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RESEARCH ARTICLE

Systematic Communal Impacts of COVID-19 On Fisheries and Fish Marketing in Nigeria

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Abstract

In 2020, Coronavirus swiftly spread to the world, relentlessly crashing lives and economies. Economic activities were severely affected by the pandemic especially the lockdown policy where transportation during the outbreak was restricted to reduce the spread of the virus in Nigeria. The effects of the pandemic on food and other agricultural sectors were evident as it interferes with supply chain, impaired production and distribution. Impacts of the pandemic on fisheries and fish marketing of Ogun State, Nigeria were assessed. One thousand and two (1,002) fish farmers and nine hundred and sixty-two (962) fish marketers were randomly examined and statistically analysed. Results showed that majority of the respondents believe in the existence of COVID-19 in Nigeria (82.7%) and worrisome of the pandemic as fish farmers can contact it. No significant relationship ($p > 0.05$) between COVID-19 pandemic and parameters of positive and negative situations of fish farmers/marketers. There were no significant relationship recorded between the pandemic and high profits gained by the fish farmers/marketersas well as increased fish marketing; between COVID-19 pandemic and decrease in fish and fingerlings production and supply; between COVID-19 pandemic and increased cost of fish feed as well as availability of feed ingredients. Significant relationship ($p < 0.05$) exists between COVID-19 pandemic and the fish demand. Conclusively, COVID-19 lockdown has empirical negative impacts on fisheries and fish marketing such as increased in cost of fish feeds, non-availability of feed ingredients, and decrease in table fish, fingerlings production and supply. Farmers' enlightenment on the virus existence (being a zoonotic disease) and safety of fisheries workers, along the supply chain should be a prioritized.

Keywords: COVID-19, Fish farmers, Fish marketers, Pandemic, Senatorial districts

1.0 Introduction

Aquaculture is the fastest growing food production sector as it generates employment, income and offers food security (Kumar *et al.* 2016; Shakya 2017; Bruijn *et al.* 2018; Lawal *et al.* 2019). Studies revealed that out of 25.4 million people employed in African fish farming sector, only 7.8 million engaged in small-scale fishing, while 17.6 millions are into fish processing, marketing, distribution and supply (FAO 2015; 2020). Globally, small-scale fisheries produce approximately 32 million direct jobs (World Bank 2012). Fishery business is an important food source and essential income to global population (FAO 2020). Owing to increase in fish demand, aquaculture played a monumental impact in achieving the increased demand besides being a foreign exchange (Ayyappan and Krishnan 2004; Hall *et al.* 2011).

In Nigeria, fishery makes up 5.40% of the Nation's Gross Domestic Products (GDP) (Adebesin2011; Olaoye and Ojebiyi 2018). However, agriculture's GDP is 22% (FDF 2018) which offers employment to 8.632 million and 19.55 million people in primary and secondary sectors respectively. Nigerian's total domestic fish production can be in three forms: aquaculture (fish farm), industrial fishing (Otubusin 2017) and artisanal fishing (inland rivers, lakes, costal and brackish water). Food and Agriculture Organisation accepted that the current situation of the pandemic causing disruptions in food supply chains could be detrimental to vulnerable populations (FAO 2020; Jomitol*et al.* 2020).

In 2020, COVID-19 swiftly spread to the world causes health and economy degradation (Adekunle *et al.* 2020; Naidoo and Fisher 2020; Alanagreh*et al.* 2022). Coronavirus forced many governments to shutdown significant part of their economies and encourage social distancing to mitigate the spread of the infections (Althouse *et al.* 2020; White and Hébert-Dufresne 2020). Fishers, processors and sellers faced the risks of COVID-19 infection, thus, have to make a hard choice, feeding their families or risk exposure. Fishing communities and ports are potential locations for swift contamination, owing to the travelling nature of fishers and regularity of international migrants (FAO 2020). Health facilities in fishing communities are not easily accessible to effectively engage the pandemic (CFFA 2020; Orlowski 2020).

The pandemic and its responses are plausibleto affect fisheries in multiple ways (Bennett *et al.* 2020). For example, fish farmers work for long hours during fishing and processing (Syron *et al.* 2018) which social distancing and lockdown policies impeded and thus reduced the production and demand for fish could have cascading effects on fish prices (Love *et al.* 2020). Coronavirus has not only interrupted farmers' economy, stocking, pre and post harvesting activities (Seshagiri *et al.* 2020), other facets of fisheries patterns (production, distribution, purchasing) were greatly influenced (FAO 2020).

In Nigeria, economic activities have been severely impacted by the pandemic especially the lockdown policy where transportation to cities was restricted to reduce the spread of the virus (Shodunke, 2022), and consequently, access to quality health care was limited. Aside overall reduction in fishing activities, a number of new factors have started to reshape fisheries landscape due to the lockdown policy (FAO 2020). These factors include increase in cost of fish distribution and marketing, reduction or collapse in demand for and market availability of fresh fish, total closure of recreational fisheries among others. Most fish farm labourers are migrant workers, therefore farm repairs, operations, seed stocking, machine usage and fish harvesting were affected (Seshagiri *et al.* 2020).

Fish farming is a profitable business (Kareem and Williams 2008; Emokaro*et al*. 2010; Oladejo 2010; Ugwumba 2011; Olasunkanmi 2012) with increasing production costs (Oladunjoye*et al*. 2021). Many fish farms were in total shutdown at the inception of social distancing, human and vehicular restrictions in addition to other farming activities, especially when considered not to be vital to national food supply systems (Immanuel 2020). After considerable stress and demand from society pointing to their fundamental role in food provisioning, fishing was authorized within some limits of operation (Mohan 2020). These actions on fishing activities possibly disclosed a pre-existing trend to underplay the position of fisheries in food systems (Béné 2020). Even where fishing are considered as crucial services, social distancing and lockdown have not permitted many small-scale fishermen or trading in local markets (Orlowski 2020).

