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Potential and Utilization Rate of Indian Scad (*Decapterus russelli*) Landed at UPTD Fishery Port Region I, Carocok Tarusan, West Sumatra Province

Potensi dan Tingkat Pemanfaatan Ikan Layang (Decapterus russelli) yang Didaratkan di UPTD Pelabuhan Perikanan Wilayah I Carocok Tarusan Provinsi Sumatera Barat

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Abstract

The utilization of Indian scad (*Decapterus russelli*) in Carocok Tarusan has made an important contribution to fishing activities, but data on the potential and rate of utilization are limited. The research aims to determine the potential and level of utilization of indian scad (*Decapterus russelli*) landed at UPTD Fishery Port Region I, Carocok Tarusan, West Sumatra Province. The research was conducted in December 2024 using secondary data from the institution on catch and fishing efforts for 2019-2023. Methods used are Catch Per Unit Effort (CPUE) and surplus production models of Schaefer and Fox to estimate the maximum sustainable yield (MSY) and optimum fishing effort (f-optimum). According to the analysis results, the Fox model is the most suitable model to describe the stock status and management of indian scad in this region. MSY was estimated at 234,653.74 kg/year with an optimum effort of 1,902 trips/year. Total allowable Catch (TAC) was 187,722.99 kg/year. The average utilization rate was 97%, which shows that the Indian scad stock is fully exploited. Meanwhile, the average level of effort at 110% showing that fishing effort exceeds the optimum level, meaning that more careful management is needed to ensure the sustainability of the stock.

Keywords: *Decapterus russelli*, Indian scad, MSY, Sustainable potential

Abstrak

Pemanfaatan sumber daya ikan layang (*Decapterus russelli*) di Carocok Tarusan memiliki peran penting dalam mendukung kegiatan perikanan tangkap, namun data mengenai potensi dan tingkat pemanfaatannya masih terbatas. Penelitian ini bertujuan untuk mengetahui potensi dan tingkat pemanfaatan ikan layang (*Decapterus russelli*) yang didaratkan di UPTD Pelabuhan Perikanan Wilayah I Carocok Tarusan, Provinsi Sumatera Barat. Penelitian dilaksanakan pada Desember 2024 menggunakan data sekunder berupa hasil tangkapan dan upaya penangkapan tahunan selama periode 2019-2023 yang diperoleh dari instansi terkait. Metode yang digunakan adalah pendekatan *Catch Per Unit Effort* (CPUE) serta model surplus produksi Schaefer dan Fox untuk memperkirakan potensi maksimum lestari (*Maximum Sustainable Yield*/MSY) dan upaya penangkapan optimum (f-optimum). Berdasarkan hasil analisis, model Fox merupakan model yang paling sesuai untuk menggambarkan status stok dan pengelolaan ikan layang di wilayah ini. Nilai MSY yang diperoleh sebesar 234.653,74 kg/tahun dengan upaya optimum sebesar 1.902 trip/tahun. Jumlah tangkapan yang diperbolehkan

(TAC) ditetapkan sebesar 202.708,02 kg/tahun. Rata-rata tingkat pemanfaatan mencapai 97%, yang mengindikasikan bahwa sumber daya ikan layang berada pada kondisi *fully-exploited*. Sementara itu, tingkat pengupayaan rata-rata sebesar 110% menunjukkan adanya tekanan penangkapan yang melebihi batas optimum, sehingga diperlukan pengelolaan yang lebih hati-hati untuk menjaga keberlanjutan stok sumber daya ikan tersebut.

Kata kunci: *Decapterus russelli*, Ikan layang, MSY, Potensi lestari

1. Introduction

The utilization of marine resources in Indonesia has developed in various economic sectors, especially in the capture fisheries sector. Fishing is an activity aimed at obtaining a certain amount of catch. Fish resources are renewable, but this does not mean they are unlimited. If not managed sustainably, it can lead to a decline in fish stocks, causing detrimental implications for the existence of resources and potentially resulting in ecosystem damage (Desniarti, 2006).

