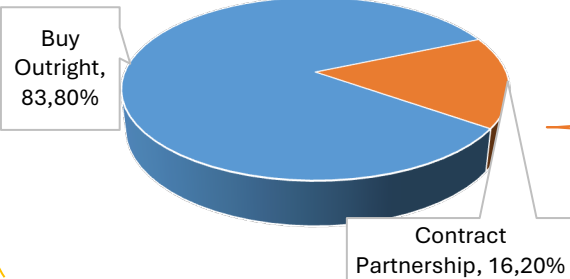
Age and Gender



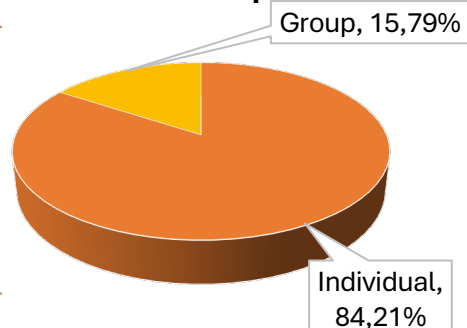
Average Monthly Income



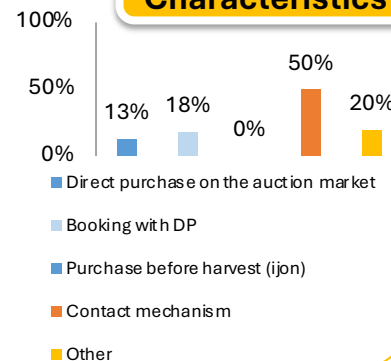
Sales System



Contract/Partnership Mechanism



Business Characteristics



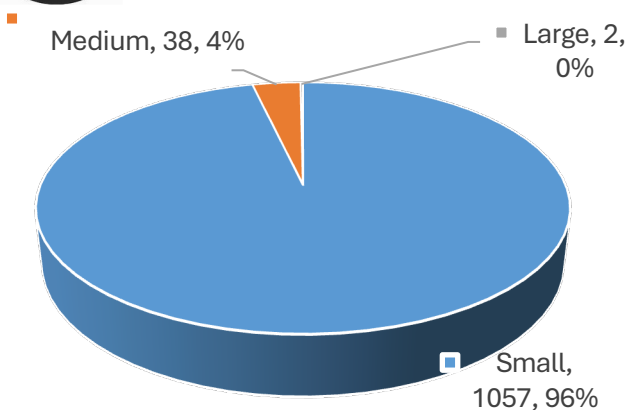


Aquaculture Farmers

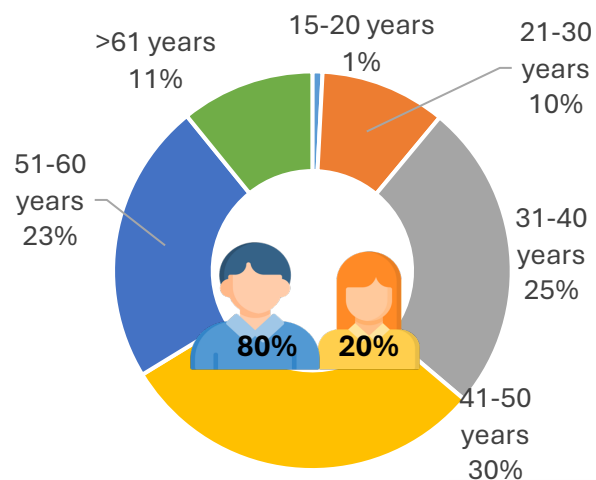
The Aquaculture farmers sector predominantly comprises small-scale aquaculture constituting approximately 96% of the total aquaculture population. The vast majority of these aquaculture are male (80%), with about 30% being over 40 years old up to 50. Most aquaculture farmers prefer to work individually rather than on formal contracts.



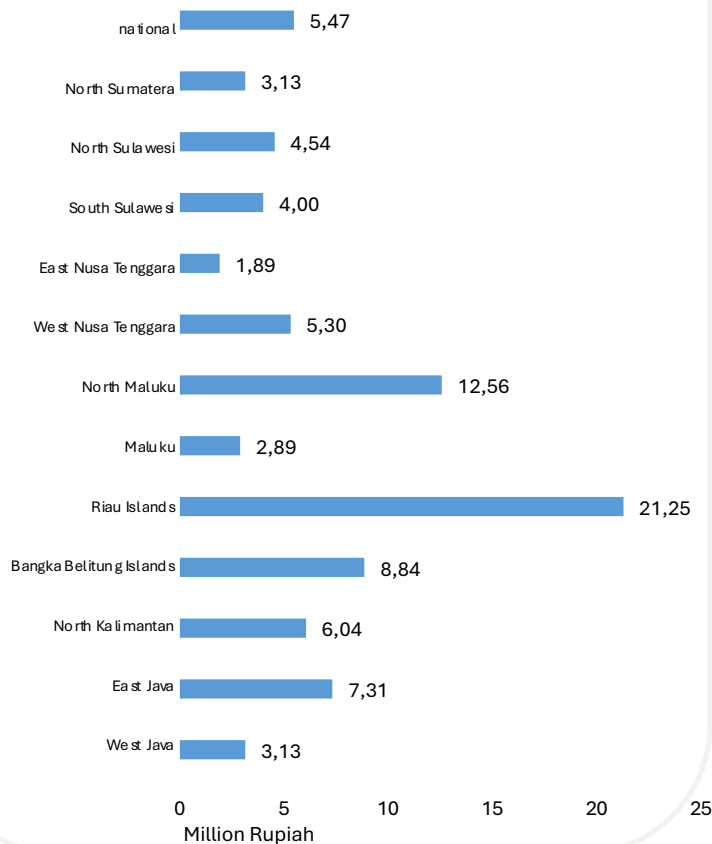
Aquaculture Farmers (N=1097)



Age and Gender

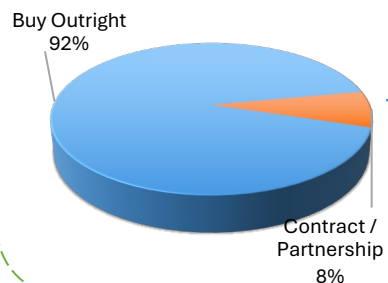


Average Monthly Income

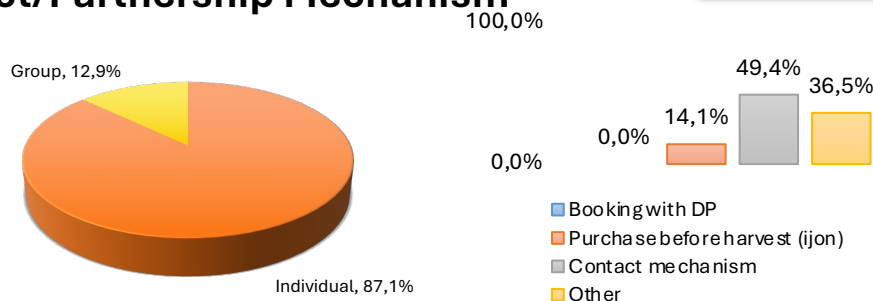


Business Characteristics

Sales System



Contract/Partnership Mechanism



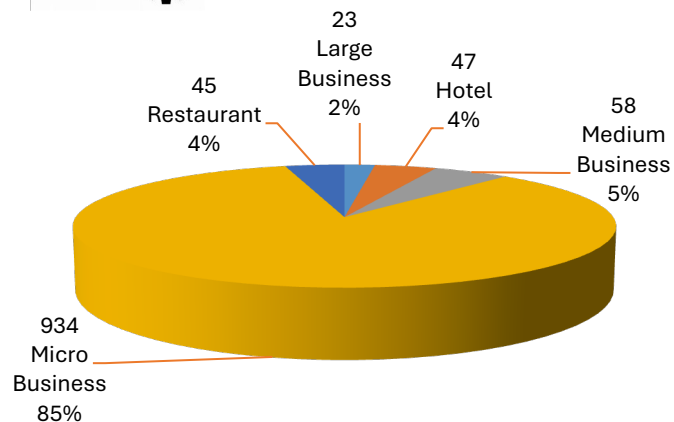


Fish Processing Units (1/2)

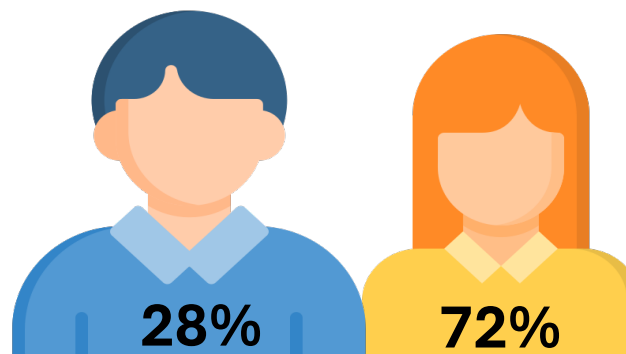
The fish processing unit predominantly comprises micro businesses constituting approximately 85% of the total fish processing unit population. In contrast to fishermen and aquaculture farmers, the vast majority of these fish processing units are female (72%). Most fish processing units prefer to sell their product domestically.



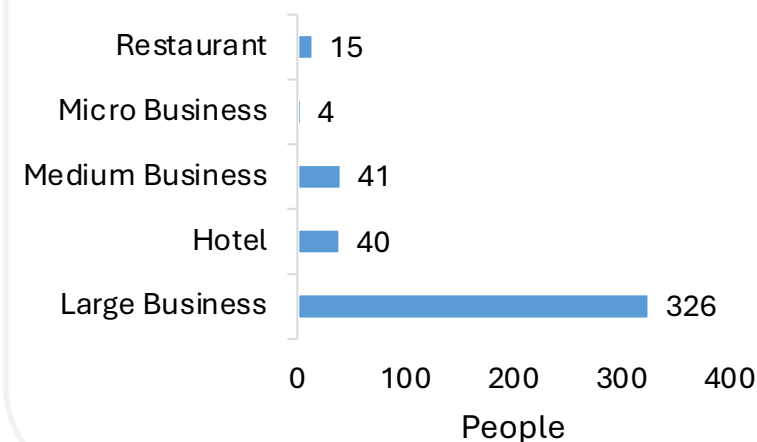
Fish Processing Unit (N=1107)



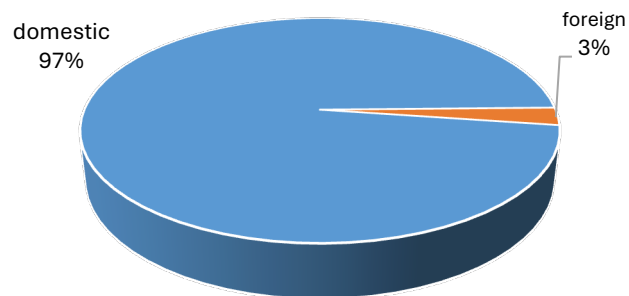
Gender



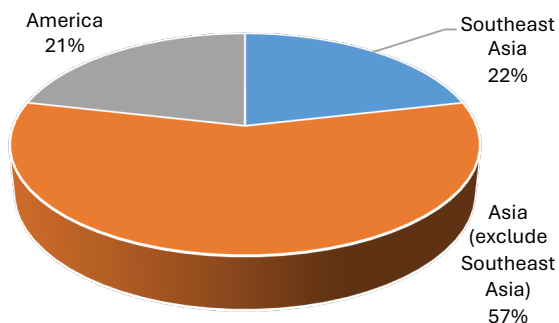
Number of Workers (average)



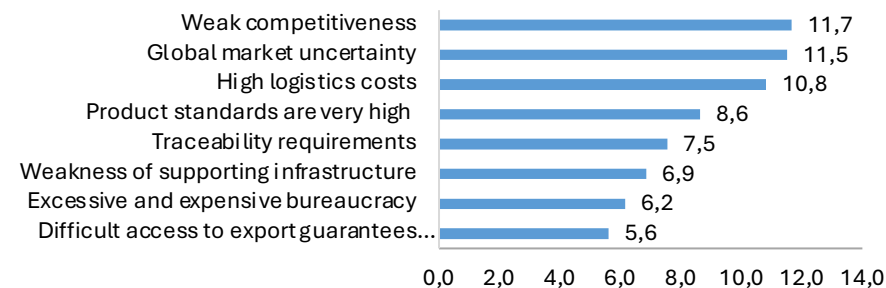
Sales Orientation



Export Destination Country



Major Export Challenges

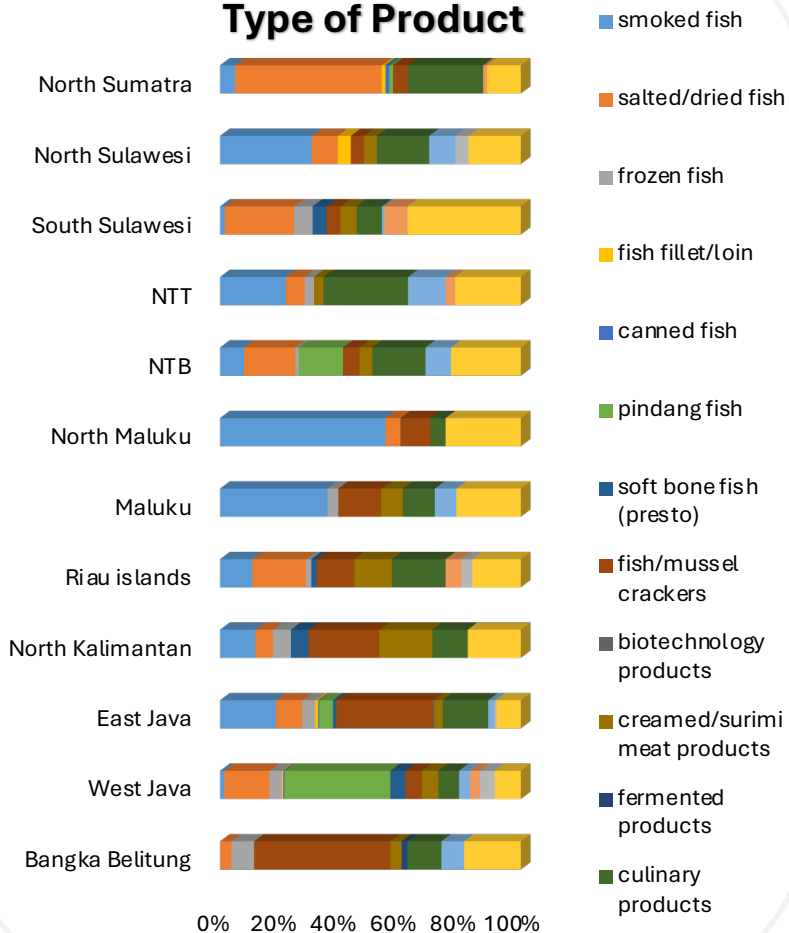




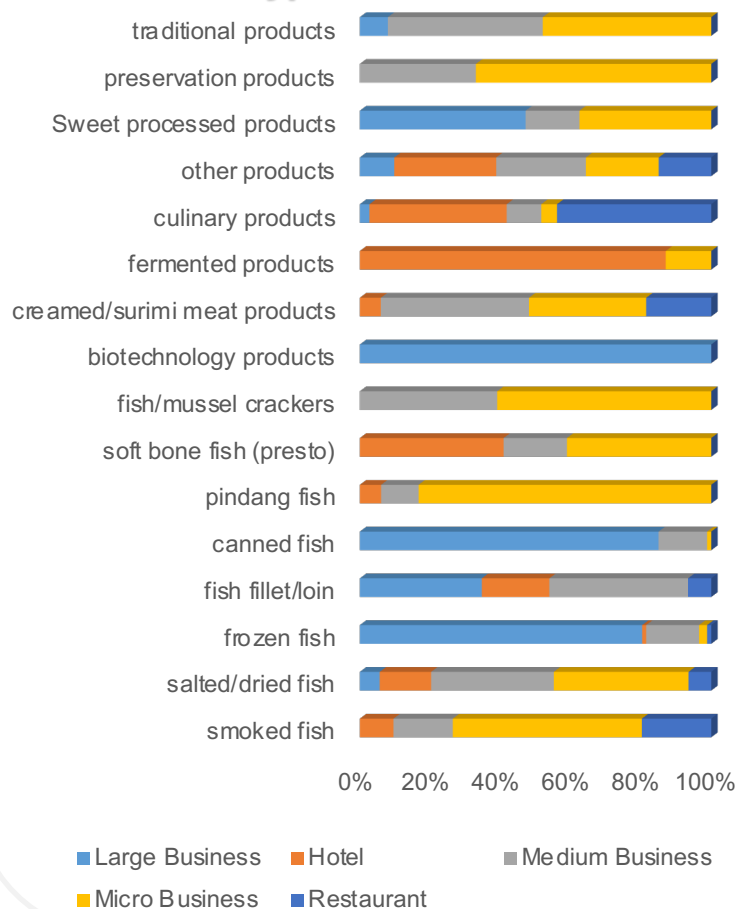
Fish Processing Units (2/2)

Origin Province Raw Material Distribution is dominated by Java. The types of fish processing unit products in 12 provinces are mostly fish fillets. Approximately 50% of waste product processing units are processed by them self.

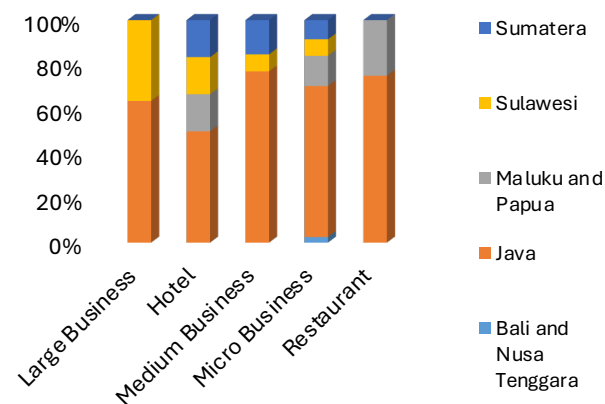
Type of Product



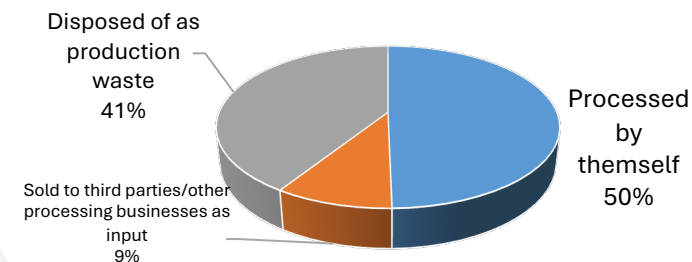
Type of Product



Origin Province Raw Material Distribution



Waste Product Processing



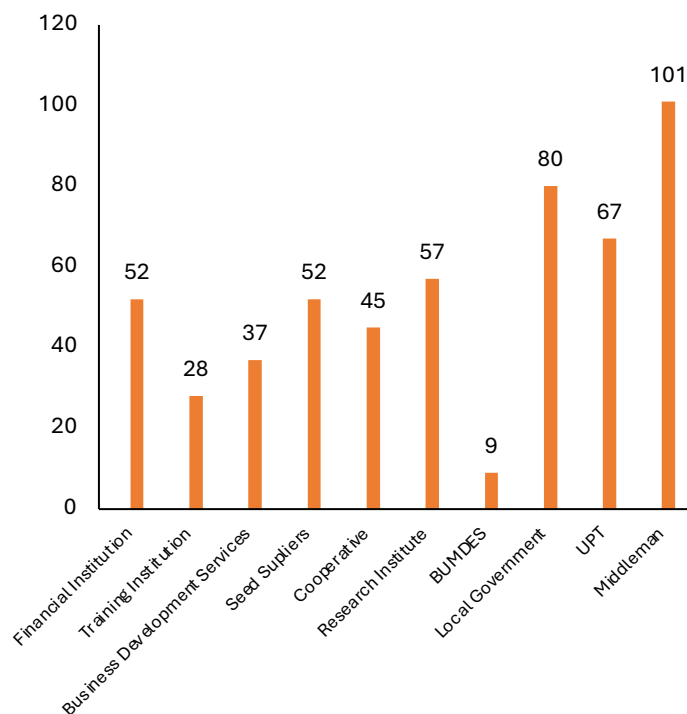


Value Chain Ecosystems (1/2)

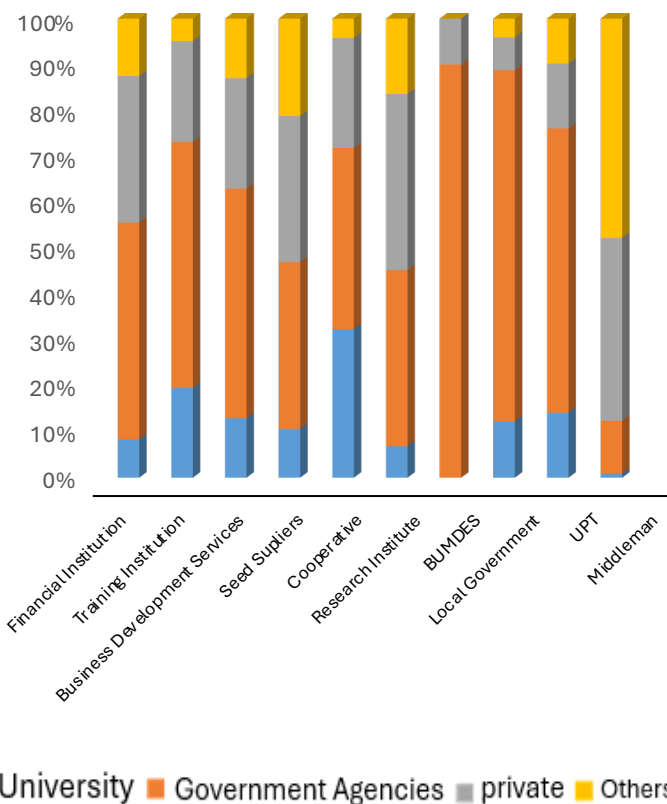
The distribution of value chain respondents at the provincial level varies, indicating differences in value chain characteristics across regions. The management of aquatic food value chains in different areas of Indonesia is supported by various actors, including the government, the private sector, and academia, each with diverse participation.



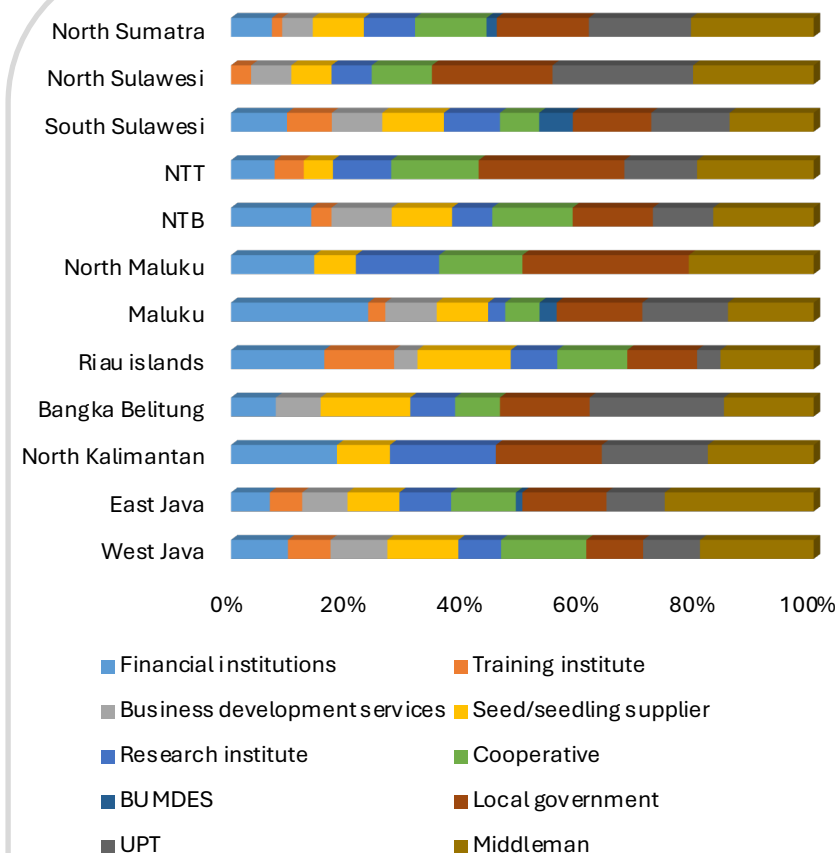
Value Chain Ecosystems (N = 528)



Distribution of Number of
Respondents Value Chain
Ecosystem



Affiliate and Partnership
Stakeholders



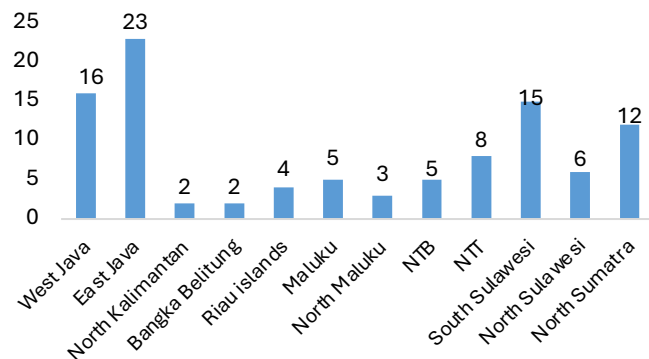
Distribution of the
Number of Value Chain
Respondents at the
Provincial Level



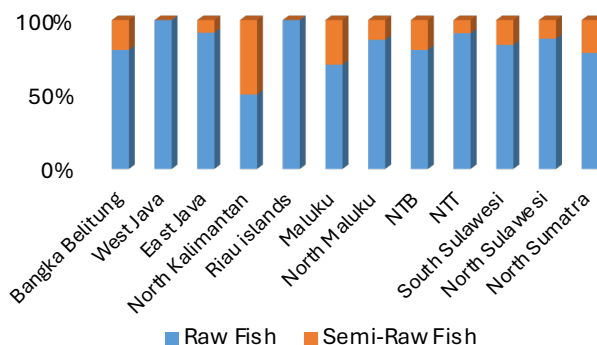
Value Chain Ecosystems (2/2)

The percentage of products sold is dominated by row fish. The source of Fish Supplier for Resale is predominantly comprised directly of fishermen and 70% have no contracts with suppliers. The type of aid for fishermen and aquaculture farmers is predominantly cash loans.

