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MORALITY BEFORE KNOWLEDGE

Analysis of the direct benefits of timber and fisheries in the mangrove forest of Babulu Laut Village, North Penajam Paser Regency

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ABSTRACT

Background: Mangrove forests are one of the natural resources of coastal areas that have an important role in terms of social, economic, and ecological aspects. The values contained in mangrove forests can be evaluated economically using the economic valuation method. This study aims to determine the direct benefits and economic value of direct benefits from mangrove forests in Babulu Laut Village. **Methods:** The time needed for this study is more or less effective starting from April 2023 – November 2023. The sampling technique or key respondents as many as 1 respondent and case respondents were carried out by accidental sampling as many as 41 respondents. Data processing and analysis using qualitative descriptive analysis methods and quantitative descriptive analysis with economic valuation methods. Data types are primary and secondary data. **Findings:** From the results of this study shows that the direct benefits in the mangrove forest of Babulu Laut Village which has an area of approximately 1,000 ha, namely the benefits of wood and the benefits of fisheries consisting of the benefits of fish, shrimp, crabs and seaweed. The total value of direct benefits of mangrove forests in Babulu Laut Village is IDR 404,069,141,162.00 per year, this value consists of wood benefits with income of IDR 69,166,666,667 per year, fish with income of IDR 40,085,011,187.00 per year, shrimp with income of IDR 63,932,374,635.00 per year, crabs with income of IDR 34,075,518,808.00 per year, seaweed with income of IDR 196,809,569,866.00 per year. **Conclusion:** The greatest value of direct benefits is obtained from seaweed products, while the smallest income comes from crab benefits. **Novelty/Originality of this study:** This study presents the comprehensive economic valuation of the direct benefits of mangrove forests. It provides an in-depth understanding of the economic contribution of various mangrove forest products to local communities. The findings provide an empirical basis for decision-making in sustainable mangrove forest management by highlighting the economic potential that needs to be optimally exploited, particularly in the seagrass sector.

KEYWORDS: analysis; babulu laut; direct benefits; economic valuation; mangrove forest.

1. Introduction

Indonesia has the largest mangrove ecosystem in the world, with a coastline length of 95,181 km^2. According to the national mangrove map of 2021, the mangrove forest area in Indonesia is estimated to be around 3.36 million hectares, consisting of 3.12 million hectares of dense mangroves, 188,366 hectares of moderate mangroves, and 54,474 hectares of sparse mangroves (KLHK, 2021). Mangrove forests are a crucial natural resource in coastal areas, playing an important role from social, economic, and ecological perspectives.

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North Penajam Paser Regency has a mangrove forest area of 14,446.60 hectares, comprising 2,940.55 hectares within forest areas and 11,506.05 hectares outside forest areas (KLHK, 2021). The types of mangroves found in North Penajam Paser Regency include Rhizophora, Avicennia, Sonneratia, and others (Subagio et al., 2020). A healthy mangrove ecosystem yields high economic value and its biodiversity value is integral to its economic benefits, ensuring its preservation (Kristiningrum et al., 2019).

Economic valuation is a specific assessment technique used to estimate the monetary value of goods and services provided by natural resources. The scope of economic valuation for mangrove ecosystems includes the total economic value, the value of damage restoration, and the prevention of ecosystem damage (Bann, 1998). This study aims to identify the direct benefits and the economic value of these direct benefits from the mangrove forest in Babulu Laut Village.

2. Methods

2.1 Research location, tools, and materials

This research was conducted in Babulu Laut Village, Babulu District, North Penajam Paser Regency, East Kalimantan Province. The research took place from April to November 2023. The location can be seen in Figure 1. The tools and materials used in this research include questionnaires, writing instruments, tally sheets, measuring tapes, clinometers, 4-meter-long poles, laptops, cameras, mangrove guidebooks, and fish species guidebooks.

2.2 Research procedure and analysis

Mangrove species identification was conducted in the mangrove forest by creating three plots, each measuring 20 x 20 meters. The diameter and height of the mangroves were measured to calculate the stand volume. Socio-economic data collection was carried out using accidental sampling, where samples were selected by chance and included respondents who lived around the mangroves and worked as fishermen, either catch fishermen or aquaculture fishermen. The data collected included name, age, education, number of family members, type of fishery, amount of catch production, selling price of fish, and estimated price of mangrove wood.

