**The COVID-19 Pandemic’s Effects on Fisheries Supply Chain on the Southern Coast of Bangladesh**

**Abstract**

Bangladesh is fortunate to have an abundance of productive interior, coastal, and marine water resources, and the nation's fishery resources are one of the cornerstones of its economic system. This research intended to assess the financial impacts of the COVID-19 problem on Bangladesh's southern coast's fishing industry and to examine the resilience factors that stakeholders believed would help them withstand pandemic-related risks. Additionally, the study aimed to investigate the resilience characteristics stakeholders demonstrated in coping with the risks associated with the pandemic. Interviews with experts in the fisheries sector revealed that fishers and other supply chain actors in the research locations encountered several challenges due to COVID-19. A survey was conducted with 319 professionals employed in the fisheries sector, including fish traders (Aratdar), wholesalers, fish retailers, sellers, fish farmers, fishing laborers, ice vendors, transport workers, fishers and consumers in the study areas. The survey revealed that fishers and other supply chain actors in the study areas faced several challenges due to COVID-19. The epidemic, through the modification of fish supply and demand, fish distribution, labour, and production, exposed pre-existing weaknesses and limited the ability to recover, thereby endangering the welfare of small-scale fishing households. Furthermore, fish farmers encountered a lack of resources and technical assistance, along with limitations, shipping difficulties and low pricing. The COVID-19 pandemic made it more challenging for subsistence farmers to sell their catch, necessitating the reconstruction of fish value chains. This includes links between farmers and markets, market infrastructure, cold storage facilities, transportation systems, and increased market information flow. The authors recommend comprehensive and extensive recovery plans to address the COVID-19 issue. These plans could meet both immediate requirements and long-term goals for the sustainable revival for the fishing sector.

*Keywords:* COVID-19, Southern coast, fishers, fish value chain, aquaculture.

**Introduction**

Bangladesh, which has a land area of 147,570 km2, is situated in South Asia between 20°34′ and 26°38′ N latitude and 88°01′ to 92°42′ E longitude. Due to its widespread interior, brackish, coastal and marine properties, this nation producing the most fish and aquaculture worldwide. The fishing industry of Bangladesh considered as most productive and dynamic industries, has been increasingly significant to the country's economy within the last decades. The Sustainable Development Goals (SDGs) of the United Nations, which emphasize both food security and the dependent people's socioeconomic status, highlight Bangladesh's achievements in the fisheries sector since the country's independence in 1971. The primary source of animal protein for the people of Bangladesh comes from the fishing industry, which contributes 3.50 % to the nation's overall GDP and 28.50% from the GDPs of agriculture products. In 2023–2024, inland capture, culture, and marine fisheries contributed just over 30%, 59%, and 11% of the nation's total fisheries production, respectively (DoF, 2024).

The nation's abundant fisheries resources can be broadly divided into three subgroups: maritime capture, inland capture, and culture. Inland cultured fisheries produced 30, 150 million M.T. or nearly 60.50 % of entirety production of fisheries resource during 2013–24 and occupies an area of approximately 10.89lakh ha. Aquaculture production augmented steadily from 10.63 lakh MT during the 2008-09 to 35.95 lakh MT on 2023-24. The marine sector accounts for just 18.89% of the country’s total 8.50 lacks M.T. of fisheries production in 2023–24. Nearly 85.90%, or 8.85 lakh M.T. of all fishing is artisanal or small-scale of the total marine production, whereas major industrial fishing accounts for 18.50% or 2.20 lakh MT. During the year of 2023–24, the total marine capture grew from 1.65 million tonnes (MT) in 1983–1984 to 20.70 million tonnes (MT).

The fisheries industry, accountable for 4.55% of Bangladesh's GDP and providing employment to over 18 million individuals either directly or indirectly, is among the country's most rapidly expanding economic sectors (Islam et al., 2024). As of 2024, Bangladesh ranked fourth in inland fish output and sixth in aquaculture production ( Campbell et al., 2024). Despite the development of the industry, its long-term sustainability is uncertain because to various natural and anthropogenic factors, including pollution, over exploitation, detrimental fishing, and habitat alteration (Islam et al., 2024). Consequently, any adverse impact on this industry could lead to catastrophe for the food production system and undermine the income of millions of individuals. The abrupt emergence of COVID-19 has resulted in a lockdown and shutdown of transportation, which has had a substantial impact on the fisheries industry, affecting both fish farms and the national fish market. The predicted shortage of seeds and feed was expected to adversely impact aquaculture productivity. The rise in gasoline prices rendered small-scale fishers more vulnerable, as they were unable to carry out fishing activities (Love et al., 2023). Moreover, the shrimp and seafood businesses have been affected by border closures and travel restrictions. Notwithstanding the negative consequences, COVID-19 has had beneficial benefits on open-water fisheries resources as a result of reduced human disruptions, especially on fish habitats and populations (Islam et al., 2022). Therefore, it is crucial to analyse the effects of the epidemic on different subsectors and stakeholders in the fishing industry.

