



Social Economic Condition of Coastal Communities Based on Utilization Pattern in Rote Ndao, East Nusa Tenggara

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Abstract

The socioeconomic conditions of coastal communities play a critical role in shaping resource utilization patterns, which directly impact the sustainability of conservation areas. In Rote Ndao, understanding the livelihoods coastal community is essential for developing effective management strategies that balance ecological preservation social economic. This study aimed to assess the socio-economic status of coastal communities and analyze their resource utilization patterns in relation to their environmental knowledge on Rote Island. Data was collected in September 2021 from 139 household heads across six randomly selected coastal villages, representing 30% of the total coastal villages and considering conservation area zoning. Cluster random sampling was used to select interview respondents. The analysis conducted using quantitative methods revealed that community education levels are relatively low and dominated by elementary school graduates. The fisheries sector dominates as the primary livelihood for 78% of the community, encompassing capture fishermen and seaweed mariculture. Household incomes varied significantly, ranging from IDR 50,000 to 5,000,000 per month with expenses that are directly proportional and balanced. Most of respondents are aware about the coastal resources, marine protected species, and waste pollution. However, coastal resources such as mangrove wood are still used for daily needs, including cooking, building, and utilization protected biota for traditional ceremonies and seagrass area used for seaweed mariculture activities.

Keywords: Social Economic, Rote Ndao, TNP Laut Sawu

1. Introduction

Rote Ndao, located at the southernmost point of Indonesia in East Nusa Tenggara Province, encompasses an area of 1,280.10 km² with 96 islands, six of which are inhabited. This strategic geographic positioning not only defines its unique cultural and ecological aspect but also emphasizes its potential and challenges in marine resource management. The district is also a critical part of the Sawu Sea Marine National Park, known for its vibrant aquatic ecosystems and significant biodiversity. Research conducted by Munasik (2011) found that the waters of Rote Ndao are the center of coral reef conservation in the Sawu Sea TNP. With such great potential, efforts to utilize coastal ecosystems need to be carried out responsibly and environmentally consciously. Through direct interviews conducted with respondents, coastal communities in NTT have a traditional ritual of taking coral reefs as lime to be consumed with betel nut. This is an example of a utilization activity that is destructive and results in disruption of the ecosystem balance. A study of the activities and efforts to utilize the ecosystem carried out by communities living around Sawu Sea Marine National Park needs to be carried out as a benchmark for the success and evaluation of the implementation of the zoning system.

Demographically, Rote Ndao has a population of 143,764, with a nearly balanced gender ratio and a predominantly young demographic profile (BPS, 2021). These demographics are crucial in understanding the region's social fabric and economic dynamics. Most of the populace engages in fishing and related activities, which are pivotal to their livelihood but are also influenced by limited access to modern technology and adequate resources. Handayani et al. (2020) in her research, emphasises that the social, economic and cultural systems of coastal communities are strongly influenced by ecological factors of the coastal area in which they live. Therefore, if there is a local ecological change, there will also be changes to the social system of the community. Adaptation to ecological changes is performed by the community to survive. The pattern of community adaptation is related to the pattern of utilizing the potential of coastal and marine resources to meet their needs. Thus, this has implications for both the economic welfare of the community and the sustainable practices within the marine park.

This research aims to delve into the socio-economic conditions of the coastal communities in Rote Ndao, focusing particularly on how they utilize marine resources within the regulatory framework of the Sawu Sea Marine National Park. By examining factors such as education, income levels, and resource utilization patterns, this study seeks to provide insights into the interplay between community welfare and conservation efforts. The findings are expected to contribute to more informed policy-making that supports both socio-economic development and environmental sustainability in marine conservation area specifically in Rote Ndao.

2. Research Method

The study was conducted in September 2021 in the sub-districts of Landu Leko, Pantai Baru, Rote Selatan, Rote Barat Daya, and Lobalain. Sample villages included Sonimanu, Daiama, Sotimori, Holulai, Baadale, and Oeseli (Fig. 1). Data collection involved direct interviews with coastal residents, using a cluster random sampling technique. Sampling locations were selected based on geographic proximity to the Sawu Sea Marine National Park, with 30% of the coastal villages in each sub-district randomly chosen. Within each village, the population was clustered by household heads, and 10% of household heads in each selected village were randomly chosen for interviews. A total of 139 respondents, each household head, were included in the sample. The method used is then known as cluster random sampling, which is a method used when the population does not consist of individuals but rather consists of groups of individuals or clusters. Area sampling techniques are used to determine samples when the object to be studied or the data source is extensive (Kish 1965).

