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Analysis of the Potential and Utilization Rate of Longtail Tuna (*Thunnus tonggol*) Landed at the Bungus Ocean Fishing Port (PPS), Padang City, West Sumatra Province

Analisis Potensi dan Tingkat Pemanfaatan Ikan Tuna Ekor Panjang (Thunnus tonggol) yang Mendarat di Pelabuhan Perikanan Samudera Bungus (PPS), Kota Padang, Provinsi Sumatera Barat

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Abstract

Fish resources have limits; therefore, it is necessary to carry out appropriate management so that resource utilization is sufficient for a long time. Areas used as fishing businesses need to know how the level of utilization. For this reason, clear information is needed on the potential and level of utilization of marine fisheries resources to support the management policy of tuna resources for optimal management and utilization and to prevent the reduction of fish stocks in the future. This research was conducted for three weeks in July 2023 at Bungus Ocean Fishing Port (PPS), Padang City, West Sumatra Province. The method used in this research is a survey method or direct review of the field. The maximum sustainable potential value was obtained at 572.36 tons with an optimum utilization effort value of 330 trips. The allowable catch of longtail tuna is 457.89 tons, with an average utilization rate of 97.41%. Based on the average value of the utilization rate obtained from 2018 to 2019, the number of allowable catches, and the MSY value, it is concluded that the longtail tuna caught by bagan boats and Tonda fishing rods at PPS Bungus has experienced overfishing. There is a need for more action and monitoring of the amount of catch obtained each year, as well as limiting the amount of catch allowed for each fisherman so that the utilization rate of longtail tuna can return to optimal catch and prevent overfishing and maintain fish stocks for the future.

Keywords: Potential, Utilization Rate, Tuna

Abstrak

Sumberdaya ikan memiliki batas; Oleh karena itu, perlu dilakukan pengelolaan yang tepat agar pemanfaatan sumber daya mencukupi dalam jangka waktu yang lama. Kawasan yang dijadikan usaha perikanan perlu mengetahui bagaimana tingkat pemanfaatannya. Untuk itu diperlukan informasi yang jelas mengenai potensi dan tingkat pemanfaatan sumber daya perikanan laut untuk mendukung kebijakan pengelolaan sumber daya tuna untuk pengelolaan dan pemanfaatan yang optimal serta untuk mencegah berkurangnya sediaan ikan di masa mendatang. Penelitian ini dilaksanakan selama tiga minggu pada bulan Juli 2023 di Pelabuhan Perikanan Samudera Bungus (PPS), Kota Padang, Provinsi Sumatera Barat. Metode yang digunakan dalam penelitian ini adalah metode survei atau tinjauan langsung ke lapangan. Nilai potensi lestari maksimum diperoleh sebesar 572,36 ton dengan nilai upaya pemanfaatan optimum sebanyak 330 kali perjalanan. Hasil tangkapan tuna ekor panjang yang diperbolehkan adalah 457,89 ton, dengan tingkat pemanfaatan rata-rata 97,41%. Berdasarkan

nilai rata-rata tingkat pemanfaatan yang diperoleh dari tahun 2018 hingga 2019, jumlah tangkapan yang diijinkan, dan nilai MSY, disimpulkan bahwa ikan tuna ekor panjang yang ditangkap oleh perahu bagan dan pancing Tonda di PPS Bungus telah mengalami penangkapan ikan yang berlebihan. Perlu adanya tindakan dan pemantauan lebih terhadap jumlah tangkapan yang diperoleh setiap tahunnya, serta membatasi jumlah hasil tangkapan yang diperbolehkan bagi setiap nelayan sehingga tingkat pemanfaatan tuna ekor panjang dapat kembali hasil tangkapan yang optimal dan mencegah penangkapan ikan yang berlebihan serta menjaga stok ikan untuk masa depan.

Kata kunci: Potensi, Tingkat Pemanfaatan, Ikan Tuna

1. Introduction

Port for Ocean Fishing (PPS) Bungus is one of the type A fishing ports, ideally situated to face the western Indian Ocean. It is a heavily industrialized location known for its specialization in fishing for tongkol, caklang, and tuna, which have grown to be the primary catch commodities. An increasing amount of resource utilization research is being done on recoverable resources, such as the marine and fishing industry (Nasir et al., 2012).