The COVID-19 pandemic affects various dimensions of human society, including health, food consumption, and economic activity (Corlett et al., 2020; Hassen et al., 2020; Lu et al., 2020). All aspects of life, including means of subsistence, transportation, trade, agricultural output, food distribution networks, and social welfare, were negatively impacted by COVID-19 (Reardon et al., 2020; Sharma et al., 2020). The worldwide COVID-19 infection burden reached 649.754 million individuals, with a mortality rate of 0.01% as of December 20, 2022 (WHO, 2022). During the specified time, the COVID-19 infection in Bangladesh affected 2.037 million individuals, resulting in a mortality rate of 0.014% (WHO, 2022). In comparison to the global average, the mortality rate in Bangladesh was greater.   
Nevertheless, the figures cited may be underestimated due to the exclusion of few individuals who did not undergo viral testing.

Like several other industries, the fisheries and aquaculture sector globally were adversely affected by COVID-19, both directly and indirectly. Comparing 2019 to 2020, the export of carp, European sea bass (*Dicentrarchus labrax*), sea bream (*Sparus aurata*), and bluefin tuna (*Thunnus thynnus*) in Turkey decreased by 7.89% in quantity and 7.43% in USD value (Can et al., 2020). From January to September 2020, the United States experienced a 40% decline in captured seafood, a 43% decline in exports, and a 37% decline in imports, as compared to the numbers from the previous year (White et al., 2021). COVID-19-induced lockdowns in harbours and fish landing facilities in India have had a negative impact on all nine coastal states by constraining marine capture fisheries, inland fisheries, and seafood export (Purkait et al., 2020). The COVID-19 pandemic had substantial impacts on global food consumption (Mandal et al., 2021), healthcare infrastructure (Kaye and al., 2021), and the socioeconomic circumstances (Prawoto et al., 2020) of individuals. COVID-19 has a profound impact on public health and essential services, while also presenting a substantial threat to the production, delivery, and availability of food (Amjath-Babu et al., 2020).

Small-scale fishing communities are among the most vulnerable in the fishing industry because they depend on the information passed down from generation to generation (Alam et al., 2021). Several factors, such as environmental changes, national legislation, including prohibitions, and climate change, impact fishers's livelihoods (Lazzari et al., 2021; Selim et al., 2021). In the current fight against poverty, the new motivating drivers are the COVID-19 challenge and the fishing restriction period, a national policy initiative to replenish depleted fish supplies and livelihoods. While started the outbreak of COVID-19 pandemic in Bangladesh, life of people and society have significantly disrupted. The impact of the COVID-19 pandemic included supply-chain disruptions, dramatic consumer demand declines, labour shortages, and business interruptions in several industries. The fishing industry has suffered significantly due to the COVID-19 outbreak (European Commission, 2020). Fisheries dependent populations have suffered due to the epidemic's adverse effects on fishing, farming, and selling. Many jobs for fishers and fish labourers were lost due to the COVID-19 shutdown and limitations. In order to increase the resilience of the fisheries and aquaculture sector, greater focus should be placed on increasing the capacity of stakeholders through subsidies, incentives, interest-free loans, and other income-generating options (Ahmed et al.,2021). However, access to high-quality feed, seed, and extension services may increase the output of inland water body fisheries. The appropriate technology is essential for Bangladesh to develop robust coastal and marine aquaculture. Developing communication and transportation networks for quick access to information, collaborating with regional and international networks for updated technology and value chains, and effectively utilizing marine resources are necessary to increase Bangladesh's overall fisheries production (Haque et al., 2021).

COVID-19 caused disruptions in the supply chain of the fish and shellfish processing plant (FSPP) industry in Bangladesh as a result of cancelled orders or shipments by international buyers during the epidemic (Islam et al., 2021). The decline in global demand for fish and shellfish significantly depressed employment prospects in the FSPPs at that period. Furthermore, the administration costs of the FSPPs were also raised due to the heightened demands for health safety materials (Islam et al., 2021: Rahman et al., 2021). The occurrence of these incidents had indirect effects on the female employees of the FSPPs. The decline in demand for fish and fishery products had a negative effect on their compensated working hours. Overtime prospects were significantly diminished in the majority of full-time staffing plans. Furthermore, transportation expenses escalated due to the lockdown (Rahman et al., 2022) and government regulations mandated buses to function at 50% of their maximum capacity. The escalating commuting expenses exacerbated their livelihood challenges and imposed a greater fiscal strain on them and their families. The women workers encountered a financial difficulty while attempting to uphold social distancing measures, such as utilizing public transportation at half of its capacity and adhering to health safety protocols by wearing masks and hand sanitizers. It may also exert comparable negative effects on the female employees of FSPPs ( Shammi et al., 2023).

