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RESEARCH ARTICLE

Resilience of Pambodi Fishermen in Facing Climate Change in Pangali-Ali Village, Majene Regency

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ABSTRACT

Climate change is a major challenge for Pambodi fishermen, causing losses and requiring Pambodi fishermen to have a license to survive in difficult conditions. This study aims to analyze the resilience of Pambodi fishermen in Pangali-ali Village, Majene Regency in facing climate change. Through an in-depth interview process with a number of fishermen, this research revealed various adaptation strategies carried out by Pambodi fishermen to deal with seasonal fluctuations and changes in water conditions. The results of the study showed that Pambodi fishermen have strong local knowledge about the seasonal cycle and weather changes. They are able to predict seasonal changes based on experience and information from BMKG. When facing the lean season, Pambodi fishermen make various adaptation efforts, namely verifying livelihoods, changing the types of fish caught, changing the fishing area. This adaptation strategy allows pambodi fishermen to continue to meet their families' food needs despite the challenges of climate change. In addition, this study also revealed the existence of a strong social system among pambodi fishermen, such as a unique financing system that supports them in facing economic difficulties.

1. INTRODUCTION

Indonesia's climate is influenced by the monsoon winds that change every six months, causing the rainy and dry seasons. This change of seasons affects the fishing season, and during the lean season, fishermen have difficulty going to sea and catching fish. The lean season occurs during the west and southeast wind seasons. During the west season, fishermen deliberately do not go to sea because nature is unfriendly, nets are difficult to spread, while the lean season during the southeast wind season causes losses (1). This is because every time fishermen go to sea which requires operational costs, fishermen cannot return them because they do not get the catch.(2). Extreme climate fluctuations in Pangali-ali Village force fishermen to adapt to ensure their survival. Their dependence on marine resources as their main source of livelihood makes unpredictable changes in the wind season cause uncertainty in fishing. Therefore, fishermen need to develop better resilience strategies to face the challenges of climate change and meet their living needs.

Pambodi fishermen, who use handlines as fishing gear, are the main subjects in this study. They spend time at sea for four days to a week, and can even reach several months (3). Days of activities at sea make them feel the significant impact of climate change, because when climate change occurs, Pambodi fishermen cannot go to sea. Negative climate change forces fishermen to develop adaptation strategies through their local knowledge formed from daily interactions with the marine environment. Social resilience, namely the ability of a community to absorb disturbances and adapt, is influenced by socio-cultural, economic, and institutional factors. Strong social networks, access to

resources, and responsive public policy support are very important in increasing the adaptive capacity of fishing communities. Climate change in Majene Regency can be seen from significant fluctuations in rainfall, making it difficult for fishermen to determine the season and have to adapt (4).

Table 1. Rainfall in Majene Regency

Month	Observation of Rainfall Amount at BMKG Majene Station (mm)		
	2023	**2022**	**2021**
January	204.8	255.1	403.1
February	141.6	214.4	133.3
March	121.6	28.1	178.8
April	94	68.9	105.8
May	144.6	243.5	66.8
June	216.5	219.1	161.3
July	81.7	149.4	32
August	1.5	146	319.7
September	8	227.3	124.9
October	32.6	354.6	164.9
November	42.9	218.9	164.3
December	153.1	372.9	371

Source: Central Statistics Agency of Majene Regency

Based on the rainfall data above, it shows quite significant fluctuations from year to year. This indicates that the rainfall pattern in Majene Regency is unstable and can experience quite drastic changes. Fluctuations in rainfall are caused by climate change due to global warming which causes changes in long-term rainfall patterns, such as increased intensity of extreme rainfall or extension of the dry season (5). Significant fluctuations in rainfall can cause uncertainty in the change of east and west seasons, this occurs due to changes in the start and end times of the season, rainfall in the rainy season may be higher or lower than average, and the duration of the rainy or dry season may be longer or shorter than usual (6).

Climate change makes it difficult for fishermen to predict when to go to sea, with high rainfall causing flooding that damages boats, and rising sea levels threatening settlements. Changes in rainfall patterns also affect salinity, temperature, and ocean nutrients, which impact fish distribution and catches. Fishermen must be able to adapt to climate change to reduce the risk of losses, through understanding the impacts, diversifying livelihoods, and building resilience (7). Climate change has complex impacts on pambodi fishermen in Pangali-ali Village, including coastal abrasion and decreased catches, especially due to extreme waves during the west season which limit fishing and threaten food security. Therefore, this study aims to evaluate the adaptive capacity of pambodi fishermen in Pangali-ali Village, Majene Regency, in dealing with the impacts of climate change.

