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Original Paper

The Effect of Differences in Fishing Time in Handline Fishing Tools on Catches in Blimbingsari Waters

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***Abstract*— Indonesian waters are waters with enormous potential. This study aims to examine the effect of differences in fishing time on hand line fishing gear on catches in Blimbingsari waters. The analysis in this study used a quantitative descriptive analysis with a purposive sampling technique in taking the sample. This research showed that 48% of the number of catches was influenced by the time of catch and 52% was influenced by other factors, while the weight of the catch was 36% affected by the time of catch and 64% was influenced by other factors. As for the difference in catching time, the morning catch produces more fish compared to the catch during the day.**

Keywords*— *Time Difference Influence, Hand Line, Fish Catches

I. INTRODUCTION

One of the waters that have the potential for abundant fishery resources is the waters of the Bali Strait [1] which supply a lot of pelagic fish and the catches obtained are used as fish for consumption by the Indonesian people in various circles [2]. The Bali Strait is relatively narrow waters (about 2,500,000 km2) [3], in the northern part the waters of the Bali Strait have a width of about one mile which is related to the Java Sea (Madura Strait) and are shallow waters (a depth of about 50,000 meters), while the width of the strait is the south is about 28.00 miles and is deep water and directly connected to the Indian Ocean [4], [5].

Banyuwangi Regency has a coast length of 282 km which is in 14 sub-districts facing the Indonesian Ocean, 7 sub-districts facing the Bali Strait and 1 sub-district facing the Bali Strait and 1 sub-district facing the Java Sea. Along the coast of Banyuwangi Regency there are sandy and coral beaches and we still find various types of mangroves that grow well along the coast [6].

The utilization of marine resources in Banyuwangi is still dominated by small-scale fisheries using simple fishing gear that does not require high costs and is primarily for self-sufficiency [7]. There are various types of fishing gear, such as gill nets, traps, sero, charts and fishing lines [8], [9]. Of the six fishing gears, the dominant type of hand line is used by fishermen, because this fishing gear has the advantages of being easy and inexpensive to manufacture, and does not require special technology to operate. One area whose marine fisheries are dominated by traditional fisheries is Blimbingsari Waters, Rogojampi District, Banyuwangi Regency. Hand line fishing gear is mostly used by Blimbingsari fishermen. Hand line is a fishing gear consisting of a number of ropes and a number of hooks consisting of many hooks arranged to resemble an anchor. At a few centimeters above the fishing line is tied bait. Hand line is included in the classification of hook and line fishing gear [10], [11].

Hand line catches in Blimbingsari Waters, Rogojampi District, Banyuwangi Regency are pelagic fish and demersal fish. In general, almost all types of pelagic fish will rise to the surface before sunset, spread in the water column after sunset and descend to deeper layers at sunrise. Meanwhile, demersal fish will generally be at the bottom of the waters in the morning, rising and spreading in the water column at night [12].

As a simple fishing gear, hand line can be used in all types of waters, both surface and bottom waters. Each target fish for handline fishing has a different time for feeding. Choosing the right time to catch fish is a factor that supports the success of fishing activities [13]–[15].

Based on the study about effect of differences in catching time on handline catches around fads in cirebon waters. The catch showed that the total weight and number of individuals in the morning were higher (114.25 kg; 178 fishes) compared to the catch in the afternoon (31.74 kg; 91 fishes) [16]. Study about the Relationship of Operating Time (Morning, Afternoon, Evening) on Fishing Gear (Thollline, Handline and Kite Line) to the Catches of the Sekocian Boat in Sendang Biru Waters, Malang, East Java reported that the best treatment based on the number and weight of fish caught occurs in handline fishing gear (f2) with fishing time during the day (T2), namely 79 individuals and weight is 565.20 kg. For the lowest treatment, it occurred in the interaction between troll line fishing gear (f1) in the afternoon (T3), with a total of 37 fishes and weight of 252.80 kg [17]. The results of study about the differences in the catch of hand lines in Bagan Siapiapi waters indicate that from the difference in operating time at night and during the day, the catch at night is more than during the day, where at night 1674.3 kg was obtained and 1600.1 kg during the day [18].