This study employs qualitative descriptive analysis and quantitative descriptive analysis. Qualitative Descriptive Analysis: This analysis is used to describe the direct benefits of the mangrove forest, the types of mangroves, and the types of fisheries present in Babulu Laut Village. Quantitative Descriptive Analysis: The data processed using quantitative descriptive analysis includes the direct benefits value of the mangrove forest in Babulu Laut Village. According to Fauzi (2010), the direct benefits value of the mangrove forest is calculated using the following equation 1.

$$TML = ML1 + ML2 + ML3 + ML4 + ML5 \quad \text{(Eq. 1)}$$

The Total Direct Benefits Value (TML) is calculated by summing up various components of direct economic benefits derived from mangrove ecosystems. These components include the value of mangrove wood (ML1), fish catch (ML2), shrimp catch (ML3), crab catch (ML4), and seaweed cultivation (ML5), all measured in Indonesian Rupiah (IDR. Each of these elements represents a significant contribution to the livelihoods of coastal communities. To specifically calculate the potential volume of mangrove wood, Equation 2 is used, as outlined in the following section.

$$V = \frac{¼\pi d^2.h.f}{10.000} \quad \text{(Eq. 2)}$$

The volume of mangrove wood (V), measured in cubic meters (m^3), is calculated using diameter (d), height (h), and form factor (f), where diameter is in centimeters and height in meters. This volume represents the total wood production, which is then multiplied by the prevailing market price of mangrove wood in 2023, set at IDR 500,000 per cubic meter. The resulting value reflects the total economic worth of mangrove wood. In addition, to calculate the direct economic benefits from fish, shrimp, crab, and seaweed, the following formula is used: $TR = Production \times Price$. Here, TR refers to the total revenue in Rupiah (IDR), while "Production" represents the total catch or yield in kilograms (kg), and "Price" indicates the market price per kilogram (IDR/kg) for each respective commodity.

3. Result and Discussion

3.1 Mangrove ecosystem

Babulu Laut Village is one of the 12 villages in Babulu District, North Penajam Paser Regency. The village covers an area of 129.99 hectares, located at the coordinates 116°30'29.42" East Longitude and 01°31'20.11" South Latitude. The mangrove forest in Babulu Laut Village spans approximately 1,000 hectares. The mangrove species in this area are quite diverse, with varying distribution patterns and densities.

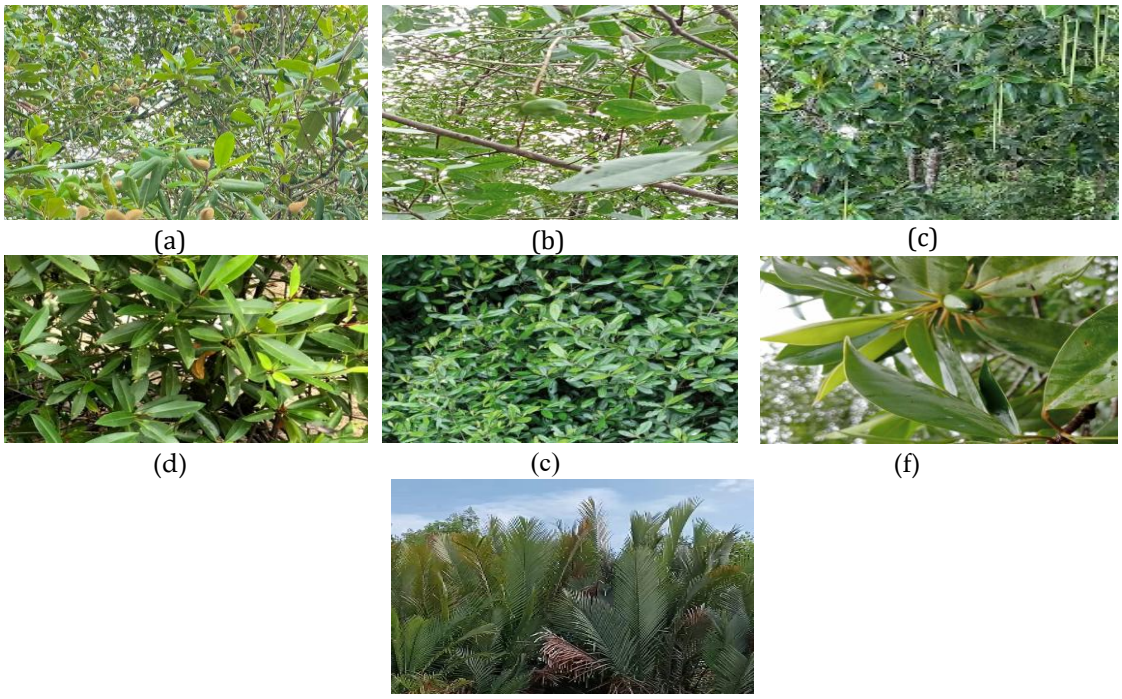

Fig. 1. Mangrove species in Babulu Laut Village, North Penajam, Paser Regency: (a) *Avicennia Marina*; (b) *Sonneratia Caseolaris*; (c) *Rhizophora Stylosa*; (d) *Rhizophora Mucronata*; (e) *Rhizophora Apiculata*; (f) *Bruguiera Gymnorrhiza*, (g) *Nypa Fruticans*

