

SUSTAINABILITY STATUS OF MANTIS SHRIMP (*Harpiosquilla raphidea*) RESOURCES IN THE WATERS OF LABUHANBATU, NORTH SUMATRA PROVINCE

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ABSTRACT

This study was conducted from May to July 2026 in the Panai Hilir and Panai Tengah subdistricts of Labuhanbatu Regency. The objective of this study was to analyze the sustainability status of mantis shrimp (*Harpiosquilla raphidea*) resource management in the waters of Labuhanbatu, North Sumatra Province, using the . The research methods employed included secondary data analysis and a sample survey. The data were analyzed using Multi-Dimensional Scaling (MDS) through the RAPFISH (Rapid Assessment Technique for Fisheries) approach. Analysis of the sustainability status of mantis shrimp resource management using RAPFISH-Hamdangtis revealed that the average sustainability index value for mantis shrimp, based on five dimensions (environmental, mantis shrimp resource, facilities and technology, social and economic, and institutional and governance). The mantis shrimp resource in the waters of Labuhanbatu is considered unsustainable, with a value of 42.82 (<50). The environmental dimension showed the lowest score, indicating that habitat quality and ecosystem conditions are priority areas for management intervention. A plan to improve the sustainability of mantis shrimp management in the waters of Labuhanbatu, North Sumatra Province can leverage dimensions classified as relatively sustainable such as substrate deposition, hydro-oceanographic conditions, coastal degradation, until relevant regulations to address and improve less sustainable aspects.

Keywords: Mantis shrimp, Labuhanbatu Regency, Sustainability, RAPFISH-Hamdangtis

1. INTRODUCTION

Mantis shrimp are one of the wild-caught fishery products with high economic value. Several species of mantis shrimp are known as exotic delicacies and are exported due to their premium taste. Species of mantis shrimp with high economic value include those from the families Harpiosquillidae and Squillidae, such as *Harpiosquilla harpax*, *H. raphidea*, *Lysiosquillina maculata*, *Squilla empusa*, and *Squilla mantis*¹. Mantis shrimp are also known by other names, such as “udang dadah,” “udang ronggeng,” “udang

kelabang,” “udang eiko,” “udang sembah,” and “udang belalang”².

Currently, there are approximately 500 species of mantis shrimp classified into 120 genera, 18 families, and 7 superfamilies. In Indonesian waters alone, more than 100 species of mantis shrimp have been identified, belonging to 54 genera, 13 families, and 5 superfamilies³⁻⁴, such as in Labuhanbatu with the species *H. raphidea*, known as the centipede shrimp (Heko). In addition, mantis shrimp are also found in eastern Indonesia, such as the species *Oratosquillina interrupta*, which was

discovered in Bone Bay, South Sulawesi⁵ and *O. interrupta* has also been found in the waters off Mimika, West Papua⁶.

Mantis shrimp are not widely consumed domestically but are very popular among international consumers, resulting in very high market demand and making them one of the most frequently caught shrimp species in Indonesian waters⁷, and they play a significant economic role as a fishery resource⁸⁻⁹. The price of mantis shrimp on the international market is \$3.50 per specimen measuring 17.5–22.5cm¹⁰, and the price in the traditional markets of Labuhanbatu ranges from Rp 40,000 to Rp 150,000 per specimen, depending on its size⁷.

The waters of Labuhanbatu are a fishing ground for *H. raphidea*, which contributes to Indonesia's shrimp stock and serves as an export commodity from the Sumatra region. The high economic value and intensive fishing of this shrimp species are believed to have led to a decline in its population within the Labuhanbatu aquatic ecosystem, threatening the sustainability of the population in its natural habitat¹¹. From a biological and ecological perspective, several mantis shrimp species have been extensively studied, including their morphology, larval development, reproductive biology, feeding ecology, population distribution, and nutritional content¹²⁻¹⁹.

In addition, several studies related to mantis shrimp have been conducted in Indonesia, including: Astuti & Ariestyani²⁰ on the economic potential and prospects of mantis shrimp in Indonesia, Situmeang et al.²¹ who examined the identification of mantis shrimp (Stomatopoda) species in the waters off Bengkulu City. Dimenta et al.¹ studied the reproductive biology of the mantis shrimp (*Cloridopsis scorpio*) in the Belawan mangrove ecosystem, Sumatera Utara²², Hasibuan & Dimenta⁷ studied the reproductive aspects of the mantis shrimp in the mangrove ecosystem of Labuhanbatu Regency, North Sumatra Province, Suman et al.²³ examined the management of mantis shrimp in the waters of West Tanjung

Jabung and surrounding areas, Jambi, and Siregar²⁴ investigated the utilization of mantis shrimp resources in the waters of Labuhanbatu, North Sumatra Province.

