

Food Security of Lift Net Fishermen in Central Tapanuli, North Sumatra

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Abstract

Food security is a critical issue directly linked to community well-being, including that of fishing households in coastal areas. Although they live in regions rich in natural resources, traditional fishermen remain vulnerable to food security challenges because their income is heavily influenced by seasonal variations, weather, and catch conditions. These factors mean that fishing households' ability to meet their food needs is highly dependent on their socioeconomic circumstances. Therefore, this study aims to analyze the level of food security among fishing households and to examine the influence of socioeconomic factors on the food security of traditional fishermen in Muara Nibung Village, Tapanuli Tengah Regency. Data for this study were collected using a survey method involving 78 fishing households using fixed nets. This study indicates that the majority of fixed-net fishing households in Muara Nibung Village are in a state of food insecurity. The factor partially influencing the level of food security among fishing households is income. Meanwhile, factors such as income, expenditure, number of family members, and the mother's education level collectively influence their food security.

Keywords: Food security, lift-net fishers, socio-economic factors, income, expenditure.

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INTRODUCTION

Food security is a strategic national issue that is directly linked to the well-being of the people. Food is not only a basic human need but also a fundamental right guaranteed by the state (Undang-Undang Nomor 18 Tahun 2012). In Indonesia, food security issues affect not only communities in remote or disaster-prone areas, but also coastal communities that potentially have abundant natural resources, particularly fishing households that are vulnerable to food security issues (Saparwadi et al., 2015; Solihati & Dayanti, 2025; Yuliantini et al., 2022). Traditional fishermen depend on their catch and simple tools for their livelihood, so they are greatly affected by the ecological conditions of the waters, the seasons, and the weather (Anugerah et al., 2021, 2026; Anugerah & Adiprayoga, 2023; Harahap et al., 2025; R. T. Putri, Harianto, et al., 2025). This instability has a direct impact on purchasing power and households' ability to meet their nutritional needs (Husni, 2024).

Food security for fishing households will be difficult to achieve if their access to food—particularly from an economic standpoint—remains limited. Food security within a household can be assessed by the proportion of household expenditures allocated to both food and non-food needs. The demand for these two types of needs has distinct characteristics. When a fishing household's income is low, the largest portion of that income is typically allocated to meeting food needs, which are often considered the top priority (Sinaga et al., 2017). Social vulnerability poses a challenge in small-scale coastal fisheries. This is particularly true in developing regions where government capacity, infrastructure, and social institutions have not yet developed evenly (R. T. Putri, Ismail, Wardhani, et al., 2026).

Located on the coast of Pandan Subdistrict, Central Tapanuli Regency, North Sumatra Province, Muara Nibung Village covers an area of 2.24 km². According to the latest data, the population of this area stands at 3,452 people. (Badan Pusat Statistik, 2024). The majority of residents in Muara Nibung Village work as fishermen (Siburian et al., 2024). The fishing profession has been passed down through generations and is an integral part of the socioeconomic identity of coastal communities. Small-scale fishing households often lack access to formal financial systems and must rely on informal sources, such as loans from relatives (R. T. Putri, Ismail, Utami, et al., 2026)(Agustin et al., 2025). This study aims to analyze the level of food security among fishing households and to examine the partial and simultaneous effects of socioeconomic factors—such as income, expenditure, household size, and the mother's education level—on food security levels, thereby identifying which factors are more dominant and determining the extent to which each factor contributes to the food security levels of traditional fishing households.

RESEARCH METHOD

This study was conducted from September to October 2025 in Neighborhoods 1 and 2 of Muara Nibung Village, Central Tapanuli Regency, North Sumatra Province. The location was selected purposefully, considering that the majority of the population in

Muara Nibung Village works as fishermen. This study employed a quantitative approach using a survey method as the data collection technique, wherein data were obtained directly from respondents using a questionnaire as the data collection instrument. The study population consisted of all fishing households using fixed-net gear in Neighborhoods 1 and 2 of Muara Nibung Village. Respondents were selected using purposive sampling. The sampling criteria were households where the head of the household worked as a fisherman and relied on capture fisheries as the primary source of income. The sample in this study consisted of 78 respondents, determined using the Slovin formula.