Identification results show that there are seven types of mangroves in Babulu Laut Village: *Avicennia marina*, *Sonneratia caseolaris*, *Rhizophora stylosa*, *Rhizophora mucronata*, *Rhizophora apiculata*, *Bruguiera gymnorrhiza* and *Nypa fruticans*. The condition of the mangroves can be seen in Figure 2. From the identification of the fisheries benefits in Babulu Laut Village, there are 15 types of fisheries, including fish, shrimp, crab, and seaweed. These include *Alpheus* sp., *Penaeus monodon*, *Scylla serrata*, *Gracilaria verrucosa*, *Chanos chanos*, *Arius thalassinus*, *Oreochromis mossambicus*, *Valamugil seheli*, *Lates calcarifer*, *Lutjanus campechanus*, *Brevitrygon heterura*, *Eleutheronema tetradactylum*, *Scomberomorus sinensis*, *Restrelliger* spp., and *Pennahia argentata*. The types of fisheries found in the mangrove forest of Babulu Laut Village can be seen in Figure 3.

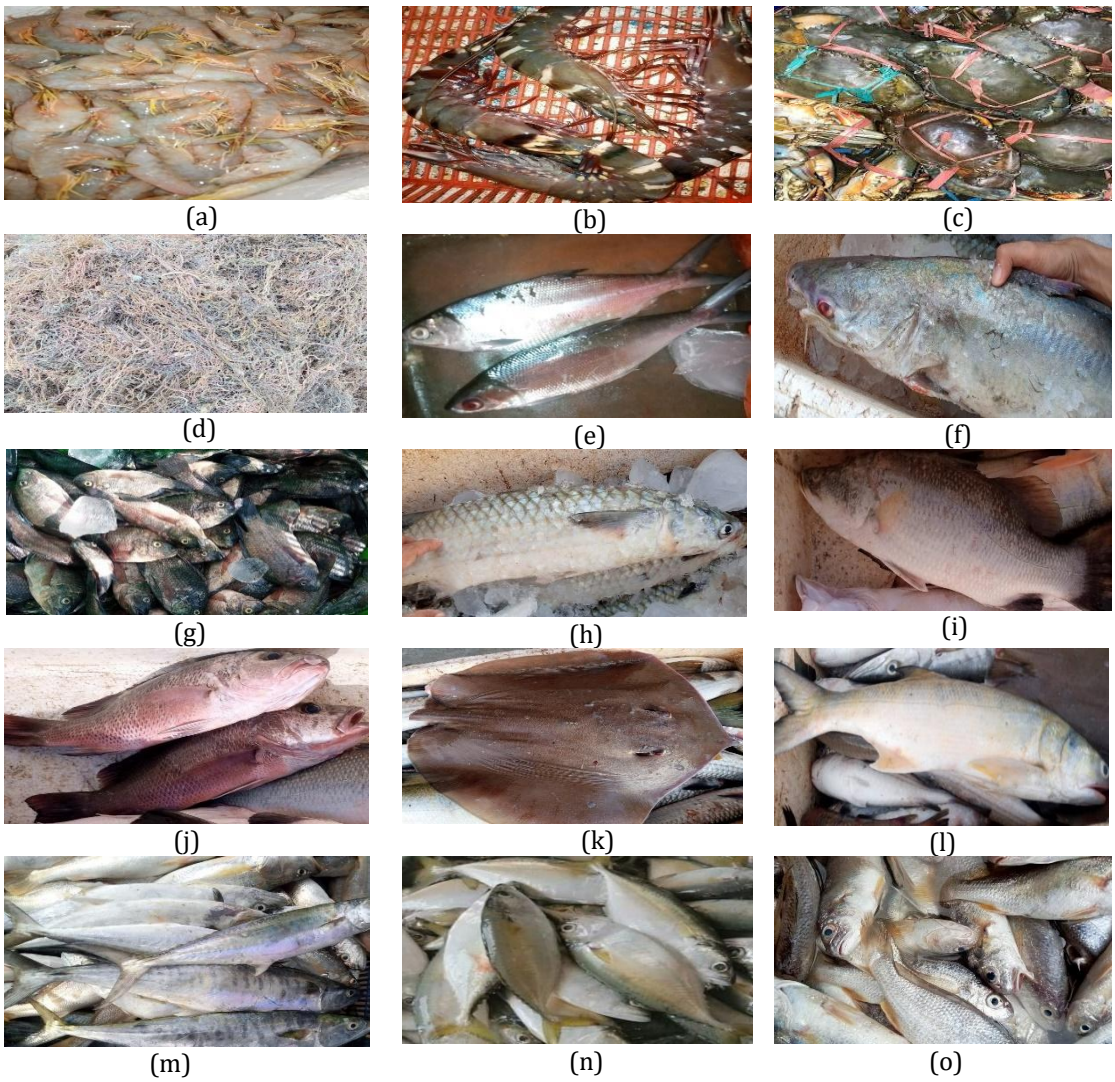

Fig 2. Fisheries in Babulu Laut Village, North Penajam, Paser Regency: (a) *Alpheus* sp.; (b) *Penaeus Monodon*; (c) *Scylla Serrata*; (d) *Gracilaria Verrucosa;* (e) *Chanos Chanos*; (f) *Arius Thalassinus*; (g) *Oreochromis Mossambicus*; (h)*Valamugil Sehel;* (i) *Lates Calcarifer*; (j) *Lutjanus Campechanus*; (k) *Brevitrygon Heterura*; (l) *Eleutheronema Tetradactylum*; (m) *Scomberomorus Sinensis*; (n) *Restrelliger* spp.; (o) *Pennahia Argentata*

3.2 Direct use value of mangrove forest

The direct use value represents the benefits that can be directly obtained from the resource. Based on the identification results at the research location, the direct benefits of mangroves that can be quantified include the value of wood and fisheries, which consist of fish, shrimp, crab, and seaweed benefits. The proportion of the total direct use value of mangroves in Babulu Laut Village is presented in Table 1.

Table 1. Direct benefit value of mangroves

No	Type of Benefit	Benefit Value (IDR/Month)	Benefit Value (IDR/Years)	Percentage
1.	Wood	IDR 5,763,888,889	IDR 69,166,666,667	17.1
2.	Fish	IDR 3,340,417,599	IDR 40,085,011,187	9.9
3.	Shrimp	IDR 5,327,697,886	IDR 63,932,374,635	15.8
4.	Crab	IDR 2,839,626,567	IDR 34,075,518,808	8.4
5.	Seaweed	IDR 16,400,797,489	IDR 196,809,569,866	48.7
6.	Total	IDR 33,672,428,430	IDR 404,069,141,162	100

The table above reveals that the total direct use value of the mangrove forest in Babulu Laut Village amounts to IDR 404,069,141,162 per year. This value is broken down into

