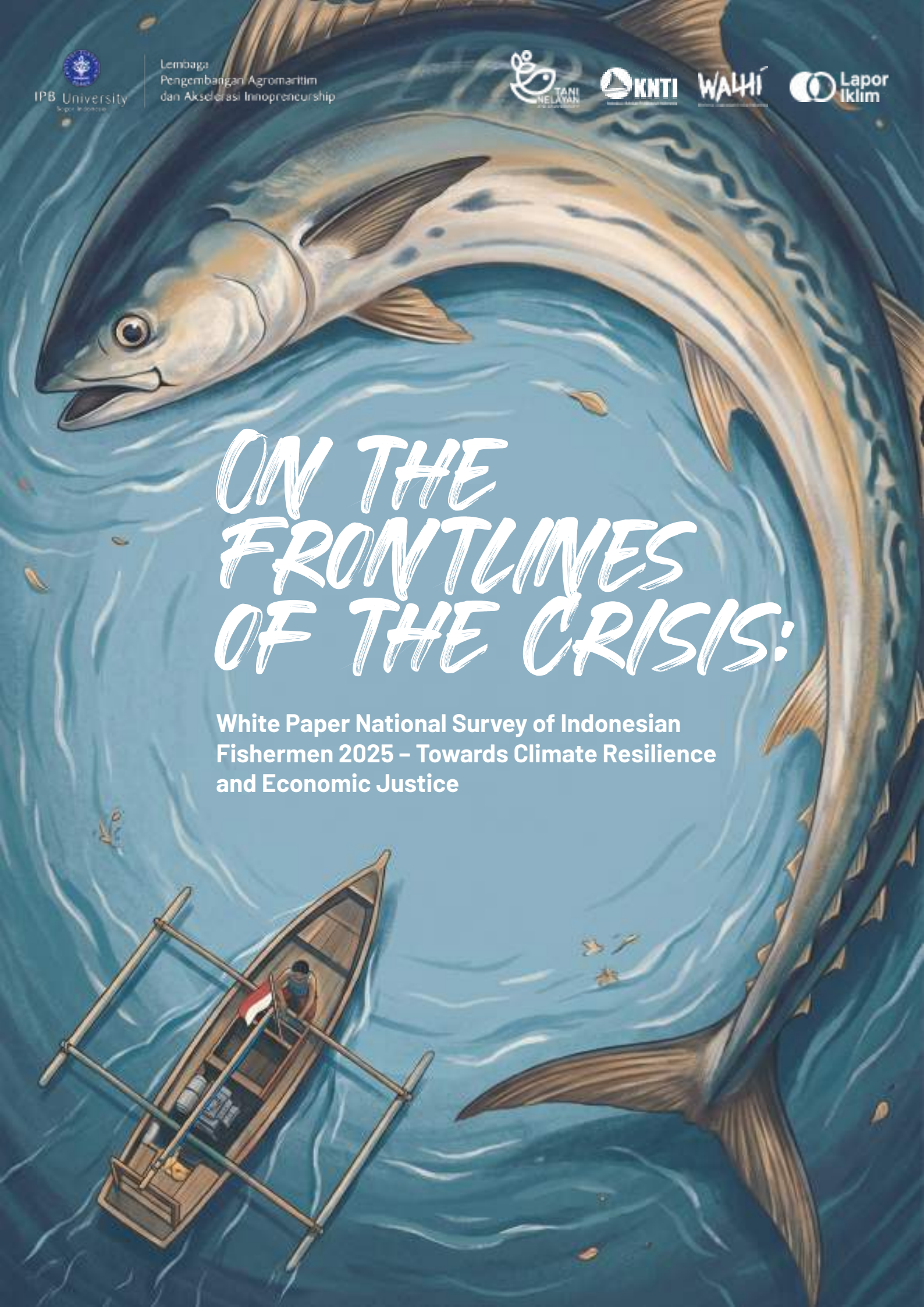
IPB University
Lembaga
Pengembangan Agromaritim
dan Akselerasi Innopreneurship
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ON THE FRONTLINES OF THE CRISIS:
White Paper National Survey of Indonesian Fishermen 2025 – Towards Climate Resilience and Economic Justice

On the Frontlines of the Crisis: White Paper National Survey of Indonesian Fishermen 2025 – Towards Climate Resilience and Economic Justice

LaporIklim Collaboration with:
Farmers and Fishermen's Center, IPB University
Indonesian Traditional Fishermen's Union (KNTI)
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EXECUTIVE SUMMARY

White Paper: 2025 Indonesian Fishermen Survey

The 2025 National Fishers Survey, conducted by LaporIklim, the Farmers and Fishermen's Center (TNC), IPB University, and the Indonesian Traditional Fishermen's Union (KNTI), surveyed 273 fishers across different regions of Indonesia. It reveals the critical conditions faced by Indonesia's 3.2 million active fishers, 96 percent of whom are small-scale fishers operating boats under 10 Gross Tonnage (GT). The survey results show that although fishers play a strategic role in national food security, they live under multidimensional vulnerability that is exacerbated by climate change, economic fluctuations, and inadequate policy support.

KEY SURVEY FINDINGS

Several key findings indicating the increasing vulnerability of Indonesian fishers include:

1. 98 percent of fishers believe climate change is occurring based on their direct experience at sea.
2. More than 60 percent stated that lean seasons are becoming more frequent compared to 5 and 10 years ago.
3. Most fishers feel that fish are getting farther away and harder to catch.
4. 73 percent of fishers admitted to not feeling safe at sea, mainly due to extreme weather and limited safety equipment.
5. 64 percent of fishers stated that they have not received any government assistance to address the impacts of climate change.
6. Average daily income remains low; the majority earn less than IDR 200,000 per day, with fuel costs continuing to rise.
7. The size of fish caught is considered to be getting smaller, affecting selling prices and income.

These key findings show that fishers have implemented various forms of adaptation independently, changing fishing hours, shortening trips, and seeking additional work on land. However, these adaptation measures only provide short-term solutions at the individual level. State intervention is still needed to provide structural and sustainable solutions.

IDENTIFIED RISKS

If this situation continues without adequate intervention, Indonesia faces several serious risks:

1. Weakening marine food security due to the declining production capacity of small-scale fishers.
2. Increasing coastal poverty due to increasingly unstable incomes.
3. Loss of fisher regeneration, as the younger generation views this profession as increasingly risky and unpromising.
4. Inequality in climate adaptation, with the most vulnerable groups receiving the least support.

RECOMMENDATION

Structured adaptation policies, technological support, and strong social protection are crucial to ensuring that fishers do not become the ones bearing the greatest risks from the climate crisis.

Therefore, this white paper emphasizes the need for swift and measurable steps, including:

1. Prioritizing small-scale fishers as a national climate adaptation priority.
2. Expanding access to real-time weather information, navigation technology, and safety equipment.
3. Strengthening social protection, including work accident insurance and insurance while away from sea.
4. Developing coastal infrastructure such as cold storage, docks, and market access to improve fishers' bargaining position.
5. Encouraging contextual and sustainable training programs, especially for young fishers.