South Pesisir Regency is a strategic area in the fisheries sector of West Sumatra. South Pesisir Regency is located along a coastline of 218 km. Its topography varies, including plains, hills, and mountains that are part of the Bukit Barisan range (Badan Pusat Statistik Kabupaten Pesisir Selatan). In this region, there is a Regional Technical Implementation Unit (UPTD) for the Carocok Tarusan Fishing Port, located in Ampang Pulai Village, Koto XI Tarusan District, which is one of the largest fish landing centers in West Sumatra and a center of activity for fishing groups in carrying out fishing activities and the loading and unloading of catches. The catch includes various pelagic fish species, such as Indian scad, mackerel, tuna, skipjack, anchovies, and other species. Fishing involves fishing gear such as bagan, tonda, payang, and gillnets (Prawira, 2024).

Among these catches, Indian scad (*Decapterus russelli*) is a dominant commodity with high economic value, widely consumed by the community, resulting in high consumer demand. Based on data from the 2016-2021 Annual Report of the Carocok Tarusan Region I Fishing Port, Indian scad production fluctuated between 167,550 kg and 277,502 kg. In 2016, it was recorded at 252,245 kg, in 2017 at 167,550 kg, 171,275 kg in 2018, 218,870 kg in 2019, 277,502 kg in 2020, and 187,975 kg in 2021. The highest production was recorded in 2020 at 277,502 kg, while the lowest was in 2017 at 167,550 kg.

The results of Pasaribu's (2024) research indicate that the sustainable potential of mackerel (*Restrelliger* sp.) in the Sibolga waters over a period of 6 years (2017-2022) is 337.59 tons/year with an average utilization rate of 43%, which is classified as moderate. Fuah's (2025) research states that the sustainable potential of red snapper (*Lutjanus malabaricus*) in the waters of Sibolga from 2018 to 2023 is 122.2 tons, which has exceeded the sustainable limit and is categorized as overfishing. Meanwhile, Prawira's (2024) research on skipjack tuna (*Katsuwonus pelamis*) in Carocok Tarusan over 5 years (2018-2022) shows an MSY of 120,014.8 kg/year with an average utilization rate of 61.82%, classified as moderate.

Based on several previous studies, there is potential for further research related to the potential and level of utilization of Indian scad at Carocok Tarusan Port. Data on the potential and level of utilization of Indian scad at Carocok Tarusan Port is still limited and has not been comprehensively documented. Thus, a study of the potential and level of utilization of Indian scad is needed to make fisheries management policies so that its utilization remains within sustainable limits.

2. Material and Method

2.1. Time and Place

This research was conducted in December 2024 at the Regional Fisheries Port Technical Implementation Unit (UPTD) I Carocok Tarusan, West Sumatra Province. The location map of the research can be seen in Figure 1.

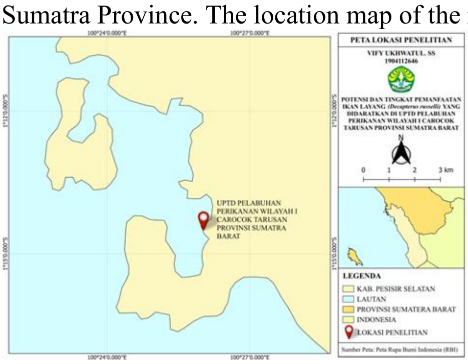

Figure 1. Research location map

2.2. Methods

The research method used was a survey conducted directly in the field. Sampling in this study was carried out using purposive sampling, which is non-random sampling where researchers deliberately chose to collect data on specific groups of fishermen to obtain information related to Indian scad catching. The criteria for respondents were active fishermen who landed Indian scad at the Carocok Tarusan Regional Fisheries Port Technical Implementation Unit (UPTD).

2.3. Data Analysis

2.3.1. CPUE (Catch per Unit Effort)

CPUE calculations aim to determine the abundance and level of fishery utilization based on the division of total catch and fishing effort. Based on Sparre & Venema (1998), the equation used to calculate CPUE is as follows:

$$CPUE=\frac{Catch}{Effort}$$

Information:

CPUE = Catch per Unit Effort (kg/trip)
Catch = Catch total (kg)
Effort = Effort total (trip)

