

ANALYSIS Catch Per Unit Effort (CPUE) AND Maimum Sustainable Yield (MSY) MALE MACKEREL (*Rastrelliger kanagurta*) FLYING IN THE SAMUDERA FISHING LAND (PPS) KENDARI

Analisis Catch Per Unit Effort (CPUE) dan Maximum Sustainable Yield (MSY) Ikan Kembung Lelaki (*Rastrelliger kanagurta*) yang Didaratkan Di Pelabuhan Perikanan Samudera (PPS) Kendari

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ABSTRACT

The Banda Sea is an Indonesian water body that holds potential for small pelagic fisheries resources. Situated between Sulawesi Island and Maluku, it is part of the Fisheries Management Area Of The Republic Of Indonesia (WPP-NRI 714), Malemackerel (*Rastrelliger kanagurta*) is one of the fish species with high economic value, greatly favored by the community for consumption. This has led to an increase in its capture rates. Therefore, the research aims to determine the CPUE and MSY of Indian mackerel in the Kendari Ocean Fisheries Port. Data collection was conducted at the Kendari Ocean Fisheries Port from logbooks, and the research lasted from November to December 2023. The results showed that the standard fishing gear used to catch these fish is purse seine. The status of the utilization of the fishery resources is said to be experiencing underfishing. Based on the research results, the maximum sustainable yield (MSY) is 96,386 kg/year, with an optimal fishing effort of 2,300 trips/year (Fox model).

Keywords: Banda Sea, Male mackerel, CPUE and MSY

ABSTRAK

Laut Banda merupakan perairan di Indonesia yang memiliki potensi sumber daya perikanan pelagis kecil. Laut ini terletak diantara Pulau Sulawesi dan Maluku merupakan salah satu bagian Wilayah Pengelolaan Perikanan Negara Republik Indonesia (WPP-NRI 714), yang terdiri atas perairan Teluk Tolo dan Laut Banda. Ikan kembung lelaki (*Rastrelliger kanagurta*) merupakan salah satu ikan yang memiliki nilai ekonomis tinggi, ikan ini banyak digemari oleh masyarakat untuk di konsumsi. Hal ini menyebabkan semakin tingginya tingkat penangkapan pada ikan tersebut. Oleh karena itu penelitian bertujuan untuk mengetahui CPUE dan MSY ikan kembung lelaki di Pelabuhan Perikanan Samudera Kendari. Pengambilan data dilakukan di PPS Kendari dari *logbook*, penelitian berlangsung selama bulan November sampai Desember 2023. Hasil penelitian menunjukkan bahwa alat tangkap standar yang digunakan untuk menangkap ikan tersebut yaitu *purse seine*. Status pemanfaatan sumber daya ikan

tersebut dikatakan mengalami *underfishing*. Berdasarkan hasil penelitian didapatkan, tangkapan Lestari maksimum 96.386 kg/tahun dengan dan upaya optimal penangkapan 2.300 trip/tahun (model Fox).

Kata Kunci: Laut Banda, Ikan Kembung Lelaki, CPUE, MSY

INTRODUCTION

The Banda Sea is a water in Indonesia that has the potential for small pelagic fishery resources. This sea is located between the islands of Sulawesi and Maluku and is part of the Fisheries Management Area of the Republic of Indonesia (WPP - NRI 714), which consists of the waters of Tolo Bay and the Banda Sea (Manik *et al.*, 2018).

Kendari Ocean Fishing Port (PPS) is an integrated fisheries area starting from fishing, fisheries processing, loading and unloading activities, and other fisheries production such as fisheries marketing, supervision and utilization of fish resources for the smooth running of production activities. From this, the fishing port activities are said to be very extensive. The fleet of ships operating at the Kendari PPS has a capacity of 10-30 GT (Gross Ton). PPS is also said to be the largest fishing port in Kendari City (Fitriani *et al.*, 2023).

Male mackerel (*Rastrelliger kanagurta*) is one of the fish that has high economic value, this fish is widely favored by the community for consumption. This causes the level of capture of the fish to increase. Continuous mackerel fishing without proper management can result in a decrease in its population (Utami *et al.*, 2014). The increasing level of mackerel fishing is because this fish is an economically important fish. Without adequate management, continuous mackerel fishing can cause a decrease in the mackerel population, which can ultimately have an impact on other fish species that are far below the food chain (Rachmad *et al.*, 2022).