The methods used in this research included survey and direct interview techniques, with a

questionnaire designed to gather information on the lives of residents living along the Sawu Sea Marine National Park's coast. Interviews were conducted in the respondents' homes. Data collection was done through primary and secondary sources. Primary data were gathered through interviews with residents using a questionnaire that covered questions about age, occupation, monthly income and expenditure, perceptions of water conditions and ecosystems in their area, as well as knowledge of waste and protected biota. Secondary data were sourced from relevant institutions, such as village monographs or general descriptions of the study location villages.

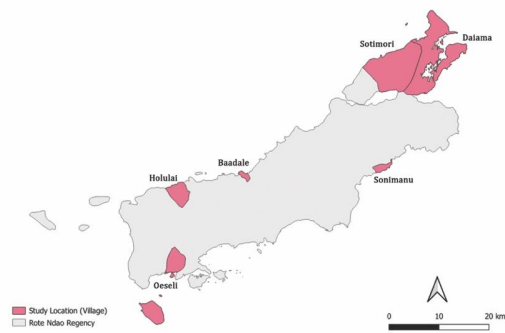


Fig.1. Map of Study Location

3. Result and Discussion

3.1 Social Condition of Community

Socio-economic studies of coastal communities are conducted to determine the conditions of the community which will later influence the utilization patterns carried out and their impact on the ecosystem around the research location.

3.1.1 Respondent Characteristic

Based on the survey conducted, the age distribution of respondents shows that the median age in most locations ranges from 40 to 50 years, indicating that the majority of respondents are in the productive middle-aged group. In Baadale and Daiama, for example, the age range is between 30 and 65 years, with a median close to 50 years. Daiama shows greater variation, with a significant outlier at age 85, reflecting the presence of elderly respondents. Conversely, Oeseli and Sonimanu have a wider age range, with some outliers in the younger age groups. Sotimori shows a relatively even distribution with no outliers. Age influences the ability of household heads to engage in work activities; younger and healthier heads of households have better physical capabilities than older ones and are more receptive to new recommendations. The distribution of male and female respondents across the six survey locations in Rote Ndao Regency includes a total of 110 men and 29 women. This shows that male respondents dominated the survey, which targeted household heads in each study village.

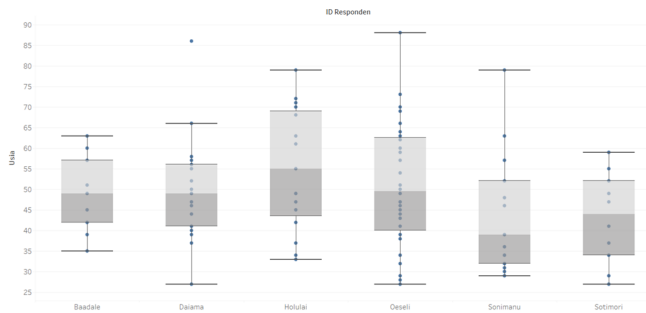


Fig.2. Aged distribution in each location

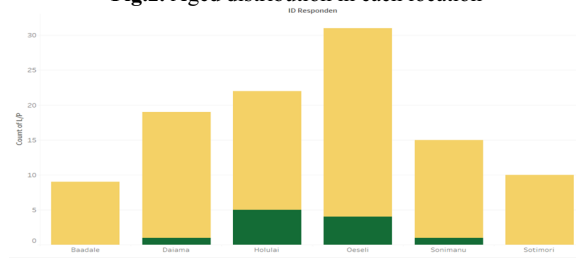


Fig. 3. Gender distribution in each location

3.1.2 Education Level

This correlates with the respondents' education levels, as education influences thinking patterns. The respondents' education levels vary and are low. This is clear from Figure 4, which shows the formal education attained by heads of households, with the majority having only completed elementary school (62%). Based on this data, it can be concluded that the education level of the heads of households is still incredibly low to absorb recent technology and innovations, and special training is needed if the government plans to implement programs in the area.

