The efficiency handline fishing gear In Gorontalo Regency, Indonesia

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Abstract

This research aims to know the technical efficiency handline fishing gear and allocative efficiency (price) handline fishing gear as well as economic efficiency handline fishing gear in the village Kayubulan Batudaa District of Gorontalo Province Gorontalo Regency Beach. This research was conducted in October-November 2018. This study uses Quantitative descriptive analysis of the data by using DEA (Data Envelopment Analysis) to measure the technical efficiency and CBA (Cost-Benefit Analysis) to measure allocative efficiency (price) and the analysis of economic efficiency is the result of technical efficiency and allocative efficiency (price). Analyzing technical efficiency using software DEAP version 2.1. The results showed that the technical efficiency (ET) note that the value of the average value of technical efficiency obtained at0788or <1, meaning that the fishing effort handline fishing is still technically efficient. On average allocative efficiency/price (EH) obtained by 3,881 or > 1, so the fishing effort by handline fishing gear has been efficient in the allocative. The average economic efficiency obtained for 3091 or > 1, so the average fishing effort by handline fishing gear is already economically inefficient.

Keywords: ***efficiency, technical, allocative, economic, handline, DEA***

Introduction

Potential of marine resources in Indonesia has been utilized in a variety of economic activities, where one of them is in the fishery business. Fisheries is itself an economic activity which is unique when compared to other activities. This relates to the condition of marine resources and the fish itself is often regarded as common property resources (common property resources) (Desniarti et al, 2006). Marine resources in Indonesia, especially in Sulawesi is relatively abundant, rich and varied, especially in coastal areas. With the increasing rate of population growth, the demand for seafood, especially fish is increasing. The increasing demand requires fishermen and entrepreneurs engaged in fishing to increase production (Suhartono, 2004).

The increase in the catch of fishermen dependent on the use of production inputs. Information on the effects of production inputs is necessary for optimal fishing effort with effective use of production inputs and efficiently to increase catches and fishing income (Alhuda et al, 2016). This means that to produce the highest efficiency value then the fisherman should be able to take into account a combination of factors of production with catches obtained. Differences between the inputs cause different efficiency values (Azizah, 2016).

According to Hasibuan (1984) in Wicaksono et al (2014), efficiency is the best comparison between inputs and outcomes between the advantages to the sources used, as well as optimal results, are achieved with the use of limited resources. Efforts to increase efficiency generally associated with a smaller fee to obtain a certain outcome or a certain cost that many results. This means that the waste be reduced to as small as possible and something that makes it possible to reduce the cost of this is done for the sake of efficiency.

Research on the efficiency of fishing gear handline yet, so far only on the efficiency of fishing gear fishery gillnet and cantrang (Study In Pemalang, Central Java) by Sutanto (2005), where the results show that the price efficiency and economic efficiency has been efficient or equal to 1, while technical efficiency not equal to 1 is not efficient so it is still possible to add or reduce the allocation of inputs.

Kayubulan village is located in the district of Batudaa Beach, Gorontalo, (Profile villages Kayubulan, 2017). The majority of the villagers Kayubulan livelihood as a fisherman. Some fishermen in this village do fishing effort using handline fishing gear or commonly known as pull fishing line. Generally, fishermen have not been able to use combinations of inputs corresponding to the catches obtained. The allocation of production inputs combination can increase the efficiency which in turn can increase the income of fishermen.

This study aims to know about the efficiency handline fishing gear in the village Kayubulan Kecamtan Batudaa Beach, Gorontalo Regency Gorontalo province. The results of this study is expected as inputs to the government and other parties in the quest for approaches to improve the technical efficiency, allocative and economic handline fishing gear and can

become the basis for further research information concerning technical efficiency, allocative and economic handline fishing gear.