2.3.2. Production Surplus Model

Two production surplus models can be used to analyze sustainable potential: the Schaefer and Fox (Sparre & Venema, 1998). The simple linear regression equation formula used is as follows:

$$Y = a+b(x)$$

Next, the values of the intercept (a) and slope (b) parameters can be calculated using the following equations:

$$b = \frac{\sum x(i)*y(i)-\frac{1}{n}*\sum x(i)*\sum y(i)}{\sum x(i)^2-\frac{1}{n}(\sum x(i))^2} \qquad a = \bar{y}-\bar{x}*b$$

Analysis of Maximum Sustainable Yield (MSY), Optimum Fishing Effort (F-Opt), and Total Allowable Catch (TAC) in the Schaefer model according to Sparre & Venema, 1998, using the following equation:

$$MSY = -0{,}25\frac{a^2}{b} \qquad F\text{-}Opt = -0{,}5\frac{a}{b} \qquad TAC = 80\%\ MSY$$

The equation in the Fox model was obtained using natural logarithm (LN) regression, with effort set as x and CPUE set as y (Sparre & Venema, 1998).

$$MSY = -(\frac{1}{d})\exp(c-1) \qquad F\text{-}Opt = -\frac{1}{d} \qquad TAC = 80\%\ MSY:$$

2.3.3. Utilization Rate and Effort Rate

Estimates of utilization and exploitation rates were made to determine the extent of utilization and fishing effort for Indian scad resources landed at the Carocok Region I Fisheries Port Technical Implementation Unit (UPTD). Utilization is calculated as a percentage based on the catch amount using the MSY value (Latuconsina, 2010), while exploitation is calculated as a percentage based on the total effort using the F-Optimum value.

$$UR_c=\frac{c_i}{MSY}\ 100\% \qquad ER_f=\frac{f_i}{F\text{-}Opt}\ 100\%$$

3. Result and Discussion

3.1. Bagan Boat

Bagan boats are fishing fleets that land fish and record their catch at the Carocok Tarusan Regional Fishing Port I. Bagan boats vary in size from 5 to 30 GT. Bagan boats weighing 5–30 GT are grouped into three fleets: small (5–10 GT), medium (10–20 GT), and large (20–30 GT). The number of fishing boats operating from 2019 to 2023 can be seen in Table 1. In 2019, there were 193 boats, increasing to 249 in 2020. The number of fishing boats decreased to 152 in 2021, then 134 vessels in 2022. In 2023, there was an increase to 148 vessels.

A buoyancy device, such as a plastic drum, is used to maintain stability and prevent the entire body of the cage from sinking. For one cage unit, typically between 4 and 6 plastic drums are used, which are placed on both sides of the cage. Farmers construct a wooden bridge to reach the cage to provide food and for other needs. Cages for raising hoven carp and tapah in this village have various sizes, such as 8 × 3 × 1.8 m, 10 × 3 × 1.8 m, and 12 × 3 × 1.8 m. Farmers can obtain it at an average price of IDR22,590,909 per cage unit for hoven carp, while the average cost per cage unit for tapah is IDR 24,375,000/m³. In conducting fisheries cultivation, especially for hoven carp, the availability of high-quality seeds is crucial for achieving high production yields. The average cost of seeds incurred by hoven carp fish farmers in Ranah Village is presented in Table 1.

The increase in the number of bagan boats from 193 units (2019) to 249 units (2020) was due to high demand for fish and increased fishing activity. Factors affecting pelagic catch include high fish prices, market demand, fishing season, fishing gear selectivity, and other technical factors (Saimona, 2021). The decline to 152 units

(2021) was influenced by new regulations from the port authorities and the impact of COVID-19. The regulation stipulates that sailing permits are only issued for fishing boats with a size of 30 GT and below, while boats above 30 GT are required to apply for departure permits through an official platform provided by the Ministry of Marine Affairs and Fisheries. The COVID-19 pandemic has caused limitations on fishing activities, mobility restrictions, and reduced vessel operations, decreasing the number of active fishing gears.

Table 1. Number of fishing gear per bagan boat

No	Year	Number of fishing gear per Bagan Boat (unit)
1	2019	193
2	2020	249
3	2021	152
4	2022	134
5	2023	148

3.2. Fishing Ground

Based on interviews with fishermen, seven fishing locations for Indian scad (*Decapterus russelli*) were identified. Based on the location descriptions, coordinate predictions were determined using Google Earth and validated with information from fishermen to ensure accuracy. The validation results showed that all locations were in the waters of West Sumatra. Fishing by Carocok Tarusan fishermen is administratively located in WPPNRI 572, which covers the Indian Ocean waters of Western Sumatra and the Sunda Strait. The coordinates of fishing gear operations are presented in Table 2.