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{345}{1 + 345(0,1)^2} = 78$$

The first objective of this study is to analyze the level of food security among traditional fishing households, as measured using the food expenditure share indicator, calculated using the following formula (Maxwell et al., 2000):

$$PPP = \frac{FE}{TE} \times 100\%$$

Description:

- PPP : Share of food expenditure (%)
 FE : Total food expenditure (IDR/month)
 TE : Total household expenses (IDR/month)

Food security category:

1. The category of low total expenditure applies when PPP is less than 60% of total expenditure, indicating food security.
2. A category is considered to have high total expenditure if PPP exceeds 60% of total expenditure, indicating food insecurity.

The second and third research objectives are to examine the partial and simultaneous effects of various factors (income, expenditure, number of family members, and the mother's education level) on the food security levels of traditional fishing households, analyzed using a descriptive quantitative approach with the assistance of SPSS version 20 software. The analysis stages include:

1. Validity and Reliability Tests

Validity testing aims to ensure the validity or appropriateness of the questionnaire used to collect research data from respondents (Setyawan et al., 2021)

- If the $r_{\text{calculated}}$ is greater than the r_{table} table r , then it is valid.
- If the $r_{\text{calculated}}$ is less than the r_{table} , then it is invalid.

The reliability test aims to determine whether the questionnaire is consistent when measurements are taken repeatedly using it.

- If the Cronbach's Alpha value is greater than 0.60, the scale is reliable

- If the Cronbach's Alpha value is less than 0.60, the scale is not reliable.
2. Test of Classical Assumptions
- a. Normality Test
- The normality test is used to determine whether the residuals are normally distributed. A good regression model is one in which the residuals are normally distributed.
- If the p-value is greater than 0.05, the residuals are normally distributed.
 - If the p-value is less than 0.05, the residuals are not normally distributed.
- b. Multicollinearity Test
- A multicollinearity test is a test conducted to determine whether there is intercorrelation (a strong relationship) among the independent variables in a regression model. A good regression model is characterized by the absence of intercorrelation among the independent variables.
- Check the tolerance value: if the tolerance value is greater than 0.10, there is no multicollinearity.
 - Check the VIF value: if the VIF value is less than 10.00, there is no multicollinearity.
- c. Heteroscedasticity Test
- A heteroscedasticity test is a test conducted to determine whether the residuals from all observations in a linear regression model have constant variance. One of the most accurate methods for detecting heteroscedasticity is the Glejser test. The Glejser test is performed by regressing the independent variable against the absolute value of its residuals.
- If the p-value for the relationship between the independent variable and the absolute residual is less than 0.05, then there is a problem of heteroscedasticity.
 - If the p-value for the test of the relationship between the independent variable and the absolute residual is greater than 0.05, then there is no issue of heteroscedasticity.
3. Multiple Linear Regression Test
- Multiple linear regression is used to determine the relationship between two or more independent variables and the dependent variable
- Regression equation:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_nX_n$$

Description:

- a = Constant or Y-intercept
- b = Regression coefficient
- Y = Level of food security
- X1 = Revenue
- X2 = Expenses
- X3 = Number of family members
- X4 = Maternal Education

The analysis was conducted using a t-test to examine the effect of each independent variable on the dependent variable and an F-test to examine the combined effect of the independent variables on the dependent variable.

Description:

- If the p-value is less than 0.05 or the calculated t-value is greater than the critical t-value, then variable X has a significant effect on variable Y independently.
- If the p-value is less than 0.05 or the calculated F-value is greater than the critical F-value, then the variables X and Y have a combined effect on variable Y.