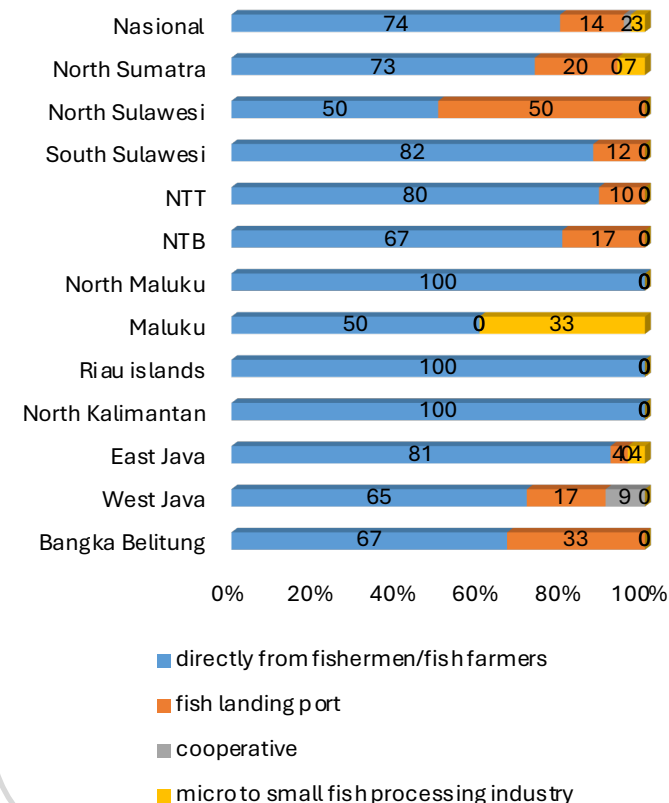
Middleman



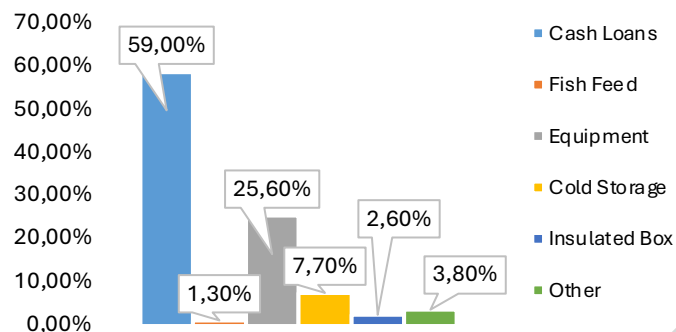
Percentage of Products Sold



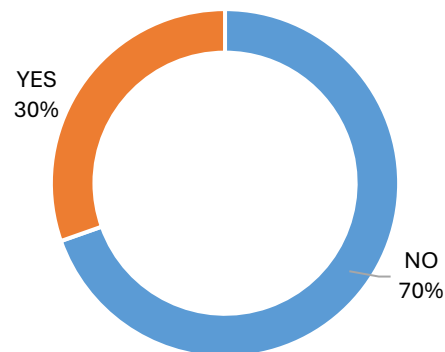
Source of Fish Supplier for Resale



Type of Aid for Fishermen and Aquaculture Farmers



Contracts with Suppliers



Key Findings : Nutrition



- Blue food in Indonesia, including fish and other seafood products, provides essential nutrients such as protein, omega-3, and vitamin D, which are vital for public health.
- In addition, blue food offers significantly higher nutritional value compared to other protein sources like chicken, tempeh, and tofu, being especially rich in omega-3, protein, vitamin B12, and vitamin D.
- Some species, such as snakehead (gabus), carp (mas), catfish (lele), and anchovies (teri), are known as "superfoods" due to their important micronutrient content. Therefore, there is a need to improve the accessibility and availability of nutritious blue food, particularly in remote and impoverished areas of Indonesia.
- Developing strategies that support the sustainable consumption and production of blue food is crucial to addressing nutritional and public health challenges, including policies related to production, export, and public health.



Key Findings : Environment

- Sustainable resource management practices are needed to minimize the negative impact on marine ecosystems and ensure the continuity of fish stocks. However, mangroves in Indonesia have experienced significant degradation, with only 7% under protection status, while mangrove deforestation is happening faster than restoration efforts, largely driven by aquaculture development.
- The intensification of fish farming must also be balanced with environmental protection to prevent water quality and habitat degradation. Therefore, strong emphasis is placed on the importance of holistic spatial planning, integrating mangrove protection into climate policies, and improving coordination and supervision to safeguard mangrove ecosystems and address the disparity between policy and implementation.

Climate Change

- The interaction between aquaculture development and the environment faces complex dynamics, where there are positive impacts such as reducing pressure on wild fish populations and restoring damaged habitats, while negative impacts include nutrient accumulation and genetic pollution leading to environmental degradation.
- Climate change adds to these challenges by affecting small-scale actors in the fisheries and aquaculture sectors through changing marine conditions, demanding adaptation through sustainable practices, species diversification, and modern aquaculture technologies to mitigate impacts and enhance resilience.

Circular Economy

- Blue Food in Indonesia holds significant economic potential through the utilization of by-products such as from tuna, shrimp, squid, and seaweed, which can be processed into high-value materials like protein hydrolysates, collagen, and chitosan.
- Key recommendations include sustainable fishing practices, efficient post-harvest management, and the implementation of circular economy strategies that integrate bio-composites, biofuels, and bioactive compounds, highlighting opportunities to expand added value and contribute to environmental sustainability.



Key Findings : Small-Scale Fisheries & Aquaculture

- **Regulatory Impact:**

More supportive regulations are needed to protect and develop small-scale fisheries and aquaculture, which are the main source of livelihood for many coastal communities.

- **Innovation and Technology:**

Innovation in fishing and aquaculture techniques should be encouraged to improve sustainability and operational efficiency.





Key Findings : Justice

- Blue Food in Indonesia offers important opportunities but faces significant challenges in terms of equitable access and participation. Although blue food is more affordable compared to other protein sources and crucial for food security, there are disparities in access and consumption influenced by social, economic, and environmental factors.
- Women play a critical role in this industry, but there is a need to increase support for their empowerment and participation. Recommendations include improving access to resources, strengthening the role of women, and integrating policies that support sustainable and equitable blue food production and consumption.

Regulation

- Although Indonesia has a legal framework aimed at supporting food security and empowering coastal communities through fisheries products, there are still shortcomings in its effective and inclusive implementation, particularly in involving indigenous communities and women in decision-making processes.
- Key recommendations include improving transparency, public participation, and strengthening law enforcement capacity, as well as the need for more resources and support to ensure that Blue Food policies can promote both environmental sustainability and social equity.

Conflict

- Blue Food in Indonesia faces both internal and external conflicts that affect fishermen's working conditions and productivity. These conflicts include intersectoral competition, such as between fisheries and tourism or mining, as well as serious environmental issues like habitat degradation caused by fishing and mining activities.
- Recommended solutions include stronger regulations, the implementation of technology for environmental monitoring, and robust government support to improve working conditions and ensure the sustainability of fishing practices.



Key Findings : Productivity, Value Creation, and Export

- Blue Food has demonstrated resilience in production during the COVID-19 pandemic but has seen only a slight increase in productivity since 2013. Productivity is particularly high among non-motorized boats, indicating that most fishermen operate on a small scale.
- Meanwhile, investment in this sector has yet to fully attract domestic investors, despite being of interest to foreign investors. To address these challenges, recommendations include strengthening national blue food policies, improving research and data management, promoting sustainable fishing and aquaculture practices, as well as enhancing transparency and monitoring within the supply chain.

Logistic

- Blue Food in Indonesia faces significant logistical challenges, including slow development of cold storage infrastructure and high transportation costs.
- The government is urged to prioritize the construction of cold storage facilities in strategic locations and improve data transparency to boost efficiency and reduce costs.
- Adopting best practices from Vietnam and Thailand in cold chain management and stimulating investment in related infrastructure are also recommended.

Export

- Blue Food in Indonesia has shown significant growth over the past decade, particularly in marine aquaculture and seaweed, with the United States, China, and Japan as the main export markets. Indonesia is currently the largest seaweed exporter in the world.
- The increase in exports of processed products such as carrageenan presents further opportunities.
- To sustain long-term growth and manage market risks, diversifying the export portfolio and improving infrastructure and supply chain efficiency are emphasized as key strategic steps.



Key Findings : Productivity, Value Creation, and Export

Technology in Processing Industry

- Indonesia's Blue Food processing industry includes both traditional and modern methods, with a focus on improving safety, food security, and product traceability.
- The technology used in fish processing is classified from basic to advanced levels, involving chemical, enzymatic, and microbiological methods.
- To support the sustainable growth of both scales of this industry, recommendations include education and training for industry players, development of adequate infrastructure, adoption of advanced technology, and adherence to sustainable fishing practices and relevant regulations.

Digital Transformation

- Blue Food in Indonesia is undergoing a digital transformation with the adoption of technologies such as robotics, drones, blockchain, and artificial intelligence (AI), which are improving the sustainability and profitability of the fisheries industry.
- However, challenges such as high costs, uneven technological infrastructure, and shortage of skilled workers still hinder full adoption.
- To address this, it is recommended to form a new technology consortium, improve data systems, integrate IT curriculum with fisheries education, and strengthen training and mentorship programs.



Recommendations



Short-Term Intervention	Medium-Term Intervention	Long-term Intervention
<ol style="list-style-type: none">1. To integrate blue foods into national nutrition programs, especially in areas with high malnutrition and stunting rates, includes:<ul style="list-style-type: none">• expanding the inclusion of fish into existing social assistance programs, like Bantuan Pangan Non-Tunai (BPNT) and Program Keluarga Harapan (PKH)• initiating fish-based school feeding programs2. To be considered in strategies and programs tackling key public health challenges, such as stunting, includes:<ul style="list-style-type: none">• dietary guidelines and social welfare programs• healthy and safe school meal programs• nutrition literacy particularly for children, adolescent girls, and pregnant and lactating women3. to support blue food value chains and reduce food loss and waste, includes:<ul style="list-style-type: none">• prioritizing sustainable production in provinces with acute nutritional needs,• developing value chains that make blue foods more widely available to consumers and communities in need, and• creating safe and healthy preservation techniques to reduce spoilage, increase shelf-life, and expand the availability and affordability of blue foods	<ol style="list-style-type: none">1. To prioritize the development and promotion of affordable fish-based products like dried fish or fish powder, collaboration with local food producers to ensure the products are nutritious, culturally acceptable, and cost-effective2. To improve consumer awareness about the nutritional value of blue foods through public education, includes Gemarikan3. To promote the consumption of locally sourced fish4. To utilize Puskesmas and Posyandu as platforms to educate communities, particularly women and children, about blue foods' health benefits, ensuring better fish uptake in daily diets	<ol style="list-style-type: none">1. To develop a comprehensive policy to make blue foods a cornerstone of national nutrition strategies, emphasize the role of blue food in improving public health and addressing malnutrition2. To integrate blue foods into existing nutrition frameworks and public health initiatives3. To ensure sustainable production and consumption practices that protect marine ecosystems, includes on investing in research and technology4. To align the fisheries sector with broader national goals of public health, economic resilience, and environmental sustainability



Short-Term Intervention	Medium-Term Intervention	Long-term Intervention
<ol style="list-style-type: none">To implement sustainable aquaculture practices, includes:<ul style="list-style-type: none">adopting integrated multi-trophic aquaculture (IMTA) and land-based recirculating systemsTo develop and enforce regulations and certifications for environmentally sound practicesTo strengthen the enforcement of regulations that limit overfishing and promote sustainable fishing practicesTo implement surveillance of illegal, unreported, and unregulated (IUU) fishing through marine patrols and monitoring technologyTo implement targeted pollution control initiatives to reduce industrial and domestic waste impacts on marine ecosystems, particularly in vulnerable areasTo develop holistic spatial plans that balance sustainable aquaculture development with mangrove conservation	<ol style="list-style-type: none">To promote sustainable aquaculture, involves expanding environmentally friendly fish and seaweed farming practices, including proper waste management, optimal feed usage, and high-water quality maintenanceTo build local capacity through training and technology transferTo improve efficiency and intensification through technological advancements and best management practicesTo restore and conserve ecosystems such as mangroves, wetlands, and coastal habitatsTo develop and implement climate resilience programs, includes<ul style="list-style-type: none">using species more tolerant to changing environmental conditionsDeveloping early warning systems for extreme weather events and disease outbreaksTo promote climate-resilient management practices for small-scale fisheriesTo build the resilience of fishing communities	<ol style="list-style-type: none">To develop of a National Climate and Marine Ecosystem Restoration StrategyTo improve monitoring and enforcement and to enhance communication and coordination between different jurisdictionsTo increase public awareness and involve local communities in planning and managementTo ensure integration of government policies with other programs aimed at protecting mangrovesTo promote circular economy principles, ensuring that marine resources are used efficiently, minimizing waste, and ensuring that economic activities do not degrade the marine environmentTo strengthen The National Commission on Fish Stock Assessment through increased funding, expertise, and collaboration to conduct regular scientific assessments of fish stocksTo launch public awareness and education campaigns to engage stakeholders and promote sustainable practices



Small-Scale Fisheries and Aquaculture (SSFA)

Short-Term Intervention	Medium-Term Intervention	Long-term Intervention
<ol style="list-style-type: none">1. To build financial security and provide targeted support for SSFA operators by developing tailored financial products, such as low-interest loans and grants, that address the unique challenges of seasonality and lack of collateral2. To implement policies that allow access to working capital loans without collateral, coupled with the creation of emergency funds and quick response systems for climate-related events3. To elevate small-scale fishers and aquaculture farmers' status and provide much-needed stability by formalizing them as professionals, complete with social security benefits and access to essential services like health insurance and retirement benefits	<ol style="list-style-type: none">To develop programs that strengthen women's roles and involvement in SSFA2. To strengthening the value chain through intervention programs that address challenges in the value chain, providing licensing or certification to reinforce the socioeconomic base of small-scale producers, and encouraging the production of high-quality products3. To encourage investment in infrastructure development, particularly in rural areas, includes enhancing fish landing sites, cold storage facilities, transportation systems, and upgrading market facilities to improve fishers' access to local markets.4. To carry out capacity building and education targeted programs on sustainable practices, modern techniques, and disaster risk reduction	<ol style="list-style-type: none">1. To support evidence-based decision-making, comprehensive data collection systems and regular monitoring mechanisms2. To promote sustainable practices, involves developing and implementing robust management plans based on scientific evidence and stakeholder engagement3. To strengthen community empowerment through the expansion and strengthening of cooperatives4. To build resilience against climate change and natural disasters



Short-Term Intervention	Medium-Term Intervention	Long-term Intervention
<ol style="list-style-type: none">1. To ensure equitable access to resources by strengthening policies to guarantee that small-scale fishers, especially women, have fair access to critical resources such as fishing grounds, equipment, and finance2. To enforce regulations to protect small-scale fishers' rights against encroachment by larger industrial fishing entities3. To pay more attention to gender equality by explicitly acknowledge women's roles, providing them with fisher identification cards and enabling their participation in insurance programs.4. To empower women in the sector, targeted training programs and access to microcredit	<ol style="list-style-type: none">1. To establishing and strengthening fisheries cooperatives, including women2. To improve labor and working conditions through infrastructure development, such as installing cold storage facilities; establishing fishery information centers to provide market and pricing information; digital technology and equipment; and capacity building focus on sustainable fishing practices, fish processing, and financial literacy to help smooth irregular incomes.3. To promote environmental sustainability and spatial planning, includes implementing and enforcing adequate laws and regulations, establishing specific Marine Protected Areas for conservation, and developing clear spatial planning.4. To introduce community-based monitoring systems, involves fishers directly in managing marine resources and ensuring sustainable practices, empowering them as custodians of their local environment, and partnering with universities and local NGOs5. To increase access to blue foods for vulnerable communities, includes offering capital support to businesses for reducing blue food waste, building capacity in post-harvest handling and preservation techniques, and developing programs to support blue food consumption	<ol style="list-style-type: none">1. To develop and implement comprehensive social protection schemes, specifically designed for small-scale fishers and aquaculture workers. These should include health, life, and work-related accident insurance, recognizing the high-risk nature of fishing2. To propose partnership between the government State-owned Enterprises and the private sector to develop and deliver subsidized insurance plans accessible for fishers, ultimately enhancing their financial stability and resilience



Productivity, Value Creation, and Export

Short-Term Intervention	Medium-Term Intervention	Long-term Intervention
<ol style="list-style-type: none">To bridging the knowledge gap in blue food processing, involves providing targeted training for small-scale fishery industries and women, not only processing techniques but also branding, packaging, and marketing strategiesTo carry out waste reduction campaigns to combat waste at the consumer level, retail and householdTo promote the utilization of by-products, transform fish by-products into valuable commodities such as animal feed, fertilizers, and cosmetics, new economic opportunities can be created while reducing wasteTo encourage infrastructure development, significant investments are needed in modern fishing ports, transportation networks, ICT infrastructure, and cold chain.To consider reviewing and reducing the tax rate for cold storage investments and encouraging foreign investment through policy incentives (government)	<ol style="list-style-type: none">To establish community-based food waste solutions, involves creating localized initiatives to convert fish by-products into resources like animal feed or biofertilizersTo improve post-harvest infrastructure through investments in cold chains, community storage, and processing centersTo enhance capacity-building programs for fishers and fish farmers, includes integrating IT and blue food curricula in universitiesTo support the transition towards a circular economy by establishing and upgrading recycling centers equipped to handle fish waste efficientlyTo promote logistical efficiency by optimizing trans-shipment routesTo Support small-scale fisheries through the provision of microfinance and grants, establishment and strengthening of cooperatives, and enhancing capacity building through training and extension services.	<ol style="list-style-type: none">To develop a comprehensive national food loss and waste (FLW) reduction policyTo Improve data systems and digital infrastructure, includes developing a reliable single source of truth for fisheries data and enhancing internet connectivity across the country to support digital transformationTo enhance quality control and enforcement mechanisms, particularly for traditional manufacturing, involves implementing hygiene certification requirements and providing incentives such as social security benefits for those who meet these standardsTo boost exports and diversify markets, includes negotiating favourable trade terms, prioritizing emerging markets with high growth potential, and establishing market development programs encompassing market research and promotional campaigns.To develop a strategic global branding campaign for Indonesian seafood, positioning as premium and sustainably sourced, highlighting the country's rich marine biodiversity and leveraging international certifications to build credibility and enhance global market penetrationTo raise public awareness about sustainable consumption and the importance of reducing food waste

Appendix 1

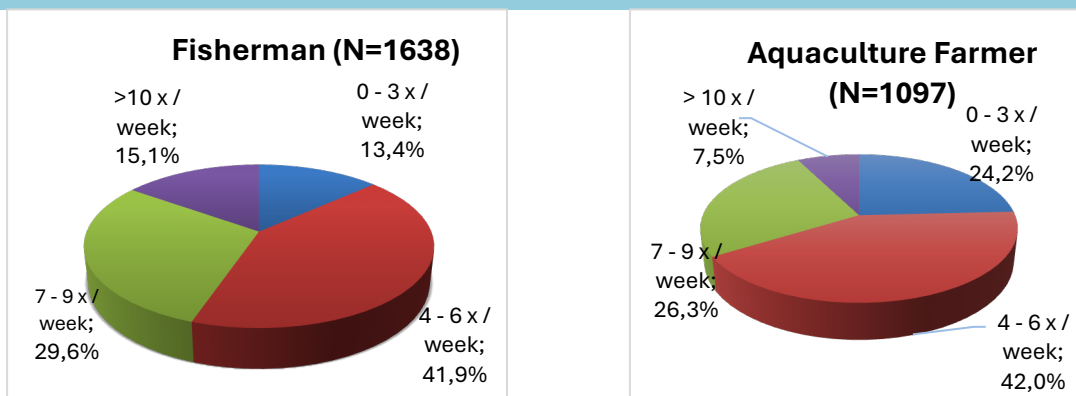
Primary Data Results



1. Consumption Pattern in Fisherman & Aquaculture Farmer Families

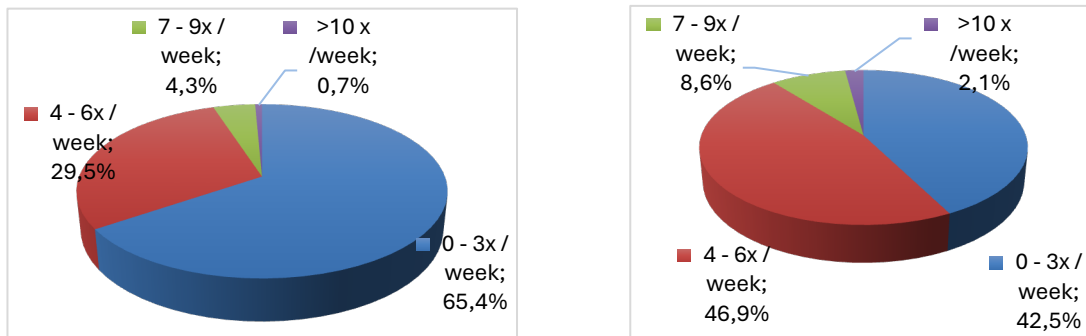
1.1 Frequency's of Fish Protein & Non Fish Protein Consumption in Fisherman & Aquaculture Farmer Families

Patterns of Fishermen and Aquaculture Farmer in Consuming Protein (Fish)



The consumption pattern of fishermen and Aquaculture Farmer can be seen through a diagram of the frequency of fish protein consumption, which is **4 – 6 times/week**.

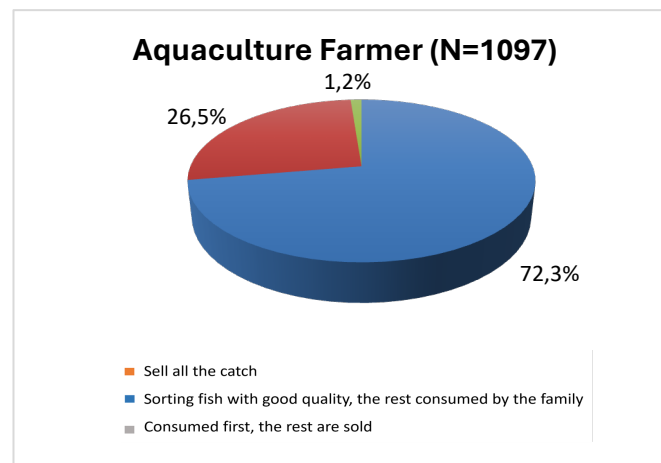
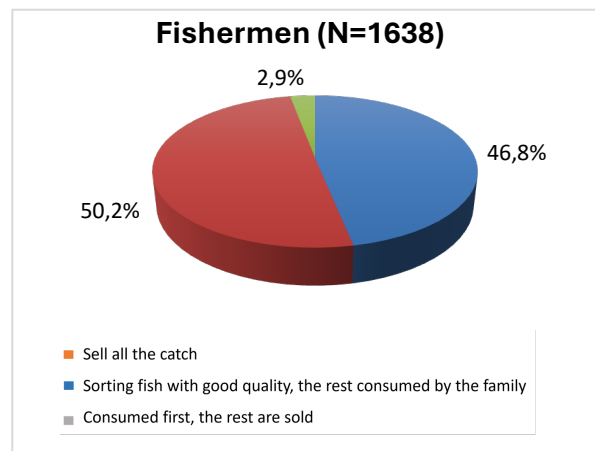
Patterns of Fishermen and Aquaculture Farmer in Consuming Protein (Non- Fish)



The consumption pattern of non-fish protein for **fisherman** is **0 – 3 times/week**, while **Aquaculture Farmer** **4 – 6 times/week**

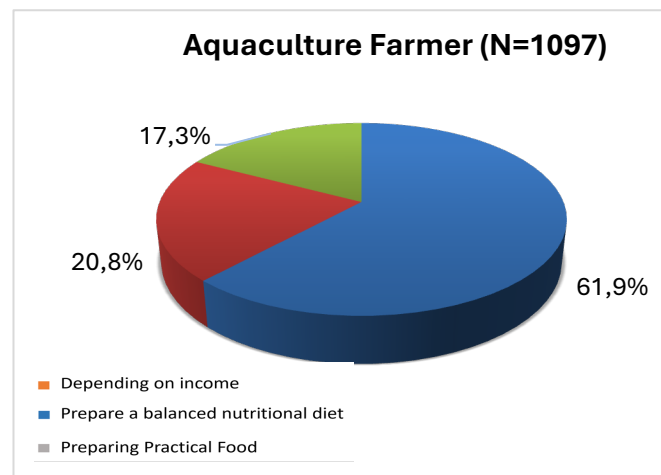
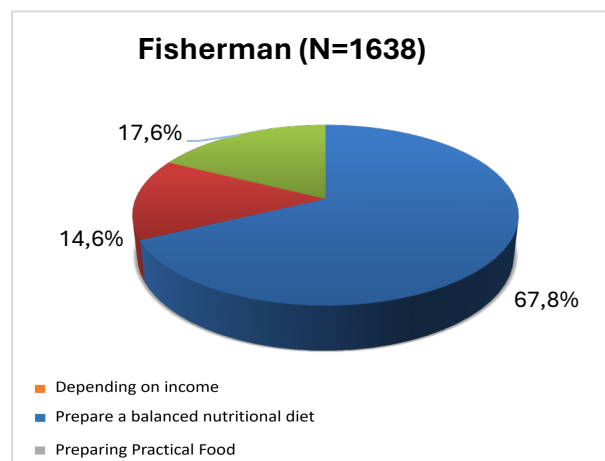


1.2. Treatment of Catch & Cultivation by Fisherman & Aquaculture Farmer



In general, the distribution process of fishermen's catches is more influenced by external factors that require quick handling to maintain fish health, while the distribution of crops from aquaculture activities is generally more structured, consistent and has a shorter supply chain.

