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A Study on the Livelihood Sources and Welfare Levels of Small-Scale Fishing Households in Tapanuli Tengah Regency, Sumatera Utara

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***Abstract*— Indonesia is known as an "undersea paradise" because of its extraordinary wealth of marine biodiversity and fishery resources. With this nickname, coastal communities should have a decent life. However, in reality, their welfare is not in line with the wealth of marine resources, especially for fishermen. The lives of fishermen are often colored by economic challenges, weather uncertainty, and environmental changes that impact their welfare. This study aims to identify sources of livelihood, identify levels of welfare, and identify livelihood strategies carried out by fishing households. Through a survey that we conducted on 35 small-scale fishing households on the West Coast of North Sumatra, we found that most of them were still classified as less prosperous. Although the livelihood analysis shows that their sources of income are quite diverse, the contribution of income outside of fishing has not been able to improve their level of welfare. The results of this study also show that fishermen are not a passive group of people. Realizing the uncertainty in their livelihoods, they try to take advantage of existing opportunities by implementing livelihood strategies. The livelihood strategies carried out by fishermen are classified into economic dimensions, ecological dimensions, and social dimensions.**

Keywords: Expenditure structure, livelihood structure, livelihood strategy, small fishermen, welfare

I. INTRODUCTION

Fishermen are one of the professions to survive, they carry out fishing activities, and the majority live in areas near the coast and have a very large dependence on the fisheries sector [1]. The lives of fishermen are often colored by economic challenges, weather uncertainty, and environmental changes that have an impact on the catch [2][3][4].

Fishermen's livelihoods generally come from sea catches, but their income varies greatly depending on factors such as fishing technology, fishing area, and type of fishery [5]. In addition, non-economic aspects, such as policies and programs for empowering and developing fishermen in coastal areas, also have an impact on their welfare [6]. This study aims to analyze the sources of livelihood of fishermen's households and their relationship to their level of welfare.

In this context, it is important to understand how income patterns and livelihood diversification strategies can affect the quality of life of fishermen. This study is expected to provide deeper insights into the socio-economic conditions of fishermen, as well as recommendations for policies that support their welfare. With a focus on holistic and data-based analysis, this study is expected to contribute to the development of better and more sustainable policies in the fisheries sector, as well as improve the quality of life of fishing communities.

II. METHOD

A. Place and Time

This research was conducted from July to August 2024. The research location was Teluk Roban Village, Sorkam District, Central Tapanuli Regency, North Sumatra Province (Figure 1).

B. Data and Data Sources

The data in this study are primary and secondary. Primary data was obtained through a survey with the help of a questionnaire to respondents, namely small-scale fishing households. Small-scale fishing households are groups of fishermen who carry out fishing activities using vessels under 10 GT [7]. Primary data in the form of characteristics of fishermen (age, education, ethnicity, population status, and experience at sea), business income, business expenses, and food and non-food consumption expenses of fishing households. Secondary data were obtained from Indonesian statistics. Respondents of 35 people were determined by purposive sampling. The respondents were fishermen who owned vessels under 10 GT and were permanently domiciled at the research location.

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Figure 1. Research location

C. Data Analysis

Data analysis in this study was analyzed using a quantitative approach. Data processing and analysis were carried out using Microsoft Excel 2021. Some of the analysis tools in the study are as follows:

1. Fisherman's Exchange Rate (NTN)

This measuring tool is used to assess the welfare of fishermen based on the ability of fishermen to meet their subsistence needs. The working method is by calculating the ratio of total income to total expenditure of fishermen's households in a certain period [8]. The calculation of NTN starts by adding up all fishermen's income.

$$Yt = Yft + YNFt \quad (1)$$

Where Yt is the total income of all fishermen's households, YFt is income from fisheries businesses and YNFt is non-fisheries income. Then calculate the total expenditure of fishermen's households.

$$Et = EFt + EKt \quad (2)$$

Where EFt is the total of all household expenditures of fishermen. EFt is the total expenditure for fisheries business and EKt is the total consumption expenditure of fishermen's families. The last step is to calculate NTN with the formula.

$$NTN=Yt/Et \quad (3)$$

Where NTN is the ratio of total income and household expenditure. Yt is the total income of all fishermen's households and EFt is the total expenditure of fishermen's households. If the NTN value is less than 1, then the fishermen's family faces difficulties in meeting their living needs and are at risk of experiencing a continuous household budget deficit. If the NTN value is around 1, then the fishermen are only able to meet their subsistence needs. If the NTN value is above 1, then the fishermen have a fairly good level of welfare to meet their subsistence needs and have the potential to consume secondary and tertiary needs or invest in valuable goods.