Catching time greatly influences the amount, size composition of the catch as well as the composition of the types of catch and the condition of environmental factors always changes from time to time, this condition will cause the types of fish present in the waters to always be different [19]. This study aims to determine the effect of time on hand line catches, and to determine differences in catches between morning and afternoon catches based on the number and weight of fish caught.

II. Prepare Your Paper Before Styling

This research was conducted in Blimbingsari waters, Rogojampi District, Banyuwangi Regency, East Java Province. Blimbingsari waters geographically located at 08°20'55" South Latitude and 114°21'24" East Longitude. In which 69 people work as fishermen. The education level of the respondents varied from elementary school (70%) to junior high school (30%). Fisherman in Bimbingsari waters have an erratic income due to the lack of technological factors, age factors, family responsibilities and education. The population of Blimbingsari fishermen was 69 fishermen, so the selection of respondents was determined by the purposive sampling method or intentional sampling with the number of samples (respondents) taken based on the provisions of the researcher with certain considerations [20]. Determining the respondents who will be surveyed based on the Slovin sampling technique. For the level of precision specified in the determination of the sample is 10%. The reason researchers use a precision level of 10% is because the total population is less than 1000. The Slovin sampling technique formula:

$$n = \frac{N}{1+ Ne^2} \quad \text{..... (1)}$$

Information :
n = sample size
N = population size
e = Allowance for inaccuracy due to possible sampling errors tolerated, then squared.

Based on the Slovin Formula, the magnitude of the number of samples drawn research were:

$$n = \frac{N}{1+ Ne^2} \quad \text{.....(2)}$$

$$n = \frac{69}{1+ 69\ (0.1)^2} \quad \text{.....(3)}$$

$$n = 40.82 \text{ (rounded to 41)} \text{.....(4)}$$

The sample in this study were 41 fishermen

The material in this research was the results of interviews and observations based on data on fish caught and hand line fishing gear on 41 fishermen in Blimbingsari waters, Rogojampi District, Banyuwangi Regency. The tools used in this study included stationery to record and record research results, scales to determine the weight of the catch, clocks to determine the time of fishing operations, cameras to document research activities and thermometers to measure temperature. The method in this study uses a quantitative descriptive research method [21]. The data obtained were then analyzed using descriptive analysis, simple regression analysis using dummy variables and t-test analysis.

The research procedures included preparation, departure, interviews and observations according to sample selection, tabulation of catch data and data analysis. Preparation is carried out by preparing supplies for the operation of fishing units with hand line which include notebooks, questionnaires, diesel fuel, food supplies, GPS, fishing gear and bait. The ship used was a 5 GT ship with one engine. Departure was carried out between 05.30 of Western Indonesian Time to the location of the fishing. Every 10 km can be reached for + 1 hour at a speed of 6 knots. Interviews and observations were carried out directly during fishing activities, starting from setting up to hauling. The tabulation of catch data is carried out by recording each time of catch (morning and afternoon) for each sample. Besides that, measurements of water parameters were also carried out which included measuring light intensity and temperature [22].

III. Results And Discussion

A. *Description of Location of Research*

Blimbingsari is a village name in Rogojampi District, Banyuwangi Regency, East Java Province, Indonesia. It is located about 17 kilometers to the south from the center of Banyuwangi City, with a ground level of 25 m above sea level. The area of Blimbingsari Village is 5.3 km2 with a population of Blmbingsari + 4,730 people/head of household (head of family) with 2,326 men and 2,404 women, population density of 910 people/family [23]. The number of hand line fishermen is 167 people, the fishing gear used is fishing rods with components of the line and hook. Geographically, Blimbingsari waters are located at 08°21'6" South Latitude and 114°21'24"East. The topography is shallow waters 200 meters from the shoreline with a depth of up to 400 meters and has a sandy and rocky bottom.

