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The Role of Women in Climate Change Adaptation in Langkai Island, Makassar, Indonesia

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ABSTRACT

This study aims to determine women's role in climate change adaptation on Langkai Island. This study uses a descriptive qualitative approach to describe the role of women on Langkai Island as an adaptation to climate change. The research was conducted on Langkai Island, Makassar, Indonesia, July 5-10, 2024. The informants numbered 12 people, including women, members of non-governmental organizations (NGOs), and local government officials. The results show that women on Langkai Island have an important role in families and coastal communities, managing small businesses and processing their husbands' catches, as part of climate change adaptation. They formed the Merpati Putih business group to address income instability, which processes octopus and fish into value-added products. Empowerment programs that improve financial skills and literacy help them manage family finances, reduce debt, and improve economic stability while contributing to the sustainability of coastal ecosystems.

Keywords: climate change, small islands, adaptation, women's empowerment

INTRODUCTION

One of the current global trends is climate change, which is a *concern* for every country and international institutions. Climate change refers to long-term shifts in temperature and weather patterns. Such shifts can be natural due to changes in solar activity or large volcanic eruptions. However, since the 1800s, human activity has been a major driver of climate change, mainly due to burning fossil fuels such as coal, oil and gas (United Nations, 2024).

Burning fossil fuels produces greenhouse gas emissions like a blanket that wraps around the earth, trapping the sun's heat and raising temperatures. The main greenhouse gases that cause climate change include carbon dioxide and methane. It comes from using gasoline to drive a car or coal to heat a building. Clearing the

soil and cutting down forests can also release carbon dioxide. Agricultural, oil, and gas activities are the main sources of methane emissions. Energy, industry, transportation, buildings, agriculture, and land use are among the primary sectors that cause the greenhouse gas effect (Rusmadi, Hadi, & Purnaweni, 2018).

In the face of climate change, common actions are carried out through mitigation and adaptation. Mitigation is an action to reduce greenhouse gas emissions and limit the warming our planet will experience. At the same time, adaptation is an action to help people adjust to the effects of climate change now and in the future (Campbell & Krol, 2023). These two branches of climate action work together to protect people from the dangers of climate change: one to make future and manageable climate change possible and the other to address the climate change we failed to prevent.

Island communities, especially those in coastal areas and small islands, face various challenges in dealing with climate change and maintaining the sustainability of their lives. Some of the main challenges faced by island communities include rising sea levels. Sea level rise due to global warming is a major threat to small islands, which can lead to coastal erosion, land loss, and threats to people's habitats. Small islands, mainly located below sea level, are particularly vulnerable to this disaster (Nurlaili, 2012).

In addition, there are changes in weather patterns and extreme weather. Climate change is increasing the frequency and intensity of tropical storms, extreme rainfall, and droughts, which impact island communities' social and economic lives, which depend on agriculture, fisheries, and other natural resources. Hurricanes and large waves damage people's infrastructure and livelihoods (Karim, Harsindhi, & Atsari, 2022).

Island communities also experience the challenge of limited natural resources. Natural resources such as freshwater, farmland, and marine products are increasingly threatened by climate change. The availability of fresh water has become very limited due to seawater intrusion and changes in rainfall, while marine resources that support the livelihoods of coastal communities are also declining due to global warming and pollution (Akmal, Patahuddin, & Bahri, 2020).

Most of the island's people depend on fishing for their livelihoods. However, climate change threatens important marine ecosystems, such as coral reefs and mangroves, which are home to many types of fish. The decline in fish catches can affect the food security and economy of the island community.

People on small islands are often geographically isolated, with limited access to healthcare, education, and other basic infrastructure. This condition makes them more vulnerable to the impacts of climate change due to limited access to resources and assistance (Lampe, Sairin, & Putra, 2005).

Island communities also tend to be less prepared for natural disasters, such as floods, storms, or tsunamis, due to limitations in disaster planning and a lack of adequate infrastructure. Coastal communities, especially women and children, are often more vulnerable to the impacts of these disasters.