Participants and Methods

This study adopted a qualitative approach with a case study design to explore in depth the resilience mechanisms of pambodi fishermen in facing the challenges of climate change in Pangali-ali Village, Majene Regency. The qualitative approach was chosen because it allows a holistic and contextual understanding of the adaptation strategies developed by the fishing community. Research data were obtained through in-depth interviews with pambodi fishermen, fishermen's wives, and community leaders as key informants. In addition, participant observation was conducted to understand the

daily practices of fishermen in facing climate change. Data analysis was carried out inductively using thematic analysis techniques to identify themes related to social capital, local knowledge, and institutional support as determinants of resilience. This study aims to provide an empirical contribution to the literature on the resilience of coastal communities such as pambodi fishermen and to develop a conceptual framework that can be used to design more effective interventions in supporting pambodi fishermen's adaptation to climate change.

FINDINGS

Pambodi fishermen in Pangali-ali Village, Majene Regency, are the dominant fishermen who use handlines and operate outside Majene waters, such as Lombok, Donggala, Bone, Kendari, and Balikpapan. They catch small and large pelagic fish, such as tuna, skipjack, and mackerel, using 12-15 GT bodied boats. Each boat has 5-7 members and operates for 3-7 days. However, they face challenges of bad weather and lean seasons that affect their catch, requiring large operational costs and resilience strategies to maintain their survival.

The fishing community, especially the Pambodi fishermen who are vulnerable to seasonal fluctuations, need to have the ability to adapt to overcome problems caused by the lean season that occurs due to climate change. The resilience in question is called resilience, which is defined as the ability of the system to absorb disturbances and maintain its basic functions (8). This reflects a person's ability to recover from difficult conditions, and in the context of climate change, the resilience of fishermen becomes an important social fact in society.

1. Ability to manage risk

Climate change often causes losses for fishing communities, both material and immaterial. Pambodi fishermen in Pangali-ali Village, Majene Regency, demonstrate their ability to manage climate change risks by understanding and reducing its impacts. They utilize experience and weather information from BMKG to anticipate seasonal changes and adjust their fishing activities or switch to other jobs to continue to meet family needs, reflecting their adaptation strategy in dealing with climate change (9).

The ability of pambodi fishermen to cope with climate change depends on their knowledge of climate change itself. This knowledge allows them to adjust their responses to the seasonal changes that occur every year. They understand the seasonal cycle through the changing of the moon and relate natural signs such as sea water color, temperature, and wind direction to fish availability. This knowledge, gained from inherited experience and direct observation, helps them adjust their fishing activities and cope better with climate change (10).

Pambodi fishermen in Pangali-ali Village understand seasonal changes through the changing of the moon and adjust their fishing activities. Although aware that the west season is high risk, they still go to sea because of economic needs. Their ability to manage risk is based on local knowledge gained from annual experience and BMKG weather forecasts via mobile phones, which helps them adjust adaptation strategies and reduce the impact of climate change on their economy. The risk management ability of pambodi fishermen in Pangali-ali Village is based on how the community understands the climate change that will occur as seen from their knowledge of seasonal changes, namely as follows.

1) The west season starts from November to March.
2) The southeast season starts in April to June.
3) The east season starts in July to August, even until September.
4) September to November is the parallino season, which is a calm season without strong winds and big waves.
5) View weather forecasts by BMKG (Meteorology, Climatology and Geophysics Agency) via mobile phone.
6) If the sea water is white and the water temperature is cold, it will be difficult to find fish.

This is knowledge of when the change of seasons will occur, so that it can maintain stable income when there is a change of seasons that makes pambodi fishermen unable to go to sea as usual by changing their fishing activities or with other jobs. This can be seen from the actions or efforts of

pambodi fishermen when there is a change of seasons. However, the estimated change of seasons does not always occur the same in those months due to weather anomalies which are the result of climate change, causing the uncertainty of the change of seasons (11).