Based on the observation and interviews results, most of the Blimbingsari fishermen are traditional fishermen (with lack of use of technology) using simple fishing gear, namely hand line fishing gear. The number of fishing gear was 167 and the fleet used by jukung using temple engines was 167 units. Blimbingsari fishermen make preparations for fishing starting at 05.00 in the morning, the usual preparations are fishing gear and bait in the form of lemuru fish, then depart for about 30 minutes to the fishing ground and start the fishing at 06.00 until 12.00 of W

Fig. 1. Map of Blimbingsari Village, Rogojampi District.

B. *Handline Fishing Equipment*

The following was the result of the interviews and observations regarding handline fishing gear based on sample data from Blimbingsari fishermen, Rogojampi District, Banyuwangi Regency.

1) Construction of hand line fishing gear

The construction of fishing gear used by Blimbingsari fishermen is as follows:

1. The rope winder uses wood with a length of 15 cm and a width of 10 cm.
2. The main fishing line (main line) uses nylon monofilament base material with a length of 40-100 m.
3. The number of hooks used is two, namely eye numbers 14-16.
4. One swivel made of stainless material that does not rust easily.
5. The branch line uses the basic material of nylon monofilament with a distance of 10-15 cm, the distance between the first branch line and the second branch line is 15-20 cm
6. Ballast used using iron.

2) Fishing vessel

The ship used in the research is a ship made of wood using a diesel engine as the propulsion of the ship.

3) Method of tools operation

The operating method of hand line during the research was that the fishing line which had been baited in the form of lemuru was sunk into the water. When the bait is eaten by the fish, the hook will get stuck in the fish's mouth and the fishing line is pulled into the boat. Fishing locations can be done in all waters.

4) Time of fishing

Catching time was carried out in the morning and afternoon, where the morning catch time starts at 06.00-08.00 Western Indonesian Time and in the afternoon at 10.00-12.00 Western Indonesia Time.

C. *Descriptive Analysis of Survey Results The Effect of Time Differences in Handline Fishing Equipment on the Fish that were Caught*

1) Fishing Time

Based on the survey results using a research tool in the form of a questionnaire on 41 Blimbingsari fishermen respondents, it can be seen that Blimbingsari fishermen caught fishes at 06.00-12.00, 06.00-13.00 and 06.00-14.00 Western Indonesian Time. The number of respondents based on the fishing time was presented in Fig. 2.

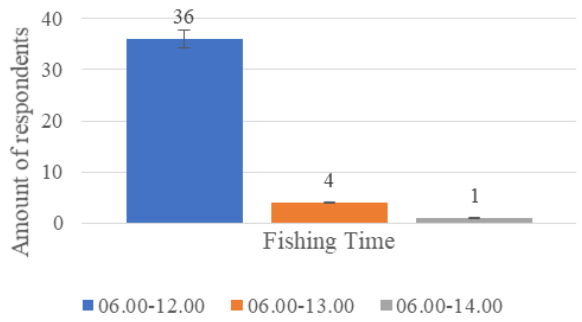

Fig. 2. Fishing Time

The bar chart above shows that based on a sample of 41 responses, Blimbingsari fishermen catch more at 06.00 and ends at 12.00 with a sample percentage of respondents, namely 88% or 36 respondents.

2) Fishing Position Based on Mileage

Based on the survey results, it can be concluded that Blimbingsari fishermen catch at distances of 1-5 miles, 6-15, and 16-20 miles. The number of respondents based on the distance of the fishing position can be seen in Figure 3.