Efforts to utilize and preserve fish resources require appropriate and sustainable management. The availability of adequate data is absolutely necessary to analyze the status of resources in a water area that is a fishing location, so that it can anticipate the possibility of making inappropriate decisions in managing these fish resources. For this purpose, information is needed on aspects of fishing, catches and fleets (Mao *et al.*, 2022). Fishing effort is a simple method to find out the condition of fish biomass in waters by comparing catches with the amount of effort expended (Nur, 2011). Therefore, CPUE and MSY analysis is needed, which is the average catch rate value of fishing gear or in other words the type of fishing gear. And it can also be said as a method used to determine the results of the amount of marine fisheries production averaged annually. Assessing the stock status in the amount of catch of male mackerel in the Banda Sea waters.

METHODS

Place and Time

The research was conducted at the Kendari Ocean Fishing Port (PPS), in November-December 2023. The data used in this study are secondary data.

Research Location Map

The location of the fishing was carried out in the Fisheries Management Area of the Republic of Indonesia (WPP RI) 714, namely the Banda Sea, position around 07°26.160' S / 128°58.647' E to 05°23.280' S / 133°53.650' E. The sampling location was carried out at the Kendari Ocean Fishing Port, Puday Village, Abeli District, Kendari, Southeast Sulawesi.

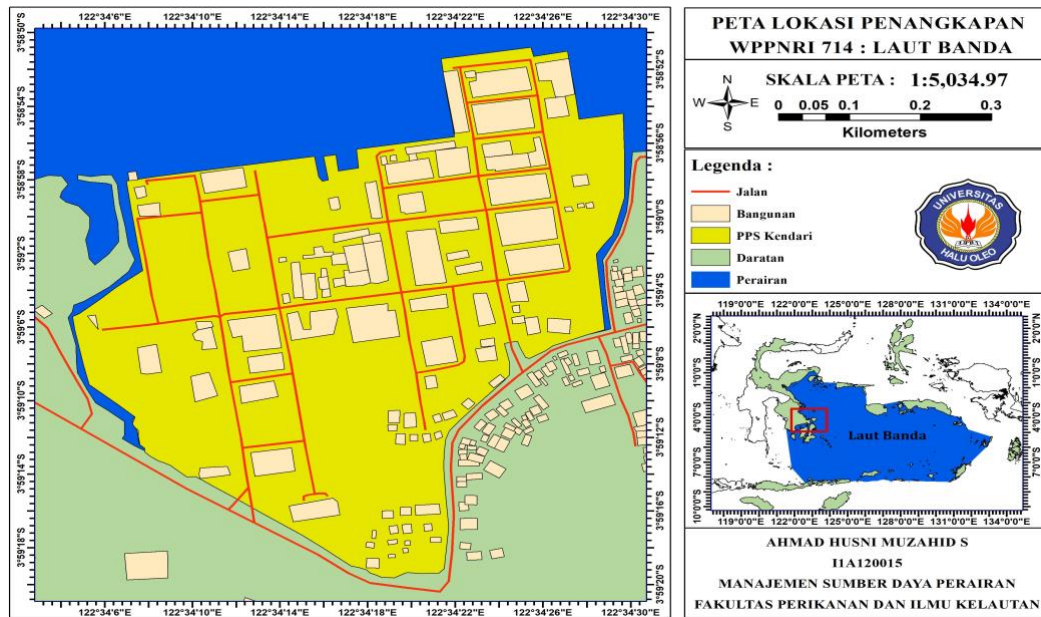


Figure 1. Map of research locations and fishing of mackerel in the Banda Sea waters of WPPNRI 714

Fish Data Collection

Data collection was carried out at the Kendari Ocean Fisheries Port (PPS). The data source is logbook data collected for 7 years, namely 2016 - 2022. The logbook contains data on fishing time, fish catch, ship name, and type of fishing gear for the male mackerel species (*Rastrelliger kanagurta*).

Data Selection

Data was obtained from ship logbooks at the Kendari PPS for a period of 7 years (2016-2022) which include the date, ship name, GT, fishing gear, and mackerel production results. After the data was collected, it was tabulated into Microsoft Excel.