In particular, there is still very little information available from studies examining the sustainability status of mantis shrimp resources in the waters off Labuhanbatu. Assessing the sustainability of this resource is crucial because it is finite and vulnerable to depletion or even extinction if exploited beyond natural recovery limits; furthermore, the species holds high economic value as an export commodity but cannot yet be cultivated. This aligns with a previous study titled "Analysis of mantis shrimp resource utilization in the waters of Labuhanbatu, North Sumatra Province," which employed the Gordon-Schaefer bio-economic model to analyze utilization rates and fishing effort based on time-series data from 2017 to 2024. The analysis indicates that the mantis resource in Labuhanbatu is currently overexploited. Specifically, the utilization rate stands at 93%, signifying that exploitation has surpassed the Maximum Sustainable Yield (MSY) threshold, while the effort rate is 91%, indicating that production capacity is approaching its maximum limit²⁴.

Therefore, further in-depth research is needed to conduct an analysis using RAPFISH to examine the ecological, economic, social, technological, and institutional dimensions including attributes that can influence sustainability and to establish sustainable management principles aimed at preserving mantis shrimp populations in the Labuhanbatu waters and improving the welfare of mantis shrimp fishermen.

2. RESEARCH METHOD

Time and Place

This research by a junior faculty member was conducted from May to July 2026 in the areas where mantis shrimp fishermen are concentrated in the waters of Labuhanbatu, specifically in the Panai Hilir

and Panai Tengah Subdistricts of Labuhanbatu Regency, North Sumatra Province.



Figure 1. Mantis shrimp sampling locations in the Labuhanbatu aquatic ecosystem

Method

The method used in this study was a survey method employing Rapid Appraisal for Fisheries (RAPFISH) analysis based on Multidimensional Scaling (MDS). The study was descriptive-quantitative in nature, using an ecosystem approach that encompassed ecological, economic, social, technological, and institutional dimensions. Data were collected from both primary and secondary sources. Primary data were obtained through field observations, in-depth interviews, and focus group discussions (FGDs), while secondary data were obtained through literature reviews and documentation from relevant agencies associated with the study's topic.

Data Analysis

The research data analysis employed a purposive sampling technique based on involvement in resource utilization to select nine respondents meeting specific criteria from the fisheries sector and among relevant stakeholders including the Labuhanbatu Regency Marine and Fisheries Agency, Environmental Organization, fishers, Community-Based Surveillance Groups (Pokmaswas), Joint Business Group (KUB) chairpersons, sub-district heads, urban/village heads, academics, and mantis shrimp entrepreneurs.

The analysis of the sustainability status of mantis shrimp resources in the waters of Labuhanbatu, North Sumatra

Province, was conducted using RAPFISH-MDS through the assessment of attributes in each dimension, the calculation of the sustainability index, goodness-of-fit tests (stress and R^2), and leverage analysis to identify the attributes most influential in sustainability. RAPFISH is based on ordination techniques, which involve arranging items in order based on measurable attributes using MDS²⁵.

The analysis covers five dimensions of sustainability: ecological, social, technological, and institutional, represented by measurable attributes and assessed based on primary and secondary data. The MDS ordination results yield a sustainability index on a scale of 0–100, classified into four categories of sustainability status. Leverage analysis was used to identify sensitive attributes as key drivers of sustainability, while Monte Carlo simulations were conducted to test the stability and uncertainty of the results. Model validity was evaluated using the stress value (<0.25) and the coefficient of determination (R^2). The analysis results served as the basis for formulating recommendations for the sustainable management of mantis shrimp resources.

Table 1. Sustainability index of mantis shrimp resources

Status Index	Status	
0 – 25	Poor	Not Sustainable
25 – 50	Insufficient	Not Sustainable
51 – 75	Sufficient	Fairly Sustainable
76 – 100	Good	Highly Sustainable

The main steps in the RAPFISH-MDS analysis consist of: inputting data into the MDS application (using Excel and the RAPFISH add-in), calculating stress values and R^2 to assess the accuracy of the multidimensional mapping, and visualizing the ordination plot. To determine the sustainability position on each dimension, leverage and Monte Carlo analyses were conducted to identify the attributes most vulnerable to unsustainability²⁶. The results were interpreted by evaluating the

sustainability index scores for each dimension²⁷ (Table 1).