2. Structure and Expenditure Structure

In this section, the livelihood structure is analyzed quantitatively by comparing livelihood activities with total household income. The livelihood structure based on the type of livelihood source consists of fishing, fishing, and non-fishing [9]. In understanding the livelihood structure of fishermen's households, answers to the following questions are needed: 1) on-fishing, namely income from selling catches; 2) off-fishing, namely income from the seafood processing industry; 3) non-fishing, namely income from productive activities outside the fisheries sector. Meanwhile, the household livelihood structure is based on the components of the livelihood structure issued by Indonesian statistics, namely food and non-food expenditures. The food component consists of rice, vegetables, side dishes, clean water, and cigarettes. The non-food component consists of house rental, electric bill, needs for a celebration event, a donation to the mosque, internet data, taxes, health, and education.

III. Results and Discussion

A. General Description of the Research Location

Teluk Roban is one of the villages located in Sorkam District, Central Tapanuli Regency, North Sumatra Province. The astronomical coordinate point is located at 1.8756 N and 98.5739 E. This village consists of 4 hamlets with an area of 200 Ha. The topographic conditions are lowlands and beaches with a land height and sea level of 8 MDPL. The village borders directly on the Indian Ocean, making its people's livelihoods dependent on marine products [10].

B. Village Population

Based on Table 1, the population in this village is 960 people with a population density of 431 people/km². The population sex ratio is 107, meaning that for every 100 female residents there are 107 male residents. The population dependency ratio is 61, meaning that every 100 productive residents must support and finance the living needs of 61 unproductive residents. Meanwhile, the population based on religion is 957 Muslims and 3 Christians. The population based on ethnicity is 956 Batak ethnic groups and 4 Minang ethnic groups [11].

Based on Figure 2, it is known that the level of education of the population is in the low category because only 6% of the population has completed 12 years of compulsory education.

TABLE 1.
DISTRIBUTION OF AGE RANGE, GENDER AND POPULATION

Age range (years)	Male	Female	Amount
0-6	54	18	72
7-12	33	26	59
13-18	54	27	81
19-25	56	34	90
26-40	82	136	218
41-55	56	103	159
56-65	36	57	93
66-74	118	53	171
>75	7	10	17
Total	496	464	960

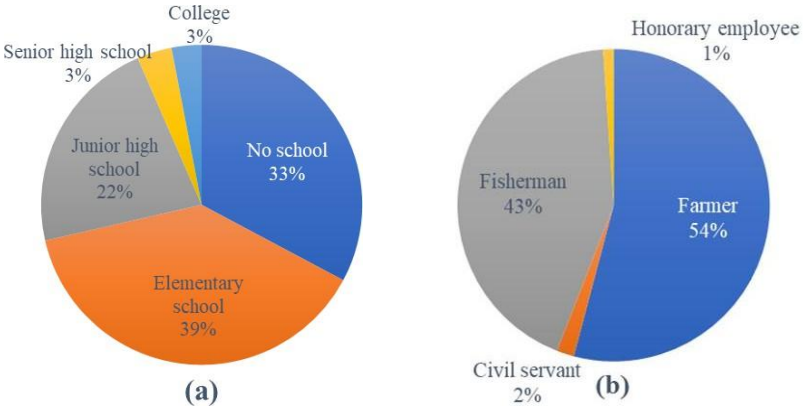

Figure 2. (a) Distribution of population education; (b) Distribution of population livelihoods

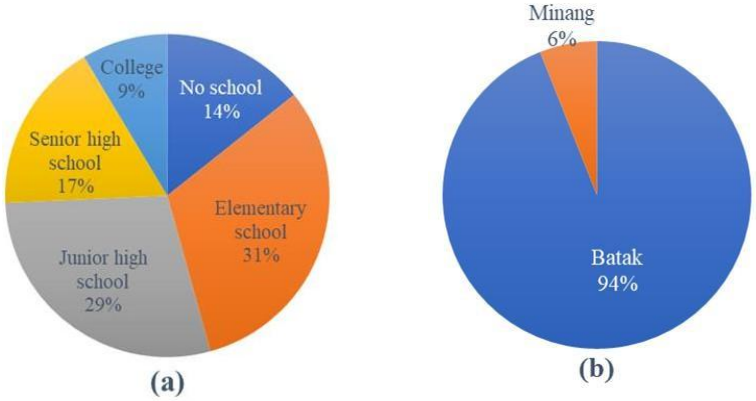

Figure 3. (a) Distribution of respondents' Education; (b) Distribution of respondents' ethnicity