Table 2. Fishing grounds in Carocok Tarusan

No	Coastal Waters	East Longitude	South Latitude
1	Nyamuk Island Waters	100°18'36.62" E	1°16'19.21" S
2	Mentawai Island Waters	99°24'44.48" E	1°36'25.77" S
3	Aua Island Waters	100°29'07.08" E	1°22'46.13" S
4	Marak Island Waters	100°19'44.26" E	1°11'11.61" S
5	Kumbang Island Waters	100°25'43.52" E	1°18'33.31" S
6	Panyu Island Waters	100°27'15.08" E	1°30'35.10" S
7	Simangkih Island Waters	100°31'34.73" E	1°20'30.16" S

The fishing grounds in Carocok Tarusan are divided into several zones based on boat size and operational distance. Fishing grounds are areas of water where target fish can be caught optimally, using fishing gear that can be operated effectively and is economically profitable (Nusantara, 2014). The fishing grounds in Carocok Tarusan are located around West Sumatra. The determination of the area still relies on traditional methods based on instinct or experience. Factors such as the phase of the moon, rainfall patterns, and seasons also influence the fishing location. The furthest fishing grounds, namely the waters of Mentawai Island, are reached by large vessels due to their ability to travel longer distances and carry more catch. Medium and small vessels operate around the port, mainly in the waters of Nyamuk Island, Aua Island, Marak Island, Kumbang Island, Panyu Island, and Simangkih Island. Salmarika et al. (2022) state that the fleet's size significantly influences the size of the fishing area. The larger the fleet, the farther the range; conversely, small fleets can only reach areas close to the fishing base or coast.

3.3. Indian scad Catch production

Indian scad production at Carocok Tarusan Fishing Port has fluctuated annually over the last five years (2019 to 2023). The fluctuating conditions of Indian scad catch production are presented in Table 3.

Table 3. Indian scad catch production

No	Year	Catch (kg)
1	2019	218,870
2	2020	277,502
3	2021	187,975
4	2022	168,921
5	2023	288,793
Total		1,142,061
Average		228,412

Based on Table 3, Indian scad catch production fluctuated from 2019 to 2023. In 2019, the catch was 218,870 kg, in 2020 it increased by 58,632 kg, in 2021 it decreased to 187,975 kg, and in 2022 it decreased again to 168,921 kg. The highest peak occurred in 2023 at 288,793 kg. The increase in production in 2020 was due to abundant stocks and high fishing effort. The lowest yield was in 2022 due to a reduction in the fishing fleet, which decreased fishing effort. Production levels are influenced by stock abundance, fishing effort, and seasonal factors. Indian scad yields tend to be abundant during the peak season and decline during the lean season. According to Ardilla (2023), fish production fluctuates due to the fishing season, weather, and fishing effort. The peak season is from July to November, while the lean season is from December to February. The graph pattern shows that high CPUE reflects abundant resources, while a decline in CPUE indicates fishing pressure or unfavorable environmental conditions.

3.4. *Indian Scad Fishing Efforts*

Indian scad (*Decapterus russelli*) catches at Carocok Tarusan Fishing Port Region I fluctuated annually from 2019 to 2023. This data is shown in Table 4. Fishing efforts peaked in 2021 with 2,798 trips, while the lowest number of trips occurred in 2023 with 1,343 trips. The decline in fishing efforts in 2022 and 2023 resulted from a reduction in the bagan boat fleet.

Table 4. Indian scad fishing efforts

No	Year	Fishing Effort (trip)
1	2019	2,286
2	2020	2,607
3	2021	2,798
4	2022	1,459
5	2023	1,343
Total		10,493
Average		2,099

According to Suwarni (2020), a decrease in fishing effort in a given year is not always accompanied by an increase in catch, and vice versa. This indicates that an increase in fishing effort is not the only factor affecting catch; it is also influenced by various other factors, such as environmental changes that affect fish abundance. Many fishing trips can potentially increase catch results, but catch results may decline if optimal marine environmental conditions are not supported. Changes in the marine environment also affect the availability and abundance of fish resources (Masturah, 2014).