3. RESULT AND DISCUSSION

Environmental Dimension

The attribute scoring data obtained were then analyzed using the Rapfish

method, named Hamdangtis. The results of the Rapfish-Hamdangtis analysis indicate that the environmental dimension's sustainability index is 23.55, indicating a lack of sustainability. Meanwhile, the Monte Carlo value is 35.45, R^2 is 93,64% and Stress is 14,57% (Figure 2).

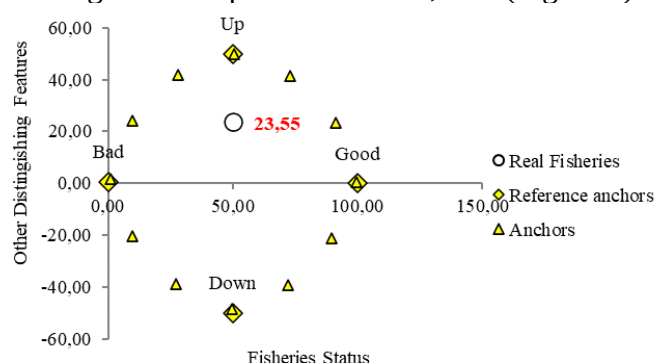


Figure 2. Rapfish-hamdangtis ordination results for the environmental dimension

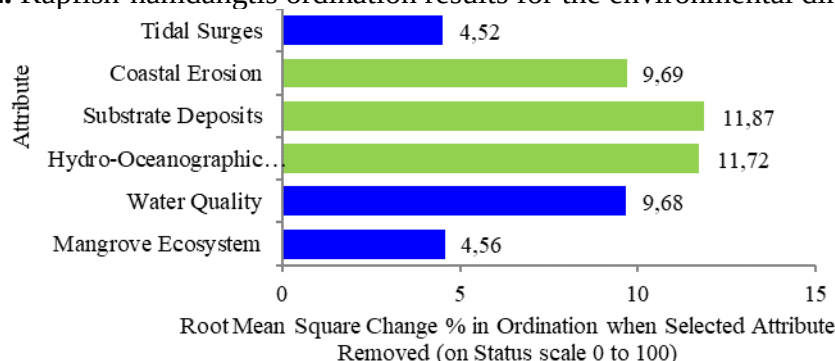


Figure 3. Results of the leverage attributes analysis for the environmental dimension

Figure 3 shows the results of the leverage analysis, which reveal an environmental dimension index value. In this context, the analysis is used to identify attributes that are sensitive to the index of the condition and sustainability status of mantis shrimp resource management in the waters of Labuhanbatu, consisting of: a) Substrate condition (RMS = 11.87), b). Hydro-oceanographic conditions (RMS = 11.72), and c). Coastal erosion (RMS = 9.68). These three attributes serve as leverage attributes because they have a maximum cumulative Pareto threshold (75%).

Hydro-oceanographic conditions in Labuhanbatu Regency are classified as strong; one distinguishing characteristic is the high water level during the tidal cycle, which frequently causes tidal flooding

(ROB) due to high water levels around the Sei Barumun waterway. Therefore, improvements are needed to ensure that hydro-oceanographic (HO) conditions remain normal. The highest tidal water level along the coast of Labuhanbatu Regency is 4.38 m, increasing the likelihood of flooding caused by high tides, also known as tidal flooding²⁸.

Mud-type substrate deposits are found on the bottom of the Sei Barumun waters in Labuhanbatu Regency, where many types of fish in addition to mantis shrimp are commonly found, such as gulama fish, shrimp, Asian redbtail catfish, and others; therefore, improvements are needed to prevent the Sei Barumun waters from becoming polluted, as the increasing amount of substrate deposits is harmful to fish. Siagian et al.²⁹, state that the conditions of

the Sei Barumun waters at Station 1 consist of an area overgrown with mangrove vegetation and very turbid mud. Coastal erosion along the Labuhanbatu coastline is characterized by an area of erosion balanced by an area of accretion. Changes in the shoreline are largely marked by moderate rates of erosion and accretion, ranging from 14.68 to 31.17 m per year³⁰.

Mantis Shrimp Resource Dimensions (MSR)

The attribute scoring data obtained were then analyzed using Rapfish-

Hamdangtis. The analysis results showed that the sustainability index for the Mantis Shrimp Resource (MSR) dimension was 43.70, indicating a lack of sustainability. Meanwhile, the Monte Carlo value is 23.89, R^2 is 93.64%, and Stress is 16.03%. The results of the Rapfish ordination for the mantis shrimp resource dimension are shown in Figure 4, and the results of the Leverage Attributes analysis for the mantis shrimp resource dimension are shown in Figure 5.