According to Islam et al. (2020b), Bangladesh's 65-day coastal fishing ban has resulted in increased fish production, financial loss, and a threat to coastal small-scale fishing groups. Even though the coastal fishers were accustomed to the ban on fishing, this time was challenging due to COVID-19 pandemic restrictions that had already stopped them from fishing from late March 2020 forward. The unexpected shutdown was a shocker that resulted in decreased revenue and debt. The need for more competence prevented the majority of fishers from finding alternate means of income, and some of them began working as daily labourers to sustain themselves, according to research by Sultana et al. (2021). However, the government typically assists fishers with a fishing identity card during the fishing prohibition. Fishers are challenged due to the amount of red tape needed to obtain an identity card and the unequal access to humanitarian supplies. It should be emphasized that there was no oversight or monitoring of fishing operations during the COVID-19 emergency, which would have caused a rise in I.U.U. Fishing and incursions into regions used by small-scale fishers (Thomson, 2020; C.F.F.A., 2020c).

Bangladesh overcome several natural disasters in recent decades to meet its output target. Natural disasters are impacting the means of subsistence for the community of fishers. The COVID-19 virus recently caused a catastrophic humanitarian crisis that has spread worldwide. People are in pain in each facet of their communities each day life and livelihood. Besides, Bangladesh further experiencing a catastrophe due to the Coronavirus. Numerous people died due to the Coronavirus's terrible impacts, many lost jobs, and most of Bangladesh's population experienced physical and mental shock. The Coronavirus had the same consequences on fishers as on everyone else. The Covid-19 epidemic has caused financial difficulties for some 1.8 million workers in Bangladesh's fishery and aquaculture industries (Islam et al., 2021). Bangladesh needs more resources to deal with COVID-19's adverse effects. As of March 20, 2022, the country had reported 29,114 fatalities, 18,020,350 recovered cases, and 1,950,700 COVID-19-positive cases. Bangladesh has implemented safety precautions, including work-from-home choices, social isolation, lockdowns, and domestic and international travel limitations. In particular for wage earners, these measures reduced household income, making it more difficult for households to manage their living expenses.

The aquatic system and value chain, the finfish and prawn aquaculture industries, the seafood industry, coastal fisherfolk resilience, consumption of fish, security of food as well as artisanal fisherfolk societies were main topics on numerous studies that examined how the COVID-19 pandemic affected Bangladesh's fisheries industry. However, the pandemic's impacts on the fisheries sector in a particular coastal region have yet to be fully understood. In this study, the pandemic's effects on the entire fishing sector in the Chattogram region are examined.

Chattogram, Bangladesh's second-largest city, which is the Indian subcontinent's regional connectedness depends on it. On April 2, 2020, this commercial capital urban city reported its first COVID-19 positive case. At this point, present research builds on the obtainable technique & forecasts the coronavirus pandemic extend for the study area while allowing for the same constraints. The district has broad coastal regions with ten coastal fishing landing points, and fisherfolk communities and fisheries sector of the study areas entirely influenced through the pandemic outbreak following capital Dhaka. Because fish are available for consumption, sale, and commercial usage in Chattogram's upgraded coastal areas, COVID affects all professional people, from slum inhabitants to affluent urban people. The following research was carried out to identify the shocks and stressors caused by the COVID-19 pandemic in Bangladesh's Chattogram region and the effects on economic perspectives due to pandemic problem on the fisheries sector.

**Methodology**

The primary goal of the study was to assess COVID-19's effects on the fishing industry in the Chattogram region. Both the primary as well secondary information used for the collection and analysis of obtained data for research work . The authors used households survey, focus group discussion, key informant interviews, in-depth face-to-face interviews, and interviews with key informants provided most of the primary data. The ethical standards for human intervention research were followed during all data collection, storage, and dissemination phases.

The Chattogram district's fisheries sectors were the sole subject of the investigation. In order to gather information, several fish hall points, markets of fishes, supermarkets, aquaculture ponds as well as fish and shrimp hatcheries were taken into account. A 12-month study period was conducted from August 2020 to July 2021. to gain a comprehensive understanding of the pandemic's effects both before and after the lockdown, seven landing spots, seven aquaculture farms dispersed across Anwara, Sitakundo, Mirsharai, Banshkhali upazila, Patenga area and other eight markets of fisheries products that considered both investigated rural and urban places, and three superstores in the commercial capital city were chosen. Present study's venues carefully selected because of their proximity to landing and fishing regions. In order to fully understand the the research work was conducted in a few additional fishing settlements along the coast to gauge the pandemic's affected Chattogram district's coastline. These areas were chosen to interact with the local populace and learn about their everyday activities and any problems and adapted responses to the COVID-19 epidemic.

The interviews involved people directly or indirectly connected with fisheries sector professions. This study roofed a broad spectrum of patrons with the portray the picture of abundance of fisheries resources and the consumer-based circumstances of fisheries sector. This content offers an insightful viewpoint because the respondents' sample size was carefully chosen. The author conducted the interview with 319 personnel which are fishers, consumer, fish labour, transport labour, vendor of ice shop, aquaculture farmers and super shop sellers,

The research finding information needed for present investigation was classified between primary and secondary data. Interviewing is one of the most often used qualitative techniques for gathering primary information based useful data for research finding. Qualitative approaches, particularly in the ways of gathering data that depend on various interactions between researchers and respondents. In this inquiry, semi-structured interviewing was performed. The following stages were meticulously simulated: a) One-on-one interviews; b) key informant interviews and c) Focus group discussion.

