Potential and Management Strategy of Small Pelagic Resources in Tomini Gulf

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Abstract

The purpose of this study was to determine the potential and level of utilization and develop a strategy for developing the small pelagic fisheries resources in Tomini Gulf in Gorontalo Province. The method used in this study using a surplus production model from Schaefer and Fox and a study of the strategy of developing small pelagic fisheries resource using SWOT analysis. The results showed that the level of utilization of small pelagic fisheries resources in Tomini Gulf was still under fishing. Using the Schaefer model, an estimated Maximum Sustainable Yield (MSY) of 29.660 tons / year was obtained with an optimal effort of 4.8240 trips / year which was equivalent to 168 purse seiners. Using the Fox model, an estimated Maximum Sustainable Yield (MSY) of 24,300 tons / year was estimated with an optimal effort of 44,000 trips / year which is equivalent to 153 purse seiners. The main thing that needs to be done in the strategy of developing small pelagic fishery resource utilization in Tomini Gulf is to improve fishing operations by adding various types of fishing gear, so as to enable fishing to be more effective and intensive, increase added value of the catch so that fishermen can sell their catch to fish processing plants at best prices.

Keywords: Potential; management strategy; small pelagic; Tomini Gulf.

Introduction

The potential of marine fisheries including capture fisheries, marine aquaculture and marine biotechnology industry are huge assets for Indonesia's economic growth, but these assets have not been utilized to the fullest. The potential of Indonesian capture fisheries is estimated at 6.28 million tons per year with the number of permitted catches of 5.01 million tons or 80% of MSY (Maximum Sustainable Yield). The number of catches to date reached 3.50 million tons, leaving an opportunity of 1.50 million tons/year. The potential for capture fisheries is estimated to have an economic value of US $ 15.10 billion (Departemen Kelautan dan Perikanan, 2003).

Figure 1 South coast of Gorontalo Province on the gulf of Tomini

Fish resources are renewable biological resources but it can experience depletion or extinction, therefore need to be managed. Fish resources is limited by the carrying capacity of their habitat. Fish resources are known as common property resources which are prone to overfishing (Monintja, 2001).

In addition to the vastness of its sea and the great length of its coastline, Gorontalo Province also has the potential of capture fisheries based on WPP (Management and Utilization Areas) recognized nationally and internationally. Potential fisheries of Gorontalo Province are included in 2 (two) WPPs, namely: WPP715 (Tomini Gulf to Seram Sea) potential of capture fisheries: 595,630 tons per year; and WPP716 (Sea of Sulawesi up to North Pasific and Halamahera and Papua) Potential of Fishing Capture: 630,470 tons/year. Potential has already included the potential of fisheries in the EEZ region in the region.

If it is separated based on the potential of the EEZ region of the Sulawesi sea to the Pacific Ocean (the northern part of Papua) of 487,600 tons/year or 21.2% of the total potential of fisheries in the EEZ region of Indonesia which is 2.3 million tons.

Seeing the potential of existing resources, then surely fisheries management is a very important tool to maintain the sustainability of these resources. So,

the large potential of marine and fisheries resources is not necessarily without problems. The amount of potential is not balanced with optimal utilization to elevate the prosperity of the people. The issue of fishermen poverty, for example, has been a structural issue for a long time for the management of the maritime and fisheries sector. At the same time, the issue of the destruction of natural resources in fisheries and marine areas has also been long known, for example the symptoms of over-fishing in Indonesian waters and the level of pelagic fish resource utilization in the waters of Tomini Gulf is predicted to be suboptimal or still under fishing. To see the condition of pelagic fish resources in the waters of Tomini Gulf in the southern waters of Gorontalo in particular, it is necessary to conduct research that aims to study the stock and how the strategy for developing sustainable utilization of small pelagic fisheries resources in Tomini Gulf.

Research Methodology

This research was conducted for 3 (three) months from August to April 2018 in 5 districts/cities of Gorontalo Province. Primary data were obtained from interviews using a questionnaire while the secondary data were obtained from fisheries statistics reports of the last 13 years of the Gorontalo Province Fisheries and Maritime Affairs Office and the District/City Fisheries and Maritime Services of the province from 2005 to 2017.

Sampling is done by purposive sampling, where respondents are considered to have the ability to answer questions posed well and can understand the existing problems. Where to take samples of each fishing gear (trawl bag, trawl ring, gill nets and lift nets) the total number of fishermen in 5 districts as informants are 75 people. Besides that, 15 (fifteen) stakeholders including the head of the fisheries service, fishing gear sub-division, and fisheries service employees in each Gorontalo regency and province were made as informants, so that the total informants was 90 people.