Interviews with each respondent revealed that the reason they did not pursue further education was the excessive costs involved and the lack of adequate facilities in each village. Additionally, fishing is a traditional occupation passed down through generations, and respondents admitted that most of them preferred to work rather than attend school, citing the income that could be earned. According to the Partiwi (2023), the fishermen conditionally forced their children to be the labor in order to improve the family economy or at least to reduce the family burden. In addition, access to education also plays a role in the decision of coastal communities to continue their education to a higher level. The low level of education among fishermen has resulted in barriers to accessing various programs, and the lack of non-formal education has led to reluctance to pursue further education. The community also fails to understand that education is a long-term investment that can improve the quality of life and increase productivity.

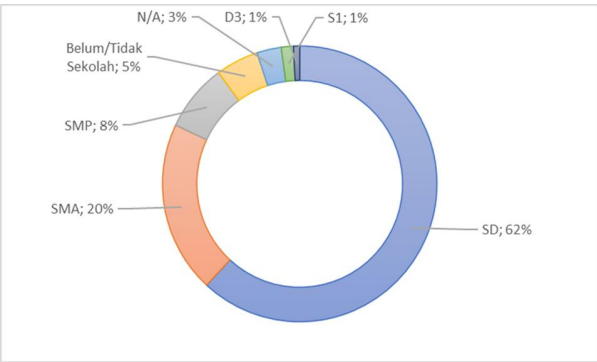


Fig. 4. Education level of Respondent

3.1.3 Livelihood

Livelihoods are related to how respondents utilize marine resources. Coastal communities do not solely rely on fishing as their main occupation. Information about the respondents' livelihoods can help estimate the extent to which coastal communities are able to manage and utilize marine resources. Further details about the age of the heads of households can be seen in Figure 2. According to the survey data, although most respondents work as fishermen, there are a variety of occupations, including both capture fishermen and seaweed farming fishermen. Other jobs outside of fishing and marine resource utilization include laborers, traders, land farmers, and teachers. Most people in Rote Ndao work as fishermen (56%), using simple fishing gear such as nets, seines, and fishing lines to catch fish. Their catch is then sold to collectors or directly to the local community in the village. Beside the fishermen, a significant number of respondents also work as seaweed farmers (22%).



Fig. 5. categories of livelihood respondent

3.1.4 Perception of natural resources

Perceptions of natural resources are used to gauge the respondents' knowledge about the coastal resources surrounding them. Questions were divided into several subcategories, including the condition of nearby waters, coastal ecosystems, protected biota, and the presence of waste. Through surveys and interviews, 66% of respondents indicated that the sea water in their village is considered clean, attributed to various factors, including high levels of supervision, favorable weather, public education, and proper area management. This is supported by the results of the EVIKA assessment of the management of the Sawu Sea TNP

which shows that the waters have been managed optimally (Sidako KKHL, 2024). Meanwhile, those who perceived the waters as polluted cited reasons such as littering and unfavorable weather conditions (34% of respondent).

A similar pattern emerged when respondents were asked about coastal ecosystems in their villages, such as mangrove forests, seagrass beds, and coral reefs. Most respondents recognized the importance of protecting these ecosystems. However, coastal ecosystem degradation continues to occur, driven by destructive human activities such as blast fishing, cyanide fishing, seagrass harvesting for seaweed cultivation, and pollution from the Montara oil spill. These findings align with Romadhoni et al. (2013), who stated that coral reef damage in Rote is caused by destructive fishing practices. In addition to pressure from the local community, harmful activities such as fish bombing are also frequently carried out by individuals from outside the East Nusa Tenggara region.

The waters of Rote, which are part of the Sawu Sea National Marine Park, are home to several species listed by the IUCN, such as turtles, dugongs, various species of sharks, and rays. Therefore, one of the government's programs to preserve marine resources is the issuance of regulations prohibiting the capture of protected marine species. The survey results show that almost all respondents (91%) are aware of the protected species and the reasons for their protection. The species mentioned by the respondents include dugongs, sharks, dolphins, rays, whales, and turtles. However, overall, only 76% of respondents have completely stopped capturing these protected species for any reason, while the remaining 24% still engage in the capture of protected species for consumption.

Figure 6 shows a map of the locations where protected species are often encountered, either while fishing or near residential areas. Respondents were also asked about their activities regarding the capture of protected species in their vicinity. The data obtained about bycatch (protected species unintentionally caught) shows that most respondents (43%) released their catch back into the water, 32% either did not know or did not answer, and the remaining 23% admitted to selling or consuming the bycatch. Some examples of protected species still being used in Rote Ndao include sharks, whose fins are sold, and rays, which are consumed.

