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Analysis of factors affecting the production of Bagan Boat catches at the Gaung Fish Landing Base (PPI) Padang City, West Sumatra Province

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Abstract
The Gaung Fish Landing Base (PPI) is one of the most actively operating sites in Padang City, under the management of the Mina Gates cooperative, and is located in Gaung Market, Lubuk Begalung. Fish production at PPI Gaung comes from the catch of fishing boats that landed at the port: local fishing boats, bagan, tonda, and gillnet. There was a decrease in total fish production landed by 911.42 tons, or a decrease of 33.95% in 2021-2022. This study aims to determine what factors affect the production of catches. The research method used is the survey method, which involves making direct observations in the field and obtaining primary data from interviews with boat-bagan fishermen and secondary data from the port. The results of multiple regression analysis show that all factors have an effect. Six factors have a positive effect, and two have a negative effect. The most influential factor is the length of the trip/sea. The coefficient of determination (R2) is 0.757 or 75.7%. The coefficient of determination (R^2) of 75.7% means that the presentation of the influence of the independent variables used in the model has an influence of 75.7% on the dependent variable, and the remaining 24.3% is influenced by other variables not included in the model. Other factors that are thought to have an influence include external factors such as the environment, weather, and existing technology. This study concludes that all factors affect the production of catches. Namely, 5 factors have a real influence: engine power, amount of fuel, area of fishing gear, number of lights, and length of trip/sea, while three factors do not significantly affect the size of the ship, the experience of the captain, and the number of crew.

1. INTRODUCTION

West Sumatra Province is one of the regions of the Republic of Indonesia, which has an area of about 329,867.61 km with a sea area of 235,306 (71.33%), while the land is only about 94,516.6 km (928.67%). The very condition of the waters makes the mainstay sector after the oil and gas sector. Aquaculture production in 2004 in the form of ponds as much as 3.70 tons, ponds 13,500 tons, cages 9,103 tons, rice field fisheries reached 3,059.90 tons, and swift water ponds 6,776.60 tons (Central Bureau of Statistics of West Sumatra, 2004).

West Sumatra Province has 27 Fish Landing Base (PPI) units, especially in Padang City there are 4 PPI units. Among them, Muaro Anai PPI in Koto Tangah Subdistrict, Gaung PPI in Lubuk Begalung Subdistrict, Pisang River PPI in Bungus Teluk Kabung Subdistrict, and Pasia Nan Tigo PPI in

Koto Tangah Subdistrict (West Sumatra Marine and Fisheries Service, 2011). PPI Gaung is visited by many small and large traders in and outside the city because it is close to the Gaung market. The activities and facilities at PPI Gaung benefit fishermen in facilitating the auction. Various types of fish are auctioned, ranging from small to large fish. The fish auctioned at PPI Gaung are generally fresh fish because they result from direct catches landed at PPI for auction (Sarwono, 2015). PPI Gaung is one of the actively operating PPI in Padang City, under the management of the Mina Gates cooperative and located in Gaung Market Lubuk Begalung. The fish catches landed at this PPI come from fishermen, both members of the collaborative and other small fishermen, especially bagan boats (Ariesta, 2016).

One fishing gear based on and carrying out fish handling activities is boat Bagan fishing gear. Boat lift net is a type of pelagic fishing gear that is very important for fishing communities in the Pesisir Selatan Regency. Boat lift net is one type of fishing gear included in the lift net classification of the type of bagan used by fishermen to catch small pelagic fish (Mallawa, 2012). According to Suherman (2007), one of the ways that can be done to increase fishermen's income is by increasing the production of their catch. The way to increase output is by cultivating a productive fishing unit that is high in the number and value of the catch. In addition, the fishing unit must be economical and efficient, use technology suitable for local conditions, and not damage the sustainability of fisheries resources. One form of fishing technology that is considered successful and is developing rapidly in the fishing industry is using light aids to attract fish in the fishing process.

Fish production at PPI Gaung comes from the catch of fishing vessels landed at the port in the form of local fishing boats, bagan, tonda, and gillnet. The total fish production in 2021 is 2,684.40 tons, valued at IDR 5,025,300,000,-. Meanwhile, the total fish production 2022 was 1,772.98 tons, valued at IDR 2,948,239,000. When comparing the total production between 2021 and 2022, there was a decrease in the total production of fish landed by 911.42 tons, or a decrease of 33.95% (Annual Report of PPI Gaung, 2022).

Production factors are the most essential things in production. In analyzing the specific technology that can be used, we must know the production process and how to manage production factors to obtain optimal and efficient production results. Production factors (inputs) in the fishing field include the number of crew members, vessels, main engines, and fishing aids. Efficient management of production factors will result in an optimal increase in production. The efficiency of the production process is very important in increasing revenue and providing maximum profit for business actors (Sinaga & Wijayanto, 2014). This study aims to determine what factors affect the production of catches. The benefit of this research is that it provides information to boat-bagan fishermen regarding the factors that affect the production of boat-bagan fishermen's catch.