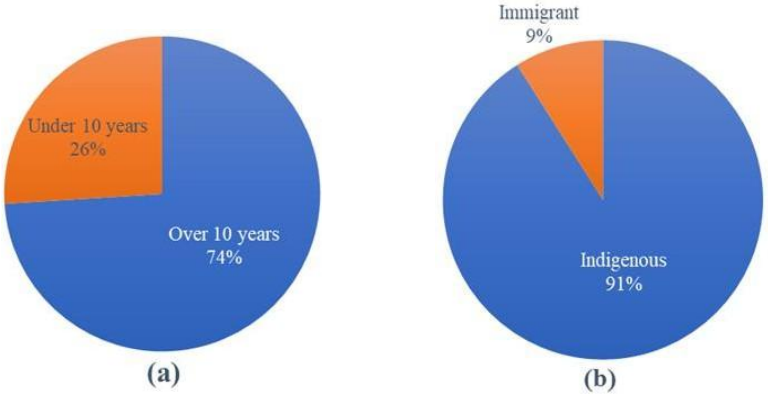

Figure 4. (a) Distribution of respondents' population status; (b) Distribution of respondents' seafaring experience

TABLE 2.
CHARACTERISTICS OF RESPONDENTS BASED ON AGE

Age	Ammount	Percentage (%)
early adulthood (18 to 40 years)	19	54,3
middle adulthood (41 to 60 years)	12	34,3
elderly adults (over 61 years)	4	11,4
Total	35	100
minimum age		23 years
maximum age		65 years
average age		41 years

Figure 2 also shows that 54% of the population works as farmers, 43% of the population works as fishermen and 3% of the population works in the formal sector. The low education and minimal skills of the population mean that they can only access jobs in the non-formal sector compared to the formal sector. People working in the informal sector often have irregular and less stable incomes than those working in the formal sector. This can hurt their economic well-being, as irregular income can disrupt financial planning and savings. In addition, if many people work in the informal sector, this can create an economy that is more based on small and informal businesses. This can affect the stability of the local economy and make it less attractive for investors to develop the area.

C. Village Infrastructure and Facilities

Based on the data obtained, the condition of the village road is asphalt with a length of 2 km. While the available means of transportation are only land transportation but do not yet have public transportation. This village has 2 elementary schools and 1 religious education institution. 1 place of worship is the Al-Hikmah Mosque, for non-Muslim residents usually worship in neighboring towns. The village's economic facilities only have 6 grocery stores. Sports facilities only have 1 soccer field. Health facilities have 1 polyclinic/treatment center and 1 integrated health post unit. Communication facilities only have 1 telephone tower with relatively strong signal conditions. The availability of clean water comes from water wells [12].

D. Village Building Index (IDM)

The village index value in 2023 is 0.6195 [13]. Based on this index, this village is included in the developing village category.

E. Respondent Characteristics

The average age of respondents in Table 2 is 41 years. This age is still considered a productive age. Fishermen who are in productive age are usually in good physical condition and have strong stamina, which is important for jobs that require heavy physical activity such as going to sea and fishing. In addition, productive age is a period in which a person can carry out various activities to meet their daily needs. In other words, individuals who are in the productive age range have a better ability to pursue various sources of income, according to the livelihood strategy they choose [14].

The education level of respondents in Figure 3 shows that only 9% graduated from college. Meanwhile, 17% graduated from Senior High School, 29% graduated from Junior High School, 31% graduated from Elementary School and 14% did not attend school. This condition indicates that the respondent's education level is relatively low. Figure 3 also shows that 94% of respondents are of Batak ethnicity and 6% are of Minang ethnicity.

The population status of respondents in Figure 4 shows that the majority or around 91% are indigenous people and the remaining 9% are immigrants. They come from West Sumatra Province. The experience of respondents as fishermen in Figure 4 shows that most of them have been fishermen for more than 10 years. Experienced fishermen have in-depth knowledge of fish migration patterns, weather conditions, and sea conditions in their area. This local knowledge is very valuable in increasing catches and avoiding risks. More experienced fishermen are more familiar with the fishing area and have better skills in placing Alaskan crab traps than novice fishermen [15]. In addition, they also have strong social networks in the fishing community, including relationships with suppliers, buyers, and fellow fishermen. This network can help them gain access to better markets and resources.

