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Dear Dr Wijayanti:

I have now read your paper entitled "Formal vs Informal Credit: Insights into Fishermen's Credit Transactions on the Island of Madura Indonesia", which you submitted to Aquaculture Economics & Management. As the scope of the journal is economic analysis of issues related to aquaculture, which do not include fisheries, I unfortunately find that your paper is not a good fit for the journal. In the interest of saving time I have therefore decided to reject the paper without sending it out for review. A more fisheries oriented journal like Marine Policy or Marine Resource Economics seems like a more appropriate outlet.

Thank you for considering Aquaculture Economics & Management for the publication of your research. I hope the outcome of this specific submission will not discourage you from the submission of future manuscripts.

Sincerely,
Frank Asche
Editor in Chief, Aquaculture Economics & Management

**Formal vs Informal Credit: Insights into Fishermen's Credit
Transactions on the Island of Madura Indonesia**

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Formal vs Informal Credit: Insights into Fishermen's Credit Transactions on the Island of Madura Indonesia

The fisheries sector has great potential to boost the economy and reduce poverty, with credit as a key factor in driving its growth. However, fishers often face difficulties in accessing formal credit, thus relying on informal credit. This study aims to determine the pattern of formal and informal credit access as well as the factors that influence the proportion of formal credit for fishermen on Madura Island. The research was conducted in Pasongsongan Village and Banyusangka Village with a sample of 200 fishermen consisting of juragan darat, juragan darat, and crew using simple random sampling technique. Data analysis used descriptive statistical analysis and fractional logistic regression. Results show that fishermen access formal credit through banks, pawnshops, and cooperatives, with banks being the main source accessed by juragan. Informal credit from family, neighbors, and boat captains is mostly accessed by crew members. Formal credit is used for large business capital, such as the purchase of fishing gear and boat repairs, while informal credit is more for daily needs. Factors influencing the proportion of formal credit are vessel length, fish finder use, access to information, income, non-credit services, and literacy.

Keywords: Credit pattern, Formal credit, Informal credit, Madura fishermen

Introduction

The Ministry of Maritime Affairs and Fisheries (2023) noted that fisheries production in 2023 reached 24.74 million tons, contributing 2.58 percent to the National GDP. This shows that the fisheries sector is a strategic sector and has the potential to be developed. Investment in the fisheries sector will create many jobs for people who depend on the fisheries sector, thus potentially reducing poverty levels (Rizkiyah & Azzatillah, 2024). However, to maximize investment in the fisheries sector, financial inclusion is key (Buckley, Arner, & Zetsche, 2020). Financial inclusion plays an important role in ensuring every fisher can access financial services as needed (Ratnawati, 2020). One

very important aspect of financial inclusion is access to credit, which can drive economic growth, as it can trigger the development of a more productive fisheries sector (Kleih *et al.*, 2013; Abisola, 2023). This is reinforced by data showing that in the last five years, conventional commercial bank credit has shown an increasing trend up to 10.38 percent in 2023 (Financial Services Authority, 2023). This increase in credit plays an important role in supporting leading sectors, including fisheries on Madura Island, which contributes 71,688 tons of fisheries production in East Java Province (BPS East Java, 2024). This makes financial inclusion very important to encourage investment in the fisheries sector (Anugerah, Arifin, & Putra, 2024).

Madura Island, especially Bangkalan and Sumenep districts, are the two districts with the largest fish production in Madura Island (Purnama *et al.*, 2022). In 2021, the marine fisheries production of Bangkalan and Sumenep districts reached 26,607 tons and 44,322 tons, respectively, becoming the fourth and second largest contributors to fisheries products in East Java (BPS East Java, 2024). The role of credit is crucial to support fishing activities such as purchasing, repairing vessels, and purchasing fishing gear (Lestari & Rahaju, 2023). However, fishermen still have difficulties in accessing formal credit (Ulfa & Mulyadi, 2020). This is due to uncertain income, which is influenced by external factors (Mbarouk, 2015). One of them is weather instability, which causes uncertain catches and has a direct impact on fishermen's income (Anwar & Wahyuni, 2019). Another challenge in promoting financial inclusion in the fisheries sector is the variety of informal credit services and the relationship between fishermen and boat captains (Parappurathu *et al.*, 2019).

