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The Applied of *Cobb-Douglas* Production Function with Determinants Estimation of Small-Scale Fishermen's Catches Production

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Abstract

The production of catches of small-scale fishermen in the west coast of Barru District, South Sulawesi Province, Indonesia has fluctuated due to changes in the seasons each year. Changes in catch production have an impact on the household economy such as household income and consumption expenditure. This study aims to estimate the factors that influence the production of small-scale fishermen's catches. The analytical method used by *Cobb-Douglas* production function equation with the qualitative independent variable regression estimation model with *cross-section* data. The respondents were small scale outboard motorized fishermen with 69 longline fishing gear and the sample area was all sub-districts directly adjacent to the coastal area of Barru District. The results of the study found that the catch production of small-scale fishermen was influenced positively by the length of the sea, the strength of outboard engines, and differences in regional differences in area, then negatively affected by gasoline, recent education, and family dependents, while fishing gear, kerosene, and age of fishermen no significant effect. The use of fuel oil, such as gasoline and the Grosstonase-powered marine fleet, is needed to reach further fishing ground and fishing gear that is not destructive to the marine ecosystem and is environmentally friendly to increase catches needs to be considered by policy makers and stockholders to improve the welfare of small-scale fishermen.

Keywords: catches production, *Cobb-Douglas* production function, small-scale fishermen

INTRODUCTION

The production of small-scale catches of fishermen in the west coast area of Barru District, South Sulawesi Province, Indonesia has fluctuated due to changes in the fishing season and famine each year. Besides climate change (Mcowen *et al.,* 2015) also affects changes or fluctuations in catch production (Eggert and Tveteras, 2001) so that it impacts on the household economy (Israel *et. al.,* 2004), such as household income (Long and Yabe, 2011; Primyastanto, 2015) and consumption expenditure (Mukarrama *et al.,* 2010; Oladimeji, 2015).

Small-scale fisheries are small-scale fishermen (Andrew and Evans, 2009; Lopes and Begossi, 2011; Barnes-Mauthe *et al.*, 2013) or traditional fishermen (Al-Marshudi and Kotagama, 2006; Rahim and Hastuti, 2018) which are found in coastal areas (Rahim *et al.,* 2018) characterized as poor and marginalized (Asiedu *et al.*, 2013) which is pursued individually, where each owner has 1-2 units (Nelwan *et. al.*, 2015) using capture technology in the form of outboard engines (Ele and Nkang, 2014) and simple fishing gear (Retnowati, 2011). Whereas according to Law No. 45 of 2009 concerning fisheries in Indonesia that traditional fishermen are small fishermen with the largest size of vessels owned 5 grosstonase (GT).

Information about the production of catches of small-scale fishermen is very important given that most small-scale fishermen are found in coastal areas and are one of the main sources of income that is important for coastal communities in developing countries (Barnes-Mauthe *et al.*, 2013). But these small-scale fisheries support the livelihoods and well-being of more than 500 million people worldwide and as an important source of income in developing countries where millions of poor people live near the coast and almost 97% of the world's fishermen are (Pomeroy and Andrew, 2011; Barnes -Mauthe *et al.*, 2013). About 90% of 38 million people are classified as small-scale fishermen, and more than 100 million people are thought to be involved in small-scale post-harvest sectors (Allison and Ellis, 2001; Wardono, 2015).

Although part of economic development (Israel *et al.,* 2004), however, the level of welfare is still below other sectors and generally occupies the lowest strata compared to other communities on land (Wijayanti and Ihsannudin 2013), even as marginal groups (Asiedu *et al.*, 2013) because it is among the poorest groups (Rhoumah, 2016) in all countries with the attribute "*the poorest of poor*", ironically as many as 32.14% of the 16.42 million coastal communities in Indonesia still live below the poverty line with income indicator of US $ 1 per day (Muflikhati *et al.*, 2010) or with monthly per capita income of US $ 7-10 (Agunggunanto, 2011).

