



Analysis of the Impact of the COVID-19 Pandemic on the Income of Tilapia (*Oreochromis niloticus*) Fishers in Darmaraja District, Sumedang Regency

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study aims to determine fishers' income, and health application protocols among tilapia fishers (*Oreochromis niloticus*) in Jatigede Reservoir, specifically, in Darmaraja District, Sumedang Regency, during the COVID-19 pandemic. The purposive sampling technique was used, where data collection is done using a questionnaire technique. Primary data was obtained using a questionnaire to determine knowledge about the COVID-19 pandemic, and its health protocols. Secondary data were obtained from various sources such as literature, journals, theses, books, and the Sumedang District Fisheries Service. The amount of profit obtained from the revenue price minus production costs, which are divided into fixed costs (ship maintenance costs, machinery, and fishing gear depreciation), and variable costs (consumption costs and fuel costs). The results showed that the COVID-19 pandemic had an impact on fishers understanding and the application of health protocols. This resulted into decrease in the number of fishing trips and a decrease in fish prices affecting supply and demand instability leading to reduction of tilapia (*Oreochromis niloticus*) fishers profits in Darmaraja District, Sumedang Regency.

Keywords: *Advantage; COVID-19; fishers; health protocols; jatigede reservoir; revenue.*

1. INTRODUCTION

Fisheries is among the fields that can be undertaken to improve the economy and welfare of the Indonesian people. The Indonesian water resources are certainly promising for the nation's progress if used sustainably. The sector can play a great role in the recovery and economic growth of the Indonesian government given the potential fish resources that are large in number and diversity [1].

Jatigede, is a reservoir located in Sumedang Regency, West Java Province. According to [2], construction of the Jatigede Reservoir is the government's strategy to overcome drought normally occurring in the dry season and flooding in the rainy season. Activities around this reservoir focused on fishing. In Jatigede Reservoir, there are many groups of fishers whose needs are also facilitated by the local government to manage fishing activities in Jatigede Reservoir [3]. However, the world is currently facing the COVID-19 pandemic, of which in Indonesia started early 2020 after it was first identified in December 2019 in Wuhan, China [4].

The COVID-19 pandemic occurred after discoveries of mutations of the SARS-CoV virus, a very infectious and high virulence. It is a challenge for the community because patients were in the incubation period and were falsely detected to spread the virus. Prevention measures are the main points that everyone must understand [5]. These coronaviruses can spread quickly from person to person from droplets when sneezing and coughing [6]. It is because of the very fast transmission of the corona virus that the World Health Organization (WHO) designated the corona virus as a pandemic on March 11, 2020. The status of a global pandemic or epidemic indicates that the spread of COVID-19 is taking place so quickly that almost no country in the world can ensure that it is protected. from the corona virus [7].

At the beginning of the pandemic, the economic sector suffered losses and even experienced a drastic decline. This includes the financial industry in fisheries and marine affairs. The selling price of fish has decreased by up to 50% due to the pandemic; this is not comparable to the operational cost of fishers catching fish. Changes in consumption patterns and employment have disrupted the market for food commodities, including fish [8]. The

implementation of government policies which are also stated in the Indonesian government regulation no. 21 of 2020 concerning implementing social distancing, physical distancing, work from home (WFH), and large-scale social restrictions (PSBB) are complicated for local fishers in marketing their catches, as their catches experience deterioration in quality and even decay. Due to the COVID-19 pandemic, according to [9], several cold storage warehouses have overstocked or accumulated fish raw materials due to delays in the distribution/supply process, as was usually done before the COVID-19 pandemic. The uncertainty of conditions and the deep concern that arose among the fishing communities in the Jatigede Reservoir resulted in a decrease in the number of fishers on fishing trips. Of course, it will affect the productivity of fishers in doing their work and the number of fish caught during the COVID-19 pandemic. The impact of the COVID-19 pandemic that fishers have felt is the price of fish, which has decreased drastically by up to 50% [10]. The decline in fish prices is certainly not commensurate with fishers' effort and operational costs when catching fish in the Jatigede Reservoir.

