



Biological Identification of Octopuses and Index Values for Fisheries Management in the Alas Strait Area, West Nusa Tenggara

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Abstract: Octopus is an important economic fishery commodity that has a high price and is a source of foreign exchange for the country, especially for fishermen in the West Nusa Tenggara region. The utilization status of the octopus fishery is not known yet and managed well for its purposes. This research aims to determine existing conditions, growth patterns, body shape, age group and condition factors, as well as to determine the index value and desired status of the biological dimensions of octopus fisheries management. The method used in this research is descriptive, where data is obtained from samples obtained from nature. The research results showed that the growth pattern of octopus caught in the waters of Alas Strait and landed on Ketapang beach, East Lombok Regency was negative allometric with a b value of 1.4516. Meanwhile, the octopus's body shape is in the less flat category with a condition factor (K) value of 1.91, with a length range between 25 cm - 60 cm. The status of stopping octopus management from the biological dimension obtained a value of 58.53% with quite sustainable status.

Keywords: Alas Strait; Biological Dimension; Growth; Octopus.

Introduction

Octopus (*Octopus vulgaris* Cuvier 1797) is a type of demersal fishery resource that lives in several ecosystems, including coral reef ecosystems (Nurdiansyah et al., 2015; Sauer et al., 2021; Toha et al., 2015). As one of the biota components that make up the coral reef ecosystem (Karnan, 2022). The *Octopus vulgaris* species is a type of octopus that lives in Indonesian waters (Omar et al., 2020; Ramadhaniaty et al., 2023), classified as a fishery commodity that can be consumed by humans. Octopus is also classified as an economically important fishery commodity which has a high price and is a source of foreign exchange for Indonesia. Indonesia exports octopus to Europe (Spain, Italy, Greece, France, Cyprus), the United States, Australia and Asia (Japan, South Korea, Vietnam) (Amimi et al., 2018).

Ecologically, the octopus's role is as a predator and also as prey for other predators (O'Brien et al., 2021;

Storero et al., 2020). As benthic animals in shallow waters, several types are able to live in various ecosystems, one of which is coral reefs. Octopuses use gills as breathing organs, and have a fairly fast life cycle. They can grow quickly and reach adulthood within a year, and are rarely found to live more than 2 or 3 years (Amimi et al., 2018; Braga et al., 2021).

The potential of octopus as a fishery commodity has high production value. The octopus type *O. cyanea* has a relatively large and strong body size. They have the ability to change color or camouflage. In various areas, such as Simeulue Regency, octopus is a superior commodity that can improve the economy of coastal communities, especially octopus fishermen (Putri & Zuraidah, 2022).

For the last ten years, octopus has been an export commodity that promises prosperity for fishermen considering that the price of the commodity exceeds the price of tuna, grouper and snapper. In recent years, this commodity has received the title of excellent commodity

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for fishermen in West Nusa Tenggara, considering that the NTB marine area has the potential for invaluable natural resources, but also great management challenges (Japa et al., 2022). The high demand in the export market and attractive prices have stimulated most fishermen to catch and hunt this commodity both as main and side catches (Alim et al., 2023). The increasing status of utilization as is currently taking place will threaten the preservation and sustainability of octopus resources because it is not balanced with research on octopus resources.

FAO (2016), revealed that internationally the trend of decreasing octopus catches has reached 40%. This means that octopus exploitation activities are not yet based on research results that provide direction for sustainable use of octopus resources. Uncontrolled octopus fishing requires direction and this research is expected to produce existing conditions for octopus fisheries management in the biological dimension based on indicators of growth patterns, body shape, age group, condition factors, suitable for spawning/maturity, suitable for catching and suitable for consumption as a direction in realizing management. sustainable octopus fisheries caught in the waters of the Alas Strait, West Nusa Tenggara.

Method

Time and Location

The research was carried out for approximately 6 months starting from January to June 2023. The field research location was carried out in the waters of Alas Strait, West Nusa Tenggara, which is the location where octopuses are caught in nature which are then landed on Ketapang Beach.

Data collection

Data collection for this research used a descriptive survey method, namely octopus samples were taken from a population in public waters, especially in the Alas Strait area, to describe the object under study. The data collected includes length and weight data from octopus measurements. Next, the results are presented descriptively and at the end of the research a descriptive analysis of the facts that have been found is carried out. The data analysis method used in this research is the comparative method, namely comparing the results with standard decisions (standards) according to expert opinion and/or regulations.