Poudel *et al.* (2020) considered the impacts of the pandemic on food and other agricultural sectors as interference with supply chain, impaired production and distribution. Emerging local market ideas are rising such as online fish selling platforms and home delivery in some country such as Seattle (Hama 2020), Ghana (CFFA 2020) and UAE (Shaaban 2020). Owing to these impacts, the need to study COVID-19 mitigating policies on fisheries and fish marketing in Ogun State, Nigeria to assess the farmers perception on their loss and gain during the pandemic and for the benefit of fisheries resources and database. The study aims to document the impact of the pandemic on fish farmers and marketers, examine its effects on fish marketing and demand, assess its influence on fish and fingerling production and supply, and analyze changes in the cost and availability of fish feeds.

2.0 Materials and Methods

2.1 Study Area

This research was carried out in three senatorial districts in Ogun State, Southwest, Nigeria. Ogun State has 20 local governments grouped into three senatorial districts, which are Ogun East, Ogun Central and Ogun West with 9, 6 and 5 Local Governments respectively (Figure 1).

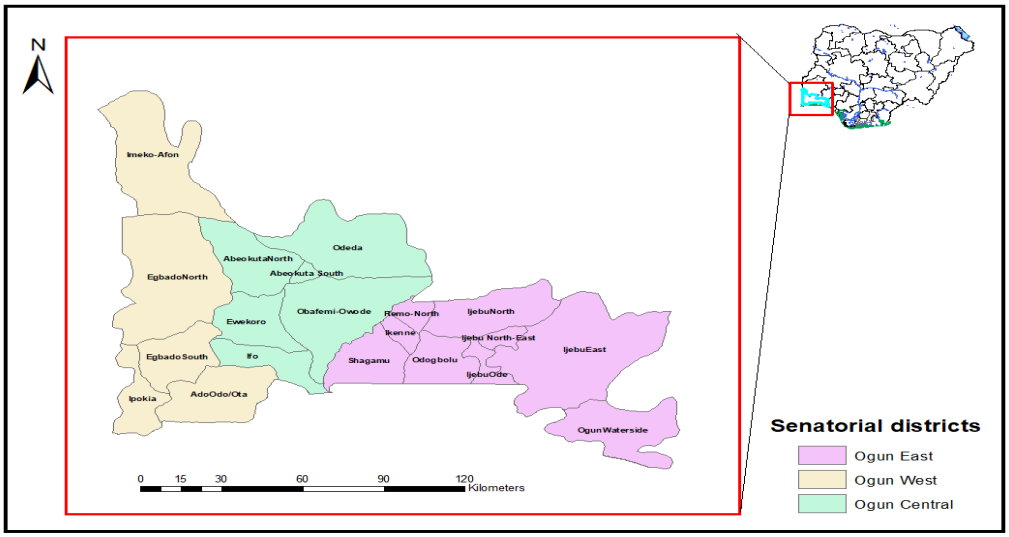

Figure 1: Map of the Study Area; Ogun State Showing Ogun East, West and Central Senatorial Districts, Nigeria. Source; Authors' Field Work, 2021

2.2 Study Population

The study population consisted of fish farmers and marketers that have their businesses located in markets, homes, farms and other places within the three senatorial districts of Ogun State, Southwest, Nigeria. Fourteen (14) local government areas vis-à-vis Ijebu North, Ijebu Ode, Ogun waterside, Odogbolu and Sagamu of Ogun East, Abeokuta North, Abeokuta South, Ewekoro, Ifo, Obafemi Owode, Odeda of Ogun Central, Ado-Odo, Ipokia, Yewa South of Ogun West were sampled.

2.3 Data Collections/Research Instruments

The research instrument for this study was Questionnaire designed to effectively gather variables related to the research objectives. Questionnaire was designed for both qualitative and quantitative data and divided into four sections. Section A consisted of four items and sought after the demographic information of the respondents. Section B has nine items that assessed farmers' perception and knowledge on COVID-19. Section C consisted of seven items to assessed personal impacts of COVID-19 on the farmers. Section D consisted of twenty-six items that investigated the effects of COVID-19 on aquaculture business.

Participants were made to understand the purpose of the questionnaire, while the researcher informed them not to write their names on the questionnaire for confidentiality. Each respondent was assured of the confidentiality of their responses and consented to participate voluntarily. Fish farms and markets were identified in towns and villages of the study areas. However, the study spanned between January and September 2021 with one thousand and two (1,002) fish farmers and nine hundred and sixty-two (962) fish marketers examined.

2.4 Validity and Reliability of the Instruments

The research instrument was properly scrutinized by the Department of Science and Technical Education, Olabisi Onabanjo University, Ago – Iwoye for constructive criticism and ensured the research questions and hypotheses were well covered and valid. The reliability of the instrument was achieved by administering the questionnaire on ten (10) respondents who are not part of the actual population for the study on two weeks interval.

2.5 Hypotheses

Six hypotheses were proposed. (i) There will be a significant relationship between COVID-19 pandemic and positive situations of fish farmers/marketers. (ii) There will be a significant relationship between COVID-19 pandemic and negative situations of fish farmers/marketers. (iii) There will be a significant relationship between COVID-19 pandemic and fish demand. (iv) There will be a significant relationship between COVID-19 pandemic and fish marketing/profit gained by fish farmers/marketers. (v) There will be a significant relationship between COVID-19 pandemic and fish/fingerlings production and supply. (iv) There will be a significant relationship between COVID-19 pandemic and availability and cost of fish feed.

2.6 Data Analysis

After gathering all the data from the instrument, the researcher studied the collected data and configured it to reflect the research questions and objectives. Data obtained were analysed using Statistical Package for Social Sciences (SPSS version 20.0). Results were presented as frequencies counts converted to percentages mean and standard deviations. Relationships between parameters were compared using Pearson Chi square. P value less than 0.05 ($P > 0.05$) was taken to be statistically significant.

3.0 RESULTS

3.1 Demographic Characteristics

The age range of the respondents was presented in Figure 2. The age ranges from less than 25 years to 50 years, while respondents of ages 31 to 40 years were highest. The respondents were more of Christianity > Islam > other religious belief (Figure 3). Also, there were more female respondents than male. Majority of the respondents have formal education and married (Figure 4). Also, most of the respondents had 3 to 4 children and been self-employed (Figure 5). Average monthly income of the respondents was less than ₦30,000 and majority earn between ₦31,000 and ₦51,000 monthly (Figure 6).