3.5. *CPUE and LN-CPUE*

CPUE and Ln-CPUE values indicate the abundance of Indian scad in the Carocok Tarusan area. CPUE and LnCPUE values are used as indices to assess the abundance of a fish species in the waters; any change in the CPUE value will reflect changes in fish stocks (Sadiyah et al., 2012). The CPUE and LN-CPUE values for Indian scad are presented in Table 5

Table 5. CPUE and LN-CPUE values for Indian scad

No	Year	Catch (kg)	Effort (trip)	CPUE (kg/trip)	Ln-CPUE
1	2019	218,870	2,286	95.744	4.562
2	2020	277,502	2,607	106.445	4.668
3	2021	187,975	2,798	67.182	4.207
4	2022	168,921	1,459	115.779	4.752
5	2023	288,793	1,343	215.036	5.371
Total		1,142,061	10,493	600.185	23.559
Average		228,412	2,099	120.037	4.712

Based on Table 5, CPUE and Ln-CPUE of Indian scad over the past five years show a fluctuating pattern. The highest value was recorded in 2023, while the lowest was in 2021. The high CPUE in 2023 was due to the abundance of fish stocks in the fishing area. In 2021, the utilization of Indian scad was very low, as reflected in the small CPUE value, which was caused by high fishing effort but no increase in yield. These results align with Nugraha (2012), who stated that an increase in effort without an increase in catch causes a decrease in CPUE. The decline in CPUE indicates that the utilization of Indian scad has been high. Fish stock biomass is a limited resource utilized by vessels, so with increased vessels, the catch distribution per vessel becomes smaller (Sparre & Venema, 1998).

3.6. *Maximum Sustainable Yield (MSY) and Optimum Effort (F-Opt)*

Figures 3 and 4 show the relationship between CPUE and effort in the Schaefer and Fox models. The Schaefer model (Figure 3) produces the equation CPUE(Y) = -0.0666(X)Trip + 259.91. This equation shows that the intercept (a) of 259.91 indicates that if there is no fishing effort (trip = 0), the potential Indian scad available in nature is still 259.91 kg/trip. Meanwhile, the slope (b) of -0.0666 indicates a negative relationship, meaning that each additional fishing trip will decrease the CPUE value by 0.0666 kg/trip. The coefficient of determination R^2 = 0.6209 or 62.09% indicates that 62.09% of CPUE fluctuations are influenced by effort, while the remaining 37.91% are influenced by other factors not discussed in this study. The correlation coefficient (r) is 0.787969, meaning that CPUE and effort have a “strong” relationship.

The Fox model (Figure 4) produces the equation LN-CPUE(Y) = -0.0005(X)Trip + 5.8152. This equation shows that the intercept (c) value of 5.8152 indicates that if there is no fishing effort (trip = 0), the potential Indian scad available in nature is still 5.8152 kg/trip. Meanwhile, the slope (d) value of -0.0005 indicates a negative relationship, meaning that every additional one-trip fishing effort will decrease the CPUE value by 0.0005 kg/trip.

The coefficient of determination R^2 = 0.6817 or 68.17% indicates that 68.17% of CPUE fluctuations are influenced by effort, while the remaining 31.83% are influenced by other factors not discussed in this study. The correlation coefficient (r) is 0.825675, meaning that LN-CPUE and effort have a "very strong" relationship