1.3. The Role of Fisherman & Aquaculture Farmer in Preparing Daily Food Consumption Needs

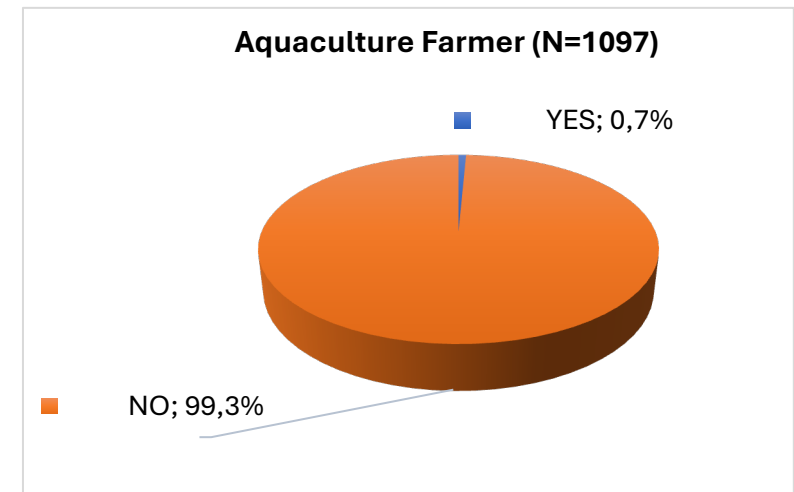
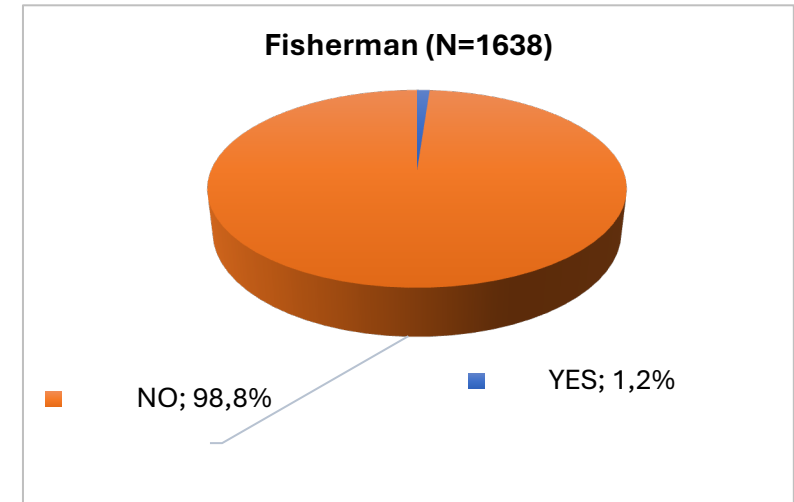


Efforts to increase the quantity and quality of food are based on the level of knowledge and parenting of parents (especially mothers) in preparing nutritious food needs (Deni et al. 2023).

2. Stunting Condition in Fisherman & Aquaculture Farmer Families

Stunting in children can be affected by several important factors:

1. Low protein consumption can inhibit the physical growth and development of children's brains (Rachim and Pratiwi, 2017).
2. Internal factors, such as family parenting and parental knowledge about nutrition, also play a major role in the risk of stunting (Putri et al., 2024)
3. Socio-economic factors, including poverty and limited access to nutritious food (Sutarto et al., 2020)
4. Limited health services and lack of effective public health programs also contribute to the high stunting rate (Alfarizi and Kurniasari, 2022).





NUTRIENTS

REGION	FREQUENCY OF FISH CONSUMPTION BY FISHERMEN IN A WEEK									
	0 – 3 x		4 – 6 x		7 – 9 x		> 10 x		Total	
	N	%	N	%	N	%	N	%	N	%
West Java	43	2,6%	41	2,5%	25	1,5%	2	0,1%	111	6,8%
East Java	13	0,8%	151	9,2%	120	7,3%	11	0,7%	295	18,0%
North Kalimantan	12	0,7%	7	0,4%	10	0,6%	2	0,1%	31	1,9%
Bangka Belitung	1	0,1%	38	2,3%	20	1,2%	2	0,1%	61	3,7%
Kepulauan Riau	44	2,7%	50	3,1%	19	1,2%	0	0,0%	113	6,9%
Maluku	1	0,1%	77	4,7%	33	2,0%	79	4,8%	190	11,6%
North Maluku	0	0,0%	35	2,1%	52	3,2%	4	0,2%	91	5,6%
NTB	25	1,5%	56	3,4%	25	1,5%	4	0,2%	110	6,7%
NTT	4	0,2%	31	1,9%	58	3,5%	23	1,4%	116	7,1%
South Sulawesi	14	0,9%	135	8,2%	50	3,1%	15	0,9%	214	13,1%
North Sulawesi	50	3,1%	7	0,4%	10	0,6%	39	2,4%	106	6,5%
North Sumatera	12	0,7%	58	3,5%	63	3,8%	67	4,1%	200	12,2%
Total	219	13,4%	686	41,9%	485	29,6%	248	15,1%	1638	100,0%

Cases of family members of fishermen (children) who experience stunting:

The occurrence of stunting in several respondents in the North Sulawesi region after being traced can be caused by:

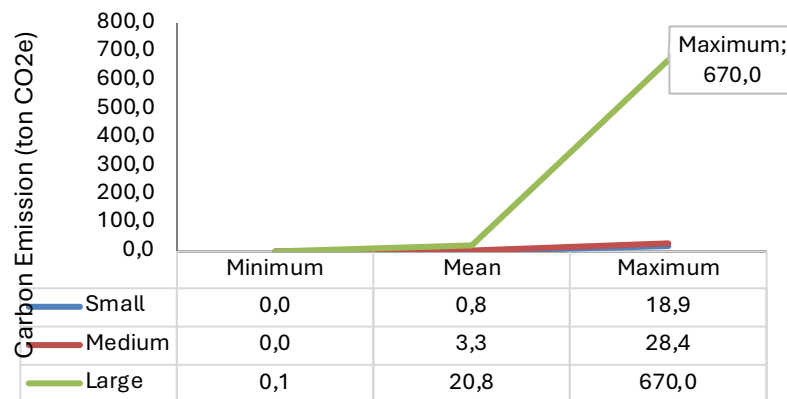
1. The frequency pattern of aquatic food (fish) is only 0-3 times a week.
2. Low income level of the head of the family who works as a fisherman.



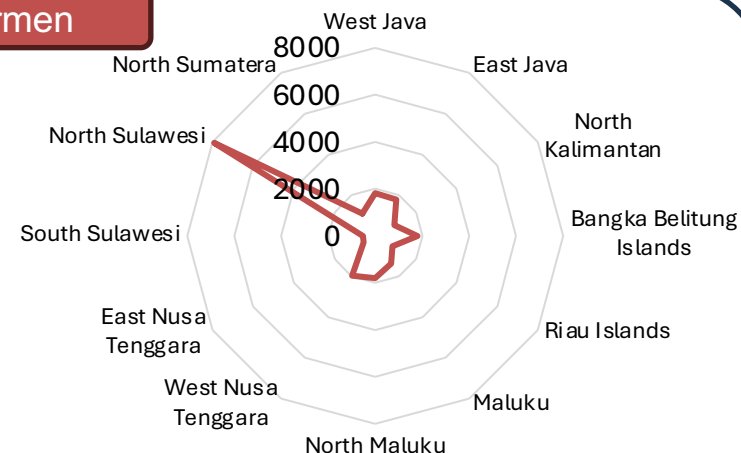
Estimated Carbon Emissions from Fuel Use:

- Fishermen with large boats produce much higher emissions than cultivators at the same business scale.
- Offshore fishing activities are more intensive in fuel use, resulting in more significant emissions.
- North Sulawesi and North Kalimantan are the highest contributors to carbon emissions from fishermen and cultivators.
- South Sulawesi and Bangka Belitung have lower carbon emissions, likely due to the smaller scale of the business.

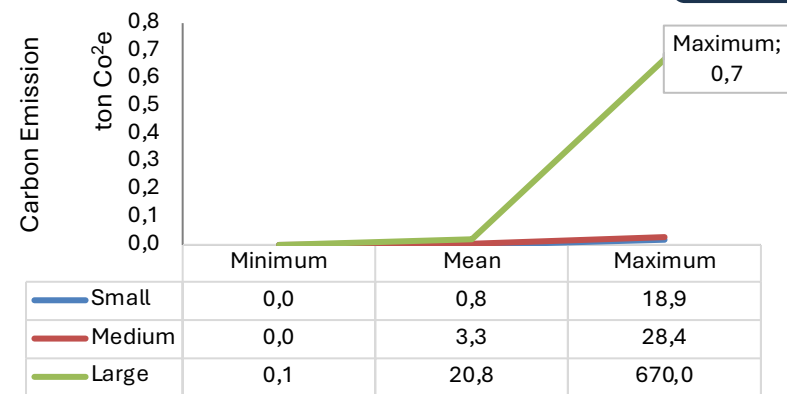
Capture Fisheries



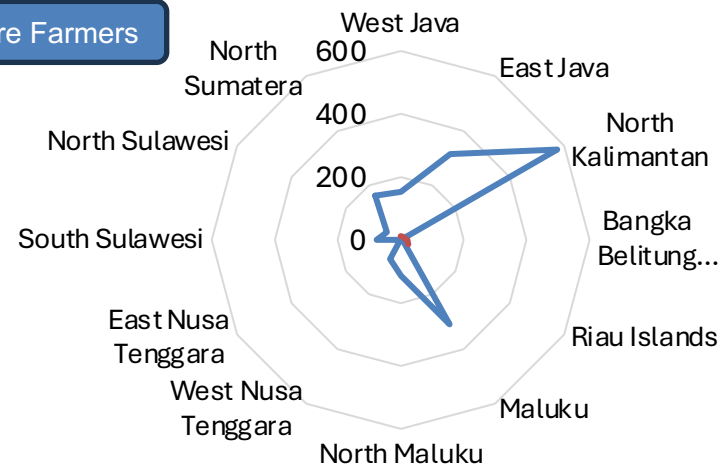
Fishermen



Aquaculture



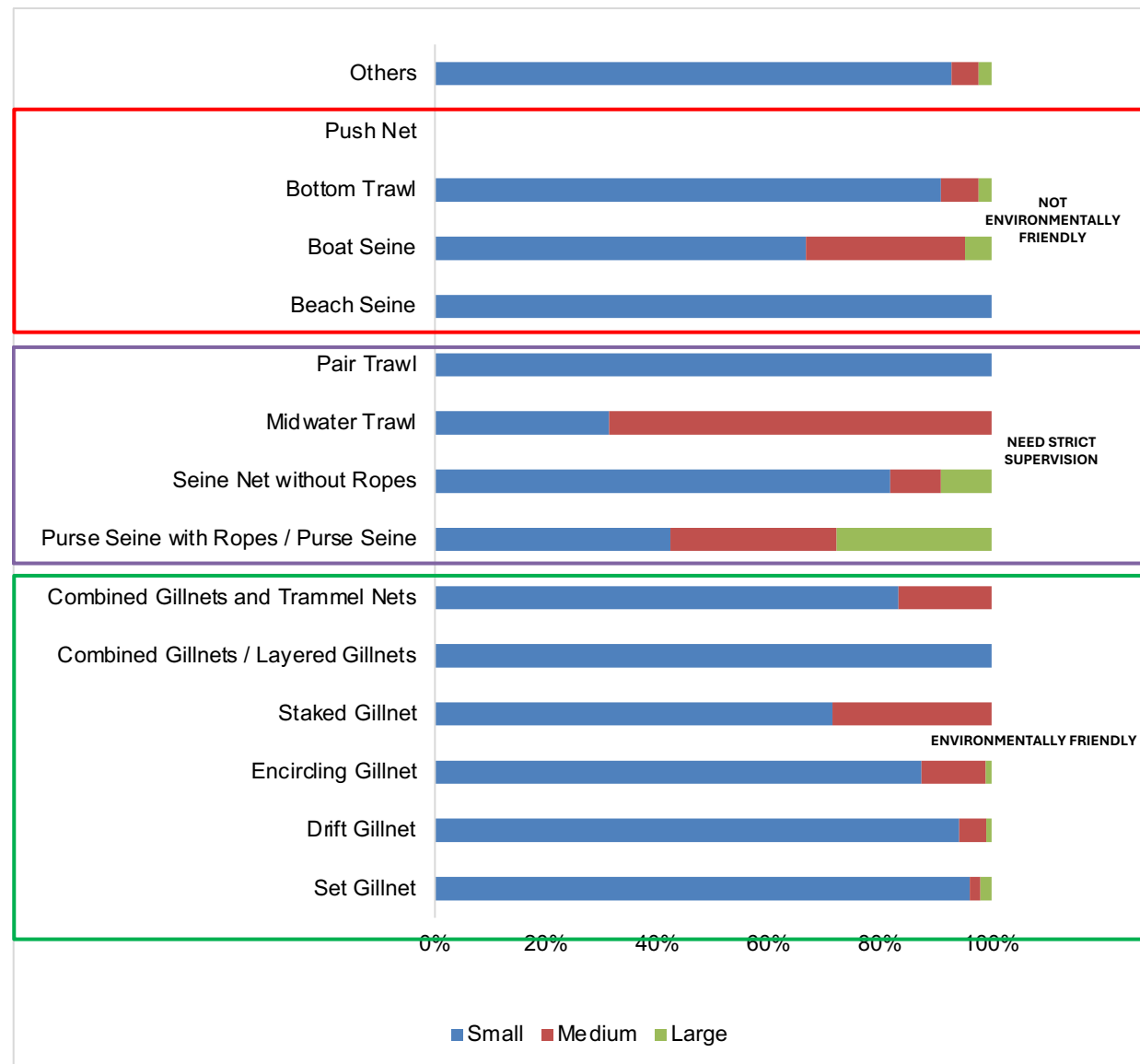
Aquaculture Farmers





Use of Capture Methods

- 1. Small Boat Dominance:** Methods such as "Fixed gill nets," "Drift gill nets," and "Combined gillnets and trammel nets" are dominated by small boats, demonstrating traditional fishing practices that are more environmentally friendly if used appropriately and do not catch protected species.
- 2. Significance of Medium Vessels:** "Medium trawls" and "shipped trawls" show significant involvement of medium vessels.
- 3. Usage by Large Ships:** "Basic trawls" and "ring trawls" are more widely used by large ships, Potential damage that can arise: damage to marine habitats, overfishing, and bycatch.

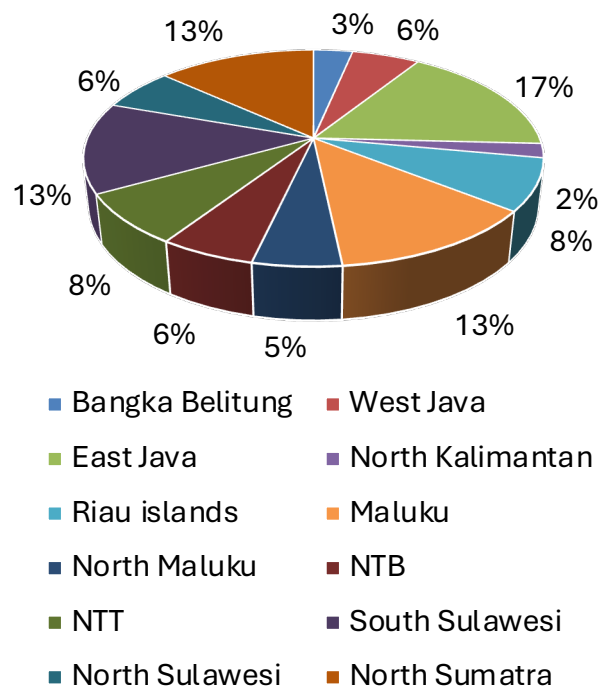




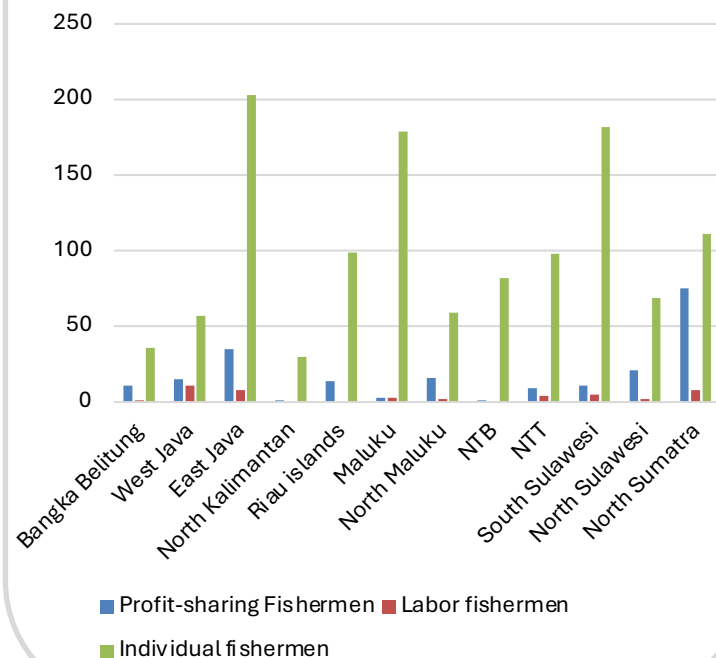
SMALL-SCALE FISHERY & AQUACULTURE

1. Small-scale Fisherman

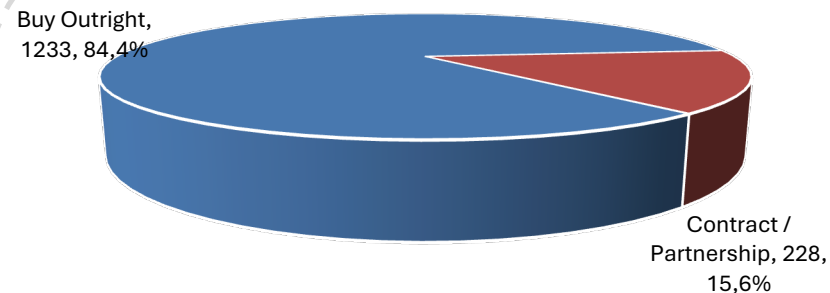
Number of Small Scale Fishermen



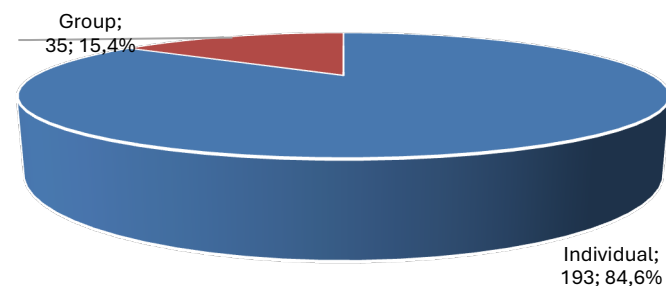
The Role of Small Fishermen in Fishing Business



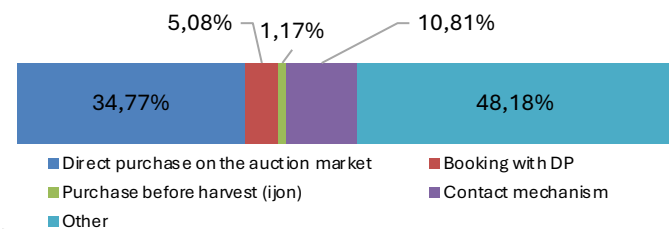
Sales System



Contract/Partnership Mechanism

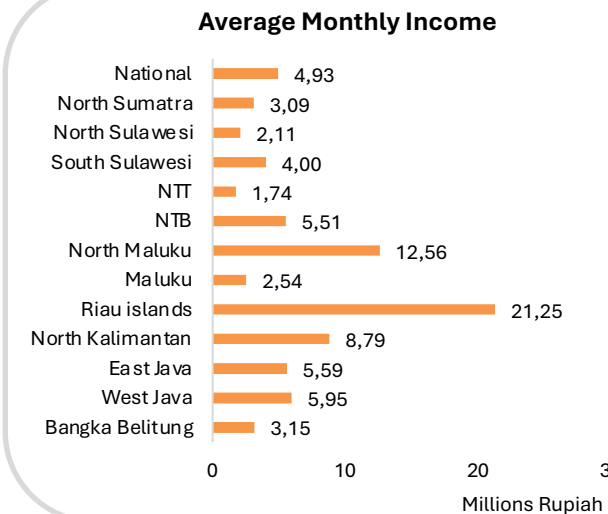
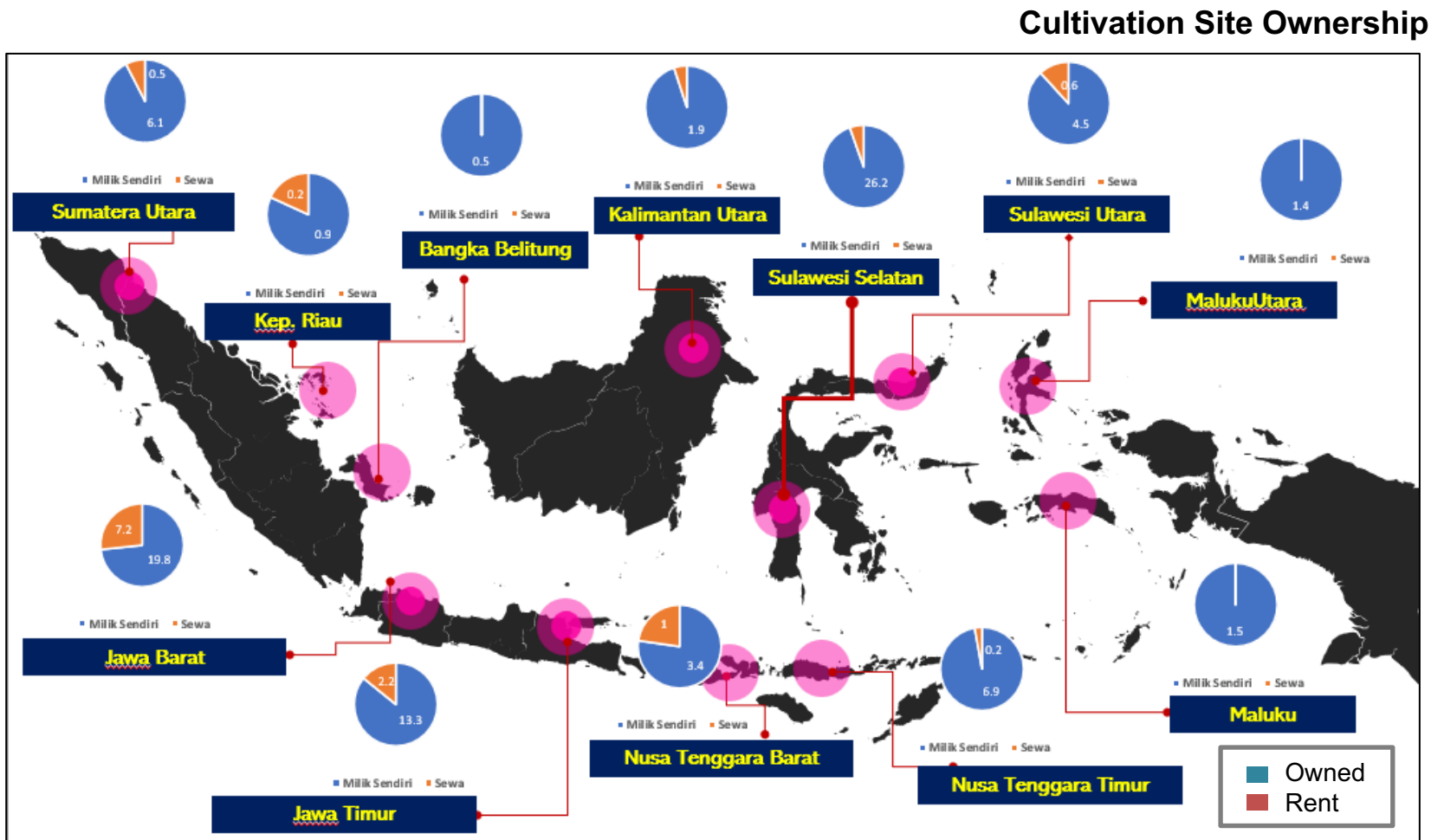