RESULTS AND DISCUSSION

Respondent Characteristics

The characteristics of the respondents in the study are described in terms of age, education, seafaring experience, and income.

Table 1. General Distribution of Respondents

No	Age Group	Number (People)	Percentage (%)
1	16-25	6	7,69
2	26-35	17	21,79
3	36-45	33	42,31
4	46-55	18	23,08
5	56-65	4	5,13
	Total	78	100

The majority of respondents were in the working-age group (15–64 years), particularly those aged 36–45 years—33 people (42.31%)—who generally had extensive experience in fishing activities and household management. The 46–55 age group, comprising 18 people (23.08%), ranked second, followed by the 26–35 age group with 17 people (21.79%), and the smallest group was the 56–65 age group, consisting of 4 people (5.13%).

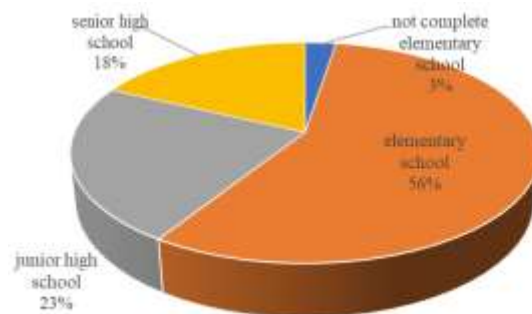


Figure 1. Respondents' Educational Level

The educational background of the respondents in Figure 1 above shows that there were no college graduates at all; 17.95% of respondents graduated from high school, 23.8% graduated from junior high school, 56.415% graduated from elementary school, and 2.56% did not graduate from elementary school. Fishing experience reflects the level of knowledge, skills, and social networks possessed by fishermen. Based on the results of the study above, the majority of traditional fishermen have more than 10 years of fishing experience (54%), while the remainder (46%) have less than 10 years of fishing experience.

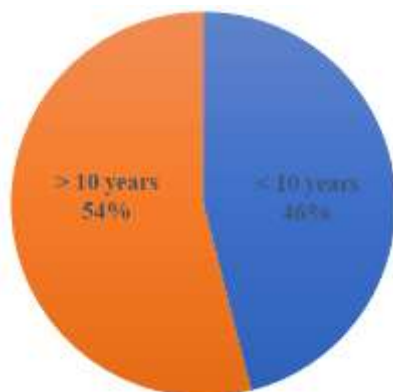


Figure 2. Respondents' Fishing Experiences

According to Table 2, the average net household income of the respondents is IDR 3,107,692 per month. The minimum household income of the respondents is IDR 1,000,000 per month, and the maximum income is IDR 7,000,000 per month. The income earned by fishermen is used to meet the family's basic needs; low income levels make it increasingly difficult to improve the quality of life, whereas an increase in income will contribute to improved family well-being (Anugerah et al., 2016).

Table 2. Respondents' Net Income

No	Income (IDR/month)	Number (People)	Percentage(%)
1	1.000.000 – 2.000.000	24	30,77
2	2.000.001 – 3.500.000	27	34,62
3	3.500.001 – 5.000.000	22	28,21
4	5.000.001 – 7.000.000	5	6,41
Total		78	100
Minimum		1.000.000	
Maximum		7.000.000	
Average		3.107.692	

Level of Food Security Among Lift-Net Fishery Households Household Expenditures of Lift-Net Fishery Households

Household expenditures are the costs incurred to meet the basic needs of each family member, which are generally allocated to food and non-food items (Anugerah,

Adiprayoga, et al., 2024). Every household has expenditures that serve as a measure of well-being, and the magnitude of these expenditures can indicate its economic development (Illahi et al., 2019).