International fisheries policy through the Fisheries Committee (COFI) and Sub-committee is to support sustainable development and protection of small fisheries in context because small-scale fisheries produce two thirds of all catches targeted for direct human consumption and provide 90% of employment in this sector (Food and Agriculture Organizations, 2016), while the goal of fisheries development in Indonesia is to improve the welfare of fishermen, fish farmers and other coastal communities (Keputusan Menteri Kelautan dan Perikanan No.18/Men/2002) through the development of economic activities, improving the quality and quantity of human resources, strengthening socio-economic institutions, and utilizing marine and fisheries resources optimally and sustainably (Keputusan Menteri Kelautan dan Perikanan No.18/Men/2004).

Research on catch production in some of the world's marine waters with the Bioeconomic model (Maouel *et al.,* 2014) through the *Maximum Sustainable Yield* (MSY) and *Maximum Economic Yield* (MEY) approach with time-series data has been carried out such as MSY in France (Omori *et al.*, 2016; Helgesen *et al.*, 2018), in the waters of the sea of Omani (El-Barr, 2016), Sea Kaspia (Aliasghari *et al.*, 2017) and MEY in Norway (Diop *et al.*, 2018). In addition, fishing is also always dominated by fishermen who are *Grosstonase* (GT) motor boats with modern fishing gear, such as in Indonesia, *Bagan Rambo* fishing gear in the Java Sea (Wiyono and Hufiadi, 2014), *Purseine* fishing gear in Southeast Maluku (Picaulima, 2012) and Banyuwani Waters (Pratama *et al.,* 2016), Payang in Probolinggo (Rahman *et al.,* 2013), *fishing line* in Majene District (Nelwan *et al.,* 2015) and Southeast Sulawesi (Alimina *et al.,* 2016), and Cantrang in Tuban District (Aji *et al.,* 2013).

However, research on the determinants of the production of small-scale fishermen's catches with the power of outboard engines and *longline* fishing gear has never been done. This research uses *Cobb-Douglas* production function approach and qualitative independent variable regression estimation model with cross-section data. The purpose of this study is to determinan estimate the production of small-scale fishermen catches with the application *Cobb-Douglas* production function approach.

MATERIALS AND METHODS

This research was conducted on the west coast of Barru District, South Sulawesi Province, Indonesia. Based on the time dimension using cross-section data sourced from primary data. The sample of respondents was 69 small-scale fishermen outboard motor boats with sampling techniques, namely purposive random sampling.

Furthermore, the estimation of the production of catches of small-scale fishermen is proxied with the *Cobb-Douglas* production function. In general the production function describes the technical relationship from the transformation of inputs (resources) to output (commodities), which are mathematically written as follows (Debertin, 1986):

$$y = f\ (x) \qquad (1)$$

where, y is the output and x is the input. Before the *Cobb-Douglas* production function was introduced, the neoclassical production function is a function or equation that describes output as a function of two inputs, namely capital and labor as follows:

$$Q = f\ (K, L) \qquad (2)$$

where, Q is the output produced during a certain period; K is capital; and L is labor. Furthermore, the production function is widely used in empirical research called the *Cobb-Douglas* production function became famous after being introduced by *Paul Cobb* and *Charles Douglas* in 1928 through an article entitled "*A Theory of Production*" in the American Economic Review 18 scientific magazine (Debertin, 1986) with production function models as follows:

$$Q = AK^2L^2 \tag{3}$$

Cobb-Douglas production function has the assumption that the number of parameters is equal to one, namely $\alpha + \beta = 1$ so that this production function is a homogeneous one-degree or linear homogeneous production function. Can be proven as follows:

if $\alpha + \beta = 1$, then $\beta = 1 - \alpha$ (4)

so that

$$Q = AK^{\alpha}L^{1-\alpha} \tag{5}$$

If the input is enlarged so that it becomes the original tx input, then the output also becomes the original ty output, so that

$$Q = (tK, tL) = A\,(tK)^{\alpha}(tL)^{1-\alpha} \tag{6}$$

$$= A\ t^{\alpha}\,K^{\alpha}\,t^{1-\alpha}\,L^{1-\alpha} \tag{7}$$

$$= t\,A\,K^{\alpha}\,tL^{1-\alpha} \tag{8}$$

$$= t\,Q\,(K, L) \tag{9}$$

The distinctive feature of the *Cobb-Douglas* production function is that the parameters α and β which are output elasticities of each input are constant. If the *Cobb-Douglas* production function is included in the profit model the maximum or minimum cost will produce a constant elasticity of substitution and the value is always equal to one *(σ=1)* (Debertin, 1986). In the form of log-log or natural logarithms (Ln) the *Cobb-Douglas* production function becomes:

$$LnQ = LnA + \alpha\,LnK + \beta\,LnL \tag{10}$$

if $\alpha + \beta = 1$ then $\beta = 1 - \alpha$ (11)

so that

$$LnA = LnA + \alpha\,LnK + (1 - \alpha)\,LnL \tag{12}$$

$$LnQ = LnA + \alpha\ LnK - \alpha\ LnL + LnL \tag{13}$$

$$LnQ - LnL = LnA\ + \alpha\ (LnK - LnL) \tag{14}$$

$$LnQ/L\ = LnA + \alpha\ LnK/L \tag{15}$$

The equation (15) connects the average labor productivity $(Q/L)$with the ratio of capital and labor (KL). As already stated, the *Cobb-Douglas* production function has the assumption $\alpha\ +\ \beta\ =\ 1$, then:

$$Q\ = (tK, tL) = A\ (tK)^{\alpha}(tL)^{\beta} \tag{16}$$

$$= A\ t^{\alpha}K^{\alpha} + t^{\beta}L^{\beta} \tag{17}$$

$$= t^{(\alpha+\beta)}AK^{\alpha}L^{\beta} \tag{18}$$

$$= t^{(\alpha+\beta)}Q(K, L) \tag{19}$$

if $\alpha\ +\ \beta > 1$then the results of increasing returns to scale are obtained, if $\alpha\ +\ \beta < 1$, the results are decreasing return to scale. Furthermore, in general the mathematical function of the *Cobb-Douglas* production is a function or equation that involves two or more variables (independent variables and dependent variables) written like:

$$Y\ = \alpha X_1\beta^1,\ X_2\beta^2, \dots,\ X_i\beta^i, \dots,\ X_n\beta^n eu \tag{19}$$

If the Cobb-Douglas production function is expressed by the relationship Y and X, then equation (19) can be

$$Q\ = f(X_1, X_2, \dots, X_i, \dots, X_n\ ) \tag{20}$$

Where Y: the variable described; X: variable that explains; α: intercept / constant; β: regression coefficient; u: disturbance term; and e: natural logarithms. To facilitate the estimation of equation (19), the equation can be changed to multiple linear forms by means of the pressure in the form of a double log or natural logarithm (Ln) as follows:

$$LnY\ = Ln\alpha + \beta_1 LnX_1 +\ \beta_2 LnX_2 +, \dots, + \beta_i LnX_i +, \dots, +\ \beta_n LnX_n + v \tag{21}$$

Furthermore, determinant estimation of the production of catches of small-scale fishermen uses the econometric approach of qualitative independent variable estimation (Gujarati, and Porter, 2009), while the analysis method with the Cobb-Douglas production function equation or non-linear regression with exponential functions is shown as follows:

$$QSCOMF_i = \beta_0 \, QGsln_i^{\beta 1} \, QKrsn_i^{\beta 2} \, TFhsngF_i^{\beta 3} \, QLl_i^{\beta 4} \, OEPwr_i^{\beta 5} AgF_i^{\beta 6}$$

$$ExpF_i^{\beta 7} \, EdF_i^{\beta 8} \, QFR_i^{\beta 9} \, SdTR_i^{\delta 1} \, SddB_i^{\delta 2} \, SdSR_i^{\delta 3} \, SdBls_i^{\delta 6} {}^{\mu 1} \quad (22)$$