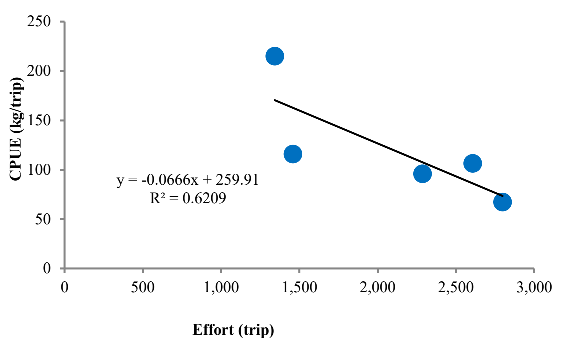

Figure 3. Relationship between CPUE and Effort Indian scad Schaefer Model

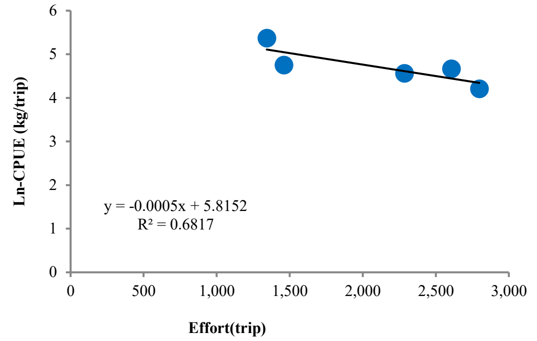

Figure 4. Relationship between LN-CPUE and Effort Indian scad Fox Model

According to Sugiyono (2017), the correlation coefficient is a value that describes the strength of the relationship between two variables. The interpretation of the correlation coefficient is as follows: a very low relationship is in the range of 0.00-0.199; a low relationship is in the range of 0.20-0.399; a moderate relationship is in the range of 0.40-0.599; a strong relationship is in the range of 0.60-0.799; and a very strong relationship is in the range of 0.80-1.00.

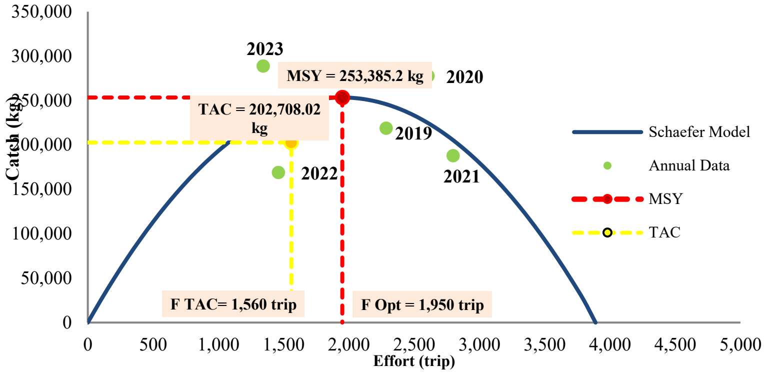

Figure 5. Schaefer model MSY

Based on Figure 5, the estimation of the maximum sustainable yield of Indian scad in the Schaefer model shows that the maximum sustainable yield (MSY) of Indian scad is 253,385 kg/year, and the optimum effort is 1,950 trips. Data from 2020 and 2023 show that catch and fishing effort have exceeded the maximum sustainable yield (MSY) limit. Conversely 2019, 2021, and 2022, catch and fishing efforts were still below the maximum sustainable yield (MSY) limit. The total allowable Catch (TAC) is 202,708.02 kg/year.

According to Listiyani (2017), sustainable potential is a reference in fisheries resource management that allows exploitation without reducing fish numbers, to maintain fish stocks at sustainable levels. According to Desniarti (2006), optimal effort is the amount of fishing effort that allows the fishing fleet to obtain maximum catch without damaging the sustainability of resources.

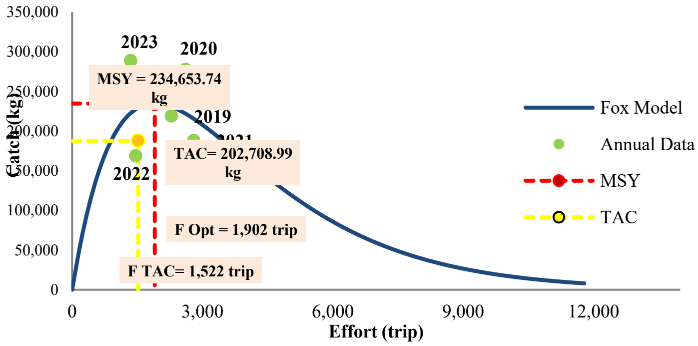

Figure 6. Fox model MSY

Based on Figure 6, the estimation of the maximum sustainable yield of Indian scad in the Fox model shows that the maximum sustainable yield (MSY) is 234,653.74 kg/year and the optimum effort is 1,902 trips. Data from 2020 and 2023 show that catch and fishing effort have exceeded the sustainable potential (MSY) limit. Conversely 2019, 2021, and 2022, catch and fishing efforts were still below the sustainable potential (MSY) limit. The total allowable Catch (TAC) is 187,722.99 kg/year.

