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BIOLOGICAL CHARACTERISTICS OF OCTOPUS (*Octopus cyanea*) IN THE EAST SEASON IN KAUR REGENCY, BENGKULU PROVINCE

KARAKTERISTIK BIOLOGI GURITA (*Octopus cyanea*) PADA MUSIM TIMUR DI KABUPATEN KAUR, PROVINSI BENGKULU

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ABSTRACT

Octopus (*Octopus cyanea*) fisheries are one of the leading small-scale fishery commodities in Kaur Regency, Bengkulu Province. However, the increasing fishing intensity without considering biological aspects threatens the sustainability of this resource. This study aims to analyze catch productivity, mantle length distribution, body weight, and the length-weight relationship of octopuses. The research was conducted from July to September 2024 in Linau Village using an accidental sampling method. Data collected included catch volume, fishing effort, mantle length, body weight, and sex. Catch Per Unit Effort (CPUE) was used to assess fishing productivity, while biological data were analyzed descriptively. The results showed that the highest CPUE was in September (5.2 kg/trip), while the lowest was in February (2.6 kg/trip). The dominant mantle length of the captured males ranged from 7.95 to 8.67 cm (121 individuals), while the dominant mantle length of the captured females was also 7.95–8.67 cm (432 individuals). The dominant body weight ranged from 120 to 465 g (83 males) and 117 to 465 g (355 females). The sex ratio indicated female dominance. The length-weight relationship revealed a negative allometric growth pattern, indicating that mantle length growth is faster than body weight gain. These findings highlight that most of the octopuses caught were under the suitable catch size. Therefore, regulations on minimum catch size and spatial-temporal closures are recommended to ensure the sustainability of octopus fisheries in Kaur Regency, Bengkulu Province.

Keywords: mantle length, stakeholders, sustainable management, weight

ABSTRAK

Perikanan gurita (*Octopus cyanea*) merupakan salah satu komoditas unggulan di Kabupaten Kaur, Provinsi Bengkulu, yang berkontribusi bagi nelayan skala kecil. Namun, tingginya intensitas penangkapan tanpa mempertimbangkan aspek biologis dapat mengancam keberlanjutannya. Penelitian ini bertujuan untuk menganalisis tingkat produktivitas tangkapan, distribusi ukuran panjang mantel, bobot, dan hubungan panjang-bobot gurita. Penelitian dilakukan pada Juli–September 2024 di Desa Linau dengan metode *accidental sampling*. Data yang dikumpulkan meliputi jumlah tangkapan, upaya penangkapan, panjang mantel, bobot, dan jenis kelamin gurita. *Catch Per Unit Effort* (CPUE) digunakan untuk menilai produktivitas penangkapan, sedangkan data biologi dianalisis secara deskriptif. Hasil penelitian menunjukkan CPUE tertinggi terjadi pada September (5,2 kg/trip) dan terendah pada Februari (2,6 kg/trip). Panjang mantel dominan jantan yang tertangkap berukuran 7,95–8,67 cm (121 ekor) dan dominan betina yang tertangkap berukuran 7,95–8,67 cm (432 ekor). Bobot dominan berkisar 120–465 g (83 jantan) dan 117–465 g (355 ekor betina). Rasio jenis kelamin menunjukkan dominasi betina, sedangkan hubungan panjang-bobot menunjukkan pola alometrik negatif, yang berarti pertumbuhan panjang mantel lebih cepat dibandingkan dengan bobot tubuh. Hasil penelitian ini mengindikasikan sebagian besar gurita yang tertangkap belum layak tangkap, sehingga diperlukan regulasi ukuran minimum serta kebijakan pengelolaan berbasis buka-tutup daerah tangkapan untuk mendukung keberlanjutan perikanan gurita di Kabupaten Kaur.

Kata kunci: bobot, panjang mantel, pengelolaan berkelanjutan, *stakeholder*

INTRODUCTION

Octopus is a high-value fishery commodity in high demand among consumers. Consequently, market demand, both domestic and export, is substantial (Tarigan *et al.* 2018; Amarullah *et al.* 2020; Dwihastuty *et al.* 2023). Recent trade data show a consistent upward trend. In 2022, Indonesia's octopus export volume stood at 162 tons valued at USD 2.18 million, increasing to 220 tons valued at USD 2.48 million in 2023 (World Bank 2022; 2023). Globally, Indonesia accounts for approximately 2.68% of total world octopus exports (Trendeconomy 2023).

The results indicate that the octopus species caught in Kaur Regency is *Octopus cyanea*. This finding aligns with various previous studies reporting *O. cyanea* as a dominant octopus species in Indonesian waters. Research by Paruntu *et al.* (2009) in the Sangihe and Talaud Islands identified *O. cyanea* as a species commonly caught by traditional fishers. Toha *et al.* (2015) used morphological and molecular approaches in Raja Ampat to identify the presence of *O. cyanea* in coral reef habitats. Hakim *et al.* (2020) reported on the morphometric characteristics and length-weight relationships of *O. cyanea*, which dominated the catch in Pelabuhanratu. Meanwhile, Noegroho *et al.* (2022) examined the fishery biology of *O. cyanea* in Ampana Tojo Una-Una, including size structure, sex ratio, and gonad maturity stages to provide a basis for octopus fishery management. Another study conducted by Mulyani *et al.* (2023) in Lombok also reported the dominance of *O. cyanea* and examined its size structure and growth patterns. The presence of this same species across various regions of Indonesia indicates that *O. cyanea* has a wide distribution and serves as a significant octopus resource for small-scale fisheries in the country. Most research on octopus biology and fishing techniques has been conducted in eastern Indonesia, with relatively little carried out in western Indonesia, particularly in the Kaur Regency, Bengkulu.

The Kaur Regency Fisheries Office (2022) reported that the regency has successfully exported 18–25 tons of octopus annually to Japan and the United States. Despite this high production volume, fishers in Kaur Regency are beginning to face difficulties in catching octopus. This decline is suspected to be the result of overfishing pressure that fails to account for the biological aspects of the resource. The Head of Marpas Village, as cited by Gromiko and Ravita (2022), stated that octopus fishers in Kaur Regency are finding it increasingly difficult to secure a catch due to declining octopus availability in fishing grounds; consequently, search times have lengthened, and catch yields tend to be lower. The Kaur Regency government lacks sufficient information regarding the biological aspects of the octopus fishery. To date, there has been no comprehensive biological study on the size structure and growth patterns of octopus in Kaur Regency. Yet, such biological information is crucial for establishing sustainable management practices. Begg *et al.* (1999) noted that understanding octopus biology is essential for providing baseline information for resource management. Studies by Guard and Mgaya (2002) and Raberinary and Benbow (2012) found that octopus weight in Tanzania and Madagascar is linked to maturity levels, which in turn determine the appropriate size for harvesting. Identifying size through length and weight measurements can provide data on stock composition, including habitat, mortality, growth, reproduction, and life cycle, to estimate the availability of various octopus sizes in the waters. This information aids in determining the appropriate size range for harvesting (Fafioye and Oluajo 2005). According to Ahmed *et al.* (2021), knowledge regarding the length-weight relationship is crucial for studying octopus biology. It aids in understanding the conditions ideal for proper growth as well as the impact of environmental changes on that growth.