To facilitate the equation model calculation then the equation is converted to multiple linear by double log or natural logarithm (Ln) method as follows:

$$LnQSCMF_i = Ln\beta_0 + \beta_1 LnQGsln_i + \beta_2 LnQKrsn_i + \beta_3 LnTFhsng_i +$$

$$\beta_4 LnQLl_i + \beta_5 LnOEPwr_i + \beta_6 LnAgF_i + \beta_7 LnExpF_i$$

$$+ \beta_8 LnEdF_i + \beta_9 LnQFR_i + \delta_1 SdTR_i + \delta_2 SdB_i + \delta_3 SdSR_i$$

$$+ \delta_4 SdBls_i + \mu_1 \quad (23)$$

Where, $QSCMF$ is small-scale outboard motor fishermen catch production (kg), β_0 and β_{10} is interceps, $\beta_1,\ldots, \beta_8$ is coefficients of independent variable regression, δ_1, ..., δ_4 is coefficients dummy variable, $QGsln$ is gasoline (liter), $QKrsn$ is kerosone (liter), $TFshng$ is time of fishing (hour), QLl is quantity of longline unit (unit), $OEPwr$ is outboard engine power (power knot/PK), AgF is age of fisherman (year), $ExpF$ is experience as fisherman (year), EdF is formal education (year), QFR is family responsibility (people), *Dummy* Small-scale outboard motor fishermen regional differences; $SdTR$: 1, for are of Tanete Rilau Sub-district; 0, for the other, SdB : 1, for are of Barru Sub-district; 0, for the other, $SdSR$: 1, for are of Soppeng Riaja Sub-district; 0, for the other, $SdBls$: 1, for are of Balusu Sub-district; 0, for the other, μ_1 are *disturbance error*

RESULTS AND DISCUSSION

Geographically, Barru District is located between 4°05'49"- 4°47'35" and 119°35'00"-119°49'16" latitude (Figure 1), about 102 km from capital of South Sulawesi, Makassar City. This area covers 1.174,72 km^2 (contributed of 2.56% to South Sulawesi area). They are bordering to Pare-Pare City in the Northern part, Sidrap, Soppeng and Bone Districts in the Eastern part, Pangkep District in the Soutern part, and Makassar Strait in the Western part. Furthermore, they are contains of seven sub-District, including Tanete Riaja, Pujananting, Tanete Rilau, Barru, Soppeng Riaja, Balusu and Mallusetasi (Barru District Statistic Center, 2017).

Topographically, it has a fairly varied area consists of sea, lowland, and mountainous areas with heights between 100-500 meters above sea level. The area is located along the east of the district while the west, the topography of the region with height of 0-20 meters above sea level facing the Makassar Strait. This area has coastlines of about 78 km and covered by sandy beaches, mangroves, sea grass meadow, coral reefs, aquculture ponds, rice fields, settlement and tourism areas (Barru District Statistic Center, 2017).

