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Condition of Octopus Fishery Resources with Ecosystem Approach to Fisheries Managament Assessment on Langkai and Lanjukang Islands, Makassar City

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ABSTRACT

The octopus is a type of fishery commodity with significant economic value in both local and domestic markets. The rise of irresponsible octopus fishing activities, particularly in the waters of the Spermonde Archipelago, has become a growing concern. Sustainable management of octopus fisheries is necessary to prevent the exploitation of resources. The areas surrounding Langkai and Lanjukang Islands exhibit high potential for octopus populations. However, the productivity and catch status of octopus fisheries require in-depth research, as there is a lack of relevant data. This study aimed to assess the status of octopus resources around Langkai and Lanjukang Islands. The research was conducted from January to March 2023 using field surveys and observation methods. Primary data were collected through direct observation of octopus fishing units and interviews with fishermen and octopus collectors on the islands. Respondents were selected using purposive sampling, focusing on active octopus fishermen. Secondary data were obtained from the South Sulawesi Agency of Marine Affairs and Fisheries. Data analysis was performed using flag modeling with several indicators in the octopus resource domain. The results indicate the following scores for each indicator: standard CPUE (0.8, medium), octopus weight trend (0.5, medium), proportion of juveniles caught (0.45, high), catch composition (0.15, high), octopus collapse range (0.2, medium), and ETP (endangered, threatened, and protected) species (0.15, high). These findings suggest that the condition of octopus fishery resources in the waters around Langkai and Lanjukang Islands is classified as moderate (yellow level), with an aggregate score of 2.25.

INTRODUCTION

In both local and domestic markets, octopus is a fishery commodity with a high economic value. In nearly every marine environment on Earth, including tropical and polar regions, octopuses can be found. Octopuses are a class of fish resources that live in sand, mud, coral reefs, and the spaces between rocks **(Norman, 1991; Herwig *et al.*,**

2012; Raberinary & Benbow, 2012). Octopus fishing in Indonesia is primarily done by small-scale fishermen near coral reefs. *Octopus cyanea*, commonly referred to as the "rock octopus" by the locals, is one of the most common species of octopus captured. According to reports, this kind of octopus can be found in Maluku, Bintuni Bay (Papua), Bunaken, Takabonerate, Pekalongan, and Prigi (East Java) (**Ghofar, 1999)**.

The majority of octopuses (Octopodidae) produced worldwide are obtained from capture fisheries. According to the FAO Figis Database, 420.000 tons of octopuses are produced worldwide annually. With 10.860 tons produced in 2010, Indonesia is the fourth-highest producing nation after China (125.776 tons), Japan (41.700 tons), and South Korea (20.759 tons) **(FAO, 2014)**.

The lack of comprehensive data and information, along with the absence of sustainable octopus management, are key issues facing Indonesia's octopus fisheries. According to the Destructive Fishing Watch (DFW)-Indonesia's indicative map, the Makassar Strait, the waters surrounding Kalimantan, and West Sulawesi are frequent locations for non-environmentally friendly fishing activities (PITRaL), also known as destructive fishing. The high intensity of PITRaL or destructive fishing has placed significant pressure on fish resources (FR), particularly priority species in the Spermonde Islands, which extend from Pangkajene Regency and surrounding islands to the coastal waters of Makassar City. This pressure has severely damaged coral reef ecosystems.

There is still a lack of data and knowledge regarding the management of octopus fisheries in the local Spermonde Islands. Despite this, the region is home to numerous islands and small-scale fishermen who rely on octopus resources. Since octopuses are less frequently utilized compared to other marine species, they have been poorly documented. However, their importance has only recently become more apparent, driven by increasing demand for octopus as a food product from several countries, which has led to rising prices. As a result, some fishermen have started targeting octopuses as part of their catch. To address the growing trend of octopus fishing, improved management practices are necessary.