Data analysis using Pelagic Fisheries Resource Utilization Analysis with surplus production methods from Schaefer (1954) and Fox (1970) to determine the maximum sustainable yield (MSY) and optimal efforts both for each district/city by compiling production data in units of weight (tons) and efforts to capture maximum sustainable yield (MSY) and optimal efforts both for each district / city by compiling production data in units of weight (tons) and efforts capture (effort) in units of trip in time series based on the type of fishing gear.

Then calculate catch per unit effort (CPUE), then standardize effort, and estimate Maximum Sustainable Yield (MSY). The study of the development strategy for the utilization of pelagic fisheries resources in the waters of Tomini Gulf was carried out using SWOT analysis (Fatimah, 2016) carried to asses the value of the problems faced by stakeholders. The greater the value, the more serious the problem that must be solved. The range of values is between 0 to 1. Then the magnitude of the rating is value to indicate the significance of the problems faced when viewed in terms of time. The more important an issue is to be resolved, the greater the rating. Rating values: 1, 2, 3 and 4. Then the score is calculated by multiplying the weight value by the rating value.

Result and Discussion

The catch per unit capture effort (CPUE) for each type of fishing gear in the waters of the Tomini Gulf waters is carried out in five districts / cities that border directly with these waters namely: Bone Bolango Regency, Gorontalo City, Gorontalo Regency, Boalemo Regency and Pohuwato Regency. The purpose of calculating CPUE per each fishing gear every year is to observe or see the trend in the ability of each fishing gear to catch small pelagic fish in Tomini Gulf.

Bone Bolango Regency

CPUE of fishing gear in Bone Bolango Regency was obtained by analyzing catch data, catching effort and catch per unit of catching effort (CPUE) of small pelagic fishing gear (Ikan Layang, Selar, Lemuru, Kembung, Layur, Teri, Japuh and Sunglir) from 2005 to 2017 (Dinas Perikanan dan Kelautan Provinsi Gorontalo. 2005-2017).

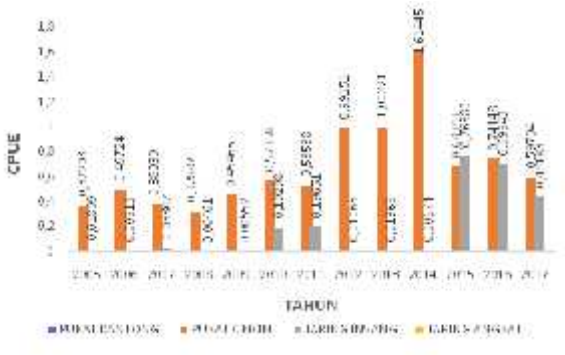


Figure 2 CPUE of pelagic fishing gears in Bone Bolango District

Figure 2 shows that the CPUE value of purse seine is greater than the gillnet from 2005 to 2014 and decreased in 2015. While the pocket trawler and lifting net did not produce at all. This shows that the capability of purse seine to catch small pelagic fish in the waters of Tomini Gulf is bigger than other fishing gears.

Gorontalo City

CPUE of fishing gear in Gorontalo City was obtained by analyzing catch data, catching effort and catch per unit of catching effort (CPUE) of small pelagic fishing gear (Ikan Layang, Selar, Lemuru, Kembung, Layur, Teri, Japuh and Sunglir) from 2005 to 2017 (Dinas Perikanan dan Kelautan Provinsi Gorontalo. 2005-2017).

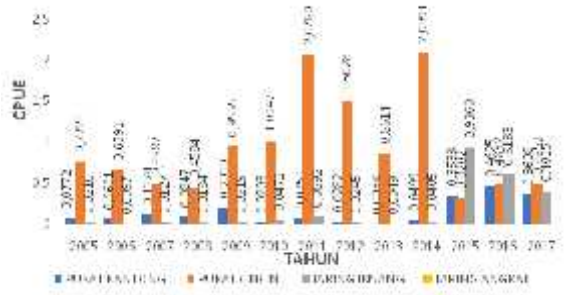


Figure 3 CPUE of pelagic fishing gears in Gorontalo City

Figure 3 shows that the CPUE of purse seine is bigger than the pocket trawl and the gill net. CPUE of purse seine has an upward trend starting in 2010, while pocket trawl and gill net are relatively stable until 2014 and rose in 2015. Besides purse seine starting in 2008, their capability experiences an upward trend. While lifting nets do not produce at all. This shows that the capability of purse seines to catch small pelagic fish in Tomini Gulf is greater compared to other fishing gears.