Data Analysis

1. Effort Standardization

Before calculating the CPUE, the fishing gear was first standardized. The fishing gear standardization process is carried out by calculating the Fishing Power Index (FPI). Standard fishing gear has an FPI value of 1 and for other types of fishing gear, the FPI value is calculated by dividing the CPUE of the fishing gear by the CPUE of the standard fishing gear. Fishing power index is used to determine the most effective fishing gear (standard) according to the equation of Sparre & Venema (1999):

$$FPI = \frac{CPUE_r}{CPUE_s}$$

$$Effort\ Std = FPI \times E_s$$

Description:

- FPI : Fishing power index of fishing gear
- CPUE_r : Male mackerel catch per fishing effort of other fishing gear (kg/trip)
- CPUE_s : Male mackerel catch per annual effort of standard fishing gear (kg/trip)
- Effort Std : Fishing effort of fishing gear after standardization
- E_s : fishing effort per year of fishing gear

2. Catch Per Unit Effort (CPUE)

After standardization of efforts, the next step is to analyze catch per unit effort according to Sparre & Venema (1998):

$$CPUE = (Catch(c)) / (Effort(f))$$

Description:

CPUE : catch per fishing effort of male mackerel in year t (kg/trip)

Catch : male mackerel catch in year t (kg)

Effort : effort to catch mackerel in year t (trip)

3. Maximum Sustainable Yield (MSY)

In calculating the sustainable potential or Sustainable Potential (MSY) of komo tuna, the Fox model approach (exponential) is used.

By using a simple regression analysis of the existing time series data, the intercept (c) and slope (d) values can be calculated according to the Sparre & Venema (1999) equation:

Fox Model

- ❖ The optimum effort value is:
 $EMS_Y = -1/d$
- ❖ The maximum sustainable potential value is:
 $CMS_Y = -(1/d) * \exp(c - 1)$

Description:

C : Fox model intercept

D : Fox model slope

EMS_Y : Sustainable effort to catch mackerel (trip)

CMS_Y : Maximum sustainable catch of mackerel (kg)

RESULT

Standardization of Efforts

Based on the results of the study in 2016-2022, the fishing gear that had the highest results in 2019 was the purse seine fishing gear with a result of 161,220 kg/trip and the lowest results in 2018 for the hand line fishing gear with a result of 5,300 kg/trip.

Table 1. Catch Results Per Fishing Gear

| Years | FISHING TOOLS | | | | | |
|-------|---------------|----|-------------|-----|-----------|----|
| | Carrier | | Purse seine | | Hand line | |
| | C | E | C | E | C | E |
| 2016 | 32.691 | 94 | 12.299 | 41 | | |
| 2017 | 7.330 | 26 | 23.177 | 42 | | |
| 2018 | | | 64.401 | 13 | 5.300 | 13 |
| 2019 | | | 161.220 | 203 | 9.840 | 8 |
| 2020 | | | 27.605 | 57 | 6.660 | 8 |
| 2021 | | | 44.955 | 32 | | |
| 2022 | 22.155 | 18 | 44.590 | 88 | | |

Source: 2023 Analysis Results

Description:

C : *Catch* E : *Effort*

Based on the results of the productivity research for the dominant fishing gear, the purse seine fishing gear with units (kg/trip) can be seen from the results of its productivity which is quite a lot from 2016-2022.

Table 2. Productivity Results Per Fishing Gear

| Years | PRODUCTIVITY | | |
|-------|--------------|-------------|-----------|
| | Carrier | Purse seine | Hand line |
| 2016 | 347,78 | 299,98 | |
| 2017 | 281,92 | 551,83 | |
| 2018 | | 4953,92 | 407,69 |
| 2019 | | 794,19 | 1230 |
| 2020 | | 484,30 | 832,50 |
| 2021 | | 1404,84 | |
| 2022 | 1230,83 | 506,70 | |

Source: Research Results, 2023

Based on the results of the FPI study, the type of fishing gear used as standard fishing gear, with an FPI (Fishing Power Index) value or catch power index, namely the purse seine fishing gear = 1. The standard fishing effort value is obtained by multiplying the FPI value and the fishing effort value. The FPI value of each fishing gear can be seen in the table above. The fishing gear that produces a lot of fish is the purse seine.

Table 3. FPI (Fishing Power Index) (Source: Research Results, 2023)

| Years | FPI | | |
|-------|---------|-------------|-----------|
| | Carrier | Purse seine | Hand line |
| 2016 | 1,16 | 1 | |
| 2017 | 0,51 | 1 | |
| 2018 | | 1 | 0,08 |
| 2019 | | 1 | 1,55 |
| 2020 | | 1 | 1,72 |
| 2021 | | 1 | |
| 2022 | 2,43 | 1 | |

Based on the research results, it shows that during a period of 7 years (2016-2022), the largest standard effort was recorded in the purse seine fishing gear, reaching 4,954 kg/trip, while the smallest standard effort was in the Hand Line fishing gear with a value of 1 kg/trip.