Furthermore, distinguishing between male and female octopuses is also essential, particularly regarding fishery management based on reproductive biology (Guard and Mgaya 2002). Previous studies indicate that males and females exhibit different body forms (Norman 1991) and play distinct roles in reproduction (Wells and Wells 1972; Guard and Mgaya 2002; Raberinary and Benbow 2012; Guard 2003). Females deposit their eggs in deeper waters and die after the eggs hatch (Heukelem 1983), whereas males transfer sperm to females using their arms (Wells and Wells 1972).

Understanding the biological characteristics of octopuses is crucial for sustainable fisheries management. Failure to address this issue early on, combined with continuous fishing that disregards biological factors, could potentially threaten the octopus resource with extinction. This concern arises because *Octopus cyanea*, which inhabits shallow tropical and subtropical waters, is estimated to have a lifespan of only one to two years (Leporati *et al.* 2009; Herwig *et al.* 2012; Leporati *et al.* 2015). However, octopuses in tropical waters like those of Indonesia may exhibit different life-history patterns, necessitating a specific study.

This study was conducted to address that need. The study aims to analyze productivity levels (CPUE), mantle length composition, body weight, and the length-weight relationship of *Octopus cyanea* in Kaur Regency. The expected results will provide insights and recommendations regarding octopus biology, serving as a foundation for sustainable octopus fisheries management in the region.

METHODS

Time and location

The research was conducted from July 2024 to September 2024 and comprised two stages. The first stage involved primary data collection in the field, carried out between July and August 2024. This period was selected because it falls within the "east monsoon" season, which is generally characterized by increased octopus fishing activity by local fishermen. During this time, sea conditions are relatively favorable for fishing, and octopus catch availability tends to be more stable, thereby enabling the collection of a sufficient sample size that is representative of actual catch conditions. The second stage, involving data processing and analysis, took place in September 2024. The study was conducted in Linau Village, Kaur Regency, Bengkulu Province. A map of the study location is provided in Figure 1.

Data collection

The data collected in this study consisted of both primary and secondary data. Primary data included catch volume, octopus fishing effort, mantle length, and octopus body weight. Secondary data comprised production figures, the number of fishing gear units, and the number of vessels, sourced from the Kaur Regency Fisheries Office (2023) and Akar Global Inisiatif (2023).

Data regarding octopus biological aspects were obtained through direct observation by the researcher in Linau Village, Kaur Regency, Bengkulu Province. These biological data were derived from the catches of octopus fishermen in Kaur Regency. Data collection involved direct observation and specimen handling by the researcher. Each captured octopus was systematically observed and measured, including sex identification, mantle length measurement, and body weight determination. Measurements were performed using appropriate instruments and followed standard procedures to ensure data accuracy and consistency. The researcher personally recorded data and measured samples obtained from the fishermen's catches. An accidental sampling technique was used to select the octopus fishermen respondents; this method involves selecting respondents based on ease of access and willingness to participate (Etikan *et al.* 2016). The researcher actively visited landing sites and selected fishermen who were landing their catches and were willing to have their octopus catches recorded for biological data. This technique was employed because the selected respondents were the most accessible individuals during the study period (Etikan *et al.* 2016).

Octopus sampling was conducted using a non-probabilistic approach, specifically convenience sampling involving fisher respondents. Convenience sampling was selected due to limitations in obtaining a sampling frame of octopus fishers, as well as catch fluctuations dependent on fishing success and weather conditions. Octopus samples were obtained from the catches of fishers who were easily accessible at landing sites and willing to participate in the study. Samples were collected from boat-based fishers specifically targeting octopus. Each collected octopus was measured for body weight and mantle length, and its sex was determined. A total of 1,073 octopus specimens were collected from fishers operating at the study site during the observation period. In this study, the population frame could not be precisely defined because the total octopus catch and the number of active fishers were not fully recorded and were dynamic in nature. The sample comprised 222 males and 851 females. This skewed sex ratio is thought to be influenced by methodological factors, particularly the sampling technique. Additionally, biological factors such as differences in behavior and spatial distribution between males and females may influence the likelihood of an individual being caught. Consequently, limitations in the sampling design and the influence of biological factors must be primary considerations when concluding. Therefore, the study's conclusions focus on the catch results during the study period and are not intended to directly generalize the overall octopus population structure.

Mantle length was measured using a fish measuring board. Following FAO (2016), mantle length was measured from the tip of the head to the eye. Weight was determined using a weighing scale (Figure 2). Finally, the sex of the octopus was identified by examining the third arm (Tarigan *et al.* 2019).

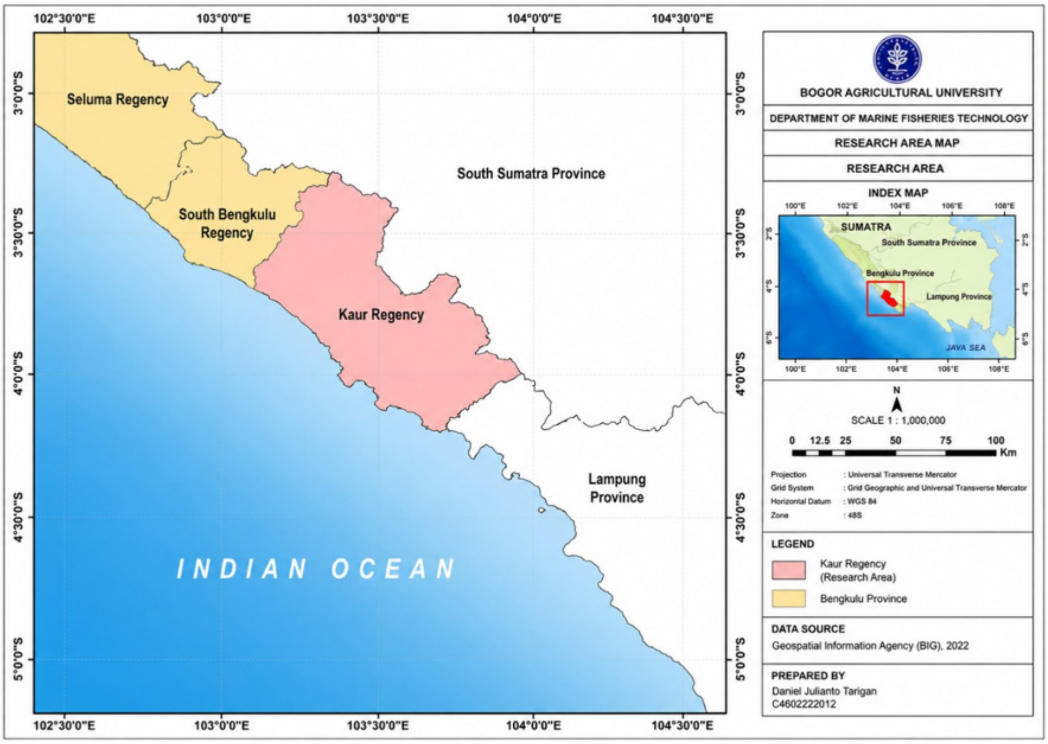

Figure 1. Map of the research location in Kaur Regency, Bengkulu.