Sales Systems

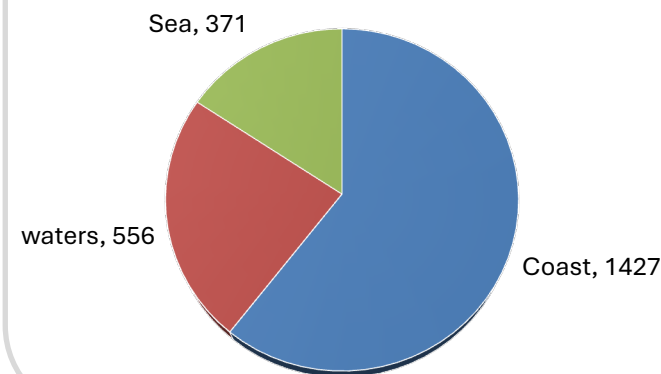




2. Small-scale Aquaculture Farmers



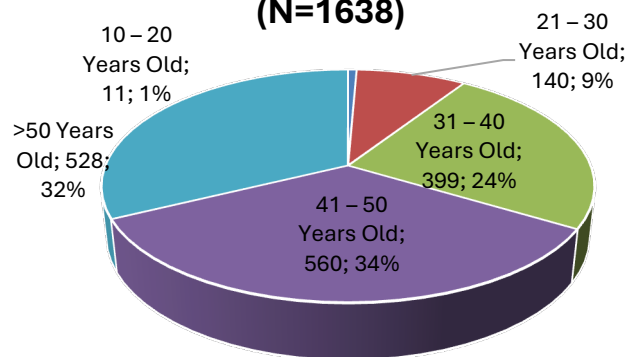
Characteristics of Small Scale Aquaculture





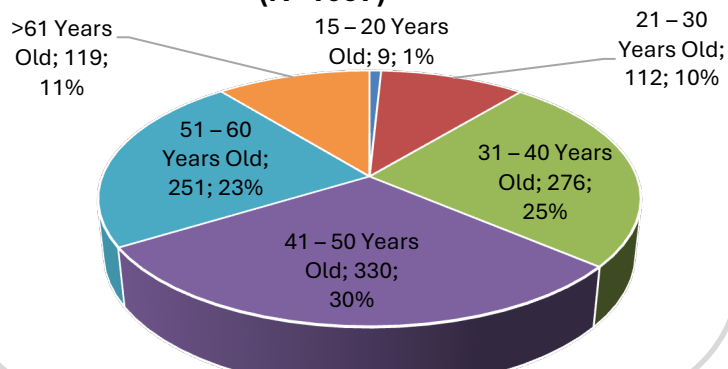
Age Distribution of Fishermen

(N=1638)



Age Distribution of Aquaculture Farmers

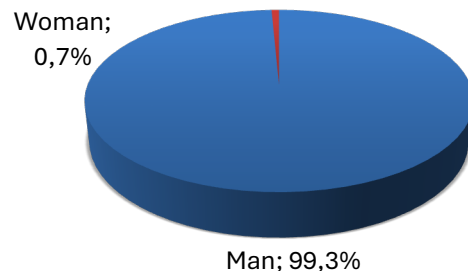
(N=1097)



Age

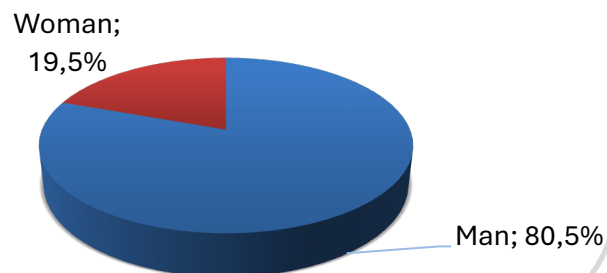
Gender of Fishermen

Respondents (N=1638)



Gender of Aquaculture farmers

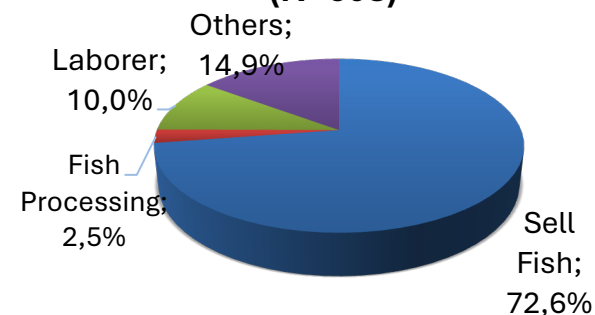
Respondents (N=1097)



Gender

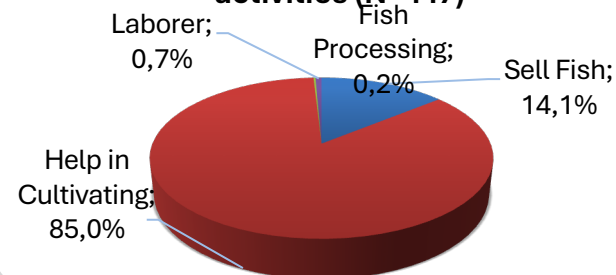
The role of spouses in capture fisheries business activities

(N=603)



The role of spouses in Aquaculture activities

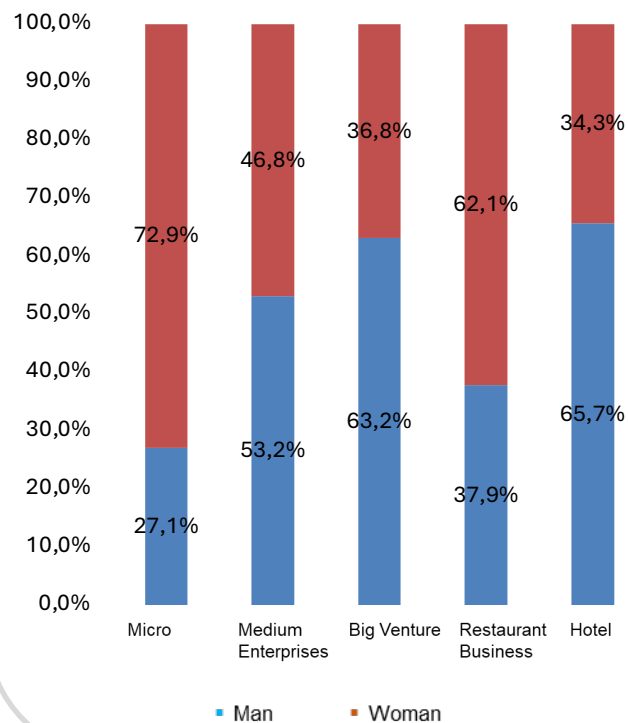
(N=447)



Involvement of Spouses
(Women) in Fishermen
and Cultivators

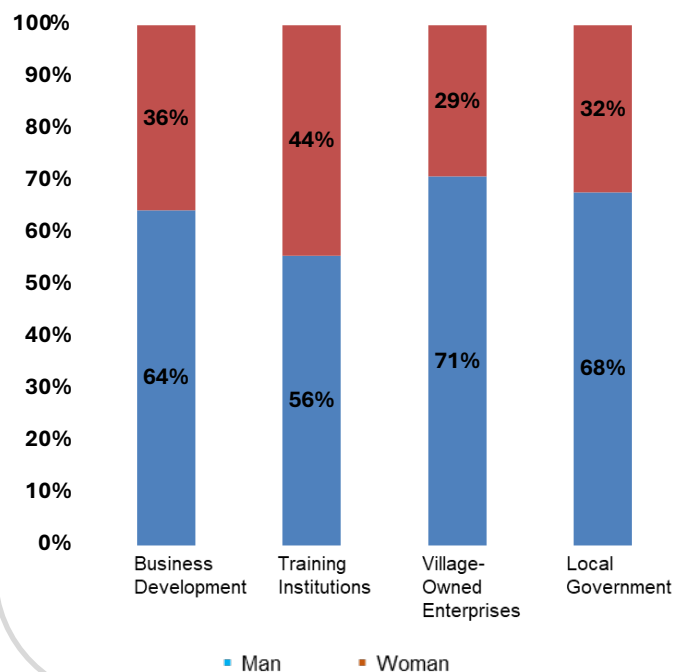


Gender Distribution of Workers in Fish Processing Units (UPI)



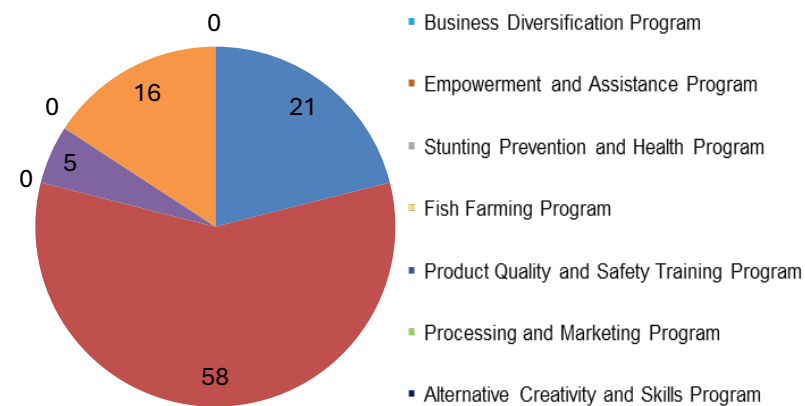
Gender of Fish Processors

Gender distribution as beneficiaries of Value Chain Ecosystem Institutions (N=154)

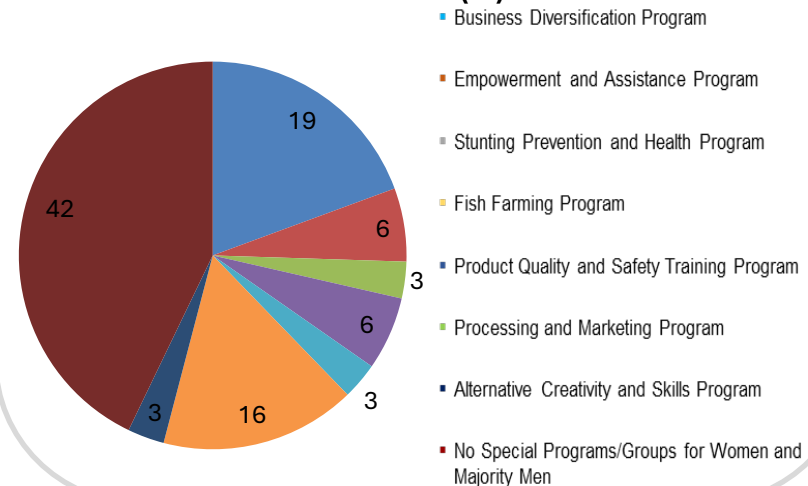


Distribution of Beneficiaries

Women's Special Program from Cooperatives or BUMDES (%)



Women's Special Program from the Regional Government (%)



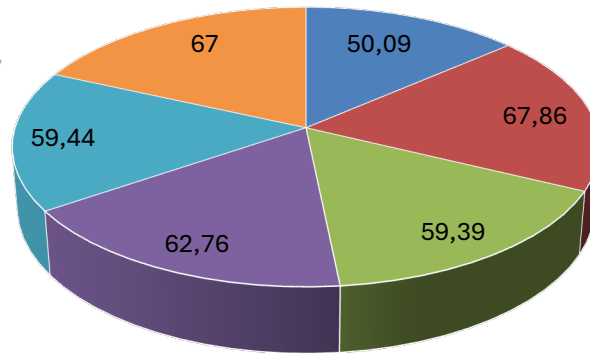


FISHERIES PRODUCTIVITY, ADDED VALUE AND EXPORTS

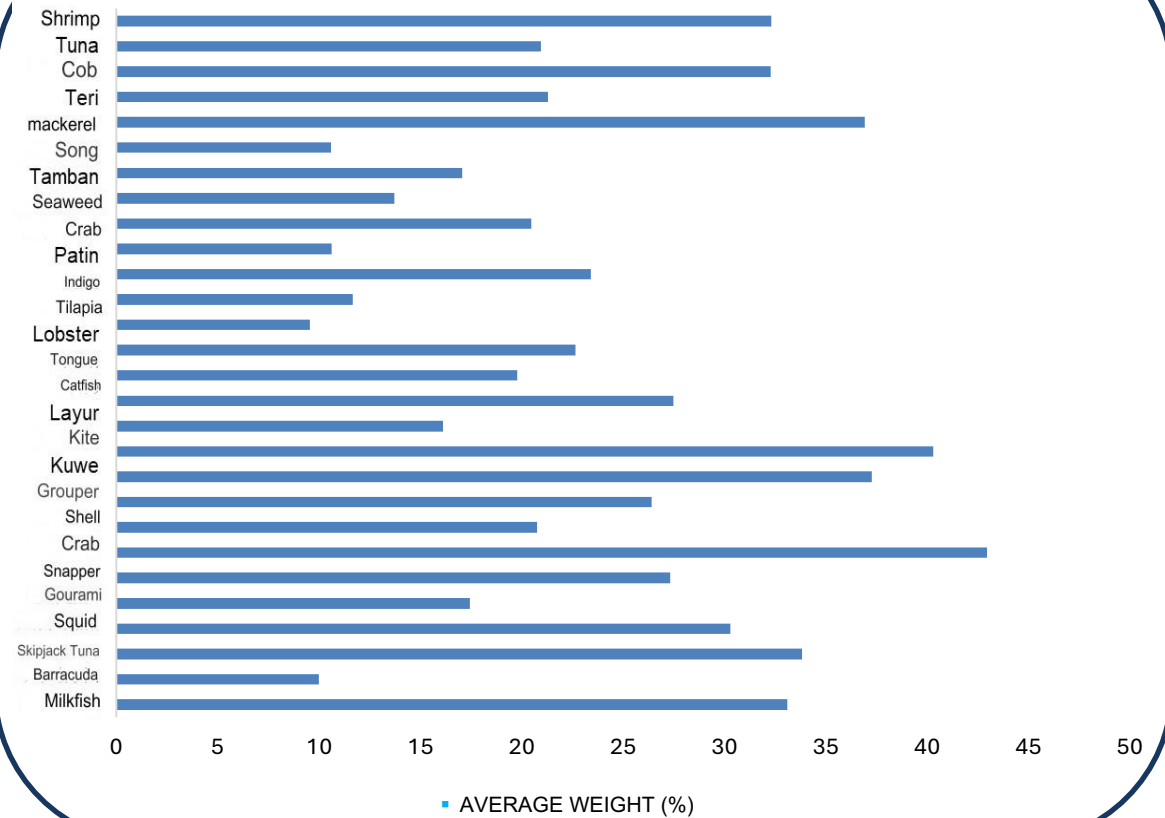
Processed Product Orientation

Distributor of Processed Products

- Other Processing Businesses
- Large Merchants (Exporters, Distributors, Agents, Wholesalers)
- Retail Merchants
- Collectors/Middleman
- Other Business Activities (Restaurants, Hotels and Others)
- End Users



MAIN RAW MATERIALS

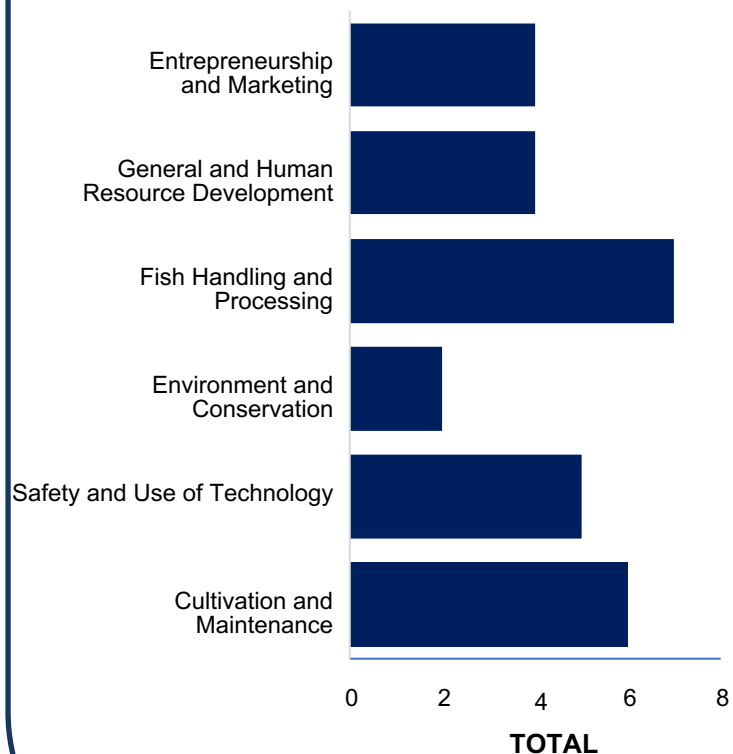




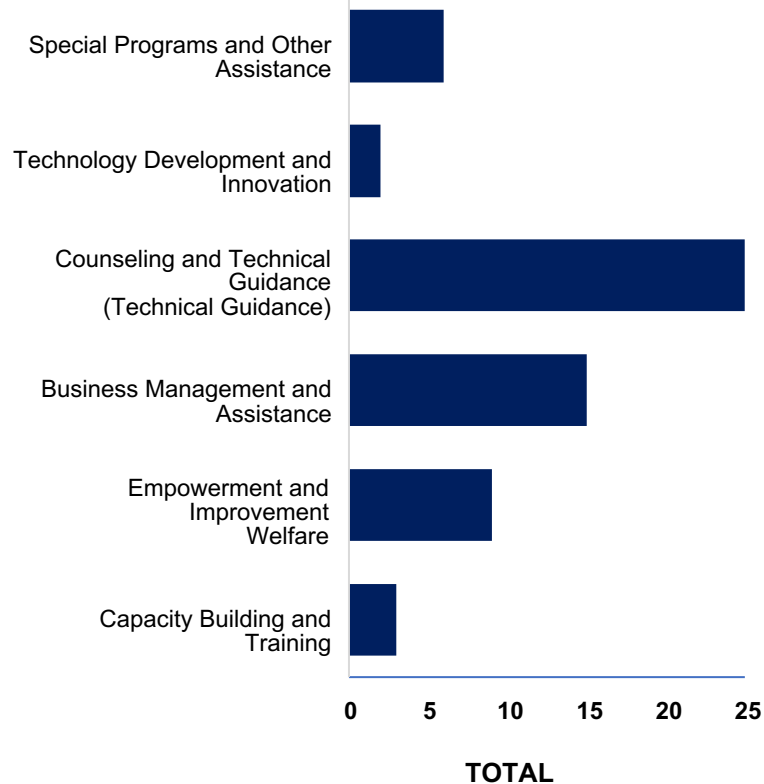
FISHERIES PRODUCTIVITY, ADDED VALUE AND EXPORTS

Training, Mentoring, and Capacity Building

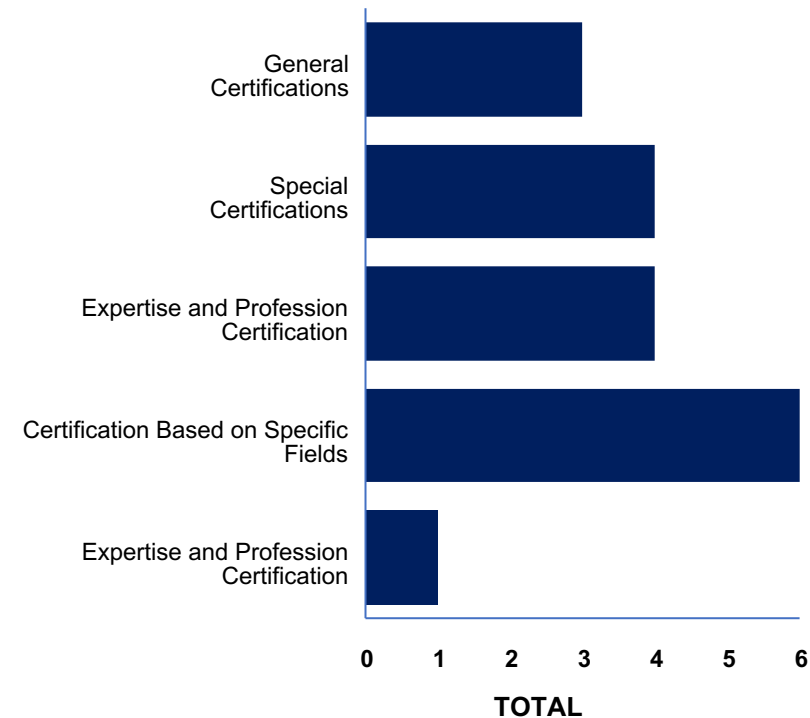
Types of Training



Capacity building and mentoring programs



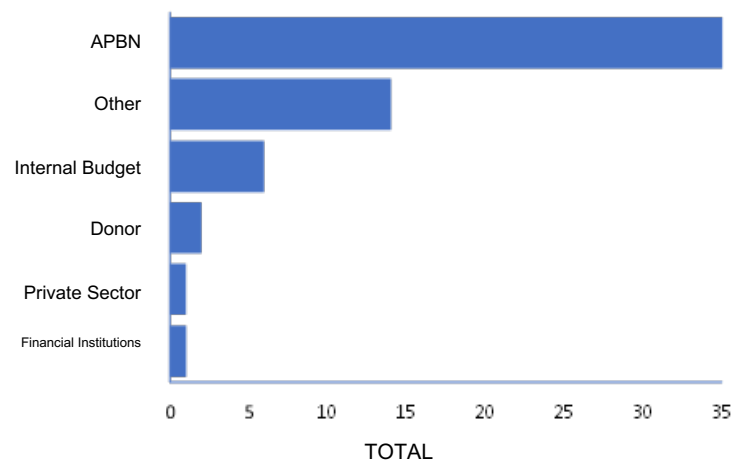
Types of Competency Certifications Given



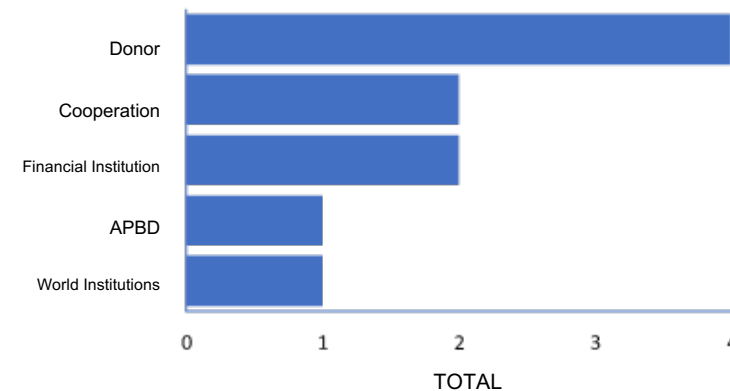


FISHERIES PRODUCTIVITY, ADDED VALUE AND EXPORTS

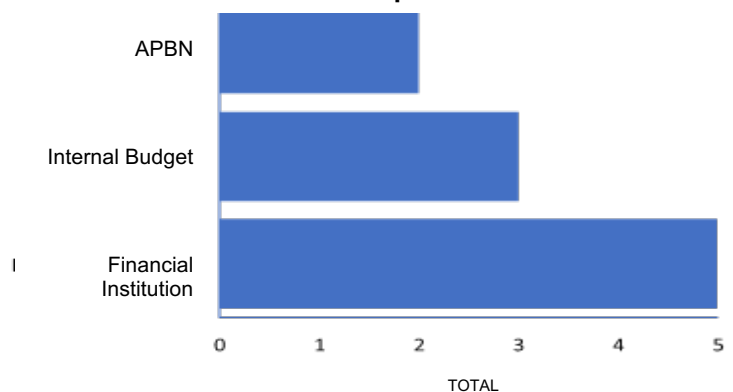
Funding Sources for Programs/Services



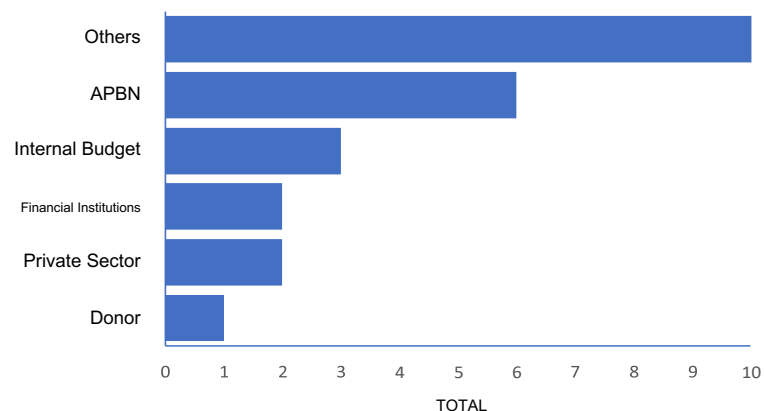
Marketing Funding Sources



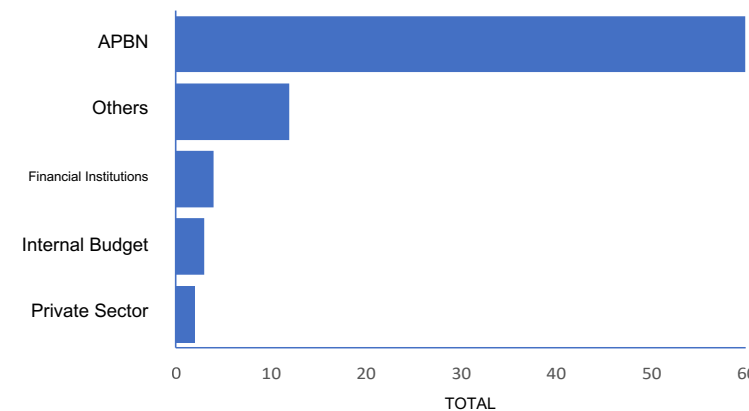
Funding Sources for Village-Owned Enterprises



