Valuation of the Coral Reef Economy in Sungai Cuka Village, Tanah Bumbu Regency, South Kalimantan Province

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ABSTRACT

The economic valuation of coral reefs in Sungai Cuka, Tanah Bumbu Regency, aims to determine the economic value of coral reefs both in terms of economic growth and conservation aspects. The research aims to analyze the economic valuation of coral reefs in Sungai Cuka Village, Tanah Bumbu Regency, South Kalimantan Province. The study was conducted in Sungai Cuka Village, Tanah Bumbu Regency, South Kalimantan Province. Fifty percent of the fishermen were sampled, totaling 15 individuals, along with 10 tourists sampled through accidental sampling, and one researcher. The economic value of coral reef ecosystems originating from the fisheries and tourism sectors in the waters of Sungai Cuka, Tanah Bumbu Regency, is significant. Coral reefs have important indirect economic value, such as erosion control, valued at Rp.3,818,650,000, as well as being research sites and carbon sinks. On the other hand, the fisheries sector also shows significant direct benefits, as seen from the fish catch value reaching Rp1,795,370,000. The Total Economic Value (TEV) reaches Rp7,709,231,786, indicating potential additional income from the tourism sector. The Willingness to Pay (WTP) is Rp. 30,240,000 per year, showing potential additional income from the tourism sector.

Keywords: Economic, Valuation, Coral Reefs, Sungai Cuka

INTRODUCTION

Indonesia has the potential for coral reefs according to Huffard et al. (2012), known as the "Coral Triangle," which is an area with the highest marine biodiversity in the world. About 18% of the world's coral reefs are found in Indonesia. The total area of coral reefs in Indonesia reaches 39,583 km2 or approximately 45.7% of the total 86,503 km2 of coral reef area in the Coral Triangle region, with the highest biodiversity peak including 590 species of hard coral and 2,200 species of reef fish. However, it is reported that due to a combination of local threats and the effects of temperature changes and bleaching, almost 45% of Indonesia's coral reefs are under high to very high threat. Referring to Provincial Regulation No. 13 of 2018 concerning the Zoning Plan for Coastal Areas and Small Islands, the waters of Sungai Cuka are included in the Public Utilization Zone for Pelagic and Demersal Fisheries, abbreviated

as KPU-PD-04. With the designation of the Sungai Cuka waters as a fishing zone, fishing activities in the Sungai Cuka waters are expected to increase.

The coral reef ecosystem in the waters around Sungai Cuka Village, Kintap Sub-district, is found to have only 1 type of Acropora coral, namely Acropora tabulate (ACT), and 4 types of Non-Acropora species, namely Coral Branching (CB), Coral Massive (CM), Coral Encrusting (CE), and Coral foliose (CF). The survival rate of coral reef coverage ranges from 1.88% to 46.38%. Therefore, the condition of coral reefs in the waters around Sungai Cuka Village, Kintap Sub-district, ranges from poor to moderate based on coral reef assessment criteria according to Minister of Environment and Forestry Regulation No. 4/2011 (Tony. F, et al., 2020).

From other studies, a total of 13 families with 18 fish species were recorded around the BioReef_Block. The composition of the target fish group consists of 10 families, while major and indicator fish consist of 2 families. There was an increase in fish abundance in each data collection, with a small diversity index and strong environmental pressure. However, there was an increase in diversity observed in each observation. Before the presence of the BioReef_Block, the uniformity index was low with a stressed community. However, after the presence of the BioReef_Block in the first month, there was a moderate increase in uniformity with an unstable community, and in the following month's observation, there was high uniformity with a stable community. As for the dominance index, there were no dominant fish criteria (Tony. et al., 2021).