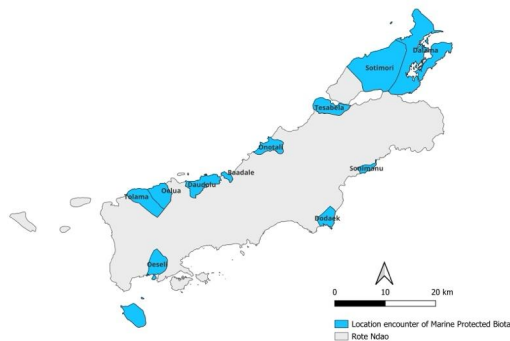


Fig. 6. Location encounter of Marine Protected Biota

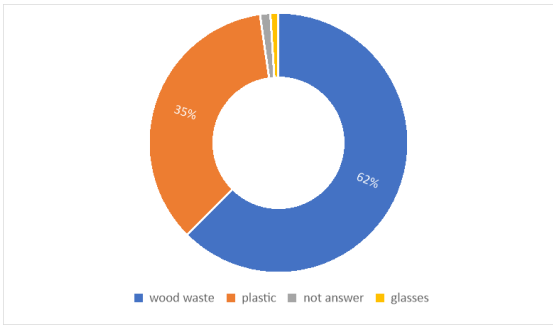


Fig. 7. Type of waste in study location

In the survey conducted, respondents were also asked questions regarding the condition of waste in their surroundings. The most commonly encountered types of waste in Rote are wood and plastic. Additionally, a significant 76% of respondents still consume plastic in their daily lives. About 64% of respondents are aware of the presence of incoming waste in the waters near their homes. The high level of plastic consumption is not accompanied by adequate facilities and infrastructure, as evidenced by the absence of sanitation workers and waste disposal sites in almost every village. Only about 21% of respondents know that there are waste collection workers, and 14% are aware of the existence of a waste disposal infrastructure in their village. Consequently, the waste management methods employed by the community include burning (82%), while the remaining 16% take their waste to disposal. Upon further examination of why this is the case, it appears that a lack of education is the main contributing factor. Although the majority of respondents (72%) no longer dispose of waste during sailing activities, 97% are unaware of what and how the recycling process works.

Although the community understands the importance of preserving the environment and wildlife around them, this awareness has yet to be reflected in their daily lives. This study highlights that low education levels, high poverty rates, and limited infrastructure are the main factors driving environmental degradation. If these conditions persist, further damage to their surrounding environment is likely to occur.

3.2 Utilization Pattern of Natural Resources

The Savu Sea Marine National Park and its surrounding areas serve as vital fishing grounds both for livelihood and commercial purposes. These sections will analyze the characteristics, patterns, and challenges faced by respondents.

3.2.1 Capture Fisheries

The majority of fishing activities (71%) are conducted within the boundaries of TNP, while the remaining 29% take place outside the marine park. The fishing areas utilized by local fishermen, categorizing them into coral reef areas and deep-sea areas across different locations. The data reveals that most fishing activities in Sotimori, Sonimanu, and Holulai are concentrated within coral reef areas, whereas in Daiama and Oeseli, deep-sea fishing is more dominant. In contrast, locations such as Baadale exhibit balanced fishing activities in both coral reef and deep-sea areas, showing that fishermen in these regions utilize diverse habitats depending on their target species or seasonal factors. The distribution of fishing grounds indicates that the TNPLS is a primary area of interest due to its rich biodiversity and relatively protected status.

The types of vessels used by fishermen in this region vary depending on their fishing strategies

and target species. The vessels include wooden boats, fiber boats, traditional ketinting, and sampans with engine capacities around 5.5 to 300 horsepower (HP). Furthermore, the fishing gears used also various that suitable with small scale fisheries. The data collected shows the nets are the most widely used fishing gear, followed by fishing rods, which are the second most used gear. The diversity in vessel types and fishing gears reflects the adaptability of fishermen to different fishing ground. According to Arkham *et al.* (2020), small-scale fishermen generally use fishing fleets of non-motorized boats, outboard motors and motorized boats with a type of <5 GT and fishing areas that are not far from the coast (at most about 5 miles from the coast). This is related to the use of fishing gear that is adjusted to the fishing ground and target fish, which are usually handlines and nets operated in shallow waters, especially around coastal and marine ecosystems. Based on these data, fishermen at the research location are included in small-scale fishermen.