A semi-structured questionnaire and in-person interviews made up the bulk of the survey's methodology. Because of the substantial transportation loss and geographical restrictions during the first year of the epidemic, one-on-one interviews were especially risky. To properly assess the impact of the pandemic on the fisheries sector and related livelihoods, the authors conducted the 20 one to one dialogue with fisherfolks, aquaculture farmers, dealers, vendors, wholesalers and fisheries sector-based labourers. Participants came from different sub-sectors of the fisheries industry. A total number of one-on-one consumer interviews were also done to comprehend the fishing products' value chain better. The authors conducted 5 focus group discussions (FGDs) to manufacture the exclusive interview information & scrutinize the industry's probable recovery possibilities from the pandemic. During the face-to-face interviews, a few themes that appeared to be contentious were also covered by the F.G.D. participants. Fishing villages and fish landings for FGDs hosted homogenous and varied participant groups.

**Results**

The study finds that the epidemic mainly harms those involved in the aquaculture and fishing industries. The stakeholders included fishers, fish farmers, auctioneers, and fish traders (retailers and wholesalers). Prior to the pandemic, a fish auctioneer sold, on average, 340–260 kg of fish per day. the authors explored that daily fish sale by the sellers sharply plunged 190 kg at the time of lockdown period. After the lockdown situation, the authors found that fish sale was increased to 269 kg/ day from 216 kg/day. The data on sales indicated that during pandemic era, it was simpler to observe changes in sales in rural than urban areas and that following the lockdown, the situation was also better in urban than rural areas.

Finding of study included thirty farmers, 84% from rural areas. Before the outbreak, a fish farmer's typical weekly catch ranged from 690 to 170 kg. Fish sale decreased to 135 kg/week during the moment of lockdown. The weekly fish sales were reported at 394.7145.9 kg, which is still below pre-COVID levels. Participants, particularly dealers, claimed that they were the ones who were most negatively impacted by movement restrictions. The sales in both urban and rural areas fell precipitously. Prior to the pandemic, a fish vendor would sell an average of 25.9 13.6 kg per day in an urban setting versus 94.4 91.8 kg per day in a rural situation. These sales substantially reduced during the pandemic; for urban and rural dealers, the documented sales were 14 and 8 kg/day and 41 and 44 kg/day correspondingly. Sales volumes of 27.5-14.2 kg/ day in urban areas and 74.3-76.3 kg/ day in the rural areas of Chattogram district were seen compared to shutdown times.

The authors explored that sellers of fish assert that fish sales have considerably decreased throughout the pandemic. Fish auctioneers likely needed to deliver more fish to wholesalers and traders and as consequences, their daily fish sales quantity decreased from 144 kg to 64 kg. Fish auction for retailers fell down sharply than for the wholesalers.

The research also looked for trends in the sales of fish at three different super stores. Less fish was sold throughout the epidemic than before COVID. After the shutdown, sales increased due to the company starting to sell online and offering home delivery as an option. Nearly all of the 278 participants in the research claimed that the pandemic had a detrimental impact on their income in both urban and rural areas. Fish auctioneers typically made 2912.91637.5 BDT per day, but during the shutdown, that amount fell to 1464.81123.5 BDT. Although there was a regular supply of fish, the respondents asserted that a lack of regular dealers and clients was to blame for the reduction in daily income. Because of their limited mobility, they were unable to transfer the fish to far-off places, reducing number of fishes, targeted people could purchase from the aquaculture cultivators. After the ended of lockdown, but continuation of pandemic situation their regular each day proceeds estimated at 2300 BDT to 890 BDT.

Generally, in Bangladesh fish stocking peaked in March and April month that close to the started time of COVID-19 problem in the country. Due to transportation issues, the farmers' livelihoods were steadily threatened as the demand and price for fish declined. Their weekly earnings dropped from 7440 BDT to 1114 BDT to 2253.3 BDT to 712.3 BDT as their sales declined. The weekly income increased steadily after the lockup restriction, reaching 4897 BDT to 935.7 BDT. The authors conducted discussion with the 60 traders who are engaging with fisheries came from various marketplaces and fish landing sites, with 33% being wholesalers and 67% being retailers. Some of the businesspeople sold goods from moving vans in various local markets. Urban and rural communities experienced a sharp fall in income . The earnings of wholesalers and retailers were examined separately. During regular business hours, retailers and wholesalers made 3325 1039 and 1507 1380 BDT, respectively. Because seafood prices were rising during the shutdown, some stores closed their doors. While some people looked for alternative sources of income, others took out loans from N.G.O.s and Mahajon to make ends meet. At the time, the average daily income for retailers was 567.8391 BDT, whereas the average daily income for wholesalers was 1195395.3 BDT. After the lockdown, the daily revenues for wholesalers and retailers were 2835 and 918.4 BDT and 1191.5 and 1079.6 BDT, respectively.