Source of Funding for Capacity Building



Source of Facilities



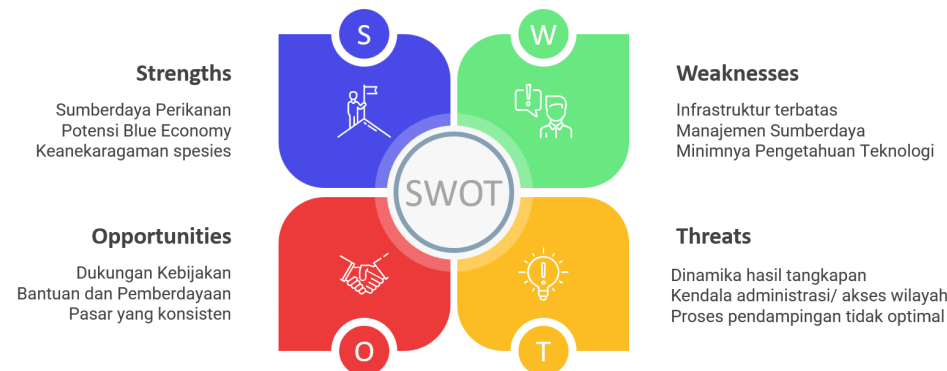


FISHERIES PRODUCTIVITY, ADDED VALUE AND EXPORTS

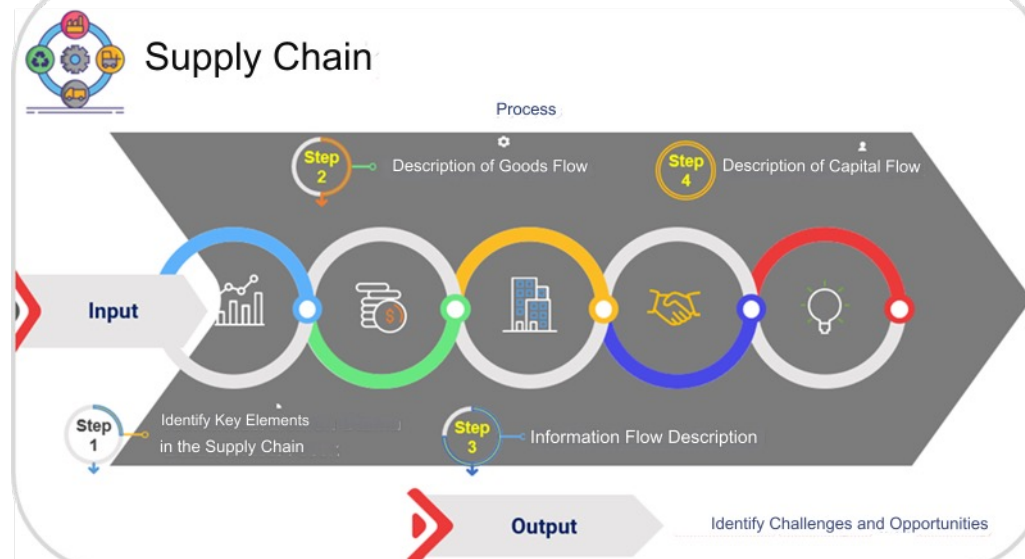
Productivity, Value Added and Exports



SWOT Analysis in Blue Food Assessment: Rantai Pasok



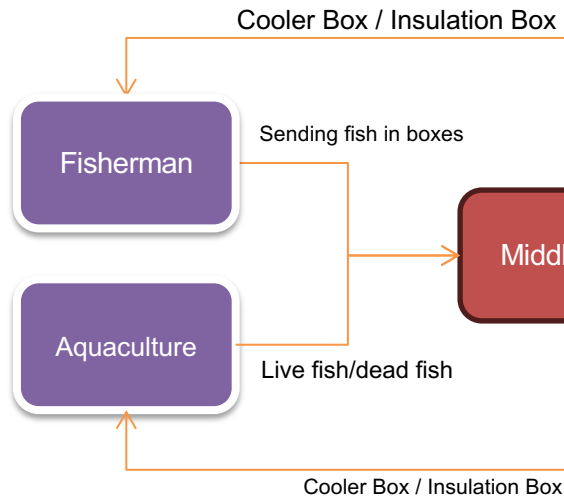
Supply Chain





SUPPLY CHAIN ANALYSIS

SUPPLY CHAIN ANALYSIS



Stored

Cool
Storage/Insul
ation Box

Transport Equipment

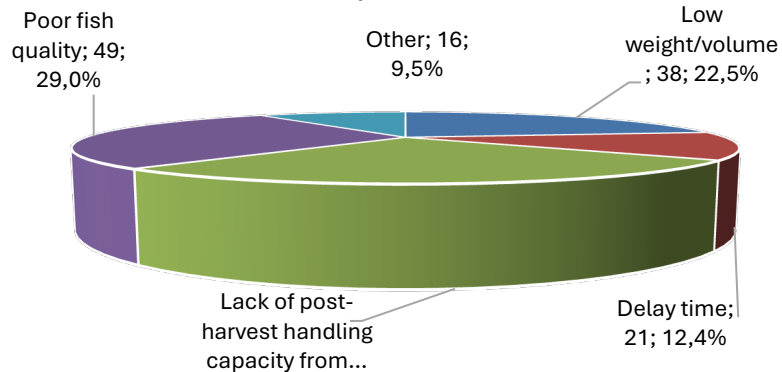
- 1.Walking (2.9%)
- 2.Bicycles (0.7%)
- 3.Motorcycles (31.6%)
- 4.Mini trucks (17.6%)
- 5.Cars (25.7%)
- 6.Trucks (6.6%)
- 7.Logistics by third parties (3.7%)
- 8.Others (11%)

User

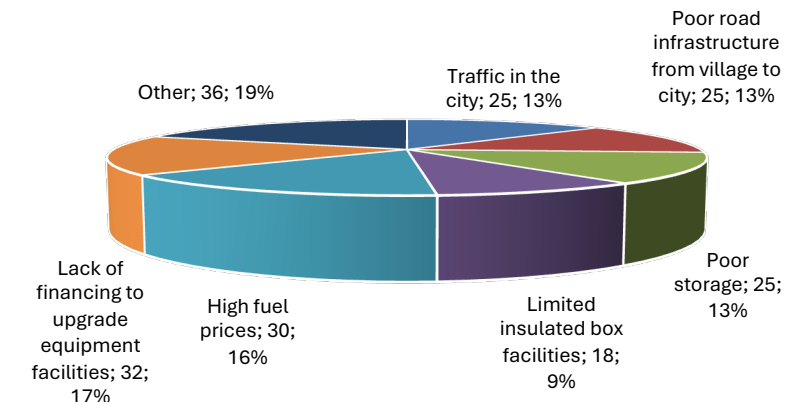
- 1.Medium to large fish processing manufacturing (18.5%)
- 2.Larger traders (28.1%)
- 3.Exporters (9.6%)
- 4.Direct-to-consumer (33.6%)
- 5.Others (10.3%)

Immediate sale

Challenges of Supplying Fish from Fishermen/Aquaculture Farmers



Challenges in the Logistics process



Appendix 2

Qualitative Data Results





Indonesia's untapped blue food sector holds immense potential for socio-economic development

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	12.1 million tons	7.5 million tons
Aquaculture	>50 million tons	7.9 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

Workers in the fishery sector are **women**

43%

21.5%

Children are **stunting** despite high fish consumption

Food loss and waste generated by the fishery sector

7-15
tons



MSC along with BAPPENAS share a collaborative vision to strengthen Indonesia's blue food economy pillars for transformative change



Opportunity

**Strengthening competitiveness
of the blue food economy**

- Productivity enhancement
- Product diversification
- Improved livelihood and social outcomes



Approach

In-depth qualitative study

- Nuanced comprehensive insights
- Complementary to the quantitative study



Expected Outcome

**Effective, contextual
roadmap**

- Local perspectives
- Strategic blueprint for progress the 6 pillars



MSC's qualitative research aims to provide a comprehensive understanding of the six key pillars that form the foundation of the Blue Food Assessment

- The qualitative research seeks to explore socio-cultural dynamics, local perspectives, and the lived experiences of small-scale fishers (both men and women) involved in blue food value chains.
- It complements the insights from the quantitative data with nuanced experiences and contextual understanding



Nutrition

Understand the dietary patterns, and socio-economic factors that influence the consumption and the availability of nutritious blue food products.



Justice

Understand Issues of maritime property and use of sea spaces
Inclusive governance and participation of women



Productivity, value creation, and export

Increasing opportunities for value addition and creation food and non-food marine products



Environment

Evaluate climate change corollaries on blue food productivity and farming.
Assess impact of mangrove deforestation, water pollution etc.



Small-Scale Fisheries & Aquaculture

Enablers and barriers for growth of small scale, and vulnerable fishing communities



Food loss & waste

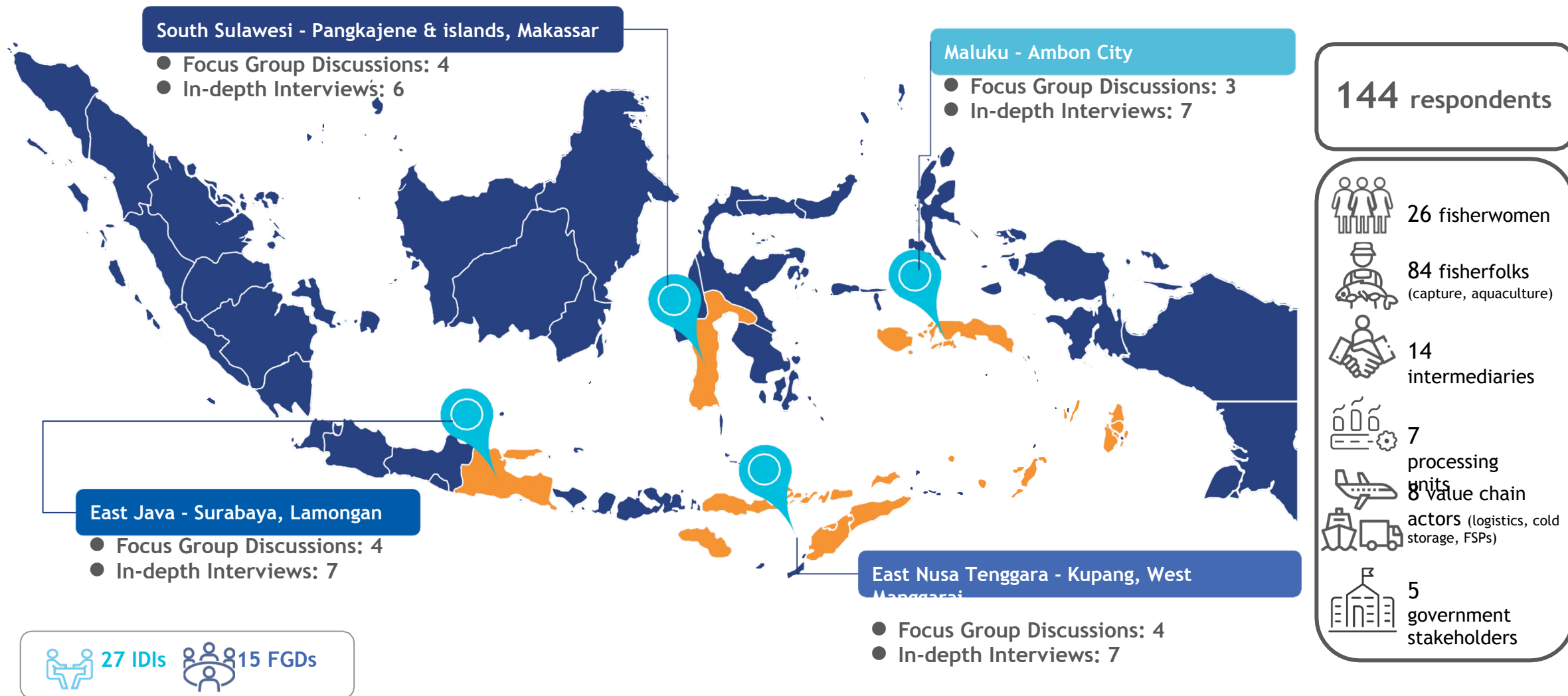
Investigate reasons and potential solutions or mitigation measures of food spoilage and wastage

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



Respondent Survey

To gain a deeper understanding of the six key pillars, we conducted in-depth interviews (IDIs) and focus group discussions (FGDs) across four provinces with various stakeholder groups.





Our research locations are strategically selected based on blue food economy, socio-economic diversity, and geographical attributes (1/2)

South Sulawesi



9.4 million
population

IDR 69.7 mn
income per capita

27.4%
stunting rate

111,064
fisher households

434,805
tons
fish productions

173,650 tons
(USD 612k)
export

Capture commodities: Indian mackerel, Indian oil sardine, and skipjack tuna

Aquaculture commodities: seaweed, milkfish, and Nile tilapia fish

1,211 micro small
and **105** medium
large processing units

East Java



41.8 million
population

IDR 71.12 mn
income per capita

17.7%
stunting rate

210,792
fisher households

595,779 tons
fish productions

352,237 tons
(USD 1.9 mn)
export

Capture commodities: Indian oil sardine, purple-spotted bigeye, and threadfin bream

Aquaculture commodities: milkfish, vannamei shrimp, and catfish

10,737 micro small
and **133** medium
large processing units



Our research locations are strategically selected based on blue food economy, socio-economic diversity, and geographical attributes (2/2)

East Nusa Tenggara



5.6 million
population

IDR 20.6 mn
income per capita

37.9%
stunting rate

45,435
fisher households

139,066 tons
fish productions

3,909 tons
(USD 9.7k)
export

Capture commodities: scads, sardines, and skipjacks

Aquaculture commodities: seaweed, Nile tilapia fish, and catfish

892 micro small and processing units

Maluku



1.9 million
population

IDR 26.1 mn
income per capita

28.4%
stunting rate

40,695
fisher households

518,614 tons
fish productions

30,987 tons
(USD 79k)
export

Capture commodities: skipjack tuna, scads, and Indian mackerel

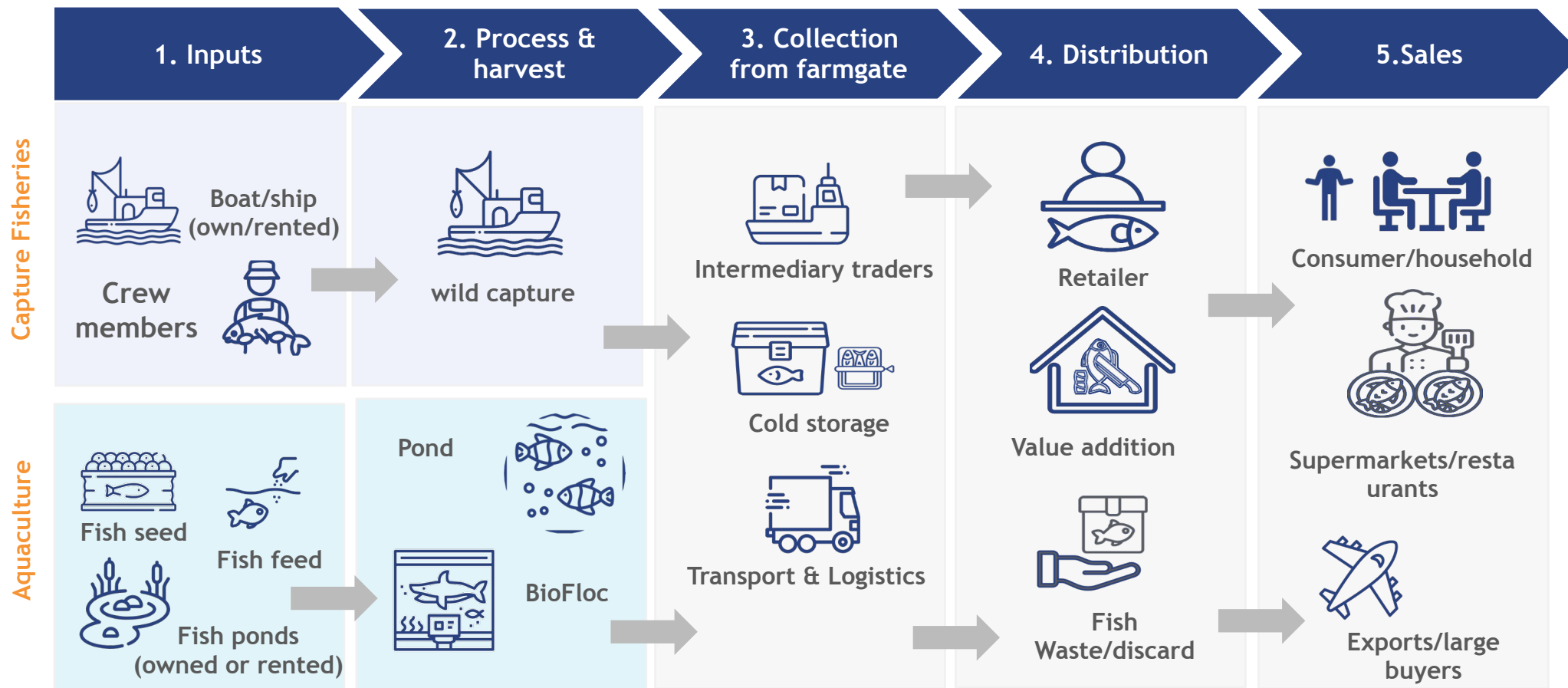
Aquaculture commodities: seaweed, Nile tilapia fish, and grouper

1,184 micro small and **20** medium large processing units



The fisheries value chain is a complex, multi-stage process involving various actors from fishers to retailers

Strengthening collaboration among value chain actors and addressing challenges at each stage will enhance sustainability, product quality, and market competitiveness.





Understanding the role and impact of small-scale fishers in Indonesia

Actor: Small scale fishers

- Our assessment explored the critical role of small-scale fishers, who are key actors in Indonesia's fisheries sector, and assess their contributions and challenges across the six core pillars of our analysis.
- Through insights from both men and women involved in capture fisheries and aquaculture, we examine their activities, environmental impact, food consumption and sales, women's roles, food loss and waste, and the influence of tourism on their livelihoods.

1. Respondents' Activities: activities and harvest



Capture Fisheries

Fishermen in Maluku and East Java engage in capture fisheries, catching species like mackerel, yellowtail scad, and tuna. While a portion of their catch is consumed domestically, most is sold in local markets or to middlemen.



Aquaculture

In East Java and South Sulawesi, aquaculture focuses on high-value species like grouper and barramundi, mainly sold for income. Respondents consume fish from their ponds during low market prices or when they fail to meet commercial standards.



Seaweed Farming

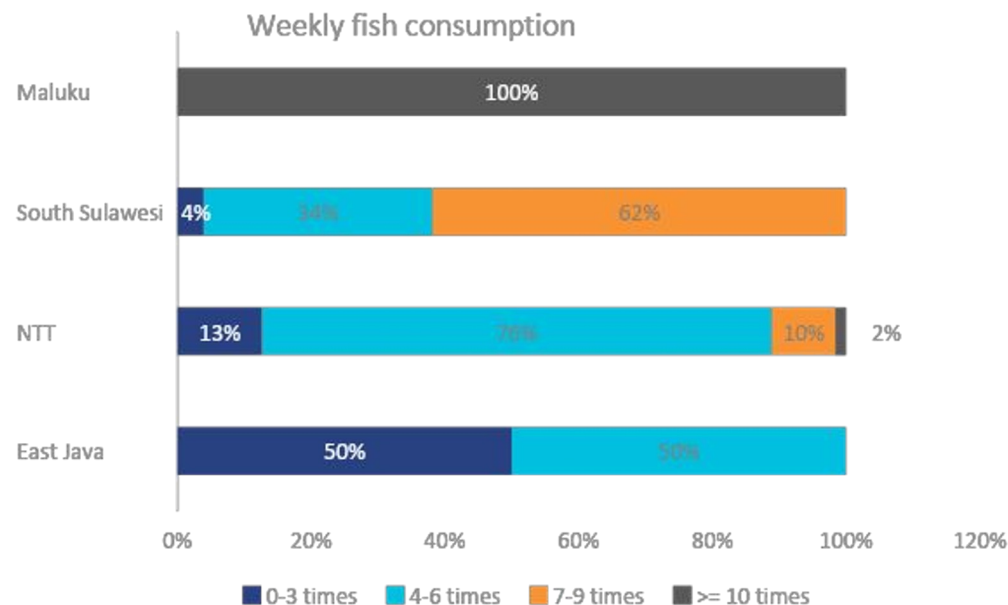
Shift from traditional fishing to seaweed farming has increased income opportunities in provinces like East Nusa Tenggara, although seaweed is not part of their diet. Most seaweed is dried and sold to middlemen.



Fish is a daily staple for small-scale fishing communities, but during market price hikes, people often prefer selling their catch over consuming it

Actor: Small scale fishers

2. Nutrition: diet and consumption



- **Fish as a Daily Staple:** Across all regions, fish is consumed nearly every day, especially in places like Ambon, where species such as mackerel tuna and yellowtail scad are popular in traditional dishes.
- **Self-Sourced Fish:** In aquaculture areas like East Java, households often consume fish from their personal ponds, maintaining a consistent fish diet even in farming regions.
- **Shift to Affordable Proteins:** In lean seasons or when fish prices increase, communities in East Nusa Tenggara turn to more affordable protein options like eggs or rely on simpler meals such as rice and water.
- **Protein Preferences for Children:** While fish is a staple, children in more economically stable families tend to prefer other protein sources like chicken and eggs when they are readily available or affordable.

“Fish is a staple food for Ambonese, if (we) eat fish, (we) feel strong enough to do more activities.” [Lalili, M, Capture Fishermen, Ambon, Maluku]

“We eat fish every day but we buy fish from the market, not from our own cages (Keramba). The fish from the cage is for sale .”
-Christina, Aquaculture fisherwoman and runs seafood restaurant, Ambon, Maluku



Small-scale fishers are increasingly vulnerable to environmental changes, with unpredictable weather, rising sea temperatures, and pollution severely impacting both capture fisheries and aquaculture

Actor: Small scale fishers

3.Environment and climate



*Thermal Power Plant near seaweed farm
in Oeba, NTT*

- **Climate Change:** Unpredictable weather patterns affect both capture fisheries and aquaculture. In Maluku, high waves during the west season prevent fishers from going to sea despite fish abundance, while rising sea temperatures in East Nusa Tenggara harm seaweed farming.
- **Sustainable Practices:** Traditional methods like purse seine nets in Maluku are less harmful to the environment, but concerns are growing in East Java about the use of tiger trawls, which are effective but environmentally damaging. The lack of alternative methods forces many to continue using harmful practices.
- **Pollution:** Industrial pollution, particularly from coal-fired power plants in East Nusa Tenggara, degrades water quality, negatively affecting seaweed farms by reducing productivity and increasing operational costs.

“Every year the fish population tends to decline, especially tuna. 2013 was the year when the tuna population was very large and continued to decline until 2024 the population declined significantly. While people said in the market there is a lot of demand for Tuna. It is because fishermen outside Maluku (Philippines) use environmentally unfriendly ink which makes the sea water dirty so that the fish get dizzy and die quickly. The fish don't like it so they stay away from the Seri Village sea area.”

[Mentary, university student, capture fisherwoman, Ambon, Maluku]

”



Women play essential roles in the fisheries sector, from direct participation in fishing to managing household finances and tasks like cleaning fish and maintaining nets

Actor: Small scale fishers

4. Women's roles in small scale fisheries



- **Direct Involvement in Fisheries:** In South Sulawesi, women like Nurlina are directly involved in capture fisheries, taking on roles traditionally held by men. Nurlina, for example, became the primary breadwinner by continuing her father's fishing business. In aquaculture, women are more commonly involved, managing ponds and contributing to the financial stability of their households.
- **Supporting Roles:** Across all regions, women play a crucial role in managing household finances. They often control the family's budget, save for lean seasons, and engage in side jobs to supplement the household income. For instance, in East Java, women engage in activities such as cutting used fishing nets, peeling crabs, and managing small retail businesses. These activities are essential in bridging income gaps and ensuring the financial sustainability of their households.
- **Community and Family Contributions:** In many cases, women's involvement extends beyond economic activities. In East Java, for instance, women also take on roles such as managing kindergartens or working as private tutors, showcasing their diverse contributions to both their families and communities.



My husband and I share responsibilities equally. While he goes to sea and brings the crabs, I focus on cleaning the catch, selling locally and maintaining the nets. Together, we make sure our household and our work run smoothly
- Lamongan, East Java





Small-scale fisheries ensure minimal wastage promoting both sustainability and efficiency within their communities.

Actor: Small scale fishers

5. Food loss and waste



Discarded fish used as fish feed for grouper fish in Lamongan, East Java

- **Handling of Unsellable Fish:** Across all regions, respondents reported that they often consume fish that are not suitable for sale. These fish may be damaged, too small, or less desirable in the market. Fish that are rejected by middlemen due to quality issues are often preserved by salting or smoking to extend their shelf life.
- **Market Fluctuations:** In regions like Maluku, respondents reported that during periods of low market prices, they sometimes resort to selling fish directly to consumers in smaller quantities, even at a loss, to avoid waste. The inability to store or preserve large quantities of fish exacerbates this issue, leading to significant food waste, especially during peak fishing seasons.
- **Repurposing discarded fish parts for feed:** Discarded fish parts such as heads and fins are often repurposed in aquaculture as feed for species like grouper fish. These parts provide a cost-effective and protein-rich food source, contributing to a sustainable cycle in fisheries by reducing waste and supporting aquaculture growth.
- **Environmental impact on food loss:** In East Nusa Tenggara the declining quality of seaweed due to environmental degradation has led to increased wastage, as poor-quality seaweed fetches lower prices or is unsellable.