Fish resources are limited because they require careful management to ensure they are used to their full potential over an extended period. Three categories apply to the conditions of marine catch exploitation: exploited, ideally exploited but requiring beginning and overexploitation, underexploited, or capturing fish that are not entirely employed (Dahuri et al., 2008).

Indonesia has a significant fishing industry, among other things. It is necessary to determine how much each fishing area is exploited (Bramantya, 2013). One of the primary and in-demand catches of the Bungus PPS is crawfish. The tonda pancing and boat charts are the instruments used to catch stick fish in the PPS Bungus.

As a marine resource, crawfish are often shared, meaning that no one has the exclusive authority to manage or restrict the use of the resource by others. On the other hand, fishermen can catch more fish than permitted if fishing operations are not limited. Even if the quantity obtained does not surpass the viability of a fishery resource, irresponsible catching practices will compromise the ability of fishery resources to regenerate (Simbolon et al., 2011). To support a strategy of stalk fish resource management and ensure optimal management and exploitation, as well as to prevent future losses in fish stocks, this calls for clear information on the potential and level of utilization of marine fisheries resources. The longtail tuna (*Thunnus tonggol*) is one of the biggest fish that have been found in the PPS Bungus.

2. Material and Method

2.1. Time and Place

In July 2023, this study was carried out for three weeks at the Bungus Ocean Fishing Port (PPS) in Padang City, West Sumatra Province.

2.2. Methods

To conduct interviews with PPS employees and multiple fishermen, a survey approach, or direct review of the field, was employed in this study at the Bungus Ocean Fishing Port (PPS).

2.3. Procedures

Primary and secondary data were gathered throughout the study. Based on a few questions from the questionnaire, preliminary data was collected directly via interviews with pertinent individuals, including fishermen and employees of PPS Bungus. The intended respondents are boat Bagan and Tonda fishing rod fishermen because they are the ones who catch tuna in PPS Bungus. Interviews were done to find out about the quantity of catch, fishing effort, and fishing area. Next, secondary data acquired from the port include catch data, information on fishing boats and gear, trip data for Bagan boat and Tonda fishing rod operations, annual data, and monthly data.

2.4. Data Analysis

The statistical information from PPS Bungus, which includes information on the production of longtail tuna and fishing efforts over the previous five years, is what has to be examined. The CPUE calculation data is required to calculate the abundance index of the fish population in a given area and to ascertain the population's current status. As stated by Sparre & Venema (1999), the formula is as follows :

$$\text{CPUE}=\frac{\text{Catch year}_i}{\text{Capture attempt year}_i}$$

Description:
CPUE : Catch per effort
i : 1,2,3,.....n

Longtail tuna can be caught using a variety of fishing gear, including Bagan boats and Tonda fishing poles. Thus, figuring out how to standardize the gear is important: standardization or uniformizing fishing equipment performance. The fishing power of each type of gear varies. The sum (fishing effort) of each type, standardized by inserting the fishing power index (FPI) value, determines the total fishing effort with different kinds of fishing effort. The following formula is applied to effort standardization (Sparre & Venema, 1999):

$$\frac{\text{Catch}}{\text{Catch per effort}}=\text{effort}$$

If it is possible to estimate the total catch (by species) accurately or CPUE by species as well as the fishing effort over several years, the surplus production model (Schaefer and Fox) can be used. Next, a model is chosen because it is seen as the most sensible and representative of the real-world scenario. The value of the R^2 (coefficient of determination) indicates this. Because it indicates that variable x significantly impacts variable y, the model with the biggest R^2 should be used to analyze the data. Before analyzing the two models, it is necessary to mathematically find the parameters a and b with the formula Y = a + bx. Parameters a and b, according to Nugroho et al. (2007), can be found with the formula :

$$a=\frac{(\sum Y_i)(\sum X_i^2)-(\sum x_i)(\sum X_iY_i)}{n\sum X_i^2-(\sum X_i)^2} \qquad b=\frac{n\sum X_iY_i-(\sum X_i)(\sum Y_i)}{n\sum X_i^2-(\sum X_i)^2}$$

Description:
Y : dependent variable;
x : independent variable;
a : intercept;
b : slope;
xi : Capture effort in period-i;
yi : Catch per unit effort in period-i.

