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ECONOMIC VALUATION OF THE DIRECT BENEFITS OF CAPTURE FISHERIES AND THE CONTRIBUTION OF MANGROVES FOR FISHERMEN OF BATU ITAM VILLAGE, BELITUNG

Valuasi Ekonomi Manfaat Langsung Perikanan Tangkap Dan Kontribusi Mangrove Bagi Nelayan Desa Batu Itam, Belitung

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ABSTRACT

The coastal area of Batu Itam Village possesses significant potential in natural resources and environmental services, along with a high level of biodiversity. **This study aims to** determine the direct economic benefits of capture fisheries within the mangrove ecosystem and assess the contribution of these direct economic values to household incomes in Batu Itam Village. The research employs a quantitative descriptive methodology and was conducted in June 2024. Respondents were selected using snowball sampling and census methods. The study involved two groups: 27 mangrove fishermen identified through a census approach and 20 general fishermen selected using the Slovin formula. Primary data were collected via respondent interviews, while secondary data were obtained through literature reviews. Mangrove area measurements were conducted spatially using Sentinel-2A satellite data. The findings reveal that the direct economic value of the mangrove ecosystem in Batu Itam Village amounts to IDR 1,376,670,000 per year, with an average of IDR 275,334,000 annually. This value is supported by the mangrove ecosystem's area of 205.13 hectares. Among the resources, fish provide the highest direct economic benefit compared to squid, crabs, shrimp, and shellfish. The contribution of income derived from the mangrove ecosystem constitutes 74% of the total household income for fishermen in Batu Itam Village.

Keywords: Mangrove Ecosystem, Economic Value, Direct Benefits

ABSTRAK

Pesisir Desa Batu Itam memiliki potensi sumber daya alam dan jasa lingkungan serta memiliki keanekaragaman hayati yang cukup tinggi di wilayah pesisirnya. Penelitian ini bertujuan untuk mengetahui manfaat ekonomi langsung perikanan tangkap di ekosistem mangrove, mengetahui kontribusi nilai ekonomi langsung ekosistem mangrove terhadap pendapatan rumah tangga di Desa Batu Itam. Jenis penelitian ini adalah penelitian deskriptif kuantitatif. Penelitian ini dilaksanakan pada bulan Juni 2024. Penentuan responden dalam penelitian ini menggunakan metode snowball sampling dan sensus. Responden dalam penelitian ini dibagi menjadi 2 yaitu nelayan mangrove yang berjumlah 27 responden yang ditentukan dengan metode sensus dan

nelayan umum yang berjumlah 20 responden yang ditentukan dengan rumus slovin. Jenis data yang digunakan dalam penelitian adalah data primer (wawancara responden) dan data sekunder (studi pustaka). Pengukuran luasan mangrove dalam penelitian ini berbasis spasial dengan menggunakan data satelit sentinel-2A. Hasil yang diperoleh yaitu nilai ekonomi langsung ekosistem mangrove di Desa Batu Itam sebesar Rp. 1.376.670.000/tahun dengan rata-rata Rp. 275.334.000/tahun, hal ini dapat terbentuk karena didukung oleh luas ekosistem mangrove sebesar 205,13 Ha. Nilai manfaat langsung dari ikan memberikan nilai manfaat yang lebih besar dibandingkan dengan nilai manfaat langsung dari cumi-cumi, kepiting, udang, dan kerang. Kontribusi pendapatan dari ekosistem mangrove terhadap total pendapatan rumah tangga nelayan di Desa Batu Itam sebesar 74%.

Kata Kunci: Ekosistem Mangrove, Nilai Ekonomi, Manfaat Langsung

INTRODUCTION

The mangrove ecosystem is a biological resource that has various potentials that can be felt by human life both directly and indirectly (Selan *et al*., 2021). Mangroves are ecosystems that have great benefits and functions for coastal areas. The functions and benefits of the mangrove ecosystem are grouped into three, namely physical, ecological, and economic (Karima, 2017). The mangrove ecosystem can provide various needs for living things such as wood providers, spawning grounds, nursery grounds, as feeding grounds for fish and other marine biota, as well as retaining ocean waves and seawater intrusion towards land, this is one of the main functions of the mangrove ecosystem (Hairunnisa *et al*., 2018).