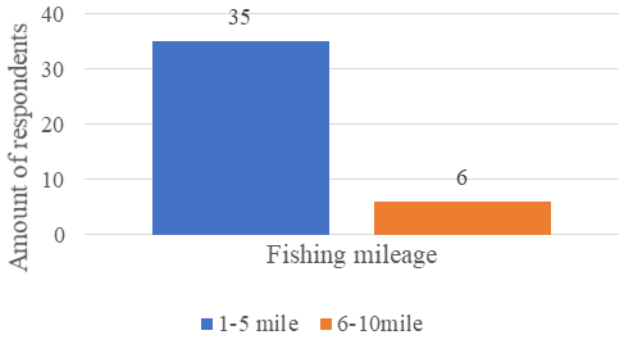

Fig. 3. Fishing Position Based on Mileage

The bar chart above shows that based on a sample of 41 respondents, Blimbingsari fishermen mostly fished in positions 1-5 miles from the shoreline with a percentage of 85% or 35 respondents who made fishing in positions 1-5 miles from the shoreline.

3) Base of fish catching waters

Based on the survey results, it can be interpreted that Blimbingsari fishermen catch on sandy, rocky and muddy sand bottoms. The number of respondents based on fishing grounds can be seen in Fig. 4.

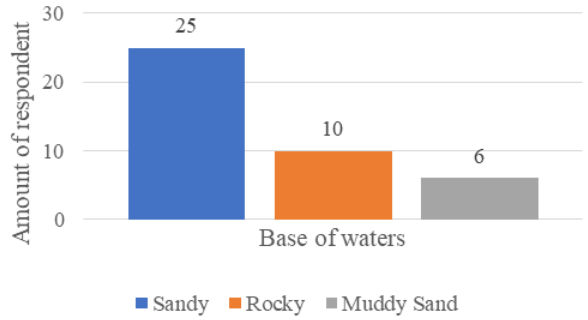

Fig. 4. Base of fish catching waters.

The bar chart above shows that based on a sample of 41 respondents, Blimbingsari fishermen mostly caught fish in sandy waters with a sample percentage of 61% or 25 samples from 41 respondents who caught fish.

4) Length of Time to the Fishing Area (Fishing Ground)

Based on the survey results, it can be concluded that Blimbingsari fishermen make catches with a length of time to the fishing area of 10-20 minutes, 21-30 minutes and 31-40 minutes. The number of respondents based on fishing grounds can be seen in Fig. 5.

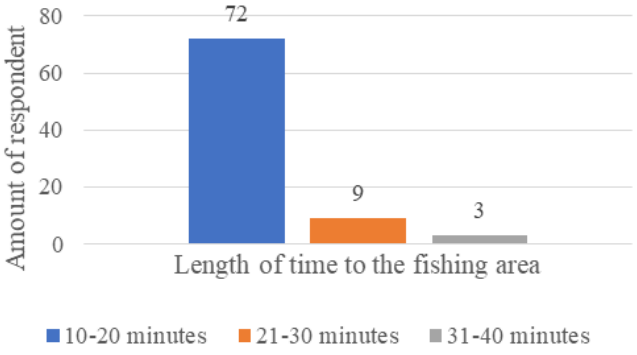

Fig. 5. Length of Time to the Fishing Area.

The bar chart above shows that based on a sample of 41 respondents, Blimbingsari fishermen make more catches with a departure time of 10-20 minutes with a sample percentage of respondents, namely 72% or 30 samples from 41 respondents who do fishing.

5) Material Type of Fishing Line

Based on the survey results, it can be concluded that Blimbingsari fishermen as a whole catch using fishing line material with monofilament with a sample percentage of respondents namely 100% or 41 samples from 41 respondents who did fishing.

6) Types of Fish Catches

The types of fish caught by hand line in Blimbingsari waters during the study were based on the results of observations of 41 respondents, consisting of 8 types of fish caught, the total number of fish caught during the study was 607 fishes, the highest number of fish during the study was the flying fish (*Nemipterusforcosus*) with a total of 215 heads or 39%. The next most caught fish were *Lutjanus fulviflamma* with a total of 155 fish or 24%, *Fylviflamma* with a total of 84 fishes or 17%, *Upeneusmullocensin* with a total of 45 fishes or 8%, *Lutjanus madras* 39 fishes or 6%, *Lethrinuslentjan* with a total of 21 fishes or 1%, *Lutjanus Ruselli* with a total of 13 fishes or 1% (Table 1).

