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# Effect of COVID-19 on Aquaculture in Bangladesh: A case from Mymensingh District

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**ABSTRACT**

Aquaculture has become one of the fastest-growing economic subsectors of the economy of Bangladesh and has provided protein-rich food sources for the population. However, COVID-19 strike has become a thundering signal for the country's fisheries sector. This study was undertaken mainly to measure the effects of COVID-19 on aquaculture and to determine strategies followed by the fish farmers to cope with the pandemic. Data were collected from 70 randomly selected fish farmers from the population of 140 fish farmers from Bailar and Dhanikhola villages of Trishal *upazila* under Mymensingh district. A pre-tested and structured interview schedule was used to collect data from the fish farmers during the period from April to May 2020. The study showed that area under fish farming, total species cultured and production per unit area, gross income and net income of the respondents were decreased with the mean of 1.61 ha, 183.2 kg, 36678.71 kg, 2031.31 Tk and 799.59 Tk, respectively compared to 2018 and 2019. While, amount of feed used, number of labors used, and cost of production per unit area were increased with the mean of 35,756kg, 3.31 and 3387Tk respectively compared to 2018 and 2019. The absolute majority (95.71 percent) of the fish farmers had a decrease in their fish farming income. A significant portion of the fish farmers were affected by COVID-19 pandemic. Therefore, respective agencies like DoF and other GOs and NGOs need to take initiatives to minimize the problems associated with fish farming in the study area.

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## Introduction

Fish is the second most valuable agricultural crops in Bangladesh and its production contributes to the livelihoods and employment of millions of people. It can broadly be classified into three categories: inland capture fisheries, inland aquaculture and marine fisheries, of which the inland aquaculture sector is contributing more than 55% of the total

production (DoF, 2016). The fisheries sector plays a very important role in the national economy, this sector contributing 3.57% to the country's Gross Domestic Product (GDP) and contributing to the agricultural GDP, almost one-fourth (25.30%) (DoF, 2018). Inland aquaculture of Bangladesh has been playing an increasingly significant role in the economy for the last few decades. The country has achieved remarkable progress in the aquaculture sector since its independence in 1971. It is contributing a very significant role in socio-economic development and deserves potential for future development in the agrarian economy of Bangladesh. Bangladesh ranked 3rd position in the world aquaculture production (FAOSTAT, 2018).

Bangladesh is one of the leading fish producing country in the world with total fish production of 4.2 million MT, of which 1.22 million MT (28 percent) were from inland open waters, 24 million MT (56 percent) from inland closed waters, and 0.6 million MT (16 percent) from marine fisheries (DoF, 2018). The aquatic food system is contributing notably to ensure food and nutrition security through consistently supporting safer and good quality animal protein (Sunny et al., 2019; Islam et al., 2018). It also helps in import earning, in 2017-18, the country earned a significant number of foreign currencies by exporting fish, shrimps, and other fishery products and the amount is BDT 0.43 million from the export of 68.94 thousand MT fishery products (DoF, 2018). Bangladesh has ranked 3rd in inland open water capture fisheries production and 5th in world aquaculture production. Currently, Bangladesh ranks 4th in tilapia production in the world and 3rd in Asia (DoF, 2018). However, global COVID-19 strike has become a thundering signal for the country's fisheries sector. The challenge ahead is to ensure uninterrupted aquatic food production and supply, fair prices for products as well as ensuring nutritious food for all. Although the COVID-19 did not disrupt aquatic food production directly it hampers transportation complexity and the poor presence of buyers causes an abnormal fall in the prices of fisheries products. So, it is not only the fishers, fish farmers, retailers, whole-sellers, and other members of the aquatic value chain who have been affected, but also the overall economy of the country.

The first cases of infection of a new corona virus (2019-nCoV) were reported in Wuhan, Hubei Province, China, on December 31, 2019 (WHO, 2020), which generates the disease known as COVID-19 (Wang, 2020). It has quickly outspread in more than 210 countries and territories as it is highly contagious in nature (Siche, 2020). The World Health Organization (WHO) has officially declared the COVID-19 as a global pandemic, as of 21 May 2020, there had been more than 6.86 million COVID-19 cases and 398483 death tolls worldwide (Worldometers, 2020). Bangladesh is facing significant challenges in combating COVID-19 as it is a densely populated country of about 160 million where 46 thousand people living per square kilometer of its Capital city Dhaka (Sunny *et al*., 2020).