3.2 Fish Farming/Marketing Experience

The respondent fish farming/marketing experience shows 55.7%, 49.4% and 76.9% for Ogun East, Central and West respectively, while others were into different aquaculture businesses (Table 1). The business locations of the respondents were mainly markets. Respondents from Ogun Central and Ogun West senatorial districts (61.9% and 81.5%) major on catfish farming, while Ogun East are foremost in tilapia farming (47.8%) with 3 – 4 years highest business experience for all the senatorial districts.

3.3 Respondents' Perception on COVID-19

Perception of respondents on COVID-19 in Ogun East and Central (68.1% and 31.1%) agreed that COVID-19 exist, meanwhile, 41.4% and 78.6%, 33.6% and 51.5%, 48.3% and 79.1% of Ogun East, Central and West agreed that animals can contact COVID-19 and disagreed that fish farmers can contact COVID-19 from fish or water bodies respectively (Table 2). However, respondents from Ogun West and East senatorial districts disagreed that COVID-19 cannot affect fish; and that COVID-19 presently has a cure. Ogun East senatorial district agreed that COVID-19 exists in Nigeria, but it's a disease of the highly rich people, but Ogun Central and West senatorial districts respondents disagreed. Majority of the respondents from the three senatorial districts (79.1%, 98.9%, 94.8%) agreed that COVID-19 is a pandemic that affect the world; that COVID-19 originated from wild animals (57.4%, 55.9%, 72.8%); and that recommended safety measures can prevent the spread of COVID-19 (72.3%, 95.1%, 94.3%).

3.4 Respondents' Personal Impacts of COVID-19

Most respondents (66.5%, 55.4%, 91.9%) disagreed that COVID-19 has brought their positive expectations to fulfilment (Table 3). Similarly, respondents of Ogun East and Ogun West senatorial districts disagreed that COVID-19 has increased their worries over the business; that they have been so unhappy with difficulty to sleep; that they had thought of harming themselves; and that they have felt sad/miserable for the effect of COVID-19, while Ogun Central respondents agreed to all these. On the other hand, respondents from Ogun East and West agreed to have overcome the pandemic and expect to enjoy the effects of the pandemic, while respondents from Ogun Central mostly (89.3%) disagreed.

3.5 Effects of COVID-19 on Aquaculture Business

Most respondents of Ogun East and Ogun West senatorial district (69.6% and 65.4%) agreed there was high demand for fish during COVID-19; and made more profit from their fish businesses (Table 4a). Similarly, 78.4% and 63.0% of the respondents of Ogun East and Ogun Central agreed to the increase in the cost of production, 48.9% and 52.1% agreed to the decrease in fish production and supply during COVID-19 lockdown.

On the other hand, Ogun East and Ogun West respondents disagreed that COVID-19 have negative effects on seafoods. However, respondents from all the districts agreed that it is safe to eat fish and other aquacultural products, while disagreed that COVID-19 pandemic affected more women than men fisher folks. Respondents of Ogun Central alone agreed (94.1%) that COVID-19 will cause long-term destruction on aquaculture developments (Table 4b). Meanwhile, respondents from Ogun West disagreed that COVID-19 has increased expenditures of farmers and increased the cost of fish feeds other than normal inflation rate.

Also, respondent from Ogun Central disagreed that COVID-19 lockdown has no effects on fish feeds accessibility since movement was allowed for agricultural products. Likewise, only respondents of Ogun East agreed that feed ingredients were still readily available during the pandemic. On the other hand, all the three senatorial districts respondents agreed that local impact of the pandemic is a huge blow to dependent economy and livelihood and that the Food and Agricultural Agencies (FAO) have a lot to do at this time, while disagreeing that local fish feed production was unhindered during the pandemic.

Also, majority (78.2%) of the Ogun Central respondents agreed that COVID-19 has affected the growth rate of fish species, while 69.7% agreed that COVID-19 has brought about reduction in population species (Table 4c). Also, majority (62.6%) of Ogun West respondents agreed that fingerlings production and accessibility were impeded during COVID-19 pandemic and disagreed that marketing of fish has increased due to the pandemic. Ogun Central and Ogun West respondents disagreed that COVID-19 pandemic brought more income to fish farmers. On the other hand, all the three senatorial districts respondents agreed the lockdown affected the local/global food chains and restrictions in movement during lockdown affected fish marketing (85.6%, 88.4% and100.0%). Meanwhile, they disagreed that COVID-19 affected the physical quality or health status, or behavioural responses of fish and people are afraid of buying fish due to fear of COVID-19 affecting wild animals.

3.6 Effects of COVID-19 on Fish Consumption and Marketing

Most Ogun State fisherfolks (81.1%, 60.9% and 82.1%) disagreed that the pandemic affected public perception on fish consumption; and price of fish dropped as a result of the pandemic (Table 5). Similarly, Ogun East and Ogun West respondents did not agree that COVID-19 pose threats to aquaculture development in Nigeria and the pandemic affected the consumption of locally farmed fish, while Ogun Central agreed. Only respondents of Ogun West agreed that the pandemic opened more marketing ways, while all Ogun Central and West districts agreed that the government have roles to play after COVID-19 pandemic.

Some roles identified by the respondents include assisting farmers with funds and equipment, provision of face masks and nose guards, giving loan to farmers, controlling of selling price, sanitizing the environment, protecting fish habitat, encouraging modern facilities, provision of storage facilities, provision of good roads for easy transportations, provision of medical equipment and good health, reduction in petrol pump price and products tax rate.

3.7 Hypotheses Testing

The relationship results between fisheries and aquaculture business and the impacts of COVID-19 on fish farmers and marketers in Ogun State, Southwest, Nigeria was shown in Table 6. The results were similar and significant in all the senatorial districts. There is Significant relationship ($p < 0.01$) exists between COVID-19 pandemic and positive expectations of fish farmers/marketers. Significant relationship ($p < 0.01$) was recorded between COVID-19 pandemic and all the parameters of negative situations of fish farmers/marketers. Also, significant ($p < 0.01$) relationship was observed between COVID-19 pandemic and fish demand.

There was significant ($p < 0.01$) relationship between COVID-19 pandemic and high profits gained and increased fish marketing by the fish farmers/marketers. Significant ($p < 0.01$) relationship existed between COVID-19 pandemic and fish/fingerlings production and supply. There is significant ($p < 0.01$) relationship observed between COVID-19 pandemic and increase in cost of fish feed as well as availability of feed ingredients.