Climate change exacerbates existing social and economic inequalities, with women and marginalized groups often the most affected. Women, who are typically

responsible for households, food, and health, must face additional burdens in dealing with the impacts of climate change, such as food and health instability (Sinombor, 2023)

In mitigation and adaptation efforts, especially adaptation, which is the focus of this study, women play an important role, especially in coastal areas and small islands. As the main managers of household resources, women are often responsible for water, food, and fuel availability. Their linkage to local ecosystems makes them more sensitive to environmental changes, such as rising sea levels and declining soil productivity. However, this role also creates greater vulnerability when climate change affects their access to these critical resources (Anggraheni, Hanura, Subhan, Setyaningsih, & Diaz, 2024; Dewi & Wongkar, 2022; Rusmadi et al., 2018; Situmeang & Aflaha, 2022; Widiantini & Manalu, 2022). The role of women in climate change adaptation is crucial, as they are often the most affected by climate change. However, they also have great potential to take effective action to mitigate and adapt to climate change (Vitasari et al., 2023).

In coastal communities, women are generally involved in small-scale farming, fisheries, and mangrove management activities. Mangrove conservation efforts reduce the risk of flooding and abrasion and support women's livelihoods through biological resources. In addition, women often play a role in encouraging the adoption of environmentally friendly practices, such as community-based waste management and livelihood diversification.

However, challenges such as limited access to education, training, and decision-making limit their contributions to the maximum. Thus, women's empowerment through climate adaptation policies and community-based programs is urgently needed to strengthen the resilience of coastal communities in the face of climate change (Robinson, 2020).

In social and cultural constructions, women are considered responsible for meeting and managing the domestic needs of the household. The vital role of women in life is the spearhead in building community resilience to adapt to climate change (Mayastuti & Sari, 2016).

Research related to the impact of climate change on fishermen has been carried out extensively, generally highlighting conditions in coastal communities. However, research on small islands focused on women is still limited. This study tries to fill this gap.

Several important studies, for example, conducted by *the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS)* in 2019, explored how climate change affects women farmers in Africa and Asia and identified strategies for women's empowerment through agricultural technology adaptation (Harahap, Manurung, Situngkir, & Simanungkalit, 2024).

Then, there was a study conducted in rural Nepal in 2017 that studied the contribution of women in dealing with climate change in rural Nepal. Researchers show how women play a role in managing water and soil resources for the sustainability of their communities (Banerjee, Hussain, Tuladhar, & Mishra, 2019). *The World Resources Institute (WRI), in a 2021* study entitled "Women as Agents of Change in Climate Action," shows how women in various countries have led local

initiatives in climate change mitigation and adaptation, particularly through community-based initiatives (Kabaseke, 2023).

Women are vital in climate change mitigation and adaptation worldwide, including Indonesia. In developing countries, women are often at the forefront of dealing with the impacts of climate change, ranging from natural disasters to resource scarcity. Various studies show that women are vulnerable parties and significant agents of change. By empowering women through education, access to technology, and inclusive policies, sustainability and resilience to climate change can be achieved more effectively. The research was conducted to explore how women on Langkawi Island play a role in climate change adaptation.

This research is expected to be a reference material for related research and add to the treasure of knowledge, especially related to climate change and the role of women. In addition, this research can be a reference for the government in formulating policies related to climate change on small islands.

METHOD

This study uses a descriptive qualitative approach to identify and describe the role of women on Langkai Island in mitigation and adaptation efforts to climate change. Qualitative research aims to understand the phenomenon thoroughly, including the behavior, perception, motivation, and actions of research subjects in a natural context. This process uses descriptive methods based on words and language (Moleong, 2019).

The research is located on Langkai Island, Makassar, and will be conducted on July 5-10, 2024. The informants in this study consisted of 12 people, including women, members of non-governmental organizations (NGOs), and local government officials. The data collected came from two main sources, namely primary data and secondary data.

Data collection techniques include several methods, namely direct observation, documentation through photos and videos, and in-depth interviews using prepared guidelines. The interview process is recorded and then transcribed for further analysis. In addition, the researcher also made field notes in the form of doodles, thoughts, and experiences while at the research site (Moleong, 2019).

The data analysis process is carried out in stages. The first step is to tidy up all the data that has been collected, including interview transcripts, photo or video documentation, and observation records. Second, a coding process is carried out on all basic data. Third, data analysis is carried out based on previous coding results. Fourth, themes are identified and arranged based on research questions. Finally, the research results are written as descriptive, narrative, and holistic reports.