Fishing activities in Rote categorize two primary periods: daily fishing and seasonal fishing. According to the data, 74% of fishermen engage in daily fishing and 26% in seasonal. This correlates with the portion of fishing activities, which is 59% of fishing activities are conducted individually, whereas 41% are performed in groups. This indicates that a majority of fishermen prefer to fish independently, possibly due to constraints such as limited access to larger vessels, financial independence, or preference for operating autonomously. Nenef *et al.* (2019) reported that fishing activities in Rote Ndao Regency are predominantly small-scale fisheries. Other researcher in Malaysia stated that small-scale fishers support their livelihoods by spending around 16 to 20 days per month at sea, typically using vessels under 24 feet with engines below 40 horsepower and limited fishing gear (Samah *et al.* 2019). Additionally, seasonal fishers often have specific catch targets that vary with the marine ecosystem's productivity and are adapted to seasonal cycles in fish availability (Arkham *et al.* 2018).

Figure 8 shows that the correlation between daily and seasonal fishermen's catches and their distribution in daily life. For daily fishermen, most of their catch is consumed and sold, while the rest is shared or distributed. However, for seasonal fishermen also exhibit a similar trend, reflecting the economic importance of fishing activities for these fishermen. The sale of fish provides a crucial source of income, and this percentage suggests that fishermen balance their catch between generating revenue and meeting personal consumption needs. Also, the practice of sharing reflects traditional social norms and communal values, where fishermen contribute to the well-being of their community by distributing part of their catch. Daily fishermen tend to have a more balanced approach in utilizing their catch for consumption and sale, while a smaller portion is shared. Seasonal fishermen, however, appear to prioritize selling a higher proportion of their catch, likely due to the sporadic nature of their fishing activities, where they accumulate and sell larger volumes during peak season. This is further supported by Government Regulation No. 32 of 2019 and Law No. 7/2016, which state that small-scale fisheries engage in fishing to meet daily living needs.

The distribution of fishing experience among fishermen, ranging from 7 to 60 years, with a dominant range of 15 to 25 years. This data suggests that a majority of the fishermen have substantial experience, making them highly knowledgeable about the fishing grounds, seasonal variations, and effective fishing techniques. The peak of fishermen's experience is concentrated around 15 to 25 years, where a large proportion of fishermen have been actively engaged in fishing activities for an extended period. The experience of fishermen plays a crucial role in determining catch results. Experienced fishermen are generally more familiar with the characteristics of their fishing areas, such as coral reef locations and deep-sea areas, and they are able to employ effective strategies to maximize their catch. They also tend to have a better understanding of seasonal fish migrations, weather patterns, and the impacts of environmental changes on fish availability. As a result, fishermen with more years of experience are likely to achieve higher catch rates and maintain consistent yields over time. This is supported by a study conducted by Lamia (2013) that work experience has a positive and significant effect on fishermen's business income, the longer the fishermen's business experience, the greater the chance of returning home with a larger catch.

Seasonal fishermen play a vital role in utilizing marine resources, particularly during peak

seasons when fish are more abundant. The fish catch volume in the coral reef areas of TNPLS varies significantly, with the highest catch volume 250 kg and the lowest is 70 kg. However, in non-coral reef areas fish catch volume also fluctuates, with a range of 10 kg to 500 kg per fishing period. The lowest catch volume is only 85 kg. Moreover, daily fishermen represent an essential component of the local fisheries sector, primarily engaging in small-scale fishing activities that contribute to both household subsistence and the local economy. Daily fishermen who operate in coral reef areas have peaks catch volume 100 kg per fishing trips and lowest is 50 kg. In non-coral reef areas, the catch volume among daily fishermen is slightly broader. The highest catch volumes reach 150 kg, and the lowest catch volume ranges from less than 10 kg to 100 kg.

The comparison of fish catch volumes between coral reef and non-coral reef areas highlights daily fishermen's adaptability to various fishing grounds and environmental conditions. Coral reef areas tend to yield lower catch volumes during certain months, likely reflecting the sensitivity of these ecosystems to external disturbances. For instance, Reppie and Luasunaung (2001) stated that coral reef areas serve as spawning grounds for pelagic fish, particularly *Hemirhamphus far*, which migrate to release their eggs in nutrient-rich coral reefs that provide natural food sources for both adult fish and juveniles. As coral reefs offer crucial habitats for numerous fish species, degradation in reef health directly impacts fish availability and, consequently, fishermen's productivity. On the other hand, non-coral reef areas offer a more stable catch volume throughout the year, making them a valuable alternative fishing ground for daily fishermen. However, the increased reliance on these areas could lead to overfishing and resource depletion if not managed properly. Thus, it is crucial to implement sustainable fishing practices and conservation measures to preserve fish stocks in both coral reef and non-coral reef areas.