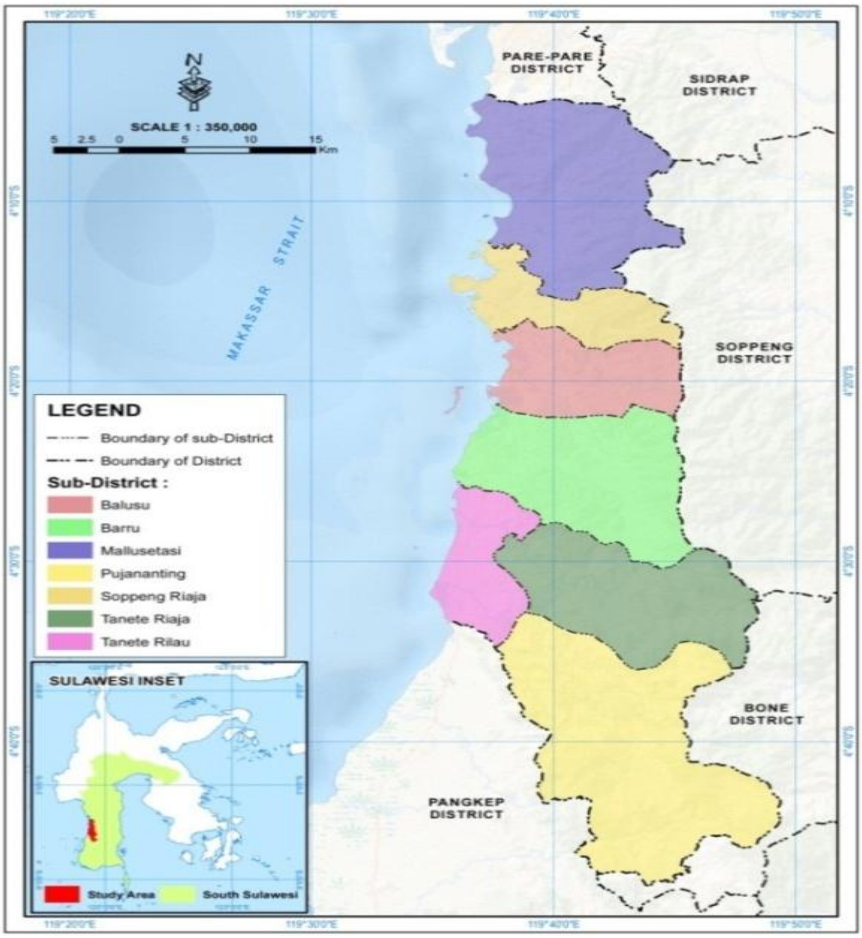

Figure. 1. Case Study Area: South Sulawesi Province, Indonesia

The estimation of the production determinations of small-scale fishermen's catches with the strength of outboard motors and longline fishing gear in the west coast area of Barru District used a qualitative independent econometric approach with the *Cobb-Douglas* production function. In addition, it also uses the measurement of the accuracy of the *adjusted* R^2 model, testing the hypothesis with the *F test* and *t test,* then testing the classical assumption of multicollinearity with the *variant inflation factor* (VIF) and heteroscedasticity with the *Park test.*

The results of the F test indicate that the estimated determinants or factors that influence the production of catches of outboard motor have a significant effect on the error rate of 1% (Table 1). This can be interpreted that all independent variables simultaneously have a significant influence on the production of catches of small-scale fishermen. Furthermore, the individual influence of each independent variable on the production of catches of small-scale fishermen uses the *t-test* (Table 1).

The relationship between the variable use of fuel oil (gasoline) as input for catching production per trip of small-scale fishermen outboard motor has a regression coefficient that has a negative and econometric significance effect on a 1% level error or 99%. Decrease in catch per trip of outboard motor fishermen in Barru Regency because the waters from their fishing area (Makassar Strait waters) are mostly used by 50 - 100 GT motorized outboard motors with *Bagan Rambo* and *Purseine* fishing gear, whose catch is certainly much more from the *longline* line used by outboard motor fishermen.

Table 1. Determinant Estimation of Small-Scale Fishermen Catch Production

Independent Variable	E.S	β_i	*t-test*	VIF	Coefficient *Park*
Gasoline	+	-0.026***	-3.297	1.940	3.754 ns
Kerosone	+	0.484 ns	1.306	8.195	5.028 ns
Time of fishing	+	0.992***	5.854	7.875	2.910 ns
Longline	+	-0.168 ns	-0.869	3.092	2.838 ns
Engine power	+	0.069**	1.967	7.082	0.001 ns
Fisherman age	-	0.771 ns	1.395	4.590	0.000 ns
Fisherman experience	+	-0.321 ns	-1.068	5.204	0.000 ns
Fisherman education	+	-0.051*	-1.702	1.219	0.005 ns
Responsiblity	+	-0.307**	-2.181	1.406	-0.005 ns
Dummy of Tanete Rilau	+	-0.009 ns	-0.029	6.035	0.000 ns
Dummy of Barru	+	0.105 ns	0.551	7.533	0.000 ns
Dummy of Soppeng Riaja	+	1.933***	-5.609	2.649	0.000 ns
Dummy of Balusu	+	-2.284***	-6.383	2.301	0.000 ns
Intercept					8.421
F-test					63.167
Adjusted R^2					0.873
n					69

*** = Significant on the level of 99 %. ** = Significant on the level of 95 %. * = Significant on the level of 90 %. ns = not significant, E.S. = Expected sign. F-test = 1 % (2,50); 5 % (1,92); 10 % (1,66). t-test = 1 % (3,012); 5 % (2,179); 10 % (1,782). If variant inflation factor (VIF) < 10, it meant there was not a Multicollinearity, but if VIF > 10 there was a Multicollinearity. if the value of β by using *Park test* not significant, therefore, there was not Heteroscedasticity. Instead, if the value of β by using *Park test* significant, there was Heteroscedasticity

The fishermen have to look for other marine waters that require large amounts of time and costs, such as the findings of Priyo (2015) in Sungai Kakap Sub-district, Kubu Raya District, on average fishermen use 50 GT motorized boats with 20 liters of fuel per trip. The findings of Tuli *et al.,* (2015) from the catch of *skipjack* in the waters of Pohuwato District, Gorontalo Province with the power of 100 GT motorboats, and the findings of Imanda *et. al.,* (2014) on Mini *Purse Seine* fishermen in Pekalongan Nusantara Fisheries Port between 120-180 *power knot* (PK).