4.0 Discussion

Demographic results showed that most of the respondents were above 40 years of age and has formal education which implied that fish farmers are knowledgeable and not illiterates. Also, average monthly income within ₦31,000 to ₦50,000 for the farmers affirmed that fisheries is an important source of food and income for significant people as economic value (Ayyappan and Krishman 2004; FAO 2020). Since most of the fish farmers were into fish marketing, hindrance in accessing market during the pandemic lockdown might daunted their businesses and economic values. This was expected as Jomitol*et al.* (2020) asserted disruption in food supply due to the pandemic, especially the small-scale sectors and Love *et al.* (2020) reported reductions in the production and demand for fish due to lockdown.

Although, majority of the farmers believed they can contact the disease which has no cure and that safety measures can prevent it, however, some are of the opinion that COVID-19 does not exist in Nigeria. This has increased the fish farmers' worries and led to expression of some health impairment symptoms which made them unhappy due to low fish demand and profit during the pandemic. The results corroborated the findings of Siche (2020) who affirmed the pandemic negative effects on food demand and supply.

COVID-19 will have long-term challenge on aquaculture, if necessary, precautions and solutions are not properly placed. Challenges such as increase in cost of fish feeds, disease outbreaks could affect fish and its products in entirety during the outbreak. Scarcity of labour, inputs, transportation and decline in marketing has aggravated the fish farmers' difficulties. This was in line with FAO (2020) who asserted that fisheries business has been significantly affected due to COVID-19.

Also, there was high inflation on fish feeds due to the lockdown and local fish feeds were hindered. The pandemic has hampered aquaculture, and its value chain became vulnerable. Other areas affected are declination in price, technical support, exportation, consumption, transportation among others. These depressing effects were experienced in Sub-Sahara African (Aloke *et al.* 2022) Asia (Amjath-Babu *et al.* 2020; Sunny *et al.* 2020) among other countries (Okeyere*et al.* 2020; Rafiquzzaman 2020). Confirming the findings of this study, Seshagiri *et al.* (2020) concluded that Coronavirus outbreak has not only interrupted aquaculture deeds but has also impacted farmers' economy.

During the lockdown, it was expected that there will be high demand for fish. Alas, the study revealed decline in fish demand which was in line with FAO (2020) report that fish farming was limited to inputs and labour shortage due to the pandemic. Non decrease in the prices of the fish sales observed might be as a result of increase in the farmer's expenditures that lead to non-decrease in the cost of fish production. Fingerlings production and accessibility were impeded during COVID-19 pandemic which agreed with the outcome of Manlosa (2021) that revealed aquaculture and captured fisheries production to be impacted due to COVID-19

pandemic. The results also conformed to Immanuel (2020) findings that fishery industries faced complete shutdowns due to social distancing and restrictions in movement.

Though, the pandemic did not affect the people's perception regarding fish consumption. Importantly, it was revealed that the lockdown affected women than men among the farmers as observed by Homyard (2020), that women make-up about 80 - 90% post-harvest sector that were in contact with processing services and retail, positioning them to higher risk of the pandemic.

Conclusion

This study presented exclusive empirical input to the global impacts of COVID-19 pandemic lockdown on aquaculture. Based on the findings, it was concluded that COVID-19 pandemic has negative impacts on fish farmers/marketers. However, significant relationship existed between COVID-19 pandemic and fish demand which translated to high profits gained as well as increased fish marketing. The study revealed decrease in fish, fingerlings production and supply, while there are increased in cost of fish feeds as well as availability of feed ingredients. COVID-19 has consequences on fisheries managements and the implications on the vulnerable were high and alarming.

Farmers should be enlightened on the existence of the pandemic and other emerging diseases, while the safety of all fisheries workers along the supply chain needs to be ensured with utmost priority. Short-term retorts from government must be besieged and rapid to the vulnerable generally. Importantly, long term development plans must be appropriately coordinated for reaction plans and system that will renovate the current state of the fishery sectors.

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APPENDICES

APPENDIX A: FIGURES

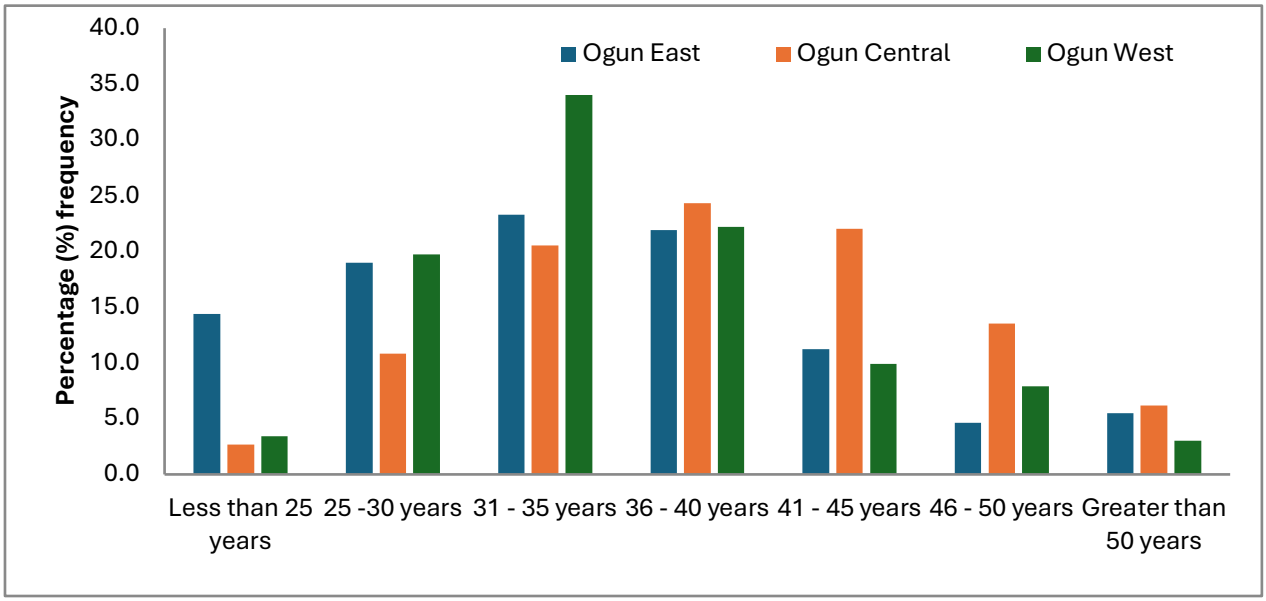

Figure 2: Age of the respondents from the three senatorial districts of Ogun State, Nigeria