“ We feed the groupers with fish waste, which is fish parts, small, stale fish from the captured fish-sellers. We need to feed in big amounts, up to 7 buckets (of 20kg) per day. We don’t know how much the processed feed costs, but it will be much more expensive thus will increase our production cost.”

[Aden, M-27, grouper pond owner, Lamongan]









The fisheries value chain offers significant potential for growth and innovation, empowering small-scale fishers to improve livelihoods, and boost economic contributions (1/2)

Stakeholders	Key Challenges	Impact on Fisheries
 Small-Scale Fisheries (SSF)	<ul style="list-style-type: none">● Limited access to formal credit and financial products● Dependence on middlemen for financing● Inadequate access to modern equipment and technology● Food loss due to lack of proper storage facilities● High cost of inputs (feed, seeds, etc.) for aquaculture● Vulnerability to climate change and environmental conditions● Gender based barriers for women in accessing resources, training, and opportunities	<ul style="list-style-type: none">● Restricted ability to invest in equipment and expand operations● Continued financial dependency and limited growth potential● Increased postharvest losses, reducing overall profitability● Reduced productivity and profitability in aquaculture● Increased risk of crop failure due to environmental factors● Lower economic empowerment and participation of women in higher value activities
 Processors and Value Addition	<ul style="list-style-type: none">● Inconsistent fish supply due to seasonality and weather● High operational costs for maintaining quality standards● Managing food loss and waste in processing● Limited access to export markets due to stringent standards	<ul style="list-style-type: none">● Difficulty in meeting export demands● Potential financial losses due to supply gaps and quality issues● Losses from food waste reduce profitability● Barriers to entering new, high value markets
 Intermediaries and Middlemen	<ul style="list-style-type: none">● 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	<ul style="list-style-type: none">● Risk of financial losses● Challenges in maintaining consistent fish supply and meeting demand● Losses from spoilage affect income and market stability



The fisheries value chain offers significant potential for growth and innovation, empowering small-scale fishers to improve livelihoods, and boost economic contributions (2/2)

Stakeholders	Key Challenges	Impact on Fisheries
 Logistics Partners	<ul style="list-style-type: none">● High operational costs and reliance on consistent power supply● Limited infrastructure in remote areas● Regulatory challenges in transporting perishable goods	<ul style="list-style-type: none">● Risk of spoilage and product loss during transit● Limited reach to remote fishing communities● Increased costs and delays in supply chains, affecting market access
 Government Actors (BAPPEDA & Dept. of Fisheries)	<ul style="list-style-type: none">● Budget constraints and shifting authority between local and central government● Challenges in enforcing regulations and providing consistent support● Implementation of national policies at local levels● Limited infrastructure to support fisheries	<ul style="list-style-type: none">● Delayed or limited support for fisheries initiatives● Inefficient regulation enforcement leading to unsustainable practices● Inadequate infrastructure hinders sector growth and sustainability
 Financial Service Providers (FSPs)	<ul style="list-style-type: none">● High risk associated with lending to SSF due to seasonality● Lack of collateral among fishers● Limited tailored financial products for the fisheries sector	<ul style="list-style-type: none">● Limited access to formal credit for SSF● Slow adoption of financial products designed for the fisheries sector● Reduced capacity for SSF to expand and invest in growth
 Exporters	<ul style="list-style-type: none">● Compliance with international standards and certification requirements● Challenges in maintaining supply chain efficiency● Vulnerability to global market fluctuations	<ul style="list-style-type: none">● Barriers to entering new export markets● Potential financial losses due to noncompliance or supply chain disruptions● Exposure to market risks and price volatility affects profitability



The research provides key insights into the six pillars that influence the blue food economy

01



Nutrition

The dietary habits of Indonesian fisherfolk communities show a strong reliance on fish for protein, yet nutritional awareness remains low.

02



Justice

Challenges in the fisheries sector are compounded by gender disparities, resource access issues, and environmental threats.

03



Small-scale fisheries

Small-scale fishers in Indonesia face challenges like limited access to finance, technology, and infrastructure, affecting their competitiveness and sustainability.

04



Value addition & export

The fisheries sector in Indonesia is dominated by the export of raw or minimally processed fish, limiting the potential for value addition.

05



Environment

Climate change, pollution, and waste mismanagement deplete fish stocks and raise costs, leaving small-scale fishers vulnerable.

06



Food loss & waste

Food loss and waste are prevalent across the fisheries value chain, from production to post-harvest handling, processing, and distribution.

The challenges and opportunities across the fisheries sector in Indonesia are deeply interconnected, with each pillar influencing the others in significant ways.



The research provides key insights into the six pillars that influence the blue food economy

Nutrition

Common fish varieties

Daily consumption includes chub mackerel (*tenggiri*), indian mackerel (*kembung*), and yellowtail scad (*ekor kuning*), while higher-value fish like tuna and grouper (*kerapu*) are primarily sold for profit.

Government programs

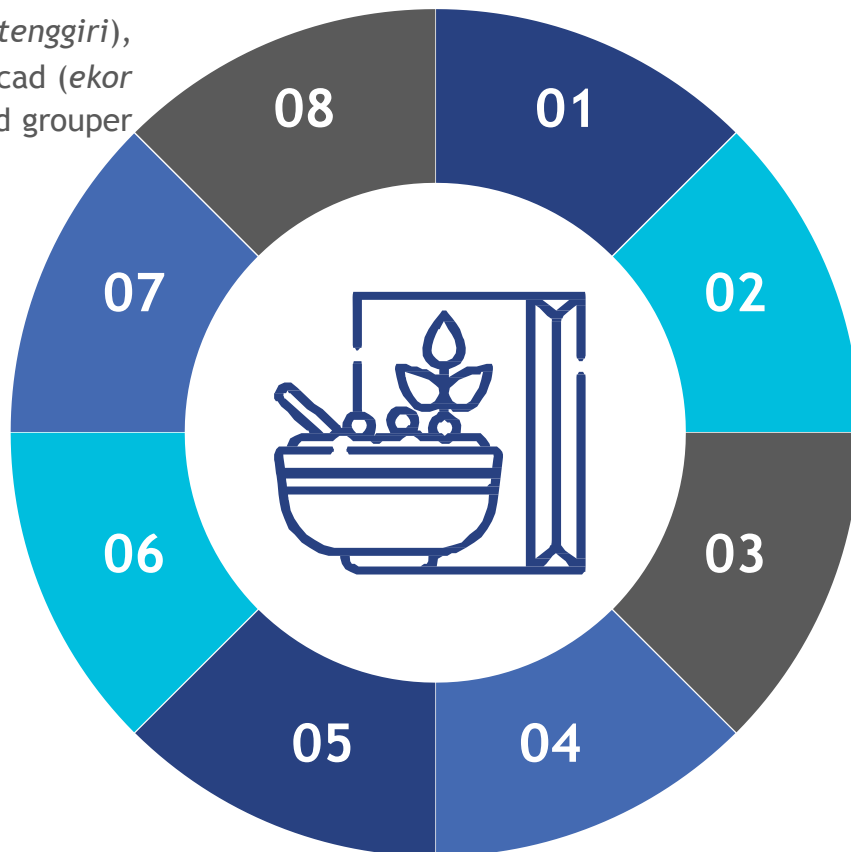
The GEMARI Program promotes fish consumption, but the community lacks awareness of its nutritional benefits.

Special occasion proteins

Chicken and eggs are consumed on special occasions, mainly by children and youth, due to their higher cost.

Fresh fish consumption

There is a cultural preference for fresh fish, with processed options largely avoided.



Economic constraints

Fisherfolk consume lower-quality fish due to economic limitations, prioritizing immediate sustenance over nutrition.

Preference for fish

Fish is favored over chicken or beef, which are seen as too expensive.

Early introduction

Fish is introduced to children as early as seven months, becoming a primary protein source.

Preservation technique

Salting, drying, and smoking are the main methods used for preserving fish, allowing longer storage.

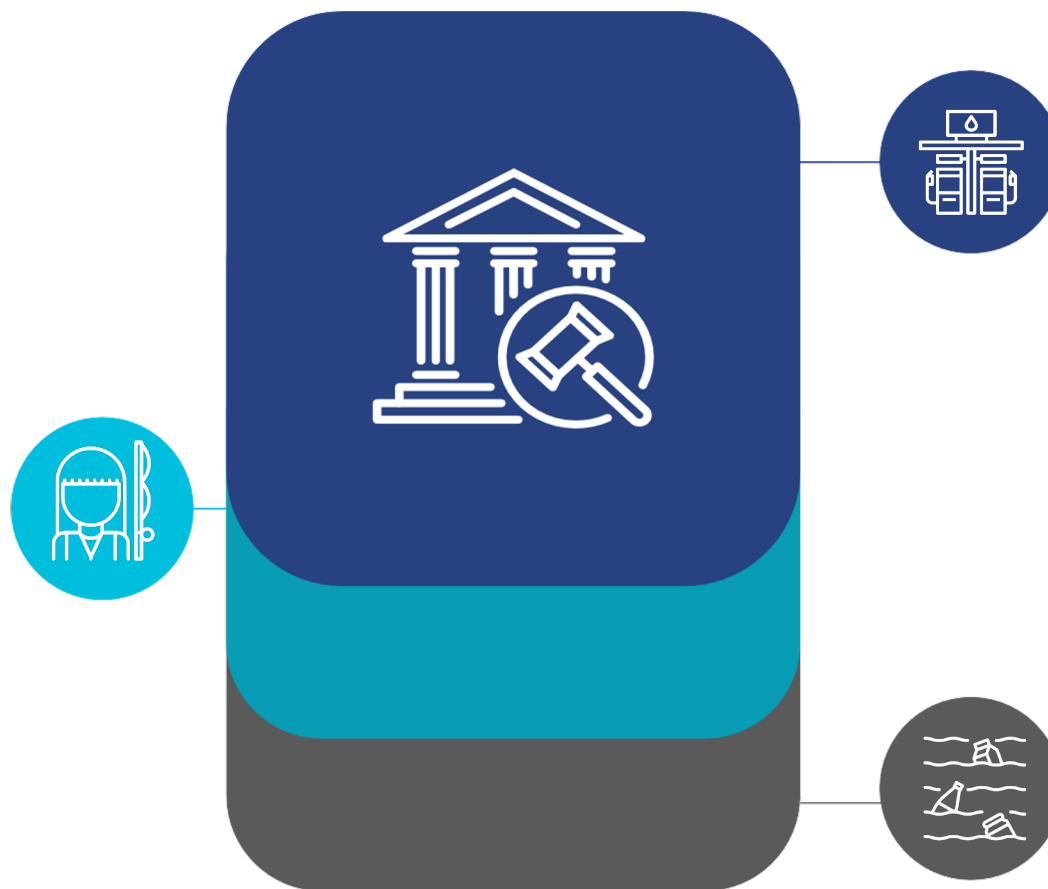


Fisheries face challenges from gender inequality, resource access issues, and environmental threats

Justice

Women's participation

- **Pre-harvest:** Women help prepare fishing gear and provisions.
- **Harvest:**
 - Capture fisheries: Few women participate, though some join husbands.
 - Aquaculture: More balanced gender roles; higher female participation.
- **Post-harvest:** Women sort, sell, buy fish, and repair gear (e.g., nets).
- **Financial management:** Women often manage household finances.
- **Processing units:**
 - Medium/large: Men handle physical tasks; women manage administration.
 - MSMEs: Predominantly employ women.



Access to resources

- **Capture fisheries:** Rely on third-party fuel/ice suppliers with deferred payment due to capital constraints.
- **Aquaculture:** Challenges include:
 - Limited access to affordable seeds/feed.
 - Price/availability fluctuations.
 - Fuel shortages and overpriced supplies from middlemen.

Environmental threats

- **Ecosystem damage:** Pollution and coal plants threaten fishers' livelihoods by degrading marine environments.
- **Weak enforcement:** Regulatory gaps undermine safety and sustainable fishing practices.
- **Responsibility issues:** Overlapping roles hinder proper regulation and management.



Small-scale fishers in Indonesia lack access to finance, technology, and infrastructure, undermining their competitiveness

Small-scale fisheries

Conflict with larger vessels

Small-scale fishers often clash with larger vessels from other regions, forcing them to relocate due to competition for fishing areas and limited equipment.

Environmental degradation and climate change

Overfishing, pollution, and rising sea temperatures deplete coastal fish stocks, straining the livelihoods of small-scale fishers who rely on nearby waters for their catch.

Limited access to technology and infrastructure

They often lack modern fishing equipment and infrastructure like cold storage, restricting their ability to fish further offshore and increasing post-harvest losses.

01

02

Dependency on middlemen

Small fishers depend on middlemen for market access and financing, preferring this over formal loans for quicker capital and established relationships.

03

Price control

In capture fisheries, market competition limits middlemen's price control, while in aquaculture, fewer players allow them to set low prices, as seen with seaweed farmers in East Nusa Tenggara and catfish aquaculture in East Java.

04

Focus on daily needs

Small-scale fishers prioritize immediate cash flow by selling their catch without further processing.

05

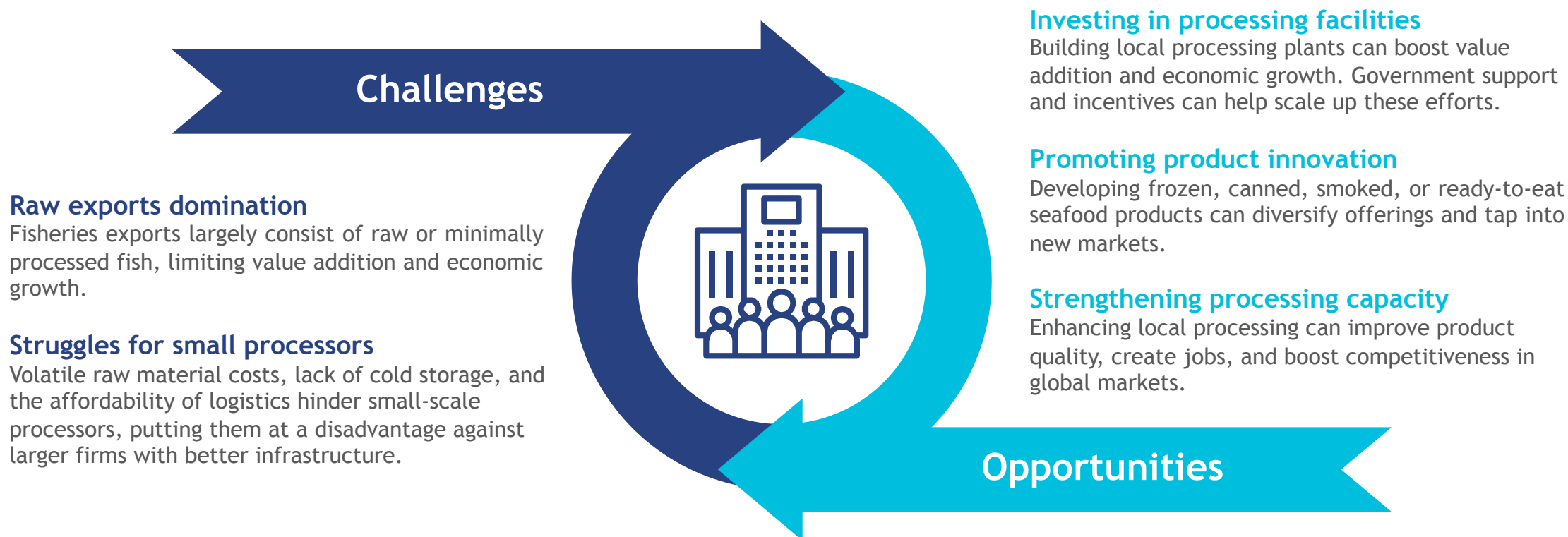
06





The Indonesian fisheries sector primarily exports raw or minimally processed fish, which restricts opportunities for value addition

Value addition & export





Climate change, pollution, and poor waste management deplete fish stocks and increase costs, putting small-scale fishers at risk

Environment

01

Climate and weather changes

- **Unpredictable weather:** Climate change has made weather patterns increasingly unpredictable, affecting both capture fisheries and aquaculture.
- **Rising temperatures:** Rising temperatures have affected both capture fisheries and aquaculture, though the impact is more noticeable in aquaculture. Seawater aquaculture operators report longer harvest times, while pond aquaculture farmers have experienced increased outbreaks and pests linked to higher temperatures.

02

Fish stock and overfishing

- **Declining Stocks:** Most fishers have to travel further as fish populations decline.
- **Retired Boats:** Some fishers even retire their large boats due to reduced catches and rising operational costs.

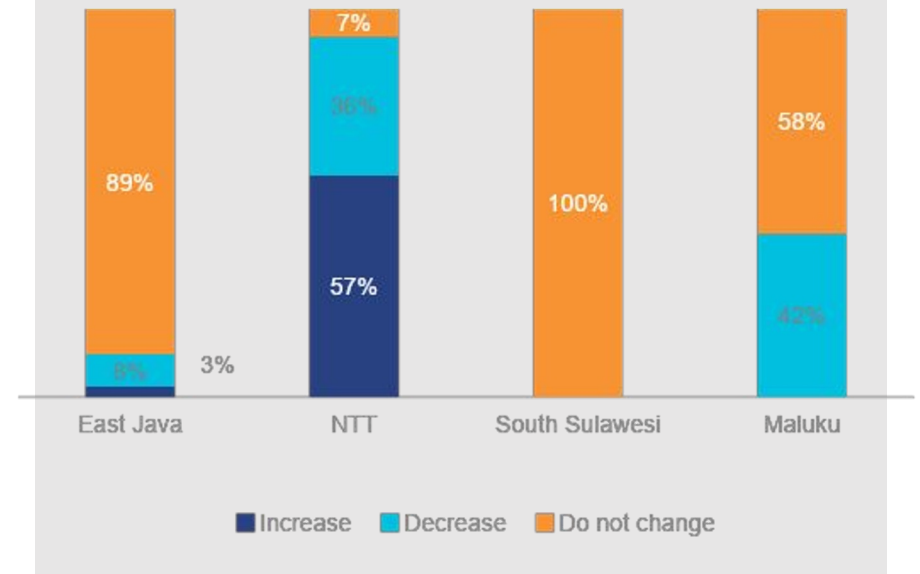
03

Environmental waste and emissions

- **Waste Systems:** Larger processing units typically comply with regulations, but smaller ones lack proper waste disposal.
- **Logistics & Emissions:** Transportation companies show little focus on reducing emissions or adopting renewable energy.
- **Waste Handling:** Waste near fish markets is collected and transferred to public disposal systems.

The small-scale fishers we interviewed are starting to notice changes in production volume due to environmental factors.

Changes observed in production volume





Food loss and waste are widespread in the fisheries value chain, from production to distribution

Food loss & waste



Production

Fishers target specific species to minimize bycatch, but any unintentional catches are still kept for sale or personal use.



Post-harvest handling and storage

Fish loss occurs due to inadequate storage on boats, especially in rough seas, and limited cold storage during long fishing trips. Lower-quality or rejected fish are sold at reduced prices, dried, or used as animal feeds. Oversupply during peak seasons leads to discarded fish, while government initiatives for fish waste processing plants are hampered by budget constraints.



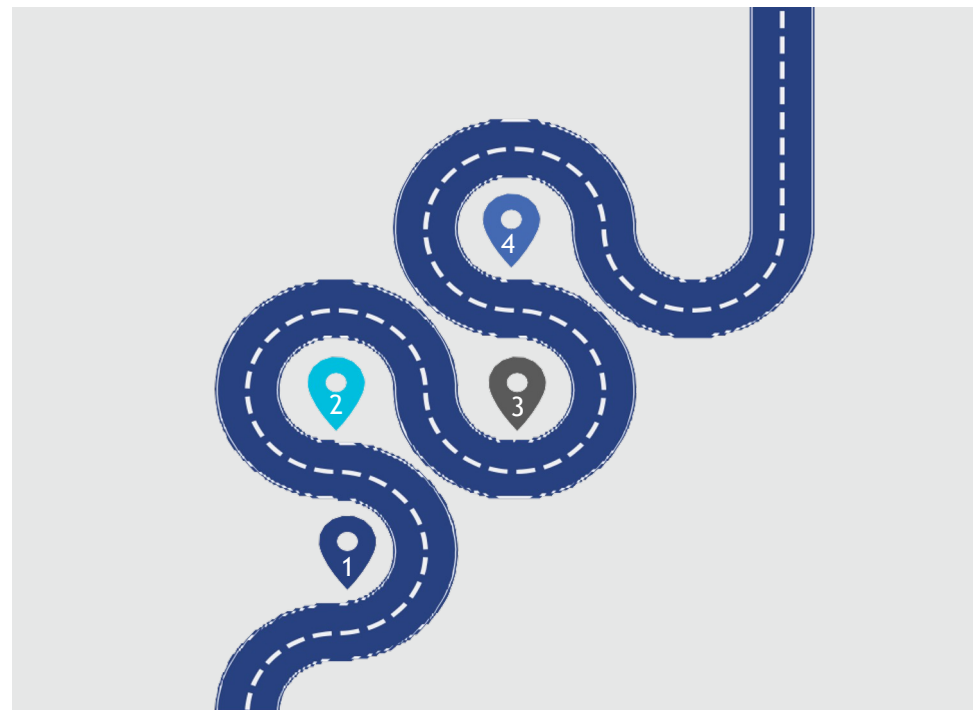
Processing and distribution

In **processing units**, unused fish parts are either taken by employees for personal use or sold to industries like fish flour and processed fish food manufacturing, which helps reduce waste. In **traditional market**, usellable fish are either disposed or given for free. Unlike processing units, some parts like intestines, head, fin, and tail are disposed while cleaning the fish.



Retail and consumption

Some fish delivered by suppliers are of poor quality and must be discarded. Cooked fish that are unappealing (e.g., broken meat) are not served to customers but consumed by restaurant staff. Leftover portions of served fish are also discarded.





Indonesia is supporting the fisheries sector through various policies and programs but greater awareness and accessibility are needed for full impact



Description & Benefits



Key Insights

Policy/Program

Quota-Based Measured Fishing Program,
Ministry of Fisheries and Marine Affairs

- The program encompasses monitoring fishing activities, regulating fishing seasons, establishing conservation areas, and restoring damaged ecosystems across six designated zones.
- It aims to conserve fish resources and the environment while fostering equitable national economic growth.

- **Improved Monitoring and Infrastructure:** Ongoing efforts to enhance monitoring systems and port infrastructure will pave the way for smoother program implementation by 2025, ensuring better oversight and operational efficiency.
- **Opportunities for Small-Scale Fishers:** While industrial zones could intensify competition, there are opportunities to create dedicated spaces for small-scale fishers, ensuring equitable access and minimizing inequalities in resource distribution.
- **Sustainability through Zoning:** The zoning system, including conservation efforts in areas like Komodo Park, aims to balance environmental sustainability with local needs. Continued engagement with fishers can help mitigate concerns about access to traditional fishing grounds and promote shared benefits.

GEMARIKAN
Ministry of Fisheries and Marine Affairs

- Gemarikan is a SBCC Campaign aims to promote fish consumption, especially among children, by raising awareness of its health benefits.
- The goal of the campaign is to increase fish intake and, in doing so, reduce the stunting rate among children.

- **Expanding Reach and Consistency:** Efforts are underway to standardize the program's implementation across provinces, ensuring that more regions can benefit equally from its positive impacts.
- **Opportunities for Increased Funding:** As the program gains momentum, there are opportunities for additional funding and partnerships to enhance its execution, further driving its effectiveness and reach.



To ensure a comprehensive strategy that accelerates sustainable growth in Indonesia's blue food sector, the key recommendations are based not only on the six-pillar approach but also on cross-cutting priorities

Six-pillar recommendations

Nutrition, justice, environment, small-scale fisheries, value addition and export, and food loss and waste.



Cross-cutting recommendations

The priorities are integrated to ensure policy coherence, multi-sectoral collaboration, and resilience.



Blue food assessment's six-pillar approach recommendations



Nutrition

- Integrate blue foods into national nutrition programs
- Support local fish consumption
- Targeted SBCC for nutrition literacy



Justice

- Ensure equitable access to resources
- Support women's empowerment and recognition
- Ensure labor rights and social protection



Small-scale fisheries

- Enhance access to finance and market
- Strengthen capacity building
- Develop Disaster Risk Reduction Plans for coastal communities



Value creation and export

- Upgrade processing facilities
- Facilitate export market access



Environment

- Implement sustainable fishing and aquaculture practices
- Climate resilience programs



Food loss and waste

- Improve post-harvest infrastructure
- Promote waste utilization
- Address food loss at retail and household levels



Cross-cutting recommendations (1/3)

Policy coherence and multi-sectoral coordination

Align policies across fisheries, agriculture, tourism, environment, and public health to support integrated development. Strengthen central and local government coordination to ensure local implementation matches national fisheries goals.