RESULTS AND DISCUSSION

Overview of the Location and Community of Langkai Island Fishermen

Langkai Island is administratively included in Barrang Caddi Village, Sangkarrang District, Makassar City, South Sulawesi, Indonesia. The entire population of Langkai Island comprises the Bugis tribe and the Makassar tribe, with the main activities of small-scale fishermen and a small part of the trading. The

distance from the mainland, namely the port of Paotere to Langkai Island, is about 22 miles with a time of approximately 2 hours.

Langkai Island has an area of about 27 hectares. The characteristics of fishermen on Langkai Island are anglers, fishermen and divers. Most fishermen are anglers, and the main catch is mackerel. In addition to mackerel, fishermen fish for squid, cuttlefish, and octopus; the main target fishermen are large pelagic fish and small pelagic fish. Meanwhile, the main target of diving fishermen is reef fish by shooting using spear guns.

If you look at the state of the community from 1900 to 1980, before the entry of modernization in the fisheries sector, it was still far from a prosperous level. Their lives are still very dependent on nature and the weather, and they cannot control the state of nature because the equipment they use is still very traditional, namely sailboats and paddles.

Entering 1980, the condition of the fishing community on Langkai Island and Lanjukang Island began to change gradually. They began to know the modernization in the field of shipping using diesel engines along with the arrival of outboard engines for *ketinting* boats and very simple fishing equipment using bait from banana stems shaped like fish, and some also used bait from chicken feathers or fins near the gills of fish.

The use of fishing gear that is not environmentally friendly, such as the use of bombs, also began in the 1980s. In 1995, the demand to export basic live fish from Hong Kong became the forerunner of using potassium-based fishing aids. Until the 2000s, it was known that the use of bombs on Langkai Island was still carried out by one of the residents. Still, in 2018, this destructive fishing activity ended after the only resident who did this became a victim of his own fishing gear (YKL Indonesia, 2021).

Fishermen know two seasons on Langkai Island. Western season and Eastern season. This season is affected by monsoon winds. In more detail, this season is divided into four parts: the east season in May - October - August; the transitional season in November; the western season in December - March (Asian monsoon); and the transition season in April. Generally, most fishermen on Langkai Island use *lepa-lepa/ketinting* and *jolloro*. People use lepa-lepa, especially for catching octopuses. Meanwhile, jolloro boats are only used to catch other commodities, such as mackerel. In addition, *jolloro* boats are used to transport catches to auctions or land collectors and as a means of transportation to the mainland (YKL Indonesia, 2021).

In addition to sunu fish, mackerel and puffed fish, one of the fishery commodities that many people of Langkai Island are engaged in is octopus. They catch octopuses using a tool called *pocong-pocong* made from coconut shells. In addition, fishing gear is made from tiger cowrie-shelled biota (*Cypraea tigris*), which local fishermen call *bole-bole*. Fleet procurement capital for octopus fishermen usually uses assistance or funding from island collectors, and some also use their own capital. Most fleets used for octopus fishing do not have official papers. Large *jolloro* and ships are usually equipped with papers as they often operate to the mainland. The composition of the catch of octopus fishermen depends on the

season. In the western season, most fishermen use getting boats, with the priority catch being an octopus. In the eastern season, fishermen do not prioritize catching octopuses but rather catch other biota, such as cuttlefish (YKL Indonesia, 2021).

Challenges faced by the Fishing Community on Langkai Island

Women play a crucial role in adapting to climate change, especially in natural resource management, using environmentally friendly fishing gear, and the management of small businesses. As the primary resource managers in households and communities, women have a deep knowledge of the local environment, making them important agents in adaptation strategies. When women are involved in natural resource planning and management, they can help formulate more effective and sustainable adaptation strategies. Village-based information systems have been used in various regions to facilitate women's involvement in climate change mitigation and adaptation efforts.

In fisheries, women are often involved in fishing and processing marine products. By adopting environmentally friendly fishing gear, they can reduce marine ecosystem degradation and the sustainability of fishery resources. However, women's access to technology and training is still limited, so further support is needed to participate in sustainable fisheries more effectively.