Gorontalo Regency

CPUE of fishing gear in Gorontalo City was obtained by analyzing catch data, catching effort and catch per unit of catching effort (CPUE) of small pelagic fishing gear (Ikan Layang, Selar, Lemuru, Kembung, Layur, Teri, Japuh and Sunglir) from 2005 to 2017 (Dinas Perikanan dan Kelautan Provinsi Gorontalo. 2005-2017).

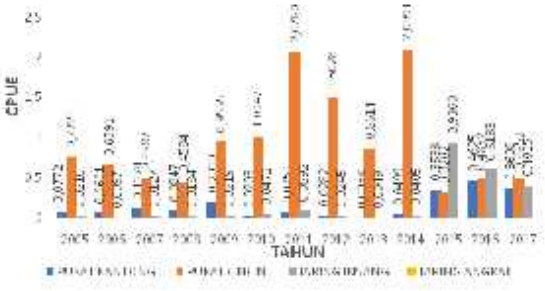


Figure 4 CPUE of pelagic fishing gears in Bone Bolango Regency

Figure 4 shows that CPUE of purse seiner is greater than pocket trawl and gill nets. Purse seine's CPUE experienced a downward trend starting in 2007, while pocket trawls and gill nets were relatively stable until 2014 and tended to increase in 2015. Besides purse seine starting in 2014, their capabilities experienced an upward trend. While lift nets do not produce at all. This shows that the capability of purse seine to catch pelagic fish in Tomini Gulf is greater than other fishing gear.

Boalemo Regency

CPUE of fishing gear in Boalemo Regency was obtained by analyzing catch data, catching effort and catch per unit of catching effort (CPUE) of small pelagic fishing gear (Ikan Layang, Selar, Lemuru, Kembung, Layur, Teri, Japuh and Sunglir) from 2005 to 2017 (Dinas Perikanan dan Kelautan Provinsi Gorontalo. 2005-2017).

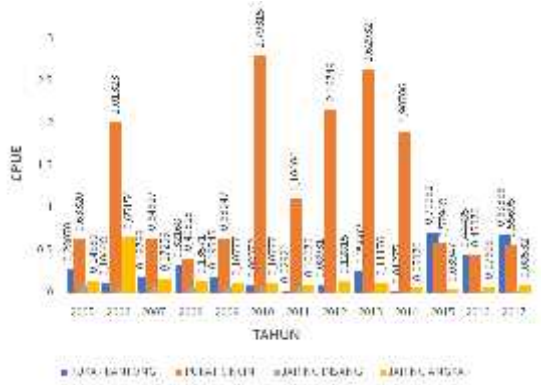


Figure 5 CPUE of pelagic fishing gears in Boalemo Regency

Figure 5 shows that CPUE purse seine is greater than pocket trawl, gill nets and lift nets. CPUE purse seine experienced a fluctuation in 2006, increased, then decreased in 2008, increased in 2010, decreased in 2011, increased again in 2012 and 2013 then decreased in 2014. Its capability fluctuated starting from 2006. While gill nets and lift

nets are relatively stable while pocket trawlers tend to increase in 2015. This shows that the capability of purse seine to catch small pelagic fish in Tomini Gulf is greater than other fishing gear.

Pohuwato Regency

CPUE of fishing gear in Pohuwato Regency was obtained by analyzing catch data, catching effort and catch per unit of catching effort (CPUE) of small pelagic fishing gear (Ikan Layang, Selar, Lemuru, Kembung, Layur, Teri, Japuh and Sunglir) from 2005 to 2017 (Dinas Perikanan dan Kelautan Provinsi Gorontalo. 2005-2017).

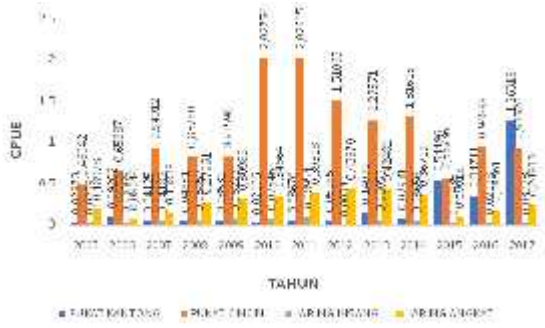


Figure 6 CPUE of pelagic fishing gears in Pohuwato Regency

Figure 6 shows that CPUE of purse seine is bigger than pocket trawl, gill net and lift net. CPUE purse seine experienced fluctuations in 2007 which increased, then decreased in 2008, increased in 2010 and decreased in 2011 to 2013 and rose again in 2014. While gill nets and lift nets are relatively stable. Whereas pocket trawl tends to rise starting in 2015. This shows that the ability of purse seine to catch pelagic fish in Tomini Gulf is greater than other fishing gear.