CONCLUSION

This white paper presents empirical evidence that changes in the ocean due to climate change have been directly felt by fishers. Follow-up measures must focus on ensuring public policies protect fishers as a group on the front lines of the climate crisis. Without comprehensive and targeted policy interventions, the structural vulnerabilities faced by fishers will further deepen inequality and potentially threaten the stability of national food security.

01 INTRODUCTION

In 2024, data from the Ministry of Maritime Affairs and Fisheries (KKP) recorded approximately 3.2 million active fishers in Indonesia, 96 percent of whom were small-scale fishers with boats under 10 Gross Tonnage (GT). The high vulnerability of this group, which plays a key role in maintaining national seafood availability, to climate change places national seafood security on a fragile foundation.

Small-scale fishers live in a paradoxical reality: on the one hand, they are strategic food producers, but on the other, data from the Central Bureau of Statistics (BPS) from 2024 shows that most fishing households are in the lower-middle income bracket, with average incomes fluctuating depending on the season and weather conditions.

This high dependence on natural and market factors makes small-scale fishers vulnerable to climate change, price fluctuations, and policies that are not in their favor.

This introductory section provides an overview of the social, economic, and cultural conditions of Indonesian fishermen as reflected in the results of the 2025 National Fishermen Survey. This survey serves as a starting point for understanding the realities of fishermen's lives amidst the dynamics of the environment, economy, and public policy.

BACKGROUND

SOCIOECONOMIC SITUATION

The results of the 2025 National Fishermen Survey indicate that fishing is not merely a hereditary profession, but a reality for most coastal communities. The majority of Indonesian fishers fall into the productive generation category, with approximately 54 percent of respondents aged 29–44 and 32 percent aged 45–60. This is also reflected in the relatively high education levels of fishers, with 34 percent having completed high school (SMA) or its equivalent, 13 percent having completed higher education, and approximately 20 percent having only completed elementary school (SD) or junior high school (SMP). However, low levels of digital and financial literacy among this group remain a challenge.

Gender-wise, the majority of fishers at sea are men. Although coastal women play a significant role in the post-harvest chain, such as fish processing, drying, and marketing, their economic contributions are rarely recognized in official statistics. This disparity highlights the need for a more inclusive policy approach that focuses on fisher households, not just individuals who go to sea.

Around 48 percent of fishermen produce less than 10 kilograms of fish per day, while the remainder can catch more than 10 kilograms, depending on the type of fishing gear and the season. High operational costs, particularly for fuel, nets, and boat maintenance, contribute to fishermen's low profit margins. The survey found that 79 percent of fishermen earn less than IDR 200,000 per day. This is in line with 2024 Statistics Indonesia (BPS)

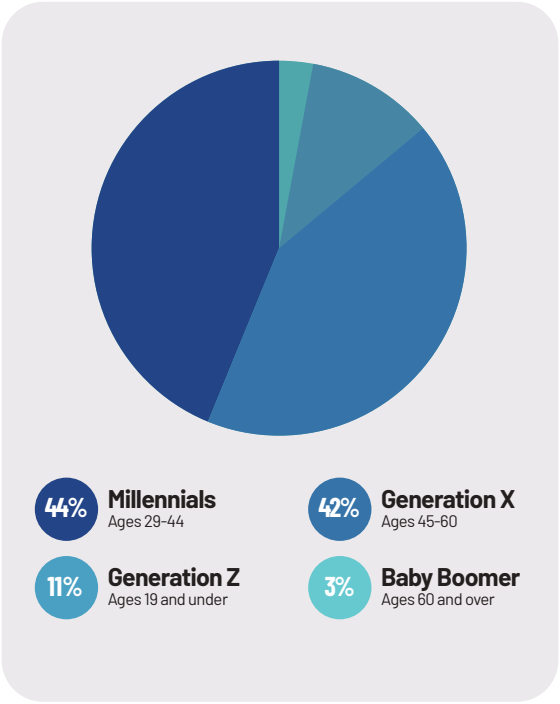

Image 1.1: Age categories of fishers
Source: Indonesian Fishermen Survey (2025)

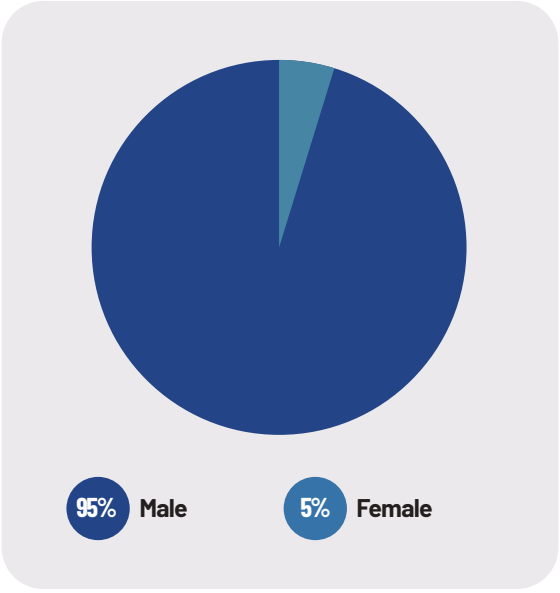

Image 1.2: Gender categories of fishers
Source: Indonesian Fishermen Survey (2025)

data, which recorded the average income of fishermen in the range of IDR 2.5-3.2 million per month. Only around 6 percent of fishermen can earn more than IDR 500,000 per day during the peak season.

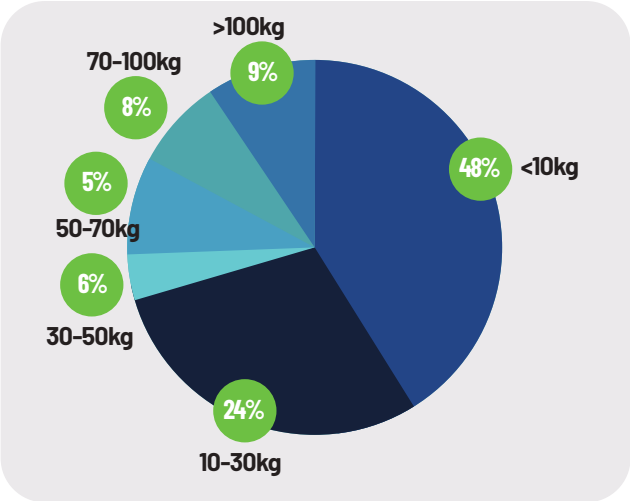

Image 1.3: Daily catches
Source: Indonesian Fishermen Survey (2025)

Image 1.4: Average daily income
Sumber: Indonesian Fishermen Survey (2025)

Image 1.5: Average daily expenditure
Source: Indonesian Fishermen Survey (2025)

To survive the unstable economic and climate situation, approximately 44 percent of fishermen have side jobs such as construction workers, dock workers, tire repairmen, market porters, or coffee shop owners. This situation is exacerbated by the fish market structure still dominated by middlemen and large traders, limiting small-scale fishermen's access to markets, storage technology, and price information. As a result, most of the added value of marine products is not enjoyed by fishermen.

Despite all this uncertainty, fishing communities maintain a system of values and culture deeply rooted in their daily lives. For them, the sea is not only a source of income but also holds social and spiritual significance. Traditions such as sea almsgiving, offerings, and mutual cooperation (gotong royong) still persist in various coastal areas, fostering strong social solidarity among fishermen, especially during times of crisis such as shipwrecks or accidents at sea.