Protective measures has been instating progressively from March 17$^{th}$, 2019, evolving into a ten-day nationwide holiday from March 26th. Offices were closed and the people were encouraged to stay at home and to maintain social distancing. Effects from the lockdown were felt across the aquaculture sector with restrictions on movement rendering fishers and fish farmers unable to move their produce to markets. Customers reportedly deserted retail markets due to fear of infection and lockdown measures, causing the price of fish to fall sharply. It was reported that fish that would otherwise have been sold at markets across the

country has remained in ponds, delaying the start of the next fish production cycle. As a result, some farmers were unable to afford to feed their fish and are facing large financial losses. Farms also reported having difficulty finding workers for harvesting due to their fear of the virus. This situation may, in turn, impact fish seed production at hatcheries and nurseries, with implications for food security in the longer run.

The prices of selected of the fish items decreased from 6 percent to 48 percent due to COVID-19 pandemic and the highest price declination was observed in case of exportable shrimp. It has hampered the homestead and commercial aquatic food production system directly or indirectly. As the marginal fish farmers cultured fish mainly to meet their home consumption demand and sold the remaining production that add in their household income. COVID-19 pandemic really hamper the entire aquaculture production and supply chain. Thus, a significant portion of mature fish remained unsold and the farmers need to spend extra money to feed the fishes that ultimately reduced their farm income and increase expenditure as well. The crisis of fish sales affected the supply chain as the local vehicles like truck and pickup drivers were afraid to transport fish, fingerling, feed, and other materials (Sunny et al., 2020).The above mentioned facts really indicate the great effect of COVID-19 on Bangladesh aquaculture sector. Thus, the present study was designed with the objectives of measuring the effects of COVID-19 on aquaculture and to determine the strategies followed by the fish farmers to cope with the COVID-19 pandemic.

## Methodology

Two villages namely Dhanikhola and Bailar of Trishal *upazila* under Mymensingh district were considered as the locale of the study. Trishal *upazila* was selected purposively because it is a noticeable *upazila* where a good number of farmers were involved with aquaculture. Map of Mymensingh district and Trishal *upazila* which was the study area presented in Figure 1.

According to the list provided by the Upazila Fisheries Office, the total numbers of fish farmers in the selected two villages were 140 that constituted the population of the study. From the population, 50 percent of the fish farmers were selected randomly which was considered as the sample of the study. Finally, seventy (70) fish farmers were selected this way and constituted the sample of the study. Table 1 shows the distribution of population and sample size of the farmers.

A structured interview schedule was carefully prepared using simple, direct, and easily understandable questions and statements. Both open and closed questions were included in the instrument and scales were included in the schedule, wherever necessary. Before going to final data collection, a pre-test was done for modification of the instrument.

The effect of COVID-19 was measured through a comparative study of fish farming during the COVID year and previous years. The comparison was done by analyzing some important issues related to fish farming. The issues were area under fish farming, species cultured, amount of feed used, production per unit area, number of labors used, and cost of production per unit area, gross income, and net profit. All the data related to

these issues were taken from the farmers and then analyzed on yearly basis to see if there were any changes or differences in fish farming during the COVID year and previous years. The changes represent the effect of COVID-19 on aquaculture. Data of 2018, 2019, and 2020 were taken from the farmers for the measurement.