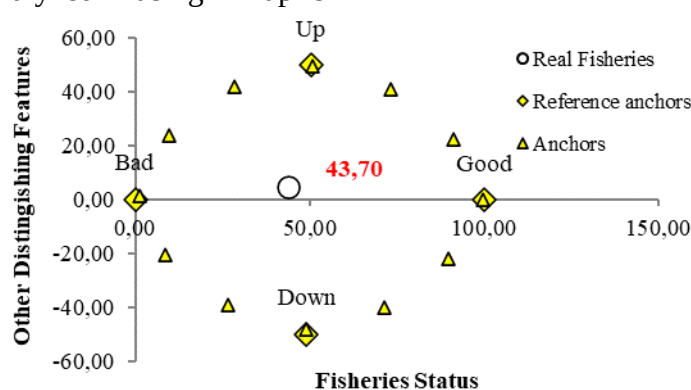


Figure 4. Rapfish-hamdangtis ordination results for the mantis shrimp resource dimension

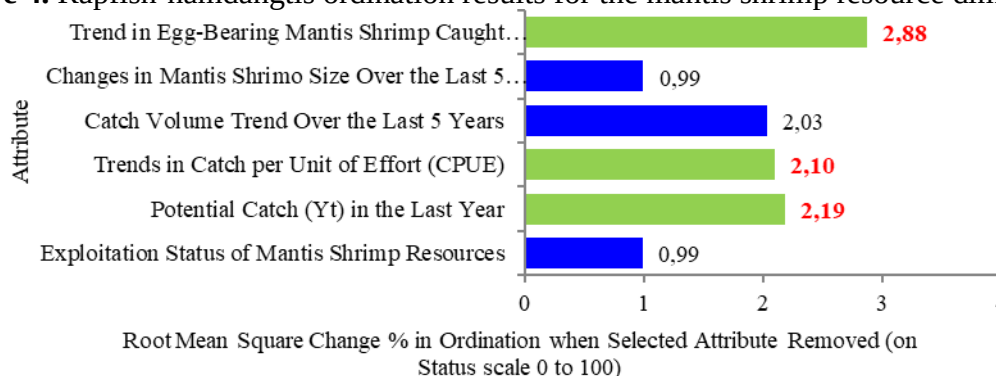


Figure 5. Results of the leverage attributes analysis mantis shrimp resource dimension

In Figure 5, the results of the leverage analysis reveal the index values for the mantis shrimp resource dimension (MSR). In this context, the analysis is used to identify attributes that are sensitive to the condition and sustainability status of mantis shrimp resource management in the waters of Labuhanbatu, consisting of: a). The Trend in egg-bearing mantis shrimp caught over the last 5 years (RMS = 2.88), b). Potential Catch (Yt) in the last Year (RMS = 2.19), and c). Trends in Catch per Unit of Effort

(CPUE) (RMS= 2.10). These three attributes serve as leverage attributes because they have a maximum cumulative Pareto threshold (75%).

The trend in the catch of egg-bearing mantis shrimp over the past 5 years has been steadily declining. This is because many people prefer to catch live, egg-bearing mantis shrimp for processing and consumption, leading to a decline in the population of these egg-bearing mantis shrimp. Therefore, measures are needed to

ensure that only adult, non-egg-bearing mantis shrimp are caught so that the population can be sustained. Uncontrolled fishing practices can deplete wild mantis shrimp populations and increase the risk of overfishing²³.

The catch potential (Y_t) for mantis shrimp in the past year in the waters off Labuhanbatu is classified as moderate ($Y_t = MSY$). This is based on the maximum sustainable yield (MSY), which is estimated at 312.84 metric tons per year. Therefore, improvements are needed to ensure that the catch potential for mantis shrimp remains high. Malo et al.³¹, state that if fishing is conducted on a massive scale without any efforts toward aquaculture, the mantis shrimp population may decline, resulting in reduced catches for fishermen.

The Catch per Unit Effort (CPUE) trend over the past five years has been on a downward trajectory from 2020 to 2024. Therefore, improvements are needed to increase the CPUE for mantis shrimp in the future. Based on the results of a study conducted by Siregar²⁴, the highest CPUE value was 0.067 metric tons/unit in 2020. The lowest CPUE value currently recorded for 2024 is 0.036 metric tons/unit. The year

2020 was the most productive year for mantis shrimp catches, and the CPUE value has continued to decline through 2024. The annual decline in the CPUE value indicates that the current level of mantis shrimp exploitation in Parit III Village, if left unchecked, will lead to overfishing³².