1

Strengthening governance and institutions

Build local government and fisheries cooperative capacity to manage fisheries. Ensure local governments have the necessary financial and technical resources to enforce regulations, manage coastal areas, and support small-scale fisheries, aligning with national sustainability objectives.

2

Promote international collaboration and leadership

Enhance Indonesia's leadership in global and regional fisheries organizations, advocating for sustainable blue foods in international forums and trade negotiations.

3

Developing guidelines and regulations

- **Standardized guidelines:** Enforce uniform sustainable fishing and trade guidelines aligned with global standards.
- **Improve data collection:** Modernize data collection for better tracking of fish stocks and fisheries performance.
- **Enhance monitoring:** Use tech solutions like satellite tracking to enforce quotas and regulations.

4



Cross-cutting recommendations (2/3)

Strengthening financial service providers

- **Expand financial products:** Encourage FSPs to create tailored products for the fisheries sector, like revenue-based financing, climate risk insurance, and seasonal micro-loans.
- **Build FSP capacity:** Train financial institutions to better understand the fisheries sector and design more effective financial solutions.

5

Formalizing middlemen and intermediaries

- **Regulate and support:** Implement regulations to formalize middlemen, ensure fair trade, and provide training, finance access, and bargaining power through cooperatives.
- **Strengthen market linkages:** Use digital platforms to connect small fishers, middlemen, and larger buyers with real-time pricing and market access.

6

Training and capacity building across the value chain

- **Comprehensive training:** Develop training for the entire fisheries value chain, covering fishing techniques, sustainable practices, business management, and food safety.
- **Enhance extension services:** Expand government extension services to offer ongoing technical support, especially in remote areas.

7

Digital transformation on the fisheries sector

- **Adopt technology:** Promote digital tools like e-commerce, mobile transactions, and blockchain for efficiency and transparency.
- **Support digital literacy:** Train fishers and processors in online marketing, mobile banking, and digital record-keeping.

8



Cross-cutting recommendations (3/3)

Strengthening infrastructure and logistics

- **Improve remote infrastructure:** Invest in better roads, electricity, and water access in underserved coastal areas to boost fisheries efficiency.
- **Enhance cold chain logistics:** Expand cold storage networks to maintain fish quality and reduce spoilage, with public-private partnerships for funding and management.

9

Youth engagement and succession planning

- **Youth incentives:** Create policies to attract young people to fisheries, offering youth-specific grants, loans, and tax incentives.
- **Succession planning:** Implement training and mentorship programs for younger fishers, ensuring knowledge transfer and workforce continuity.

10

Research and innovation

- **Encourage R&D:** Promote research in sustainable aquaculture, new fish species, and processing innovations, with grants for universities and companies.
- **Share research:** Make research findings accessible through online hubs, workshops, and collaborations with local governments and NGOs.

11



Blue food pillars

Countries

Key insights



Nutrition



Myanmar



Zambia

The the Small Fish Production, Processing, and Marketing (SPM)

- Combating malnutrition in Myanmar and Zambia by promoting nutrient-rich small fish products, leveraging fish-based solutions
- Empowering communities through education and training
- Fostering partnerships for sustainable aquaculture.



Environment



Productivity, value creation, and export



Norway

Sustainable Salmon production through technology innovations

- Adopting technology innovations like floating cages, automated breeding
- Implementing strict environmental regulations that boosted efficiency and reduced environmental impact
- Setting global standards for responsible aquaculture



Food loss & waste



Singapore

Blue Aqua and the Government of Singapore Initiative

- Transforming food waste into sustainable fishmeal alternatives for aquaculture.
- Using energy-efficient farming and insect farming, the project
- Repurposing food waste to nourish black soldier flies, which are processed into high-quality protein



Justice



Japan



Iceland

Pension programs for fishers in Iceland, Japan, and Morocco

- Providing secure and sustainable retirement benefits tailored to the unique challenges of the fishing profession, ensuring inclusivity and flexibility.
- Providing flexible contributions to accommodate seasonal income fluctuations. Similarly, the



Small-Scale Fisheries & Aquaculture



Philippines



Morocco

FishCORAL Project in the Philippines

- Enhancing financial access for marginalized small-scale fishers through special loans and microfinance from LAND BANK, building resilience against income volatility.
- Special loan for fishers to invest in essential equipment and to upgrade vessel enabling Small-scale fisheries compete with large-scale fisheries.



Case Study 1: Financial needs and priorities of small-scale fishers in Indonesia



- Name: Pak Azis and Pak Akbar
- Age: 45 and 53
- Location: Oeba, Kupang, East Nusa Tenggara

Overview

Fishers generally prioritize short-term financial needs, focusing on daily household expenses and working capital like fuel and fishing supplies. However, **Pak Azis and Pak Akbar recognized the importance of long-term planning by investing in larger boats**, each using formal or informal financing methods.



Challenges

Although they recognize the need for formal financing, they faced several challenges:

- Social and cultural barriers, as fishers often feel unwelcome in formal banking settings.
- The unpredictable nature of fishing, which is seen as a high-risk profession.
- The lengthy banking process and the requirement for collateral.



Solutions

- Lacking collateral, **Pak Azis initially relied on informal loans** and deferred payments from middlemen for financing.
- In contrast, Pak Akbar used his motorcycle BPKB to secure a **formal bank loan**.



Results

- After upgrading his boat, Azis used the boat certificate to get a larger bank loan for further improvements.
- Akbar, after obtaining IDR 20 million for a new boat, later took another loan to upgrade its engine as his business expanded.

Their cases show that better access to finance for boats can boost livelihoods by increasing productivity and creating jobs. Pak Azis and Pak Akbar now offer informal loans to their crews, continuing the cycle of informal finance. As boat owners, they no longer need to fish themselves, extending their careers even as they age. This also highlights how informal finance can lead to formal financial access.



Case study 2: Gender lens in blue food system: Access, participation, and empowerment



- **Name:** Mentary
- **Age:** 23
- **Location:** Seri village, Nusaniwe, Ambon city
- **Profession:** Fisher (capture) and nursing student
- **Motivation:** Passion, family duty, and funding her education

Overview

- Women in Ambon, like Mentary, are **underrepresented in fishing** due to societal norms that view it as male-dominated.
- Most women engage in fish processing, sales, and aquaculture, while sea fishing is considered a **"man's job,"** discouraging others.

Challenge

- **High fuel costs** and **deteriorating equipment** impact her fishing and financial stability.
- **Lack of formal cooperatives** in her village delays government assistance, affecting her family.
- **Relies on informal loans** and personal networks for financing, adding to economic strain.

Solutions

- Uses **traditional methods with creative tweaks**, like self-made lures and "Rompong" devices, to improve her catch.
- **Participation in local fisher groups** helps access limited government support, highlighting the importance of community networks.

Results

- Mentary **supports her studies and family** with her fishing income.
- Her participation in fisher groups aids in **accessing government assistance**, though the lack of a cooperative slows the process.
- Her resilience and success make her a **role model** for other young women, breaking societal norms and empowering her community.



BFA Qualitative Research – Conceptual Framework



Actors in the blue food value chain

We use our flagship design thinking approach, Market Insights for Innovation and Design (Mi4iD), to analyze both demand and supply sides with a user-centric focus within the context of the BFA pillars.



Pillars of the Blue Food Assessment



Small scale fisheries



Analyze small-scale fisheries activities, focusing on consumption, sales, nutrition, environmental impact, women's roles, food loss, and the influence of tourism.



Input management



Analyze the challenges faced by fish seed producers, hatcheries, feed producers, and equipment suppliers and their impact on fishers and fish farmers' productivity.



Intermediaries



Examine middlemen's roles in distribution, value addition, export potential, and associated challenges, along with environmental impacts and growth opportunities in the sector.



Processors: Value addition & export



Explore value addition in blue food products and export potential, examine food loss and waste management, and assess growth opportunities and challenges.



Logistics



Examine cold storage management, quality maintenance, supply chain coordination, food loss and waste management, regulatory compliance, and operational challenges.



Government



Analyze the role of the national government, as well as the contributions of BAPPEDA, DKP, and local government in supporting the blue food sector.



Financial service providers



Analyze the role of national and regional banks, specialized financial products for the blue food sector, and the challenges of financial access within the industry.



We apply two layers of screening process to narrow down the provinces / regions

First layer of screening

What for?

- Identify provinces/regions requiring significant intervention.
- Ensure these areas also have a sufficient basic enabling environment.

Second layer of screening

Dig deeper into the feasibility of intervention, especially from the perspectives of stakeholder management and project management to narrow down the regencies on the chosen provinces.

How?

- Create indexes using sets of relevant variables.
- Construct a priority quadrant based on these indexes.

- Choose the most viable provinces from the quadrant.
- Evaluate the regencies within these provinces based on a predefined set of qualitative criteria.



Deep dive - First layer of screening (provinces)

Development Index.

1. Financial Inclusion Index - *OJK*, 2022 (25%)
2. Poverty Rate - *OJK*, 2022 (25%)
3. Stunting Rate - *Kemenkes*, 2022 (25%)
4. Gender Inequality Index - *BPS*, 2022 (25%)

Blue Economy Index

1. Indonesia Blue Economy Index - *Bappenas*, 2023



Deep dive - Second layer of screening (regencies)

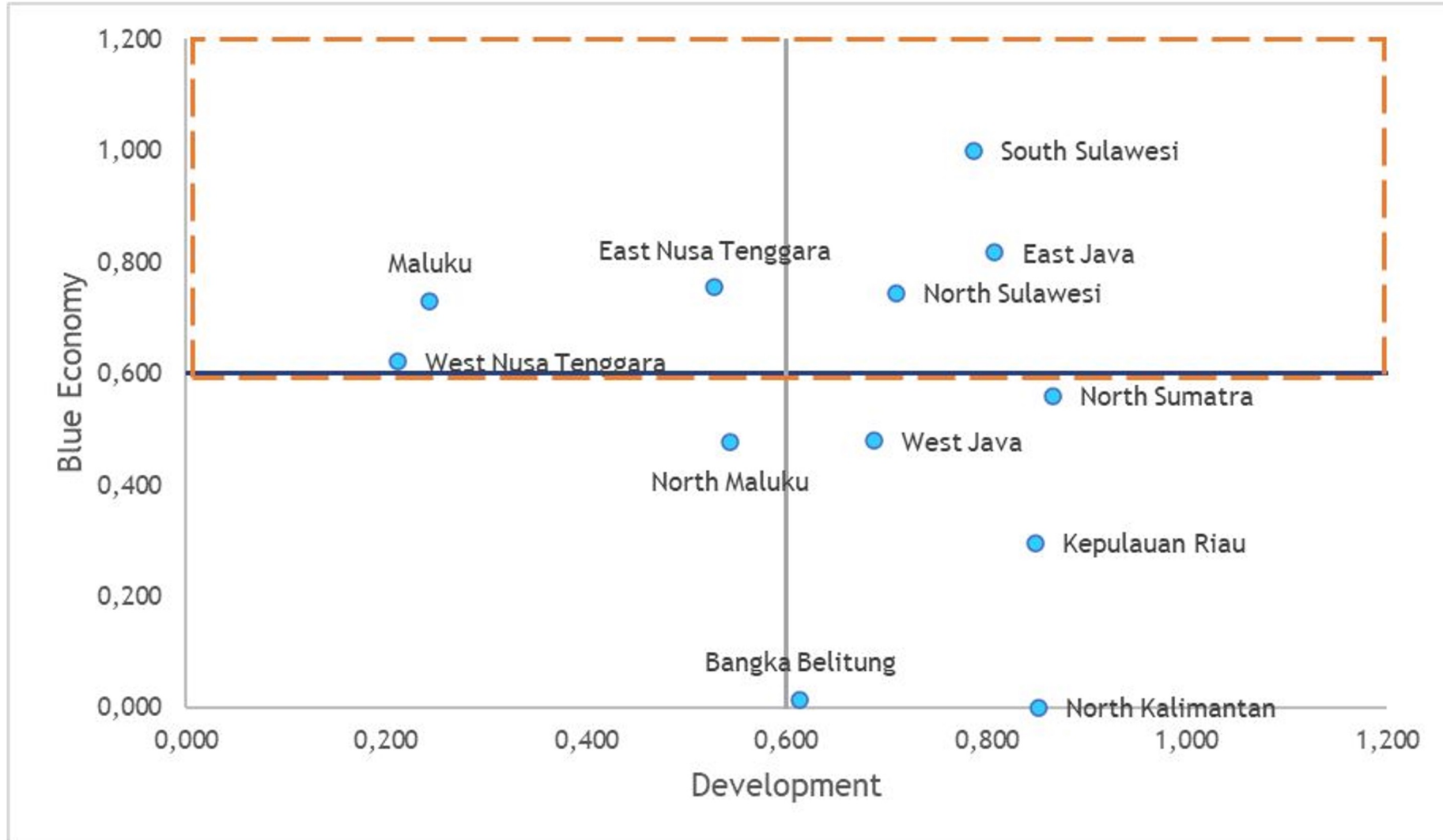
Narrowing
Down

1. List of regencies in quantitative study
2. Unique cases or attributes in regards to the Blue Food sector

1. Alignment with BFA pillars
2. Potential impact in shaping national policy
3. Cultural/ social / logistic enablers
4. MSC's/Bappenas network availability



First Layer Screening



Out of the six eligible provinces, we chose **Maluku, East Nusa Tenggara, South Sulawesi, and East Java** for our fieldwork locations. This decision was made to ensure a more geographically balanced sample distribution.



Second Layer Screening

Provinces	Regency	Alignment with BFA Pillars	Potential to Shape National Policy	Logistic Enabler	MSC/ Bappenas Network
Maluku	Western Seram	High	Low	No	Yes
	Ambon	High	High	Yes	Yes
East Nusa Tenggara	Alor	Moderate	High	Yes	Yes
	West Manggarai	High	High	Yes	Yes
	Rote Ndao	Moderate	Low	No	Yes
East Java	Gresik	Moderate	Moderate	Yes	Yes
	Lamongan	High	High	Yes	Yes
	Banyuwangi	Moderate	High	Yes	Yes
South Sulawesi	Pangkajene & Islands	High	High	Yes	Yes
	Bone	Moderate	Low	Yes	No
	Takalar	Moderate	Low	No	No



Potential target locations

1st Layer

Maluku

East Nusa Tenggara

East Java

South Sulawesi

2nd Layer

Ambon City

West Manggarai

Lamongan

Pangkajene and
Islands

Appendix 3

Secondary Data Results





Objective

- To examine **the interaction between aquaculture development and the environment.**
- To identify **the climate change impact on small-scale actors in fisheries and aquaculture (SSFA).**
- To explain **the climate change consideration that should be taken into account for aquaculture productivity, added value/value creation.**

Findings

- The **positive interaction** between aquaculture and environment include **reducing pressure on wild fish population, restoring degraded habitats, and recycling nutrients.**
- Meanwhile, **the negative interactions** are **accumulation of nutrients** such as nitrogen and phosphorus (causing algal blooms), **water pollution** resulted by chemicals, **spread of disease and parasites to wild fish population, genetic pollution, sedimentation and siltation of waterways, and habitat degradation.**
- **Small-scale actors and aquaculture operations** in Indonesia are likely to be impacted by **warmer sea water temperatures, ocean acidification, extreme weather events, rising sea levels, and disease outbreaks.**
- **To add or create value in aquaculture,** the following consideration should be taken into account: **product diversification, species selection, best management practices, and high-quality standard that promote sustainability, biodiversity, and healthy ecosystem.**

Recommendation

- Mitigating the impact of climate change on aquaculture includes **sustainable practices, modern aquaculture technologies and practices, climate change resistant infrastructure, efficient water management practices, species diversification, monitoring system, and research and innovation.**
- Mitigating the impact of climate change on small-scale fisheries includes **the adaptive capacity of SSFA, effective fisheries management practices, access to financial resources, diversification of livelihoods, and investment in climate-resilient infrastructure.**



TECHNOLOGY AND DIGITAL ADOPTION IN THE BLUE FOOD SECTOR

Objective

Mu'awanah and Akbar (2024)

- To map **the digital ecosystem** in the blue food sector.
- To analyze **the gap (status) of the current ecosystem** regarding the use of technology.
- To identify **the role of new technology** supporting the blue food industry.
- To develop **strategies and recommendations** to promote growth in the blue food industry by leveraging innovation and technology.

Findings

- **A broad spectrum of robotic technology and autonomous systems is utilized in the blue food sector** for addressing complex task and laborious work.
- **The use of drone is still at a new level.**
- **Blockchain and AI has become instrumental** to enhance the sustainability and profitability of fisheries.
- **Challenge** in digitalization and technology adoption in blue food sector include **high cost, uneven technology infrastructure, shortage of skilled talent, and limited access to finance.**

Recommendation

- **A blue food new technology consortium** with a collaboration between the government, private sector, government R&D and universities.
- **Continuous improvement on data system and management** for blue food products.
- **A curricula that combines the IT and blue foods** in both fishery higher education and universities' IT department.
- **Regular training program for fishers and aquaculture farmers** conducted by matured start-ups
- **Stronger mentorship programs for matured to new starts-ups** and connecting with investors.



BLUE FOOD ASSESSMENT FOR INDONESIA: ENVIRONMENT PAPER

Objective

Stanford Center for Ocean Solutions (2024)

- To assess **the current extent and protection status of mangroves** by province across Indonesia.
- To **quantify how mangroves have changed over the last 20 years**, particularly in relation to aquaculture development and anthropogenic uses.

Findings

- **Only 7% of mangrove area in Indonesia has protected status.**
- Protection of existing mangroves is hampered due to **discrepancies between policy and implementation of zoning** intended to protect mangroves.
- **Mangrove deforestation rates have consistently outpaced restoration rates** over both recent (2-year) and longer-term (20-year) periods in which **aquaculture remains the primary driver of mangrove loss** in East Kalimantan, in other regions, deforestation is increasingly driven by other activities.

Recommendation

- **Planning:** a) develop holistic spatial plans that balance the sustainable development of aquaculture with the conservation and restoration of mangrove forest; and b) ensure alignment in policies and zoning across scales from *Kabupaten* to provincial to national.
- **Conservation:** a) prioritize the conservation of healthy mangrove ecosystem over restoration efforts; and b) enable aquaculture development that preserves mangroves.
- **Climate policy:** integrate mangrove protection into climate plans.
- **Monitoring and enforcement of mangrove protection:** a) enhance communication and coordination between different jurisdictions; and b) establish a program of proactive monitoring to detect and respond to unlawful conversion activities.
- **Coordination:** ensure coordination and integration of government policies with other programs.
- **Community engagement:** increase public awareness and engage local communities in planning and management processes.



BLUE FOOD ASSESSMENT FOR INDONESIA: JUSTICE PAPER

Stanford Center for Ocean Solutions (2024)

Objective

- To describe **key patterns in employment in blue food sectors**, including women's participation.
- To identify **how blue food consumption varies and its relationship to affordability**.
- To assess **how social, economic, and environmental factors relate to inequalities in access to benefits** across blue food sectors.

Findings

- The Illuminating Hidden Harvests (IHH) estimates that **26 million out of the 275 million people in Indonesia belong to a household where at least one person works in fisheries sectors or engages in subsistence fishing**.
- **Over 1.5 million women are active in marine and freshwater fisheries**.
- **In the majority of *Kabupaten/Kota*, most blue foods are less expensive**, per kilogram, than chicken and much less expensive than beef.
- **Products from capture fisheries and aquaculture are similarly affordable**, but capture fisheries species tend to be more nutrient-rich.
- **Household consumption of blue foods varies widely** both across and within *Kabupaten/Kota*. This is true even in regions where prices are low, suggesting **the importance of culture and household preferences**.

Recommendation

- **Access to blue food resources:** a) in allocating fisheries access, take account of the role that fisheries play in supporting local livelihoods and meeting nutrition security needs; and b) in policies that change access, consider how and whose pre- and post- harvest sector livelihoods.
- **Role of women:** a) mandate and support the system collection of sex-disaggregated socio-economic data; b) recognize the critical contributions women make in fisheries; c) strengthen women's agency in the sector; and d) strengthen collaboration among national entities to promote gender equality and support women's empowerment.
- **Access to blue foods:** a) integrate blue foods into public programs that provide school meals for children or meals for young women, pregnant women, and nursing mothers; b) offer capital support to businesses; c) build capacity to support post-harvest activity; and d) develop programs in regions with higher levels of affordable blue food production.



BLUE FOOD ASSESSMENT FOR INDONESIA: NUTRITION PAPER

Objective

Stanford Center for Ocean Solutions (2024)

- To identify **opportunities for enhancing nutrition now and in the future**, including an assessment of the risks of climate change to nutrient-rich blue foods.

Findings

- **Compared to chicken, tempeh, and tofu, blue foods are rich in omega-3s (DHA & EPA), protein, vitamin B12, and vitamin D**, for which there are known deficiencies in Indonesia.
- **Some species groups, such as *gabus*, *mas*, *lele*, and *teri* are nutrient rich across several micronutrients**, making them “superfoods” compared to others.
- Indonesians consume approximately twice the amount of preserved products compared to fresh products and, generally, **preserved blue foods are more nutrient rich than many fresh blue food products**.
- **Some species at greatest climate risk**, like *selar kuning*, *japuh*, *tongkol* and tuna, **are especially rich in nutrients** for which there are known deficiencies in Indonesia, including DHA & EPA, calcium, iron and vitamin B12.

Recommendation

- **Production:** a) consider the nutrient content of fisheries resources; b) consider nutrition objectives along with conservation objectives, livelihood opportunities, and revenue generation; c) consider the nutritional benefits provided by different aquatic species; d) design fisheries and aquaculture development plans; and e) develop adaptation strategies for blue food systems.
- **Export:** reform policies governing trade decisions to mandate that policymakers consider both economic interests and nutritional needs.
- **Public health:** a) consider the potential of blue foods to contribute to strategies and programs to tackle key public health challenges; b) include blue foods in dietary guidelines and social welfare programs; c) incorporate blue foods into healthy and safe school meal programs; and d) develop public education programs to increase awareness of blue food nutrition.
- **Value chains:** a) prioritize developing sustainable production in provinces; b) develop value chains that make blue foods more widely available; and c) develop safe and healthy preservation techniques that reduce spoilage and increase shelf-life.
- **Consumers:** support and strengthen awareness and education programs on the nutritional benefits of blue foods.



Objective

Nurilmala (2024)

- To identify **current conditions of blue food manufacturing**, encompassing both traditional and modern scales.
- To analyse, review, and map **blue food manufacturing in Indonesia** towards small, medium, and large enterprises.

Findings

- **Traditional processing** has the following characteristics: **home industry scale and non-continuous production; processing is dependent on the weather or climate in an area.**
- **Modern processing** in blue food is based on **safety and traceability, innovations, and ready-to-eat and convenience products** (cooked shrimp, value-added seafood, frozen meals, and pizza).
- **Modern processing** also applies **food safety standards** such as SNI, HACCP, and BPOM, as well as halal standards and uses **more sophisticated tools.**
- **Technology level of fishery products are classified into a) level 1:** fishery products that are either unprocessed or have only been subjected to physical processing; **b) level 2:** products that have undergone simple processing; and **c) level 3:** derived products that have been processed using chemical, extraction, enzymatic, and microbial methods.

Recommendation

- **Traditional manufacturing:** a) training for small-scale fishery industries; b) small-scale industries must be accompanied throughout the registration procedure for the required hygiene certification; c) build adequate infrastructure such as ports, docks, cold storage facilities, processing factories; d) encourage sustainable fishing practices through regulations and incentives; and e) invest in research and development initiatives.
- **Industrial manufacturing:** a) the appropriate technology can be used to support the development of fishery products; b) manage the risks through careful planning and compliance with applicable fisheries regulations; c) regulating fishing limits, minimum fish catch sizes, fishing gear regulations, and establishing marine conservation areas; d) educate fishermen and fish farmers on sustainable cultivation and processing practices; e) build adequate infrastructure such as ports, docks, cold storage facilities, processing factories as well as advanced technologies such as GPS and sonar; f) promote fishery products through trade shows, branding and digital marketing; g) the industrial ecosystem needs to be built starting from upstream to downstream; and h) manage the risks through careful planning and compliance with applicable fisheries regulations.



AN OVERVIEW OF SMALL-SCALE FISHERIES AND AQUACULTURE IN INDONESIA

Wiryawan and Soemodinoto (2024)

Objective

- To provide an overview of existing small-scale fisheries (SSF) and small-scale aquaculture (SSA) in Indonesia, including the **most recent situation in terms of (i) production** (quantity and value), **(ii) supporting communities** (fishers and aquaculture farmers, as well as their families/households), and **(iii) poverty, gender equality, and other relevant issues** affecting SSF and SSA development in Indonesia.

Findings

- **Small-scale fisheries:**
 - SSF has employed **small-scale fishers who account for more than 90% of three million fishers** registered in Indonesia in 2022 (MMAF, 2024b), with wider benefits enjoyed **by around 1.3 million households** (MMAF, 2024c).
 - In terms of income, data shows that **millions of people working as small-scale fishers do not necessarily have enough income to fulfill their needs. However, the poverty of small-scale fishers needs to be interpreted with caution** as some studies suggest that small-scale fishers are not inherently poor.
 - The low income of small-scale fishers prevents them from investing in adopting better fishing technologies. **The vicious cycle of “low income discourages investment and technology adoption, and the absence of investment and technology adoption discourages income generation”** seems to be operating here.
- **Small-scale aquaculture:**
 - In 2022, **more than two million individuals worked in aquaculture** (MMAF, 2024g), and **more than 1.2 million households** benefited from the industry (MMAF, 2024h). Although there is no specific data, it is assumed that more than **90% of aquaculture farmers are small-scale**.
 - Aquaculture has more **complex value chains** than small-scale fisheries **resulting in low economic benefits for small-scale aquaculture farmers** compared to the substantial profits earned by seaweed collectors and processors.
 - **In respect to welfare improvement, it appears that small-scale aquaculture farmers do better** than small-scale fishers.
 - Small-scale aquaculture farmers, like small-scale fishers, rely on **patron-client relationships**.