The calculation of the sustainable potential value (MSY) and optimum effort (fopt) using the Schaefer and Fox formula is as follows (Sparre & Venema, 1999)

(1) Model *Schaefer*
   a. The Schaefer equation model can be written as follows: $\frac{Y(i)}{f(i)}=a+b*f$
   b. The relationship between c and f is : $Y(i)=a*f(i)+b*f(i)^2$
   c. Sustainable potential value (MSY) at a stage of effort : $f_{MSY}=-0{,}5*\frac{a}{b}$
   d. The catch at the optimal effort stage is: $MSY=-0{,}25*\frac{a^2}{b}$

(2) Model *Fox*
   a. Fox's equation model can be written: $ln\left(\frac{Y(i)}{f(i)}\right)=c+d*f(i)$
   b. The relationship between c and f is : $\frac{Y(i)}{f(i)}=\exp(c+d*f)$
   c. The sustainable potential value is : $f_{MSY}=-\left(\frac{1}{d}\right)$
   d. The optimum effort value is $MSY=-\left(\frac{1}{d}\right)*\exp(c-1)$

Description :
Catch (c) : Total catch (kg);
Effort (f) : fishing effort (trip);
MSY : Maximum Sustainable Yield;
CPUE : Catch per effort (kg/trip).

After acquiring CMSY, the degree of exploitation of fish resources can be estimated. Subsequently, the computation involves dividing the total catch in a given year by the JTB value. JTB is calculated by multiplying 80% of MSY by MSY. The following formula can be used to determine a fishing resource's usage rate :

$$\text{TP}=\frac{\text{total catch}}{\text{MSY}}\times 100\%$$

The results of the MSY computation are displayed as a graph once the value has been determined. The y coordinate represents the amount of catch (tons/year), and the x coordinate represents the amount of fishing work (effort) (trip/year). Next, draw a curve on the graph to show where the MSY point is.

3. Result and Discussion

3.1. Longtail Tuna Production

Based on statistical data, the production of longtail tuna (*Thunnus tonggol*) increased in 2018 and 2019. However, there was a notable fall in production the following year until 2021, and then a moderate rebound in production in 2022.

Tabel 1. Longtail tuna (*Thunnus tonggol*) production

Year	Longtail tuna production (ton)
2018	700,63
2019	704,23
2020	470,25
2021	435,19
2022	477,45

Table 1 shows that throughout the last five years (2018–2022), the year with the highest production of longtail tuna was 2019 (704.23 tons), while the year with the lowest production was 2021 (435.19 tons).

3.2. Catch per Fishing Effort (CPUE)

Table 2 displays the findings of the CPUE computation for boat and Tonda fishing equipment for 2018–2022.

Table 2. Standardized CPUE rate of longtail tuna (*Thunnus tonggol*)

Year	Total catch (ton)	Standard effort (trip)	Standardized CPUE	ln CPUE
2018	700,63	224	3,13	1,14
2019	704,23	363	1,94	0,66
2020	470,25	257	1,83	0,60
2021	435,19	193	2,26	0,81
2022	477,45	403	1,18	0,17

Because the Bagan boat has the greatest average CPUE of 1.71 tons/trip compared to the average value of 1.15 tons/trip for trolling fishing gear, it is considered standard fishing gear. From 2018 to 2019, more effort was put forth to catch longtail tuna, and more were captured. But between 2020 and 2021, there was another decline in fishing effort and catch. The following year saw a slight increase in both fishing effort and catch.

3.3. Estimation of MSY Yield Value and Optimum effort (Fopt)

The maximum sustainable potential, or MSY, is the point at which fish resources can be used without endangering their sustainability and allowing the population to increase once more. By utilizing linear regression analysis to ascertain the values of a (intercept), b (slope), and R2 (coefficient of determination), the surplus production model to be employed is chosen. After obtaining the R2 values for the two models—the fox model being 0.61 and the Schaefer model being 0.54 the fox model will be utilized for additional study as it has the greatest R2. Figure 1 illustrates the link between catch and effort.