Data from the South Sulawesi Province Maritime and Fisheries Service for 2015–2019 indicate an annual increase in the number of fishing vessels in Makassar City. However, catch data show a decline, suggesting that overfishing is affecting the sustainability of Makassar City's octopus resources. To date, fishermen have prioritized financial gain over habitat preservation and often disregard sustainable fishing techniques. It is crucial to manage both the resources and the ecosystem to ensure their continued health and achieve sustainable fisheries.

Thus, this study aimed to assess the condition of octopus fishery resources using the Ecosystem Approach to Fisheries Management (EAFM) in the waters of Langkai and Lanjukang Islands.

MATERIALS AND METHODS

1. Study area

The research was conducted on two islands, namely Langkai Island and Lanjukang Island, in Barrang Caddi Village, Sangkarrang Islands District, Makassar City, from January to March 2023.

2. Collection data

Surveys and field observations were conducted for this study, with both primary and secondary data collected. Primary data were gathered through direct observation of octopus fishing units and interviews with respondents using a set of questions. Respondents were selected based on their active involvement in fishing, and the number of participants was determined through purposive sampling. Among the respondents were octopus fishermen and collectors from Langkai and Lanjukang Islands. Secondary data were obtained from research-related organizations and publications, specifically from the South Sulawesi Province Maritime and Fisheries Service.

3. Data analysis

The data analysis in this study pertains to the establishment of the technical guidelines for EAFM indicators in the fish resources domain, which were determined in 2014 by the Center for Coastal and Marine Resources Studies, the Ministry of Maritime Affairs and Fisheries, WWF-Indonesia, and the Directorate General of Capture Fisheries. Six indicators are present in the domain of fish resources. Table (1) displays the fish resource domain indicators that were used in addressing the NWG in **EAFM (2014)**:

Table 1. Domain indicators for fish resources

No	Indicators	Criteria	Portion
1	CPUE	1 = drastically decreased (mean > 25% / year) 2 = decreased slightly (mean < 25% / year) 3 = stable or increasing	40
2	Octopus weight trends	1 = The mean size of caught fish is trending smaller.; 2 = the size trend is steady; 3 = increasing size trends	25
3	Juvenile octopuses caught	1 = numerous (> 60%) 2 = plenty (30 - 60%) 3 = slightly (<30%)	15
4	The catch's species composition	1 = slightly targeted (< 15% total volume) 2 = targeted proportion as same as non-target (16-30% of total volume) 3 = mostly targeted proportion (> 31 % of total volume)	5
5	"Range Collapse" of fish resources	1 = fishing grounds are increasingly distant 2= fishing grounds are distant 3= fishing ground distance is steady	10
6	ETP Species	1= caught ETP species not released; 2 = caught but not released; 3 = No ETP species were caught	5

Weight and score values were assigned to each indicator based on its importance and relevance to the commodity under investigation. The evaluation was conducted via comparing actual conditions to ideal ones. Each indicator was assessed using a 1-3 Likert scale, and the results are presented using a flag model, as shown in Table (2).

Table 2. Composite index value of the EAFM assessment

Score range	Flag models	Annotation
1		Bad
2		Moderate
3		Good

RESULTS AND DISCUSSIONS

1. Status of fisheries management based on octopus resource domains

Although various species of octopuses inhabit the waters around Langkai Island and Lanjukang, Makassar City, fishermen exclusively target the *Octopus cyanea* species. The assessment of the octopus resource domain yielded the following results: a CPUE value of 2 (medium), an octopus weight trend of 2 (medium), a juvenile catch percentage of 3 (high), a catch composition of 3 (high), an octopus resource collapse range of 2 (medium), and ETP (endangered, threatened, and protected) species of 3 (high). With an overall score of 2.25, these findings indicate that the status of octopus resources in the waters around Langkai and Lanjukang Islands is classified as moderate (yellow level), as shown in Table (3).