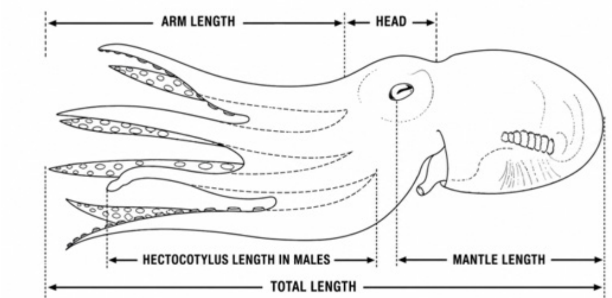

Figure 2. Illustration of octopus mantle length measurement according to FAO (2016).

Data analysis

Octopus fishing activities were analyzed descriptively and presented in the form of tables or graphs. Octopus fishing productivity was analyzed using Catch Per Unit Effort (CPUE). Fishing effort can be measured by the number of fishing trips or the duration of time. The formula used to calculate productivity is:

$$CPUE = \frac{C_i}{E_i}$$

Description:
$CPUE$ = Catch per unit effort
C_i = Catch (tons) in month i
E_i = Capture efforts (ships) in the i-th month

Data on coat length, octopus weight, and sex distribution were processed using Microsoft Excel and analyzed descriptively to determine the relationship between coat length, octopus weight, and sex distribution of those caught.

The sex ratio of male and female octopuses is calculated by comparing the number of male and female individuals caught. Next, differences in gender proportions were tested using the chi-square test (x^2) based on the Zar (2010) method with the following calculations:

$$\chi^2 = \sum_{1-i}^{k} \frac{(f_0 - f_h)^2}{f_h}$$

Description:
x^2 = Chi-square
f_0 = Frequency of male and female octopuses observed

f_h = Expected frequency of male and female octopuses

Value x^2 result of the calculation, based on the assumption of normally distributed data was compared against the tabulated x^2 value at a 95% confidence level with one degree of freedom (df = 1) to determine whether the octopus sex ratio differed significantly from a 1:1 ratio. The x^2 test was conducted assuming that the observed data were independent and considering the expected frequencies, with the hypotheses formulated as follows:

H_0 = There is no significant difference between the number of male and female octopuses.
H_1 = There is a significant difference between the number of male and female octopuses.

The decision regarding the hypothesis concerning the difference in the number of male and female octopuses is made as follows: if $x^2_{calc} < x^2_{table}$, then H_0 is accepted (or H_1 is rejected); if $x^2_{calc} > x^2_{table}$, then H_0 is rejected (or H_1 is accepted).

The length-weight relationship of the octopus was analyzed using the approach of Effendie (2002), with the following equation:

$$W = aL^b$$

Description:
W = Weight of the octopus in grams
L = Octopus length in cm
a and b = Length-weight relationship constant

Before analyzing the length-weight relationship, the data were first tested to ensure that the statistical assumptions underlying the use of parametric analysis were met. The normality test was carried out using the Shapiro-Wilk test on residual data to determine whether the data were normally distributed. In addition, independence between samples is assumed to be fulfilled because each individual (octopus) is observed separately, while homogeneity of variance is tested using the homogeneity of variance test. If the assumptions of normality and homogeneity of variance are not met, then the analysis is adjusted using a non-parametric approach or appropriate data transformation.

Next, the regression coefficient b in the length-weight relationship equation was tested using the t-test to determine the octopus growth pattern by testing whether the b value was equal to 3 (Zar 2010). If b = 3 indicates an isometric growth pattern, the result means growth in body length (total or coat) and balanced body weight. If the b value < 3 indicates a hypoallometric growth pattern (negative allometric), namely the growth in body length (total or coat) is faster than the increase in body weight. On the other hand, if b > 3 indicates a hyperallometric growth pattern (positive allometric), that is, the increase in body weight is faster than the increase in body length (Effendie 2002).

RESULTS AND DISCUSSION

Octopus fishing productivity

The highest CPUE values were recorded in September 2023 and November 2023, at 5.2 and 5.1, respectively (Figure 3). The lowest CPUE value was observed in February (2.6). The average CPUE for 2023 was 3.98. CPUE values fell below the average in February, April, May, June, July, and October, while values above the average were recorded in January, March, August, September, November, and December. CPUE values remaining above the average indicate that the catch per unit effort remained high, suggesting that fishing operations were still viable. However, biological factors regarding the octopus must still be considered, given that some values fell below the average CPUE. This pattern differs from the findings of Noegroho et al. (2022) in Tojo Una-Una (Central Sulawesi), who reported peak fishing productivity during different periods. These differences in peak timing and productivity levels are likely influenced by seasonal variations, oceanographic conditions, habitat characteristics, and the reproductive cycle of O. cyanea in each respective region. Therefore, interpreting CPUE trends requires consideration of the species' biology, particularly mating and spawning seasons as a basis for octopus fishery management.

Catch data from the 2023 Global Octopus Initiative indicate that peak periods occurred early in the year (January to April) and again from October to December 2023. The total octopus catch for 2023 was 11.879 tonnes, with an average catch of 0.98 tonnes (980 kg). The highest catch was recorded in December (1.634 tonnes), while the lowest was in April (0.445 tonnes). Catches exceeded the average in January, June, September, November, and December and fell below the average in February, March, April, May, July, August, and October (Figure 3). The low catch levels during these months were attributed to unfavorable weather and high waves, which prevented octopus fishers from going out to sea. The fishers targeting octopus in Kaur Regency are classified as small-scale fishers; they operate non-motorized boats, use simple handlines, and fish in nearshore waters. This aligns with the findings of Salas *et al.* (2004), who noted that small-scale fishers are characterized by various limitations, including limited time at sea and the types of vessels and fishing gear they employ.

The catch and CPUE data shown in Figure 3 reveal fluctuations throughout the year and distinct patterns. Overall, the total catch correlates with CPUE values; however, a high CPUE indicates fishing efficiency during a specific period rather than necessarily reflecting a large total catch. This suggests that high CPUE values at certain times represent efficiency levels rather than high catch volumes. Therefore, CPUE data must be interpreted cautiously, taking into account factors such as fishing effort, seasonality, and aquatic environmental conditions (Owiredu *et al*. 2024). Above-average CPUE values were observed alongside low catch volumes in August, whereas below-average CPUE values coincided with substantial catches in June. High catch volumes and high CPUE values occurred in January, September, November, and December, while low catch volumes and low CPUE values were recorded in February, March, April, May, July, and October. Overall, CPUE trends reveal peak periods early in the year (January to April 2023) and late in the year (August to December 2023). Meanwhile, significant catch volumes were observed from September to December 2023. This indicates that octopus fishing operations take place year-round, but yield fluctuating catches. The results shown in Figure 3 indicate an overall seasonal pattern, with the end of the year serving as a productive period for octopus fishing. Conversely, April and July recorded the lowest yields and efficiency, likely corresponding to the octopus reproductive period (Raberinary and Benbow 2012). This seasonal pattern has implications for octopus fishery management; specifically, management policies such as fishing season regulations or temporary closures must consider fishing timing and reproductive protection periods to ensure the sustainability of *Octopus cyanea* stocks. The observed discrepancy between CPUE values and catch volumes is likely attributable to the fishing pressure present in Kaur Regency. Octopus fishing operations are conducted by vessels under 5 GT and non-motorized boats. The total number of vessels rose from 114 in 2019 to 183 in 2022 (Ministry of Marine Affairs and Fisheries 2023). This reflects high fishing intensity in Kaur Regency, suggesting a decline in the octopus catch. At the same time, octopus commands a relatively high market value of IDR 40,000 per kg. There is also considerable public interest in Kaur Regency regarding processed octopus products. Octopus is processed into various items, including crackers, octopus sticks, skewered dried octopus, meatballs, and caramelized beef stew (Kaur Regency Fisheries Office 2023).