Based on the data, it can be concluded that seasonal fishers achieve the largest catches in coral reef areas, while daily fishers generally obtain higher yields in deep-sea areas. Seasonal fishers engage in fishing over extended periods, typically ranging from 1 to 3 months per trip, often conducting their activities outside the waters of Rote Ndao. In contrast, daily fishers who operate within coral reef areas generally use simple fishing gear and small boats. The fishing practices of these daily fishers primarily aim to meet their household consumption needs, with any surplus catch sold after their daily requirements are met. This indicates that the small-scale fishing activities commonly conducted by the community are unlikely to harm the coral reef ecosystem.

This also highlights that fishing activity within coral reef areas tends to be limited, as the condition of the reefs does not support extensive fishing efforts. As a result, fishing efforts are predominantly carried out beyond the coral reef areas or outside Rote Ndao waters. This statement is further supported by research conducted by Widodo (2023), which found that the coral reef conditions, based on their coverage, are in the low category, with many locations showing limited recovery potential. According to interviews with respondents, this situation has been exacerbated by destructive fishing activities originating from outside the community, such as the use of explosives and trawl nets.

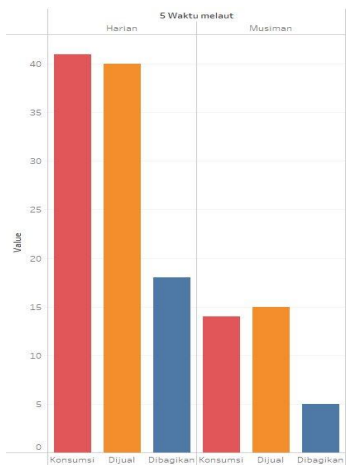


Fig. 8. Daily and Seasonal Fishermen's Catch

3.2.2 Mariculture

In Rote, seaweed farming is a prominent occupation among the local community. Interviews revealed that seaweed mariculture can be harvested between 0 to 24 times annually. Figure X (left) illustrates that the majority of farmers harvest between 0 to 4 times per year yielding an average of 251.4 kg per harvest, with a diminishing trend as the frequency of harvesting increases, up to a maximum of 24 harvests annually. Income from each harvest ranges from IDR 200,000 to IDR 20,000,000, with an average income of IDR 2,400,000. According to respondents, these variations are influenced by factors such as seed quality, weather conditions, environmental factors affecting growth, and equipment like floats and anchors. Sunadji and Dewi (2019) study supports these findings, demonstrating a positive correlation between the cost of equipment—such as ropes, buoys, and wooden pegs—and income generated from seaweed farming. Seaweed mariculture activities present strong economic potential in Rote Island. This already proven by Rimmer et al (2021) found that Indonesia is the largest global producer of carrageenan and agar from seaweed maricultur.

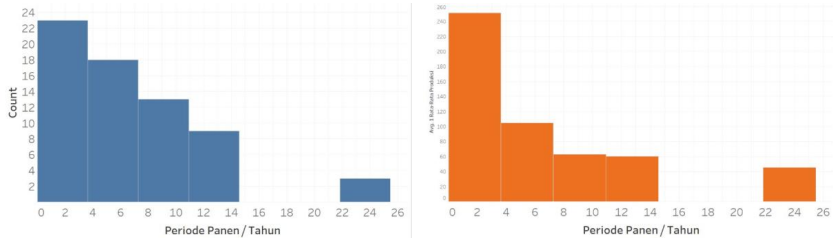


Fig.10. Harvest Period (left) and Average Production (right) in a year

Seaweed farming can lead to various ecological impacts, including loss of native species,

reduced habitat diversity, lowered water column productivity, declines in benthic (seafloor) production, and broader ecosystem changes (Phillips, 1990). Although most respondents understand the importance of protecting coastal ecosystems, destructive activities such as dredging, pollution, and oil spills continue to harm these areas in the field, further increasing their vulnerability. However, in Rote Island seaweed cultivation is predominantly conducted by dragging in seagrass areas. This is proven by the recent data which shows that seagrass in Rote Ndao is in an unhealthy condition (Fakhrurrozi *et al.* 2021). Therefore, if not managed sustainably, this practice can cause substantial harm to seagrass beds. By balancing seaweed cultivation with sustainable practices, it may be possible to harness the economic benefits while safeguarding the health of critical ecosystems like seagrass beds. Therefore, policies on area management and seagrass relocation are needed to restrict the utilization of seagrass ecosystems for mariculture activity activities and to adjust the locations.