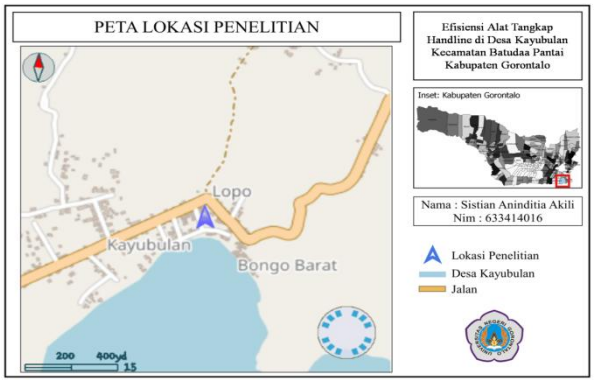

Figure 1. Map Village Kayubulan (Source: Essential GPS)

Data collection technique

Data collected consist of primary data and secondary data. Primary data were obtained from observations and interviews with respondents directly in the field. Data collected on the volume of catches (Kg / Trip), cost of supplies (USD / Trip), fuel (Liters / Trip), the number and length of trips, the size of the machine (PK), the size of the boat (GT) and the number of crew members (fishermen). Secondary data was used to support the information obtained from the village profile, previous studies, and literature related to this research.

The sampling technique was conducted by purposive sampling, ie sampling based on the consideration or related to the purpose of information and research (Hiola, 2017). Samples taken was set at 65 185 the number of fishermen (Kayubulan Village Profile, 2017). This sampling is determined by using the formula Slovin (Simanjuntak, 2016):

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

$$n = \frac{185}{1+185\ x\ 0{,}1^2}$$

$$n = \frac{185}{1+1{,}85}$$

$$n = \frac{185}{2{,}85}$$

n = 64, 91 (65 respondents)

Information:
n = Large Sample
N = population size or number of fishermen
e = Percent leeway inaccuracy due to sampling error that can be tolerated (tolerance degree of sampling error) is 10% (0.1).

Data Analysis

The analytical method used in this research is the descriptive quantitative method. The research methods are used to collect data or information about a population from a sample. The

characteristics of this research method are obtained from the samples and information collected through referred the questions (oral or written) (Aprilia, 2011).

1. *Data Envelopment Analysis* (DEA) 2.1

Data Envelopment Analysis (DEA) is an analysis for the measurement of efficiency is a free value (value-free) because it is based on the data available without having to consider the assessment (judgment) of the decision-makers. DEA model approach, which is a mathematical programming approach to estimate the technical efficiency (TE) and output capacity. DEA analysis aimed at measuring the performance of a relatively (relative performance) of the unit of analysis on the condition of the existence of multiple inputs and outputs (Wardono, 2016).

The technique is also known as CCR (first name three inventors: Charnes, Cooper and Rhodes, 1978), performance measurement of the relative efficiency of decision-making unit DMU (decision-making units) in an activity. In the application of fisheries, DEA has an advantage in its ability to estimate capacity under the constraint of particular policy implementation (Nababan and Sari, 2010). Another feature of the DEA model is its ability to accommodate multiple outputs and multiple inputs (Wardono, 2016). Data Envelopment Analysis (DEA) in this study was undertaken with the help of DEAP version 2.1,

1. *Cost-Benefit Analysis* (CBA)

B / C is the value or benefits derived from each unit costs. Where B / C is obtained by dividing the total revenue to total spending. Kadariah and Gray (1987) in Alhuda et al (2016), states that to determine the level of efficiency of a business can be a parameter that is by measuring the amount of income divided by the amount of expenditure, in which:

B / C =

With the following criteria:

B / C> 1: Efficient

B / C = 1: Breakeven

B / C <1: Inefficient

1. economic efficiency

Economic efficiency is a product of technical efficiency and price efficiency. (Susantun, 2000, in Sutanto, 2005). So the economic efficiency can be achieved if both the efficiency is achieved so that it can be written as follows:

EE = ET.EH

Where :

EE = Efficiency Economies

ET = Efficiency Technical

EH = Efficiency Price (allocative)

1. **Findings and Discussion**

Technical Efficiency

Technical efficiency is a measure of the best production capabilities and optimal output that may be achieved from a variety of inputs and technologies used (Viswananthan et.al., 2003, in Sutanto, 2005). In this research, technical efficiency is measured by the program Data Envelopment Analysis (DEA) Version 2.1

The average results of the analysis of technical efficiency of fishing effort by handline fishing gear in detail can be seen in Table 1 below.

Table 1. Results of DEA analysis of the average technical efficiency handline fishing gear in the village Kayubulan.