2. RESEARCH METHODS

The research method used in this research is a survey method that involves making direct observations in the field, obtaining primary data from interviews with boat-began fishermen, and secondary data received from the port.

Data Analysis Method

Data analysis in this study uses classical assumption tests (data normality test and multicollinearity analysis) and multiple regression analysis using the F-test and T-test. The normality test aims to evaluate whether the data that has been collected is normally distributed or not. Multicollinearity analysis determines whether each independent variable (factors of production) is truly free or does not affect each other. Meanwhile, multiple regression analysis is used to see the effect of each independent variable factor (production factors) on the dependent variable (Bagan boat catch). The F-test was conducted to see the effect of all independent variables on the dependent variable. The T-test was conducted to test the research hypothesis regarding the impact of each independent variable partially on the dependent variable.

3. RESULTS AND DISCUSSION

General Condition of the Research Location

The location of the Padang City Gaung Fish Landing Base (PPI) is on Jalan Makassar Teluk Bayur, Gates Nan XX Village, Lubuk Begalung District, Padang City, West Sumatra, distance from the main road to the location ±500 M. The more fleets that conduct fishing operations at PPI Gaung, the more catch there will be and the more production there will be. The total fisheries production of PPI Gaung is 9,783.38 tons over the last four years, and revenues tend to decrease starting from 2019 to 2022, and the production value tends to decline from 2019 to 2022 with a total production value over the last four years of IDR 18,247,479,000.

Bagan Boat

Based on the study of 15 samples of Bagan vessels, there are different vessel sizes ranging from 17% to 20% to 30 GT, with the smallest ship size being KM Andre 04, and the largest ship size is KM Popy 01 and KM Puspa 01. The length of the Bagan boat ranges from 15 to 20 m, where the shortest ship is KM Andre 04, and the longest is KM Popy 01, KM Diah, and KM Puspa 01. The most priority used by PPI gaung is the bagan boat fishing gear. The number of crew members on each bagan boat is around 8-15 people, depending on the ship's size and the time at sea. The catch of bagan boats at PPI Gaung is anchovies. On average, these manga boats make fishing trips at sea for 1 to 15 days. The driving engine used is a Mitsubishi brand engine with an engine power of 100 to 190 PK, where the most negligible engine power is KM Hokaido and the largest is KM Popy 01, KM Diah, and KM Puspa 01.

Bagan Boat Fishing Gear

Bagan boat fishing gear is operated by fishermen at night using a boat as a tool to carry or pull the bagan boat (fishing gear) to the fishing operation area. Bagan boat fishing gear has a unique ship shape that has wings on both sides of the ship. The parts of the boat bagan fishing gear construction used at PPI Gaung consist of boat poles, steel ropes, nets, and waring frames. Bagan boat fishing aids comprised lights, warning rollers, scrapers, and baskets.

Ship Tonnage

Gross tonnage (GT) is a measure that shows the ship's volume to accommodate the results of fishing operations in the context of utilizing fisheries resources. Given the importance of data on the size of fishing vessels and the number of stakeholders who require this data, conducting an objective study on the measurement of GT of fishing vessels is essential. The tonnage of Bagan boats in PPI Gaung ranges from 17 GT to 30 GT, which is the size of KM Popy 01, KM Diah, and KM Puspa 01 is the vessel with the giant GT.

Engine Power

According to Wijopriono & Genisa (2003), the power of the engine is related to the driving force of the ship to the fishing ground and as a driving force for the ship and the engine power is also helpful to turn on the lights that are useful for making fish swarm around the bagan lights. The engine used for bagan vessels in PPI Gaung is Mitsubishi, with power ranging from 100 to 190 PK. The engine's power is used as a boat thruster to the fishing area and to turn on the lights.

Fuel Quantity

Mukhtar (2008) in his research which states that fuel has a natural effect on catches because fuel is used as a driving force in boat engines and generator engines for lights in conducting fishing operations; without the availability of fuel, fishing operations will be hampered. The fuel fishermen use in one fishing trip is around 60 to 900 L, depending on how long and far to carry out fishing operations.

Fishing Gear Area

According to Sudirman & Mallawa (2012), the longer and wider the net, the more comprehensive the range of fishing, entangling fish already in the net, making it difficult to get out. The area of fishing gear owned by Bagan boats in PPI Gaung is 15 m^2/225 m to 29 m^2/841m.