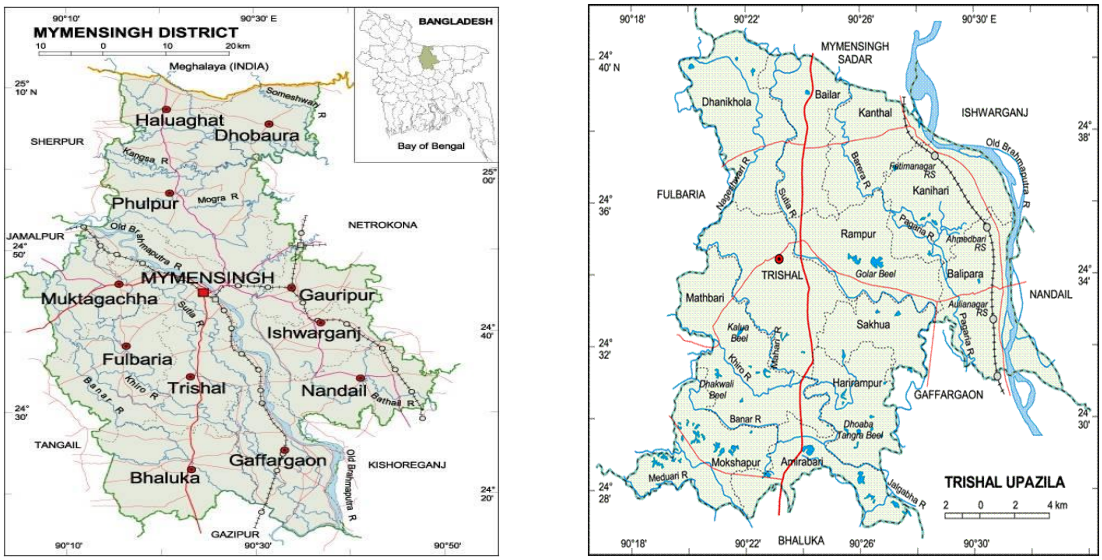


Figure 1 Map of Mymensingh district (left) and Trishal *upazila* (right) showing the study area

The area under fish farming was measured in hectare (ha). The species cultured was measured in kilogram (kg). The amount of feed used and production per unit area was measured in kilogram (kg). The number of labors used was measured in the actual number of the labor used by the farmers (1, 2, 3…). Cost of production per unit area, gross income, and net profit was measured in "thousand" BD taka ("000" Tk).

Table 1 Distribution of the sampled farmers in the study area

| Name of villages | Total number of fish farmers | Number of samples |
|---|---|---|
| Dhanikhola | 77 | 40 |
| Bailar | 63 | 30 |
| Total | 140 | 70 |

To cope with the COVID-19 crisis a number of strategies were followed by the respondents. A total of seven (7) strategies were selected through discussion with the Upazila Fisheries Officer (UFO). These seven strategies were included in the questionnaire. The respondents were asked to give their responses against each of the strategies and their responses were measured either Yes or No and the score was assigned as 1 or 0. Finally based on the mean score a rank order of the coping strategies was made.

Data were collected from the selected fish farmers by using the personal interview schedule from 25 March to 10 May, 2020. Before starting the collection of data, the researchers collect a list of the fish farmers from the study villages meeting with the UFO. From this data were collected from 70 fish farmers following simple random sampling method. For analyzing data SPSS v.16 was used.

## Result & Discussion

### *Selected characteristics of the fish farmers*

Eight selected characteristics of the fish farmers were considered in order to describe the farmers' socio-economic characteristics (Table 2). These selected characteristics were age, household size, level of education, fish farming experience, land holding, annual family income, access to credit, and access to extension services provided by DoF.

The age of the fish farmers varied from 22 to 60 years, with an average of 40.78 years and a standard deviation of 10.08 years. Based on their age, the farmers were classified into three categories namely, "young" (18-35 years), "middle-aged" (36-55 years), and "old" (>55). Table 2 indicates that the majority of the respondents (52.9 percent) were in middle-aged category while 35.7 percent and 11.4 percent of them were young and old, respectively. The household size of the farmers observed range was from 3 to 10 members. The mean number was 5.88 with a standard deviation of 1.63. It is evident from Table 2 that about half (48.6 percent) of the farmers had medium household size while 47.1 percent of the farmers had a small household size and only 4.3 percent had large household size. The level of education of the farmers ranged from 0 to 16. The mean score of level of education of the respondent fish farmers were 7.17 with standard deviation of 4.37. Table 2 demonstrates that half of the farmers (50.0 percent) had secondary education. While, 17.1 percent of the fish farmers had higher secondary and above level of education and 15.7 percent had primary level of education. This was really exceptional that 17.1 percent of the fish farmers were illiterate. Almost similar findings were found by Hoque (2011) and Kowsari (2014).

Fish farming experience of the farmers ranged from 2 to 20 years. The mean and standard deviation were 8.26 and 4.09 respectively. Data presented in Table 2 indicates that less than half of the respondents (42.9 percent) had medium length of fish farming while 40.0 percent had a short duration of fish farming and 17.1 had a long duration of fish farming experience. However, land holding of the fish farmers ranged from 0.24 to 12.0 ha. The mean and standard deviation were 1.82 and 1.93 respectively. Table 2 shows that less than half (42.9 percent) of the farmers had medium size land holding, while 20.0 percent had high land holding, 20.0 percent had small land holding and 17.1 percent had marginal land holding.