Figure 6. *H. raphidea* mantis shrimp measuring 16.6 cm

Facilities and Technology Dimension

The results of the Rapfish-Hamdangtis analysis indicate that the sustainability index for the facilities and technology dimension is fairly sustainable at 55.24. Meanwhile, the Monte Carlo value is 33.20, R^2 is 94,59% and Stress is 14,12%. The Rapfish ordination results for the facilities and technology dimension are shown in Figure 7, and the results of the leverage attributes analysis for this dimension are shown in Figure 8.

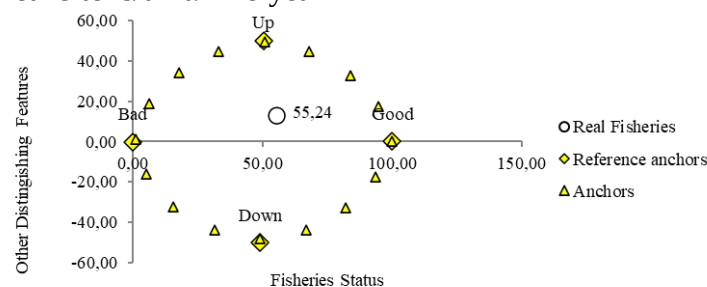


Figure 7. Results of the Rapfish-hamdangtis ordination on the facilities and technology dimension

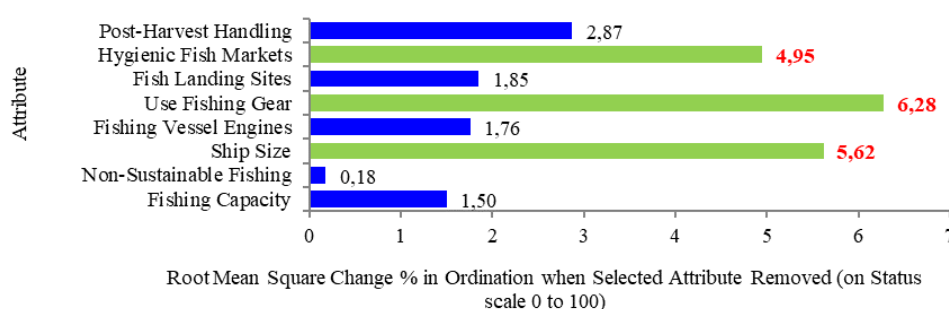


Figure 8. Results of the leverage attributes analysis facilities and technology dimension

In Figure 8, the results of the leverage analysis show the index values for the facilities and technology dimension. In this case, the analysis is used to identify attributes that are sensitive to the index of the condition and sustainability status of mantis shrimp resource management in the waters of Labuhanbatu, consisting of: a) the use of fishing gear (RMS = 6.28); b) ship size (RMS = 5.62); and c) hygienic fish markets (RMS = 4.95).

Mantis shrimp fishermen use only one type of fishing aid. This finding is based on interviews with the fishermen, who reported that they use only one type of fishing aid a flashlight for illumination at night. The reason for not using GPS, buoys, and other such equipment is financial constraints.

Mantis shrimp fishermen in the waters of Labuhanbatu mostly use boats under 5 GT, and almost all use Robin outboard motors; therefore, improvements are needed so that in the future, boat size can be increased beyond 5 GT, allowing fishermen to diversify beyond catching only mantis shrimp. Efizon et al.³³, state that the types of fishing gear and vessel sizes used in the waters influence fish catch. Fishing operations can expand with larger fishing gear and vessels, or different types of fishing gear, resulting in higher utilization of fish resources, which can lead to more consistent exploitation.

There are no hygienic fish markets or fish auctions in the Panai Hilir and Panai Tengah subdistricts, fishermen typically sell directly to mantis shrimp dealers or collectors near their homes. Therefore, improvements are needed to establish hygienic fish markets or fish auctions that can help boost the economy of the mantis shrimp fishing community. According to Simbolon & Kesuma³⁴, a hygienic fish market is a modern market that serves as a hub for the trade of fish products and must meet strict quality standards that prioritize health, food safety, and environmental sanitation.

Social and Economic Dimensions

The attribute scoring data were then analyzed using the Rapfish-Hamdangtis method. The analysis results showed that the sustainability index for the social and economic dimensions was 45.24, indicating a lack of sustainability. Meanwhile, the Monte Carlo value is 26.93, R^2 is 95.03% and Stress is 13.75%. The Rapfish ordination results for the social and economic dimensions are shown in Figure 9.

In Figure 10 the results of the leverage analysis reveal an index value for the social and economic dimensions. In this context, the analysis is used to identify attributes that are sensitive to the index of the condition and sustainability status of mantis shrimp resource management in the waters of Labuhanbatu, consisting of: a) alternative livelihoods (RMS = 3.90), b) Labor Absorption (RMS = 3.13), c) fishermen's business profits (RMS = 3.10), and d) primary livelihood of fishermen (RMS = 2.43).