Skipper Experience

Sulandari (2011) states that an experienced captain can quickly drive the ship to determine the fishing area, quickly overcome all problems during fishing operations, and experience using fishing technology. The captain's experience with the Bagan boat is different. Each ship must be able to analyze the right fishing location and have a good leadership spirit so that the crew works according to their instructions. The captain's experience on the Bagan boat at PPI Gaung is 5 to 9 years.

Number of Lights

Oktafiandi et al. (2016), state that the catch with 12 lights will produce more catches when compared to using five and 9-watt lights. So, the greater the wattage of the lamp used, the more fish will gather under the lamp and vice versa. The more lights are used, the more fish gather in the boat area, and vice versa. The number of lights used on boat mooring vessels anchored at PPI Gaung is around 40 lights to 120 lights. The lights used are LED lights and fluorescent lights.

Number of crew members

Sulandari (2011) states that crew members are all on board except the captain, and the number and skills of crew members affect the process of operating fishing gear. The number of crew members owned by Bagan boats at PPI Gaung varies in each ship, ranging from 8 to 15 crew members.

Length of time at sea

Putra (2019) states that time spent at sea affects the production of captured fish. The positive and significant relationship between the length of time at sea and the output of captured fish illustrates the time at sea for fishermen who use outboard motorboats. The longer the fishermen go to sea, the more precision is needed to catch fish, and the greater the number of fish caught. The length of the trip / going to sea, which is usually carried out by the outboard motorboats in PPI Gaung, is around one day to 15 days of fishing time.

Classical Assumption Test

Data Normality Test

The normality test aims to test whether, in the regression model, confounding or residual variables have a normal distribution, and a good regression model has a standard data distribution (Ghozali, 2018). Based on the normality test results of data processed using the SPSS application, the significant value obtained was 0.704 using 2-way results, commonly referred to as positive and negative. The data is expected because it has an asymp sig 2-tailed value of 0.704> 0.05.

Multicollinearity Test

The multicollinearity test aims to test whether there is a correlation between independent variables in the regression model. A good regression model should not correlate with the independent variables. If the independent variables correlate with each other, then these variables are not orthogonal. Orthogonal variables are independent variables with a correlation value between fellow independent variables equal to zero (Ghozali, 2018). The multicollinearity test results can be seen in the following Table 1.

Based on the multicollinearity test results above, it can be seen that the data in the table above has a Tolerance value of eight independent variables> 0.1 and the VIF value of eight independent variables <10, it can be concluded that the independent variable data has no multicollinearity disorder.

Since the data is usually distributed without multicollinearity disorder, it can proceed to the following data analysis.

Table 1. Multicollinearity test

No	Dependent variable	Collinearity statistics	
		Tolerance	VIF
1.	Ship size	.153	6.546
2.	Engine power	.138	7.240
3.	Fuel quantity	.381	2.622
4.	Fishing gear area	.131	7.611
5.	Skipper experience	.865	1.156
6.	Number of lights	.513	1.949
7.	Number of crew members	.377	2.650
8.	Length of trip/at sea	.391	2.555

Multiple Linear Regression Analysis

A multiple regression test was conducted after the normality and multicollinearity tests. From the results of multiple regression tests, it is obtained that the relationship between data on Ship Size, Engine Power, Total Fuel, Fishing Gear Area, Skipper Experience, Number of Lights, Number of Crew, and Length of Trip / Sea with the amount of catch obtained in the form of multiple regression equations as follows.

$$Y = -61.073 + 5.181X_1 - 2.735X_2 + 0.206X_3 + 23.004X_4 + 10.538X_5 + 1,092X_6 - 11,584X_7 + 47,778X_8$$

Description:

Y = Total catch (kg)
A = Intercept (cut-off point)
$b_1 - b_8$ = Regression coefficient of each production factor X_1 = Ship Size (GT)
X_2 = Engine Power/(Paarden Kracht) X_3 = Amount of Fuel (L)
X_4 = Fishing Gear Area (m^2)
X_5 = Skipper experience (years)
X_6 = number of lights (units)
X_7 = Number of crew members (people)
X_8 = Trip length (days)

The equation of production factors obtained shows the influence of production factors on the catch. All regression coefficients in the equation are not positive, so increasing each production factor does not always increase production.

Coefficient of Determination (R2)

The coefficient of determination (R2) essentially measures how far the model can explain the variation in the dependent variable. The coefficient of determination is between zero and one. A small R2 value means that the ability of the independent variables to explain the variation in the dependent variable is minimal. A value close to one means that the independent variables provide almost all the information needed to predict variations in the dependent variable (Ghozali, 2018). The coefficient of determination test results can be seen in the following Table 2.