Data analysis

Octopus body shape (fat, ideal, thin) can be shown from the growth pattern value (Asrial et al., 2017). Growth patterns are calculated using Equation 1.

$$\ln BW = a + b \ln ML \quad (1)$$

Where:

BW = octopus body weight (g)

ML = octopus coat length (cm)

a & b = constant.

In this study, growth pattern status (b) and body shape were used to estimate octopus availability for sustainable fisheries management. The conditions are as follows: (a) $b < 3.0$ = minor allometric (thin/ectomorph) = Less Sustainable (KB); (b) $b = 3.0$ = isometric (ideal/mesomorph) = Sufficiently Sustainable (CB); (c) $b > 3.0$ = major allometric (obese/endomorph) = Continuous (B).

Result and Discussion

Determining the body shape of an octopus can be done through analyzing growth patterns by collecting data on the length and weight of the octopus. According to Kurniawan et al. (2019), that the analysis of the length-weight relationship is one of the factors that really needs to be known in relation to fisheries resource management. Measuring the length and weight of fish or other biota aims to determine variations in the weight and length of fish individually or in groups of individuals, so that it can be used as an indicator or guide regarding the level of fatness, health of the biota, productivity, and also the physiological condition of gonad development.

This research used a sample of 200 octopuses that came from fishermen's catches at Ketapang Beach, East Lombok Regency. The results of measuring the length and weight of the octopus showed that the length range was 25-60 cm (mean $42.20 \pm SD 7.62$ cm), while the weight range was 200-2,500 grams (mean $1,470.50 \pm SD 629.49$ grams). The results of the analysis of the relationship between octopus length and weight showed that the equation model was $y = 0.3166x + 1.45159$ with the coefficient of determination being $R^2 = 0.74$. This means that 74% of the increase in body weight is estimated to be caused by an increase in the octopus's body length, while 26% of the increase in octopus weight is caused by other factors such as environmental factors and also the age of the octopus.

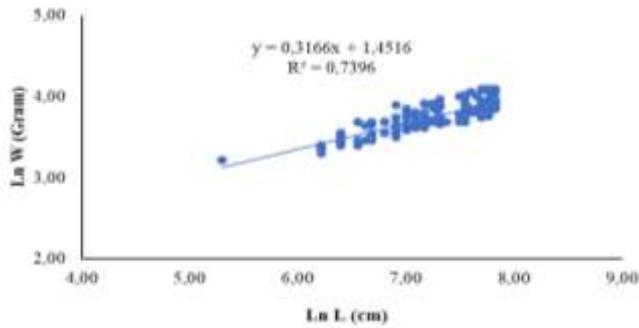


Figure 1. Length-Weight Relationship of Caught Octopuses

The results of the analysis of the length and weight of the octopus obtained a b coefficient value of 1.4516, which means that the growth pattern of the existing octopus is negative allometric ($b < 3$) indicating that the octopus's body shape is included in the thin category. where the growth in length is faster than the increase in body weight. This is in accordance with the statement of Amir et al. (2021) that if the b coefficient value < 3 means a negative allometric growth pattern, where the increase in length is faster than the increase in weight. However, if $b > 3$, it means that the allometric growth pattern is positive, which means that the octopus's weight increase is faster than the increase in the octopus's body length (Voss & Mehta, 2021).

Long-frequency distribution analysis can be applied to estimate the age group of biota, which in this case is marine biota such as fish (Marzuki et al., 2018). This is because the long frequency histogram distribution of fish can provide an overview of several age groups, each of which is distributed according to a normal distribution. Length frequency distribution for octopus age groups was carried out using class intervals of 4 cm, resulting in 8 class intervals. The largest frequency of octopus length in the 40-44 cm class interval was 51 individuals (25.50%), while the smallest range in the 60-64 cm class interval was 4 individuals (2.00%).

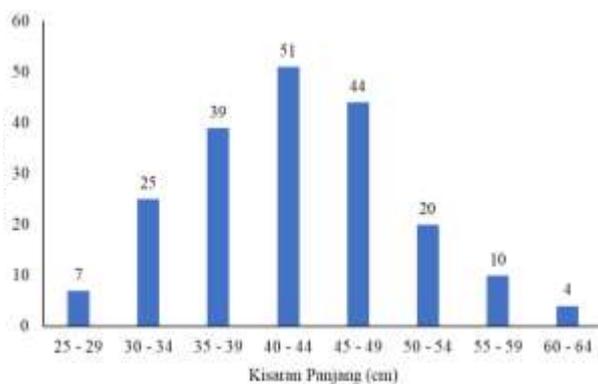


Figure 2. Frequency Distribution of Octopus Length

The results of the analysis obtained 1 age group, namely the age group with a length range of 25 cm - 64 cm, a mean octopus value of 43.30 cm with a frequency of 200 octopuses caught. Differences in size between age groups are caused by the influence of migration or movement from various aquatic areas, this is related to food availability (Balansada et al., 2019).