Climate change is also causing economic uncertainty, especially for communities that depend on agriculture and fisheries. In facing this situation, women who manage micro, small, and medium enterprises (MSMEs) play an essential role in maintaining the economic stability of families and communities. However, they often face obstacles such as lack of access to information, limited business networks, and low bargaining power, which make them more vulnerable to disruptions in the supply of raw materials due to climate change. Therefore, women's empowerment through increased access to information, training, and business networks is key to building community economic resilience.

The role of women in adaptation to climate change is very significant. By increasing their involvement in natural resource management, the use of green technologies, and the management of small businesses, communities can increase resilience to the impacts of climate change while ensuring economic and environmental sustainability.

Distance to The Mainland

Langkai Island is one of the outermost islands owned by Makassar City. Located about a 2-hour drive fishing boat from the mainland, its remote location presents significant challenges for the local community, especially regarding mobility, economic access, and social sustainability.

One of the main obstacles faced by the community is limited transportation. The people of Langkai Island only depend on a small boat with a single engine of 25 PK as the main means of transportation. The use of this boat is highly dependent on weather conditions, so people's mobility becomes uncertain. Usually, the trip is done in the morning, around 6 o'clock, and must return before 4 p.m. to avoid the risk of high waves. The absence of public transportation further narrows mobility

options, especially in urgent situations such as access to health facilities or major markets on the mainland of Makassar.

People's dependence on traditional transportation is further exacerbated by bad weather conditions that often occur, especially during the westerly wind season or rainy season. When the weather does not allow sailing, fishermen's activities stop, drastically decreasing their income. It also impacts trade activities and the availability of staples, which often depend on supplies from the mainland. In this situation, women on Langkai Island have an important role in managing limited household resources, including regulating expenditure on basic needs when family income decreases.

The impact of these limitations is not only felt in the short term but also creates significant socio-economic vulnerabilities for communities. As the leading managers of the household, women often must face additional pressure to balance family needs. In addition, these challenges are exacerbated by the impacts of climate change, such as the increasing frequency of storms and changing weather patterns, which further hamper fisherman ship activities and transportation access. Better infrastructure support and appropriate mitigation policies are needed to improve the quality of life of the people of Langkai Island. For example, providing larger capacity vessels or developing adequate docks can help reduce transportation risks. In addition, skills training and economic diversification programs for communities, especially women, can be a long-term solution to reduce dependence on fishing alone. With these measures, the people of Langkai Island can better face their geographical and socio-economic challenges while improving their overall well-being.

Limited Power Facilities

The people of Langkai Island face major challenges in accessing electricity. Although electricity facilities are available, their use is limited to only six hours daily, from 18.00 to 24.00. This condition affects various aspects of life, ranging from the economy and education to people's social activities.

The limited electricity significantly impacts the economic sector of the people of Langkai Island, which mostly depend on marine products such as fish and octopus. Fishermen who need a freezer to preserve their catch cannot use it optimally, thus affecting the quality and durability of the product. This causes the selling value of the catch to decrease, making people's income unstable. In addition, micro-businesses such as seafood processing or electricity-based crafts are challenging to develop due to limited power and operational time for electricity.

The impact is felt in the economic sector and the community's education and social life. Children face difficulties learning at night because there is insufficient time to use adequate lighting. As a result, they rely on oil lamps or alternative energy sources that tend to be less efficient and environmentally unfriendly. In addition, the limitation of electricity limits the use of technology that can support daily life, such as communication, entertainment, or information.

In the long term, this electricity limitation slows down the social and economic development of the people of Langkawi Island. Dependence on

expensive and inefficient conventional energy sources creates an additional burden for people, especially to improve their quality of life.

To overcome this problem, efforts are needed to increase electricity availability sustainably. One potential solution is the development of renewable energy-based power plants, such as solar, wind power, or biomass, that can meet people's electricity needs throughout the day. Programs such as installing solar panels in homes or constructing hybrid power plants on small islands can be concrete steps in creating more stable access to electricity.

In addition, support from government and non-governmental organizations (NGOs) is essential to ensure the sustainability of the solution. The public's education about renewable energy and the efficiency of electricity use also needs to be improved. With these measures, the people of Langkai Island are expected to have adequate access to electricity, improving their overall welfare.