TABLE I. TYPES OF FISH CATCHED BY LONGLINE BASED ON CATCHING TIME

Types of Fish	Amount of fish		Total Amount	Percentage of catched fish (%)
	Morning	Afternoon		
Lutjanus campechanus	19	2	21	1%
Epinephelus fuscoguttatus	7	6	13	1%
Lutjanus fulviflamma	110	45	155	24%
Lutjanus madras	27	12	39	6%
Fylvislamma	79	5	84	17%
Lethrinus lentjan	3	32	35	4%
Nemitterus forcosuss	176	39	215	39%
Upeneus mulflocensin	35	10	45	8%
Total	456	157	607	100%
Average	57	19	76	

Based on the number and weight of fish caught, the overall catch in the morning is higher than the catch during the day, both the number and weight of the fish caught. The proportion of fish caught in the morning based on the number is 456 fish while for the catch during the day there were 151 fish. The proportion of fish to catch weight was 113.78 kg in the morning catch and 39.42 kg in the afternoon catch (Table 2).

Table 2 shows the number and weight of *Lutjanus campechanus*, *Epinephelus fuscoguttatus*, *Lutjanus fulviflama*, *Lutjanus madras*, *Flyvislamma*, *Lethrinus lentjan*, flying fish (*Nemitterus forcosuss*), and *Upeneus mulflocensin* in the morning catch more than in the afternoon catch.

TABLE II. THE NUMBER AND WEIGHT OF FISH CAUGHT BY HAND LINE BASED ON THE TYPE OF FISH IN THE MORNING AND AFTERNOON CATCHES

Types of fish	Morning		Afternoon	
	Amount of fish	Weight (kg)	Amount of fish	Weight (kg)
Lutjanus campechanus	19	9,73	2	1,1
Epinephelus fuscoguttatus	7	2,98	6	2,92
Lutjanus fulviflamma	110	24,67	45	10,44
Lutjanus madras	27	6,3	12	2,36
Fylvislamma	79	22,09	5	2,35
Lethrinus lentjan	3	0,6	32	7,95
Nemitterus forcosuss	176	39, 56	39	9,95
Upeneus mulflocensin	35	7,85	10	2,35
Total	456	113,78	151	39,42
Average	57	14,22	18,87	4,92

D. Analysis of the Effect of Catching Time on the Number of Fish Catched by Longline

1) Regression Analysis

Based on the results of the regression analysis, the value of the influence between fishing time, namely morning and afternoon, on the number of hand line catches in Blimbingsari waters can be seen in Table 3.

TABLE III. LINEAR REGRESSION VALUES BETWEEN THE NUMBER OF HANDLINE CATCHES AND CATCHING TIME (MORNING AND AFTERNOON)

Model Summary[b]				
Model	**R**	**R Quare**	**Adjusted R Square**	**Std. Eroor of the Estimate**
1	.694[a]	.482	.475	3.882

a. Predictors: (Constant), Time
b. Dependent Variable: Amount

2) Regression Coefficient Test (t test)

The t-test was carried out with the aim of testing the effect of each independent variable, namely catching time both in the morning and during the day, on the dependent variable in the form of the number of catches. The t test was carried out by comparing the t count of each independent variable with the t table at the 5% level of significance.

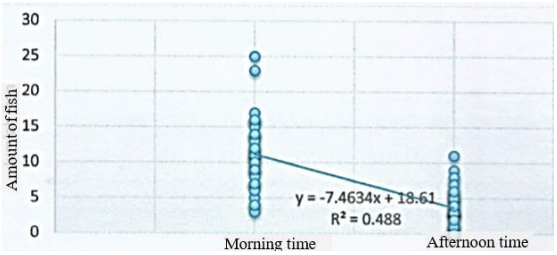

Fig. 6. The Effect of Catching Time on the Number of Fish

From the graph above, it can be seen that the coefficient of determination R Square (R^2) was 0.48, which means that 48% was influenced by the time of catch and 52% was influenced by other factors.