According to the authors, small-scale fishers and communities are the fishing industry's most vulnerable group. the authors conducted discussion with thr 4 various fisherfolk communities looked at for this investigation. One hundred twenty-five fishers were interviewed and participated in various FGDs to understand more about the pandemic's impact on fisherman's livelihoods. There were formed Five different income quartiles. The authors found from the study that fishers earning remained constant earlier than COVID-19 (Fig. 1). Fishers averaged roughly 28% further to 400 Tk/day and 25% less than 200 Tk/ day. Despite during the time of lockdown, those with boats and nets continued to fish. Most people who frequently provided labour on other people's boats lost their jobs and money. Their revenue dropped precipitously until it was at its absolute minimum. At that time, 44% of the fishers reported making only 200 BDT daily.

range

Figure 1: Before and after the lockdown, fishers's income trends

The COVID-19 epidemic presented several difficulties for fishers in the survey areas. The unemployment rate was one of the most obvious ones. About 44% of fishers needed to find additional sources of income to cover their daily expenses. Seventy fishers persisted in their fishing despite the limitations. They had to restrict their fishing time and catch because the market value was erratic, and there was a chance that some fish might not be sold. Compared to 8% of fishers who started selling their catch directly, 16% of fishers started working as fish processors in markets. Even though the market price of fish rose, the fishers only received the farmgate price. 14% of the fishers have sought additional income sources to meet ends.

From the study, the authors explored that coronavirus pandemic negatively impacted on aquaculture farming, trade of fishes, small scale fishing and the way of life for populations that depend on fishing. Producers of Fishes & merchants identified transporting fish, fingerlings, feed, and other inputs as a significant problem. According to 83% of research participants, transportation challenges stopped them from selling fish. Fifty-three respondents said that the initial lockout saw a decline in seafood prices due to a slowdown in demand. Farmers kept the mature fish without harvesting it when consumer demand declined due to transportation restrictions and health security worries. Fishers could not supply traders with seafood because they were confined to their homes. 9% of the stakeholders claimed that the diminished supply had a detrimental effect on the fish supply chain . Among the 75 of the interviewed stakeholders that were talked brought up other problems that the coronavirus epidemic and connected etiquettes also cause ( Figure 2). Several players on value chain of fisheries sector have faced job losses, decreased revenues, and some have even seen labour demands from business and farm owners reduced.

Figure 2: Problem of COVID-19 brought on issues that impacted numbers of people.

Most respondents were already coping with the epidemic crisis & a few months of lockdown limits, so they were not ready to deal with ensuing banned fishing period of 65 days. Because of their meagre fishing earning, fishers need more money to maintain their dwellings. They could not invest in risk-reduction plans because of their financial predicament, including those for unanticipated actions like epidemic. Several fisherfolks & dealers could find employment as labourers due to their poor fishing skills, while others remained jobless. Government subsidies are given to fishers and other participants to assist them in getting through the Prohibition era. Throughout the shutdown, the Bangladeshi government assisted those in need. Only 10% of respondents indicated that they had received help (Fig. 2). They claimed that the help they got was needed to get them through the lockout. 90% of the participants took loans with the support of various NGOs or intermediaries.

Figure 3: Reaction to getting aid from the government or an NGO.

The stakeholders acquired many backup plans to handle the pandemic issue. These tactics also included problem-specific countermeasures. 28% of the respondents, primarily fishers, claimed they started selling their catch directly because it was difficult to contact the traders. Many fish breeders and auctioneers started offering fresh and processed fish for home delivery. Most farmers preserved the mature stock without starting a new cycle to obtain a reasonable price for the produce. Four per cent of the participants were reliant on loans from welfare organizations. Some people were given Bangladesh Government financial support that helped keep the people afloat withing few weeks. In response to pandemic crisis, there are 35 respondents claimed they had not made any preparations. They continued to labour despite the obstacles but still lived in poverty.

The authors explored that consumer insist and penchant were also impacted by the COVID-19 epidemic. From the research work, this was found that 40 fish customers appreciate better the collision on populace who often eat fish. Nearly the majority of the respondents agreed that the lockout affected the availability of fish. Because they could not get to usual markets because of transportation restrictions, consumers were compelled to cut back on their monthly fish consumption. Before the shutdown, 33% of consumers bought 16–20 kg of fish each month, while 35% bought 11–15 kg. These percentages decreased to 20% and 23% during lockdown, respectively. According to 12 respondents, their monthly purchasing power had dropped to 5–10 kg due to issues associated with the pandemic, such as difficult accessibility, rising fish costs, decreased income, joblessness, to mention but a few.

During the epidemic, households' regular diets slightly modified. 22 respondents claimed to have altered their fish consumption during lockdown. Some of the shoppers who were questioned avowed that shopers ever purchaed fish at the moment of lockdown period since this was so pricey. The authors found that 18 of the interviewers had not altered their foods because fish is generally a highly nutrient-dense meal rather than other products of meat. Patrons generally concur that prior to closure, fish was mainly purchased from street sellers, neighbourhood markets, and kitchen markets. Online fish sales were only prevalent after the ban, but some affluent customers did buy fish from big-box stores. Customers were imperfect to visiting neighbourhood bazaars and particular merchants throughout the closing. Consumers with higher incomes have continued to purchase fish from superstores due to convenience, even though wet food items are now readily available for online ordering.