2. Livelihood Adaptation

Climate change often affects the economy of fishermen, especially pambodi fishermen, by disrupting fishing activities. To survive, pambodi fishermen in Pangali-ali Village have developed adaptation strategies to deal with annual seasonal changes, including the west and dry seasons. They have become accustomed to these changes and have implemented adaptation strategies such as diversifying livelihoods, changing the types of fish caught, and adjusting fishing areas to survive in difficult conditions (12).

a. Verified livelihood

When there is a change in season from east to west which causes difficulties in obtaining fish catches, pambodi fishermen make changes to their fishing activities. When pambodi fishermen cannot go to sea as usual, they will change their fishing activities such as mangadang, which is going to sea at night because of the difference in capital required. When mangadang usually collects capital together to buy diesel and each brings their own supplies and fishing equipment and the difference in the amount of catch because mangadang activities are very dependent on luck or fortune where the amount of catch is very different from mambodi and the price of fish sometimes goes up and down, as well as the distance traveled.

In addition to mangadang, pambodi fishermen will mammasina when there is a change in season that causes them to be unable to go to sea as usual, because the distance traveled is closer so it will be safer from bad weather such as strong winds and high waves in the open sea. The capital needed for mammasina is relatively smaller compared to mambodi, so it becomes an alternative adaptation for pambodi fishermen. In addition, the choice of mammasina with smaller capital is an effort by pambodi fishermen to minimize the risk of loss if the catch is not as expected. In addition to changing fishing activities, some pambodi fishermen also switch jobs to become bricklayers.

The livelihood verification strategy carried out by Pambodi fishermen as a response to the challenges of climate change, especially when the west season arrives and sea conditions do not allow for going to sea. In this case, Pambodi fishermen do not only depend on the fisheries sector, but also switch to the construction sector by becoming masons when sea conditions do not allow for going to sea. This shows the existence of significant sectoral verification. Although the income from being a mason is lower than going to sea, this job remains an option because it provides a steady income, especially when the west season arrives and fishermen cannot go to sea. And from the explanation of the second informant who said that he worked with his uncle as a mason, it shows that there is a strong social network among fishermen that can help them find alternative jobs. Where a strong social network among Pambodi fishermen plays an important role in facilitating livelihood verification.

Based on the presentation of informants through in-depth interview process, it is understood how Pambodi fishermen adapt to seasonal changes, especially when entering the west season. The west season which is marked by bad weather and high waves makes the fishing activities of Pambodi fishermen difficult and risky. The verified livelihoods carried out by Pambodi fishermen include:

1) *Waiting,*namely fishing at night. This activity was chosen because the capital needed is less, the distance is closer and the risk is lower compared to going to sea mambodi.
2) *Mommy,*namely using a smaller type of boat or commonly called katinting to catch fish with a capacity of 1 to 2 people/boat. This activity also requires smaller capital and short travel time, namely leaving at dawn and returning in the morning around 10 to 12 noon.
3) Turning to other jobs, some fishermen choose to work as masons or other jobs as an alternative source of income during the lean season.

Some of the things above are done by the pambodi fishermen because the weather conditions during the extreme west season make going to sea with large boats impossible. Capital in mangadang and mammasina activities requires smaller capital compared to going to sea with mambodi, and the risk is considered safer because the distance is closer and the boat is smaller. And the main reason is the economy so that they can still earn income and meet the needs of the family.

b. Changes in the types of fish caught

Climate change that causes weather anomalies causes Pambodi fishermen to feel the impact of unpredictable seasonal changes and unpredictable periods of time, making Pambodi fishermen have to be licensed, one of which is by changing their fishing activities as explained in the livelihood verification section. Therefore, in addition to changing fishing activities, the types of fish caught are certainly also different.

The changes in fishing activities have significant differences, namely the types of fish obtained and different fishing gear. Where when mambodi the types of fish obtained are large fish, such as tuna, skipjack and mackerel and in the east season, the tuna catch is usually very abundant using handline fishing gear (13). While mammasina which is an alternative activity for fishermen to continue to earn income in the lean season to meet their living needs, produces more small fish such as selar and mackerel using flying fish bait and these fish are types of fish that often appear in the west season. In addition to mammasina, pambodi fishermen also change their fishing activities by mangadang, the types of fish obtained are the same as mammasina but have differences in the time of capture, the boat used and the capital outlay.

Climate change has had a significant impact on fishing activities by Pambodi fishermen. Unpredictable seasonal fluctuations have forced fishermen to adapt by changing their fishing strategies which have also changed the types of fish they catch. Where Pambodi fishermen previously caught more large fish such as tuna, skipjack and mackerel especially during the east season. However, with climate change, small fish such as selar and layang have become the target of catch especially during the west season.

c. Changes in catchment area

Climate change not only changes the types of fish caught by pambodi fishermen but also changes the distance traveled by fishing areas. In response to this challenge, pambodi fishermen in Pangali-ali Village are adapting by changing their fishing areas. Where usually pambodi fishermen catch fish in the waters of Majene Regency with a distance of 40 miles to 100 miles, in addition pambodi fishermen also catch fish in the waters of Makassar City, Mamuju, Donggala, Lombok and Kalimantan.