Fishers' income is obtained from the accumulation of fishers' business results, which are influenced by various factors [11]. Based on the background of these problems, it is necessary to conduct research on the analysis of the income of tilapia fishers (*Oreochromis niloticus*) in Jatigede Reservoir, precisely in Darmaraja District, Sumedang Regency, during the COVID-19 pandemic and the application of health protocols carried out by fishers.

2. METHODOLOGY

The method used in this research is a survey method with a questionnaire to provide a detailed description of the background of a case, where fishers are directly involved as respondents. The research process includes site surveys, data collection, and conducting surveys with questionnaires with direct distribution to respondents, namely tilapia fishers (*Oreochromis niloticus*) in Darmaraja District, Sumedang Regency.

2.1 Data Collection Method

In this study, we used primary and secondary data. Preliminary data were obtained directly from the object under investigation through a

questionnaire to determine knowledge about the COVID-19 pandemic and its health protocols and vaccine used. We also determined perceived impact, including income of fishers before and during the COVID-19 pandemic and the results of the number of fishing/searching fish. Secondary data were obtained from various sources such as literature, journals, theses, books, and the Sumedang District Fisheries Service.

2.2 Data Analysis

Data analysis of fishers' knowledge level was conducted using descriptive statistics using qualitative methods, tabulations, and narratives to explain their understanding of the COVID-19 pandemic and the impact they felt due to the pandemic. At the same time, the fishers' income analysis uses quantitative methods by calculating total revenue and profit.

Total fisherman's profit income is obtained from the respondent's fisherman's payment (total amount of money produced by marketed products) minus operational costs, which consist of fixed and variable costs. The income of respondent fishers is different; fishers often get many results and little or no results, coupled with adverse pandemic conditions.

2.2.1 Revenue analysis

Total fisherman's profit income is obtained from the respondent's fisherman's payment (total amount of money produced by marketed products) minus operational costs, which consist of fixed and variable costs. The income of respondent fishers is different; often, fishers get a lot of results and little or no results, coupled with adverse pandemic conditions.

This business income analysis aims to determine the benefits obtained from fishing efforts. A systematic analysis of operating income can be formulated as follows:

$$TR = P.Q$$

Where:

TR = Total revenue (Rp)

P = Product price (Rp)

Q = Number of catches (Kg)

2.2.2 Advantage analysis

Based on [12] research, advantage analysis can be formulated as follows:

$$\pi = TR - TC$$

Where:

π = Advantage

TR = Total acceptance

TC = Total expenditure

2.2.3 Business criteria

TR > TC, then the decent effort

TR < TC, then the effort is not worth it

TR = TC, then the business is in a break-even state

3. RESULTS AND DISCUSSION

The COVID-19 pandemic, which began to spread in Indonesia in March 2020, considerably impacted the community in Darmaraja District. The COVID-19 pandemic has impacted fishery production, prices, and costs, affecting the decline in fishers' income in the Jatigede Reservoir, especially anglers in the Darmaraja District.

3.1 Geographical Location and Circumstances

Jatigede Reservoir has an inundation area of about 4,122 ha. It stems from the flow of the Cimanuk River, which inundated five sub-districts in the Sumedang Regency namely Jatigede District 760.55 Ha (consisting of the villages of Ciranggem, Jemah, Mekarasih, Cijeungjing, and Sukakersa), Jatigede District 239.89 Ha (consisting of the villages of Patangan and Sirnasari), Wado District 459.23 Ha (consisting of Padajaya, Wado, and Cipurat villages), Darmaraja District 1,575.67 Ha, Cisitu District 48.65 Ha (consisting of Pajagan Village) [6]. Darmaraja sub-district, the largest area with the largest number of villages (i.e., Ranggon, Tarunajaya, Neglasari, Pakualam, Karangpakuan, Cieunteung, Cipeteuy, Cikeusi, Sukaratu, Sukamenak, Darmajaya, and Darmaraja village). Every fishing community is allowed to make operations such as to arrest because the fishing community views the resources of the Jatigede reservoir as an open access [13].

3.2 Population Condition

3.2.1 Total Population

Darmaraja District has a total of 37,343 people, of which 18,864 are males and 18,479 females.