From the results of Septiady's study (2021) on the Analysis of the Relationship between Coral Cover and the Abundance of Chaetodontidae Fish Families in the Waters of Sungai Cuka, Tanah Bumbu Regency,

South Kalimantan, it was stated that the density of coral reefs in the waters of Sungai Cuka is categorized as low and very poor in terms of coral diversity. Meanwhile, research on the economic valuation of coral reefs in the Sungai Cuka area is very rare. Researchers are interested in conducting research from an economic valuation aspect to facilitate policymakers in determining steps to develop the economy of capture fisheries.

Research on the economic valuation of coral reefs in Sungai Cuka, Tanah Bumbu Regency, aims to determine the economic value of coral reefs both from the perspective of economic growth and conservation. Through this research, it is hoped to provide benefits for subsequent researchers to conduct studies related to the potential of coral reefs for coastal communities and as an evaluation material for the government related to conservation programs for coral reefs in Sungai Cuka specifically and Tanah Bumbu Regency in general. The study aims to analyze the economic valuation of coral reefs in Sungai Cuka Village, Tanah Bumbu Regency, South Kalimantan Province.

MATERIALS & METHODS
Place of Research
This research was conducted in Sungai Cuka Village, Tanah Bumbu Regency, South Kalimantan.
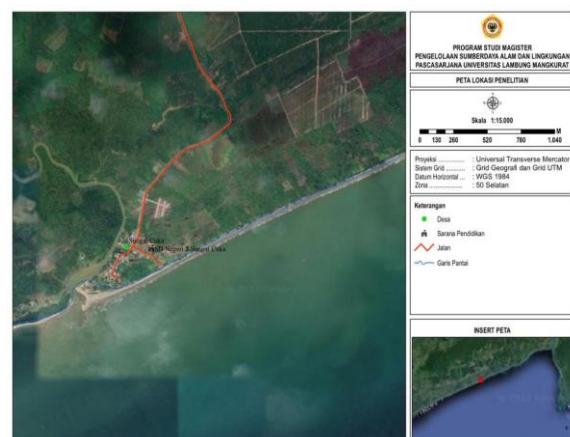

Figure 1. Research Location Map

Sample

The sampling for fishermen and tourists was conducted using the Purposive Sampling method, where each sample was selected based on specific considerations (Singarimbun and Effendi, 2000). Specifically, 50% of the fishermen were sampled, totaling 15 individuals, and 10 tourists were sampled using accidental sampling, along with 1 researcher.

Data Analysis

The approach used to calculate the total economic value of the coral reef in Sungai Cuka Village is through the following formula (Soemarno, 2017).

$$TEV = UV + NUV$$

dimana :
TEV : *Total Economic Value*
UV : *Use Value*
NUV : *Non Use Value*

There are two aspects calculated for direct benefits, namely fisheries and tourism aspects. The direct benefits from the fisheries aspect can be calculated as follows:

$$ML = TR + NK$$

Where:
ML: Direct Benefits
TR: Value of fish catch
NK: Value of tourism visits

To analyze the value of fish catch, it can be calculated using the following approach:

$$TR = P \times Q$$

dimana :
TR: Value of fish catch
P: Price of fish / kg
Q: Quantity of catch

Meanwhile, for the tourism aspect, direct benefits can be calculated using the Travel Cost Method, which is a method to assess the expenses incurred by each individual to visit recreational places around the research location.

$$NK = Y_1 + Y_2$$

Where:
NK: Value of Tourism Visits
Y_1: Travel costs (fuel, consumption, toilet)
Y_2: Entrance ticket price
The formula used is as follows:

$$N = V_1 + V_2 + V_3$$

Where:
N: Indirect benefits of coral reefs
V_1: Coral reefs as erosion control
V_2: Coral reefs as research sites
V_3: Coral reefs as carbon sinks

Development strategies for recommendations to relevant management parties using the Willingness to Pay (WTP) approach can be obtained from the calculation results using the formula:

$$WTP = S \times Y$$

Where:
S: Total Number of Visitors per Year
Y: Amount of willingness to pay more by visitors