Table 3. Average Household Food Expenditures

No	Food Expenditures	(IDR/month)	Percentage (%)
1	Grains (Rice)	464.087	24,09
2	Root Vegetables	25.910	1,34
3	Fish	51.410	2,67
4	Meat	53.013	2,75
5	Eggs and dairy	103.577	5,38
6	Vegetables	42.308	2,21
7	Lagumes	170.051	8,83
8	Fruits	84.949	4,41
9	Oil and coconuts	138.474	7,19
10	Beverage Ingredients	127.295	6,61
11	Spices Processed	173.192	8,99
12	Foods and Beverages	84.141	4,37
13	Cigarettes and Tobacco	306.064	15,88
14	Other Consumption	102.346	5,31
Total		1.926.818	100

Based on the research results shown in Table 3, it was found that the average monthly expenditure on food consumption by traditional fishing households in Muara Nibung Village was IDR 1.926.818. The largest expenditure within the food group is on cereals (rice), with an average expenditure of IDR 464.087 (24.09%) per month, while the smallest expenditure on food consumption is on tubers, amounting to IDR 25.910 (1.34%) per month.

Table 4. Average Household Non-Food Expenditures

No	Non-Food Expenditures	(IDR/month)	Percentage (%)
1	Education and health	399.953	40,55
2	Housing and household facilities	163.197	16,55
3	A variety of goods and services	15.598	1,58
4	Clothing, footwear, and headwear	136.391	13,83
5	Taxes, fees, and insurance	36.019	3,65
6	Transportation and communication	209.192	21,21
7	Party and ceremony supplies	25.985	2,63
Total		986.335	100%

The research findings show that the average monthly non-food expenditure for traditional fishing households in Muara Nibung Village is IDR 986,335. The largest non-food expenditure in the table above is for education and health costs at IDR 399,953 per month (40.55%), while the lowest non-food expenditure is for miscellaneous goods and services at IDR 15,598 per month (1.58%). For the majority of small-scale fishermen living on the west coast of North Sumatra, their expenditures are dominated by food

expenses, with a relatively small allocation for investment, which consequently affects their level of well-being. (Anugerah, Siburian, et al., 2024).

Share of Food Expenditures

Food expenditure shares (FES) are classified as “low” if $FES < 60\%$ and “high” if $FES \geq 60\%$, indicating the extent to which households are able to ensure food availability. A high proportion of food expenditure reflects limited food stocks, while a low proportion indicates that food availability is sufficient.

Table 5. Share of Household Food Expenditures

No	Share of Food Expenditures	Category	Amount	Percentage (%)
1	Less than 60% of total expenses	low	27 RT	34,62
2	More than 60% of total expenditures	high	51 RT	65,38
Total			78	100

The results of the study indicate that 65.38% of traditional fishing households have a food expenditure share of $\geq 60\%$; this indicates that 51 traditional fishing households in Muara Nibung Village fall into the food-insecure category, while 27 households, or approximately 34.62%, fall into the food-secure category. These findings align with previous research indicating that households in Lakkang Village are food insecure, with a food expenditure share of 81% (Rahman et al., 2020).

Partial Effects of Various Factors on the Level of Food Security Among Fishing Households Using Lift Nets

Table 6. Validity Test Results

Question No	r-calculate	r-table	Description
P1	0,378	0,222	Valid
P2	0,232	0,222	Valid
P3	0,257	0,222	Valid
P4	0,352	0,222	Valid
P5	0,431	0,222	Valid
P6	0,306	0,222	Valid
P7	0,213	0,222	Invalid
P8	0,352	0,222	Valid
P9	0,344	0,222	Valid
P10	0,488	0,222	Valid
P11	0,357	0,222	Valid
P12	0,383	0,222	Valid
P13	0,383	0,222	Valid
P14	0,290	0,222	Valid