Table 4. Standard Effort Results (Source: Research Results, 2023)

| Years | STANDARD EFFORT | | |
|-------|-----------------|-------------|-----------|
| | Pengangkut | Purse seine | Hand line |
| 2016 | 109 | 300 | |
| 2017 | 13 | 552 | |
| 2018 | | 4954 | 1,07 |
| 2019 | | 794 | 12,39 |
| 2020 | | 484 | 13,75 |
| 2021 | | 1405 | |
| 2022 | 44 | 507 | |

2. Catch Per Unit Effort (CPUE)

Based on the CPUE graph in Figure 3, in 2018 the catch of male mackerel was 14 kg/trip, in 2019 the catch was 212 kg/trip and in 2020 the catch decreased to 69 kg/trip and in 2021 the catch continued to decrease, in 2022 the catch increased from the previous year to 121 kg/trip. Table 5. Standard Effort Results

| Years | STANDARD EFFORT | | |
|-------|-----------------|-------------|-----------|
| | Carrier | Purse seine | Hand line |
| 2016 | 109 | 300 | |
| 2017 | 13 | 552 | |
| 2018 | | 4954 | 1,07 |
| 2019 | | 794 | 12,39 |
| 2020 | | 484 | 13,75 |
| 2021 | | 1405 | |
| 2022 | 44 | 507 | |

Source: Research Results, 2023

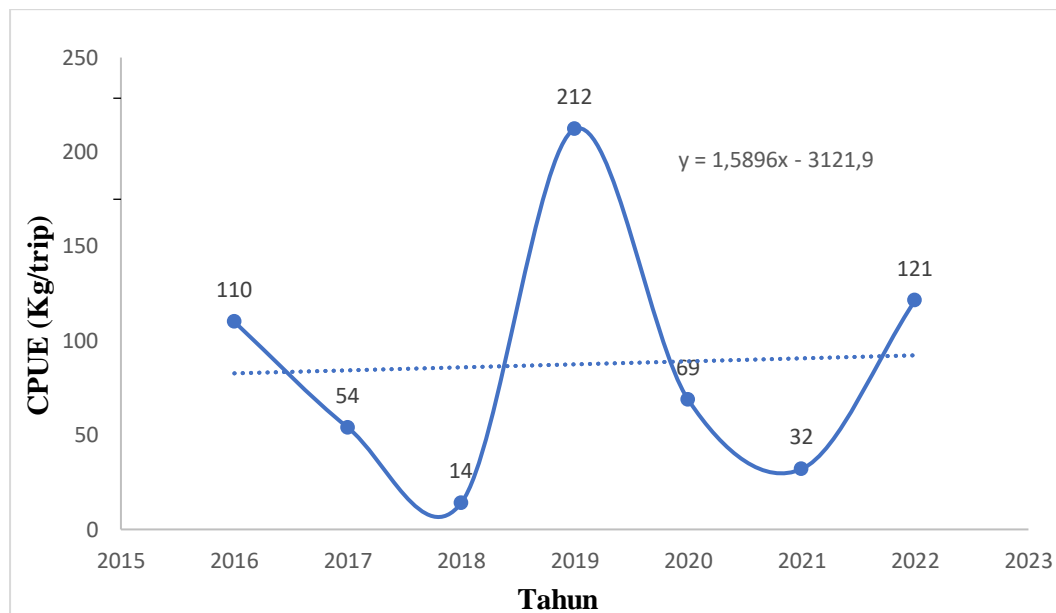


Figure 2. Male Mackerel CPUE graph
 Source: 2023 analysis results

Maximum Sustainable Yield (MSY)

Based on mackerel production data during MSY using the Fox surplus production method, the maximum fishing effort and sustainable catch value were 96,386 kg/year and the optimal fishing effort was 2,300 trips/year.