Provinsi Gorontalo

CPUE of fishing gear in Gorontalo Province was obtained by analyzing catch data, catching effort and catch per unit of catching effort (CPUE) of small pelagic fishing gear (Ikan Layang, Selar, Lemuru, Kembung, Layur, Teri, Japuh and Sunglir) from 2005 to 2017 (Dinas Perikanan dan Kelautan Provinsi Gorontalo. 2005-2017).

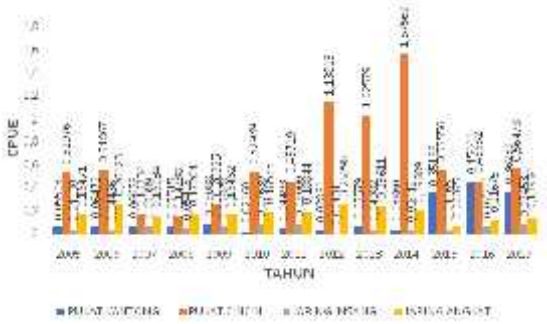


Figure 7 CPUE of pelagic fishing gears in Gorontalo Province

Figure 7 shows that the CPUE of the purse seine is greater than the pocket trawl, gill nets and lift nets. CPUE of purse seine experienced fluctuations in 2009 to 2010 has increased, then decreased in 2011, increased in 2012 and fell again in 2011. Then in 2012 tended to go up and down again in 2013 then up in 2014 and down again in 2015. While gill nets and lift nets are relatively stable. Whereas pocket trawl tends to rise starting in 2015. This shows that the capability of purse seine to catch small pelagic fish in Tomini Gulf is greater than other fishing gear.

Estimasi Maximum Sustainable Yield (MSY)

Determination of the Maximum Sustainable Yield (MSY) of small pelagic fishery resources in Tomini Gulf is done using the Schaefer and Fox formulations. Production data and capture effort of all regencies / cities are used to calculate MSY. Efforts to capture (trip) the entire fishing gear first standardized by making purse seine as a standard.

Model Schaefer

MSY estimation and optimal capture effort using the Schaefer (1954) formulation, namely CPUE = a - bE, yields the equation:

CPUE = 1,230 - 1,275e-05 E with R2 = 0.783, so that the estimated MSY and optimal capture effort can be calculated as follows:

$MSY = - a^2/4b = 29{,}660$ ton/year.

$E_{MSY} = E_{opt} = - a/2b = 4.8240$ trip/year.

Model Fox

MSY estimation and optimal capture effort using Fox (1970) formulation namely: Ln CPUE = a - bEt produced the equation:

Ln CPUE = 0,405 –2,27E with R^2 = 0,863, so that the estimated MSY and optimal capture effort can be calculated as follows:

MSY = - 1/b e $^{(a-1)}$ = 24.300 ton/year

E_{MSY} = E_{opt} = - 1/b = 44.000 trip/year

Utilization rate

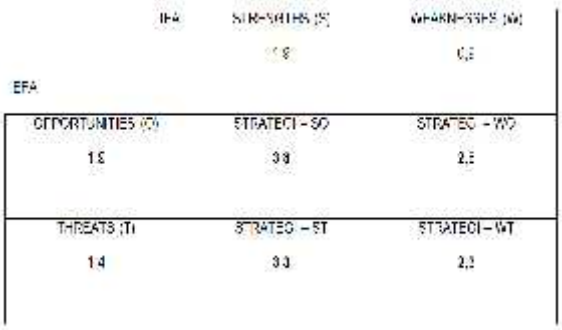
To find out the level of utilization of pelagic fishery resources in Tomini Gulf, a comparison between actual production and sustainable potential (MSY) is done using the Schaefer (1954) and Fox (1970) models. Development of the level of pelagic fishery resource utilization in Tomini Gulf from 2005 to 2017 can be seen in Figure 8.

Figure 8 Development of pelagic fisheries resource utilization level in tomini Gulf 2005 – 2017

Figure 8 shows that the level of pelagic fishery resource utilization in Tomini Gulf from 2005 - 2017 is still below the optimal level of utilization (under fishing) except in 2015 it has exceeded the optimal utilization level when calculated using Fox (1970) formulae.