Pambodi fishermen take resilience measures by verifying their livelihoods, then they will change their fishing areas, such as the distance traveled to get fish. Usually they travel a distance of 40 to 100 miles, but in the west season they only travel a distance of 5 to 10 miles to avoid various risks that could occur due to unfavorable weather.

Pambodi fishermen adjust their travel distance to the season. The east season with better weather allows fishing with a longer journey, while in the west season with bad weather limits fishing activities which forces them to adapt. The amount of capital brought greatly affects the distance traveled and the duration of the trip. Larger capital allows fishermen to go to sea further and for a longer period of time, unlike when pambodi fishermen are resilient with mangadang which only requires a little capital and a fairly close distance so that it becomes an alternative job when pambodi fishermen cannot go to sea as usual in the lean season.

Fishing activities by pambodi fishermen in Pangali-ali Village show different dynamics between the large-scale fishing method with high capital and high risk, and the mangadang method which is more efficient and requires less capital. The unique financing system, where fishermen take capital from basic food vendors, reflects the complex interaction between fishermen and local business actors. Climate change affects their activities with fluctuations in weather and water conditions forcing adjustments in fishing areas, duration of fishing, and distance traveled.

In the east season with good weather, they dare to go to sea up to a distance of 100 miles. However, in the heavy season with bad weather, the distance traveled is limited to only 5 to 10 miles to avoid risk. Where when sea conditions do not allow for going to sea as usual, fishermen switch activities with mangadang and mammasina as alternative livelihoods because they only require smaller capital and a shorter distance. In addition, pambodi fishermen have a financing system that is for taking capital in advance from basic food sellers. This system shows the dependence of fishermen on the surrounding community.

3. Ability to Meet Food Needs

The resilience of Pambodi fishermen is also seen in how they are able to meet their food needs even in difficult circumstances. Fishermen have high resilience in meeting their families' food needs, especially when facing the lean season or bad weather conditions that disrupt fishing activities (14). Where as a fisherman, he consciously sets aside some of his income during the good season to be used as savings that function as emergency funds during the lean season or when the catch is uncertain. And has a mature plan regarding the use of income, he distinguishes which should be spent on daily needs and which should be saved for the future and chooses to rely on the savings they have set aside rather than going into debt during times of difficulty, this shows their awareness of the importance of maintaining family financial stability.

Meanwhile, some other pambodi fishermen when they do not get income, then to meet their food needs they choose to borrow money from family, namely siblings or parents. However, the interesting thing about their presentation is that they both work to meet household needs even though it is uncertain every day, where in the Mandar language there is a term sibaliarriq in household life. Sibali parriq is a concept of cultural values of helping each other, working together between husband and wife and children to create a prosperous life both in terms of economy and education.

When fishermen are unable to meet their food needs, they will borrow money from their families, and when they have financial problems they will borrow money from banks and savings and loan cooperatives such as Mekar. However, because of their resilience, they managed to pay it off. The Pambodi fishermen's family works together to meet the needs of their families and solve the problems they face. In this case, their family adheres to sibaliparriq in their household life, which is also a characteristic of husband and wife in a Mandar tribe family.

Therefore, the main findings in the ability to meet food needs carried out by Pambodi fishermen are as follows.

a. Saving for the future. As a fisherman, like Mr. Yahya, he has a high awareness of the importance of saving. They set aside part of their income during the good season as an emergency fund to face difficult times. This strategy shows mature financial planning and the ability to adapt to changing natural conditions.
b. Borrowing for daily needs. Some fishermen prefer to borrow from family, namely siblings and parents, or financial institutions such as banks and savings and loan cooperatives when facing financial difficulties. However, they still try to pay off their debts as quickly as possible.

The cultural values of sibaliparriq play an important role in both strategies. The concept of mutual assistance and cooperation within the family is the basis for fishermen to face economic challenges. Whether they save or go into debt, the spirit of mutual cooperation and family togetherness is the main strength in maintaining food security. Pambodi fishermen show varying levels of resilience in facing economic challenges. Although the strategies they use vary, local cultural values such as *sibaliparriq* are a determining factor in their success in meeting family needs.

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