The income of mantis shrimp fishermen is quite unpredictable because, depending on the mantis shrimp catch, they only fish for about three months a year from June through August. After that, from September through June, it is the off-season for mantis shrimp fishermen. In 2026, many mantis shrimp fishermen have suspended fishing activities due to the difficulty in obtaining fuel, both diesel and Peralite. This is caused by fuel shortages at the Simpang Ajamu and Negeri Lama gas stations, which have driven fuel prices to extremely high levels with diesel priced at IDR 20,000 per liter and Peralite at IDR 19,000 per liter. Consequently, the price of mantis shrimp has skyrocketed to IDR 350,000 per piece.

The primary livelihood of mantis shrimp fishermen is catching mantis shrimp; only a few have alternative livelihoods such as selling goods, raising livestock, and so on. The fishermen lack the skills or knowledge regarding alternative livelihoods. Therefore, improvements are needed so that mantis shrimp fishermen can receive training on alternative livelihoods, broadening their

horizons so they are not solely dependent on mantis shrimp fishing. Astuti et al.²⁰, state that aquaculture efforts need to be

undertaken to prevent a decline in catch yields while also preserving the mantis shrimp population.

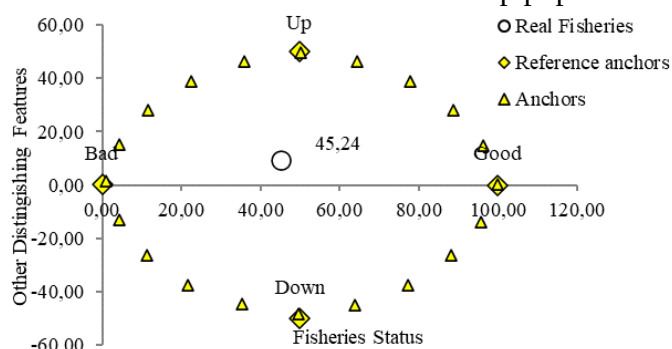


Figure 9. Rapfish-hamdangtis ordination results for the social and economic dimensions

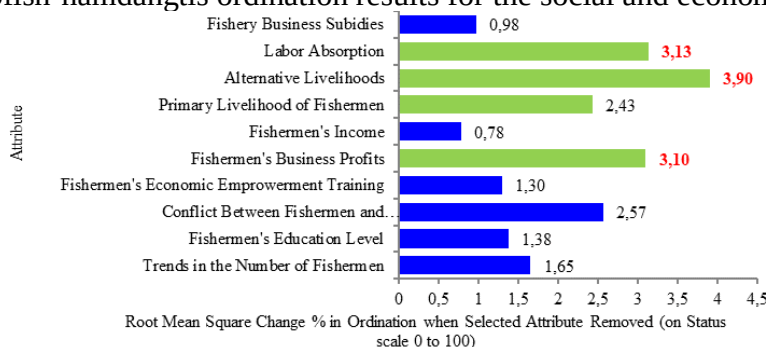


Figure 10. Results of the leverage attributes analysis social and economic dimensions

The mantis shrimp fishing business is quite profitable; during peak season, fishermen can catch up to 100 mantis shrimp, with each shrimp selling for IDR 250,000–350,000, making it very difficult for them to give up this line of work. Furthermore, due to poor financial management, mantis shrimp fishermen remain trapped in a cycle of poverty. Therefore, improvements are needed so that mantis shrimp fishermen can better understand financial management and thus make more optimal use of their business profits. Astuti et al.²⁰, when sold live, mantis shrimp are priced per shrimp based on their length.

Labor absorption is the fourth sensitive attribute regarding the sustainability of mantis shrimp resource management in the waters of Labuhanbatu. Employment is relatively low, at fewer than 3 people, as mantis shrimp fishermen typically fish alone because the fishing grounds are close to their homes; only during the peak season do they bring along one

family member to assist with the catch. Therefore, improvements are needed to equip mantis shrimp fishermen with knowledge such as alternative livelihoods aimed at creating job opportunities within the mantis shrimp fishing community. To increase labor absorption, fisheries subsector development strategies could include increasing fishery production, the number of fishing vessels, and the number of fishing companies³⁵.