Octopus mantle length

The mantle lengths of the captured octopuses showed considerable variation, as illustrated in Figure 4. For males, mantle lengths ranged from 4.6 to 20 cm, with an average of 7.7 cm. The majority of captured males fell within the 7.95–8.67 cm range, comprising 121 individuals (55%). Other significant size groups included the 6.2–6.9 cm range (36 individuals, or 15%) and the 9.6–10.4 cm range (28 individuals, or 13%).

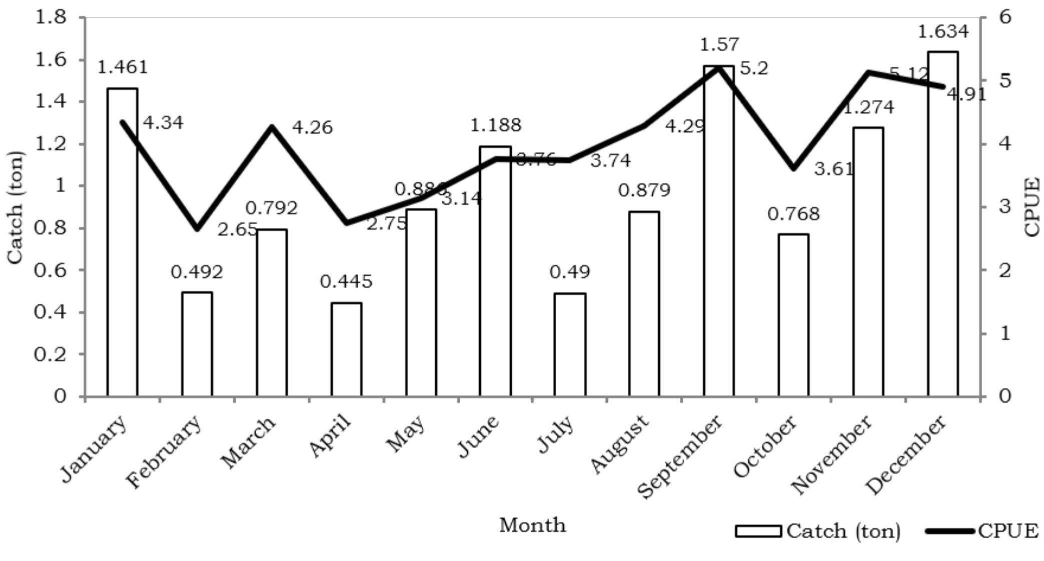

Figure 3. Monthly octopus catch per unit effort (CPUE) values in Kaur Regency in 2023 (Source: Akar Global Inisiatif 2023).

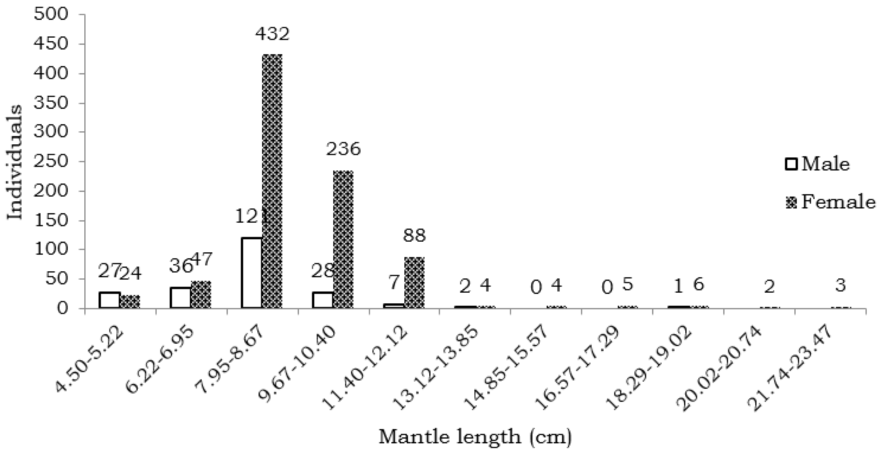

Figure 4. Mantle length distribution of male and female octopuses caught in Kaur Regency.

The mantle lengths of the captured female octopuses ranged from 4.5 to 23 cm, with an average of 8.6 cm. The most frequently captured females fell within the 7.95–8.67 cm mantle length range (432 individuals or 51%); this size range also predominated the female sample set, accounting for 9.67–10.40 cm for 236 individuals (28%). This indicates that female octopuses possess longer mantles than males. These findings are likely attributable to females allocating more energy to somatic growth to support ovarian development and enhance fecundity. Conversely, males generally reach sexual maturity at a smaller body size, causing their somatic growth to cease earlier. Consequently, female mantle sizes tend to be larger than those of males (Herwig *et al.* 2012).

In the study, small mantle sizes predominated, differing from the results of other researchers. Variations in octopus mantle length results are attributed to differences in environmental conditions, sample size, and capture locations. Influential environmental factors include light, temperature, and food availability (Mangold 1987; Alves and Haimovici 2011). The full distribution of *Octopus cyanea* mantle lengths is presented in Table 1.

A total of 1,073 octopuses were caught during the study, comprising 222 males and 851 females. The male-to-female ratio was 1:3.8. The p-value was significantly lower than $\alpha = 0.05$, indicating an unbalanced sex distribution in the sample, with the proportion of females being much higher than that of males. Figure 5 illustrates that the catch included a higher number of females than males. The weight of the male octopuses caught during the study ranged from 120 g to 3,089 g; thus, the lightest specimen weighed 120 g and the heaviest weighed 3,089 g. The male catch was dominated by individuals weighing 120–465 g (83 specimens), followed by those weighing 466–813 g (77 specimens). The average weight of male octopuses caught in Kaur Regency during the study was 601 g.

Table 1. Comparison of *Octopus cyanea* mantle length based on several studies.