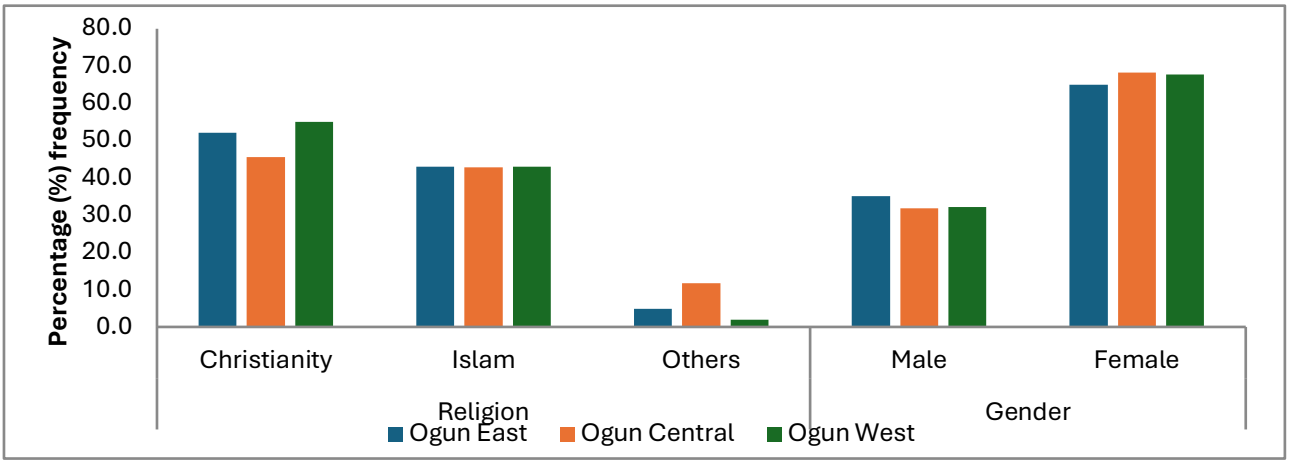

Figure 3: Religion and gender of the respondents from the three senatorial districts of Ogun State, Nigeria

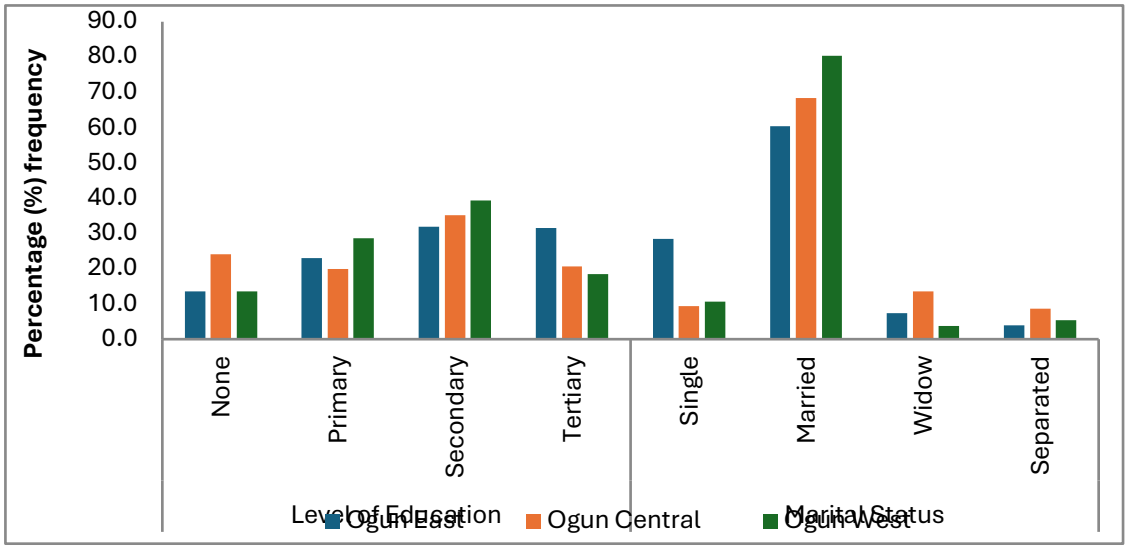

Figure 4: Level of education and marital status of the respondents from the three senatorial districts of Ogun State, Nigeria

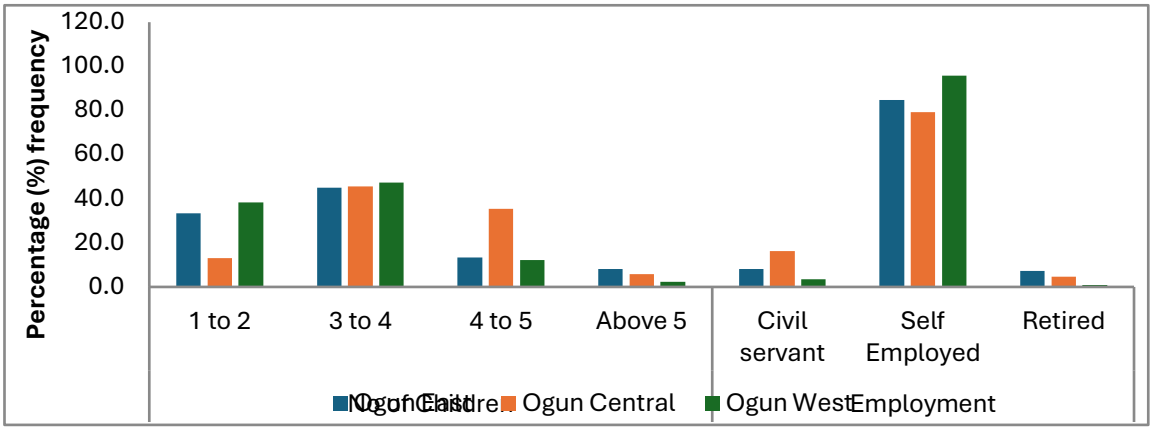

Figure 5: Employment status and number of children of the respondents from the three senatorial districts of Ogun State, Nigeria