**Discussion**

The Bangladeshi government imposed movement restrictions to stop the Coronavirus from spreading, which worried people experiencing poverty and led to other restrictions on providing aquatic food and other necessities, leading to a tragedy. The study concluded that decreased fish demand and pricing, more significant input and transportation costs, and detrimental consequences were related. Fish feed companies must account for a 10%–12% increase in feed prices due to labour shortages, transportation constraints, and production challenges.

Shamsuddin et al., (2023) stated that COVID-19 pandemic and related preventative measures have had a substantial impact on the nation’s fishing sector. In this study, a survey was performed in the Brahmanbaria subdistrict of Bangladesh to assess the impact of COVID-19 and the subsequent efforts made by the Department of Fisheries (DoF), Bangladesh, to mitigate the negative impact on the culture and capture fisheries. They found that COVID-19 pandemic had a negative impact on the income of fishery stakeholders and their livelihoods. The income of fish farmers decreased by 47.49% in 2020 as compared to the base year of 2019 but increased by 129.34% in 2021, showing the effects of COVID-19 and mitigation efforts. Transport and movement restrictions adversely affected the culture fisheries while favouring capture fisheries with an increased annual catch. The DoF constructed fish sanctuaries and implemented law enforcement in 2020 and 2021 to safeguard the habitat for small indigenous species (SIS). These actions might have improved the stakeholders’ income and the post-pandemic scenario by increasing fish productivity. However, further study is recommended on the effective mitigation measures for drawing a clear conclusion.

read less

Additionally, it took work to find ready meals and feed supplements. Farmers were obligatory to utilize fewer fish feed into cultured ponds because of scarcities and amplified expenses, which inhibited the growth of the fish. Fish fry and fingerling stocking declined as a result of the epidemic. Due to transportation constraints, fewer fry and fingerlings were available, resulting in lower aquaculture productivity in the Philippines (Manlosa et al., 2021). Several studies (Kibria et al., 2020; F.A.O. 2020) conducted in Bangladesh's rural areas found that reducing market demand causes farmgate prices to fall by 17–70%. In contrast, urban areas tend to have high retail prices. A 20% increase in transportation costs, a labour shortfall, and a shortage of production-level inputs, including feed, seed, and medications, were among the problems farmers reported when asked about marketing and exporting their products (F.A.O., 2020). The year 2020 was predicted to see more significant restrictions on farm profits due to lower farmgate prices and rising input costs. Interestingly, while demand for fish has recently decreased in urban markets, it is anticipated to rise in rural fish markets. More people are moving back in with their relatives due to the closing of numerous offices and the loss of jobs in cities, raising the demand for fish in rural areas (Anwar et al., 2020). The study's sales data for farmers illustrated this point by estimating their weekly sales at 144.8 66.8 kg for rural farmers and 93 19.9 kg for urban farmers.

The authors explored the research findings support idea that coronavirus pandemic negatively affected fishing communities, which were already in danger. Due to their lower income, they were more susceptible to several different socioeconomic problems. Fishers's earnings and comforts are appreciably impacted through the declining fish and related products and services are in high demand, according to FAO (2020a), and this effect is expected to last for some time. Due to limits on their mobility, fishers had lost their livelihoods, setbacks or not having good carrying process as well as recurrent order cancellations because of not possible to sell their caught fish for the anticipated price. They were forced to sell instead at a low price (Hossain et al., 2022).

Additionally, numbers of fisherfolk have left their employment and businesses, and transitioned to become labourer work or give up the 100-year-aged hereditary profession. The problem has significantly impacted household economics regarding food and other necessities (Sunny et al., 2021; Lima et al., 2021). The majority of fishers and dealers continued with their regular activities of fishing and dealing as their primary strategy for adapting to these disruptions despite declining demand and lower prices for catches, according to a different study on the immediate impact of COVID-19 on tropical small-scale fishing communities by Campbell et al. (2021).

This study demonstrated that fishers needed to discover a range of alternative sources of income to provide for their families and, at the very least, survive the epidemic. The participants did not make any investments in risk mitigation or have emergency procedures in position to deal with disturbances. Fisherfolk communities have very low resources that might use to create assets during the time of natural disaster, fisherfolk had no money and no other resources, could not mitigate the consequences of the pandemic and adopt alternate livelihood strategies to achieve the preferred livelihood endings. In addition to the lockdown peropd, fishers have to deal with a time of fishing restrictions which was created to improve the management & conservation of maritime fish diversities. Bangladesh Government provides each registered fisherman's family 40 kg of rice per month as part of the Vulnerable Group Feedings (VGF) and food security support program (DoF, 2020). These support actions were also put on hold due to the lockdown's limitations on transportation, which delayed the delivery of V.G.F. Since there is now more food insecurity among fishers due to the combined effect, some of them have turned to I.U.U. (illegal, unreported, and unregulated) fishing. The government's aid was arbitrarily distributed among the fishers, who needed more to feed a family. They were forced to borrow money from banks and other lenders, such as N.G.O.s. They could not get a loan from the relevant bank since they needed more money for a mortgage (Sunny AR et al., 2019).