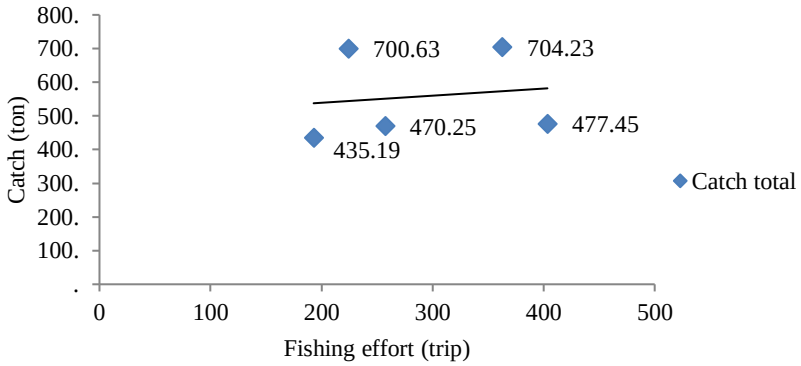

Figure 1. Relationship between catch and effort of longtail tuna (*Thunnus tonggol*)

The results, which are the MSY value of 572.36 tons and the fopt value of 330 trips, are obtained by doing computations to find the values of a and b. Figure 2 shows the MSY point graph using the Fox model.

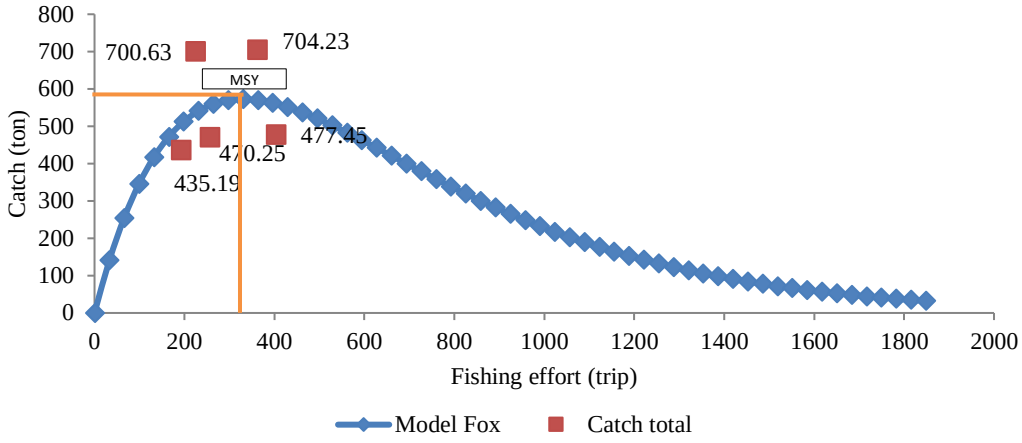

Figure 2. Fox model longtail tuna (*Thunnus tonggol*) resource

3.4. Utilization Rate

Based Table 3 displays the consumption rate of longtail tuna. The maximum sustainable potential (MSY) value of aquatic resources is only partially realized, at around 80% of their potential. 457.89 tons is the maximum amount of longtail tuna that can be caught.

Tabel 3. Utilization rate of longtail Tuna (*Thunnus tonggol*)

Year	Catch total	Utilization rate %
2018	700,63	122,41
2019	704,23	123,04
2020	470,25	82,16
2021	435,19	76,03
2022	477,45	83,42
Average	557,55	97,41

Table 3 shows that longtail tuna was overfished in 2018 and 2019, as evidenced by the catch exceeding the MSY value in those years. Additionally, based on Table 2's standard effort, longtail tuna can be considered overfished after 2019 because the catch, which tended to decrease, was unaffected by the effort fluctuations that occurred in the following year. However, from 2018 to 2022, the average longtail tuna capture and utilization rate will either be at the catch-intensive stage or already very close to overfishing.

4. Conclusions

This leads to the conclusion that there are indications of annual ups and downs or changes in the quantity of catches and fishing efforts. 572.36 tons is the maximum sustainable potential value, while 330 trips is the optimal usage effort value. *Thunnus tonggol*, the longtail tuna, has an authorized catch of 457.89 tons and an average utilization rate of 97.41%. Based on the number of authorized catches, the MSY value, and the average usage rate from 2018 to 2019, it is determined that overfishing has occurred in the longtail tuna taken at PPS Bungus using boat nets and tonda fishing rods.

5. Suggestion

After conducting this research, recommendations that can be made include increased action, close monitoring of the annual catch amount, and a catch limit per fisherman to restore the longtail tuna utilization rate to optimal fishing, avoid overfishing, and preserve fish stocks for the future.

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