Table 3. Examining indicators within the domain of octopus resources

INDICATORS	SCORE	(%)	VALUE
CPUE standard	2	40	0.8
Octopus trends wight	2	25	0.5
Juvenile octopus caught	3	15	0.45
The catch's species composition	3	5	0.15
Range collapse of octopus resources	2	10	0.2
Etp species	3	5	0.15
AGGREGATE		100	2.25

2. CPUE Standard

From 2015 to 2019, octopus landings in Makassar from small-scale fishing vessels (capacity less than 3 GT) in the waters of Langkai and Lanjukang Islands revealed declining yields annually. Data from the South Sulawesi Province Maritime and Fiheries Agency indicate a rise in the number of vessels and a fall in the production of octopus catches (Table 4).

Table 4. Catch conditions and vessel count in Makassar City from 2015 to 2019

Years	Effort, ∑ Vessels (unit)	Production (Ton)	CPUE (Ton/unit)
2015	1528	241.6	0.16
2016	1568	110.2	0.07
2017	2034	244.8	0.12
2018	2015	23.3	0.01
2019	3049	35.3	0.01

Source: Data on fishing catch production from the South Sulawesi Province Maritime and Fisheries Agency

Table (4)'s catch per unit effort (CPUE) condition indicates that, over five years, CPUE has decreased by 18%; this value falls into the medium category (yellow). These outcomes were derived from 2015–2019 CPUE computations. A drop in CPUE is a sign that the number of octopus resources available at a given location is decreasing. This decline in CPUE suggests that there has been an excessive amount of fishing pressure on the waters around Langkai and the Lanjukang Islands. Following **Nabunome** (**2007**), an increase in fishing fleets and gear will lead to overfishing in the region because resource production decreases with increased effort since an increase in fishing trips is directly correlated with an increase in fishing gear. Aside from that, contamination of the aquatic environment can also contribute to the decrease in resource production.

3. Octopus trends weight

With a score of 2, the octopus size trend indicator falls into the medium (yellow) category. This demonstrates that the weight of octopuses caught by fishermen from the Lanjukang and Langkai Islands is essentially consistent. Fig. (1) illustrates trends in body weight of male octopuses, and Fig. (2) shows trends in body weight of female octopuses in more detail.