Limited Telecommunications Access

Langkai Island, one of the outermost islands in Makassar City, faces major challenges in telecommunication access. Its remote geographical location is the main cause of this limitation. Available telecommunication networks, such as Telkomsel, can only be accessed in certain areas, especially in high-altitude areas. It is not uncommon for people to have to climb trees to get adequate signals. This condition makes communication activities ineffective and makes daily life difficult.

The limitations of this telecommunication network affect various aspects of people's lives. One of the impacts is the high cost of internet access, which is not proportional to the quality of service obtained. Most people, including fishermen, are burdened by the high cost of internet vouchers. Despite the cost, unstable connections often do not support their activities, such as communicating with trading partners or obtaining important information. These limitations greatly affect fishermen's ability to access weather forecasts or market data, which should improve their work efficiency.

In addition to the economic sector, telecommunication limitations also impact public services. The government administration process that requires communication with outside parties is hampered, slowing down services to the community. In the education sector, children on Langkai Island face major challenges in accessing online learning materials. This became even more evident during the COVID-19 pandemic when online learning became a major need. This difficulty widens the educational gap between small island people and urban communities with better internet access.

This condition also affects the social life of the community. Limitations in communicating with family or colleagues on the mainland create a sense of isolation and exacerbate people's dependence on outsiders to convey important information. To overcome this problem, investment in more adequate telecommunications infrastructure is needed. Adding signal towers on Langkai Island is an urgent solution so that everyone can enjoy a stable network. In addition, satellite-based technology can be an alternative to reach remote areas more effectively.

Government support is urgently needed to encourage telecommunication service providers to increase access in remote areas such as Langkai Island.

Subsidy policies or internet cost incentives must also be considered to ease the burden on people with high living costs.

In addition, educating the public about the use of digital technology is also important to ensure they can maximize the benefits of internet access. With better telecommunication networks, the people of Langkai Island can improve their quality of life and accelerate social and economic development in their region. This will open new opportunities for the young generation on the island to compete with people from other regions.

The Impact of Climate Change on Langkai Island

Catch Around Fish Islands Decreases

Climate change significantly impacts the lives of people on Langkai Island, especially fishermen who depend on marine catches for their livelihoods. One of the most pronounced impacts is the decline in fish catching around the island. To overcome this, fishermen must go to sea further, which leads to increased travel time and production costs. If previously fishermen only needed 5-7 liters of fuel oil (BBM) once at sea, now they must spend up to double the cost, especially with the increase in fuel prices that are getting higher. Although there are subsidies and facilities for fishermen, such as fishermen's cards and boat permits, these facilities are limited to fishermen who meet administrative requirements. Many fishermen do not have both permits, so they cannot use subsidized facilities. Climate change has brought significant challenges to the fishing community on Langkai Island. Unpredictable weather and fluctuating catches affect the income of fishing families.

In addition, environmental damage caused by climate change also worsens fisheries conditions. Rising waves and worsening sea conditions damage coral reefs and cause turbid seawater, impacting fish habitats. The practice of uncontrolled fishing (overfishing) also exacerbates this condition. Fishermen who choose to fish near the coast to avoid lousy weather are putting pressure on local fish stocks, which are dwindling.

These causes are intertwined and create increasingly severe economic difficulties for the people of Langkawi Island. Declining fish catches threaten their food security and livelihoods and exacerbate social and economic disparities. This impact is felt by fishermen's families and communities, who depend on marine products as their primary source of income.

To overcome this problem, comprehensive mitigation efforts are needed. One is sustainable fisheries management that can reduce pressure on marine resources. This includes enforcing rules related to fishing limits, using environmentally friendly fishing gear, and monitoring marine ecosystems to prevent further damage. In addition, supporting infrastructure development, such as seafood processing facilities and access to cheaper energy resources, can also increase people's resilience to the impacts of climate change. This is in line with research conducted by Gaol and Nababan (2012), which found that the impact of climate change has reduced pelagic fish production in Indonesia by 15 to 30 percent due to ocean warming. Changes in sea temperature caused by climate

change affect the distribution and abundance of pelagic fish, directly impacting fishermen's catches. In addition, a report by the Food and Agriculture Organization (FAO) (2010) noted that during 2010, monsoon patterns and La Niña events affected fishery activities in Indonesia, leading to a decline in capture fisheries production in several regions. For example, in the Bali Strait, lemuru fish production has decreased significantly due to climate change.