Based on Table 1 above, of the 65 respondents were analyzed using a handline fishermen averaging DEA technical efficiency (ET) to INPUT_1 amounted to 2,557, INPUT_2 amounted 0427, INPUT_3 amounted 1115, INPUT_4 of 0126, INPUT_5 amounted 0051 and input_6 amounted 2622 and amounted to 0.064 input_7, This shows that the variable cost of supplies (INPUT_1), a variable number of trips (INPUT_3) and variable size already technically efficient machine that efficiency score above 1 or> 1. This may imply that as more supplies are brought on when at sea it will encourage more optimal fishing performance so it will get bigger catches. According to Aprilla et al (2013), the acquisition of catches can be further enhanced with the addition of the cost of supplies. In other words, there is always a chance to rearrange the combination and use of factors of production of the cost of supplies such as to obtain larger catches. With the proper supplies can drive more optimal crew performance, based on interviews of fishermen stated that the guarantee of all the requirements then their performance will be optimized.

The number of fishing operations and the size of the engine is also one of the factors that affect the catch. The more the number of fishing operations or the number of trips will increase larger catches and by regulating the engine size combination by following the size of the vessels used so that there is a balance and there will be no technical inefficiency. Based on a study by Iskandar and Thunder (2014), the number of fishing operations and reach a broader fishing area will provide opportunities for fishermen to obtain more catches. The greater size of the machine will be able to reach the desired area with a fishing ground further and faster so that the fishermen will get bigger catches.

Variable Fuel (INPUT_2), long trip (INPUT_4), the size of the boat (INPUT_5) and the number of crew members or fishermen (input_7) has not reached the score of technical efficiency (TE) or

inefficiency. This shows that there has been the use of factors of production that is less than optimal by handline fishermen in the village Kayubulan the arrest operation. In general, handline fishermen in the village Kayubulan limited use of fuel according to the fishing areas backfire because almost the average fisherman uses a range of catchment area far enough from the mainland this is what causes the variable fuel is not to score for efficiency. According to Sutanto (2005), the fuel is a factor of production is very important because without fuel boat cannot run and determine the extent to which the boat can reach the fishing ground.

Variable long trip or have not yet reached a negative effect of efficiency. This may imply that the number of catches is not determined by the length of time at sea. In general, handline fishermen in the village Kayubulan if already get enough results, or the average time at sea is already 2-6 hours/ trip then they will go back to the mainland because it carries sufficient fuel for the fishing operation time with bringing their catch. Variable size of the boat (INPUT_5) used by handline fishermen have not yet reached this matter because efficiency score handline fishermen in the village Kayubulan generally operate on a small scale and size of the boat is also small. Size handline fishing boats in the village Kayubulan range of 2-3 GT. According to Effendi (2018), there is no guarantee that the larger the ship, the more catches. It is theoretically shown that the large size of the ship will have implications for the range of fishing areas farther. Besides, factors which increasingly limited fish resources cause increasing vessel size does not necessarily have high efficiency.

The variable number of crew members (fishermen) is one of the variables that have not yet reached a score of efficiency,because handline fishermen in the village Kayubulan almost an average of only using manpower or the number of fishermen who sail a little. This may imply that the number of fishermen that more will not affect catches obtained at the time of the arrest operation. According to Aprilla et al (2013), the addition of the use of production factors can result in total production decreased, to achieve efficiency of the use of factors of production hence the need for a reduction in the use of the input powerboat engines, the number of crew on board, and the amount of light that can be efficient in obtaining catches. Reducing the use of engine power boats used can be adjusted to the size of the ship. In addition,the income of fishermen depend on operating costs in the arrest of a fishing trip and catch obtained.

Based on studies by Sulistyowati (2017), the time at sea and fishing experience ratio of 0, which means fishermen are not limited by time when it is getting the catch kept returning to the fishing ports to fuel more effectively. Experience is not required to fish for fishermen too long because the longer mean fishermen are old so that the energy is reduced. Therefore, it is necessary to use the appropriate input to obtain optimal catches.

Based on this research, technical efficiency handline fishing gear in the village Kayubulan can be seen in Figure 2.

Figure 2. Graph of technical efficiency handline fishing gear in the village Kayubulan

Based on Figure 7 the individual, the level of technical efficiency and technical inefficiency of the 65 ships that were analyzed were varied, namely between 0:41 to 0:50 and 0.91-0.99, Overall, it can be said that some handline fishermen still in inefficient use of inputs, for the production of fish.