Institutional and Governance Dimensions

The attribute scoring data were then analyzed using Rapfish-Hamdantis. The results of the sustainability index analysis for the institutional and governance dimensions indicate a level of unsustainability, with a score of 46.38. Meanwhile, the Monte Carlo value is 18.22, R^2 is 94,79% and Stress is 14,26%. The results of the Rapfish ordination for the social and economic dimensions are shown in Figure 11, and the results of the leverage attributes analysis for the institutional and

governance dimensions are shown in Figure 12.

The results of the leverage analysis reveal an index value for the institutional and governance dimension. In this context, the analysis is used to identify attributes that are sensitive to the index regarding the condition and sustainability status of mantis shrimp resource management in the waters of

Labuhanbatu, consisting of: a) authority over mantis shrimp fisheries management (RMS = 4.37), b) authority for the empowerment of mantis shrimp fishermen (RMS = 3.26), c). Authority for TPI Management (TPI) (RMS = 1.85), and d). legislation related to mantis shrimp (RMS = 1.61).

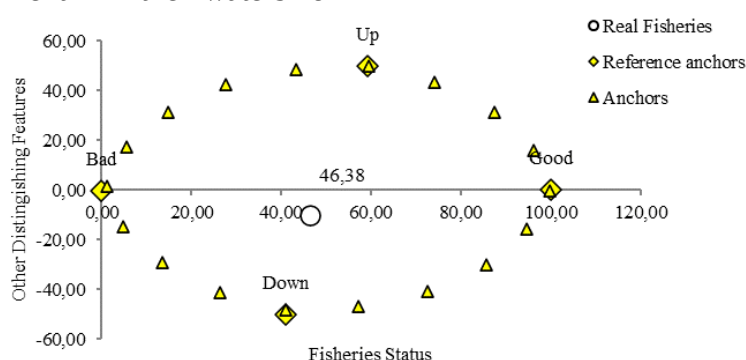


Figure 11. Rapfish ordination results for the institutional and governance dimensions

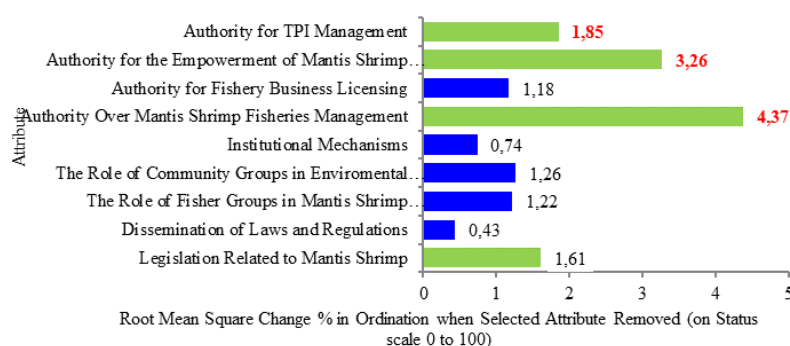


Figure 12. Results of the leverage attributes analysis institutional and governance dimensions

Authority for mantis shrimp management lies with the central government, based on Law No. 23 of 2014 on Regional Government regarding the division of responsibilities in the maritime and fisheries sectors. Therefore, improvements are needed so that the central government, when formulating regulations regarding mantis shrimp management in the waters of Labuhanbatu, can further coordinate with relevant stakeholders such as the North Sumatra Provincial Government, the Labuhanbatu Regency Government, the Padang BPSPL Medan Field Office, and the Belawan PSDKP Field Office to ensure shared responsibility for the success of the mantis shrimp conservation program in the waters of Labuhanbatu.

Consequently, an approach that views the community as both the object and subject of development must be implemented, as the development of coastal communities is an essential part of coastal and marine resource management for the prosperity of the people³⁶.

The authority to manage fish auction sites (TPI) lies with the regency government. According to Nadjib³⁷, Law No. 23 of 2014 on Regional Government regarding the Division of Responsibilities in the Maritime and Fisheries Sectors stipulates that one of the regency government's authorities is the management and operation of fish auction sites (TPI)³⁸⁻³⁹. To date, there are no regulations specifically addressing mantis shrimp in Labuhanbatu Regency; therefore,

regulations need to be established to ensure the sustainability of mantis shrimp populations. The index values for the five dimensions used as indicators to assess the sustainability status of mantis shrimp resource management in the waters Labuhanbatu are presented in the form of a kite diagram, as shown in Figure 13.