Table 2 Salient feature of the fish farmers

| Characteristics (Scoring system) | Category | Respondents (n=70) | | Mean ± SD |
|---|---|---|---|---|
| | | No. | Percentage | |
| Age (Year) | Young (18-35)) | 25 | 35.7 | 40.78± 10.08 |
| | Middle (36-55) | 37 | 52.9 | |
| | Old (>55) | 8 | 11.4 | |
| Household size (no. of members) | Small (up to 4) | 33 | 47.1 | 5.88± 1.63 |
| | Medium (5-6) | 34 | 48.6 | |
| | Large (>6) | 3 | 4.3 | |
| Level of education (Year of schooling) | Illiterate (0) | 12 | 17.1 | 7.17± 4.37 |
| | Primary level (1-5) | 11 | 15.7 | |
| | Secondary level (6-10) | 35 | 50.0 | |
| | Above secondary (>10) | 12 | 17.1 | |
| Fish farming experience (Year) | Short duration (up to 6) | 28 | 40.0 | 8.26± 4.09 |
| | Medium duration (7-12) | 30 | 42.9 | |
| | Long duration (>12) | 12 | 17.1 | |
| Land holding (ha) | Marginal land (0.02-.2) | 12 | 17.1 | 1.82± 1.93 |
| | Small land (0.21-0.99) | 14 | 20.0 | |
| | Medium land (1.0-3.0) | 30 | 42.9 | |
| | High land (>3.0) | 14 | 20.0 | |
| Annual family income (‘000’Tk.) | Low income <400 | 39 | 55.7 | 705.21± 224.45 |
| | medium income (400.1-700) | 13 | 18.6 | |
| | High income >700 | 18 | 25.7 | |
| Access to credit (‘1’ for yes and ‘0’ for no) | Formal credit | 18 | 25.7 | - |
| | Non-formal credit | 52 | 74.3 | |
| Access to extension services (score scale) | Low (up to 5) | 15 | 21.4 | 10.41± 4.32 |
| | Medium (6-12) | 39 | 55.7 | |
| | High (>12) | 16 | 22.9 | |

The annual family income of the farmers ranged from 93 to 4471 (‘000’ BDT). The annual family income of the farmers was assessed based on their total amount of income earned by the all family members in the year 2020. Table 2 shows that the mean and standard deviation of annual family income of the farmers were 705 and 224 respectively. On the basis of their annual income, the farmers were classified into three categories “low income” (<404), “medium income” (405-740), and “high income” (>740). Table 2 shows that most of the farmers had low income (55.7 percent), while 18.6 percent had medium income and 25.7 percent had high income in 2020. On the contrary, Table 2 shows that about three-fourths (74.3 percent) of the fish farmers had received non-formal credit and 25.7 percent of them had received

formal credit for aquaculture operations. However, access to extension services of the fish farmers ranged from 4 to 18. The mean extension access score was 10.41 with standard deviation of 4.32. It is demonstrated in Table 2 that more than half (55.7 percent) of the fish farmers had medium access to extension services, while 22.9 and 21.4 percent had high and low access to extension services, respectively. The findings of the study of Ahmed *et al*. (2018) confirmed the same findings.

### *Comparative scenario of fish farming during COVID-19 and previous years*

The data presented in Table 3 shows the comparative scenario of fish farming during COVID-19 and the previous years. The data shows that area under fish farming was comparatively lower with a mean of 1.61 ha in the year 2020 due to the COVID-19 pandemic than the previous year of 2018 and 2019 with the mean of 1.78 ha and 1.67 ha respectively.

Table 3 Comparative scenario of fish farming during COVID-19 and previous years

| Issues | | In 2018 | In 2019 | In 2020 (COVID-19 Year) | t-Value |
|---|---|---|---|---|---|
| | | Mean | Mean | Mean | |
| Area under fish farming (ha) | | 1.78 | 1.67 | 1.61 | 1.20 |
| Species cultured (Kg) | Pangus | 244.00 | 205.41 | 141.97 | 1.83 |
| | Tilapia | 8.07 | 11.14 | 8.36 | |
| | Carp fish | 29.80 | 28.80 | 23.83 | |
| | Catfish | 11.97 | 6.90 | 9.04 | |
| | Total | 293.84 | 252.25 | 183.2 | |
| Amount of feed used (Kg) | | 32991.74 | 29748.90 | 35755.18 | -2.31 |
| Production per unit area (Kg) | | 37675.60 | 40040.50 | 36678.71 | 0.36 |
| Number of labors used | | 2.11 | 2.00 | 3.31 | -7.35 |
| Cost of production per unit area (‘000’ Tk.) | | 2674.48 | 2697.66 | 3386.86 | - 3.98 |
| Gross income (‘000’ Tk.) | | 2757.30 | 2555.44 | 2031.31 | 6.62 |
| Net income (‘000’ Tk.) | | 1415.50 | 1371.97 | 799.59 | 8.20 |