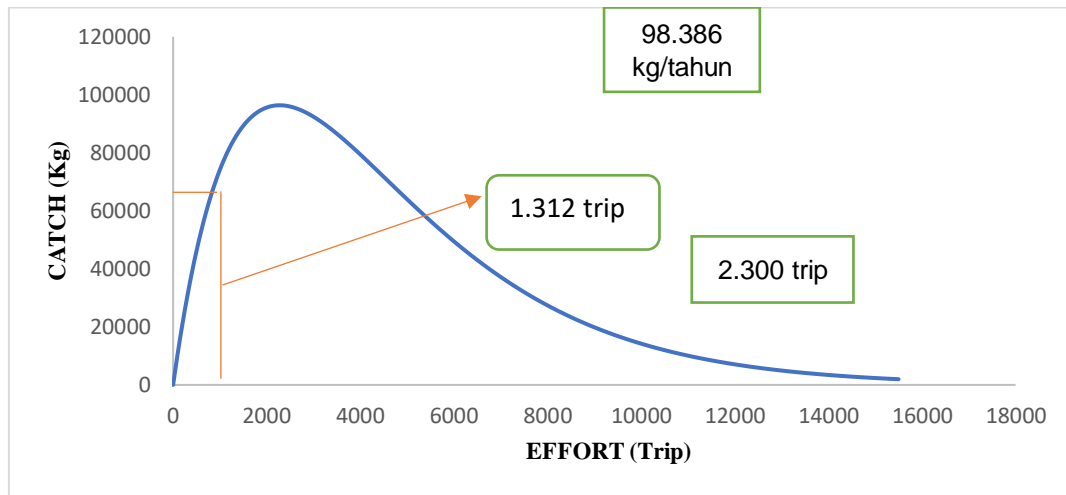


Figure 3. MSY Graph of Fox Model Male Mackerel
Source: 2023 analysis results

Note: MSY value = —
Actual value = —

DISCUSSION

Standardization of Effort

Purse seine is used as a standard fishing gear because it has high catch and productivity and is better than other fishing gear. This is in accordance with the statement of Abubakar *et al.*, (2019), which states that the most effective fishing gear used by fishermen to catch mackerel is the purse seine fishing gear or purse seine. Nelwan *et al.*, (2015), which states that groups of small pelagic fish species are obtained from several fishing gears operated, but the most effective fishing gear is the purse seine.

Catch Per Unit Effort (CPUE)

The largest standard effort result for fishing gear in carrying out fishing is the purse seine, which is 4,954 kg/trip and the smallest fishing gear is the Hand Line 1 kg/trip (table 4). This is in accordance with the statement of Listiani *et al.*, (2017), which states that if the effort value increases, the CPUE value will decrease. This is because each additional effort means that more fishing gear is operating even though fish resources are limited and tend to decrease, so that increasing efforts will cause limited resources to decrease. Based on the results of the study of male mackerel, the highest results occurred in 2019, namely 212 kg/trip and the lowest results in 2018, namely 14 kg/trip. The CPUE value fluctuates every year, where in 2019 and 2022 it increased and decreased in 2020 and 2021. This happened because during the annual period there was an increase and decrease in the number of fishing efforts (figure 5). This is in accordance with the statement of Nugraha *et al.*, (2012), which states that fluctuations in fish catches are influenced by several factors including the presence of the fish, the number of fishing efforts made, and the level of success of fishing operations. Cahyani *et al.*, (2013), stated that the CPUE value describes the level of productivity of fishing efforts. The higher CPUE value indicates that the productivity level of the fishing gear or trip used is also higher. CPUE has a slight upward trend (estimate). So it is necessary to increase the catch of male mackerel. This is in accordance with the statement of Cahyani *et al.*, (2013), the increasing CPUE trend is a picture that the level of exploitation of fish resources can be said to be still at the developing stage. Kristiana *et al.*, (2021), stated that although a slight increase in the CPUE trend can be considered a positive signal, further analysis is needed to understand the long-term consequences for the mackerel population. The CPUE trend can be seen from the

relationship between CPUE and effort. This CPUE trend can illustrate the indication of the status of fish resource utilization in a waters.

Maximum Sustainable Yield (MSY)

Based on the results of male mackerel production using the Fox surplus production method. Production of male mackerel MSY using the production method, the fox method, the maximum sustainable catch value is 96,386 kg/year with an actual value of 66,031 kg, this must add an effort of around 30,355 kg and an optimal fishing effort of 2,300 trips/year with an average value of 1,312 trips, this must add trips of around 988 trips. From this, the male mackerel in the Kendari PPS is still underfishing (figure 3). This is in accordance with Nurhayati's statement (2013), stating that if the catch is less than the MSY value, it is called underfishing. Conversely, if the fish catch exceeds MSY, it is considered overfishing. Thus, it is necessary to increase fishing efforts for male mackerel. Rosana & Prasita (2015), stated that one of the actions that can be taken if underfishing occurs is to increase the number of fishing vessels to achieve optimal catches. Purwanto & Wudianto (2011), stated that increasing fishing efforts such as increasing the number of boats and ships operating with the target of over-exploited fish resources will cause a decline in sustainable production and threaten its fish resources. If there is a continued increase in these conditions, it can cause over-exploited resources.

CONCLUSION

1. The CPUE trend of mackerel male fish in the period of 7 years has increased.
2. The fox method maximum sustainable catch value is 96,386 kg/year and the optimal fishing effort is 2,300 trips/year. The actual value is 66,031 kg and the trip is 1,312. The stock status of mackerel male fish resources is still underfishing so that fishing efforts are needed.

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