Limited access to formal credit has led informal financial institutions to play a strong economic role among fishers (Haque *et al.*, 2019; Gunarathna & Dushani, 2013). Formal financial institutions are reluctant to provide large amounts of credit as fishers

usually lack adequate collateral. In contrast, informal credit offers easy access, making fishers increasingly dependent on informal credit (Ertör-akyazi, 2019; Ninh, 2019). Reliance on informal credit will only hinder fishers in accessing formal financial services (Mutsonziwa & Fanta, 2021). Fishers' dependence on informal credit causes fishers to be trapped in a credit cycle. The more fishers depend on informal credit, the more difficult it is to improve their living standards and move out of poverty (Asom *et al.*, 2023). Informal credit does not have legal guarantees because it is not regulated by law, so fishermen do not have legal protection if there is a problem with the lender. Informal credit has a limit on the amount of credit, so fishers cannot borrow large amounts for investment in boats or fishing gear (Nadjib & Thoha, 2023).

It is important to understand the factors that influence the proportion of fishermen accessing formal credit. This will provide insights into fishers' engagement in the formal financial sector, particularly in accessing formal credit financing sources, which can provide greater financial stability and support the long-term sustainability of fishers' businesses (Alvarez *et al.*, 2023; Khairani *et al.*, 2022; Sumaila *et al.*, 2021). Although several studies have discussed the factors that influence fishers' decision to choose formal credit (Parappurathu *et al.*, 2019; Pomeroy *et al.*, 2020; Nga 2022; Suresh 2023). However, the variables studied focus on fisher households. Not many studies focus on fishing unit variables. Therefore, this study focuses on the variable of fishing units. Based on this background, the objectives of this study are (1) to determine the pattern of formal and informal credit of fishermen on Madura Island, (2) to determine the factors that affect the proportion of formal credit of fishermen on Madura Island. Material and Method

Material and Method

Data of Study

The research was conducted in Pasongsongan Village, Sumenep District and Bangkalan District. The selection of research locations was carried out purposively, based on certain considerations (Sekaran & Bougie, 2019). The location was chosen because Sumenep and Bangkalan districts are the second and fourth largest contributors to capture fish production in East Java in 2021. Pasongsongan Village and Banyusangka Village are villages where the entire population works as fishermen and are located near the fish auction port. This research was conducted in August-December 2024. This study used primary data. Data collection was conducted through interviews with fishermen using questionnaires designed in an open-ended form, thus allowing in-depth responses and relevant data for research purposes (Thalib, 2022). The population in this study were fishermen in Pasongsongan Village, Sumenep Regency and Banyusangka Village, Bangkalan Regency totaling 1,274 and 4,000 fishermen. The sample in this study amounted to 200 fishermen, the criteria of land juragan fishermen, sea juragan (ship captain), and crew. The sample determination used simple random sampling method because it provides an equal opportunity for each individual in the population to be selected, so that the research results can be representative (Noor & Tajik, 2022).

Data Analysis

Data analysis used descriptive statistical analysis to determine the pattern of formal and informal credit accessed by fishermen. The analysis was conducted using the STATA 14 application. According to Washington *et al* (2020), the stages of descriptive statistical analysis are; (1) Calculating the mean, (2) Calculating the median, (3) Calculating the standard deviation, (4) Looking at the minimum and maximum credit scores. Quantitative

descriptive analysis to determine the factors affecting the proportion of formal loans with fractional logistic regression analysis. Fractional logistic regression analysis is a statistical method used to model the relationship between a dependent variable in the form of a proportion (0 to 1) and one or more independent variables (Ramalho & Ramalho, 2011). The fractional logistic regression model allows for a more accurate analysis of the factors influencing the proportion of formal credit accessed by fishers. The analysis was conducted using STATA 14. The fractional logistic regression model in this study is formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 \dots \dots \dots (1)$$

Description,

Y : Proportion of formal credit (0-1), X1 : Vessel length (m), X2 : Trip length (hours), X3 : Fish finder (dummy, 1 if using fish finder and 0 if not), X4 : Age (years), X5 : Number of family members (people), X6 : Access to information (dummy, 1 if having access to formal credit information and 0 if not), X7 : Income (million rupiah), X8 : Non-credit services (dummy, 1 if you receive non-credit services such as in-kind assistance/counseling and 0 if not), X9 : Reading ability (dummy, 1 if having reading ability and 0 if not), α : Constant or model intercept, β_i : Coefficient of variable X_i , where i is the order of the variable.