Due to the COVID-19 pandemic, there has been a lot of changes occurred in the aquaculture system. Some of the fish farmers did not get fish seed at the right time. Besides the market demand of consumers and the price of fish was also fall. This fact discourages a number of the fish farmer to do the production cycle like previous years and some of the fish farmers stopped fish farming temporarily. As a result, the area under fish farming was decreased.

The total species cultured in fish farming was comparatively lower in the year 2020 with a mean of 183.2 kg compared to previous year 2018 and 2019 with the mean of 293.84kg and 252.25 kg. Most of the farmers who live in Trisal *upazila* fully depend on fish farming as a means of their livelihood and they must have to do the fish production. But due to the COVID-19 pandemic, they did not take any risk to go into full production like previous years. So, they put a lower number of fish species in their pond for the production cycle. The area under fish farming was also low in COVID year as mentioned before. As a result, the total species cultured was low in COVID year.

The amount of feed used in fish farming was comparatively higher in the year 2020 with a mean of 35755.18 kg due to the COVID-19 pandemic than the previous years of 2018 and 2019 with the mean of 32991.74 Kg and 29748.90 kg. This is due to the reason that the fish farmers need to keep the fishes a longer time in their pond that required an additional amount of feed. Production per unit area was comparatively lower in the year 2020 with a mean of 36678.71kg than the previous year of 2018 and 2019 with the mean of 37675.60 kg and 40040.50 kg.

The number of labors used was also comparatively higher in the year 2020 with a mean of 3.31 than the previous years of 2018 and 2019 with the mean of 2.11 and 2.00. Actually, COVID-19 made a big impact on the labor use issue in aquaculture. Due to lockdown in the country and health risk, there was a labor shortage in the 2020 year. In such a situation farmers need to utilize relatively more labor as they need to keep the fishes for a longer time in the pond due to the COVID-19 pandemic.

The cost of production per unit area was comparatively higher in the year 2020 with a mean of 3386.86 Tm than the previous year of 2018 and 2019 with the mean of 26874.48 Tk and 2697.66 Tk. The cost of production increased because of higher feed costs and labor costs for fish production.

However, gross income was comparatively lower in the year 2020 with a mean of 2031.31Tk than the previous year of 2018 and 2019 with the mean of 2757.30 Tk and 2555.44 Tk. Although the fish farmers had the production the price of fish in the market in 2020 was very low because of the COVID-19 pandemic as purchasing capacity of the consumers goes down. Fish prices fell down during the first weeks of April, in line with reduced demand, despite fish being the most consumed animal-source food in Bangladesh. At the next stages, the price of a kilogram of pangasius in Mymensingh retail markets was said to have plummeted from Tk 120/kg to Tk 50/kg. The price of a kilogram of catfish plummeted from BDT 350/kg to Tk 200/kg. The price of carp fish and tilapia fish decreases 15 percent in the market as indicated by the farmers. As a result, the farmers did not get a good price for their fishes like in previous years, and their gross income decreases. Finding of the study of Sheheli *et al.*, (2017) also support the same.

Net income was comparatively lower in the year 2020 with a mean of 799.58Tk compared to previous year of 2018 and 2019 with the mean of 1415.50Tk and 1371.97Tk. With the lower gross income as a consequence, the net income of the farmers also decreased due to the COVID-19 pandemic.

The t-value of all issues related to the comparative scenarios of fish farming during COVID-19 year and previous years has a significant change and which was statistically significant. Thus, it can be said that the fish farmers had significant economic losses. This is clear from Table 3 that the overall cost of production was increased due to higher prices of feed and additional labor costs. On the other hand, fish production also declined to some extent thus the gross and net income from fish farming reduced significantly. This finding is confirmed with the findings of Miah *et al.* (2016); and Razeim *et al*. (2017).

An additional attempt was also made to understand the changes in income of the fish farmers from fish farming and data are presented in Figure 2.