F. Structure of Fisherman's Household Income

The livelihood structure is a collection of household income from businesses they run to fulfill their living needs [16]. Household livelihoods can be distinguished based on the type of source, especially in rural areas. In Teluk Roban Village, fishing households rely on three main sources: on-fishing, off-fishing, and non-fishing. Their income mostly comes from on fishing, namely from selling the fish caught, which contributes 66% of total income, while 33% comes from non-fishing, such as wages, trading, government assistance, livestock, gardening, and remittances. Only 1% of income comes from off-fishing, such as the fish salting industry. Figure 5 displays these proportions, illustrating the importance of diverse livelihood sources for their welfare.

Fishermen are a profession whose livelihood is uncertain, where the amount of income is highly dependent on natural conditions. When nature is friendly, they can gain abundant profits, but conversely, when the weather is bad, income can decrease drastically. Realizing the uncertain nature of their livelihood, fishermen try to maximize existing resources, with some choosing to become entrepreneurs to increase their income. In addition, many of them utilize their land for oil palm plantations and rice fields. These efforts reflect the resilience and creativity of fishermen in maintaining their existence and survival amidst existing challenges.

The processed data from Table 3 shows the total income of 35 fishermen households is IDR

1,377,740,000 per year. The largest income comes from on-fishing, which is IDR 915,900,000 per year. Followed by income from non-fishing of IDR 449,840,000 per year and income from off-fishing of IDR 12,000,000 per year. The results of the study show that fishermen's dependence on income from the fisheries sector is still very high. Although fishermen have several other sources of income, the contribution of these sources to the total income is minimal, especially from fish salting activities. This dependence makes fishermen increasingly vulnerable to change. If their livelihood structure is homogeneous, the risk will increase; when the only source of income owned by a fishing household is threatened, and there are no other alternative incomes that can support it, then the household has the potential to collapse financially. Their survival is highly dependent on the stability of the fisheries sector, which can put them in a very risky situation.

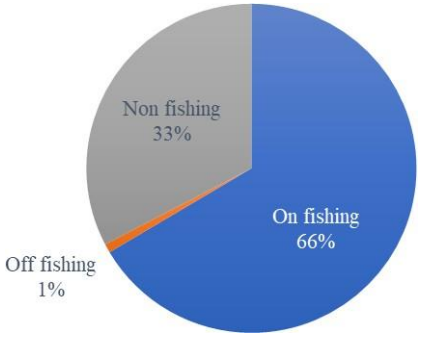

Figure 5. Household income structure of fishermen according to income source, calculated in percentage

TABLE 3.
FISHERMEN'S HOUSEHOLD LIVELIHOOD STRUCTURE, CALCULATED IN ABSOLUTE FIGURES

Livelihood structure	activity	Income (IDR/years)
On fishing	selling fish	915.900.000
On fishing	making salted fish	12.000.000
Non-fishing	wages outside the fishing business (civil servant, laborer, worker & others)	127.400.000
	businessman (food stalls, grocery store & others)	50.640.000
	jobs in the service sector	-
	receive government assistance	15.200.000
	farming (buffalo, local chicken or cow)	131.900.000
	income from palm oil	55.800.000
	income from rice fields	54.500.000
	remittance	14.400.000
Total		1.377.740.000

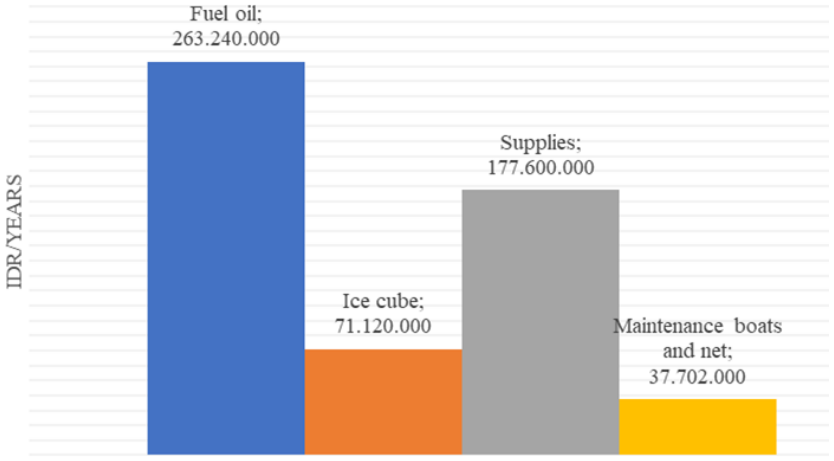

Figure 6. The operational components of fishing households are calculated using absolute figures