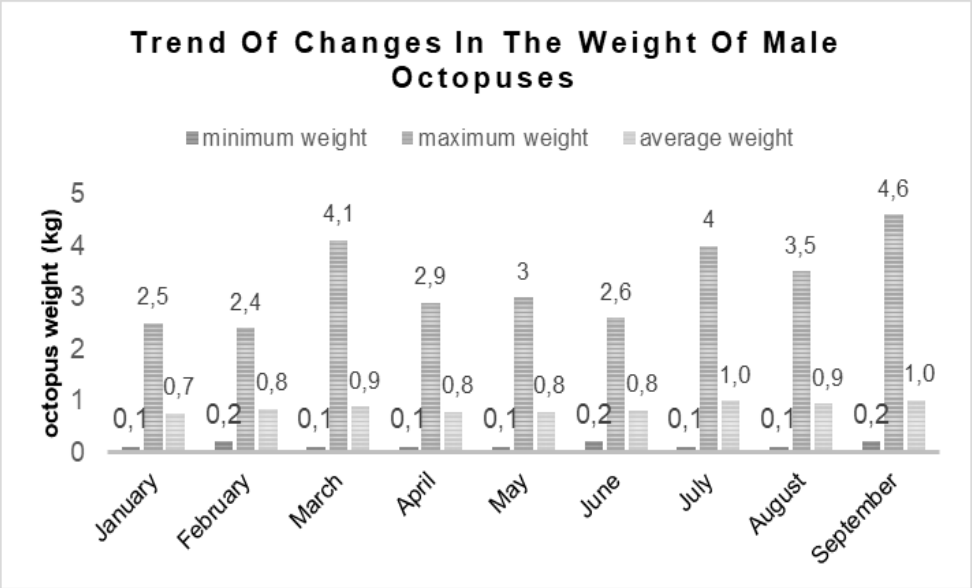

Fig. 1. Trends in body weight of male octopuses

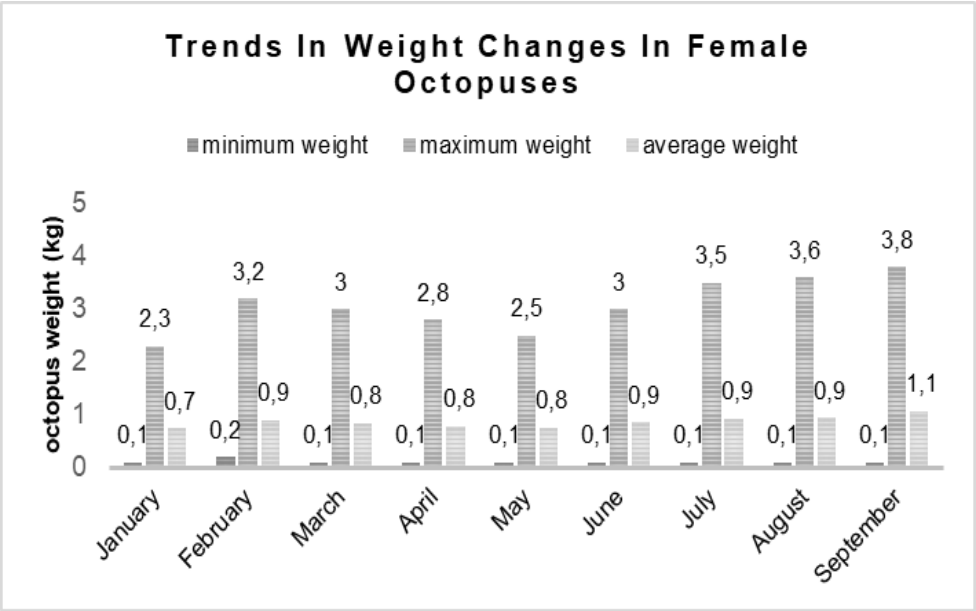

Fig. 2. Trends in body weight of female octopuses

The findings indicate that 3.472 female octopuses and 6.716 male octopuses were caught out of a total catch of 10.188 octopuses recorded at the collector level in the Langkai and Lanjukang Islands between January and September 2023. The weight of a caught octopus ranges from a minimum of 0.1kg to a maximum of 4.6kg, with an average weight between 0.7 and 1.1kg. According to interviews with fishermen who have been fishing continuously for over a decade, the weight and size of the catches are generally consistent.

Percentage of juvenile octopus captured

The percentage of juveniles caught has an indicator score of 3, which is good (green). This demonstrates that the majority of octopuses that fishermen from the Langkai and Lanjukang Islands catch are of an appropriate size. Fig. (3) displays the percentage of young octopuses that were captured.

Fig. 3. Percentage of juvenile octopus captured, both male and female

The proportion of male (A) octopus juveniles that were suitable for catching was 2.770 (80%), while those that were not suitable for catching were 702 (20%). The proportion of female (B) octopus juveniles that were suitable for catching was 5.263 (78%) and those that were not suitable for catching were 1.453 (22%). According to **Guard and Mgaya (2002)**, male octopuses at the adult stage weigh 320 grams. Meanwhile, female octopuses enter the adult stage and weigh 600 grams. This indicates that octopus catches in the waters of Langkai and Lanjukang Islands from January-September 2023 are dominated by the octopus category that is worth catching.

4. The catch's species composition

The indicator for catch species composition has a score of 3, indicating a high (green) value. Nearly all of the fish caught by fishermen in the Langkai and Lanjukang Islands are octopuses, with only 1 to 5 percent of the catch being non-octopus species, if any. This demonstrates that, compared to other commodities, octopus constitutes a higher proportion of the catch. Interviews with fishermen from Langkai and Lanjukang Islands reveal that most primarily catch octopus, with a small percentage also catching cuttlefish.