The results of the analysis of the composition of catchable octopus in this study refer to the weight of the octopus. Based on the total number of octopus samples of 200 whose weight was measured, there were 2 octopuses (1%) which were not yet in the suitable catch category because they weighed 200 gr (< 320 gr), then 9 octopuses (4.50%) were in the suitable category. caught weighing 320 gr - < 600 gr, and is estimated to be a male octopus. Furthermore, 189 octopuses (94.50%) with a weight of 600 gr - 2,700 gr, were in the catchable category and were estimated to be female octopuses.

Table 1. Number of catchable compositions of octopus landed at Ketapang Beach, East Lombok Regency

Weight Range (grams)	Number of Octopuses (tail)	Percentage (%)
0 - < 300	2	1,00
> 320 - <600	9	4,50
> 600	189	94,50
Total	200	100

Sustainability in the biological dimension is a description or phenomenon of the quality conditions of fishery resources and coastal waters (Sidabutar & Indra, 2021) which process and interact directly or indirectly with processes and life cycles individually (individuals) and together (populations) in achieving a certain category or status of sustainability (Alim et al., 2023). The results of the Rapcotopus analysis of 6 (six) influential attributes in the biological dimension include the size of the octopus caught, migration range, stock enrichment, collapsing range, octopus growth patterns and also marketability. Until a sustainability index value of 58.53% was obtained.



Figure 3. Sustainability Index Value for Octopus Biological Dimensions

Based on the sustainability index values listed in Figure 3, it shows that these values are in the quite sustainable category. The use of the octopus commodity in the waters of Ketapang Beach, East Lombok Regency by fishermen is still in good condition, however, so that in the future there will still be sustainability as expected, so that the attribute criteria that give rise to negative impacts must be immediately corrected. Meanwhile, on the contrary, in order to have a positive impact, things must be maintained and improved, such as catching suitable octopuses, such as those with mature gonads or octopus size above 80.63 cm, and a body weight of 802.88 gr. So it is hoped that the size of the octopus caught will get bigger over time (Dan et al., 2021). According to Tarigan et al. (2019), the medium value category indicates that the level of sustainability is still within the realm of possibility of being a poor indicator. The value of this indicator shows the need for more appropriate management. According to (Alim et al., 2023), implementation of management can be carried out starting from octopus fishermen, such as not catching octopuses that are not suitable for catching and also not overfishing (Barrett et al., 2023; Pita et al., 2021).

Based on the results of the leverage analysis carried out on the biological dimension, it was found that the stock enrichment attribute indicators and range collapse had a negative influence on the results of the sustainability status index values obtained. The stock enrichment attribute is one of the factors that has an influence on the sustainability of octopus resources. Limiting population fishing can reduce the occurrence of overfishing (Silas et al., 2023). The small catch size and the start of a decline in catch results due to over-exploitation have become considerations in order to determine a suitable and good size for fishing (Hutagaol et al., 2019). Stock enrichment activities for the octopus commodity must be carried out, considering that the demand and market value for octopus continues to increase from year to year. A good understanding of market demand and consumer trends (Kasmi et al., 2023) provides an illustration that this commodity is a commodity that is capable of providing economic improvements to fishing communities. Development and trade activities can have an influence on water quality in fishing areas (Supardiono et al., 2023). Octopus fisheries worldwide account for around 10% of the number of cephalopod landings with an increasing trend in recent decades due to high prices (Leitão et al., 2023). Octopus fishing activities will continue to be carried out as long as market demand and purchasing prices are high, so if they are not managed properly, it is not impossible that this commodity will be threatened with extinction.

Conclusion

The sustainability status index value for the management of octopuses landed on Ketapang Beach is 58.53%, which means the status is quite sustainable.

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Author Contributions

Conceptualizer, methodology, M. M.; determining the location for drafting articles, discussion and data analysis, D. D., W. A. L.; improvement of the overall draft of the article, M. M.

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Conflicts of Interest

The authors declare that there's no conflict of interest. The funders had no role in the design of the study, in the collection, analyses, or data interpretation and the writing of the manuscript.

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