TABLE IV. TIME REGRESSION COEFFICIENT TEST (T TEST) ON THE NUMBER OF FISH

Coefficients[a]						
Model		**Unstandardized Coefficients B**	**Std. Error**	**Standardized Coefficients Beta**	**t**	**Sig.**
1	(Constant)	18.543	1.359		13.643	.000
	Time	-7.396	.863	-.694	-8.573	.000

a. Dependent Variable: Amount

The t-test results table shows a significant value, namely for the time of catch, a significant value of 0.000<0.05 is obtained, so it can be concluded that changes in the variable time of fish catch have a significant effect on the number of fish caught, so that the catch time can be made an equation that can be used to predict the number of fish catch. Based on Table 4, the constant a value is 1,637, the time regression coefficient is -7,396 so that the regression equation is obtained as follows:

$$y = 18.547 - 7.396x \quad \text{.....(5)}$$

Note :
y = predicted number of fishes
a = constant
b = coefficient of regression
X = fishing time

The regression equation above can be used to predict the number of fish caught based on the time of catching. From the results of the regression equation above, it can be seen that:

The time coefficient (X) which is negative was -7.396, this shows that every change in time from morning to noon, the number of catches decreases by 7.3% assuming that the time was constant.

E. Analysis of the Effect of Catching Time on the Weight of Fish Catched by Fishing Line

1) Regression Analysis

Based on the results of the regression analysis, the value of the relationship between fishing time in the morning and during the day on the weight of fish caught by hand line in Blimbingsari waters can be seen in Table 5.

TABLE V. LINEAR REGRESSION VALUES BETWEEN THE NUMBER OF HANDLINE CATCHES AND CATCHING TIME (MORNING AND AFTERNOON)

Model Summary[b]				
Model	**R**	**R Quare**	**Adjusted R Square**	**Std. Eroor of the Estimate**
1	.694[a]	.482	.475	3.882

c. Predictors: (Constant), Time
d. Dependent Variable: Weight

2) Regression Coefficient Test (t test)

The t-test was carried out with the aim of testing the effect of each independent variable, namely fishing time both in the morning and during the day, on the dependent variable in the form of weight of fish caught. The t-test is carried out by comparing the t-count of each independent variable with the t-table at the 5% level of significance.

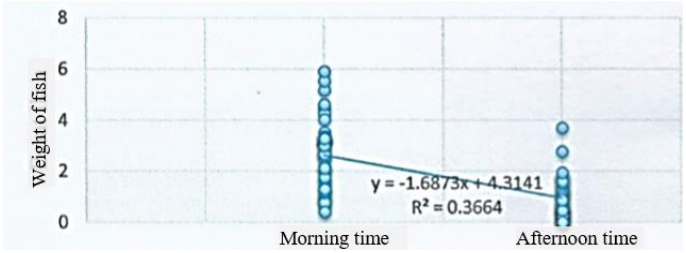

Fig. 7. The effect of fishing time on the weight of the fish caught by hand line.

From the graph above, it can be seen that the coefficient of determination R Square (R^2) is 0.36, which means 0.36, which means that 36% is influenced by catching time and 64% is influenced by other factors.