Batu Itam Village is managed as part of Sijuk District, Belitung Regency, Bangka Belitung Islands Province and is a village located close to the coast. Batu Itam Village is known for its tourism, namely marine tourism, mangrove forests, wooden shipbuilding or what can be called Jeramba Kubu, and fishing tourism which can be called by the community as siro (Farisma *et al*., 2022). The coast of Batu Itam Village has the potential for natural resources and environmental services and has biodiversity that can be said to be quite high in its coastal area. The Batu Itam Village Mangrove Forest consists of three layers. The first layer facing the sea, the dominant species is Sonneratia alba. The second layer, there are Rhizophora Sp and Bruguiera gymnorrhiza. The third layer which coincides with the mainland forest, there is Nypa fruticans. The presence of mangrove forests has a positive impact on the coastal communities of Batu Itam Village, such as clear well water that does not change color and taste since it was first made, many biota associated with the mangrove ecosystem (shellfish, mangrove crabs) are found, and a place for fish to spawn (Ramadhani and Angelia, 2022). The livelihoods of the Batu Itam Village community are very diverse, one of which is as fishermen. Population data according to type of work in Belitung Regency in 2021 recorded 101 fishermen in Batu Itam Village.

The mangrove ecosystem in Batu Itam Village is the clearing of mangrove land, such as clearing land to be used as a harbor for fishermen to anchor their boats. In addition, the clearing of mangrove land in Batu Itam Village is a canal that divides the mangrove ecosystem. The threat to the mangrove ecosystem in Batu Itam Village is the planned development of tourism infrastructure such as hotels, resorts, villas in the mangrove area of Batu Itam Village. This development is predicted to clear around 20-40 hectares of mangroves (Ramadhani and Angelia, 2022). The consequences of clearing mangroves on a large scale will certainly have a negative impact on fish catches.

Fishermen or the people of Batu Itam Village are very dependent on the sea and the mangrove ecosystem. Batu Itam Village has a mangrove ecosystem that is still relatively healthy with a canopy cover of around 80-90%. The Batu Itam Village community has made many uses of the mangrove ecosystem, one of which is direct use of the mangrove ecosystem.

Direct use of the mangrove ecosystem by the community as a place to find biota associated with the mangrove ecosystem (fish, shrimp, shellfish, and crabs). The purpose of this study is to determine the economic value of direct benefits of capture fisheries in the mangrove ecosystem, to determine the contribution of the economic value of direct benefits of the mangrove ecosystem to household income in Batu Itam Village, Sijuk District, Belitung Regency.

RESEARCH METHODS

Place and Time

This research was conducted in June 2024 in the coastal area of Batu Itam Village, Sijuk District, Belitung Regency, Bangka Belitung Province.

Tools and Materials

The tools and materials used in this research are stationery, camera, Excel, questionnaire list.

Types and Methods of Data Collection

The data used in this study are primary data and secondary data. Primary data were obtained from direct interview activities between researchers and respondents in the form of question and answer communication or indirect interviews were conducted by distributing questionnaire sheets to respondents. Secondary data used are data that already exists or has been presented by other parties. This secondary data can be obtained from the Batu Itam Village Government, as well as literature studies from research results and studies that have been conducted by other parties. Secondary data for this study include population data, types of livelihoods of residents, minimum wage data for the Regency/City (UMK), the price of the value of biodiversity utilized, and thematic maps of the Batu Itam Village mangrove ecosystem in shapefile format and sentinel 2-A image data.

The determination of respondents in this study used the snowball sampling method. Snowball sampling is a method of collecting respondent samples using an approach to find key informants who have a lot of information. The first contact will find other respondents through recommendations (Nurdiani, 2014). The population in this study were all fishermen who directly utilize the mangrove ecosystem, especially in capture fisheries. The determination of the number of respondents used the census method. The number of respondents who directly utilize the mangrove ecosystem is 27 people out of a total of 101 fishermen in Batu Itam Village.