G. Fishermens's Operation Costs

Operational costs are the total expenditure required to carry out fishing activities. Fishermen in fishing require operational costs allocated to meet fishing equipment and supplies [17]. Fishermen's operational costs come from the purchase of fuel, ice blocks, food and beverage supplies, and maintenance costs. The average operational costs incurred by fishermen are IDR 15,704,628 per year. The highest operational cost component comes from the purchase of fuel and the lowest from maintenance costs, more details can be seen in Figure 6.

H. Household Expenditure Structure of Fishermen's

Household Expenditure is the cost that must be incurred by a family during a certain period to meet the consumption of all family members [18]. The largest expenditure of fishermen's households in Teluk Roban Village comes from food expenditure followed by non-food expenditure (Table 4). Household expenditure for food needs includes the purchase of rice, vegetables, side dishes, clean water, and cigarettes. While non-food expenditures include house rent, electricity, celebrations, donations to the mosque, internet data, taxes, levies, insurance, health, education, and others. The average expenditure of fishermen's households is IDR 15,735,114 per year.

TABLE 4.
FISHERMEN'S HOUSEHOLD EXPENDITURE STRUCTURE, CALCULATED IN ABSOLUTE FIGURES

Type of expenditure	Expenditure components	Amount (IDR/Years)
Food	rice	52.360.000
	vegetables	53.640.000
	side dishes	51.180.000
	clean water	2.160.000
	cigarette	182.035.000
Non-food	house rental	12.000.000
	electric bills	42.960.000
	needs for a celebration event	10.020.000
	donation to mosque	9.024.00
	internet data	49.404.000
	taxes, levies or insurance	1.476.000
	health	9.300.000
	education	55.560.000
	others	19.610.000
Total (IDR/Years)		550.729.000

Most of the fishermen's households in this village have well-managed rice fields. The rice fields produce two harvests a year, and the harvest is generally used for family consumption. Only a small amount is sold to the market, so most of the rice production is used to meet daily food needs. In this way, the behavior of the fishermen indirectly helps reduce household expenditure on food, giving them independence and stability in meeting basic needs. This approach also shows how important it is to diversify livelihoods for fishermen, who do not only depend on sea catches.

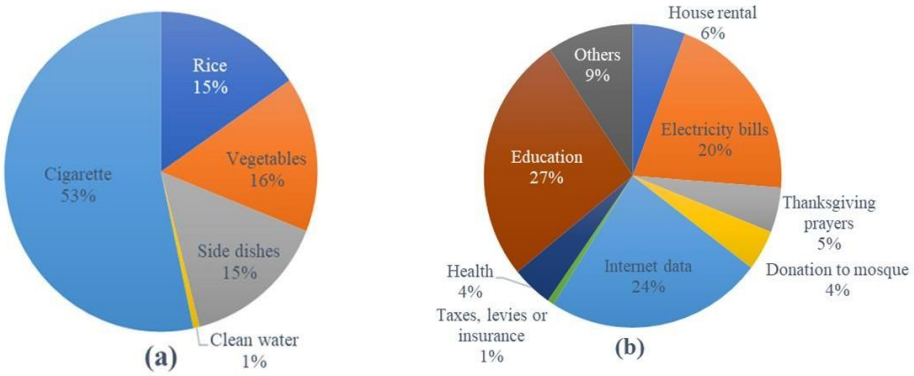

Figure 7. (a) Food expenditure calculated as a percentage; (b) Non-food expenditure calculated as a percentage

The largest food expenditure of the fishermen's households shown in Figure 7 is for cigarettes and the smallest expenditure comes from clean water. Fishermen are a profession that often deals with difficult and dangerous working conditions while in the middle of the sea, where unpredictable weather and high waves can threaten their safety. In addition to these physical challenges, income that is often unreasonable and adds to the economic burden also adds to the mental burden they face. In this situation, many fishermen experience quite severe stress and psychological pressure. One way they cope with or divert this stress is by smoking, although this practice can hurt their health. This habit is often an easily accessible form of refuge, even though there are many other healthier alternatives to managing stress and improving their mental well-being.