Researchers and Year	Research Locations	Mantle/Body Size of Specimens Found	Additional Information
Diniariwisan *et al.* (2023)	East Lombok waters	>12 cm; 38 individuals; 9–11 cm; 7 individuals	Individual size distribution
Tarigan *et al.* (2019)	Banggai Laut waters	>7.7 cm; 551 individuals; <7.7 cm; 253 individuals	Predominantly small sizes
Omar *et al.* (2020)	Makassar waters	Average mantle length 12.5–15 cm	Males and females
Noegroho *et al.* (2022)	Ampana, Tojo Una-Una	Dominant mantle length 13 cm	Relatively large size
Paruntu *et al.* (2009)	Sangihe waters	Total length 487–1,015 mm	Based on total size
Norman *et al.* (2016)	General (global) references	Mantle length up to 160 mm; total length >1 m	Maximum octopus size potential
This study (2025)	Kaur Regency	Dominant range 7.95–10 cm	Larger than Banggai Laut and Sangihe; smaller than Makassar and Tojo Una-Una

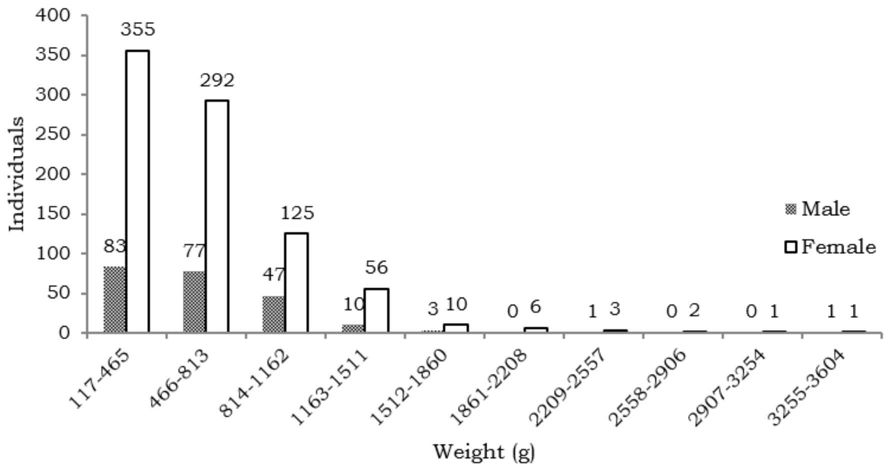

Figure 5. Weight distribution of male and female octopuses caught in Kaur Regency.

The weight of female octopuses caught during the study ranged from 117 g to 3,350 g. The heaviest female octopus weighed 3,350 g, while the lightest weighed 117 g. The results indicate that the most frequently caught octopuses fell within the 117–465 g weight range (355 individuals), followed by those weighing 466–813 g (292 individuals). The average weight of female octopuses caught in Kaur Regency was 587 g.

Overall, Figures 4 and 5 illustrate the status of octopus resources in Kaur Regency. A key observation is that the majority of the caught octopuses were relatively small in terms of mantle length and weight; specifically, the individuals were caught before reaching sexual maturity. This suggests the occurrence of "growth overfishing," meaning most octopuses are harvested while still in an active growth phase and before attaining maximum weight. Harvesting octopuses at such small sizes has serious implications if the stock becomes dominated by smaller individuals, as the number of larvae that successfully hatch and survive to adulthood will likely decline significantly. This shift toward smaller sizes suggests fishing pressure on the resource. Continued fishing without appropriate management measures risks a future decline in the octopus population. Therefore, stakeholders in Kaur Regency should urgently establish policies regarding permissible harvest sizes to ensure the sustainability of the octopus resource. Guard and Mgaya (2002) noted that the weight at sexual maturity is 320 g for male *Octopus cyanea* and 600 g for females. Based on these weight criteria, the catch of female octopuses in Kaur Regency was dominated by individuals below the harvestable size, totaling 647 specimens, or 76% of the 851 caught, while only 204 specimens (24%) were of harvestable size. Among male octopuses, 139 specimens (63%) were of harvestable size, whereas 83 specimens (37%) were below the harvestable size (Figure 6). The predominance of octopuses below the harvestable size indicates fishing pressure on the octopus stock in Kaur Regency. Fishers in Kaur Regency also catch octopuses from morning until late afternoon. Observations revealed fishers catching octopuses along the shoreline using wire or spears, resulting in the capture of small-sized octopuses.

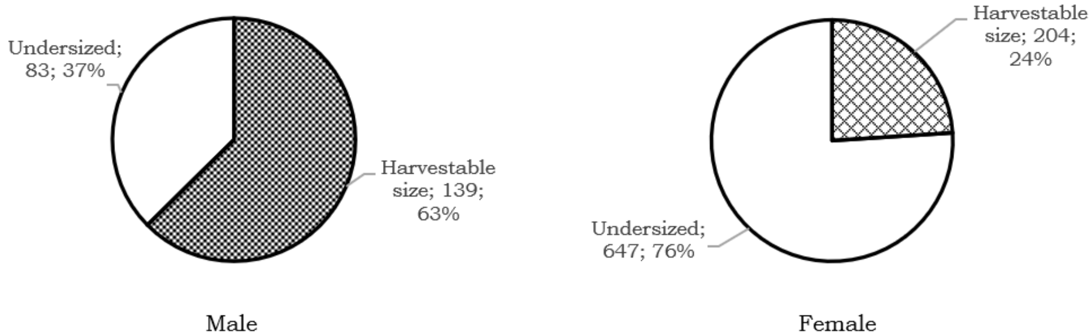

Figure 6. Proportion of male and female octopuses classified as harvestable and undersized based on weight in Kaur Regency.

Previous studies on octopus weight, such as those by Raberinary and Benbow (2012), report that the weight of mature males is 643 g and mature females is 2,246 g. Their findings indicate that the octopuses predominantly caught in Australian waters fall into the mature category. In Tanzanian waters, Guard and Mgaya (2002) found that 80% of the 334 captured males were mature, whereas only 18 of the captured females were mature. Tarigan *et al.* (2019) researched octopuses in Banggai Laut and found that the catch was dominated by mature individuals. Alim *et al.* (2023), researching at Pandanan Beach, reported that 99.17% of the octopus catch was of a size suitable for harvesting. Noegroho *et al.* (2022) showed that the octopus catch in the waters of Ampana, Tojo Una-Una, was dominated by weights of 800 g for males and 1,000 g for females. The largest octopus weights were recorded by Norman *et al.* (2016) and Heukelem (1983), who stated that the maximum weight could reach 5–6 kg.

Variations in the weight of captured octopuses are thought to be influenced by the fishing season, habitat conditions, and fishing intensity. Higher weights reflect favorable growth conditions and relatively low fishing pressure, whereas lower weights are likely due to high fishing pressure, resulting in larger individuals being caught earlier. Additionally, other factors include sex, stress, gonad development, food availability, and feeding activity (Zargar *et al.* 2012; Awasthi *et al.* 2015). Research in Kaur Regency indicates that the majority of octopuses caught between July and August were below the size suitable for harvesting. Research results indicate that the octopus catch in the waters of Kaur Regency is dominated by small individuals, suggesting that the population structure of the catch is skewed toward the juvenile phase. From a biological perspective, this condition is likely linked to the life cycle dynamics of *Octopus cyanea*, specifically the post-spawning phase, when juveniles actively utilize shallow-water habitats, thereby increasing their susceptibility to capture. Beyond biological factors, the prevalence of small octopuses also reflects relatively high fishing pressure in the study area. Continuous fishing intensity threatens to reduce the proportion of adult individuals in the population, resulting in a catch composition dominated by smaller sizes. These findings align with fisher interviews indicating that octopuses caught between July and September are generally small. This period likely coincides with the population recruitment phase; consequently, fishing during this time could negatively impact stock sustainability unless accompanied by regulations on minimum catch sizes and adaptive management of fishing seasons.