Analysis Method

This study uses descriptive analysis and quantitative analysis. Descriptive analysis in this study is used to describe and explain the condition of an area to find out how the surrounding community carries out social and economic activities and to find out the condition of the mangrove ecosystem in Batu Itam Village, Sijuk District, Belitung Regency, Bangka Belitung Province.

Quantitative analysis is a method with objects in the form of data in numerical or numerical form (Dhewy, 2022). Quantitative analysis in this study is used to determine the direct benefit value of capture fisheries in the mangrove ecosystem using a market price approach to goods or services. According to Maulida *et al*., (2019) the formula for determining the Direct Use Value is:

$$ML = ML_1 + ML_2 + ML_3 + ML_4 + \ldots + ML_n \quad (1)$$

Information : ML = Immediate Benefits
ML_1 = Direct benefit value of Fish, (amount of fish production (kg) × price of fish/kg - production costs)
ML_2 = Direct benefit value generated by crabs (amount of crab production (kg) × selling price of crabs/kg – production costs)
ML_3 = Direct benefit value generated by shrimp (amount of shrimp production (kg) × shrimp selling price/kg – production costs)
ML_4 = Direct benefit value generated by mussels (amount of mussel production (kg) × selling price of mussels/kg – production costs)

Meanwhile, the contribution of the mangrove ecosystem to the income of fishermen's households was analyzed using sources of income from direct utilization of capture fisheries in the mangrove ecosystem and income from outside the mangrove ecosystem area. The formula according to Lugiana *et al*., (2019) to determine how much the contribution of mangrove forests to fishermen's household income is as follows:

$$K = \frac{PI}{PT} \times 100\% \quad \text{.....(2)}$$

Information : K = Contribution (Rp)
PI = Income from mangroves (Rp)
PT = Total Revenue (Rp)

Calculating the average income of fishermen's households from direct utilization of capture fisheries in the mangrove ecosystem using the following formula:

$$\bar{I}_{SF} = \frac{\sum_1^n ISF}{n} \quad \text{.....(3)}$$

Information : $\bar{I}_{SF}$ = Average household income from mangrove utilization activities
I_{SF} = RT income from mangrove utilization activities
n = Number of village respondents from mangrove utilization activities

RESULT

Economic Value of Direct Benefits of Capture Fisheries in Mangrove Ecosystems

Based on the calculation results on the direct utilization of capture fisheries including fish, shrimp, crab, squid, and shellfish, the total economic value of the direct benefits of the mangrove ecosystem in Batu Itam Village is presented in Table 1.

Table 1. Total economic value of direct benefits of capture fisheries in the mangrove ecosystem

Types of Economic Value Benefits	Catch/Year (Kg)	Total Revenue/Year (Rp)	Percentage
Fish	18.314	696.652.000	51%
Squid	3.808	283.136.000	20%
Crab	4.986	237.131.000	17%
Shrimp	3.076	130.951.000	9%
Clams	834	28.800.000	2%
Total	**31.018**	**1.376.670.000**	**100%**

(Source: Primary data processing, 2025)

Contribution of Mangrove Ecosystem Utilization to Fishermen's Household Income

The contribution that has been given by the mangrove ecosystem to the income of fishermen's households is the contribution of direct benefits of the mangrove ecosystem from the fisheries sector (fish, shrimp, crabs, shellfish, and squid). The economic benefits of the mangrove ecosystem based on the contribution to the income of fishermen's households are presented in Table 2.

Table 2. Contribution of the utilization of the mangrove ecosystem area to the income of fishermen's households

No	Source of Income	Total RTN Revenue/Year (Rp)	Average Total Revenue RTN/Year (Rp)	Percentage (%)
1.	Income from carrying out activities around the mangrove ecosystem area.	1.376.670.000	50.987.778	74%
2	Income from outside the mangrove ecosystem area	480.000.000	17.777.778	26%
Total		**1.856.670.000**	**68.765.556**	**100%**

(Source: Primary data processing, 2025)