The number of handline fishing boats which were analyzed in the village Kayubulan reached 65 boats. Of these 12 boats (18%) were efficient with a score of efficiency equal to 1, and 53 boats (82%) of them not efficient with less efficiency score of 1 for 5 boat (8%) had a score of efficiency of between 0.91 to 0 , 99, 12 boats (18%) had a high score from 0.81 to 0.90, 16 boats (25%) had a score of efficiency between 0.71 to 0.80, 12 boats (18%) had a score of efficiency between 0, 61 to 0.70, 7 boats (11%) had a score of efficiency of between 0.51 to 0.60, and the rest that one boat (2%) had a score of efficiency between 0.41 to 0.50.

According to Olii et al (2007), ships that have a percentage value below 70 efficiency requires a lot of improvement to achieve efficiency, while the value of the ship efficiency below 10% should not be used to carry out fishing activities. Technical efficiency handline fishing gear, mostly only reached 12 boats from 65 the number of boats. Thus the actual use of the handline fishing gear is not yet approaching the efficient use of inputs. While that inefficiency at 53 boats with an average score of efficiency that is 0788, Therefore, to increase the income of fishermen from fishing effort should fisherman uses inputs more efficiently.

In this regard the technical viability of fishing operations, fuel is an important factor for the mobilization of fishermen in exploring the fishing area. Adequate amount of fuel allows fishermen to achieve better capture site (Aprianto 2008 in Guntur, 2013).

Based on study by Azizah (2016), technical efficiency is calculated based fishing season, due to differences in the number of production factors. Based on the results the total value of the technical efficiency of the peak season, the season of transition, and the famine that has the highest efficiency value is a category 4 set net the submarine nets that carry 7 pieces of fishing equipment.

A study conducted by Olii et al (2007), indicated that the most efficient gear for the territorial waters of the southern coast of Gorontalo is the purse seine and fishing, while the gill net is a type of fishing gear that is not efficient so to consider its use in the future. This shows that in addition to purse seine and fishing, trawl fishing gear bag, gill nets and lift nets caused "excess capacity".

Gigentika et al (2016), stated that, tuna fishing activities in Kupang using troll lines, handline and pole and line, indicates that their area many of vessels are not efficient because of excessive use of production inputs. However, the ship that matches the size of ≤ 20 GT has been efficient in the use of fishing capacity and production inputs. Therefore, catching tuna in Kupang needs to increase production and reduced use of inputs.

Efficiency Price (allocative)

This can be interpreted as an attempt input use the smallest attempt to get as much the big production. If the value of B/C is smaller than the one it is not efficient. This situation indicates inefficient use of inputs, to be efficient, it needsreduced input use (Soekartawi 2003 in Sutanto, 2005).

Based on the results of the study, the average total monthly income and expenses in the Village Kayubulan handline fishermen can be seen in Table 2.

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No.	variables	ET
1	INPUT_1 (Cost Supplies)	2,557
2	INPUT_2 (BBM)	0427
3	INPUT_3 (Total Trip)	1115
4	INPUT_4 (Long Trip)	0126
5	INPUT_5 (boat size)	0051
6	Input_6 (Size Machine)	2,622
7	Input_7 (Total ABK)	0064

(Source: Primary Data Processed, 2018)

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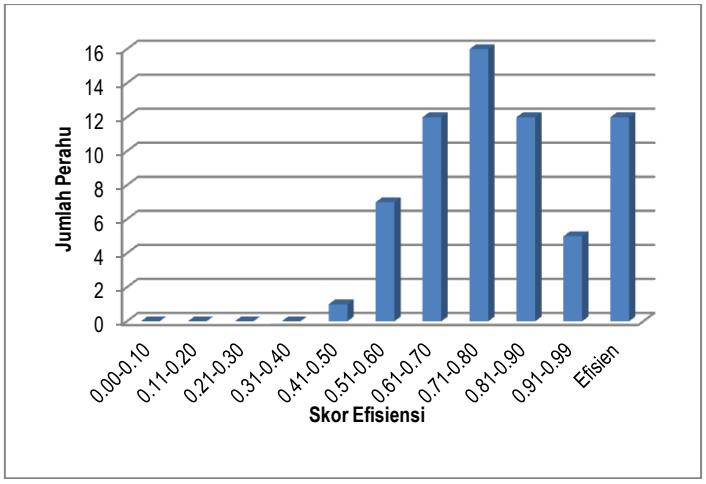

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Based on the results of the study, the average total monthly income and expenses in the Village Kayubulan handline fishermen can be seen in Table 2.