Their smallest expenditure comes from clean water expenditure, which is one of the important factors in managing the household budget. The majority of people in this village have adequate dug wells so that the need for clean water can be met safely and efficiently. The existence of these wells not only reduces the cost of buying water but also provides easier and faster access for families to get clean water every day. In addition, by relying on water sources from wells, people can be more independent and not dependent on external water supplies, which are often unstable. This also contributes to improving the quality of life and health of the community, considering that access to sufficient clean water is very important for maintaining cleanliness and preventing disease. Based on Figure 7, the largest non-food expenditure of fishermen's households is for

education. Research that has been conducted shows that most fishermen have children who are still studying at various levels, starting from Elementary School, Middle School, to High School, and some even continue to college. Based on government policy, education costs from elementary to high school have been made free, so that fishermen's expenses are mostly allocated for transportation costs, pocket money, and the purchase of books and stationery.

Meanwhile, for fishermen's children who continue to college, financial needs become more significant, including living costs, boarding costs, and tuition fees. This shows how important education is for fishermen, even though they face economic challenges.

On the other hand, the lowest non-food expenditure of fishermen's households comes from taxes. The low awareness of fishermen to pay taxes is influenced by a culture of non-compliance and minimal knowledge of the importance of tax contributions to regional development. This lack of understanding has the potential to hinder the development of infrastructure and public services that should be obtained by the community. Therefore, efforts are needed to socialize and educate about the benefits of taxes, so that the community better understands their important role in supporting village progress and improving their quality of life.

TABLE 5.
FISHERMAN HOUSEHOLD WELFARE LEVEL BASED ON NTN

NTN Value	Amount	Percentage (%)	Criteria
>1	10	29	prosperous
1	9	26	puite prosperous
<1	16	46	less prosperous
Total	35	100	

I. Level of Fishermen's Welfare Based on Fishermen's Exchange Rate (NTN)

From the results of the study, it is generally known that the level of welfare of fishermen's households is relatively not prosperous, where 46% of them are at the level of not prosperous, 26% are quite prosperous and 29% are at the prosperous level (Table 5). Small-scale fishermen's households in developing countries are generally in lower-middle economic conditions [19]. The welfare conditions of fishermen will get worse due to environmental damage and the impact of climate change [20]. Based on the expenditure conditions discussed in the previous chapter, it can be seen that their expenditure is dominated by food expenditure compared to non-food. This shows that they have limited income and allocate most of their budget to meet basic needs, such as food, to maintain health and survival. Fishermen's families who are not prosperous are characterized by higher food expenditure compared to non-food expenditure [21].

TABLE 6.
LIVELIHOOD STRATEGIES IMPLEMENTED BY FISHERMAN'S HOUSEHOLDS

Economic dimension	Ecological dimension	Social dimension
• farming (cows, buffalo and local chickens)	• rice farming	• remittance
• fish salting home industry	• oil palm plantation	• debts between fishermen
• optimizing family members to help earn a living		
• access assistance programs provided by the government to support family financial needs		
• open a grocery store and food stall		

J. Fisherman Household Livelihood Strategy

Fishermen are not a group that simply surrenders to the uncertainty of livelihood. They think hard and try to optimize existing resources to continue to survive. The livelihood strategies of fishermen's households are classified based on the dimensions of livelihood, namely economic, ecological, and social.

IV. CONCLUSION

Fishermen's households have heterogeneous sources of income, namely from on-fishing, off-fishing, and non-fishing income. Income from fishing dominates the total income of fishermen's families, where 66% comes from the sale of fish caught. Meanwhile, fishermen's household expenditure per year is greater for meeting food needs than non-food, with cigarettes being the main expenditure in the food category. In addition, the most significant non-food expenditure comes from the cost of educating fishermen's children and the cost of credit or internet data.

Fishermen's households have a relatively low level of welfare, where 46% of them are at the level of not yet prosperous, 26% are quite prosperous and 29% are at the level of prosperous.

Fishermen's households in facing livelihood uncertainty apply several livelihood strategies. These strategies are classified based on the dimensions of livelihood. In the economic dimension, they raise livestock (cows, buffalo, and local chickens), make salted fish, optimize family members to help earn a living, access government assistance, and open grocery stores, and food stalls. In the ecological dimension, they farm rice and open oil palm plantations. In the social dimension, they rely on remittances and debts between fishermen.

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