Pelagic fisheries resource development strategy in Tomini Gulf

In order to prioritize the strategy to be carried out, the sum of the scores from each internal and external analysis (Fatimah, 2016) is summarized as shown in Figure 9. The score that has the highest value becomes the first priority and the one with the smallest score becomes the last.



EFA		
OPPORTUNITIES (O)	STRATEGI – SO	STRATEGI – WO
1.8	3.8	2.3
THREATS (T)	STRATEGI – ST	STRATEGI – WT
1.4	3.3	2.3

Figure 9 Strategy scores in SWOT analysis

Figure 9 shows that the sequence of strategies that will be run in a row are: SO Strategy, ST Strategy, WO Strategy and WT Strategy.

SO Strategy

The SO strategy consists of strategies to improve fishing operations and build fish processing plants to maintain the quality of pelagic fish.

The results of the analysis of the level of pelagic fishery resource utilization in Tomini Gulf show that the utilization is still under fishing, for that the strategy of increasing fishing operations is by increasing the type of fishing gear (multi gear), so as to enable more effective and intensive fishing efforts.

Building a fish processing factory needs to be done. With the existence of the fish processing industry, this can indirectly increase the added value of fish caught by fishermen, so that fishermen can sell their catch to the fish processing factory at the best price.

ST Strategy

The ST Strategy consists of a strategy of establishing a fisheries conservation area and regulating the fishing system. Strategies for maintaining sustainable fish resources by making protection of spawning, growing and foraging areas so that fisheries reproduction and stock can increase. Tomini Gulf waters in Gorontalo Province cover five regencies/cities with a fairly extensive fishing ground area.

To maintain the sustainability of pelagic fishery resources, it is necessary to regulate the fishing system. For example setting the time of capture, the number of gears and auxiliaries. This arrangement needs to consider the authority of each region in accordance with applicable regulations.

WO Strategy

The WO strategy consists of strategies to improve the quality of the catch and strengthen the institutional system of fishermen. The results of the sustainability analysis show that the attributes of processing before making a sale need attention, so that the added value of the economy can increase. The strategy to improve the quality of the catch can be done by, for example, increasing the number of ice factories and processing plants in several places in each district in Gorontalo Province.

The strategy of strengthening the institutional system of fishermen can be done by creating groups of fishermen with the same type of fishing gear in each district / city and the need for the establishment of a network to be able to mutually cooperate between fishing groups. This strategy aims to increase the bargaining position in marketing the catch. With the groups of fishermen working together to facilitate banking access. The formation of these fishing groups will make it easier to record catches so as to improve the capture fisheries statistics that are very useful for sustainable fisheries resource management.

WT Strategy

The WT strategy consists of increasing law enforcement and business diversification. The strategy of diversification of fisheries business that can be carried out is by providing or opening jobs, not just being a fisherman, for example providing employment to process fishery products or to become cultivators.

Law enforcement strategies that can be implemented are by providing legal counseling, monitoring and enforcement of illegal fishing practices and sanctions that can provide a deterrent effect so that the sustainability of fisheries resources can be guaranteed.

Conclusion and Suggestion

The cumulative level of utilization of pelagic fishery resources in Tomini Gulf in 5 (five) districts/ cities in Gorontalo Province is still under fishing. By using the Schaefer model an estimated Maximum Sustainable Yield (MSY) of 29,660 tons/year with an optimal effort of 4,8240 trips/year which is equivalent to 168 puse seiners. Using the Fox model an estimated Maximum Sustainable Yield (MSY) of 24,300 tons/year with an optimal effort of 44,000 trips/year which is equivalent to 153 purse seiner.

The main thing that needs to be done in the strategy of developing pelagic fisheries resource utilization in Tomini Gulf in Gorontalo Province is to improve fishing operations by increasing the type of fishing gear (multi gear), so as to enable more effective and intensive fishing efforts and build a fish processing factory. With the existence of the fish processing industry, it can indirectly increase the added value of fish caught by fishermen, where fishermen can sell their catch at the best price.

Research on the potential and level of utilization of pelagic fisheries resources in Tomini Gulf in Gorontalo Province uses a surplus production model that can estimate maximum sustainable catches (MSY), optimal efforts, utilization rates so that they can be used in formulating strategies for pelagic fisheries resource utilization. The study of strategies for developing pelagic fisheries resource use using SWOT analysis can determine several alternative strategies that can be used as the development of pelagic fisheries resource use. The utilization of pelagic fishery resources is still under fishing so to maintain its sustainability it is necessary to develop an integrated utilization of its resources by involving various stakeholders.

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