Table 2. Income and expenses monthly total handline fishing gear

No.	commentary	minimal	Maximum	Average
1	Income	1,500,000	11,500,000	6,306,154
2	Total costs	1,030,833	4,506,251	1,776,446
3	Fixed cost	130.833	2,239,583	389.053
4	variable costs	832.500	2,358,000	1,387,393
5	B / C			3,881

Table 2 The above shows that the income of the average monthly total of 65 analyzed handline fishing is Rp. 6,306,154 whereas the average total cost per month is Rp handline fishermen 1,776,446 the result of the average fixed cost per month handline fishing is Rp 389.053 and the average variable cost handline fishermen per month are Rp 1,387,393, Comparison between total revenue and total cost obtained the B / C ratio of 3,881. This proves that the fishing effort using handline fishing gear carried in the peak season in the village of allocative Kayubulan already efficient manner.

Based on this research, allocative efficiency (price) handline fishing gear in the village Kayubulan can be seen in Figure 3.

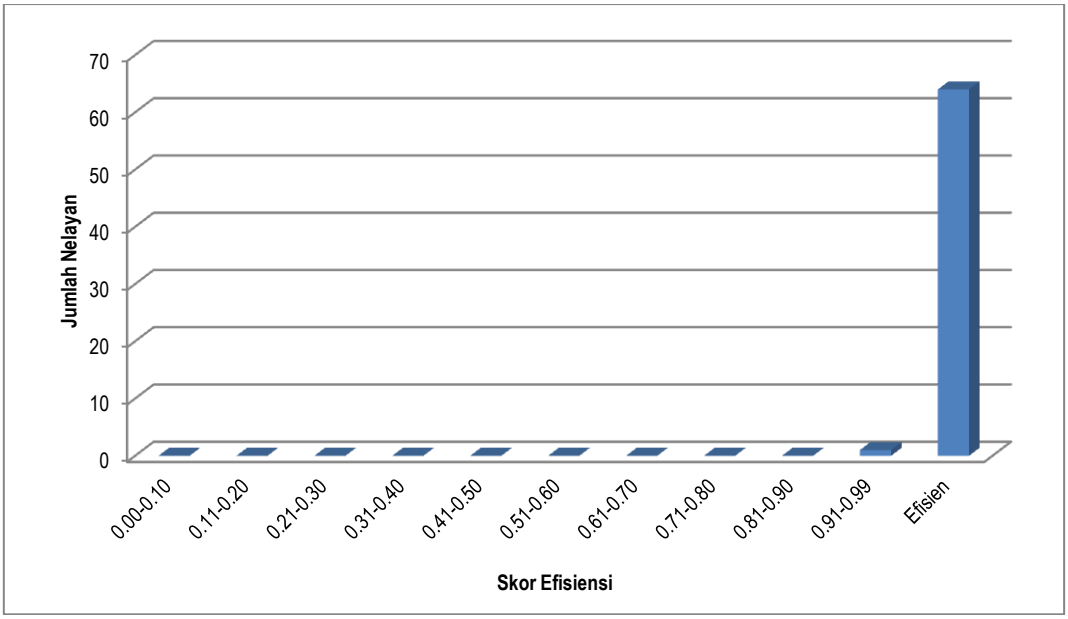

Figure 3. The allocative efficiency handline fishing gear in the village Kayubulan

Based on Figure 8 shows that individual, allocative efficiency rate (price) of the 65 respondents analyzed were varied, namely between 0.91-0.99, Overall, it can be said that part handline fishermen have been efficient in using inputs for the production of fish. Allocative efficiency (price) handline fishing gear, mostly at 97% of 65 respondents. Thus of the total 65 respondents on average use, handline fishing gear is already approaching the efficient use of inputs. While respondents inefficiency reaches 3% with an average score the efficiency is of3,881, Therefore, to increase the income of fishermen from fishing effort should fisherman uses inputs more efficiently. For more details can be found in Appendix 9.