In addition to wiser management of natural resources, it is also important to strengthen the social and economic resilience of the community through women's empowerment and increasing financial literacy. Empowering women, especially fishermen, who are often involved in household management and small businesses, is hoped to help create alternative jobs, strengthen local economies, and reduce dependence on marine products. With these steps, the people of Langkai Island can be better prepared to face the challenges of climate change and maintain their economic sustainability. On Langkai Island, women play an important role in fisheries and natural resource management. They support their husbands, who work as fishermen and are active in productive economic activities to improve the family's welfare. One prominent initiative is forming marine products processing groups, such as the White Pigeon group chaired by Nurjanah and the Cahaya Rembulan group led by Nirma. These groups produce processed products such as octopus chili sauce and shredded fish, which have been widely known on the island and its surroundings.

Reduced Seagoing Activity

Extreme weather changes that are increasingly frequent have a major impact on the lives of fishermen on Langkai Island, especially with limited access to transportation and communication in this remote area. Bad weather forced fishermen to postpone their activities at sea and wait for conditions to improve, resulting in a long vacuum in their economic activities. The community's dependence on marine products as the main livelihood makes weather change a major challenge. When fishermen cannot go to sea, the available job alternatives are minimal, which triggers more profound financial difficulties.

In this challenging situation, many fishermen are forced to owe money to the retainers or juragan, who are the owners of capital and collectors of catches. Although the retainers did not collect interest on debts, fishermen remained deeply dependent on them. This happens because they have no choice but to accept the low prices offered by juragan, which often does not reflect the true value of the seafood they catch. This situation causes fishermen to be unable to meet their daily needs and worsens their social and economic conditions.

Strong social and economic dependence on retainers creates a very unprofitable system for fishermen. Low prices from collectors are economically detrimental and create inequality in trade relations. Although fishermen's catches have a higher market value, they do not have the bargaining power to increase prices. As a result, fishermen are trapped in a cycle of debt that continues to swirl due to insufficient income to pay for the family's basic needs. This is in line with the results of Dita Rusiani L. Tobing's research (2022) that fishermen who owe toke fish are required to sell their catch to toke at below-market prices. This shows the weak

bargaining position of fishermen due to their financial dependence on toke fish. Another study by La Ode M. Aslan (2018) where his research shows that debt is used as a tool to bind fishermen, so they are forced to sell their catch to fishermen at a price determined by fishermen. This situation causes fishermen to have low bargaining power in fish sales transactions.

This phenomenon shows the inequality between small fishermen and large financiers who control the local economic system. In this situation, fishermen face difficulties obtaining optimal marine products due to climate change and stormy weather and need access to a fair market. Without a system that supports economic justice and provides more open market access for fishermen, this condition will worsen their welfare.

To overcome this problem, efforts are needed to improve a more transparent and fair distribution system for marine products. Access to better financial facilities, forming joint business groups, and strengthening fishermen's capacity to manage their catches independently help reduce dependence on retainers. In addition, the development of supporting infrastructure, such as a broader market and a more efficient distribution network, can increase the bargaining power of fishermen in the market. With these changes, it is hoped that fishermen can get out of the debt cycle and improve their socio-economic conditions.

The Role of Women on Langkai Island in Climate Change Adaptation

Main Characteristics of Women on Langkai Island

Regarding ethnicity, the residents of Langkai Island come from the Bugis and Makassar tribes. They have unique characteristics shaped by their social, cultural, and economic environment. As part of coastal communities, they play a vital role in families and supporting the financial sustainability of their households and communities. These characteristics of women reflect the strength, resilience, and adaptability that allow them to face natural and economic challenges in coastal areas.

In addition to carrying out domestic roles, such as preparing food for family needs, childcare, and taking care of households, Bugis and Makassar fisherwomen also play an active role in the family economy. In fishermen's families, men are usually responsible for fishing activities, while women are often responsible for sorting catches, preparing fishing equipment, and processing catches for resale.