According to Faisal (2020) The stages of fractional logistic regression data analysis are carried out in the following stages; (1) Pseudo Test (R^2), to measure how well the model explains the dependent variable. A high Pseudo R^2 value indicates the ability of the independent variable to explain the dependent variable well. (2) Simultaneous parameter test, to determine whether all independent variables in the model are simultaneously significant to the dependent variable. The model is considered significant if the chi-square probability value (Prob chi^2) < 0.1 (3) Partial parameter test, to determine the significance

of the independent variables. Independent variables that have a p-value < 0.1 then H1 is accepted, otherwise if the p-value > 0.1 then H0 is accepted (Zou *et al.*, 2019). The following is the hypothesis of this research:

H0 : There is no significant influence between the independent variable (X) on the variable (Y)

H1 : There is a significant influence between the independent variable (X) on the variable (Y)

Results and Discussion

General Profile of Fishermen

According to Parappurathu *et al* (2019), fishing boats can be categorized based on the length of the boat used. Table 1 shows that there are three categories of vessels used by fishermen based on length, namely small (7-9.6 m), medium (9.7-12.3 m), and large (12.4 m-15 m). Describes vessel categories based on operational characteristics, trips, and capital in one month. Medium and large vessels operate in closer areas, while small vessels operate over longer distances, even into Kalimantan waters. The difference in operating distance causes the capital required by small fishers to be greater than medium-sized vessels. This makes small vessels require more engine power and capital for fuel and supplies. In line with Iry & Hujan (2020), longer operating distances lead to higher capital requirements and operational costs. According to Bastardie *et al* (2022) although operational costs such as expenses incurred are greater, large vessels with purse seines are more economically efficient.

Table 1. Fishing boat profile

Details	Ship Length Category		
	Small	Medium	Large
	7-9,6 m	9,7-12,3 m	12,4-15 m
Number of ships	25	31	144
Average vessel length	7,9	11,8	14,3
Average engine power	182,3	87,3	294,5
Average crew size	9,5	12,5	17,5
Trip			
Average trip time	11	10,3	18,4
Average number of trips (times/week)	6,9	6,8	5
Capital (rupiah)/month			
Average expenditure	40.103.866	25.173.758	51.720.656
Average fuel expenditure	28.854.000	12.547.097	31.100.556
Crew share (% of net revenue)	25	25	25

Descriptive Statistical Analysis of Respondent Characteristics

Based on Table 2, it can be seen that the dependent variable of credit proportion of fishermen has an average credit proportion of 0.21 with a standard deviation of 0.41, fishermen have a formal credit proportion of 0 with a maximum of 1. A proportion of formal credit of 0 indicates that fishermen do not access formal credit, while a proportion of formal credit of 1 indicates that fishermen only access formal credit. Fishermen who only access formal credit are boat captains. Formal credit is utilized by fishers for the purchase, repair and purchase of fishing gear. The average length of vessels owned or operated by fishermen is 13 meters, with the smallest vessel length being 7 meters and the largest being 15 meters. This shows that there are variations in the length of vessels used by fishermen in fishing. Variations in vessel length reflect differences in business scale, types of fishing gear, and catches. Differences in vessel size have implications for

financing needs, where fishermen on larger vessels require larger amounts of credit for repairs and purchase of fishing gear (Damasio, Lopes, Pennino, Carvalho, & Sumaila, 2016).

The average duration of a fishing trip is 16.22 hours, with a minimum trip duration of 5 hours and a maximum of 24 hours. Fishermen with short trips operate in nearshore waters, while long trips fish in more distant waters and require more time in the process of spreading and pulling the net. The use of fish finders showed an average value of 0.45, which means that almost half of the fishers use fish finders. Fishermen who use fish finders are fishermen with large boats who have the resources and financial capacity to purchase fish finders. The average age of fishermen is 42.99 years, indicating that most fishermen still have the physical ability to go to sea.

The average number of family members is 4 people, with a range of 2 to 9 people per family. Family members are also involved in fishing activities, where male family members go to sea to fish and women are involved in selling the catch. Only 25% of fishers have access to information on credit services from formal financial institutions, with an average of 0.25. Most fishers obtain information not only through self-search, but also from personal experience or fellow fishers who have accessed credit. Non-credit support services are only available to 25% of fishers, which include in-kind assistance, training, or counseling. Only a small proportion of fishers receive non-credit services, namely only boat captains. These non-credit services are provided by both the government and the private sector. Fishermen's monthly income varies widely with an average of IDR 36.15 million and a standard deviation of IDR 110.69 million, indicating significant income inequality. Fishermen with high incomes are generally big boat captains who earn much more. The majority of fishermen can read with an average of

0.91. The ability to read will enable fishermen to better understand information regarding requirements, and procedures in accessing formal credit.