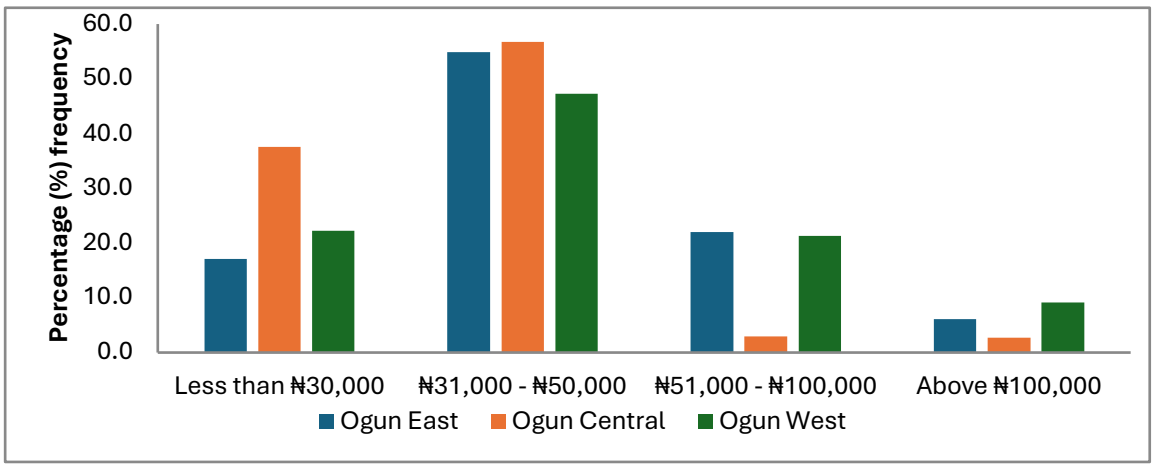

Figure 6: Average monthly income of the respondents from the three senatorial districts of Ogun State, Nigeria

APPENDIX B: TABLES

Table 1: Fish farming/Marketing experience of the respondents from the three senatorial districts of Ogun State, Nigeria

		Ogun East (%)	Ogun Central (%)	Ogun West (%)
Fish and Aquaculture Business	Table Size Fish Production	8.1	31.8	9.6
	Fish Marketing	55.7	49.4	76.9
	Processed Fish Selling	14.2	8.0	12.0
	Fingerlings Production	9.8	4.2	0.5
	Broodstock Production	2.3	3.1	0.0
	Fish Feed Production	6.7	2.7	0.5
	Other Fishery Products	3.2	0.8	0.5
Business Location	Market	58.3	49.4	76.8
	Home	15.5	27.7	5.8
	Farm	20.7	22.1	17.4
	Others	5.5	0.8	0.0
Type of Fish Farmed	Catfish	42.9	61.9	81.5
	Hybrid Catfish	8.3	21.5	3.5
	Tilapia	47.8	14.7	14.0
	Lady Fish	1.0	1.9	1.0
Years of Business Experience	1 – 2years	27.1	23.3	20.1
	3 - 4 years	35.0	41.4	57.8
	4 – 5 years	17.5	13.2	11.1
	Above 5years	20.4	22.1	11.0

Values represent percentage (%) frequency

Table 2: Respondents' perception on COVID-19 pandemic from the three senatorial districts of Ogun State, Nigeria

		Ogun East (%)	Ogun Central (%)	Ogun West (%)
Coronavirus (COVID-19) disease is a pandemic that affect the world	Strongly Agree	63.5	71.3	64.0
	Agree	15.6	27.6	30.8
	Disagree	4.2	0.7	5.2
	Strongly Disagree	16.7	0.4	0.0
COVID-19 exist, but not in Nigeria	Strongly Agree	18.4	4.5	0.0
	Agree	15.4	7.1	6.6
	Disagree	28.5	47.8	42.7
	Strongly Disagree	37.7	40.7	50.7
COVID-19 exist in Nigeria, but it's a diseases of the highly rich people	Strongly Agree	38.5	16.9	0.5
	Agree	29.6	14.2	16.1
	Disagree	18.4	39.0	30.8
	Strongly Disagree	13.4	30.0	52.6
COVID-19 originates from wild animals	Strongly Agree	29.4	42.5	37.6
	Agree	28.0	13.4	35.2
	Disagree	20.3	24.3	15.2
	Strongly Disagree	22.3	19.8	11.9
Animals can contact COVID-19	Strongly Agree	17.9	22.8	18.0
	Agree	23.5	10.8	30.3
	Disagree	29.1	40.3	37.0
	Strongly Disagree	29.4	26.1	14.7
COVID-19 cannot affect fish	Strongly Agree	22.6	36.2	10.9
	Agree	15.4	23.9	5.7
	Disagree	29.6	23.5	68.7
	Strongly Disagree	32.4	16.4	14.7
Fish farmers can contact COVID-19 from fish or water bodies	Strongly Agree	8.7	28.7	7.6
	Agree	12.6	19.8	13.3
	Disagree	30.3	32.5	34.1
	Strongly Disagree	48.3	19.0	45.0
Presently, COVID-19 has a cure	Strongly Agree	11.0	34.0	7.2
	Agree	32.4	35.8	18.3
	Disagree	36.9	18.3	54.3
	Strongly Disagree	19.7	11.9	20.2
Recommended safety measures can prevent the spread of COVID-19	Strongly Agree	40.2	63.8	70.1
	Agree	32.1	31.3	24.2
	Disagree	10.1	3.0	5.7
	Strongly Disagree	17.6	1.9	0.0

Values represent percentage (%) frequency

Table 3: Respondents' personal impacts of COVID-19 pandemic from the three senatorial districts of Ogun State, Nigeria