Table 2. Test results of the coefficient of determination (R2)

Model	R	R Kuadrat	R square that has been customized	Std. Error Estimasi
1	0.870[a]	0.757	0.743	100.131

Based on the model summary test results, the coefficient of determination (R2) is 0.757 or 75.7%. The coefficient of determination (R^2) of 75.7% means that the presentation of the influence of the independent variables used in the model has an impact of 75.7% on the dependent variable, and the remaining 24.3% is influenced by other variables not included in the model. Other factors influencing this include external factors such as the environment, weather, and existing technology. Furthermore, the correlation coefficient R-value is 0.87 or greater than 0.5. This means that the production factors strongly relate to the dependent variable or the amount of catch obtained.

ANOVA test

According to Ghozali (2018), the simultaneous test is used to determine whether the independent variables jointly affect the dependent variable and to measure the accuracy of the sample regression function in estimating the actual value through goodness of fit. The hypothesis will be tested with a significance level of 0.05. If the significance value is <0.05, the hypothesis is accepted, meaning there is a significant influence between the independent and dependent variables.

Table 3. ANOVA test

ANOVA

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	4554039.604	8	569254.950	56.777	.000[a]
	Residual	1463819.144	146	10026.159		
	Total	6017858.748	154			

T-test

The t-statistical test shows the influence of one explanatory/independent variable individually on explaining the variation in the dependent variable. The t-statistical test has a significance of 5%.
T table = 1.976

Table 4. T test result

Coefficient[a]

Independent variable	Coefficient non-standard		Coefficient standard		
	B	Std. Error	Beta	t	Sig.
(Constant)	-61.073	79.503		-.768	.444
Ship Size	5.181	5.038	.107	1.028	.306
Engine power	-2.735	.866	-.347	-3.157	.002
Fuel quantity	.206	.070	.196	2.959	.004
Fishing gear area	23.004	5.877	.441	3.914	.000
Skipper experience	10.538	6.725	.069	1.567	.119
Number of lights	1.092	.497	.125	2.196	.030
Number of crew members	-11.584	6.745	-.114	-1.718	.088
Length of trip / at sea	47.778	4.288	.727	11.142	.000

Based on the results of the t-test/hypothesis test in the Table 4, we can conclude that the ship size variable has a t value of 1.028 < from the t table of 1.976 and a significance of 0.306> 0.05, which concludes that the ship size variable h a s has no partial effect on the catch variable. The ship size variable has no real effect partially because there is no significant difference in size.

The engine power variable has a t value of -3.157> from the t table of -1.976 and a significance of 0.002<0.05, which concludes that the engine power variable has a partially negative effect on the catch variable. The variable engine power has a real effect partially but negatively because there is a significant difference in engine power. The variable amount of fuel has a t value of 2.959> from the t

table of 1.976 and a significance of 0.004<0.05, which concludes that the variable amount of fuel has a partial positive effect on the catch variable. The variable amount of fuel has a real effect partially in a positive direction because there is a significant difference in the amount of fuel.

The variable area of fishing gear has a t value of 3.914> from the t table of 1.976 and a significance of 0.000<0.05. It concludes that the variable area of fishing gear has a partial positive effect on the catch variable. The variable area of fishing gear has a real effect partially in a positive direction because there is a significant difference in the area of fishing gear. The captain's experience variable has a t value of 1.567 < from the t table of 1.976 and a significance of 0.119> 0.05, which concludes that the captain's experience variable has no partial effect on the catch variable. The captain's experience variable has no real effect partially because it does not have significant data differences.

The variable number of lights has a t value of 2.196> from the t table of 1.976 and significance equal to 0.030 <0.05, it concludes that the variable number of lights h a s a partial positive effect on the catch variable. The variable number of lights has a real effect partially in a positive direction because there is a significant difference in the number of lights. The variable number of crew members has a t value of -1.718 < from the t table of -1.976 and a significance of 0.088> 0.05, which concludes that the variable number of crew members has no partial effect on the catch variable. The variable number of crew members has no real effect partially because there are no significant data differences. The variable length of trip/sea has a t value of 11.142> from the t table of 1.976 and a significance of 0.000 <0.05, which concludes that the variable length of trip/sea has a partial positive effect on the catch variable. The variable length of trip/fishing has a real effect partially in a positive direction because there is a significant difference in the length of trip or fishing data.

4. CONCLUSIONS

The results of multiple regression analysis show that all factors have an effect. Six factors have a positive effect, and two have a negative effect. The Length of trip/sea (X7) factor is the most influential. Based on the summary model output results, the coefficient of determination (R^2) is 0.757 or 75.7%. The coefficient of determination (R^2) of 75.7% means that the presentation of the influence of the independent variables used in the model has an influence of 75.7% on the dependent variable, and the remaining 24.3% is influenced by other variables not included in the model. Other factors that are thought to have an influence include external factors such as the environment, weather, and existing technology.

For further researchers, it is hoped that they can develop research on other variables related to production factors that affect the boat mules' catch at the Gaung Fish Landing Base (PPI) in Padang City, West Sumatra Province.

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