However, economic pressures and modernization are slowly changing the face of coastal communities. What was once an egalitarian social relationship has shifted to a patron-client relationship between boat owners and fishing workers. The changing lifestyles of the younger generation of coastal communities, who are more open to the digital world, have also influenced their perspectives on the ocean. Revitalizing coastal culture is crucial to ensuring collective values and social solidarity remain a strength for communities amidst rapid economic and environmental change.

CLIMATE CHANGE

Climate change is a crucial factor in the livelihoods of Indonesian fishermen. Nearly all survey respondents reported experiencing the impacts of climate change, from extreme weather and high waves to shifts in fishing seasons. FAO data (2023) shows that sea surface temperatures in tropical

regions are increasing by 0.11°C per decade, causing fish to migrate to deeper, cooler waters. Consequently, small-scale fishermen must travel farther out to sea, incurring higher fuel costs.

Furthermore, in 2024, the Ministry of Marine Affairs and Fisheries (KKP) noted that in several coastal areas, abrasion and sea level rise were threatening fishing settlements in areas such as Demak, Pekalongan, and Subang, with coastal villages beginning to be submerged. Survey findings also indicated that fishermen reported increasingly frequent lean seasons in the past five to ten years, with more than 60 percent of fishermen reporting that fish were becoming scarcer. This exacerbates the socio-economic vulnerability of coastal communities.

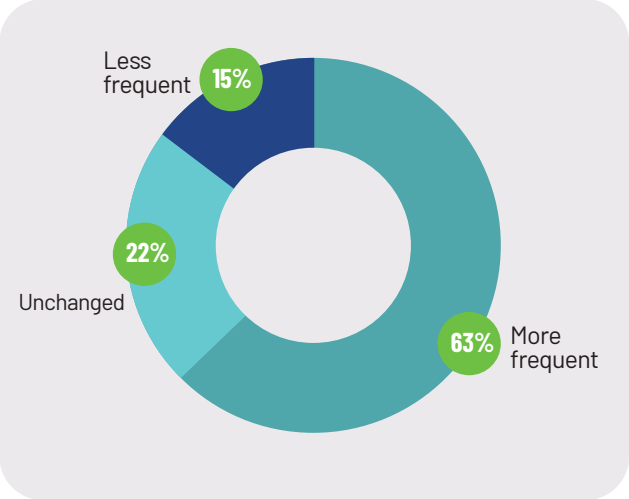

Image 1.6: Lean season compared with 10 years earlier
Source: Indonesian Fishermen Survey (2025)

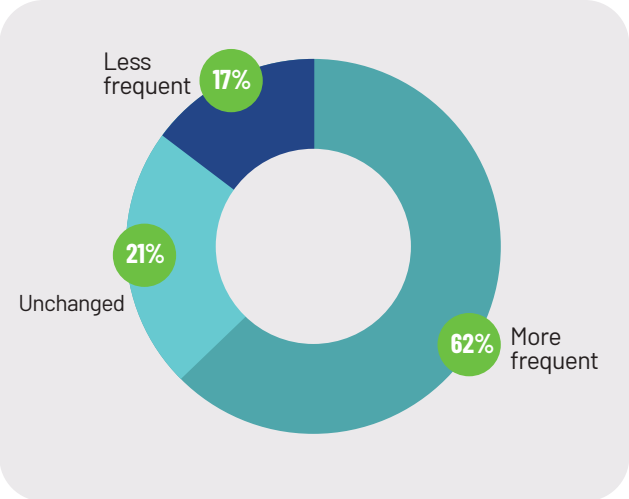

Image 1.7: Lean season compared with 5 years earlier
Source: Indonesian Fishermen Survey (2025)

In response, fishermen have implemented adaptation strategies, including repairing their boats, adjusting their fishing schedules, and seeking alternative employment on land. However, this adaptive capacity remains limited by limited access to capital, training, and climate information. Therefore, coastal community-based climate change adaptation programs are urgently needed to enable fishermen not only to survive but also to transform themselves in the face of these challenges.

KEY CHALLENGES FOR FISHERMEN

The 2025 National Fishermen Survey identified three key challenges facing Indonesian fishermen:

1. **Increasingly unpredictable weather and seasons.**

More than 60 percent of fishermen admitted that lean seasons are now more frequent than five or ten years ago. This uncertainty makes planning fishing trips difficult and impacts income fluctuations.

2. Fish distribution is increasingly distant from the coast.

Many fishermen must travel farther out to sea than usual to find productive fishing grounds. This shift is caused by changes in sea temperatures and coastal habitat degradation.

3. Increasingly dangerous ocean waves.

As many as 73 percent of fishermen feel unsafe at sea, primarily due to aging vessels, extreme weather, and limited safety equipment.

Apart from these three factors, this survey also found other supporting factors, namely: (1) low levels of technology adoption where only 21 percent of fishermen use tools such as Global Positioning System (GPS) or fishfinders, (2) low levels of satisfaction with policies where 77 percent of fishermen think that government policies related to subsidies, training, and social protection are not sufficiently supportive, and (3)

limited coastal infrastructure such as small docks, fish auction places, and cold storage.

OBJECTIVES

The initial presentation shows that Indonesian fishermen face complex challenges ranging from unpredictable weather and seasons, limited access to technology, and the increasingly severe impacts of climate change. This situation emphasizes the importance of robust empirical data as a basis for developing more targeted policies and intervention programs.

Therefore, this survey is designed to achieve three main objectives:

1. Describes the social, economic, and cultural profile of Indonesian fishers in a factual and up-to-date manner.
2. Identifies the main challenges faced by fishers, particularly those related to climate change, public policy, and coastal socio-economic dynamics.
3. Provides an analytical basis for formulating policy recommendations, empowerment programs, and adaptation strategies relevant to the needs of small-scale fishers.

The analytical results of this survey are expected to serve as a shared reference for policymakers, researchers, civil society organizations, and fishing communities themselves in strengthening the position of fishers as key actors in the development of the fisheries sector and sustainable coastal economy.

METHODOLOGY

This survey captures fishers' perceptions and experiences regarding government performance in the maritime sector, while documenting the socio-economic and ecological challenges they face. The survey's primary focus includes:

1. access to government policies and programs,
2. the economic conditions of fishermen's households,
3. the impact of climate change on fishing activities, and
4. fishermen's hopes and recommendations for marine governance.

Data collection was conducted online and offline by LaporIklim, TNC IPB University, and the Indonesian Traditional Fishermen's Union (KNTI) among fishermen across Indonesia from July 4-31, 2025. This approach was used to reach a wider range of respondents, including fishermen in coastal areas with limited internet access.

After data cleaning and weighting to ensure data quality and proportionality, 273 fishermen were selected as final respondents, covering the regions of Sumatra, Java, South Kalimantan, North Kalimantan, West Sulawesi, South Sulawesi, Central Sulawesi, Bali, East Nusa Tenggara and West Nusa Tenggara, Maluku, North Maluku, West Papua, and South Papua. Assuming a simple random sampling method and a 95 percent confidence level, the survey's margin of error is estimated to be within ±6 percent.