3.3 Economic Condition

The economic conditions of coastal communities can be analyzed by examining the main livelihoods of residents and their monthly income levels (Rahmadani and Siburian, 2020). Survey results indicate that 26% of respondents fall into the lowest income bracket, earning between IDR 300,000 and IDR 800,000 per month. The middle-income group, comprising 22% of respondents, earns between IDR 800,000 and IDR 1.3 million, while 21% earn between IDR 1.3 million and IDR 2 million. For the highest income group, 45% of respondents earn over IDR 2 million per month. Data shows that respondents typically experience their highest incomes during January–February and July–August, months in which favorable weather and seasonal conditions enhance fishing activities. The east monsoon marks the peak fishing season in the Savu Sea, where easterly winds from Australia drive cooler, nutrient-rich water toward the Savu Sea, causing an upwelling phenomenon.

This upwelling enriches the upper layers of seawater with nutrients and increases phytoplankton biomass in the shallow straits and coastal areas. Research by Maro *et al.* (2021) indicates that the Savu Sea experiences low sea surface temperatures and high chlorophyll levels during the east monsoon, creating optimal conditions for plankton growth. This, in turn, boosts plankton density, attracting small fish to the area for feeding and breeding. Additionally, this season coincides with the peak presence of cetaceans, suggesting elevated levels of primary productivity and fish biomass. However, the gross income of people in Rote Ndao varies depending on factors such as ownership of boats, engines, fishing gear, and the additional jobs held by each respondent.

Income levels are directly proportional to respondents' expenditures. Generally, respondents' daily expenses cover basic needs such as daily consumption, education, clothing, taxes or insurance, savings, and credit payments. Annual expenses include celebrations, seaweed farming supplies, boat maintenance, and housing facilities. Based on collected data, the largest share of respondents' expenses goes toward daily consumption, followed by education and savings. In terms of monthly spending, 47% of respondents report expenses below IDR 1.2 million, while 41% spend between IDR 1.2 million and IDR 2 million. The highest expenditure months are August and December. This increase in expenses is attributed to school-related purchases (uniforms and supplies) in August, and festivities, particularly Christmas, in December, as the majority of the Rote Ndao community identifies as Christian. Additionally, the number of family members significantly impacts spending; respondents' family sizes range from 4 to 8 members, indicating relatively large household sizes among fishermen, which in turn influences their consumption patterns.

Overall, the data highlights a balanced economic pattern within this coastal community: income generally aligns with expenditures. As income rises, so do expenses for meeting economic needs, and vice versa. However, some months see expenses exceeding the highest

income levels. Data shows that only about 5% of respondents set aside savings, suggesting a reliance on alternative resources, such as loans, to meet financial needs. According to the World Bank (2014), countries are classified into four categories based on per capita income: low income (less than \$1,045), lower middle income (\$1,045 to \$4,125), upper middle income (\$4,125 to \$12,746), and high income (over \$12,746). Based on income data, the coastal community of Rote Ndao defined to the lower-middle-income category.

4. Conclusion

The coastal communities in Rote Ndao are dominated by respondents with low educational characteristics and generally work as fishermen, both capture fishermen and seaweed farmers. The pattern of capture fisheries utilization carried out does not have the potential to damage the coastal ecosystem, but activities originating from outside NTT cause damage and have an impact on the economic conditions of the Rote Ndao community. Seaweed cultivation activities carried out have an impact on damaging the seagrass ecosystem, even though the community understands the importance of coastal ecosystems for the survival of the community. This happens because of the community's needs to meet their daily economy. It can be concluded that although people understand the importance of preserving the environment around them, its implementation has not been reflected in real life. This study shows that low levels of education, low community economy, and inadequate infrastructure are the main factors that trigger activities that have an impact on environmental damage. If these conditions persist, the degradation of coastal ecosystems is likely to escalate, exacerbating socio-economic challenges for the community. Immediate interventions focusing on education, alternative livelihoods, and infrastructure development are essential to halt environmental damage and improve the socio-economic resilience of coastal communities in Rote Island.

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