As the leading manager of household finances, fisherwomen have significant control over the family economy. Many manage small businesses such as fish stalls, food stalls, or processed seafood. This role gives women economic autonomy that helps meet their daily needs and encourages more efficient financial management amid fishermen's often unstable incomes. Although women's contribution to Langkai Island is huge, this role often receives little recognition from the community and the government. They face considerable social and economic pressures, especially because the husband's work as a fisherman is high-risk and the income is precarious. When the husband's catch is minimal or non-existent, women often must rack their brains to cover the family's needs.

In addition, women fishermen also face challenges in accessing education and financial literacy. Low levels of education, especially among coastal women, are an obstacle to improving their skills for business management or economic diversification. Several women's empowerment programs in coastal areas show that improving financial literacy and seafood processing skills can significantly impact the welfare of fishing families.

Women on Langkai Island also play an important role in environmental conservation. In coastal communities, women are often pioneers in implementing sustainable practices, such as household waste management or marine resource conservation. A study shows that coastal women are more sensitive to environmental damage and contribute to encouraging eco-friendly behavior in their communities.

On Langkai Island, for example, women are involved in marine conservation activities facilitated by non-governmental organizations. They not only process the catch into value-added products but also educate children about the importance of protecting the marine environment. This shows that women play a role in the family economy and building collective awareness for environmental sustainability.

As part of the Bugis and Makassar communities, women on Langkai Island are resilient, independent, and multitasking. In addition to carrying out domestic duties, they often support the family economy. When the husband finishes going to sea, their duties continue, starting from managing the catch to preparing household needs for the next day.

This dual role not only illustrates the resilience of fisherwomen but also shows how they are the backbone of the family in various aspects. Sometimes, women even take the lead when their husbands cannot go to sea due to bad weather or health conditions. This shows their flexibility in facing the challenges of living in coastal areas.

Improving financial literacy and business management skills is important in empowering women fishermen on Langkai Island. Empowerment programs conducted by various institutions, such as seafood processing training and small business management, have helped women increase family income while creating economic autonomy.

For example, women fishermen on Langkai Island are now processing their catches into value-added products such as shredded fish and octopus chili sauce. This activity adds value to the catch and creates new jobs for other women in their community. Thus, women's empowerment on Langkai Island impacts family welfare and the community's economy.

Women fishermen on Langkai Island are important to families and coastal communities. Their role is limited to household management and includes contributions to the family economy, environmental conservation, and community strengthening. Although these roles are often undervalued, their resilience and independence demonstrate that women are significant change agents in coastal areas.

Through empowerment and literacy programs, fisherwomen can optimize their role in building a prosperous family while preserving the environment. Thus,

recognizing the role of coastal women is an important step in encouraging economic and social sustainability in the coastal communities of South Sulawesi.

Diversification of livelihood sources

One form of adaptation for women in the face of climate change is diversifying their livelihoods. In this case, they formed a joint business group called Merpati Putih. This group focuses on processing marine products, especially shredded and octopus chili sauce. This group was formed two years ago with the facilitation of the Yayasan Konservasi Laut (YKL) Indonesia. The main purpose of forming this group is to add value to the marine products caught by their husbands while reducing marine catch waste. They take advantage of damaged or deformed octopuses, which buyers usually reject because their quality is not up to market standards.

Octopus fishermen often face situations where their catch is physically disabled, such as injuries from fishing gear. Octopuses like this are usually valued much less than intact, high-quality ones. Before the White *Pigeon group*, this deformed octopus was sold at a very low price because there was no other alternative. This problem adds to the economic pressure on fishing families due to limited catches. This situation is the fundamental reason for the formation of the Merpati Putih group, with a vision to utilize catches that are considered "less valuable" to have a higher selling price. NJ (40), the chairman of the Merpati Putih group, said:

> *Sometimes, the husband catches a large octopus, but there is a slight defect, so it is rejected or bought at a very low price. Inevitably, it must still be sold regardless of the price given by the collector. We process this deformed or damaged octopus so that the selling price remains good.* (NJ Interview, June 5, 2024)

With the innovation carried out by this group, octopus that was previously considered less valuable can now be processed into octopus chili sauce products, which can increase the selling price by up to two times. In addition, this group also produces shredded fish by utilizing fish whose prices have dropped drastically due to the abundant catch in certain seasons. This process involves careful calculations and comparing the potential profits from selling fresh fish and fish processed into shredded products. In this way, they increase family income and reduce the risk of losses due to fluctuations in fish prices in the market.