RESULT

The Economic Value of Coral Reef Ecosystems

The research findings indicate that the economic value of the coral reef ecosystem in the waters of Sungai Cuka, Tanah Bumbu Regency, originates from two main sectors: fisheries and tourism. In the fisheries sector, coral reefs serve as habitats for various fish species with high commercial value. The analysis results of the economic value of the coral reef ecosystem from the fisheries and tourism sectors in the waters of Sungai Cuka, Tanah Bumbu Regency, are as follows:

Table 1. Economic Non-Use Benefits of Coral Reef Ecosystem

V_1	
Breakwater/m³	Rp. 550.000
Length of coastline	6.943 Meter
Value of Coral Reef as Erosion Protection	Rp. 3.818.650.000
V_2	
Land transportation	Rp. 750.000
Sea transportation	Rp. 800.000
Consumption	Rp. 400.000
Crew honorarium	Rp. 600.000
Publication	Rp. 100.000
Data processing	Rp. 250.000
Total	Rp. 2.900.000
Total per year if one person/year	Rp. 34.800.000
V_3	
Carbon Absorption/m²	Rp. 2.400
Coral Reef Area	825.000 M²
	Rp. 1.980.000.000

Description:
N: Non-use benefits of coral reefs
V1: Coral reef as erosion protection
V2: Coral reef as a research site
V3: Coral reef as carbon sink

Table 2. Indirect Benefit Values

N	V_1	V_2	V_3
Rp 5.833.450.000	Rp. 3.818.650.000	Rp. 34.800.000	Rp. 1.980.000.000

The catch result can be calculated using the following approach:

Table 3. Fish Catch Value

TR (Value of Fish Catch)	P (Fish Prices / kg)	Q (Number of Catches / Year)
Rp1.795.370.000	Rp24.796	62.232

Table 4. Value of Tourism Visits

NK (Visit Value)	Y_1 (Travel expense)	Y_2 (Entry Ticket Price)
Rp80.411.786	Rp 49.962.858	Rp 30.448.929

Table 5. Direct Benefit Value

ML (Direct Benefits)	TR (Value of Fish Catch)	NK (Value of Visits)
Rp1.875.781.786	Rp1.795.370.000	Rp80.411.786

The development strategy for recommendations to the relevant management parties using the willingness-to-pay approach can be obtained from the analysis results as follows:

Table 6. Total *Economic Value*

TEV (*Total Economic Value*)	UV (*Use Value*)	NUV (*Non Use Value*)
Rp7.709.231.786	Rp1.875.781.786	Rp5.833.450.000

Table 7. *Willingness to pay*

WTP (Willingness to pay approach technique)	Y (Amount of value of willingness to pay more by visitors)	S (Total Number of Visitors Per Year)
Rp. 30.240.000	Rp4.200	7.200 visitors

The research findings indicate the economic value of coral reef ecosystems originating from both the fisheries and tourism sectors in the Sungai Cuka waters of Tanah Bumbu Regency. Table 1 reveals that coral reefs have significant indirect economic value.

The value of coral reefs as coastal erosion buffers reaches Rp. 3,818,650,000, demonstrating their contribution to shoreline protection against erosion. Additionally, coral reefs provide benefits as research sites valued at Rp. 34,800,000 per

year, as well as carbon sequestration worth Rp. 1,980,000,000. The research results in Table 2 show the indirect benefits of fish catches in the coral reef area of Sungai Cuka Village, Tanah Bumbu Regency, South Kalimantan Province. These benefits consist of three variables: V_1 amounting to Rp. 3,818,650,000 plus V_2 amounting to Rp. 34,800,000, plus V_3 amounting to Rp. 1,980,000,000, with the total reaching Rp. 5,833,450,000.

Direct benefits (ML) can be calculated by adding the value of fish catches (TR) to the value of tourism visits (NK). The value of fish catches can be analyzed using the calculation approach outlined in Table 3. In this table, the value of fish catches (TR) amounts to Rp. 1,795,370,000, with a production (P) of 24,796 tons and a catch quota (Q) of 62,232 kg/year. The value of tourism visits (NK) can be analyzed using the calculation approach in Table 4. In this table, Y_1 amounts to Rp. 49,962,858 added to Y_2 amounting to Rp. 30,448,929, resulting in the value of tourism visits (NK) amounting to Rp. 80,411,786/year.