DISCUSSION

Economic Value of Direct Benefits of Capture Fisheries in Mangrove Ecosystems

The mangrove ecosystem area of Batu Itam Village is utilized by the surrounding community, especially fishermen, to search for marine biota such as fish, shrimp, crabs, shellfish, and squid. Fishermen who catch marine biota around the mangrove ecosystem area are a tradition in Batu Itam Village which is named sero fishermen and nyulo fishermen. Sero is a traditional fishing gear that is generally used to catch fish and squid. The sero fishing gear used by the people of Batu Itam Village is a passive fishing gear or fishing gear with a fixed operating nature (not moving) and is installed at a depth of 2-4 meters. According to Ardiansyah (2022), sero fishing gear is generally installed in shallow waters and is greatly influenced by the life cycle of fish. The working principle of this sero fishing gear is to cut the migration route/swimming direction of fish that migrate to coastal areas. Catching fish using this tool follows the ebb and flow of sea water in the mangrove area, where at high tide the fish will enter the siro and be trapped while at low tide it is used to collect the catch (Setianto *et al*., 2019). Nyulo fishermen in Batu Itam Village is a nickname for fishermen who catch shrimp, crabs, and shellfish using fishing gear in the form of tangguk. Nyulo is carried out at night when the sea water recedes or is not too deep around the mangrove ecosystem. The direct benefits of the mangrove ecosystem from capture fisheries in Batu Itam Village, Sijuk District, Belitung Regency consist of five types of utilization, namely direct benefits of fish, squid, crab, shrimp, and shellfish.

The mangrove ecosystem of Batu Itam Itam Village, Sijuk District, Belitung Regency with an area of 205.13 Ha has provided a total economic value of direct benefits from the mangrove ecosystem of IDR 1,376,670,000/year or an average of IDR 275,334,000/year, which means that each hectare of catchment area has an economic value of IDR 6,710,922/year. The economic value of capture fisheries in the mangrove ecosystem of Batu Itam Village is greater than the research of Yustina *et al*. (2024), which states that the economic value of capture fisheries in the mangrove ecosystem of Sungai Nibung Village, West Kalimantan is only IDR 388,168,000/year. Each mangrove area in various regions has abundant biodiversity and its utilization methods are certainly different (Deviasari *et al*., 2023). According to

Kurniawati (2017), differences in the economic value of direct benefits of capture fisheries in the mangrove ecosystem are influenced by the number of catches per year, market prices, and the condition of the mangrove ecosystem in each different region.

Based on the data in Table 1. shows that the largest number of types of direct economic benefits of the mangrove ecosystem in Batu Itam Village is the direct benefit of fish, which is IDR 696,652,000/year (51%) with a total catch of 18,314 kg/year. This happens because the types of fish caught by fishermen are diverse and have high economic value. According to Sunardy *et al*., (2021), the amount of fish caught is greater than the catch of shrimp, crab, squid and shellfish, also a factor causing the direct utilization of fish to be the largest.

The second largest direct economic benefit of the mangrove ecosystem is the direct benefit of squid, which is IDR 283,136,000/year (20%) with a total catch of 834 kg/year. There are 5 fishermen who utilize squid and all of them are men. Niapele *et al*. (2017), stated that the direct benefits of squid are the largest direct economic value of the mangrove ecosystem because squid have a high economic value compared to shrimp, crab, squid and mussels. Squid caught by fishermen in Batu Itam Village are by-catch because they are trapped in the fishermen's nets.

The type of direct benefit of crab in Batu Itam Village is IDR 237,131,000/year (17%), higher than the direct benefits of shrimp and mussels because the total crab catch is greater, namely 4,986 kg/year. Crabs are sold at a higher price than mussels, while crabs and shrimp are sold at the same price but the total shrimp catch is only IDR 3,076/kg. Another factor that causes the direct benefits of crabs to be higher than shrimp and mussels is the number of fishermen who utilize crabs is greater.