Several fisheries completely collapsed after social distance rules went into force. Such new restrictions on fishing activities expose an ongoing tendency to minimize the contribution of fish to food systems (Béné et al., 2015). The size of their vessels or the difficulties of conducting business in close quarters in their local marketplaces have prevented many small-scale fishers from venturing to sea, even though fishing is necessary (Orlowski, A. 2020). Fishing activity has dropped due to local markets, eateries, and lodging facilities purchasing less seafood. Retailers, Business has decreased for processors, carriers, financiers, and other players in the supply chain of small-scale fishing. Due to decreased fishing activity, access to ice, gasoline, bait, and fishing equipment has also been impeded (Ferrer et al., 2021). The primary problems experienced by fishers during lockdown periods were, The ban time, poor fishing rates, low revenue, a lack of alternative sources of income, low consumer demand, a weak value chain, a gradual increase in lockdown days, and a restriction on dadon (lease money), in short, are all factors that contribute to this situation. A few others also complained that there was not enough fishing equipment.

Verma et al., (2024) reviewed the analysis of COVID-19 pandemic's impact on aquaculture, rivers, and fisheries, highlighting reduced tourism, decreased demand, and changes in water quality parameters, fish biodiversity, and exploitation of fish resources. The authors highlight a significant reduction in tourism, which has led to a decline in the Indian economy. They also discussed the impact of the pandemic on the aquaculture industry, which has been severely affected by the reduction in demand. This review article further discusses the changes in water quality parameters, including increased plastic waste, improved water quality index due to reduced human activities and reduced availability of nutrients due to decreased agricultural activities. The authors also found the impact of the pandemic on fish biodiversity, including population restoration due to reduced industrial pollution and changes in the reproductive state of fish. They concluded by discussing the impact of the pandemic on the exploitation of fish and the aquaculture and fishing industries, including increased fishing effort and harvest with prolonged lockdowns and decreased fish production.

The authors explored that distribute fish, fingerlings, feed, and other goods were transported by large and small pickup vehicles were reluctant, the fish sales issue needed to be improved in the supply chain. Sunny et al.,2021, conducted a different experiment and came to similar conclusions. Most backwards and forward participants in aquaculture value chains collaborate with farmers and take on most of the chain's risk. Borrowing money from banks is advantageous for rearward segment of the supply chain, which mainly comprises pharmaceutical, chemical industries and fish feed. Like backlinking, processing companies can readily get loans from the financial institutions and commercial banks, permitting the interested persons to spread significant danger. The COVID-19 epidemic caused all of these problems for Bangladeshi fish producers to worsen (M.M. Haque, 2020).

Bhendarkar et al., (2023) stated that COVID-19 pandemic-induced lockdown has indisputably affected the aquaculture and fisheries industry across the globe. They found that a majority (81%) of the stakeholders were aware of COVID-19 lockdown impacts on their businesses. Due to this unprecedented lockdown, labour availability was hampered, transport facilities were fully halted and access to inputs like seed, feed, and advisory were largely affected. Importantly, all stakeholders unanimously adduced to the uncertainty over the future of the fisheries sector. Moreover, fishery experts feel that enabling policies for the promotion of awareness, appropriate training, and transparency in the implementation of schemes, credit facilities, and price regulation can have a massive positive impact. Furthermore, the study also recommends utilizing the potential of e-resources (ICTs and IoT) to digitize the business networking of fishery sector stakeholders.

**Muntaha et al., (2023) explored that** COVID-19 pandemic has caused unprecedented disruption to the global economy and society, including fisheries and aquaculture in Indonesia. This study compared data from 2019 (before the pandemic) and 2020 (during the pandemic) to assess changes and trends in the volume and value of fish production, the number of fishing trips, fish prices, and fishers' income at Pondokdadap Fishing Port. This study found that COVID-19 has significantly reduced the volume and value of fish production, the number of fishing trips, fish prices, and fishers' income at Pondokdadap Fishing Port. There are several possible causes and consequences, such as decreased demand, supply chain disruption, health risks or food insecurity. This research also identifies several policy responses and recommendations to mitigate the negative impacts and enhance the recovery of the fisheries sector, such as providing income support, facilitating market access, improving health measures, or strengthening policies on the capture fisheries sector.

Islam et al. (2021) claims that the fish feed businesses have been significantly impacted by the pandemic. The fish feed businesses have been significantly impacted by the pandemic. because of the lacking expert labour and ingredients, inferior auction of the feed, advanced carrying costs (30–70%), greater maintenance operating costs for wellbeing standards & societal isolation. As a result of these factors, the factories have been forced to raise feed prices. The cost of feed per unit had also increased because of the challenges associated with transporting feed on the market. This surge in feed prices hurt not only fish farmers but also the hatchery owners. A hatchery owner claimed they were forced to pay more for the same food amount during the lockout.

