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Productivity Analysis of Milkfish Farming in Areas Surrounding Mines in Tinanggea District, South Konawe Regency

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Abstract

This study aims to determine 1) the productivity of milkfish farming in mining-affected areas, and 2) the income and revenue from the productivity of milkfish farming in mining-affected areas in Tinanggea District, South Konawe Regency. The research was conducted in Wadonggo Village, Tinanggea District, South Konawe Regency, Southeast Sulawesi Province. The research took place from March to June 2024. The population in this study consisted of all milkfish pond farmers around the mine in Wadonggo Village, Tinanggea District, South Konawe Regency, totaling 41 people. The sampling technique used in this study was saturated sampling, which is a sampling technique where all members of the population are used as samples, resulting in a sample size of 41 people. The data analysis used includes farming productivity analysis and income analysis. The results of the study indicate that the productivity of milkfish farming in mining-affected areas in Wadonggo Village, Tinanggea District, reached 1,363.63 kg/ha/season. This productivity reflects the farmers' efforts in applying efficient farming techniques and the appropriate use of inputs to support the growth of milkfish. The average income of milkfish pond farmers in Wadonggo Village is IDR 56,485,165/season. This substantial net income indicates the effectiveness and efficiency of pond operations, as well as the high profitability potential of milkfish farming in this area.

Keywords: Milkfish; productivity; income.

INTRODUCTION

Indonesia, as one of the largest archipelagic countries in the world, has the potential for abundant fisheries resources, which if managed optimally can restore the national economy,

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especially through the development of aquaculture-based businesses (Kurniawan, 2021). With most of its territory in the form of coastal areas, this area plays an important role as a source of livelihood, especially for fishermen farmers, who utilize brackish, marine and coastal aquaculture, including milkfish ponds that can support national production targets (Alikodra, 2005). In addition, Indonesia is also rich in mineral resources, especially nickel in Southeast Sulawesi Province, with reserves of 97.4 billion tons spread over 480 thousand hectares, although between 2008 and 2015, 56.9 million tons have been exploited, leaving 97.3 billion tons (Center for Energy and Mineral Resources Data and Information Technology, Ministry of Energy and Mineral Resources, 2015). However, this mining activity, while providing positive economic impacts, also triggers negative environmental impacts such as declining soil fertility, dust and noise, so nickel resource management requires a technically, socially and economically appropriate mining system to be optimal (Prodjosoemanto, 2006).

Milkfish (Chanos chanos) is a potential commodity in aquaculture that is resistant to environmental changes and can live in various types of water, such as fresh, salty and brackish water, and is resistant to disease. With good meat flavor, rich protein, low cholesterol, and enlargement technology that has been mastered by the community, the demand for milkfish continues to increase as consumption also increases (Badan Pusat Statistik, 2014). Southeast Sulawesi is one of the provinces with promising potential for the development of the marine and fisheries sector, having a land area of 153,018.98 km², a coastline length of 1,754 km, and marine waters of 114,879 km² that support aquaculture businesses, including milkfish pond culture (Imelda, et al., 2018). Traditional milkfish farming, both with monoculture and polyculture systems, has long been the livelihood of people in this region, with South Konawe District as the main production center. Milkfish production in Southeast Sulawesi in 2020 reached 53,987 tons, but production patterns often unstable due to seasonal fluctuations, while consumer and industrial demand require constant supply all the time. Therefore, developing the potential of milkfish farming is very important to meet the needs of the community and increase the income of pond farmers (BPS Southeast Sulawesi, 2020).

Table 1 Milkfish Production in Southeast Sulawesi in 2020

No.	District/City	Milkfish Production (tons)	Value (Rp)
1.	Buton	14	408.515
2.	Muna	34	2.819.100
3.	Konawe	91	933.930
4.	Kolaka	13.402	220.851.558

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5.	South Konawe	18.413	266.927.000
6.	Bombana	1.409	19.720.428
7.	Wakatobi	-	-
8.	North Kolaka	6.952	139.040.000
9.	North Buton	-	-
10.	North Konawe	11.498	229.960.400
11.	East Kolaka	-	-
12.	Konawe Islands	-	-
13.	West Muna	2.120	59.138.820
14.	Central Buton	-	-
15.	South Buton	1	59.520
16.	Kendari City	44	1.525.055
17.	Bau-Bau City	9	161.345
	Southeast Sulawesi	53.987	941.545.671

Source: Southeast Sulawesi Central Bureau of Statistics, (2020)

Based on Table 1, it is known that in 2020 the amount of milkfish production in Southeast Sulawesi is 53,987 tons. In the 17 districts in Southeast Sulawesi, South Konawe district is one of the districts that produces milkfish which is the first largest with a total production of 18,413 tons and a value of 266,927,000 tons.