The results of this survey are expected to provide an indication of fishermen's perceptions and experiences regarding government performance in the maritime sector, as well as describe the dynamics of fishermen's struggles in facing economic pressures and increasingly vulnerable marine conditions due to the impacts of climate change.

02

FISHERMEN ON THE FRONTLINES OF THE CLIMATE CRISIS

Climate change is no longer a distant threat, but rather a daily reality felt by Indonesian fishermen. Ninety-eight percent of fishermen believe that climate change is already occurring, based on their experiences with increasingly wild seas, as evidenced by seasons that are no longer in sync with traditional fishing calendars, increasingly dangerous waves, and increasingly difficult-to-catch fish.

These experiences are consistent with findings from the Meteorology, Climatology, and Geophysics Agency (BMKG), which noted an increase in the frequency of marine heatwaves and a shift in monsoon patterns in Indonesia (BMKG, 2024). The findings of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR6), which noted that changes in sea temperature, wind speed, and tropical storm intensity affect fish migration, catches, and shipping safety (IPCC, 2021), are also consistent with the impacts of climate change on small-scale fisheries. This situation is further exacerbated by the sensitivity of Indonesian waters to the El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD), which influence when the "fishing season" or "famine" occurs.

THE REALITIES AND OPERATIONAL IMPACTS OF THE CLIMATE CRISIS

Low fish availability has forced fishermen to adapt their fishing habits. Many must venture farther out to sea to meet their families' economic needs. This directly increases operational costs and increases safety risks. Increased safety risks also impact the duration of fishermen's fishing trips: whereas a single trip could last two days and two nights, many now only venture out for eight hours (Maurizka & Adiwibowo, 2021).

This situation is exacerbated by coastal environmental damage. As many as 67 percent of fishermen report that the coastal areas they depend on for their livelihoods have been damaged by abrasion, pollution, and development pressures. The loss of natural protective ecosystems such as mangroves, seagrasses, and corals has resulted in the loss of these ecosystems' vital functions of absorbing wave energy, providing nursery grounds for fish for marine protein production, and maintaining coastal stability (Duarte et al., 2020). Consequently, the burden of adaptation must be borne directly by coastal communities lacking adequate protection.

The impacts of climate change threaten not only current livelihoods but also the future of fishing families. As many as 94 percent of fishermen expressed concern that this situation would impact their income, children's education, and overall family well-being. This concern is understandable, given that their work lacks a financial buffer.

As a group of workers unable to work from home, fishers are highly vulnerable to the impacts of extreme weather. Studies on the coasts of Sulawesi and Nusa Tenggara show that these conditions have forced fishers to stay off the sea for 20-45 days per year (Lukum et al., 2023). In the context of the household economy, the loss of income for 20 days constitutes a micro-disaster that impoverishes fishing communities that are highly dependent on nature and increases social inequality.

FISHERMEN'S ADAPTATION STRATEGIES

Although fishermen have a high level of awareness of climate change, their level of understanding and attitudes vary due to disparities in information and how they interpret the urgency of the crisis (Lole et al., 2025). This aligns with the findings of Lukum et al. (2023), who showed that a lack of weather knowledge leaves fishermen without guidance in determining fishing seasons. Nurlinda et al. (2024) also emphasized that weather knowledge is the basis for planning fishing activities, especially in coastal areas.

Amidst this situation, two main social responses emerged: solidarity and diversification. Information about fish locations became collective knowledge shared among fishermen as a form of solidarity. The awareness that the sea does not belong to individuals, but rather a shared living space, encouraged practices of mutual trust and information sharing. These practices demonstrate that amid the pressures of climate change, fishermen continue to maintain social cohesion and the value of mutual cooperation as a survival strategy (Ulfa, 2024).

In Tamansari Village, Dringu District, Probolinggo Regency, trust and strong networks among community members serve as social capital in the face of uncertainty. Ethical values formed in daily

life create relationships of mutual trust that serve as the foundation of social solidarity. This network of trust plays a crucial role in facilitating the exchange of information regarding weather conditions, fish availability, and access to capital providers who can assist fishermen in difficult situations caused by climate change (Ulfa, 2024).

On the other hand, adaptation strategies based on marine ecosystem conservation have also emerged. A study in Bangsring, Banyuwangi, showed that restoring the marine ecosystem through coral reef conservation had a positive impact on the economic sustainability of fishermen. After marine conditions improved, the local community developed the Bangring Underwater tourist destination, diversifying local livelihoods as tour guides, ticket attendants, and souvenir sellers. This success demonstrates that conservation can be a form of long-term adaptation that is ecologically and economically beneficial (Hidayati & Pandjaitan, 2020).

However, not all locations have the opportunity to develop ideal adaptation options. In Gampong Lhok Lamteungoh, Peukan Bada District, Aceh Besar Regency, fishermen have had to make extreme adaptations and become construction workers, while their wives and children gather mangrove crabs and oysters, or process seafood into food products for sale. Temporary migration strategies have also been employed, with some moving to relatives' homes in the city to find more stable employment (Bari et al., 2024).

POLICY GAPS AND THE URGENCY OF CLIMATE JUSTICE

Unfortunately, government support to address this enormous challenge remains minimal. Data shows that 64 percent of fishers stated they received no government assistance to address the impacts of climate change. This group is on the front lines of the crisis, lacking the option to shelter or work from home during extreme weather.

Adaptation models in developing countries tend to prioritize "large" sectors such as energy and industry, while local social resilience remains secondary (Roberts & Huq, 2015). Yet, fishers constitute a critical climate workforce, managing the nation's primary protein source, given that fish is the primary source of animal protein for over 200 million Indonesians. Failure to adapt to these challenges means failing national food security. Within a climate justice framework, this is a burden-sharing issue, with the most vulnerable groups bearing the greatest risks but receiving the least support.

Nevertheless, there have been several government interventions aimed at training and capacity-building fishers, providing environmentally friendly fishing gear, and cross-actor coordination between the government, communities, and civil society organizations. Initiatives like these are considered crucial to ensure adaptation strategies are participatory, not simply top-down (Sartika & Mokodompit, 2024).

Despite these challenges, fishers are adapting to the constraints, even though these adaptation efforts are also driving up the cost of living. Three key strategies employed by fishers are adjusting their departure times, changing fishing duration, and strengthening their vessels and fishing gear to better withstand extreme weather. Ironically, the increased costs resulting from these adaptations do not necessarily guarantee increased catches.

These strategies, demonstrating fishers' resilience, emerging without adequate state support, represent a form of autonomous adaptation that emerges spontaneously from social wisdom, not the result of policy programs (IPCC, 2021). While effective in the short term, this form of adaptation has limitations because it only reduces risk at the individual level, rather than providing structural solutions.

These survey results serve as a reminder that climate adaptation is not simply a matter of technology or large-scale projects, but also a matter of accountability and justice. As guardians of the ocean and providers of food for the nation, fishers should not struggle alone in the face of the climate crisis, the impacts of which are becoming increasingly apparent every day. If the state fails to provide adequate interventions for frontline groups such as fishermen, the climate crisis will only deepen structural inequalities by passing on climate risks to future generations.