Accordingto Digal et al (2017), factors that can affect the efficiency of fishing gear handline fishers use a model Tobit, it was found that the arrest operation, length of trip, number of crew, the cost of supplies, the cost of the radio, the fuel and the number of trips to significantly affect the efficiency of fishing gear handline.

According to Sukiyono and Romdhon (2016), increased efficiency should be more emphasis on increasing the number of catches and maintain the price stability of the fish. In other words, efforts to improve the allocative efficiency does not always have to do with the increase in the number of inputs used, but can also be done through efficiency-forming component itself. Specialized in fishery business, improving the allocative efficiency is through an increase in the number of catches to maintain the sustainability of marine fisheries.

According to Wardono (2013), changes in efficiency and scale efficiency change is a tool to drive efficiency improvement programs fishermen to steer decision-makers in determining priorities regarding fishing technology and fishing skills. Total factor productivity changes reflect changing technology level compared to the change in the level of efficiency.

Efficiency in the production process is of significant importance in the effort to increase revenue. If the efficiency of production carried out correctly it will encourage the use of production factors optimally, which in turn will provide the maximum benefit for the businesses. (Sutarni, 2013 in Mariani et al, 2013).

Economic efficiency

Economic efficiency is also a product of technical efficiency and price efficiency. Based on research, the average economic efficiency handline fishermen in the village Kayubulan can be seen in Table 3.

Table 3. Average economic efficiency handline fishing gear in the village Kayubulan

No.	commentary	Value
1	minimal	0966
2	Maximum	7663
3	Average	3091

(Source: Primary Data Processed, 2018)

Based on technical efficiency (ET) and the efficiency of the price / allocative (EH) then obtained an average economic efficiency (EE) fishing effort by using a handline fishing gear for 3091, Therefore, economic efficiency is greater than 1, it can be concluded handline fishing gears in the village Kayubulan already efficient, so that the average handline fishermen can already be said to be economically efficient to use a particular input. It is expected the efficient use of inputs that will produce the optimal fish catch.

Based on the results, scores of individual economic efficiency of handline fishing gear in the village Kayubulan can be seen in Figure 4.

Figure 4.