The existence of this group also has a significant socio-economic impact. The women who are members of Merpati Putih receive training in business management, financial planning, and marketing techniques. This increases their capacity as independent local economic actors. In addition, this group also opens opportunities to build networks with other business actors in the fisheries and food processing sectors. Thus, women not only play the role of household managers but also as agents of change that encourage community welfare improvement.

The Merpati Putih Group is also a concrete example of how adaptation to climate change can create economic opportunities. By utilizing previously considered worthless seafood, they reduce their dependence on traditional markets

that are often unfair to small fishers. This effort also reduces marine catch waste, thereby contributing to the sustainability of coastal ecosystems.

Through measures like these, women are proving that they can adapt to climate change and become key drivers for inclusive and sustainable economic development in coastal areas. Programs like this simultaneously show the importance of women's empowerment in facing environmental and economic challenges.

Financial Literacy

One of the main problems often faced by fishing communities is poor financial management, which is generally carried out without adequate recording. As a result, they have difficulty accurately calculating income and expenses, so they often face a negative financial situation or must go into debt to meet their daily needs. This habit makes them vulnerable to economic crises, especially when catches are reduced due to weather changes or other factors. One of the factors causing the lack of financial literacy is low education levels. Most of them only graduated from elementary school, and some did not even go to elementary school or school at all.

In the digital era, consumptive behaviors such as online shopping have worsened the financial condition of some fishing communities. Even though internet access in coastal areas is limited, some residents can still take advantage of it through available network signals. This phenomenon is used by specific individuals who provide deposit services, helping other residents buy goods online. Ironically, many residents use this service to buy tertiary necessities, often in debt. This exacerbates their financial burden, especially when debt is used for goods that do not support productivity or urgent needs.

To overcome this problem, a systematic and community-based approach is needed, one of which is through financial literacy programs. For example, the women's business group Merpati Putih has developed a financial literacy program that focuses on empowering women fishermen. The program helps women learn to manage family finances, record income and expenses, and prioritize primary needs. With this group's guidance, some women can now create simple bookkeeping to document daily expenses and plan monthly budgets.

> *In the past, we did not know about financial records. If there were money from seafood, my husband would immediately spend it until it ran out. All expenses must be carefully considered, whether they are necessities or desires. Likewise, children's expenses have been well-regulated. The most important thing is always to try to set aside money from the husband's business to save, in addition to being a long-term investment, just in case you face a difficult situation* (MN/40/woman. Interview June 5, 2024).

Through consistent education and practice, women become more independent in managing their finances and acting as agents of change in their communities. They began to teach family members and neighbors about the importance of recording finances and reducing consumptive spending. With these small steps, fishing communities can slowly improve their economic stability and reduce their dependence on debt, making them better prepared to face the

challenges that come their way, including fluctuations in income due to climate change and other economic pressures.

CONCLUSION

Women on Langkai Island have an important role in the family and society. In addition to taking care of the household and children, they also manage small businesses, such as fish stalls, and process their husband's catch. When the husband's income is unstable, women become the breadwinner of the family economy. They also contribute to environmental conservation and marine conservation. Despite the challenges of limited access to education and financial literacy, empowerment programs that improve financial skills and literacy help improve family well-being and community economics. Women on Langkai Island are vital agents of change in coastal communities.

Women on Langkai Island are making various adaptations to climate change; one is by forming a business group, Merpati Putih, which focuses on processing marine products such as shredded fish and octopus chili sauce. This group processes deformed octopuses and fish whose prices have dropped into value-added products, increasing the income of fishing families. In addition, they also receive training in business management and financial literacy, which helps reduce dependence on debt and improve the economic stability of families. Through better financial management, women on Langkai Island can prioritize primary needs and reduce consumptive spending, thereby supporting the economic resilience of families and coastal communities. The group also contributes to the sustainability of coastal ecosystems by reducing marine catch waste. The role of literacy must be carried out continuously but through sustainable programs and government support.

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