Table 2. Descriptive analysis of respondent characteristics statistics

Variable	Definition operational	Mean	Sts. Dev.	Min	Max
Proportion of formal credit	Proportion of formal credit out of all credit accessed by fishers (0 to 1)	0,21	0,41	0	1
Vessel length	Vessel length Length of vessel owned or operated for fishing activities (m)	13,09	1,26	7	15
Trip duration	Trip duration Duration of fishing in one trip (hours)	16,22	7,16	5	24
Fish finder	Fish finder Use of fish finder in fishing activities (dummy, 1 yes and 0 otherwise)	0,45	0,50	0	1
Age	Age Age of fishermen (years)	42,99	10,49	20	74
Number of family members	Number of family members Number of fishermen's family members (people)	3,86	1,08	2	9
Access to information	Access to information Fishermen's access to relevant and sufficient information on credit services from formal financial institutions, including requirements and procedures (dummy, 1 yes and 0 otherwise)	0,25	0,43	0	1
Income	Income Income of fishermen in one month (million rupiah)	36,15	110,69	1,6	975
Non-credit services	Non-credit services Non-credit support provided to fishermen, such as in-kind assistance, training or counseling (dummy, 1 yes and 0 otherwise)	0,25	0,43	0	1

Reading ability	Reading ability Fishermen's ability to read (dummy, 1 yes and 0 if no)	0,91	0,29	0	1
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Characteristics of Fisherman's Credit Contract

Bank credit is the formal credit accessed by fishermen with the largest average of IDR 35,628,571, while informal sources with the largest average of neighboring IDR 1,338,095. In line with Turkson *et al* (2022), banks are considered the most efficient institution because they are able to provide large amounts of credit compared to informal sources. This shows that formal financial institutions generally provide larger amounts of credit than informal sources. Formal credit usually requires collateral. However, fishermen who access credit from cooperatives are often not required to provide collateral because the amount of credit applied for is small, averaging only Rp500,000. Meanwhile, large amounts of credit, such as Rp5,000,000, still require collateral. Informal sources, including family, neighbors, and juragan, charge no interest and no collateral. However, the amount of credit that can be accessed is much smaller. Formal sources of credit have more variable terms. The majority of fishers repay the credit within one year. Credit from pawnshops is accessed by fishers and repaid within two years, and Cooperative credit is mostly repaid within two years. Informal sources provide credit without term limits or within a fairly short period of <1 year. In line with Turkson *et al* (2022), formal credit is more suitable in providing medium- to long-term credit because it allows borrowers with large investment needs to repay credit without a heavy financial burden.

Table 3. Characteristics of credit contracts

Details	Formal credit			Informal credit		
	Bank	Pawnshop	Cooperative	Family	Neighborhood	Shipowner
Average credit (rupiah)	35.628.571	20.000.000	4.833.333	690.476	1.338.095	1.219.231
Interest rate (%)	6	6	3	0	0	0
Collateral requirements (%)						
Land/house certificate	100	0	16,7	0	0	0
Vehicle	0	100	33,3	0	0	0
None	0	0	50	100	100	100
Credit term (%)						
<1 year	5,71	0	33,33	100	100	0
1 year	51,43	0	16,67	0	0	0
2 years	22,86	100	50	0	0	0
3 years	17,14	0	0	0	0	0
5 years	2,86					
Unspecific	0	0	0	0	0	100
Payment schedule						
Monthly	100	100	100	-	-	-
Flexible	-	-	-	100	100	100

Fishermen's Credit Pattern by Boat Size

Table 4 shows that banks are the largest source of credit for fishermen, with the highest utilization percentage among medium vessels at 92.71% and a total contribution of 88.03% of all vessel sizes. According to Gumilar & Nuryasin (2022), special programs to support small businesses often make bank loans more attractive to fishers. This results in not many fishermen accessing credit from pawnshops and cooperatives. Informal credit sources Boat juragan contributes more than other informal credit sources, with an overall percentage of 4.48%. The use of juragan as a source of credit is most widely utilized by

small vessels at 6.48%, compared to medium vessels at 1.81% and large vessels at 5.16%. Small vessels utilize juragan credit due to their involvement in the fishermen's social network and the flexibility of repayment when catches decline with loan amounts that are suitable for the fishermen's needs. Family and neighbor loans are used in a very small proportion by fishers, indicating that support from relatives or neighbors plays only a minor role in financing fishers' needs. According to Arif & Ashari (2021), family and neighbor credit are only used by fishermen if they need a small amount of credit for daily needs.