This finding aligns with the one in KP Kepmen No. 19 of 2022 on Estimating Fish Resource Potential and Allowed Catch. In WPPNRI 572, namely the Indian Ocean waters west of Sumatra and the Sunda Strait, it is stated that the estimated potential of small pelagic fish resources is 479,503 tons per year, with a TAC of 431,553 tons and a utilization rate of 0.2, which is in the low category. Although nationally the utilization rate of small pelagic fish in WPP 572 is classified as low, the findings of this study indicate that on a local scale, such as in Carocok Tarusan, fishing activities are actually showing a trend approaching MSY, making data-based management crucial to implement.

3.7. Comparison of Scaefer and Fox

Based on Table 6, the Schaefer model produced a TAC value of 202,708.02 kg with an R^2 value of 0.6209. Meanwhile, the Fox model produced a TAC value of 187,722.99 kg with an R^2value of 0.6817. A comparison of the two models is shown in Table 6.

Table 6. Comparison of the Schaefer and Fox Models

Value	Schaefer	Fox
Intercept	259.9068007	5.815224638
Slope	-0.066649111	-0.000525773
R^2	0.6209	0.6817
MSY	253,385.02 kg	234,653.74 kg
F Optimum	1,950 trip	1,902 trip
TAC	202,708.02 kg	187,722.99 kg

The most appropriate model for describing the stock status and management of the Indian scad (*Decapterus russelli*) is the Fox model. The best model is the one that produces the highest R^2value and the lowest TAC (Fauziyah et al., 2019). The best model selection is based on the lowest TAC value and a high coefficient of determination. A high R^2 The value indicates that the model works better. Low TAC aligns with the principle of prudence to reduce the risk of overexploitation. When there is uncertainty in the data, for example, due to a lack of accurate data or fluctuations in fish stocks, models that produce smaller TAC are considered safer.

3.8. Utilization Rate and Effort Rate

Based on Table 7, it can be concluded that the highest level of Indian scad utilization was recorded in 2023 at 123%, while the lowest occurred in 2022 at 72%. According to the policy in KP Permen No. 19 of 2012, the utilization rates in 2020 and 2023 are categorized as Over-exploited, because the annual catch exceeds the estimated limit. 2019 and 2021 fall into the Fully-exploited category, where the annual catch is 80%–100% of the estimated potential. 2022 falls into the Moderate category, as the annual catch has not reached 80% of the estimated potential. Exploitation rates that exceed MSY have the potential to threaten fish sustainability, as they can disrupt the availability and continuity of the fish resource life cycle and lead to a decline in fish stocks (Akbar, 2023)

Table 7. Utilization Rate and Effort Rate

No	Year	Utilization Rate	Effort Rate
1	2019	93%	120%
2	2020	118%	137%
3	2021	80%	147%
4	2022	72%	77%
5	2023	123%	71%
Total		487%	552%
Average		97%	110%

Based on the table, it can be seen that the fishing effort rate for Indian scad at Carocok Tarusan Port was highest in 2021 at 147%, while the lowest fishing effort rate was in 2023. The average fishing effort rate over the 5 years was 110%. Reducing fishing efforts at Carocok Tarusan Port is highly recommended to preserve existing fish resources. Overfishing occurs when the fishing effort rate exceeds the optimum level.

Excessive fishing can lead to overfishing, which is usually characterized by several symptoms in fish resources, including a decline in catch, increasingly distant fishing grounds, and smaller fish caught (Widodo, 2002). In addition, fishing operational costs will increase beyond revenue, because the amount of catch obtained is decreasing

4. Conclusions

Based on the research results, it can be concluded that the most appropriate surplus production model for analyzing the potential of Indian scad (*Decapterus russelli*) at the Carocok Tarusan Regional Fisheries Port UPTD is the Fox model. Based on this model, the maximum sustainable yield (MSY) is 234,653.74 kg/year, with an optimum effort of 1,902 trips/year. Furthermore, the TAC is set at 187,722.99 kg/year. The average utilization rate of Indian scad during the research period reached 97%, indicating that Indian scad are fully exploited. Meanwhile, the average effort rate reached 110%, indicating the need for more careful fishing management.

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