This result is different from the findings of Rachman *et al.*, (2013) in Gili Ketapang, Probolinggo District, East Java and the findings of Wiyono and Hulfiadi (2014) in the Java Sea, each gasoline does not have a significant effect on fishermen's catches. Referring to the use of gasoline used by outboard motor fishermen in the West Coast Coastal Area of Barru District each time an average of 8.3 liters of fuel per catch trip.

Variables of fishing time for fishing as fishing activities for fishing boats in fishing have a positive influence on production of catches at an error rate of 1% (Table 1). This result occurred because on average the fishermen who came out sought fish for 14 hours to get the catch. This finding is in line with research Wiyono (2012) that the length of time of capture or duration of fishing operations has a positive influence on the catch of fishermen in Pekalongan, Central Java (Picaulima, 2012) findings in Southeast Maluku waters.

In addition, this finding is different from the study of Nelwan *et al.* (2015) that the productivity of fishing in Majene District waters using fishing lines shows a decreasing trend with increasing fishing time. This finding is further different from the findings of Pratama *et al.,* (2016) in Banyuwangi, East Java that the duration of the trip had a negative impact on catches, as well as the findings of Imanda *et al.,* (2014) in Pekalongan Fisheries Port with no significant production of catches.

In general, small-scale fishing hours are relatively short, usually one day catching up. Such conditions or habits will certainly have an impact on non-optimal catches, resulting in low income (Retnowati, 2011) because activities carried out on small-scale fisheries, to a certain extent have a correlation to reducing biomass, abundant fish resources, or size individual target fish (Wiyono, 2012).

The power of outboard engines as production inputs from capture technology has a positive and significant effect on the error rate of 1% of catches per trip (Table 1). This result is in line with the findings of Suryana *et al.*, (2013) in Prigi Water, Trenggalek District, that the higher the size of the engine power, the greater the costs used, which affects the production of the catch. The average power of small-scale outboard motors of fishermen in the West Coast Coast of Barru District fishing in the Makassar Strait waters is 6 PK with the highest outboard motor power of 7 PK and the lowest 3 PK. This result is different from motorboat fishermen in Probolinggo who use outboard engine power from 12-20 PK (Rachman et al., 2013).

Conversely, the characteristics of respondents such as formal education of small-scale fishermen boat outboard motors indirectly have a negative influence on the 10% error rate of catch production (Table 1). This result is different from the findings of Kadir and Sohor (2009) in Sabak waters Bernam, Selangor and Shettima et al., (2014) in

Nigeria that the higher the level of education the more catches are due to the innovations of the fishermen. Likewise, the number of family dependent variables as input of production indirectly has a negative and significant effect on catch production (Table 1) so that it can have an impact on business income. Increasing family dependence will increase the motivation of fishermen to make a living as family heads.

The difference in the fishing area of small-scale fishermen uses the *dummy* variables of each Soppeng Riaja District (influenced positively) and Balusu District (negatively affected) with an error rate of 1% and 10% (Table 1). The difference in the production of catches from small-scale fishermen in each sub-district / village in the west coast area of Barru District must have been explained by changes in the influence of each independent variable, such as longline fishing, gasoline, fishing time, outboard engine strength, and fisherman characteristics in the form of age of fishermen, length of time as fishermen, experience as fishermen, formal education of fishermen, and number of family dependents (Table 1) based on fishing time and season (Raodah, 2015; Tuli *et al.,* 2015). The coastal fishing community is a group of people living in coastal areas with a distinctive culture associated with their dependence on the use of coastal resources in economic activities (Fahrunnisa *et al.,* 2015) and having collective resource rights that provide benefits and efficiency from sustainable sources power available.