several components: wood provides 17.1% of this total with an annual income of IDR 69,166,666,667; fish contributes 9.9% with an annual income of IDR 40,085,011,187; shrimp accounts for 15.8% with an income of IDR 63,932,374,635 per year; crabs add 8.4% with IDR 34,075,518,808 per year; and seaweed constitutes the largest share at 48.7% with an annual income of IDR 196,809,569,866. The highest direct use value is derived from seaweed, whereas the smallest comes from crabs. Previous studies have reported varying figures for the direct use value of mangroves. Suris (2018) estimated a total direct use value IDR R3,318,500,000 per year, Jumrianto (2018) reported IDR 5,487,000,000 per year, and Kurniawan et al. (2008) indicated IDR 504,766,000 per year. These discrepancies can be attributed to factors such as soil fertility, mangrove growth, annual catch amounts, market prices, and the condition of the mangrove ecosystem in each region (Kristiningrum, 2020).

The findings of this research highlight the substantial direct use value of the mangrove forest in Babulu Laut Village. A significant portion of the village's population relies on the mangrove forest for their livelihoods, working as either catch or aquaculture fishermen. The mangrove forest serves as a crucial spawning ground for fish, shrimp, crabs, and seaweed. Damage to the mangrove forest would significantly impact the income of these fishermen. Therefore, it is imperative to preserve the mangrove forest's sustainability. If the mangrove forest were to be damaged, the restoration cost, based on its direct use value, would amount to IDR 404,069,141,162. In addition to direct benefits such as wood and fisheries (including fish, shrimp, crabs, and seaweed), mangrove forests provide numerous other benefits. These include indirect benefits such as wave attenuation, organic matter provision, and carbon sequestration, option value in terms of biodiversity, and existence and heritage value reflected in the willingness to pay for mangrove forest conservation. The vast array of benefits underscores the critical importance of preserving mangrove forests.

4. Conclusion

In conclusion, the mangrove forest in Babulu Laut Village holds significant direct use value, amounting to IDR 404,069,141,162 per year. This value is derived from various sources, with the largest contributions coming from seaweed, followed by wood, shrimp, fish, and crabs. The substantial income from these resources underscores the importance of the mangrove forest to the local economy, particularly for the many villagers who rely on it for their livelihoods as fishermen.

Previous studies have reported varying direct use values, highlighting differences due to local conditions such as soil fertility and ecosystem health. The preservation of the mangrove forest is crucial, not only for maintaining the direct economic benefits but also for its indirect benefits, biodiversity, and heritage value. Damage to the mangrove forest would result in significant restoration costs, emphasizing the need for sustainable management and conservation efforts to protect this vital ecosystem.

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