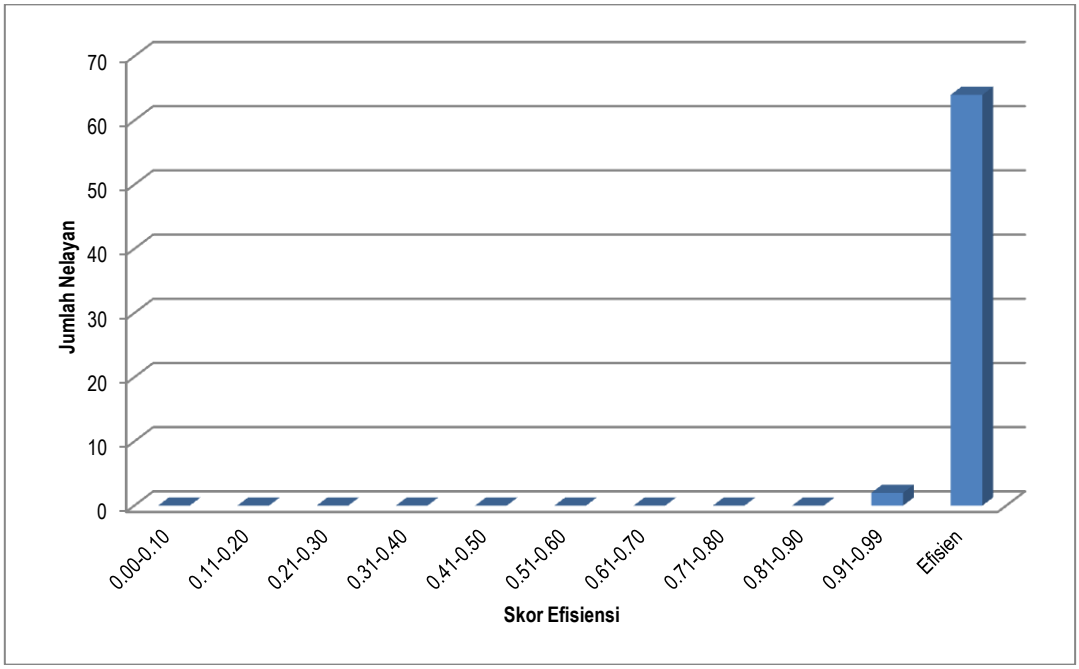

Figure 4. Economic efficiency handline fishermen in the village Kayubulan

Based on Figure 9 shows that the individual, the level of economic efficiency of 65 respondents analyzed were varied, namely between 0.91-0.99 are not efficiency or inefficiency, the use of production factors handline fishing gear fishing unit in the village of Kayubulan are in already economically efficient conditions, where the most value is greater than one with an average score of efficiency of3091, Overall, it can be said that part already efficient handline fishermen. For more details can be seen in appendix 10.

According to Aprilla (2013), this condition requires fishermen more careful in the use of production factors that affect the fishing effort of the catch that was obtained so that the achievement of economic efficiency. Another thing that affects the level of economic efficiency here in addition to the availability of fish resources is minimal in west season, also because fishermen can not reach the fishing areas further away, the fishermen just do fishing operations close to the beach and the cost of production factors arrest the price increases so that the pressing operating expenses arrest.

Overall efficiency gain can occur if the quality could be improved fishing-related mastery of technology that can provide clear guidelines for the presence of groups of fish waters. Operating cost management ability is also very influential arrest to allocate the existing fish resources effectively and efficiently which ultimately result from maximum output (Aprilla et al, 2013).

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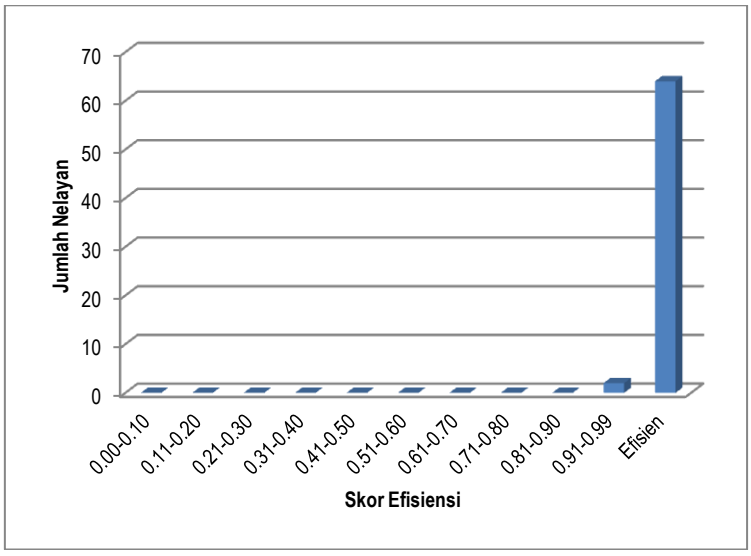

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Based on Figure 9 shows that the individual, the level of economic efficiency of 65 respondents analyzed were varied, namely between 0.91-0.99 are not efficiency or inefficiency, The use of production factors handline fishing gear fishing unit in the village of Kayubulan are in already economically efficient

conditions, where the most value is greater than one with an average score of efficiency of 3091, Overall, it can be said that part already efficient handline fishermen. For more details can be seen in appendix 10.

According Aprilla ddk (2013), this condition requires fishermen more careful in the use of production factors that affect the fishing effort of the catch that was obtained so that the achievement of economic efficiency. Another thing that affects the level of economic efficiency here in addition to the availability of fish resources is minimal in west season, also because fishermen can not reach the fishing areas further away, the fishermen just do fishing operations close to the beach and the cost of production factors arrest the price increases so that the pressing operating expenses arrest.

Overall efficiency gain can occur if the quality could be improved fishing-related mastery of technology that can provide clear guidelines for the presence of groups of fish waters. Operating cost management ability is also very influential arrest to allocate the existing fish resources effectively and efficiently which ultimately result from maximum output (Aprilla et al, 2013).

Conclusion

The results showed that the technical efficiency (ET) average value obtained was 0788 or <1, meaning that the handline fishing effort was technically inefficient. The average allocation /price efficiency (EH) obtained is 3,881 or> 1, catching with handline fishing gear has been efficient in the allocation and theaverage economic efficiency obtainedwith handline fishing gear is economically efficient.

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