The type of direct benefit of shrimp in Batu Itam Village is IDR 130,951,000/year (9%), has a higher value than the direct benefits of mussels. This happens because shrimp have a higher selling price compared to the selling price of mussels. The type of direct benefit of shellfish is IDR 28,800,000/year (2%) with a total catch of 834 Kg/year. The direct benefit of shellfish is the lowest direct economic value of the mangrove ecosystem in Batu Itam Village. This is because the catch is small, and the small number of fishermen who collect shellfish compared to other direct benefits. The size of each type of direct benefit of the mangrove ecosystem in Batu Itam Village is generally caused by the selling price, total catch, operational costs, and the number of fishermen who utilize each different commodity. Haris *et al*. (2023), stated that the high and low value of the direct benefits of the mangrove ecosystem depends on the management and utilization of the results of the mangrove ecosystem by fishermen, the amount of catch, costs incurred during production, selling price.

Contribution of Mangrove Ecosystem Utilization to Fishermen's Household Income

The mangrove ecosystem has provided various benefits, one of which is economic benefits for the community. Communities utilize the mangrove ecosystem in different ways depending on their respective regions. The Batu Itam Village community utilizes the mangrove ecosystem through capture fisheries productivity. The contribution that has been made by the mangrove ecosystem to the income of fishermen's households is the contribution of direct benefits of the mangrove ecosystem from the capture fisheries sector in the form of fish, shrimp, crabs, shellfish, and squid.

Income is the main center in households to meet living needs such as food needs (Ersan *et al*., 2022). Based on the data in Table 2. shows the total income from the mangrove ecosystem in Batu Itam Village is IDR 1,376,670,000/year (74%) with an average of IDR 50,987,778/year and total income from outside the mangrove ecosystem is IDR 480,000,000/year (26%) with an average of 17,777,778/year. The average income of fishermen per year shows that fishermen's income is greater from the utilization of the mangrove ecosystem compared to income outside the mangrove ecosystem. The work done by fishermen

outside the mangrove ecosystem is as farmers, daily laborers, traders with an income of IDR 12,000,000 / year - IDR 42,000,000 / year.

The contribution of the mangrove ecosystem to the household income of fishermen in Batu Itam Village is 74% which consists of income from direct utilization of fish, shrimp, crab, squid and shellfish. The household income of fishermen from direct utilization of the mangrove ecosystem in Batu Itam Village averages around IDR 4.2 million / month / household. This income can be said to be relatively large even though the community only does business upstream (catching fish, shrimp, crab, squid, and shellfish). According to Lugiana et al. (2019), if the community has carried out integrated businesses to downstream (restaurants) they will have greater profits. Fishermen's income when viewed from the minimum wage of Bangka Belitung Province (UMP), the average income from the mangrove ecosystem in Batu Itam Village can guarantee the welfare of households, especially fishermen. This income can meet the primary needs of fishermen's households.

The community in Batu Itam Village has a relatively low level of dependence on the mangrove ecosystem, this is because there are other more varied alternative livelihoods reaching 13 types of jobs. The community who have a livelihood as fishermen in Batu Itam Village is 101 people. Working as a fisherman is one of the jobs that is widely done by the people of Batu Itam Village, but there are two alternative livelihoods that are classified as high, such as self-employed as traders reaching 162 people and private employees as many as 105 people.

The community who live around the mangrove ecosystem generally has a high level of dependence on the existence of mangroves because basically they get income for their daily needs from mangrove ecosystem utilization activities (Setiawan *et al*., 2017). Limited capacity, in terms of education and skills, is an obstacle to switching livelihoods. Developing alternative livelihoods that are sustainable and economically viable is one strategic approach to supporting mangrove ecosystem conservation efforts.

CONCLUSION

The conclusion obtained from the research conducted in Batu Itam Village, Sijuk District, Belitung Regency is that the economic value of direct benefits of capture fisheries in the mangrove ecosystem of Batu Itam Village is Rp. 1,376,670,000/year with an average of Rp. 275,334,000/year which includes direct benefits of fish, squid, shrimp, crabs and shellfish. This is supported by the area of the mangrove ecosystem of Batu Itam Village which stretches over 205.13 Ha, which means that the economic value of the mangrove ecosystem per hectare is Rp. 6,710,922/year. The contribution of income from direct utilization of capture fisheries in the mangrove ecosystem to the total income of fishermen's households in Batu Itam Village is 74%.

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