Table 1. Total Population by Gender in Darmaraja District, 2021

Gender	Total	Percentage (%)
female	18.479	49,48
male	18.864	50,52
Total	37.343	100

Source: [14]

Based on Table 1 above, it can be seen that the male population in Darmaraja district is higher than the female population. It can be conclude that Darmaraja District is dominated by males.

Table 2. Total Population by Age in Darmaraja District, 2021

Age	Total	Percentage (%)
0-5	496	7,82
6-19	1.331	20,97
20-60	11.757	53,48
More than 60	3.526	16,04

Source: [14]

The table above shows that most of the population of the Darmaraja district in 2021 is at 20-60 age. It shows that the population in the Darmaraja district is dominated by people who have a productive age, which 20-60 years old.

3.3 Knowledge about the COVID-19 Pandemic

In terms of understanding the COVID-19 pandemic, is realized in the daily life of fishers to carry out health protocols. The knowledge, and understand among fishers of the COVID-19 pandemic and the application of health protocols have not been optimal. This is due to the low level of education and poor information dissemination, which is still not going well received because of their busy activities on fishing trips. According to research [15], in the level of understanding of fishers, there is the level of knowing enough and the level of knowing very well. For fishers with sufficient knowledge, he/she only knows of the COVID-19 pandemic and learn how to prevent it, while the level of very knowing fishers knows in detail about the COVID-19 pandemic such as modes of transmission, methods of prevention, and the latest news regarding the spread of COVID-19. Difference in the level of understanding of the COVID-19 pandemic is caused by several factors, such as differences in education levels, and economic levels of the individual fisherman.

The level of concern on the COVID-19 pandemic has also an effect. These are several levels of worry i.e., normal, moderately worried, and very worried. These different levels of anxiety are reflected in the attitude of fishers on carrying out their daily activities. If fishers are at a familiar story, then their daily activities usually run and are not affected by the COVID-19 pandemic and do not apply health protocols in their activities. Then for fishers who are at a level that is quite worried, in their daily activities, the fishers will carry out their health protocols even though they have not been fully implemented. Fishers also begin to take care of their health. Then, fishers who are at a very worrying level in their daily activities show an alert response and strictly implement health protocols, taking precautions and controlling the spread of COVID-19.

3.4 Implementation of Health Protocol

In the application of health protocols for fishers, there are several levels, namely, not implementing health protocols, implementing health protocols, and strictly implementing health protocols. According to research [15], among fishers, information regarding health protocols initiated by the government has been received, but in practice, it returns to their respective personalities. Based on the results of survey research [15], the level of application of health protocols is divided into three, namely continuing to work and carrying out activities as usual; this belongs to the group of not implementing health protocols; then fishers continue to work but sometimes leave the house, this is classified as fishers with a level of implementing health protocols, and the last one staying at home, not working, and only going out when urgent; this condition is classified as fishers with a very high level of implementing health protocols.

3.5 Fisherman's Productivity

Fisherman productivity is the ability of fisher to obtain catches per fishing trip. Based on research from [16], fishers were still carrying out fishing operations during the pandemic, even though social distancing did not limit fishers to continue going to sea to meet their daily needs. Compared to before the pandemic, catch production continued to increase due to influence of fish seasonality. The price of fish in the market also affected the productivity of fishers on fishing trips. If conditions of the COVID-19 pandemic require consumers to stay at home, then markets and other public facilities are closed, demand will

decrease, but supply will continue to increase. This underlies the decline in fish prices when supply is higher than demand. This condition causes the productivity of fishers to decrease, although not significantly.

3.6 Fisherman’s Income

According to [17], fishers’ income is the number of fish caught after fishing operations. Income is the value of money obtained from the sale of fish production, which is influenced by the large number of fish seen and the price formed at the time of landing [18].

3.6.1 Total revenue

Fishers’ income is calculated from total revenue minus production costs / operational costs. Where operational costs are obtained from fixed and variable costs, this total revenue is one aspect of determining the income of fishers. Full payment will differ for each season, depending on the number of fish in the market. The theory of supply and demand affects total revenue because supply conditions will affect market demand and vice versa. During the COVID-19 pandemic, PPKM was implemented in various regions, including in Sumedang Regency, which had implemented a level 4 PPKM policy due to the high spread of COVID-19. In this condition, all public facilities are closed, many are advised to stay at home, and even some traditional markets are closed. This, of course, impacts demand in the market, which has decreased drastically, but supply remains in normal conditions resulting in a decrease in fish prices. According to [10], fish prices have drastically reduced by up to 50% during the COVID-19 pandemic. Of course, this decline in fish prices impacts the decline in the fisher’s total income. The Demand Determination Theory states that, “If demand increases, relative prices will rise; otherwise, if demand decreases, relative prices will fall” [19].