Table 4. Fishermen's behavior patterns based on vessel category in utilizing credit (%)

Category	Bank	Pawnshop	Cooperative	Family	Neighborhood	Shipowner
Small	77,16	0,00	0,00	12,65	3,70	6,48
Medium	92,71	0,00	3,96	0,46	1,06	1,81
Large	87,05	1,85	1,57	2,17	2,19	5,16
Overall	88,03	1,41	2,05	2,05	1,98	4,48

Fishermen accessing formal credit in the research locations are boat owners who use it for investment. The crew members accessed informal credit to fulfill their daily needs. Formal credit was accessed by 42 boat captains with loans totaling hundreds of millions. Informal credit was mostly accessed by crew members in small amounts for their daily needs. Fishermen utilize bank credit more than informal credit, which plays a small role in financing fishermen. Formal credit is utilized by the juragan for capital in the purchase and repair of vessels and the purchase of fishing gear. Informal credit is used by crew members to fulfill their daily needs. In line with Kamal & Rao (2022), ishermen with small incomes consider formal institutional credit to be high risk due to income uncertainty, making them more dependent on informal credit. The crew tends to choose informal credit sources in accessing smaller amounts of credit because it is fast, easy, and the loan amount is flexible according to need (Harcourt & State, 2021). This causes informal credit sources to have a smaller average credit score than formal credit sources.

Table 5. Average value of fishermen's credit based on vessel category (million rupiah)

Average	Bank	Pawnshop	Cooperative	Family	Neighborhood	Shipowner
Small	25	0	0	0,68	0,6	0,42
Medium	31,22	0	4	0,28	1,6	1,38
Large	37,64	20	5,67	0,76	1,39	1,30
Overall	35,63	20	4,83	0,69	1,34	1,22

Factors influencing the proportion of formal credit

The estimation results of fractional logistic regression analysis shown in Table 4, has a pseudo R2 value of 0.4487. This indicates that the factors affecting the proportion of formal loans can be explained by the variables studied by 44.87%, the remaining 55.13% is explained by other variables not studied. Factors that may affect the proportion of formal loans but are not examined in this study include high collateral, administrative requirements that are difficult to fulfill, unstable income, ownership of savings or deposits, and high interest rates. Based on the analysis, the Prob > chi value of 0.0000 < 0.1 indicates that the independent variables in the model are simultaneously significant to the dependent variable. The results of the fractional logistic regression analysis show that the variables of vessel length, fish finder, access to information, income, non-credit services, and literacy have a significant effect on the proportion of formal credit.

Table 6. Results of fractional logistic regression analysis

Proportion of formal credit	Coef.	Robust Std. Err.	z	P> z
Vessel length	0.28	0.14	1.94	0.05*
Trip duration	-0.03	0.03	-0.80	0.42
Fish finder	2.13	0.62	3.42	0.00*
Age	0.00	0.02	0.06	0.95
Number of family members	-0.08	0.17	-0.48	0.63
Access to information	2.68	0.71	3.80	0.00*
Income	0.01	0.00	1.87	0.06*
Non-credit services	1.19	0.70	1.69	0.09*
Reading ability	1.97	1.14	1.72	0.09*

_cons	-11.40	3.62	-3.14	0.002*
Prob > chi	0.00			
Pscudo R ²	0.45			

Note:* significant with error level 10% (0,1)

The length of the vessel has a positive effect on the proportion of formal credit. This shows that the longer the vessel used by fishermen, the greater the proportion of credit accessed by fishermen. Variations in the length of vessels used by fishermen at the research location reflect differences in business scale and the type of fishing gear used. The average length of vessels owned or operated by fishermen is around 13 meters. Fishermen with a vessel length of 13 m are included in the large vessel category. This is in accordance with the conditions at the research location, fishermen who access formal credit are ship owners to support investment in purchasing, repairing vessels, and purchasing fishing gear. This is in line with the findings of Parappurathu *et al* (2019), the length of the vessel has a positive effect on the proportion of credit accessed by fishermen because it is related to investment costs and large catch capacity. According to Robinson *et al.*, 2020, large vessels have the capacity to catch larger amounts of fish and increase potential income. With high income potential, fishermen will be more confident in accessing larger credits to maximize fishing efforts (Pomeroy *et al.*, 2020).

Fish finder has a positive effect on the proportion of formal credit. Showing that vessels with fish finder will increase the proportion of formal credit accessed by fishermen. Vessels using fish finder are large vessels with a length of 12.4-15 m with fishing gear in the form of large nets. In line with Granado *et al* (2021), vessels with trawls or nets are considered fishing vessels that carry out more fishing activities so that they utilize technology to make it easier to find fish. The use of fish finder helps fishermen to find fish locations more accurately (Happel, Murchie, Willink, & Knapp, 2020). Fish finder Fish finder helps fishermen save time and operational costs by minimizing fishing

in unproductive locations. This has the potential to increase catches, which will directly increase fishermen's income. The increase in income makes fishermen more confident in accessing formal credit for additional investments such as purchasing better fishing equipment or improving ship facilities, thereby increasing the proportion of formal credit accessed.