03

DYNAMICS OF FISH DIVERSITY AND STOCKS IN INDONESIAN WATERS

FISH DIVERSITY IN INDONESIAN WATERS

The ocean is the largest ecosystem on Earth, covering more than 70 percent of the Earth's surface and home to millions of species of living things, including fish. The diversity of fish species and changes in the number and size of fish in the ocean are important indicators in assessing the health of marine ecosystems and the impact of human activities on them. Indonesia boasts a very high fish diversity, with an estimated 4,000–6,000 species of fish distributed throughout Indonesian waters (LIPI, 2010). Indonesian waters are divided into 11 Fisheries Management Areas of the Republic of Indonesia (WPPNRI), established by Regulation of the Minister of Marine Affairs and Fisheries No. 18 of 2014. Each region has distinct climate characteristics, ecosystems, and dominant fish resources.

The distribution of fish species in Indonesian waters shows significant species variation across regions. These differences in fish species distribution are closely related to oceanographic and environmental factors such as water temperature, depth, salinity, food availability, ocean currents, and climate differences. The Sumatra region is dominated by mackerel (Rastrelliger sp), ribbonfish (Trichiurus sp), and snapper (Lutjanus sp). Meanwhile, the waters around Java are dominated by mackerel (Rastrelliger sp), anchovies (Stolephorus sp), and skipjack tuna (Euthynnus affinis). The most common fish species caught in the Bali and Nusa Tenggara regions include red snapper (Lutjanus campechanus), geronggong or gerhaheng fish (Caranx sp), and white snapper (Lates calcarifer). Kalimantan waters are dominated by baung fish (Hemibagrus nemurus), scad (Decapterus sp), and skipjack tuna (Euthynnus affinis). In the Sulawesi region, the dominant species include rabbitfish (Siganus sp), mackerel (Rastrelliger sp), and katamba fish (Lethrinus lentjan). Meanwhile, the waters of Maluku and Papua are known as prime habitats for large pelagic species such as tuna (Thunnus sp), skipjack tuna (Katsuwonus pelamis), and mackerel (Euthynnus affinis).

The diversity of fish species in a marine area reflects ecosystem stability, resilience to environmental disturbances, and economic potential through sustainable fisheries. Four factors influence fish species diversity:

1. **Physical conditions of the ocean:** Temperature, salinity, currents, and depth influence species distribution.
2. **Supporting ecosystems:** Coral reefs, seagrasses, and mangroves provide important habitats for a variety of fish species.
3. **Biological interactions:** Competition, predation, and symbiosis between species.
4. **Human activities:** Overfishing, pollution, and climate change can reduce biodiversity.

CLIMATE VARIABILITY AND ITS IMPACT ON WATERS

Climate differences across Indonesia are influenced by various factors, including geographic factors like latitude and altitude, as well as weather events like monsoons, El Niño, and La Niña (BMKG 2023). Coastal areas frequently experience extreme weather changes, characterized by increased frequency of high-intensity rainfall, uncertainties between the rainy and dry seasons, rising sea levels that threaten coastal areas, and the emergence of various disasters caused by climate change (Ahmady and Rahman 2025). Consequently, community activities are significantly affected by climate change and weather, especially for communities whose livelihoods are fishermen (Hajrina et al. 2025).

Climate change, as a result of global warming, affects marine ecosystems and oceanography (Henson et al. 2016). Oceanographic parameters such as Sea Surface Temperature (SST), chlorophyll-a, and tides are significantly affected by climate and weather changes. Chlorophyll-a is an important pigment contained in phytoplankton in the process of photosynthesis (Lubis et al. 2017). This photosynthesis process is significantly influenced by temperature, both directly and indirectly. Global chlorophyll content changes from year to year due to changes in SST. Optimal SST will increase the growth and production of chlorophyll-a in the water, but if the temperature is too high or too low, chlorophyll-a concentration will decrease. Low chlorophyll-a concentration will cause fish distribution patterns to move away from or towards waters with higher chlorophyll-a concentrations (Franz et al. 2005). Changing fish distribution patterns will affect the marine food chain and influence fishing activities, for example by reducing the amount of catch obtained per fishing trip.

CHANGES IN FISH QUANTITY AND SIZE AND THEIR IMPACT ON FISHERMEN

Small-scale fishers in Indonesia generally operate in coastal areas, as their small vessels pose risks when sailing at sea. Furthermore, small-scale fishers in Indonesia only use traditional fishing gear such as rods and nets due to limited capital and income (Wahyono 2018). This indicates that fishers in Indonesia still face various limitations that directly impact their catch productivity and income. Increasingly unpredictable weather also reduces the number of days at sea and limits the fishing areas accessible to fishermen. If the weather worsens while at sea, fishermen must stop fishing and immediately return to shore.

Fish migration caused by increasing sea level (SST) makes it difficult for fishermen to determine fishing locations. Changing marine ecosystems and unstable fish stocks further challenge fishermen in maintaining adequate catches. Based on fisherman survey data, the number of fishermen's catches has decreased compared to 5 and 10 years ago.

Temperature instability resulting from weather and climate change also affects fish growth. Continuously increasing temperatures will result in faster fish growth in the early stages, but reduce the maximum size achieved by fish (Lindmark et al. 2022). Because large fish play a significant role in the biomass and reproductive potential of fish populations, reduced growth, resulting in failure to reach maximum mature size, will impact future fish populations and sizes (Lindmark et al. 2022).

This is consistent with fisherman survey data, which found that fish caught are smaller than they were 5-10 years ago. This indicates that fish are reaching maturity before reaching their maximum size. Extreme temperature changes require fish to adapt to maintain population viability (Niu et al. 2023). Furthermore, the average size of fish in some marine areas is decreasing (Yusfiandayani, 2004) due to:

1. **Selective fishing:** Larger fish are caught more frequently, leaving smaller fish to reproduce.
2. **Environmental stress:** Suboptimal conditions inhibit fish growth.
3. **Evolutionary adaptation:** Some species exhibit genetic changes to survive new conditions.

As a result, waters are dominated by smaller fish, which directly impacts income. Small fish have a lower market value. On the other hand, consumers also prefer medium- or large-sized fish, both for consumption and for businesses such as restaurants. The low market value of smaller fish means fishermen must catch more fish to earn the same income as larger fish (Tsikliras and Polymeros 2014).

Furthermore, there has been a decline in ocean fish populations in recent decades, also caused by the following factors:

1. Overfishing disrupts the reproductive cycle and population regeneration.
2. Marine pollution in the form of plastic waste, heavy metals, and chemicals damages habitats and the food chain.
3. Climate change, in the form of warming ocean temperatures and ocean acidification, affects fish migration and survival.

Many fish species are experiencing drastic population declines, while some invasive species that are more resilient to environmental changes are beginning to dominate. This is causing changes in species composition and reducing diversity. Furthermore, changes in fish abundance in the oceans are subject to fluctuations due to natural and anthropogenic factors. Overfishing can lead to drastic declines in target fish populations and also impact non-target species through bycatch. Deteriorating environmental conditions, such as rising sea temperatures, ocean acidification, and coral reef damage, also affect fish survival and reproduction.