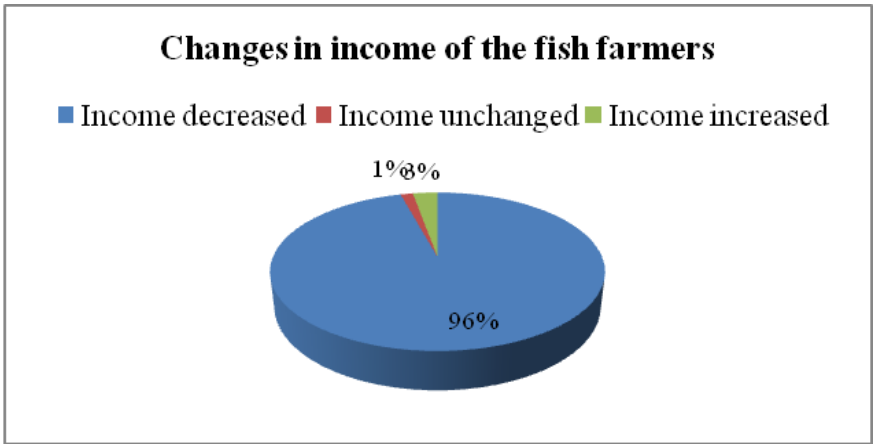


Figure 2 Changes in income of the fish farmers due to COVID-19

The data presented in Figure 2 shows the differences in net income from fish farming by the respondent in 2020 compared to 2018. It is found that the absolute majority (95.71 percent) of the fish farmers had a decrease in their fish farming income. While only 1.42 percent had unchanged income from fish farming, rest 2.85 percent of the respondent fish farmers had increased income even during COVID-19 in 2020.

### *Strategies followed by the fish farmers to cope with COVID-19 pandemic*

To cope up with the crisis due to COVID-19 pandemic the fish farmers had adopted a number of strategies. The strategies along with their associated rank order are

presented in Table 4. Table 4shows the strategies followed by the fish farmers to cope with the COVID-19 pandemic. From the data presented in Table 4, it is evident that sold fishes even in under rate was the 1st ranked strategies followed by the fish farmers to cope with COVID-19 pandemic with the highest mean score of 0.71.

Table 4 Rank Order of the strategies followed by the fish farmers to cope with COVID-19

| Strategies | Mean Score | Rank order |
|---|---|---|
| Reduction in amount of feed | 0.39 | 3 |
| Reduction of labors | 0.6 | 2 |
| Selling fish with low price | 0.71 | 1 |
| Taking loan to continue fish farming | 0.24 | 5 |
| Distributed some portion of fishes as relief to poorer people<br>Distributing some fishes as relief to poor people | 0.29 | 4 |
| Stopping fish farming temporarily | 0.21 | 6 |
| Stopping fish farming permanently and switched to other professions | 0.11 | 7 |

Reduction of labors in the farm was ranked as 2nd strategies followed by the fish farmers with the number of the mean score of 0.6. Reduction in the amount of feed was the 3rd ranked strategy followed by the fish farmers. Fish farmers had distributed some portion of fishes as relief among the poorer people was ranked 4th strategy followed by the fish farmers.

However, "Taking loans to sustain fish farming" was ranked as 5th strategy with the mean score of 0.24. While, 'Stopping fish farming temporarily" was ranked as 6th strategy followed by the fish farmers with the mean score of 0.21. However, "Stopping fish farming permanently and switching into other professions" was the last strategy followed by the fish farmers with the mean score of 0.11 to cope up the COVID-19 pandemic.

## Conclusion & Recommendations

Findings of the study revealed that most of the fish farmers had medium level socio-economic status of the fish farmers in the study area. The study showed that area under fish farming, the total amount of various species cultured, production per unit area, gross income, and net income of the fish farmers were decreased due to COVID-19 pandemic. On the other hand, the amount of feed used, the number of labourers used, and the cost of production per unit area was increased due to longer period of maintaining their fish farm during COVID-19 pandemic compared to normal time. Thus, it may be concluded that COVID-19 pandemic

had an absolutely negative effect on aquaculture of the study area. It was found that most of the fish farmers in the study area followed a number of strategies to cope with the pandemic due to COVID-19. Among the strategies followed by the fish farmers, the important strategies were like "Selling fishes with low price", "Reduction of labors" and "Reduced in amount of feed"to cope with COVID-19 pandemic. Thus, it is essential to provide necessary supports to the fish farmers by DoF and other concerned agencies to rehabilitate them and rebuild the aquaculture sector of Bangladesh.

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