		Ogun East (%)	Ogun Central (%)	Ogun West (%)
I have been able to overcome the Pandemic	Strongly Agree	42.6	16.4	37.4
	Agree	26.1	13.0	23.2
	Disagree	17.0	27.9	11.4
	Strongly Disagree	14.2	42.7	28.0
I looked forward to enjoyment at the effects of COVID-19	Strongly Agree	34.4	3.4	0.5
	Agree	23.9	7.3	59.2
	Disagree	26.7	49.2	0.0
	Strongly Disagree	15.1	40.1	40.3
COVID-19 has brought my positive expectations to fulfilments	Strongly Agree	23.0	17.6	0.5
	Agree	10.5	27.1	7.6
	Disagree	33.5	23.7	63.5
	Strongly Disagree	33.0	31.7	28.4
COVID-19 has increased my worries over the business	Strongly Agree	26.1	62.1	24.6
	Agree	18.5	32.6	16.1
	Disagree	18.8	3.1	33.6
	Strongly Disagree	36.6	2.3	25.6
Thought of hurting myself has come to my mind	Strongly Agree	10.5	27.4	9.0
	Agree	17.4	28.6	20.5
	Disagree	32.5	27.8	34.3
	Strongly Disagree	39.6	16.2	36.2
I have difficulty in sleeping because of the pandemic	Strongly Agree	11.9	49.8	7.6
	Agree	16.2	36.4	21.3
	Disagree	30.7	10.7	41.7
	Strongly Disagree	41.2	3.1	29.4
I felt sad or miserable for the effect of COVID-19	Strongly Agree	27.8	55.7	16.1
	Agree	17.0	35.5	21.3
	Disagree	14.8	3.8	29.9
	Strongly Disagree	40.3	5.0	32.7

Values represent percentage (%) frequency

Table 4a: Respondents' perspective on the effects of COVID-19 on aquaculture business from the three senatorial districts of Ogun State, Nigeria

		Ogun East	Ogun Central	Ogun West
There was high demand for fish during COVID-19	Strongly Agree	46.9	4.5	33.6
	Agree	22.7	2.3	31.8
	Disagree	13.9	50.6	14.7
	Strongly Disagree	16.5	42.6	19.9
There was increase in cost of production during COVID-19 pandemic	Strongly Agree	42.6	33.1	15.6
	Agree	35.8	29.9	20.9
	Disagree	8.8	16.1	28.4
	Strongly Disagree	12.8	20.9	35.1
I make more profits from my fish business during COVID-19	Strongly Agree	36.4	13.3	24.8
	Agree	28.1	12.5	31.0
	Disagree	18.5	47.9	38.1
	Strongly Disagree	17.0	26.2	6.2
There was decrease in fish production and supply during COVID-19 lockdown	Strongly Agree	32.1	55.4	12.3
	Agree	41.2	30.8	30.3
	Disagree	7.7	6.5	21.8
	Strongly Disagree	19.0	7.3	35.5
COVID-19 has a negative effect on seafoods	Strongly Agree	19.0	32.8	2.4
	Agree	28.7	29.4	28.9
	Disagree	16.5	21.8	24.6
	Strongly Disagree	35.8	16.0	44.1
It is still safe to eat fish and other aquaculture products	Strongly Agree	50.0	38.0	33.8
	Agree	37.8	34.2	53.8
	Disagree	9.9	21.7	9.0
	Strongly Disagree	2.3	6.1	3.3
There are COVID-19 consequences for fisheries Managements	Strongly Agree	24.8	59.5	10.9
	Agree	45.0	27.5	30.8
	Disagree	14.0	10.1	28.4
	Strongly Disagree	16.2	2.8	29.9
The implications for the vulnerable people is high and alarming	Strongly Agree	33.2	50.0	11.8
	Agree	38.4	31.3	36.0
	Disagree	14.3	15.4	19.9
	Strongly Disagree	14.0	3.3	32.2
This Pandemic affected more women than men fisher folks	Strongly Agree	9.8	24.5	0.5
	Agree	16.7	25.3	4.3
	Disagree	32.6	39.5	67.1
	Strongly Disagree	40.9	10.7	28.1

Values represent percentage (%) frequency

Table 4b: Respondents' perspective on the effects of COVID-19 on aquaculture business from the three senatorial districts of Ogun State, Nigeria

		Ogun East (%)	Ogun Central (%)	Ogun West (%)
COVID-19 has caused destruction of long term expectation on aquaculture development	Strongly Agree	22.5	53.1	12.8
	Agree	23.1	41.0	33.6
	Disagree	20.5	5.0	24.2
	Strongly Disagree	33.9	0.8	29.4
Local impacts of the pandemic is a huge blow to dependent economies and livelihood	Strongly Agree	33.1	59.1	29.4
	Agree	28.6	36.2	41.7
	Disagree	20.9	3.9	14.2
	Strongly Disagree	17.4	0.8	14.7
COVID-19 has increased expenditures of farmers	Strongly Agree	24.5	50.4	16.7
	Agree	48.7	37.7	24.3
	Disagree	13.4	5.8	24.8
	Strongly Disagree	13.4	6.2	34.3
Food and Agricultural agencies (FAO) have a lot to do at this time of pandemic	Strongly Agree	48.0	54.0	38.9
	Agree	39.2	42.6	32.2
	Disagree	8.5	2.7	15.2
	Strongly Disagree	4.3	0.8	13.7
The pandemic has increase the cost of fish feed other than normal inflation	Strongly Agree	43.8	54.8	20.9
	Agree	33.8	32.7	24.2
	Disagree	8.0	8.7	24.2
	Strongly Disagree	14.5	3.8	30.8
The lockdown has no effects on fish feed accessibility since movement was allowed for agricultural products	Strongly Agree	44.5	10.9	20.4
	Agree	25.2	12.4	40.3
	Disagree	10.4	35.2	26.1
	Strongly Disagree	19.9	41.6	13.3
Local fish feed production was unhindered during the pandemic	Strongly Agree	20.8	4.8	13.7
	Agree	21.6	33.3	30.3
	Disagree	27.5	31.0	38.4
	Strongly Disagree	30.1	31.0	17.5
Feed ingredients was still readily available during the pandemic	Strongly Agree	22.2	7.7	15.2
	Agree	30.1	6.9	26.1
	Disagree	19.9	40.7	37.4
	Strongly Disagree	27.8	44.8	21.3