Changes in fish populations and species will have ecological, social, and economic impacts. Ecologically, the marine food chain will be disrupted, characterized by a decline in ecosystem functions such as plankton population control and nutrient cycling, as well as the loss of key species that play a role in maintaining ecosystem balance. Socially and economically, declining fish catches will threaten the food security of coastal communities and lead to changes in consumption

SUSTAINABLE MANAGEMENT OF FISH RESOURCEST

Sustainable management and conservation of fish resources are crucial. Strategies such as ecosystem-based fisheries management and local wisdom, setting catch quotas, establishing marine conservation areas, banning fishing during the spawning season, using environmentally friendly fishing gear, habitat restoration, and regular monitoring and research on fish stocks and biodiversity are all part of efforts to maintain the balance of marine ecosystems and ensure fisheries sustainability.

The participation of fishers in the planning process is essential to secure strong support for capture fisheries development planning. This will facilitate legal enforcement of all management policies. The implementation of a Monitoring, Controlling, and Surveillance (MCS) system and the establishment of an effective and accurate information system are crucial to ensuring sustainable fishing efforts (Monintja and Yusfiandayani, 2001).

A sustainable approach should also include educating fishers about selective fishing and breeding seasons, developing aquaculture as an alternative, and collaborating with government, academics, and local

communities. Responsible conservation and management efforts are needed to maintain the sustainability and continuity of the economic, social and ecological benefits contained in marine ecosystems.

04

THE IMPACT OF CHANGING SEASONAL PATTERNS ON FISHERIES PRODUCTIVITY

The Republic of Indonesia, as an archipelagic nation with an area of 1,904,569 km^2 and comprising 17,380 islands, enjoys a unique geographical location at the confluence of the Indian and Pacific Oceans, flanked by the Asian and Australian continents. Indonesia's geographical and climatic conditions significantly influence the productivity of small-scale fisheries, which divide the fisheries productivity season into three seasons based on catch: lean, peak, and normal.

Administratively, Indonesian waters are divided into 11 Fisheries Management Areas (WPPNRI) based on Ministerial Regulation of Maritime Affairs and Fisheries No. 18 of 2014, as follows:

1. WPPNRI 571 covers the waters of the Malacca Strait and the Andaman Sea.
2. WPPNRI 572 covers the waters of the Indian Ocean west of Sumatra and the Sunda Strait.
3. WPPNRI 573 covers the waters of the Indian Ocean south of Java to the southern part of Nusa Tenggara, the Sawu Sea, and the western part of the Timor Sea.
4. WPPNRI 711 covers the waters of the Karimata Strait, the Natuna Sea, and the South China Sea.
5. WPPNRI 712 covers the waters of the Java Sea.
6. WPPNRI 713 covers the waters of the Makassar Strait, Bone Bay, the Flores Sea, and the Bali Sea.
7. WPPNRI 714 covers the waters of Tolo Bay and the Banda Sea.
8. WPPNRI 715 covers the waters of Tomini Bay, the Maluku Sea, the Halmahera Sea, the Seram Sea, and Berau Bay.
9. WPPNRI 716 covers the waters of the Sulawesi Sea and the northern part of Halmahera Island.
10. WPPNRI 717 covers the waters of Cendrawasih Bay and the Pacific Ocean.
11. WPPNRI 718 covers the waters of the Aru Sea, the Maluku Sea, the Maluku Sea, the Seram Sea, and the Berau Bay. Arafuru, and the eastern Timor Sea.

The division of the WPPNRI was carried out by considering:

1. Natural territorial boundaries and the natural division of sea and land,
2. Areas developed by fisheries agencies established based on conventions and agreements between countries,
3. General national practices,
4. National maritime boundaries,
5. Longitude and latitude grid systems,
6. Distribution of aquatic fauna, and
7. Resource distribution and environmental conditions in the area.

Image 4.1: The 11 WPPNRI based on Ministerial Regulation of Marine Affairs and Fisheries No. 18 of 2014
Source: lokalarasindonesia.id

SEASONAL DYNAMICS AND REGIONAL CATCH PATTERNS

Unlike these administrative divisions, the 2025 Indonesian Fishermen Survey divides the Republic of Indonesia's fisheries into six regions based on the location of the main islands or island groups where fishermen originate and conduct their fishing activities. Data from this fisherman survey shows differences in lean, peak, and normal periods in each region, as illustrated in the map below.

Image 4.2: Map of differences in lean-season timing in Indonesia
Source: Indonesian Fishermen Survey (2025)

The results of the 2025 Indonesian Fishermen Survey show that each region in Indonesia experiences a lean period—a period when fishermen experience difficulties going to sea and fishing, often caused by high waves and westerly winds—which varies. The Maluku and Papua regions experience a lean period from June to August, the Bali and Nusa Tenggara regions experience a lean period from December to February, the Sulawesi region from June to October, the Kalimantan region from August to November, the Java region from November to January, and the Sumatra region from May to July each year.

Similar to the lean period, the normal fishing season and peak season also differ for each region. The Sumatra region experiences a peak season from August to September, the Java region from March to June, the Kalimantan region from December to January, the Sulawesi region from November to January, the Bali and Nusa Tenggara region from May to July, and the Maluku and Papua region from September to December. The data shows that the length of the peak season in each region also varies, with fishermen in the Java and Maluku-Papua regions experiencing a peak season of four months each year, the Sulawesi and Bali-Nusa Tenggara regions experiencing a peak season of three months each year, and the Sumatra and Kalimantan regions experiencing only two months each year.

THE THREAT OF CLIMATE CHANGE AND WEATHER PATTERN DISRUPTION

However, the seasonal patterns mentioned above could change due to climate crises affecting weather patterns in each region. As an illustration, on November 26, 2025, the Meteorology, Climatology, and Geophysics Agency (BMKG) reported the evolution of Cyclone 95B into Tropical Cyclone Senyar in the Strait of Malacca, east of Aceh. The cyclone moved towards Aceh at a speed of 10 km/h, bringing extreme rainfall and strong winds of up to 80 km/h. This event was exacerbated by the destruction of forest and land areas in the north of Sumatra, encompassing Aceh, North Sumatra, and West Sumatra, triggering flash floods and landslides. The impact of this climate event, which occurred outside the lean season, extended to coastal areas and small islands, preventing fishermen from going to sea due to damage to their boats and being swept away by high tides. Furthermore, the beaches and fishing villages were submerged in water and littered with logs, making it difficult for fishermen to return to the sea.

The 2025 Indonesian Fishermen Survey found that the majority of fishermen feel that lean seasons are becoming more frequent compared to five and ten years ago. More than 60 percent of fishermen feel their catches are declining due to the increasingly scarce fish.