Access to information has a positive effect on the proportion of formal credit. This shows that access to formal credit information will increase the proportion of formal credit. Fishermen at the research location obtain credit information not only through independent searches, but also from personal experience or fellow fishermen who have accessed credit. The average education of fishermen is only elementary school, making fishermen at the research location very dependent on social networks to obtain information related to credit, especially through interactions with fellow fishermen. This dependence is in line with field conditions, where the majority of fishermen are members of fishermen groups which are the main source of sharing information and experiences about access to credit. According to Abunyuwah & Blay (2013) and Twumasi *et al* (2020), education is one of the factors that influences fishermen's access to credit, because a higher level of education can make it easier for fishermen to understand formal credit information. Fishermen who have better information about formal credit, including terms, interest, and providing institutions, are better able to make the right decisions when applying for credit. According to Pentury (2021), having access to credit information helps fishermen choose appropriate credit products and increases fishermen's opportunities to access formal financing.

Income has a positive effect on the proportion of formal credit. It shows that the higher the income of fishermen, the greater the proportion of formal credit will be. Fishermen at the research location have an average monthly income of 36.15 million

rupiah. Formal credit is widely accessed by ship owners with high incomes. Ship owners need large capital to invest in buying fishing gear, repairs or buying new ships. In line with Wilson *et al* (2024), fishermen with large incomes tend to be more daring to invest more in fishing gear by utilizing formal credit, so they have a higher chance of increasing fishing intensity. A higher income allows fishermen to pay installments, because they have enough income to pay installments every month (Pomeroy *et al.*, 2020). Making it easier for large ship fishermen to get approval for formal credit. High income makes fishermen more daring to access formal credit in a higher proportion because they have the ability to repay the credit.

Non-credit services have a positive effect on the proportion of formal credit. This shows that the existence of non-credit services received by fishermen will increase the proportion of formal credit. Non-credit services such as counseling, training, direct assistance in the form of goods are widely received by ship owners. This is appropriate, where fishermen who access formal credit are ship owners. Non-credit services at the research location are provided by the government and also the private sector. Non-credit services received by fishermen at the research location include counseling on GPS (global positioning system), fish finders and assistance with tools such as boats and nets. The existence of non-credit services allows fishermen to get new information and tools to support fishing activities. Non-credit services help fishermen gain new knowledge and more efficient tools, which allows for increased catches. In line with Hieu & Minh (2022); Wetengere & Kihongo (2012), non-credit services have an important role for fishermen in obtaining information to support increasing knowledge and business capacity. This makes the proportion of formal credit accessed by fishermen increasingly large, because they are better prepared to utilize credit to develop their fishing businesses.

Reading ability has a positive effect on the proportion of formal credit. Showing that fishermen's reading ability will increase the proportion of formal credit. The majority of fishermen at the research location have good reading skills, even though the average level of education is only elementary school. According to Artadi *et al.*, (2023) good reading ability is closely related to financial literacy, which is important in accessing and understanding credit-related information, such as requirements, interest, and credit application procedures. Fishermen who have better reading skills can understand the available credit options and manage their finances better to be able to pay installments. According to Pranata (2019), reading ability has a positive effect on fishermen's credit. In line with Hafid *et al* (2021), reading ability can make it easier for fishermen to complete the required documents and communicate with formal financial institutions. Fishermen are more confident and able to make better decisions in accessing credit that suits their needs (Binshad *et al.*, 2021).

Conclusion and Policy Recommendations

The analysis shows that fishermen in Banyusangka Village and Pasongsongan Village access formal credit through banks, pawnshops, and cooperatives. Banks are the largest source of formal credit utilized, especially by fishermen with medium-sized boats. Fishermen access credit from informal sources, such as family, neighbors, and boat juragan. Boat juragan credit is the main choice for crew members, especially fishermen using small and large boats. The diversity of credit sources reflects the different needs and credit access capabilities of fishermen. Formal credit is utilized by fishers to support business development, while informal credit is more for personal needs. The proportion of formal credit is influenced by vessel length, fish finder use, access to information, income, non-credit services, and literacy. It is recommended that formal bank financial institutions offer more accessible microfinance schemes for fishers so that fishers with

small credit needs can switch to accessing formal credit. The government is advised to expand non-credit services, such as counseling, training on the use of technology such as fish finders, and fishing gear assistance to support fishermen's business development. Future research is suggested to focus on one category of fishermen, such as juragan, juragan darat or anak buah kapal, to obtain more representative results. It is recommended to further explore the socio-economic factors that influence the proportion of fishers' credit and the impact of credit on fishers' income, so as to provide an overview of how credit accessed by fishers can play a role in increasing fishers' income

Author's Contributions

AUH : Conceptualization, methodology, data analysis, writing; DEW: Data search, data validation, writing, editing, drafting, and finalizing the study; TRD: original draft preparation, review, and editing. All authors have read and approved the manuscript for publication.