TABLE VI. TIME REGRESSION COEFFICIENT TEST (T TEST) ON THE NUMBER OF FISH

Coefficients[a]						
Model		**Unstandardized Coefficients B**	**Std. Error**	**Standardized Coefficients Beta**	**t**	**Sig.**
1	(Constant)	4.298	.395		10.884	.00
	Time	-1.671	.251	-.600	-6.667	.00

a. Dependent Variable: Weight

The t-test results table shows a significant value, namely for the time of catch, a significant value of 0.000 <0.05 was obtained, so it can be concluded that changes in the variable time of fishing have a significant effect on the weight of the fish caught, so that the fishing time can be made into an equation that can be used to predict fish weight catch. Based on table 4, the constant a value was 4,298, the time regression coefficient was -1,671 so that the regression equation obtained as follows:

$$y = 4.298 - 1.671x \quad \text{.....(5)}$$

Note :
y = predicted number of fishes
a = constant
b = coefficient of regression
X = fishing time

The regression equation above can be used to predict the weight of fish caught based on the time of fishing. From the results of the regression equation above, it can be seen that:

The time coefficient (X) which is negative was -1.671, this shows that every change in time from morning to noon, the catch weight decreases by 1.6% assuming that the time was constant.

F. Analysis of differences in morning and afternoon catches based on the number of fish caught

Based on the results of the t test analysis, the difference in the number of morning and afternoon catches was obtained based on a sample of 41 respondents in Blimbingsari waters and can be seen in table 7.

TABLE VII. ANALYSIS OF DIFFERENCES IN MORNING AND AFTERNOON CATCHES BASED ON THE NUMBER OF FISH CAUGHT

One-Sample Test						
Test Value = 0						
Time	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference	
					Lower	Upper
Morning	12.205	40	.000	2.62683	2.1918	3.0618
Afternoon	7.614	40	.000	.93951	.6901	1.1889

The results of the student t-test conducted on the number of morning and afternoon catches showed that t count > t tab 0.05, which means H_0 was rejected and H_i was accepted, meaning that in this study there was a difference in the number of fish caught between morning and afternoon. Where the most amount obtained in the morning.

G. Analysis of differences in morning and afternoon catches based on the weight of the fish caught

Based on the results of the t test analysis, the differences in the number of morning and afternoon catches were obtained which can be seen in Table 8.

TABLE VIII. ANALYSIS OF DIFFERENCES IN MORNING AND AFTERNOON CATCHES BASED ON THE NUMBER OF FISH CAUGHT

One-Sample Test						
Test Value = 0						
Time	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of Difference	
					Lower	Upper
Morning	12.205	40	.000	2.62683	2.1918	3.0618
Afternoon	7.614	40	.000	.93951	.6901	1.1889

The results of the t-student test conducted on the weight of the morning and afternoon catches showed that t count > t tab 0.05, which means H_0 was rejected and H_i was accepted, meaning that in this study there was a difference in the weight of fish caught between morning and afternoon. Where the most weight was obtained in the morning.

CONCLUSION

From the research findings in Blimbingsari waters, catching activities using handlines by 41 fishermen carried out in the morning gave better catches than during the day with a total number of fish caught 607 with a total catch of 456 in the morning and 157 in the afternoon, a total weight of 153.2 kg with a morning catch of 114.2 and afternoon 39.42 consisting of 8 types of fish namely Lutjanus Campechanus, Ephinephelus Fuscoguttatus, Lutjanus Fulviflamma, Lutjanus Ruselli, Fylvislamma, Lethrinus lentjam, Nemitterus forcosuss, and Upeneusmufloc-ensim. From the results of testing the hypothesis testing statistical t research, this study shows that the effect of time on the number of catches was 48% and 52% was influenced by other factors while the effect of time on the weight of the catch was 36% and 64% was influenced by other factors. The fishermen in Blimbingsari waters were lack in use of technology, have a relatively low level of education, getting older (lack of regeneration) and have a high responsibility in the family. These factors may affect the quantity of the result of fish caught and impacted to the fisherman welfare. For the future research, the fish dimensions, mass, and temporal fluctuations could be included in order to obtain the broader information on fish catches. Therefore it will increase the understanding of fishing practices and dynamics in Blimbingsari waters. Besides, the comparation of another fishing equipments or another gear alternatives could also be included in order to support the results' credibility.

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