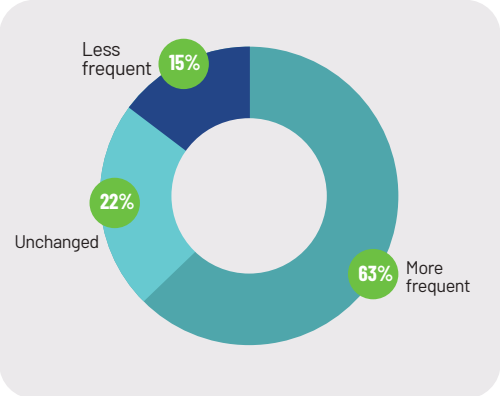

Image 4.3: Lean season compared with 10 years earlier
Source: Indonesian Fishermen Survey (2025)

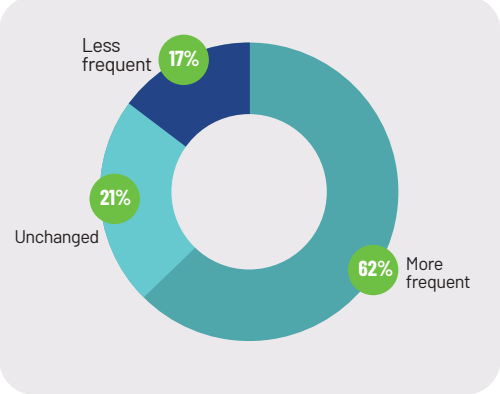

Image 4.4: Lean season compared with 5 years earlier
Source: Indonesian Fishermen Survey (2025)

Interestingly, when asked about changes in the peak fishing season, fishermen were fairly evenly split between those who felt the peak season was becoming more frequent and those who felt it was becoming less frequent. Around 22 percent of fishermen did not perceive any changes in the peak fishing season in their area.

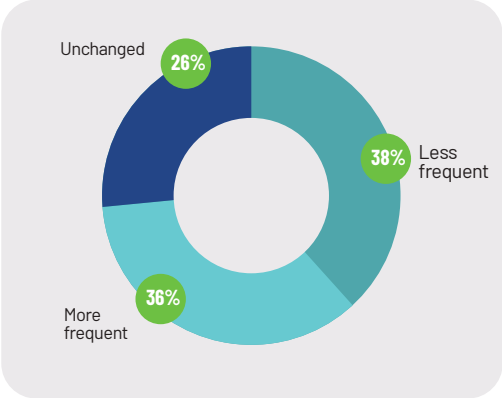

Image 4.5: Current peak season compared with 5 years earlier
Source: Indonesian Fishermen Survey (2025)

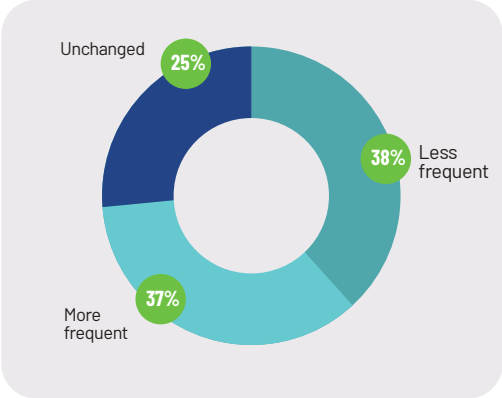

Image 4.6: Current peak season compared with 10 years earlier
Source: Indonesian Fishermen Survey (2025)

05

SOCIAL PROTECTION FOR INDONESIAN FISHERMEN

The fisheries sector plays a crucial role in the national economy, with its contribution to the national Gross Domestic Product (GDP) increasing year after year. The vast marine potential continues to make fishing a primary source of income for coastal communities.

However, climate change, extreme weather, and increasingly unpredictable seasonal uncertainties present increasingly complex challenges for fishermen. Unstable sea conditions make fishing activities increasingly risky, requiring fishermen to be physically prepared and equipped to operate safely and efficiently.

Furthermore, increasingly remote fishing grounds require fishermen to sail longer distances and incur higher operational costs. Strong government support in terms of safety guarantees, work insurance, and the use of modern technology is crucial in helping fishermen cope with risks and increase their productivity.

The 2025 Indonesian Fishermen Survey revealed that only 24 percent of fishermen felt they received specific assistance in the form of engines, boats, and fishing gear, subsidized fuel programs, fish seed assistance and training, and programs for fishermen groups and empowering small-scale fishermen. This indicates that aid distribution and outreach programs are still less than optimal.

OCCUPATIONAL HEALTH AND SAFETY OF FISHERMEN

Occupational health and safety were a key focus of the 2025 Indonesian Fishermen Survey. Indonesian fishermen are vulnerable to infectious diseases such as respiratory, skin, and gastrointestinal infections due to environmental exposure and their working conditions (Ministry of Health, 2024). Deaths from leptospirosis in Banten in 2024 (Metro TV, 2024) and other health problems such as physical injuries, cardiovascular disorders, and vitamin deficiencies further highlight the dangers faced by fishermen.

The survey showed a positive trend, with 76 percent of respondents finding it easy to access community health centers (Puskesmas) or health services. However, nearly a quarter of respondents still faced geographical barriers or limited facilities. Furthermore, approximately 17 percent of fishermen do not have a Social Security Agency (BPJS) Health card or a Healthy Indonesia Card (KIS) for various reasons, including not having had the opportunity to apply, lack of outreach, inability to pay contributions, and difficulty accessing administrative services. The government can expand the reach of BPJS Health or KIS by facilitating collective registration in fishing villages.

Furthermore, the government can also encourage small-scale fishermen to register for the Social Security Agency (BPJS Ketenagakerjaan). Currently, BPJS Ketenagakerjaan remains a regional initiative and has not yet become a national focus. Fishing is a profession with a high level of risk and difficulty, requiring physical endurance, expertise, and the courage to face unpredictable natural conditions. Survey results show that 73 percent of fishermen admitted to feeling unsafe at sea due to unpredictable weather, long distances from land, the lack of adequate work insurance coverage, and limited safety equipment on board.

This low level of safety impacts low levels of welfare and work productivity. Therefore, more serious policies are needed to strengthen occupational safety in the fisheries sector. Programs such as providing safety equipment, expanding marine work insurance, and training in extreme weather mitigation should be prioritized to protect fishermen and support the sustainability of their livelihoods.

INCREASING THE USE OF TECHNOLOGY

To overcome instability at sea, adaptation through the use of technology is key to the survival of fishermen. The use of appropriate technology can help fishermen work more safely, efficiently, healthily, and resiliently. Innovations such as digital navigation systems, fish radar, and marine weather forecasting applications can be invaluable tools. With real-time data, fishermen can determine safer sailing times and routes while reducing the risk of being caught in a storm or becoming disoriented at sea. Technology can act as a first line of defense to prevent disasters, before BPJS Ketenagakerjaan, which covers work-related accidents, becomes a priority.

The vulnerability of small-scale fishermen makes support in the form of training, mentoring, and access to environmentally friendly technology a strategic

step to ensure they can adapt to changing conditions. Access to and understanding of these technologies can provide a more stable income, which can ensure fishermen access to health insurance programs, both government-subsidized and independent.

The use of technology also opens up opportunities for more sustainable management of marine resources. With a data-based fisheries information system, fishermen can identify safe fishing areas that do not damage the marine ecosystem. Additionally, innovations such as energy-efficient boats, selective fishing gear, and environmentally friendly cooling technologies help fishermen contribute to climate change mitigation efforts. From a health perspective, these sustainable practices also reduce exposure to hazardous fuels and ensure a more hygienic catch, positively impacting the health of both fishermen and consumers.

SYNERGY OF MODERNIZATION AND SOCIAL SECURITY

Technological modernization not only increases fishers' productivity but also strengthens their resilience in the face of climate change. However, this is incomplete without an inclusive and affordable safety and health insurance system. With the support of appropriate policies—which not only facilitate access to technology but also ensure comprehensive social protection—cross-sector collaboration, and equitable access, Indonesian fishers can move towards a more resilient, greener, and more sustainable future, with guaranteed safety and health.