South Konawe Regency is one of the main centers of aquaculture development in Southeast Sulawesi Province, with an area of 451,420 ha or 11.3% of the province's land area, which includes 12,256 ha of ponds, 6,215 ha of ponds, and more than 9,368 km² of marine waters, spread across 25 sub-districts with 351 villages (Muarifah, 2021). Southeast Sulawesi milkfish production in 2022 reached 53,987 tons, with South Konawe as the main contributor (Irmasila, 2021). In addition, ponds in Tinanggea are located in the vicinity of nickel mining, where mining activities provide positive impacts in the form of employment and income, but also cause environmental damage that can affect pond businesses. Therefore, analyzing the productivity of ponds around the mine is important to evaluate the impact and design optimal production management by considering human aspects, funds, materials, machines, methods, and markets (Fathul, 2012).

Mining activities around rice fields and ponds in South Konawe Regency continue, but have negative impacts such as mud pollution that harms rice farmers and results in crop failure, and decreased productivity of milkfish ponds due to dust, mud and residue from mining

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operations. In 2012, the local government brokered a deal between the mine and the pond farmers, with compensation in the form of impact fees that matched the farmers' capital. For pond farmers, pond land is a vital asset that requires protection and adaptation involving ongoing cooperation between farmers, government and the mining company to address impacts.

Based on the explanation above, the researcher is interested in examining the Productivity Analysis of Milkfish Farming in the Area Around the Mine in Tinanggea District, South Konawe Regency.

METHOD

This research was conducted in Wadonggo Village, Tinanggea Sub-district, South Konawe Regency, Southeast Sulawesi Province. The population as well as the sample in this study amounted to 41 people who were taken using the saturated sampling method. Data collection techniques were carried out using interviews, recording, and observation techniques. The first objective related to the productivity of milkfish farming in the area around the mine was analyzed using productivity analysis. Mathematically it can be written as follows:

1. Productivity of milkfish farming

$$\text{Produktivitas} = \frac{\text{Jumlah Produksi (Kg)}}{\text{Luas Panen (Ha)}}$$

Description:

Productivity = Productivity (Kg/Ha)
Total Production = Milkfish Production (Kg)
Harvest Area = Milkfish Harvest Area (Ha)

The second research objective related to revenue and income of milkfish farming in the area around the mine was analyzed using income analysis.

TR = Y . Py

Description:

TR = *Total* Revenue (Rp/season)
Y = *Output* (Production obtained) (Rp/season)
Py = *Price* (Rp/season)

Income is the difference between revenue (TR) and all costs (TC). The income formula is written in the following equation (Sokeartawi, 1995):

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I = TR - TC

Description:

I = Farm income (Rp/season)

TR = *Total* Revenue (Rp/season)

TC = *Total* Cost (Rp/season)

RESULTS AND DISCUSSION

Farm Productivity Analysis

Productivity in general is a comprehensive evaluation process of the efficiency and effectiveness of production in an activity or sector (Suratiyah, 2019). Its main objective is to measure the outputs produced compared to the inputs used.