Persistent fishing of undersized octopuses could make them increasingly difficult to catch in the future. Observations and interviews at the study site revealed that fishers are having to travel further afield to catch octopuses, as those in the waters near Linau have become scarcer and smaller in size. The conditions in Linau waters regarding the prevalence of small octopuses warrant further study. Measuring octopus weight over a full year with a substantial sample size would yield more comprehensive data and information.

Government bodies and stakeholders are encouraged to raise awareness and disseminate information regarding appropriate catch sizes for octopuses in Kaur Regency. Additionally, further study is needed on the fishing grounds that yield small octopuses, given the unique nature of the species: octopuses grow rapidly but have short lifespans. Octopuses in warm waters likely have a lifespan of 1 to 2 years (Mangold 1983; FAO 2016). They have a short lifespan and can reach a weight of 200 g within 15 days. Based on gonad maturity thresholds of 320 g for males and 600 g for females (Guard and Mgaya 2002), it is estimated that octopuses reach sexual maturity within 40–50 days. Implementing a system of alternating open and closed fishing zones over several months is necessary to allow for the octopus reproductive period. This measure is essential for the sustainability of octopus resources in Kaur Regency.

Length-weight relationship

Growth is defined as an increase in length or weight over a specific period. It can be estimated using the length-weight relationship, wherein weight is considered a function of length. Additionally, growth can be measured using length data (specifically, the length of a fixed body part). Information regarding the length-weight relationship of octopuses in Indonesia is scarce, and data for Kaur Regency is entirely lacking. This lack of information stems from insufficient research on octopus fisheries, despite octopuses being a dominant catch in Kaur Regency. In this study, the length-weight relationship is characterized by the relationship between mantle length and total body weight.

The length-weight relationship equation for the octopuses yielded values of a = 0.0054 and b = 1.9782 (Figure 7). A regression coefficient (b) value of less than 3 indicates negative allometric growth. This implies that the octopuses in Kaur Regency exhibit faster mantle length growth relative to body weight growth. Mantle length and weight growth are influenced by both internal and external factors. Internal factors include age, size, sex, diet, activity levels, inter- and intra-specific interactions, and population or geographical influences. External factors such as environmental conditions like temperature, light, salinity, and food availability also affect octopus growth (Forsythe and Heukelem 1987; Herwig *et al.* 2012; Chande *et al.* 2021; Silas *et al.* 2021).

Previous studies on length-weight relationships have been conducted by Omar *et al.* (2020) in Makassar waters; Guard and Mgaya (2002) in Mafia Island, Mtwara, and Tanga (Tanzania); Raberinary and Benbow (2012) in Madagascar; Noegroho *et al.* (2022) in Tojo Una-Una; Diniariwisan *et al.* (2023) at Ketapang Beach; Hutagaol *et al.* (2019) in Popisi, Banggai Laut; Marzuki *et al.* (2023) in the Alas Strait, West Nusa Tenggara; and Amir *et al.* (2021) in Teluk Bone. Research in several regions has indicated negative allometric growth. The study conducted in Kaur Regency also showed negative allometric growth, with results lower than those found in some other studies. A different length-weight relationship was reported by Hutagaol *et al.* (2019), who found that octopuses in Popisi, Banggai Laut, exhibited positive allometric growth, meaning mantle length growth was slower than weight growth. This discrepancy is likely attributed to the species observed during data collection; the present study examined *Octopus cyanea*, whereas the other study examined *Octopus vulgaris*. Species differences influence the length-weight relationship of octopuses. Additionally, variations in water locations, such as oceanographic conditions and water characteristics at the time of the study, may also affect the results.

The findings of the study enrich the limited biological information available on *Octopus cyanea*, particularly regarding mantle length and weight. This information can serve as a scientific basis for establishing minimum harvestable sizes and supporting the formulation of sustainable octopus fishery management policies in Kaur Regency. The study found that 76% of the octopuses in Kaur Regency weighed less than 600 g, had b < 3, and predominantly had a mantle length of less than 10 cm. These results provide biological insights to inform the sustainable management of octopus fisheries. Furthermore, field observations indicate a need to establish open and closed seasons for octopus fishing based on minimum size criteria for captured individuals, ensuring that management focuses not only on catch volume but also on resource sustainability. Consequently, stakeholders can assume their respective roles in safeguarding the sustainability of the octopus fishery, particularly in Kaur Regency. These research findings provide an initial scientific basis for formulating policies regarding minimum catch sizes and time- or area-based open/closed fishing regulations tailored to the characteristics of the octopus resource. The further development of such policies requires comprehensive data on biology and population dynamics.

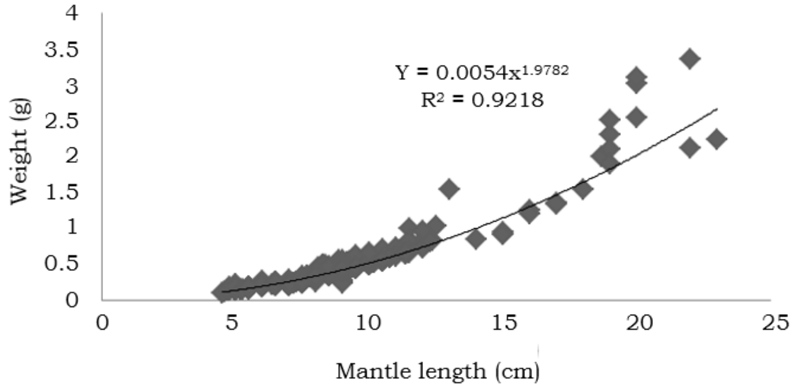

Figure 7. Regression relationship between mantle length and body weight of octopuses in Kaur Regency.

CONCLUSION

Octopus catch productivity in Kaur Regency fluctuated, with the highest CPUE recorded at 5.2 in September 2023 and the lowest at 2.6 in February 2023. During the east monsoon, the catch of female octopuses was higher (851 individuals) compared to males (222 individuals). The dominant mantle length of octopuses caught during the east monsoon ranged from 7.95 to 8.67 cm (comprising 121 males and 432 females), while the dominant weight ranged from 117 to 465 g (comprising 83 males and 355 females). The prevalence of relatively small individuals and the fluctuations in CPUE during specific periods indicate seasonal dynamics and may serve as an early sign of fishing pressure. However, given the limited study period, this phenomenon requires further monitoring and analysis to comprehensively assess the resource status before it can serve as a basis for fisheries management. The length-weight relationship of octopuses in Kaur Regency indicates a pattern of negative allometric growth.

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REFERENCES

Ahmed AS, El-Ganainy AA, Osman MF, Khalil MT. 2021. Observations on Some Morphometric Characters of the Webfoot Octopus, *Amphioctopus membranaceus* (Quoy and Gaimard 1832) from the Suez Gulf, Red Sea, Egypt. *Egyptian Journal of Aquatic Biology and Fisheries*. 25(2): 103–115. DOI: https://doi.org/10.21608/EJABF.2021.158705.

Akar Global Inisiatif. 2023. *Pendataan Gurita di Kabupaten Kaur, Provinsi Bengkulu*. Bengkulu (ID): Yayasan Akar Global Inisiatif.

Alim S, Marzuki M, Nuryadi R. 2023. Analysis Existing Conditions of Octopus (*Octopus vulgaris*) in Pandanan Beach, Malaka Village, North Lombok. *Jurnal Biologi Tropis*. 23(2): 535–542. DOI: https://doi.org/10.29303/jbt.v23i2.5278.