The research findings also illustrate the direct benefits of fish catches, as listed in Table 5, which is the sum of the fish catch value (TR) of Rp. 1,795,370,000 plus the tourism visit value (NK) of Rp. 80,411,786/year, resulting in direct benefits (ML) of Rp. 1,875,781,786.

Development strategies and recommendations for relevant management parties using the willingness-to-pay approach, as shown in Tables 7. Table 6 presents the Total Economic Value (TEV) of coral reef ecosystems, reaching Rp. 7,709,231,786, consisting of Use Value (UV) and Non-Use Value (NUV). Meanwhile, Table 7 presents the magnitude of the willingness to pay more by visitors (Willingness to Pay) amounting to Rp. 30,240,000 per year, indicating the potential for additional income from the tourism sector.

Based on the economic valuation of the Sungai Cuka coral reef in Tanah Bumbu Regency, South Kalimantan Province, this research provides a deep understanding of the economic value of fish catches within coral reef ecosystems. With this information, stakeholders can develop more effective and sustainable management strategies and design policies that support the preservation and sustainable utilization of this natural resource. The high value of coral reefs as erosion buffers demonstrates their contribution to protecting coastlines from erosion, while their benefits as research sites and carbon sinks are also significant. The direct economic benefits of fish catches from coral reef areas highlight the importance of this ecosystem as a habitat for economically valuable fish species for local fishermen. The willingness-to-pay approach can be an effective strategy in developing recommendations for relevant management parties by exploring Total Economic Value (TEV) and the willingness to pay more by visitors, which can help optimize the economic benefits of coral reef ecosystems for both the fisheries and tourism sectors.

The sea waters in Sungai Cuka Village, Kintap District, Tanah Laut Regency, South Kalimantan Province with a sand base and coral reefs which are mostly live coral with quality (Tony *et al.* 2021). Reef fish are one of the groups of animals associated with coral reefs, their presence is conspicuous and found in various micro-habitats on coral reefs. Reef fish live permanently and forage in coral reef areas (sedentary), so that if coral reefs are damaged or destroyed, reef fish will also lose their habitat (Rani et al., 2010). Technology on the diversity of reef fish in the sea waters of Sungai Cuka Village, Kintap District, Tanah Laut Regency, South Kalimantan, with the government's very important role in managing the utilization of coastal potential and empowering coastal village communities to support development diversify their business (Hidayat A. S., and Agusliani, E., 2020).

The coral reef ecosystem functions as spawning grounds, nursery grounds, and feeding grounds for marine life, while also providing a stock of nutrients for the surrounding waters. Therefore, the extent of coastal areas becomes an input for the productivity of fish catches, which are the end products for communities. Burke (2002), in analyzing changes in coral reef productivity as natural capital (Putri, 2009), suggests that coral reefs will contribute to the economy and welfare of communities, especially those around the coral reef ecosystem (Widayatun, 2011). Besides serving as habitats for fish and associated marine life, the ecological benefits of coral reefs include coastal protection and carbon absorption (Azhar, 2016).

CONCLUSION

The economic value of the coral reef ecosystem originating from the fisheries and tourism sectors in the Sungai Cuka waters of Tanah Bumbu Regency includes significant indirect economic benefits. For instance, coral reefs serve as crucial erosion buffers, valued at Rp. 3,818,650,000, and as sites for research and carbon sequestration. On the other hand, the fisheries sector also demonstrates significant direct benefits, evident from the fish catches amounting to Rp1,795,370,000. The Total Economic Value (TEV) reaches Rp7,709,231,786, indicating the potential for additional income from the tourism sector. The Willingness to Pay (WTP) is Rp. 30,240,000 per year, indicating further potential revenue from the tourism sector.

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