Table 2 Productivity Analysis of Milkfish Farming

	Description	Value
Land Area	Highest	12 Ha
	Lowest	3 9 Ha
	Average	4.4 Ha
Production Quantity	Highest	12,000 Kg/season
	Lowest	4,000 Kg/season
	Average	6,000 Kg/season
Productivity	Production quantity	6,000 Kg/season
	Land area	4.4 Ha
	Productivity	1,363.63 Kg/ha

Based on table 2 above, the productivity analysis of milkfish farming can be explained as follows;

1. The productivity of milkfish farming is strongly influenced by several factors, one of which is the area of land used for cultivation. Harvested land area is one of the main indicators that determine the production capacity and development potential of milkfish farming. The land available for milkfish farming must be adequate in terms of area and soil quality. The ideal soil for milkfish ponds is one that has a sandy loam or clayey loam texture with good drainage to avoid excessive waterlogging (Mikaila, 2018). Table 2 shows that the average land area of milkfish farms is 4.4 hectares. The largest land area used for harvesting reached 12 hectares, while the smallest land area used was only 3

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hectares. This difference in land area reflects the variation in business scale and production capacity of farmers in the area. Field conditions show that farmers with larger landholdings tend to have higher production yields and can apply better cultivation technology.

2. The amount of milkfish production is one of the main indicators in assessing the success of fisheries farming in the area around the mine. The production of milkfish farming in the area around the mine in Tinanggea District, South Konawe Regency shows significant variation. Based on data in Table 2, the highest production achieved by farmers was 12,0000 kg/season. This suggests that with good pond management, farmers can achieve very high production yields. However, not all farmers were able to achieve the same level of production. The lowest production was 4,000 kg/season, reflecting that there are still constraints and challenges faced by some farmers. The average milkfish production reached 6,000 kg/season, indicating that farmers were generally able to achieve quite good production results. Field conditions show that there are significant differences between farmers who are able to adopt modern farming technologies and those who still use traditional methods. Farmers who apply technologies such as aeration, high-quality artificial feed, and a good water management system tend to have higher production. On the other hand, farmers who still use traditional methods face various challenges that can hinder production.
3. Farm productivity is generally a measure of efficiency in the agricultural production process. It refers to the amount of output produced per unit of input used. In the context of agriculture, productivity can be measured in various ways depending on the type of crop or livestock being cultivated (Hernanto, 2008). Based on Table 2, the average amount of milkfish production per season reaches 6,000 kg/season, with an average land area of 4.4 hectares. This results in an average productivity of about 1,363.63 kg/season/ha. This gives an idea of how milkfish farmers manage their ponds to achieve optimal yields. This productivity reflects farmers' efforts in applying efficient farming techniques and the use of appropriate inputs to support milkfish growth.

Revenue Analysis

Income analysis in the context of this study includes all costs associated with farming operations. These operational costs are part of the total costs that must be incurred to produce milkfish. Operational costs consist of *fixed* costs and *variable* costs, which are more clearly described in the following sections.

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Table 3 Average Fixed Costs of Milkfish Farming

Description	Total	Price (Rp/unit)	Total Price (Rp)	Age (Season)	Final Grade (Rp/season)
Net	4 units	500.000	2.000.000	1	1.000.000
Construction	1 time	2.500.000	2.500.000	5	500.000
Aerator	1 unit	3.000.000	3.000.000	3	600.000
Crowbar	2 pieces	120.000	240.000	2	120.000
Hoe	1 piece	165.000	165.000	2	82.500
Machete	2 pieces	100.000	200.000	2	100.000
Tarpaulin	2 units	150.000	300.000	2	150.000
Average depreciation per season					3.552.500

Table 3 shows that the average fixed costs incurred by respondents of milkfish farms in Wadonggo Village amounted to Rp3,552,500/season. The highest use of fixed costs is the cost of using nets with a final value due to the usage period of Rp1,000,000/season, and the lowest cost is the use of hoes with a final value of Rp82,500/season. Equipment included nets, pond construction, aerators, crowbars, hoes, machetes and tarpaulins. Nets, dykes, aerators, crowbars, hoes, machetes and tarpaulins are essential equipment in milkfish ponds to maintain productivity and pond health, with depreciation costs calculated based on the economic life of each tool. Fixed costs, such as land tax, water tax, and depreciation of equipment and buildings, are not depleted in a single production period and are not affected by short-term changes in activity levels (Samryn, 2013; Hernanto, 1989). These costs are a major investment for the farmer in ensuring that the farm remains optimally functional throughout the season.