Alves J, Haimovici M. 2011. Reproductive Biology of *Octopus tehuelchus* d'Orbigny, 1834 (Cephalopoda: Octopodidae) in Southern Brazil. *The Nautilus*. 125(3): 150–158.

Amarullah T, Zuraidah S, Gazali M. 2020. Strategi Peningkatan Pendapatan Nelayan Skala Kecil Berkelanjutan Melalui Pemanfaatan Potensi Gurita (*Octopus* sp.) di Kabupaten Simeulue Propinsi Aceh. *Jurnal Perikanan Tropis*. 7(1): 13–25. DOI: https://doi.org/10.35308/jpt.v7i1.1806.

Amir F, Mallawa A, Umar MT. 2021. Pola Pertumbuhan dan Nisbah Kelamin Gurita (*Octopus vulgaris*) di Teluk Bone. *Agrikan: Jurnal Agribisnis Perikanan*. 14(2): 527–532. DOI: https://doi.org/10.52046/agrikan.v14i2.873.

Awasthi M, Kashyap A, Serajuddin M. 2015. Length-weight Relationship and Condition Factor of Five Sub-populations of *Trichogaster lalius* (Osphronemidae) of Central and Eastern Regions of India. *Journal of Ichthyology*. 55: 849–853. DOI: https://doi.org/10.1134/S0032945215060028.

Begg GA, Friedland KD, Pearce JB. 1999. Stock Identification and its Role in Stock Assessment and Fisheries Management: An Overview. *Fisheries Research*. 43(1–3): 1–8. DOI: https://doi.org/10.1016/S0165-7836(99)00062-4.

Chande MA, Mgaya YD, Benno LB, Limbu SM. 2021. The Influence of Environmental Variables on the Abundance and Temporal Distribution of *Octopus cyanea* around Mafia Island, Tanzania. *Fisheries Research*. 241: 1–10. DOI: https://doi.org/10.1016/j.fishres.2021.105991.

Diniariwisan D, Marzuki M, Lestariningsih WA. 2023. Identifikasi Dimensi Biologi Gurita di Pantai Ketapang Lombok Timur untuk Pengelolaan Perikanan Berkelanjutan. *Jurnal Ganec Swara*. 17(4): 1308–1312. DOI: https://doi.org/10.35327/gara.v17i4.609.

Dwihastuty L, Arkham MN, Digdo AA, Putriraya AR. 2023. Pengelolaan Perikanan Gurita dengan Pendekatan Pengelolaan Perikanan Berbasis Ekosistem (EAFM) di Kabupaten Minahasa Utara, Provinsi Sulawesi Utara. *Buletin Ilmiah Marina: Sosial Ekonomi Kelautan dan Perikanan*. 9(2): 179–194. DOI: https://doi.org/10.15578/marina.v9i2.12825.

1315/420/1/012011.

Effendie MI. 2002. *Biologi Perikanan* (Edisi Revisi Cetakan Kedua). Yogyakarta (ID): Yayasan Pustaka Nusatama.

Etikan I, Musa SA, Alkassim RS. 2016. Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*. 5(1): 1–4. DOI: https://doi.org/10.11648/j.ajtas.20160501.11.

Fafioye OO, Oluajo OA. 2005. Length-Weight Relationships of Five Fish Species in Epe Lagoon, Nigeria. *African Journal of Biotechnology*. 4(7): 749–751. DOI: https://doi.org/10.5897/AJB2005.000-3136.

[FAO] Food and Agriculture Organization of the United Nations. 2016. *Cephalopods of the World: An Annotated and Illustrated Catalogue of Cephalopod Species Known to Date*. Rome (IT): FAO.

Forsythe JW, Heukelem VWF. 1987. *Growth*. In: Boyle PR (Editor). *Cephalopod Life Cycles*, *Vol. II*. London (GB): Academic Press.

Gromiko R, Ravita R. 2022. Mengintip Aktivitas Konservasi Gurita di Terumbu Karang Laut Kaur, Salah Satu Hasil Laut Andalan Kabupaten Kaur. https://www.tvonenews.com/daerah/sumatera/49404-mengintip-aktifitas-konservasi-gurita-di-terumbu-karang-laut-kaur-salah-satu-hasil-laut-andalan-kabupaten-kaur. [February 25, 2025].

Guard M. 2003. Assessment of the Artisanal Fishery of *Octopus cyanea* (Gray 1929) in Tanzania: Catch Dynamics, Fisheries Biology, Socio-economics and Implications for Management [Dissertation]. Aberdeen (GB): University of Aberdeen.

Guard M, Mgaya YD. 2002. The Artisanal Fishery for *Octopus cyanea* Gray in Tanzania. *AMBIO: A Journal of the Human Environment*. 31(7): 528–536. DOI: http://dx.doi.org/10.1579/0044-7447-31.7.528.

Hakim AA, Bagaskoro B, Mashar A, Farajallah A, Wardiatno Y. 2020. Morphology and Molecular Identification on Octopus (Genus *Octopus* Cuvier, 1798) Caught in Palabuhanratu, Sukabumi, West Java. *International Symposium, "Coastal Ecosystem and Biodiversity on Asia-Pacific: Achieving SDG 14", August 12–16, 2019, Bogor, Indonesia*. IOP Conference Series: Earth and Environmental Science. DOI: https://doi.org/10.1088/1755-1315/420/1/012011.

Herwig JN, Depczynski M, Roberts JD, Semmens JM, Gagliano M, Heyward AJ. 2012. Using Age-Based Life History Data to Investigate the Life Cycle and Vulnerability of *Octopus cyanea*. *PLoS ONE*. 7(8): e43679. DOI: https://doi.org/10.1371/journal.pone.0043679.

Heukelem VWF. 1983. *Octopus cyanea*. In: Boyle PR (Editor). *Cephalopod Life Cycles*, *Vol. I*. London (GB): Academic Press.

Hutagaol ID, Redjeki S, Susilo ES. 2019. Morfometri *Octopus vulgaris* Cuvier, 1797 (*Cephalopoda*: Octopodidae) dari Perairan Popisi, Pulau Banggai Laut, Sulawesi Tengah. *Journal of Marine Research*. 8(2): 149–156. DOI: https://doi.org/10.14710/jmr.v8i2.25095.

Kaur Regency Fisheries Office. 2022. *Profile of Fisheries Resources Development in Kaur Regency in 2022*. Kaur (ID): Kaur Regency Fisheries Office.

Kaur Regency Fisheries Office. 2023. *Aquaculture, Capture Fisheries, and Fisheries Processing/Marketing Production in Kaur Regency in 2023*. Kaur (ID): Kaur Regency Fisheries Office.

Leporati SC, Hart AM, Larsen R, Franken LE, Graaf MD. 2015. Octopus Life History Relative to Age, in a Multi-Geared Developmental Fishery. *Fisheries Research*. 165: 28–41. DOI: https://doi.org/10.1016/j.fishres.2014.12.017.