Question No	r-calculate	r-table	Description
P15	0,307	0,222	Valid
P16	0,254	0,222	Valid
P17	0,307	0,222	Valid
P18	0,307	0,222	Valid
P19	0,407	0,222	Valid
P20	0,309	0,222	Valid
P21	0,359	0,222	Valid
P22	0,404	0,222	Valid
P23	0,229	0,222	Valid
P24	0,316	0,222	Valid
P25	0,275	0,222	Valid
P26	0,234	0,222	Valid
P27	0,239	0,222	Valid
P28	0,281	0,222	Valid
P29	0,247	0,222	Valid
P30	0,364	0,222	Valid
P31	0,312	0,222	Valid

Based on the results of the validity test of the 31 questionnaire items, only 30 items were deemed valid because their calculated r-values were greater than the critical r-value (0.222), while 1 item was deemed invalid because its calculated r-value was less than the critical r-value. The validity test was conducted to determine the extent to which each question item could accurately and appropriately measure the intended variable. Only 30 question items were deemed suitable for use in the data analysis process, while the one invalid item—P7—was eliminated from the research instrument because it did not meet the criteria for validity as a valid measurement tool.

Table 7. Reliability Test Results
Reliability Statistics

Cronbach's Alpha	N of Items
,682	31

The Cronbach's Alpha value from the reliability test of the research instrument above is 0.682, based on 30 items. It can be concluded that this research instrument is reliable or consistent, as the Cronbach's Alpha value of 0.682 is greater than 0.60; therefore, the reliability of these items is considered good.

**Table 8. Results of the Normality Test
One-Sample Kolmogorov-Smirnov Test**

		Unstandardized Residual
N		78
Normal Parameters ^{a,b}	Mean	0E-7
	Std. Deviation	2,35229614
Most Extreme Differences	Absolute Positive	,055
	Negative	-,036
Kolmogorov-Smirnov Z		,485
Asymp. Sig. (2-tailed)		,973

Based on the results of the normality test, the Kolmogorov-Smirnov value was found to be 0.485 with a significance level of 0.973 > 0.05; therefore, it can be concluded that the residuals are normally distributed and satisfy the classical assumptions.

**Table 9. Results of the Multicollinearity Test
Coefficients^a**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	13,334	5,232		2,548	,013		
Income	,489	,106	,475	4,618	,000	,944	1,060
Expenses	,160	,212	,093	,752	,454	,653	1,532
Number of Family Members	-,112	,167	-,072	-,673	,503	,865	1,156
Mother's Education	,177	,222	,101	,800	,427	,628	1,592

**Table 10. Results of the Heteroscedasticity Test
Coefficients^a**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	,327	3,160		,104	,918
	Income	-,045	,064	-,082	-,701	,486
	Expenses	-,033	,128	-,036	-,257	,798
	Number of Family Members	,185	,101	,224	1,833	,071
	Mother's Education	-,049	,134	-,053	-,369	,713

Based on the output above, it is evident that the significance values (sig) for all independent variables (X) are greater than 0.05; therefore, in accordance with the decision-making criteria of the Glejser test, it can be concluded that there is no evidence of heteroscedasticity in the regression model

Table 10. Results of the Partial Test (t-Test)
Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	13,334	5,232		2,548	,013
Income	,489	,106	,475	4,618	,000
Expenses	,160	,212	,093	,752	,454
Number of Family Members	-,112	,167	-,072	-,673	,503
Mother's Education	,177	,222	,101	,800	,427

Based on the Coefficients table, in column B, the Constant (a) is 13.334, while the value of b1 is 0.489, the value of b2 is 0.160, the value of b3 is -0.112, and the value of b4 is 0.177; thus, the regression equation can be written as:

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4$$

or

$$Y = 13,334 + 0,489X1 + 0,160X2 + -,112X3 + 0,177X4$$

1. The significance value for the income variable (X1) was $0.000 < 0.05$, and the calculated t-value of $4.618 >$ the critical t-value of 1.991; therefore, H0 is rejected and H1 is accepted, meaning that X1 has a significant effect on Y. This indicates that income is the primary factor determining economic access to food. Households with high income have greater purchasing power, making them better able to meet diverse and nutritious consumption needs. Meanwhile, fishermen with low income tend to experience limited purchasing power, especially during lean seasons or when

catch yields decline. This study aligns with previous research indicating that household income partially and significantly influences the level of resilience among fishing households (Amalia et al., 2020).