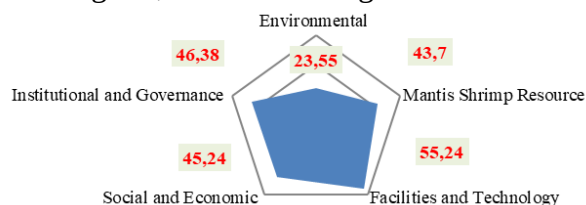


Figure 13. Kite diagram of the sustainability status of mantis shrimp resources in the waters of Labuhanbatu

Based on the index values for all five dimensions shown in Figure 13, the multidimensional sustainability index value for mantis shrimp resources in the waters of Labuhanbatu is 42.82 (<50), indicating that

these resources are not sufficiently sustainable. This is evident in the sustainability indices across all dimensions, which range from a low of 23.55 to a high of 55.24. All these characteristics must be addressed through appropriate policy interventions to enhance the sustainable management of mantis shrimp resources in the waters of Labuhanbatu, North Sumatra Province.

This is consistent with the study by Warningsih et al.⁴⁰, in which, based on the index values across the five dimensions ecological (29.68), economic (52.07), social (36.78), technology at 52.27, and institutional at 42.99, the average sustainability index value for anchovy resources in the Labuhanbatu waters was 42.76 (<50), meaning that these resources are not sustainable. The sensitive attributes regarding the sustainability status of mantis shrimp resource management in the Labuhanbatu waters are shown in Table 2.

Table 2. Sensitive attributes for the sustainability status of mantis shrimp resource management in the Labuhanbatu Waters

No.Attribute	Dimension	Value RMS
1. Substrate depth	Environment	11,87
2. Hydro-oceanographic conditions	Environment	11.72
3. Coastal Erosion	Environment	9.68
4. Use fishing gear	Facilities and Technology	6.28
5. Ship size	Equipment and Technology	5.62
6. Hygienic fish markets	Facilities and Technology	4.95
7. Authority over mantis shrimp fisheries management	Institutional and Governance	4.37
8. Alternative livelihoods	Social and Economic	3.90
9. Authority for the empowerment of mantis shrimp fishermen	Institutional and Governance	3.26
10. Labor absorption	Social and Economic	3.13
11. Fishermen's business profits	Social and Economic	3.10
12. Trend in egg-bearing mantis shrimp caught over the last 5 years	Mantis Shrimp Resources	2.88
13. Primary livelihood of fishermen	Social and Economic	2.43
14. Potential Catch (Yt) in the Last Year	Mantis Shrimp Resources	2.19
15. Trends in Catch per Unit of Effort (CPUE)	Mantis Shrimp Resources	2.10
16. Authority for TPI management	Institutional and Governance	1.85
17. legislation related to mantis shrimp	Institutional and Governance	1.61

Thus, the proposed sustainability status of mantis shrimp management in the waters of Labuhanbatu, North Sumatra Province, can utilize the dimensions of

attributes classified as sufficiently sustainable namely, mantis shrimp resources to support or improve the less sustainable dimensions, thereby supporting the

sustainability status of mantis shrimp management in Labuhanbatu Regency.

Fisheries management must promote the maintenance of the quality, diversity, and availability of fishery resources in sufficient quantities for present and future generations, within the context of food security, poverty alleviation, and sustainable development⁴¹.

Developing a fisheries management concept through a holistic approach known as the Ecosystem Approach to Fisheries Management (EAFM) entails balancing socio-economic objectives, such as fisher welfare, within fisheries management. EAFM utilizes six domains to assess the status of ecosystem-based fisheries management: resources, habitat and ecosystems, fishing techniques, economics, social aspects, and institutions⁴². The EAFM approach has the potential to improve ecosystems and human well-being in the future, as well as contribute to the blue economy in achieving a number of SDG targets⁴³⁻⁴⁴.

A key implementation of Indonesia's maritime policy in support of SDG 14 involves expanding marine conservation and strengthening sustainable fisheries management. Although this policy has positively impacted fish stock recovery and ecosystem stability, challenges persist regarding conservation financing, the strengthening of local monitoring capacities, and law enforcement. Consequently, the effectiveness of the national policy in supporting SDG 14 requires science-based adaptive governance and sustained

collaboration among the government, the private sector, and coastal communities⁴⁵.

4. CONCLUSION

Based on the results of this study, it can be concluded that sustainability status of *H. raphidea* management in Labuhanbatu waters was categorized as unsustainable, with a multidimensional index of 42.82. The environmental dimension showed the lowest score, indicating that habitat quality and ecosystem conditions are priority areas for management intervention. A plan to improve the sustainability of mantis shrimp management in the waters of Labuhanbatu, North Sumatra Province can leverage dimensions classified as relatively sustainable such as substrate deposition, hydro-oceanographic conditions, coastal degradation, until relevant regulations to address and improve less sustainable aspects, ultimately boosting the sustainability of mantis shrimp management in the waters of Labuhanbatu.

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