Recommendation

- Building small-scale fishers and aquaculture farmers **financial security**.
- Recognizing and realizing **the women’s role and involvement** in small-scale fisheries and aquaculture.
- Building and strengthening **value chains that improve the well-being** of small-scale fishers and aquaculture farmers.



Objective

- To discuss **the general idea regarding the implementation of circular economy** in blue food sectors.

Findings

- **Tuna by-products and the economic value** include protein hydrolysate (up to IDR 8.4 trillion), animal feed from processed tuna dark meat (up to IDR 820 billion), fish flour (IDR 598 billion), gelatin and collagen from processed tuna skin (IDR 192 billion), tuna oil, bone powder, and tuna silage.
- **Shrimp by-products offer economic value** through the production of novel food ingredients, nutraceuticals, pharmaceuticals, etc. **Chitin and chitosan are the most significant natural polymer shrimp by-products obtained from shrimp waste (from the shells)**. The economic value of chitin reached IDR 278 trillion at a price of IDR 600,000 per kg.
- **Squid by-products such as ink, skin, ovary, and visceral organs** can be utilized in various channels **including pharmaceuticals (e.g., collagen), food, and other industries**.
- **The key crab by-product is the shells** which can be processed into chitosan (60%), food products (25%), feed (15%), and fertilizer (20%). **Chitosan generates the highest economic value** (up to 6.77 trillion).
- **Seaweed by-products (carrageenan and agar) can be utilized for making bio-composites, biofuel, and bioactive compounds**.
- **Tilapia by-products include fish oil, collagen, gelatin, or nutraceuticals**.

Recommendation

- **Fisheries industry:** sustainable fishing practices, efficient post-harvest handling, cold chain management, market diversification and value added-products, traceability and certification, education and training, and enforcement on sustainable regulation and policy.
- **Aquaculture industry:** strict biosecurity measures, water quality management, stocking density optimization, feed management practices, proper harvesting and handling techniques, investment in infrastructure and technology, and market diversification and value-added.
- **Small and medium scale enterprises:** efficient supply chain management, utilization of by-products, innovative preservation techniques, consumer education and engagement, and policy advocacy.



Objective

Suardhini and Mugijayani (2024)

- To identify **conflicts that may arise** in the blue food sector.
- To understand **the cause and impacts of these conflicts** on various dimensions highlighted in the framework.
- To assess the **possible conflict resolution** that can be offered, particularly in the case of Karimunjawa National Park and Bangka-Belitung.

Findings

- **Fishery labour and working conditions are relatively insufficient** as they receive lower wages and limited health and workers' insurance coverage.
- **One of the sources of conflict – intersectoral rivalry - is the economic aspect**, particularly wages.
- **Rivalries can occur between the fishery and tourism sectors or between fishery and mining** in some regions with mineral resources.
- **The core issue in Karimun Jawa National Park arises from the environmental degradation caused by shrimp farming businesses**, while, in **Bangka Belitung, the issue is about environmental degradation in coral reef caused by tin mining**.
- **The proposed conflict resolution** include strategies for exit from the conflict, review of regulations, policies, and institutions, as well as information, education, and communication.

Recommendation

- **In regard to environment and spatial issues:** implementing adequate laws and regulations, adopting digital technology to detect environment (underwater) damage and capacity building on sustainable fishing practices, and providing robust government support alongside the backing of other key stakeholders.
- **In regard to labor and working condition issues:** infrastructure development (cold storage or fishery information centres), specific support to increase fishers' production and productivity, and capacity building to ensure sustainable fishing practices.



PRODUCTIVITY AND VALUE CREATION OF BLUE FOOD IN INDONESIA

Objective

Artha and Wicaksono (2024)

- To provide **a comprehensive analysis of productivity** in the blue food sector in Indonesia.
- To examine **the role of investment and propose policy recommendations** to address the identified challenges.

Findings

- **By catch: even though** it has proven to be **resilient in terms of production during the COVID-19 pandemic**, the productivity of the fishery sector measured by its growth in Indonesia **has only shown slight improvement since 2013**.
- **By type of vessel:** It is evident that **motorless boats consistently exhibited the highest productivity**, indicating that **the most of fishermen in Indonesia operate on a small scale**.
- **By trend, both marine capture fisheries** (measured by catch per unit effort) **and aquaculture** (measured by yield per unit area) **show declining productivity** during 2020-2023.
- In blue food sector, **domestic investment has not been particularly appealing to the public**. Meanwhile, **the sector is relatively appealing to foreign investors** driven by the significant profit potential offered by marine resources.

Recommendation

- Strengthen **a comprehensive and integrated national blue food policy**.
- Improve **research institutions and increase funding for applied research on fisheries and aquaculture**.
- Improve **data collection and management systems**.
- Strongly encourage **the adoption of sustainable fishing and aquaculture practices**
- **Investment is important**.
- On capacity building, providing **training and extension services to fishermen and fish farmers**.
- Promoting **entrepreneurship and business development skills** among fishermen and fish farmers.
- Establish **transparency and traceability** standards in supply chains as well as **a monitoring and evaluation framework** to assess policy and program effectiveness.



Objective

Junaidi and Rohman (2024)

- To find the **current logistics aspect** of blue food products in Indonesia.
- To map **production and distribution center** of blue food products in Indonesia and to map **flow and type of logistics transportation mode** for blue food products in Indonesia (domestic & export).
- To provide blue food **logistics cost perspective** (insight from several logistics provider) and **the blue food logistics benchmarking best practice**.

Findings

- **Comprehensive management of logistics routes and transportation modes** is crucial.
- Infrastructure development has been a priority for the government yet the **cold storage facility remain scarce**. In addition, leveraging ICT particularly through **electronic tracking systems is also critical** to enhance efficiency and transparency.
- Indonesia's **cold chain infrastructure grows slowly**. By distribution, **a significant portion of cold storage infrastructure is located in major cities and industrial hub** such as Jakarta, Surabaya, and Medan; while, **the proliferation of cold storage facilities is witnessed in regions with prominent agricultural and seafood production** (West Java, Central Java, and Sumatera).
- Average **freight rate for blue food in air freight is higher than sea freight**. In addition, **the cost of blue food cargo is on average 2 times higher than the dry cargo**.
- **Best practices: Vietnam** (offering insights into regional logistics considerations) and **Thailand** (a recognized leader in efficient cold chain management and large-scale aquaculture).

Recommendation

- Seeing the urgency, the government needs to **prioritize the construction of cold storage** located in or very close to the main ports **in the two provinces (West Papua and Maluku Provinces)**, or the ports of Sorong and Ambon.
- In regard to **long transshipment, short term scenario** include **direct incentives** for increasing the shipping schedule on certain routes; while, **in the long term scenario, infrastructure development in eastern Indonesia** is important.
- Increase **data transparency** in port website **regarding the capacity and tariff of the reefer plug**.
- The government needs to provide a **catalyst to stimulate investment acceleration in cold storage or other cold infrastructure**.



REGULATORY ASSESSMENT OF BLUE FOODS IN INDONESIA

Indonesia Ocean Justice Initiative (2024)

Objective

- To find **how the laws and regulations regulate and support blue foods**-related matters or objectives.
- To identify **the gaps** in the laws and regulations.
- To provide **the recommendations** to improve the existing laws and regulations to better support the blue foods objectives.

Findings

- **The Food Law in Indonesia stipulates that in order to ensure food security**, it is necessary to guarantee access to food, in this case including fishery products, to all Indonesian people.
- **Marine and coastal ecosystems are regulated in various regulations, potentially causing inconsistencies** in implementation and ineffective law enforcement.
- Law on Small-Scale Fishers addresses the protection and empowerment of small-scale fishers, **the discussion of women fishers is very limited**.
- **The practical recognition and implementation of the provisions on the role of indigenous communities** in the marine conservation and management **are lacking**.
- **Small-scale actors often face significant challenges in participating in decision-making processes** related to fisheries policy and regulation.
- **Law 7/2016 has ensured a budget for credit and financing for the community** through the state budget, regional budget, and other legal funds under statutory provisions; **guarantees access to subsidies for fishers** consisting of fuel, feeds, and fish medicine; and **guarantee safety net for fishers** (facility provision and pricing).

Recommendation

- There is still **a need to strengthen and reaffirm the role of blue foods in food security** in Indonesia through Indonesia's Ocean Policy.
- **Collaboration and strengthening the capacity of law enforcement** officers is one of the keys to protecting marine and coastal ecosystems.
- **Acknowledge women's role at all stages of fishing activities and indigenous people rights and territories** to ensure equal access to all benefits available to fishers.
- **Transparency and public participation still have to be developed**, especially in relation to increasing public knowledge and understanding of the capital and assistance facilities that can be used.



Objective

Wicaksono and Narjoko (2024)

- To examine **the performance, trend, and characteristics** of Indonesia's blue food export.
- To identify **the strength of Indonesia's blue food exports** as well as the globally growing products.
- To conduct analysis on **factors affecting export and export growth** of blue-food products.

Findings

- **Remarkable growth over the last decade**, especially in **marine aquaculture and seaweed**. By share, **seaweed, tuna, and shrimp** are the predominant exports.
- **Main export markets: United States, China, and Japan** (67% of exports in 2022).
- **Opportunity to increase value-added exports of processed products** like carrageenan.
- **Growth is driven by demand for processed and intermediate products** (e.g., prepared tuna and shrimp).
- **Indonesia emerged as the largest global exporter of seaweed**.
- Using CMSA method, the study shows that **there is volatility in regional and commodity effects**, possibly reflecting changes in preferences or domestic policies in export destinations.
- **Diversification of export portfolio is crucial** for sustaining long-term growth and mitigating risks.

Recommendation

- Improving productivity and quality through **better infrastructure and logistics**.
- **Address challenges related to sustainability, productivity, value chains, competition policy, and regulations** to facilitate the development of the blue food sector.
- **Support small-scale fisheries**.
- **Diversify and target strategic market expansions**, especially in processed products.
- **Market Development Program** by conducting market research and promotional campaigns in targeted countries.
- **Improve value chain efficiencies** to leverage blue food resources better.



Proposed Priority Projects For Blue Food Development



RATIONALE FOR PROPOSED LIST OF PRIORITY PROJECTS (STANFORD PAPERS)

Topics	List Proposed Priority Projects	Rationale for Proposed Projects
Nutrition	Targeted blue food consumption to address stunting	Develop targeted programmes to increase the availability and consumption of sustainably caught (low risk) nutrient-dense blue foods in regions with high stunting rates, particularly in East Nusa Tenggara, Papua, and East Java. Such programmes should establish a health baseline before implementation of the blue foods initiative and include regular monitoring to measure impact.
	Sustainable aquaculture development for enhanced nutrient supply	Advocate for sustainable aquaculture practices that preserve mangroves, and focus on producing nutrient dense local species. This project aims to enhance local food availability, support nutrient security, reduce dependence on less nutritious imports, and protect vital ecosystems.
	Blue Food processing and preservation of nutrient retention, value addition and reduction of food waste	Research, develop, support and implement improved blue food processing and preservation techniques that maximise nutritional value of blue foods, add value, and reduce food waste. This project will focus on creating value-added products that retain high nutrient levels, minimize loss throughout the supply chain, and are accessible to marginalized or nutritionally vulnerable communities.
	Climate change impacts on nutrient supply	Evaluate the impact of climate change on blue foods using a recent regional assessment to quantify likely future production changes on production species, which will then be connected to nutrient data to understand future changes in nutrient supply.
Justice	Empowering women and supporting their active participation in decision making within blue food spaces	<ol style="list-style-type: none">1. Enhance the active participation of women across blue food sectors. This could build or expand on the type of support provided around capacity building, entrepreneurship opportunities and access to capital such as through the work undertaken by RARE.2. Implement a plan whereby women have access to ID cards that would facilitate their active participation in blue food spaces and give them access to financial and capacity building opportunities they are currently being excluded from.
	Strengthening community-based fisheries management	Draw lessons from existing programmes and structures (what works, where, and why? What does not, where, and why?) with a view to empowering local communities to manage blue food resources with a focus on ensuring equitable access and sustainable modes of production.
	Legal frameworks for blue food equity and access	Review and strengthen legal frameworks to ensure equitable access to blue foods, particularly for marginalized and indigenous communities and to protect these communities' rights in the face of industrial expansion. Ensure mechanisms are in place to support enforcement to ensure that these frameworks are not only robust on paper but are also enforceable and effective in practice.



RATIONALE FOR PROPOSED LIST OF PRIORITY PROJECTS (STANFORD PAPERS)

Topics	List Proposed Priority Projects	Rationale for Proposed Projects
Justice	Capacity-building opportunities for small scale fishers	Provide gender responsive capacity building for small-scale fisheries to improve their livelihoods, adaptive capacity and resilience through better access to markets, sustainable fishing and processing practices, and financial literacy. Work with relevant NGOs that are operating in this space.
Justice/Nutrition	Integration of blue foods in national school meals programs	Such programs would support the integration of blue foods into school meal programs by targeting regions where nutrient deficiencies are most acute and identify and promote the use of sustainable, locally produced and nutritious (low risk) species that could help to address nutrient deficiencies.
	Monitoring rigorous monitoring and evaluation of Gemarikan program's effects on specific indicators of health	Conduct rigorous monitoring and evaluation of the Gemarikan program's impact on specific health indicators, focusing on the effectiveness of increasing blue food consumption in improving nutritional outcomes, particularly in vulnerable populations.
Environment	Aligning mangrove policies across jurisdiction	Identify and correct misalignment in mangrove-related policies and zoning between ministries and across geographic scales. This will involve a comprehensive policy analysis of local, regional and national documents.
Justice/Nutrition/ Environment	Assessing aquaculture's impact on fishing communities	Investigate the socio-economic impacts of aquaculture development on fishing communities adjacent to mangroves, by combining production data with labor and other household surveys.



RATIONALE FOR PROPOSED LIST OF PRIORITY PROJECTS

Topics	List Proposed Priority Projects	Rationale for Proposed Projects
Environment (Mitigation)	Adopt sustainable aquaculture practices – proper waste management, water quality monitoring, and biodiversity conservation measures.	<ul style="list-style-type: none">• Aquaculture has the potential to reduce pressure on wild ocean species and to provide a valuable protein source for an expanding population. However, it has also caused several problems, including pollution, the spread of disease, land conversion, and sedimentation.• large-scale aquaculture farms often result in the destruction of mangroves, wetlands, coral reefs and other important ecosystems. Infrastructure associated with aquaculture operations, such as nets, cages, and pens, can also contribute to habitat degradation.• Climate change impact on aquaculture operations: leads to warmer sea water temperatures, ocean acidification, extreme weather events, rising sea levels, disease outbreaks and algae blooms.• These impacts, which are discussed, can dramatically reduce the production of aquaculture operations and lead to closure, job loss, and economic ruin. <p>Based on these challenges, Indonesia needs to:</p> <ol style="list-style-type: none">1. Mitigate impacts of aquaculture pollution, the spread of disease, land conversion (especially mangrove) and sedimentation2. Adaptation actions to prevent aquaculture from warmer seawater temperatures, ocean acidification, extreme weather events, rising sea levels, disease outbreaks and algae blooms
	Adopt advance technology to optimize land use and increase productivity, such as recirculating aquaculture system, vertical farming system and Integrated Multi-Trophic Aquaculture (IMTA)	
	Investing in the restoration and conservation of ecosystems, such as mangrove, wetlands, and coastal habitats.	
	Implement strict bio-security protocols, monitor and manage disease outbreaks	
Environment (Adaptation)	Adopt modern aquaculture technology for sustainable practice	
	Implement monitoring system and utilize climate-smart technology to track environmental changes and early warning system.	
	Diversity the species farmed and cultivate a variety of species that are resilient to changing environmental conditions.	



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Small-Scale Fishers and Aquaculture (SSFA)	Small-scale fishers and aquaculture farmers' quality of life improvement program (SSFA QLIP), Package A: Building a fair access and supportive environment for fisheries and aquaculture financing.	Small-scale capture fisheries and aquaculture are the dominant fisheries in Indonesia, and they are crucial to the growth of Blue Food. However, given the poverty that some small-scale fishers and aquaculture farmers suffer, as well as their limited access to capital in general, it would be difficult for them to realize their potential to promote Blue Food growth, let alone meet their daily food and nutrition needs. Providing a conducive business climate is the first step toward meeting the needs of small-scale fishers and aquaculture producers before producing high-quality Blue Food products for the rest of society. Therefore, a program must be designed that ensures fair access to small-scale fisheries and aquaculture funding, and an adequate business environment for small-scale fishers and aquaculture farmers. This initiative must be developed progressively in a few important provinces before being extensively deployed across Indonesia. The proposed program's goals are to increase the financial security of small-scale fishers and aquaculture farmers by providing various supports such as access to financial capital (backed by a guaranteeing body) and recognition of small-scale fishers and aquaculture farmers as a formal profession by providing (i) a minimum salary, (ii) health insurance, and (iii) pension insurance or savings. Furthermore, the program might be expanded to include an insurance system for small-scale fishers and aquaculture farmers to mitigate the harmful effects of climate change.
	Small-scale fishers and aquaculture farmers' quality of life improvement program (SSFA QLIP), Package B: Strengthening women's and youth roles for the financial security of small-scale fishers and aquaculture farmers' households.	Women's roles and involvement in small-scale fisheries and aquaculture are well known, but they have yet to be fully recognized. Outside the home, women are active participants in a variety of occupations, including pre-fishing preparation, serving as middlemen or direct sellers, and post-harvest processing. Inside the home, women are responsible for managing household finances and providing nutritious food for family members, particularly youngsters. Furthermore, women's responsibilities and involvement are critical in drawing young people to small-scale fisheries and aquaculture, especially given the declining number of people who desire to work as fishers. It is vital to create a program that aims to recognize women's suitable roles in the families of small-scale fishers and aquaculture farmers, as well as to assure family financial security while expanding youth participation. The program should be gradually established in a few key provinces before being widely implemented throughout Indonesia. The proposed program aims to empower women and youth to achieve and maintain financial security for small-scale fishers and aquaculture farmers' families by building capacity in (i) household financial planning and management, and (ii) household-based business planning and management. To provide a real-world scenario, microfinancing and revolving fund schemes will be established for eligible women and youth from small-scale fishers and aquaculture farmers' households. In addition, a women's and youth-friendly value chain will be built to assist their business.



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Small-Scale Fishers and Aquaculture (SSFA)/Environment	<p>Implement climate-resilient fisheries management practices:</p> <ol style="list-style-type: none">1. improve planning for protection and preservation zone, and allowed fisheries zone2. Identify and advocate the customary sea rights and incorporate it into the zone as community based sea conservation initiatives	<p>Climate change impacts SSF operations, as warmer seawater temperatures, ocean acidification, extreme weather events, rising sea levels, disease outbreaks, and algae blooms lead to wild fish deaths, reduced catches, and a decline in income. Due to climate change, SSF is threatened by environmental changes. Indonesia needs to take action to strengthen SSF's ability to adapt to these changes in order to maintain its sustainability. Therefore, adaptation actions to prevent SSF from warmer seawater temperatures, ocean acidification, extreme weather events, rising sea levels, reduced catches, disease outbreaks and algae blooms.</p>



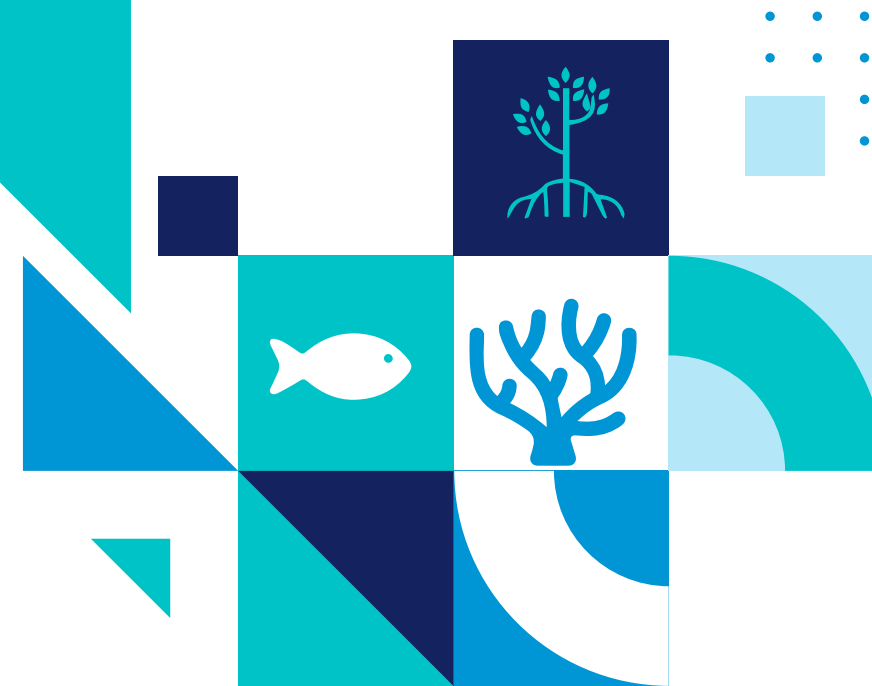
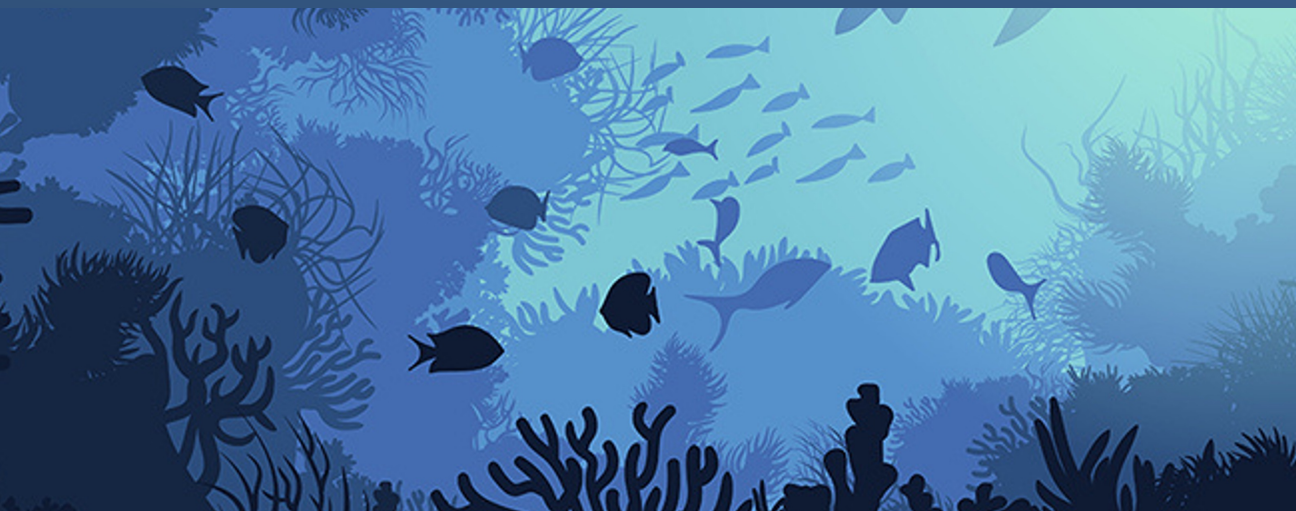
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Logistics	Reefer Plug in Maluku/Ambon Ports	Based on information from the GM TPK Ambon, the number of reefer plugs at TPK Ambon was 99 in 2021 (latest data available). This number is relatively low compared to the fish surplus in Maluku Province, which amounted to 546 thousand tons in 2022 based on the processed data on Fish Production & Consumption from KKP. Assuming one container holds 20 tons of fish, which estimated that the minimum number of reefer plugs required is 200-250 plugs.
	Refer Plug in Sorong Port	Based on information from the Pelindo TPK Sorong website, there is no listed ownership of Reefer Plugs. This needs to be taken into consideration given the fish surplus in West Papua Province, which amounted to 382 thousand tons in 2022, based on processed data on Fish Production & Consumption from KKP. Assuming that one container holds 20 tons of fish, it is estimated that the minimum number of reefer plugs required is 100-200 plugs.
	Cold Storage in West Papua	Based on data from the KKP in 2023, there is only one cold storage unit in West Papua with a capacity of 30 tons. This is relatively insufficient considering the fish production surplus in West Papua, which amounted to 382 thousand tons in 2022, based on processed data on Fish Production & Consumption from KKP.
	Cold Storage in Papua	Based on data from the KKP in 2023, there is only one cold storage unit in West Papua with a capacity of 100 tons. This is relatively insufficient considering the fish production surplus in Papua, which amounted to 38 thousand tons in 2022, based on processed data on Fish Production & Consumption from KKP.
	Study on Export Hub Ports for Blue Food in Eastern Indonesia	Based on data from the KKP, the export volume of fishery products from Eastern Indonesia is around 300-350 thousand tons. However, the majority is still shipped through Tanjung Perak and Tanjung Priok, which involves high logistics time and costs. A study on more effective and potential ports in Eastern Indonesia to serve as export hubs is important to undertake.



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