Values represent percentage (%) frequency

Table 4c: Respondents' perspective on the effects of COVID-19 on aquaculture business from the three senatorial districts of Ogun State, Nigeria

		Ogun East (%)	Ogun Central (%)	Ogun West (%)
COVID-19 has affected the growth rate of fish	Strongly Agree	16.8	53.3	14.7
	Agree	17.9	24.9	23.2
	Disagree	28.3	13.6	39.8
	Strongly Disagree	37.0	8.2	22.3
COVID -19 affects the physical quality or health status or behavioural responses of fish	Strongly Agree	16.0	30.4	13.3
	Agree	18.0	14.8	11.4
	Disagree	30.9	35.0	47.9
	Strongly Disagree	35.1	19.8	27.5
COVID-19 has brought about reduction in population species	Strongly Agree	16.7	42.6	16.6
	Agree	17.5	27.1	26.1
	Disagree	27.7	21.9	23.2
	Strongly Disagree	38.1	8.4	34.1
Fingerlings production and accessibility was impeded during COVID-19 pandemic	Strongly Agree	12.9	20.7	20.4
	Agree	15.2	21.1	42.2
	Disagree	36.2	42.2	15.6
	Strongly Disagree	35.7	15.9	21.8
COVID-19 pandemic brought more income to fish farmers	Strongly Agree	31.6	23.8	21.0
	Agree	29.1	22.6	29.5
	Disagree	19.5	35.2	37.6
	Strongly Disagree	19.8	18.4	11.9
The lockdown has affected the local/global food chains	Strongly Agree	39.9	66.5	24.2
	Agree	24.4	23.0	23.2
	Disagree	17.3	6.2	20.4
	Strongly Disagree	18.4	4.3	32.2
Marketing of fish has increased due to Coronavirus pandemic	Strongly Agree	42.7	33.5	27.0
	Agree	28.7	22.2	20.9
	Disagree	17.7	25.6	34.6
	Strongly Disagree	11.0	18.8	17.5
Restrictions in movement during lockdown affect fish marketing	Strongly Agree	50.0	58.3	41.0
	Agree	35.6	30.1	59.0
	Disagree	9.3	7.1	0.0
	Strongly Disagree	5.1	4.5	0.0
People are afraid of buying fish due to fear of COVID-19 affecting wild animals	Strongly Agree	16.3	26.3	10.4
	Agree	14.4	7.5	6.2
	Disagree	19.2	36.1	42.2
	Strongly Disagree	50.1	30.1	41.2

Values represent percentage (%) frequency

Table 5: Respondents' perspective on the effects of COVID-19 on fish consumption and marketing from the three senatorial districts of Ogun State, Nigeria

		Ogun East (%)	Ogun Central (%)	Ogun West (%)
Do you think COVID-19 pose threats to Aquaculture development in Nigeria?	Yes	44.9	97.0	48.3
	No	55.1	3.0	51.7
Does the pandemic affect public perception on fish consumption?	Yes	18.9	39.1	17.9
	No	81.1	60.9	82.1
Has the price of fish dropped as a result of the pandemic?	Yes	28.8	7.1	2.5
	No	71.2	92.9	97.5
Has the pandemic affect the consumption of locally farmed fish?	Yes	34.2	76.6	21.7
	No	65.8	23.4	78.3
Did the pandemic open more marketing ways?	Yes	42.1	25.6	62.8
	No	57.9	74.4	37.2
Do government have role to play after COVID-19 pandemic?	Yes	49.3	88.3	79.2
	No	50.7	11.7	20.8
If yes, list				
Assist farmers with funds and equipment		2.5	7.8	6.1
Provide face masks and nose guards		0.8	0.0	0.0
Give loan to farmers		1.7	5.9	4.2
Reduce the price of feed and control fish selling price		1.7	2.6	1.9
Sanitize to make environment clean		0.0	11.5	0.5
Protect fish habitat		0.0	2.2	0.9
Encourage modern facilities		0.0	1.9	0.0
Provide Extension services to educate farmers		0.0	4.5	0.0
Provide storage facilities		0.0	3.0	0.0
Provide good road for easy transportation		0.6	0.7	0.0
Provide medical equipment and health facilities		0.0	8.6	0.0
Reduce petrol price		0.3	0.0	0.0
Reduce tax rate on products		0.3	0.0	0.0

Values represent percentage (%) frequency

Table 6: Relationship between fisheries and aquaculture business and impact of COVID-19 pandemic from the three senatorial districts of Ogun State, Nigeria

		Ogun West		Ogun Central		Ogun East	
Hypothesis	Items	χ^2	Sig.	χ^2	Sig.	χ^2	Sig.
1	I have overcome the Pandemic	73.092	0.01*	25.82	0.03*	113.987	0.01*
	COVID-19 has brought my positive expectations to fulfilments	235.851	0.01*	37.621	0.01*	54.862	0.01*
2	COVID-19 has increased my worries over the business	95.383	0.01*	28.698	0.04*	116.279	0.01*
	Thought of hurting myself has come to mind	48.166	0.01*	63.601	0.04*	79.365	0.01*
	I have difficulty in sleeping because of the pandemic	62.003	0.01*	18.51	0.02*	122.598	0.01*
	I felt sad or miserable for the effect of COVID-19	58.201	0.01*	36.413	0.04*	136.913	0.01*
3	There was high demand for fish during COVID-19	44.656	0.01*	36.201	0.01*	122.679	0.01*
4	I make more profits from my fish business during COVID-19	59.356	0.01*	49.349	0.01*	127.826	0.01*
	Marketing of fish has increased due to Coronavirus pandemic	34.697	0.03*	41.886	0.01*	64.227	0.01*
5	There was decrease in fish production and supply during COVID-19 lockdown	87.868	0.01*	39.556	0.01*	51.653	0.01*
	Fingerlings production and accessibility was impeded during COVID-19 pandemic	44.07	0.01*	46.094	0.01*	82.312	0.01*
6	The pandemic has increase the cost of fish feed other than normal inflation	61.671	0.01*	7.503	0.01*	54.821	0.01*
	Feed ingredients was still readily available during the pandemic	31.024	0.01*	27.756	0.07	81.993	0.01*

***Relationship significant at $p < 0.05$; χ^2 = Chi-square value; Sig. = p-value**