06

POLICY PRIORITIES FOR CAPACITY, INSTITUTIONS, AND FAIR FISHERIES SUPPLY CHAINS

Following up on the challenges and needs identified in previous chapters, this chapter explores the perspectives of Indonesian small-scale fishers to ensure the survival and growth of this profession in a changing socio-economic and ecological context. The Indonesian Fishermen Survey 2025 captured the expectations of fisher respondents in four key areas: (1) technical capacity and capabilities, (2) institutions and access to capital, (3) stable and equitable fisheries supply chains, and (4) government policy frameworks and priorities.

These expectations are closely linked to the realities of climate change discussed in previous chapters, as reinforced by local and international reports and case studies. For example, the study "Small-Scale Fisher's Livelihood Strategies" found that Indonesian fishers rely on income diversification due to catch uncertainty caused by changes in the marine environment (Saksono et al., 2023). A report from the Food and Agriculture Organization of the United Nations (FAO) confirms this, stating that nearly 90% of Indonesia's catch comes from small-scale fisheries, so the impacts of climate change and stock fluctuations directly affect the livelihoods of the majority of fishers (FAO, 2015).

CAPACITY BUILDING AND TECHNICAL CAPABILITY

This survey found that only 29 percent of fishers had ever received training, whether from the local fisheries office, NGOs, or fishing community organizations. Training topics included safety at sea, basic modern fishing techniques, catch processing, and environmentally friendly practices.

In-depth interviews revealed that many fishers who had received training felt that the training they received was general and not always relevant to the local context, such as local water conditions, the types of fish targeted for fishing, traditional fishing gear used, or fishing seasons. In some areas, the training methodology, lacking practical experience and follow-up support, made it difficult for fishermen to apply or adapt training materials to field conditions.

Capacity building and technical skills related to climate change adaptation are crucial, especially for small-scale fishers. The FAO states that small-scale fishers often lack representation and voice in resource management and require participatory policy support that strengthens local capacity to address climate challenges (FAO, 2016).

In this context, the capacity building and technical skills expected by fishers extend beyond fishing and processing techniques, but also include climate adaptation training: how to predict the weather, when it's safer to go to sea, utilize local weather/seasonal data, and use fishing methods that minimize risks to fish stocks and the safety of informants.

Conversely, capacity building and technical skills targeted at younger generations through vocational education programs, scholarships, and incentives can increase interest in the fishing profession and ensure fisher regeneration and the transmission of traditional knowledge to the next generation.

Many older fishers report that their children tend to choose other jobs because fishing is perceived as risky, the income is unstable, or the prospects are uncertain. Training from school, integrated business opportunities, or policy support to make this profession attractive to younger generations are cited as part of the solution.

STRENGTHENING INSTITUTIONS AND ACCESS TO CAPITAL

Furthermore, the survey found that only 65 percent of respondents were members of cooperatives, fishermen's associations, or joint venture groups, while another 35 percent were not members of any formal institution.

Participation in cooperatives or joint venture groups improves fishermen's bargaining power, increases access to information about subsidies or government programs, facilitates the purchase of fuel and equipment at more competitive prices, strengthens access to capital, and strengthens distribution networks. Institutions such as cooperatives or associations can also serve as a hub for climate adaptation knowledge, a forum for sharing experiences, and a collective mechanism for risk mitigation (e.g., joint funds, joint fuel purchases, safe storage of catches).

All of these can contribute directly and indirectly to higher incomes from catches. Membership also allows for solidarity mechanisms among members, for example, in sharing knowledge about fishing techniques or adapting to extreme weather conditions, as well as sharing the risk of equipment damage or loss due to adverse weather conditions.

Some of the reasons put forward for why fishermen have not yet joined institutions include a lack of information or understanding of the benefits of cooperatives or associations, low levels of trust in the effectiveness or transparency of cooperative management, and administrative constraints (participation costs are considered high compared to the benefits received) or geographical constraints (cooperative meeting locations are too far away).

Research from the University of Indonesia on Fishery Cooperatives and the Sustainable Blue Economy found that fisheries cooperatives can contribute to a sustainable blue economy if they implement good business practices, transparency, and active member involvement. Cooperatives have also been shown to increase members' incomes when they sell collectively and reduce reliance on middlemen (Rahmayanti and Sari, 2022).

STABLE AND FAIR FISHERIES SUPPLY CHAIN

MicroSave Consulting's "Strengthening the Backbone of Indonesia's Fisheries" report states that access to finance is a major obstacle: fishermen seeking to upgrade equipment or improve efficiency often cannot or are not yet able to access formal financing, thus relying on informal debt or middlemen (MicroSave Consulting, 2025).

The lack of stability and fairness in the supply chain has led many fishermen to feel that distribution margins are monopolized by middlemen or intermediaries, while they themselves receive insufficient revenue to cover operational costs, particularly fuel and vessel maintenance. To address these issues, fishermen expect regular and targeted support in the form of subsidies for fuel and fishing gear, provided sustainably and with clear terms to ensure effective distribution.

Supporting facilities such as adequate docks, cold storage in small ports, and rapid transportation of catches to markets are also cited as essential needs. Delays in transport vehicles, spoilage of catches due to lack of refrigeration, or post-harvest damage often cause fishermen to lose a significant portion of their income.

To ensure fishermen's resilience, adequate social protection in the form of insurance for fishermen against the risks of accidents, loss of gear, or the impact of extreme weather; emergency assistance or funds in the event of maritime disasters; and a social security system that takes into account seasonal uncertainties in fishing operations are crucial to ensuring supply chain stability.

GOVERNMENT POLICY FRAMEWORK AND PRIORITIES

Image 6.1: Word cloud visualization

In the word cloud visualization above, terms such as fishermen, government, assistance, and tools appear as the most frequently mentioned. Systematic and comprehensive government support related to the aspects outlined above is an integral part of the needed support.

These suggestions, in the context of public policy, align with recommendations emerging from small-scale fisheries policy studies by the FAO and the Organisation for Economic Co-operation and Development (OECD). For example, the OECD Review of Fisheries 2025 emphasizes the importance of public policies that favor small-scale fishers in aspects of stock management, reducing illegal practices, and investing in infrastructure and post-catch handling technology (OECD, 2025). Furthermore, the FAO Guidelines for small-scale fisheries highlight the need for small-scale fishers to have access to financial services, insurance, credit, and training tailored to the local context (FAO, 2015).

Summarizing the inputs outlined previously in this chapter, policy inputs emerging from the 2025 Indonesian Fishermen Survey include:

1. Improved coastal infrastructure that directly supports their activities.
2. Fishing gear subsidies or assistance can be designed to be more targeted and sustainable.
3. Regular training and mentoring based on an analysis of local needs—fish species, sea conditions, fishing gear, seasons, and extreme weather challenges, including technical assistance from local parties who understand the context.
4. Simplifying bureaucratic procedures for obtaining assistance, accessing insurance, and accessing government programs.
5. Strengthening regulations and oversight regarding middlemen or loan sharks who exploit market uncertainty to ensure a more equitable distribution of profits within the value chain.
6. Increasing attention to the younger generation through vocational education programs, scholarships, and incentives that make the fishing profession attractive.

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