The variable *longline* fishing gear used by small-scale fishermen in Barru District does not significantly influence the catch production variable per trip. This can happen when motorboat fishermen catch with an average of only 12 units of fishing rods. The highest average catch per trip was obtained by small-scale fishermen from Balusu District and the lowest production in Tanete Rilau District. These results are in line with (Rafiqie, 2016) findings in the Madura Strait there are differences in catches using branch line distance, namely the basic long line fishing for demersal fishing such as a distance of 2 *depa* (1.8 m), 3 *depa* (2.7 m) and 4 *depa* (3.6 m). In addition to *longline* fishing, the catches of fishermen are also influenced by feed and operating time, such as the findings of *Kantun et al.,* (2014) in the Makassar strait waters that catch Makassar fishermen using squid to get groupers. fish with catching time day and night. Whereas the bait used by traditional fishermen in Barru District is *malalugis* with morning and evening operations.

Outboard motor fishermen in Barru District in catching fish in the Makassar Strait waters use an average number of longline capture units of only 12 units with outboard engine power on average 6 PK (3 - 7 PK) so that the duration of arrest is very small, that is on average 14 hours so that it can affect the catch. If this condition continues, the marketing of catches (Lubis *et al.*, 2012) and the income of small-scale fishermen is difficult to increase (Vijverberg *et al.,* 2016) so that it impacts on the household economy (Long and Yabe, 2011; Oladimeji *et al.,* 2015). This result is in line with that proposed by Gebremedhin *et al.,* (2013) that there is a significant income difference in Ethopia between fishermen using modern vessels and small-scale vessels.

In general, fishermen have a strong tendency to choose the same fishing gear and depend on changes in economic and biological conditions (Eggert and Tveteras, 2001) by developing it based on the calculation of the type and operation of fishing gear (Rodrigues and Andrade, 2006). Progress in capture technology can help fishermen increase their catch (Marzuki *et al.,* 2012), but the price of fishing gear is quite expensive so small-scale fishermen only use simple tools. It is different from strong capital fishermen who are able to have large fishing vessels and modern equipment, such as the *bagan rambo* and *purse seine*. The low ability of the fishing fleet with simple fishing gear used by small-scale fishermen also causes the capture of illegal fishing in various Indonesian waters due to over-exploitation and overcapacity of large fishing fleets throughout the world (Ritzau *et al.,* 2014), as in the case Nigerian waters (Ezenwaji *et al.,* 2014)

CONCLUSION AND SUGGESTION

The findings show that the estimation of factors influencing small scale fisherman production per trip with the *Cobb-Douglas* production function approach in the West Coast region of Barru District, South Sulawesi Province, is a positive influence, namely long sea fishing, outboard engine strength, and regional differences for Soppeng Riaja Sub-district, then negative influences are fuel oil, fishermen's last education, number of family dependents, and regional differences for Balusu Sub-district, while no significant effect is kerosene, fishing gear, age of fishermen, time of fishing, and regional differences for Sub-districts Tanete Rilau and Barru.

The fuel oil such as gasoline is needed to reach a further fishing ground to increase the catch of traditional fishermen in the West Coast Coast of Barru District, for the need to hold a fuel oil base around the coast to meet the fuel needs as well as the help of 12-20 outboard engines. PK and fleet with a strength of 20 - 30 GT so that the catch duration can reach 15 - 20 hours per trip.

The role of longline fishing gear needs to be increased in number to increase the production of the catch, for example 50-100 units through the help of a stocholder or local government. The fishing gear must not be destructive to the marine ecosystem and environmentally friendly in order to maintain the sustainability of the waters (technically easy to use, economically beneficial, and biologically not damage to the environment), for example the fishing rod used must be larger so that the catch fish is also large to preserve baby fish.

The variables of age, sea experience, formal education, and family dependency as the characteristics of respondents, although indirectly affect the catch production, but can have a direct impact on household income, for that stockholders need to pay attention to formal education in order to innovate. Furthermore, the difference in catch production from traditional fishermen in each sub-district / village in the west coast region of Barru District will certainly be different because there are differences in the use of the amount of fuel oil, the length of the sea fishing, the strength of the outboard engines, and the characteristics of respondents in each region. the local government must support the livelihoods of coastal fishermen in each region.

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