Table 4 Average Variable Costs of Milkfish Pond Farming

No.	Description	Cost (Rp/season)
1	Cost of nener seed	11.929.878
2	Labor cost	4.141.463
3	Fertilizer cost	1.771.971
4	Feed cost	119.023
	Total	17.962.335

Table 4 shows the total variable cost of milkfish ponds is Rp17,962,335 per season, with the main components including the cost of nener seeds Rp11,929,878, labor Rp4,141,463,

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fertilizer Rp1,771,971, and feed Rp119,023. Nener seeds are the biggest expense as fish seeds are raised until harvest, while labor is required for activities such as stocking, maintenance, and harvesting. Fertilizer is used to maintain water quality and plankton growth, while artificial feed provides additional nutrients for milkfish. These variable costs always fluctuate according to the activity level of the pond, such as production volume or number of working hours (Rudianto, 2013).

Table 5 Average Total Cost of Production of a Milkfish Pond Farm

No.	Description	Cost (Rp/season)
1	Fixed costs (depreciation)	3.552.500
2	Variable cost	17.962.335
	Total	21.514.835

Table 5 shows that fixed costs in milkfish farming include depreciation of equipment such as nets, aerators, and pond construction, while variable costs include seeds, labor, fertilizer, and feed, which dominate total production costs at IDR 20,514,835 per season. The highly variable input-dependent nature of pond operations demands effective cost management to ensure revenue from milkfish sales can cover production costs and provide a profit. As stated by Saputra et al. (2018), the greater the production costs incurred, the smaller the potential revenue, so cost analysis is important in making strategic decisions regarding selling prices and profit targets.

Revenue of milkfish farming

Every business focuses on costs and revenue to maximize income, where revenue includes money earned from the sale of goods or services during a certain period (Horngren et al., 2005; Soekartawi, 2003). In milkfish farming, revenue is calculated from the harvest based on the volume of fish and the selling price per kilogram, reflecting the efficiency of operations and the pricing strategy applied by farmers. High revenue is expected to cover fixed and variable costs, thus providing a profit for milkfish farming. More details can be seen in Table 6.

Table 6 Average Revenue of Respondents of Milkfish Pond Farmers

	Description	Value
Reception	Production quantity	6,000 Kg/season
	Selling price	13,000 Rp/kg
	Reception	78.000.000

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Revenue	Reception	78,000,000 Rp/season
	Total production cost	21,514,835 Rp/season
	Revenue	56.485.165

Based on table 6 above, the average revenue of respondents of milkfish pond farmers can be explained as follows;

1. That milkfish pond farmers in Wadonggo Village obtained an average income of Rp78,000,000 per season, with production reaching 6,000 kg and a selling price of Rp13,000/kg. This income reflects production efficiency and good farm management, as well as competitive selling prices. The revenue is used to cover production costs, both fixed and variable, while providing a profit for farmers, which in turn improves welfare and encourages the development of pond businesses in the region. This high profitability potential confirms that milkfish farming can be a stable and profitable source of income in Wadonggo Village.
2. The average net income of milkfish farmers in Wadonggo Village was IDR 56,485,165 per season, reflecting a significant profit after covering all production costs. However, this income has decreased compared to previous years, due to factors such as fluctuations in the selling price of milkfish, increased production costs, and changes in government policy. The decline in fish selling prices due to declining market demand and changes in trade policies are the main constraints, as stated by H. Isa, one of the pond farmers. In addition, rising prices of feed, labor, and fuel have added to operational expenses, reducing profit margins even though production has remained stable. Mining activities around milkfish ponds in Wadonggo Village have had a significant negative impact on the pond environment, especially water quality. Mining waste that pollutes the water disturbs fish health, increases susceptibility to disease, and damages the pond ecosystem, such as the loss of buffer vegetation. To address these impacts, local governments and mining companies provide compensation in the form of "impact fees" equivalent to pond operational costs. However, the additional costs that farmers must bear for infrastructure improvements, water treatment, and fish care, increase the burden of production and reduce profit margins. This decline in net income emphasizes the importance of sustainable environmental management and collaboration between the government, mining companies and communities to mitigate the negative impacts of mining activities for the sustainability of milkfish farms.

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CONCLUSION

Based on the results of the research that has been done, it can be concluded that the productivity of milkfish farming in the area around the mine in Wadonggo Village, Tinanggea District reaches 1,363.63 kg/ha/season. The average income of milkfish farmers in Wadonggo Village is Rp56,485,165/season.

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