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Data Availability Statement

Not Applicable

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Conflict of Interest

The authors declare no conflicts of interest exists.

References

- Abisola, M. H. (2023). Effect of Microfinance Credit on Poverty and Income Inequality of Small-Scale Fish Farmers in Niger State, Nigeria. *Doctoral Dissertation Federal University of Technology Minna Nigeria.*
- Abunyuwah, I., & Blay, J. K. (2013). Accessibility Constraints Of Small-Scale Fish Farmers To Formal. *Journal of Economics and Sustainable Development*, 4(1), 128–133.
- Alvarez, L., Arcaya, G., Cueto, F., & de la Torre, R. (2023). Can public credit programs improve artisanal fisher performance? The case of Fondepes a credit program. *Marine Policy*, 156(August), 105792. <https://doi.org/10.1016/j.marpol.2023.105792>
- Anugerah, A. D., Arifin, S., & Putra, D. F. (2024). The New Direction of Madura Tourism Development. *Public Corner*, 19(1), 31–45. <https://doi.org/10.24929/fisip.v19i1.3534>
- Anwar, Z., & Wahyuni, W. (2019). Poor in a rich sea: Indonesian fishermen and poverty. *Sosioreligius: Scientific Journal of the Sociology of Religion*, 4(2), 52–60.
- Arif, H., & Ashari, M. (2021). Investigation of Usury Practices in Financing to Fishermen: A Case Study in Takalar Regency. *Journal of Islamic Economics Theory and Application*, 8(1), 108. <https://doi.org/10.20473/vol8iss20211pp108-115>
- Artadi, E., Dama, H., & Pongoliu, Y. I. D. (2023). Financial Literacy Analysis of Coastal Communities in North Gorontalo Regency in 2022. *JAMBURA: Scientific*

- Journal, 6(3), 1411–1422. Retrieved from
<https://ejurnal.ung.ac.id/index.php/JIMB/article/view/23356>
<https://ejurnal.ung.ac.id/index.php/JIMB/article/download/23356/7747>
- Asom, S. T., Ewurije, A., Ijirshar, V. U., & Ogodu, S. I. (2023). Impact of informal credit on output of small scale farmers in Nigeria. *Journal of Public Administration, Finance and Law*, 27(1), 38–57.
- Bastardie, F., Hornborg, S., Ziegler, F., Gislason, H., & Eigaard, O. R. (2022). Reducing the Fuel Use Intensity of Fisheries: Through Efficient Fishing Techniques and Recovered Fish Stocks. *Frontiers in Marine Science*, 9(June), 1–22. <https://doi.org/10.3389/fmars.2022.817335>
- Binshad., Muhammed, A. A., & Muhammed, F. P. P. (2021). A study on financial literacy and saving pattern of fisherman community with reference to ponnani harbour, kerala. *International Journal of Research and Analytical Reviews*, 8(2), 371–382.
- Bougie, Roger, & Sekaran, U. (2019). *Research methods for business: A skill building approach*. (7th ed.; J. W. & Sons, ed.). United Kingdom: John Wiley & Sons.
- BPS East Java. (2024). East Java Province in Figures 2024 (B. P. S. J. Timur, ed.). East Java: East Java Central Statistics Agency.
- Buckley, R. P., Arner, D. W., & Zetsche, D. A. (2020). Driving Digital Financial Transformation in Support of the SDGs - A Strategy to Leverage Fin Tech for Financial Inclusion, Development, Stability and Integrity. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3387359>
- Damasio, L. D. M. A., Lopes, P. F. M., Pennino, M. G., Carvalho, A. R., & Sumaila, U. R. (2016). Size matters: Fishing less and yielding more in smaller-scale fisheries. *ICES Journal of Marine Science*, 73(6), 1494–1502.

Bone Sub-District. *International Journal of Innovative Science and Research Technology*, 6(10), 21–27.