In a study by [12], the total revenue from 3 types of fishing gear in the Jatigede reservoir within one year is presented in Table 3.

From the results of this study, gill net is the fishing gear with the highest total revenue each year, which is Rp. 105,000,000/year. Gill net has the highest amount of production with a total catch of 7,000 kg, followed by throwing nets with total income of Rp. 60,000,000/year from a total yield of 4,000 kilograms, and the least was chart

with total revenue of 45,000,000/year obtained from a total catch of 3,000 kg.

Table 3. Total admission of arrest in jatigede reservoir

Types of Fishing Gear	Catch (kg)	Percentage (%)
Gill Net	7.000	105.000.000
Throwing Net	4.000	60.000.000
Bagan	3.000	45.000.000

Source: [12]

3.6.2 Production costs

Production costs are all costs incurred to produce a product, and are associated with the production function or incurred in one fishing trip activity. According to [20], production costs consist of fixed and variable costs. In the fishing business it include ship maintenance costs, machinery, and depreciation of fishing gear.

The highest fixed costs incurred in fishing activities in the Jatigede Reservoir were for fishers using gill nets, followed by throwing nets, and charts [12]. This fixed cost condition will not change in amount even though fishing trip activity increases or decreases.

Variable or operational costs in this fishing business include consumption and fuel costs (BBM). They change in number in proportion to changes in activities, such as fishing trips. Variable costs will adjust the number of fishing trips according to the situation and conditions of activities. In line with research according to [21], the variable costs consist of the cost of fuel (BBM) and consumption (food and cigarettes). Fishersowning gill nets incur the highest variable costs, followed by throwing traps and charts. This variable cost difference follows the type of fishing gear used because there are differences in the size of the ship, which use of different amount of fuel.

Variable costs were influenced by the conditions of the COVID-19 pandemic. During the COVID-19 pandemic, the prices of several essential food items, including fuel, which affected the total income of fishers in the Darmaraja District.

3.6.3 Advantage

Ishers obtain their total profit from a reduction in total revenue and production. Total gain can also be called the total net income of fishers. During

Table 4. Advantages of Fish Fishing Business in Jatigede Reservoir

Types of Fishing Gear	Total Admission (Rp/Year)	Fixed Fee (Rp/Year)	Variable Fee (Rp/Year)	Advantage (Rp/Year)
Gill net	105.000.000	5.210.000	32.850.000	72.150.000
Throwing net	60.000.000	1.740.000	25.550.000	34.450.000
Bagan	45.000.000	1.100.000	18.250.000	26.750.000

Source: [12]

the COVID-19 pandemic, payment and production costs were interrelated leading to fishers total profit earned.

Based on research [12], the total profit obtained by fishers in the Jatigede reservoir in a year using three fishing gear is presented in Table 4.

In the Jatigede reservoir fishers obtained the highest profits for fishing with gill nets, followed by throwing nets, and charts. These differences in total gain refers to total revenue and production costs incurred on the fishing gear used. This proves that COVID-19 pandemic will ultimately impact the profits of fishers in the Jatigede reservoir.

4. CONCLUSION

Based on the research carried out, it can be concluded that:

1. The COVID-19 pandemic will eventually destabilize the economic stability of fishers in the Jatigede Reservoir
2. The COVID-19 pandemic requires everyone to implement health protocols, including fishers in the Darmaraja sub-district, and Sumedang district
3. The productivity of fishers in the Jatigede reservoir showed decreased during the COVID-19 pandemic.
4. Total revenue decreased due to unbalanced supply and demand in the market and reduced fish prices during the COVID-19 pandemic.
5. Total profit is reduced, because it is affected by a decreased in the productivity of fishers and total revenue.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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