2. The significance value for the expenditure variable (X2) was $0.454 > 0.05$, and the calculated t-value was $0.752 < \text{the critical t-value of } 1.991$; therefore, H0 is accepted and H1 is rejected, meaning that X2 has no significant effect on Y. This is consistent with previous research indicating that household expenditure does not have a significant effect on the level of food security among fishing households (Amalia et al., 2020). Expenditures do not always reflect actual economic capacity. Many fishing households have their own food sources, such as fish they catch or social assistance, so their food needs can be met.
3. The significance value for the number of family members variable (X3) was $0.503 > 0.05$, and the calculated t-value of $-0.673 < \text{the critical t-value of } 1.991$; therefore, H0 is accepted and H1 is rejected, meaning that X3 has no significant effect on Y. The results of this study are consistent with previous research indicating that family size does not have a significant effect on the level of food security among fishing households (Delly et al., 2019) This situation can be explained by considering the socioeconomic characteristics of fishing communities, where in most cases only the head of the household works as a fisherman, while other family members do not play a direct role in the household's economic activities.
4. The significance value for the variable "maternal education" (X4) was $0.427 > 0.05$, and the calculated t-value was $0.800 < \text{the critical t-value of } 1.991$; therefore, H0 is accepted and H1 is rejected, meaning that X4 has no significant effect on Y. These findings are supported by previous research indicating that the mother's educational level does not have a significant effect on the food security of fishing households. (Utami & Mamilianti, 2021). This indicates that the educational level of housewives in Muara Nibung Village tends to be uniformly low, and decisions regarding food consumption and management are based more on experience, time-honored traditions, and local wisdom than on formal education. Local wisdom plays a vital role in shaping the character of the community; therefore, the government needs to implement policies to protect the continuity of local traditions (N. S. Putri, Harianto, et al., 2025).

The Simultaneous Effects of Various Factors on the Level of Food Security Among Lift-Net Fishing Households

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	159,423	4	39,856	6,829	,000 ^b
Residual	426,064	73	5,836		
Total	585,487	77			

The table above shows that the calculated F-value (6.829) is greater than the critical F-table (2.50), with a significance level/probability of $0.000 < 0.05$; therefore, the multiple regression model can be used to predict the dependent variable. It can thus be concluded that, simultaneously, all independent variables (income, expenditure, number of family members, and mother's education) have a significant effect on the dependent variable. This study is consistent with previous research indicating that the independent variables collectively influence the dependent variable (Amalia et al., 2020). This highlights the need for interventions in income diversification, infrastructure development, targeted subsidies, and community-based resource management to enhance resilience for the sustainable development of coastal households (R. T. Putri, Ismail, et al., 2025).

CONCLUSION

This study shows that the majority of fishing households in the Muara Nibung subdistrict who use fixed nets are food insecure (65.38%). Meanwhile, the factor that partially influences the level of food security among fishing households is income (X1). Conversely, simultaneously, factors such as income, expenditure, family size, and the mother's education level influence their food security levels. The findings of this study indicate the need for more targeted government interventions to improve the food security of fishing households by strengthening the economic and social aspects of these households. Local governments need to promote programs to increase fishermen's income through community-based economic empowerment, such as business capital assistance, training in livelihood diversification, the development of fisheries processing businesses, and expanded access to formal financial institutions. Additionally, efforts to enhance the capacity of fishing families through education on household financial management, consumption planning, and family nutrition counseling must be strengthened, particularly targeting housewives as the primary managers of the family's food needs. On the other hand, fishing communities are encouraged to raise awareness about developing alternative sources of income, managing household expenses more efficiently, and recognizing the importance of family members' education as a long-term investment in improving household well-being and food security.

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