- Happel, A., Murchie, K. J., Willink, P. W., & Knapp, C. R. (2020). Great Lakes Fish Finder App; a tool for biologists, managers and education practitioners. *Journal of Great Lakes Research*, 46(1), 230–236. <https://doi.org/10.1016/j.jglr.2019.12.002>
- Haque, C. E., Idrobo, C. J., Berkes, F., & Giesbrecht, D. (2019). *Small-scale fishers' adaptations to change : The role of formal and informal credit in Paraty , Brazil*. 51, 401–407.
- Harcourt, P., & State, R. (2021). Micro-Credit Acquisition Among Small-Scale Fish Farmers in Obio-Akpor Local Government Area of Rivers State , Nigeria. *African Journal of Sustainable Agricultural Development*, 2(3), 17–28. <https://doi.org/10.46654/2714>
- Hieu, N. Van, & Minh, D. N. N. (2022). The Role of Non-Credit Service in Bank Performance: Empirical Evidence in Vietnam. *Vnu Journal of Economics and Business*, 2(4), 103–114. <https://doi.org/10.57110/jeb.v2i4.4873>
- Iry, N., & Hujan, D. (2020). Analysis of the Influence of Operational Costs on Fishermen's Income in Mimika Regency. *Critical Journal (Policy, Research, and Innovation)*, 4(1), 38–61.
- Ministry of Marine Affairs and Fisheries. (2023). Marine and Coastal Resources Statistics 2023. In Ministry of Marine Affairs and Fisheries (Ed.), Ministry of Marine Affairs and Fisheries (1st ed.). Ministry of Marine Affairs and Fisheries.
- Khairani, Susiana, Kadriah, R. (2022). Implementation Of A Capital Provision Policy For Common Fishermen Through People's Business Credit Fund. *Syiah Kuala Law Journal*, 6(1), 53–66.
- Kleih, U., Linton, J., Marr, A., Mactaggart, M., Naziri, D., & Orchard, J. E. (2013).

- Parappurathu, S., Ramachandran, C., Baiju, K. K., Kurisunkal, A., Evaluation, S., Division, T. T., ... O, E. N. P. (2019a). Formal versus informal : Insights into the credit transactions of small-scale fishers along the south west coast of India. *Marine Policy*, *103*(September 2018), 101–112.
<https://doi.org/10.1016/j.marpol.2019.02.032>
- Parappurathu, S., Ramachandran, C., Baiju, K. K., Kurisunkal, A., Evaluation, S., Division, T. T., ... O, E. N. P. (2019b). Formal versus informal : Insights into the credit transactions of small-scale fishers along the south west coast of India. *Marine Policy*, *103*(September 2018), 101–112.
<https://doi.org/10.1016/j.marpol.2019.02.032>
- Pentury, F. (2021). The role of financing accessibility on boosting micro scale coastal communities ' fisheries related business activities : case study from Kei Islands. *Agrikan (Jurnal Agribisnis Perikanan)*, *14*(2), 292–299.
- Pranata, N. (2019). Financial inclusion in Indonesia's fishery sector: Factors determining credit participation. *Institutions and Economies*, 51–77.
- Ramalho, E. A., & Ramalho, J. J. S. (2011). *Alternative Estimating And Testing Empirical Strategies For Fractional Regression Models*. *25*(1), 19–68.
<https://doi.org/10.1111/j.1467-6419.2009.00602.x>
- Ratnawati, K. (2020). *The Impact of Financial Inclusion on Economic Growth , Poverty , Income Inequality , and Financial Stability in Asia*. *7*(10), 73–85.
<https://doi.org/10.13106/jafcb.2020.vol7.no10.073>
- Robert Pomeroy, Carlos Arango, Christopher G. Lomboy, S. K. (2020). Financial inclusion to build economic resilience in small-scale fisheries. *Marine Policy*.
- Robinson, J. P. W., Robinson, J., Gerry, C., Govinden, R., Freshwater, C., & Graham, N. A. J. (2020). Diversification insulates fisher catch and revenue in heavily

Rural Areas: The Case of Fish Farmers in Rural Morogoro, Tanzania. *Journal of Applied Aquaculture*, 24(2), 107–117.

<https://doi.org/10.1080/10454438.2012.663696>

Wilson, G., Turyahabwe, N., Isubikalu, P., Martins, O., Okodudu, S., & Udoekpo, N. (2024). Influence of reciprocal financial resources on shrimp fishers' income sources in Southern Nigeria. *Marine Policy*, 162(106050), 1–10.

<https://doi.org/10.1016/j.marpol.2024.106050>

Zou, X., Hu, Y., Tian, Z., Shen, K. (2019). *Logistic regression model optimization and case analysis* (1st ed.; IEEE, ed.). Tiongkok: IEEE 7th international conference on computer science and network technology (ICCSNT).