5. Range collapse of octopus resources

Octopus fishing is typically done by fishermen from the Langkai and Lanjukang Islands starting from the early morning till midday or evening. The weather has a significant influence on octopus hunting in the waters surrounding the Langkai and Lanjukang Islands. The waters surrounding Makassar City, including those of Pangkajene Regency and the Islands, are home to fishing spots for octopuses. As seen in Table (3), the octopus resource range collapse indicator has a score value of 2, or medium (yellow). This indicates that octopus fishing is taking place farther away. According to fishermen

who participated in interviews, the reason for this shift in fishing territory was that fewer octopuses were present on the island, which forced them to fish farther out. In addition, unpredictable seasonal variations force fishermen to relocate their fishing grounds. The fishing grounds of Langkai and Lanjukang Island fishermen are listed in Fig. (4).

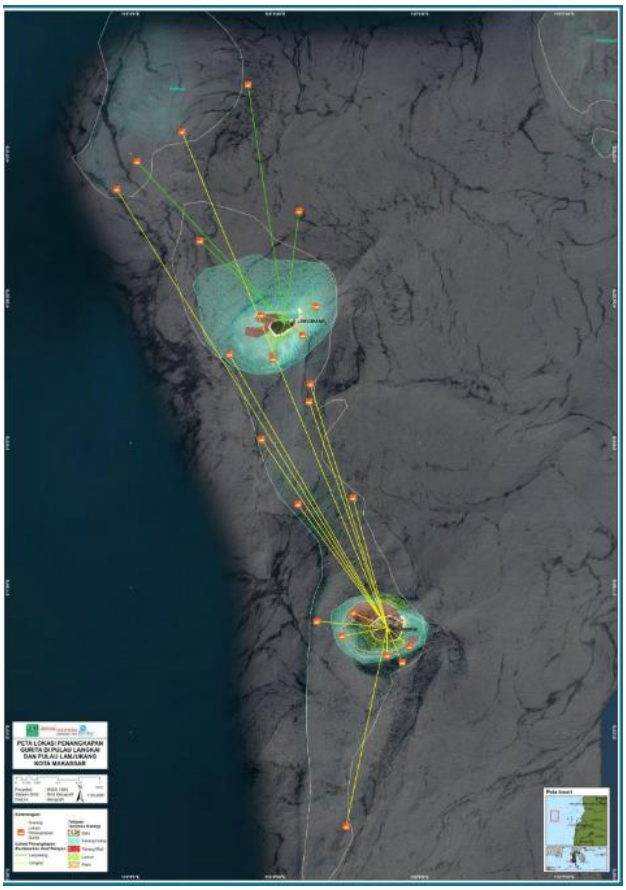

Fig. 4. Map of the Langkai and Lanjukang Islands' octopus fishing locations

6. ETP species

Based on fishermen's encounters, the ETP species found in the waters of Langkai and Lanjukang Islands include whale sharks, green turtles, hawksbill turtles, and several other types of sharks. Table (3) displays the indicator score values for Endangered, Threatened, and Protected (ETP) species. A value of 3 indicates good (green). These findings demonstrate that no ETP species were captured during the octopus fishing operations conducted by fishermen on the Langkai and Lanjukang Islands. Based on information from fishermen and direct observations in the field during the research, no ETP species were caught, this is because the type of fishing gear used to catch octopus does not allow catching other types of commodities.

CONCLUSION

With an aggregate value of 2.25 (green) across all indicators—CPUE indicator 2 (medium), octopus weight trend 2 (medium), proportion of juveniles caught 3 (high), catch composition 3 (high), range collapse of octopus resources 2 (medium), and ETP species 3 (high)—the condition of octopus fisheries management using the EAFM approach in the waters around Langkai and Lanjukang Islands is classified as moderate.

Author Contribuition

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