Leporati SC, Ziegler PE, Semmens JM. 2009. Assessing The Stock Status of Holobenthic Octopus Fisheries: Is Catch per Unit Effort Sufficient?. *ICES Journal of Marine Science*. 66(3): 478–487. DOI: https://doi.org/10.1093/icesjms/fsn224.

Mangold K. 1983. Food, Feeding and Growth in Cephalopods. *Memoirs of Museum Victoria*. 44: 81–93. DOI: https://doi.org/10.24199/j.mmv.1983.44.08.

Mangold K. 1987. *Reproduction*. In: Boyle PR (Editor). *Cephalopod Life Cycles*, *Vol. II*. London (GB): Academic Press.

Marzuki M, Diniariwisan D, Lestariningsih WA. 2023. Biological Identification of Octopuses and Index Values for Fisheries Management in the Alas Strait Area, West Nusa Tenggara. *Jurnal Penelitian Pendidikan IPA*. 9(12): 12149–12154. DOI: https://doi.org/10.29303/jppipa.v9i12.5956.

Ministry of Marine Affairs and Fisheries. 2023. *One Data of the Ministry of Marine Affairs* *and Fisheries*. Jakarta (ID): Ministry of Marine Affairs and Fisheries.

Mulyani LF, Arfiati D, Ekawati AW, Widodo MS. 2023. Identification of Land Suitability as the Basis for Cultivation of *Octopus cyanea* in Lombok Waters. *The 12th International and National Seminar of Fisheries and Marine Science* (*ISFM XII 2023*). BIO Web of Conferences. DOI: https://doi.org/10.1051/bioconf/20237404009.

Noegroho T, Kembaren DD, Nurdin E, Panggabean AS, Taufik M, Fauzi M, Wibowo S. 2022. Characteristics of Octopus Fishery in Ampana Tojo Una-Una Sea Waters. *7th International Conference on Tropical Coastal Region Eco-Development in September 2022 (ICTCRED-2022), September 20–22, 2022, Semarang, Indonesia*. IOP Conference Series: Earth and Environmental Science. DOI: https://doi.org/10.1088/1755-1315/1224/1/012010.

Norman MD. 1991. *Octopus cyanea* Gray, 1849 (Mollusca: Cephalopoda) in Australian Waters: Description, Distribution and Taxonomy. *Bulletin of Marine Science*. 49(1–2): 20–38.

Norman MD, Finn JK, Jereb P, Roper CFE. 2016. *Cephalopods of the World, An Annotated and Illustrated Catalogue of Cephalopod Species Known to Date* (*Volume 3. Octopods and Vampire Squids*). Rome (IT): Food and Agriculture Organization of the United Nations.

Omar SBA, Safitri ARD, Ramadhani A, Tresnati J, Suwarni, Umar MT, Kaseng ES. 2020. Pertumbuhan Relatif Gurita, *Octopus cyanea* Gray, 1849 di Perairan Selat Makassar dan Teluk Bone. *Prosiding Simposium Nasional VII Kelautan dan Perikanan, 5 Juni 2020, Fakultas Ilmu Kelautan dan Perikanan, Universitas Hasanuddin, Makassar*. 109–130.

Owiredu SA, Onyango SO, Song EA, Kim KI, Kim BY, Lee KH. 2024. Enhancing Chub Mackerel Catch Per Unit Effort (CPUE) Standardization through High-Resolution Analysis of Korean Large Purse Seine Catch and Effort Using AIS Data. *Sustainability*. 16(3): 1307. https://doi.org/10.3390/su16031307.

Paruntu CP, Boneka FB, Talare SL. 2009. Gurita (Cephalopoda) dari Perairan Sangihe, Sulawesi Utara. *Ekoton*. 9(2): 13–27.

Raberinary D, Benbow S. 2012. The Reproductive Cycle of *Octopus cyanea* in Southwest Madagascar and Implications for Fisheries Management. *Fisheries Research*. 125–126: 190–197. DOI: https://doi.org/10.1016/j.fishres.2012.02.025.

Salas S, Sumaila UR, Pitcher T. 2004. Short-term Decisions of Small-scale Fishers Selecting Alternative Target Species: A Choice Model. *Canadian Journal of Fisheries and Aquatic Sciences*. 61(3): 374–383. DOI: https://doi.org/10.1139/f04-007.

Silas MO, Kishe MA, Mshana JG, Semba ML, Mgeleka SS, Kuboja BN, Ngatunga BP, Chande MA, Matiku P. 2021. Growth, Mortality, Exploitation Rate and Recruitment Pattern of *Octopus cyanea* (Mollusca: Cephalopoda) in the WIO Region: A Case Study from the Mafia Archipelago, Tanzania. *Western Indian Ocean Journal of Marine Science*. 20(1): 71–79. DOI: https://doi.org/10.4314/wiojms.v20i1.7.

Tarigan DJ, Simbolon D, Wiryawan B. 2018. Strategi Pengelolaan Perikanan Gurita di Kabupaten Banggai Laut, Provinsi Sulawesi Tengah. *Jurnal Teknologi Perikanan dan Kelautan*. 9(1): 13–24. DOI: https://doi.org/10.24319/jtpk.9.13-24.

Tarigan DJ, Simbolon D, Wiryawan B. 2019. Evaluasi Keberlanjutan Perikanan Gurita dengan Indikator EAFM (Ecosystem Approach to Fisheries Management) di Kabupaten Banggai Laut. *Marine Fisheries: Jurnal Teknologi dan Manajemen Perikanan Laut*. 10(1): 83–94. DOI: https://doi.org/10.29244/jmf.10.1.83-94.

Toha AHA, Jeni, Widodo N, Hakim L, Sumitro SB. 2015. Gurita *Octopus cyanea* Raja Ampat. *Konservasi Biodiversitas Raja 4: Lindungi Ragam, Lestari Indonesia*. 4(8): 4–8.

Trendeconomy. 2023. World Exports of Octopus. https://trendeconomy.com/data/commodity_h2/030759?utm. [September 23, 2025].

Wells MJ, Wells J. 1972. Sexual Displays and Mating of *Octopus vulgaris* Cuvier and *O. Cyanea* Gray and Attempts to Alter Performance by Manipulating the Glandular Condition of the Animals. *Animal Behaviour*. 20(2): 293–308. DOI: https://doi.org/10.1016/S0003-3472(72)80051-4.

World Bank. 2022. Fishery Trade Statistics: Indonesia. https://wits.worldbank.org/trade/comtrade/en/country/IDN/year/2022/tradeflow/Exports/

partner/ALL/product/030199?. [September 23, 2025].

World Bank. 2023. Fishery Trade Statistics: Indonesia. https://wits.worldbank.org/trade/comtrade/en/country/IDN/year/2023/tradeflow/Exports/partner/ALL/product/030199?. [September 23, 2025].

Zar JH. 2010. *Biostatistical Analysis* (Fifth Edition). Upper Saddle River (US): Pearson Education International.

Zargar UR, Yousuf AR, Mushtaq B, Jan D. 2012. Length–Weight Relationship of the Crucian Carp, *Carassius carassius* in Relation to Water Quality, Sex and Season in Some Lentic Water Bodies of Kashmir Himalayas. *Turkish Journal of Fisheries and Aquatic Sciences*. 12: 683–689. DOI: https://doi.org/10.4194/1303-2712-v12_3_17.