The pandemic impacted fish hatcheries because of a drop in fry sales prices, labour shortages, and increased transportation and maintenance expenses to meet healthiness related laws and societal estrangement. The Coronavirus epidemic had severely hampered shipping of fries of the fishes around the country, just like other sectors. The hatcheries' owners asserted that a shortage of permanent employees had led to a catastrophe, forcing them to hire temporary workers daily. This increase in labour costs led to financial instability for the hatcheries, notwithstanding lower sales of fish fries even in the height of the growing season. Due to the financial volatility, fish cultivators and the owners of hatcheries have taken numerous stepladders to set up for future development. Since frequent transportation restrictions have made it more difficult for agricultural commodities to be transported between cities, many of the more enormous intermediaries have been reluctant to continue frequently purchasing fish from nearby farms (S. Anwar et al., 2020; S. Ramachandran, 2020). The intricate and extensive supply chain, a defining feature of the aquaculture supply chain before the COVID outbreak and required numerous intermediaries, has been replaced by local mask middlemen. Farmers were forced to sell their crops at an unjust and inadequate price due to the unpredictable supply chain and market conditions (A. Hasan, 2020).

The COVID-19 issue impacted numerous customers. When it comes to purchasing, customer preferences have evolved. They need help keeping their jobs. Therefore, their wages have been withheld. Most consumers bought less fish due to the high retail prices. Lower-income customers retorted that they hardly ever bought fish during the closure. Fish intake was observed to have drastically declined after COVID, and more people were turning to eggs as their primary protein source. The likely emergence of a "new poor" as a result of the COVID-19 pandemic, a 13% increase in unemployment (BIDS, 2020), a 60% drop in urban income (Z. Amin et al., 2020), and an 80% decline in rural income (R. Kibria et al., 2020), among other factors, may make this situation worse.

Due to the rising cost of living, people are being forced to make sacrifices in other areas of their lives, like their foodstuff choices, prefering inexpensive eggs, expensive fish or else less expensive fish generate for additional luxurious species. According to Akhtar et al. (2018), the consumption of eggs has increased the most, followed by chicken and fish. According to recent research, the outbreak caused many households to reduce fish consumption and pricey animal products. According to studies from Addis Ababa, Ethiopia (Abate et al., 2020), this is accurate.

A modest drop in people's weekly fish purchases was also found to vary. Following COVID, many customers modified their chosen species, focusing more on price than nutritional value. According to research by Mandal et al. (2021), most households significantly reduced their shopping times at the moments of lockdown periods due to COVID-19 problems. Maximum people became conscious of epidemic & thought that individuals could spread the coronavirus to one another. Many people became reluctant to left homes because of considerable publicity & the obtsuction of Government that reduced the number of actual food-related transactions.

Three different explanations for the fishing community's and stakeholders' resilience were offered by a few studies conducted during the Covid-19 incident. The individual, domestic, and social levels are a few examples (Sultana et al., 2021). Different shocks and stresses have different effects on these resilience attributes. Fish scarcity and fishing rules mostly had an impact on individual fishers. Most farmers and stakeholders who answered said they were struggling to make ends meet. The fishing community had minimal access to any other employment opportunities that may provide income except commercial fisheries business and & they regularly lamented the absence of aptitude in the surrounding places. Because of the movement restrictions & loss of income occasions, those fisherfolks that usually travelled to nearby cities at the moments of banned time of fishing could not do so this time. Although some fishers were employed as labourers in experimental places, fisherfolk communities in addition had lower incomes & less employment options at the moments of pandemic outbreak.

Low trade demand, according to fish dealers and a substantial part of fishers, was causing supply chain disruptions, they claimed, because traders were unable to support local fishing operations because they could not sell fish (FAO, 2020a; 2020b). Even though they received lower prices for their catches, most fishers and traders indicated that continuing their fishing operations was their best coping method. In contrast to this pattern, 48% of Mexico's small-scale fisheries reported stopping their operations, and 44% claimed they could not adapt and had ceased selling their catch because they lacked wholesalers or storage space (COBI, 2020). Due to COVID-19's increased redundancy & imperfect occupation occasions, fisherfolk communities had forced to depend on confined stakeholders for financial loans with huge percantages for existence.

From the finding of the research, the authors revealed a variety of behaviours that contributed to lessening household stress. These included turning to neighbours or family members for help, accepting country’s financial support meant for fisherfolks, utilizing alternating basis of income throughout the banned time of fishing, participating in the shring of collected foods with neighbours, obtaining definite interest loans from NGOs (microcredit), vending the home items & relocating to close urban places. Dealers and other stakeholders developed defensive coping mechanisms that emphasizing uneven price decrease or effort substitute due to poor artifact insist & imperfect contribution accessibility. It is more common for smaller businesses with fewer resources to make last-minute alterations. These actions are frequently required to reduce expenses, prevent dangers, or overcome challenges, yet they unintentionally reduce output and profitability. In the Belton et al. (2021) study, respondents from Bangladesh and Africa named the following reactive adjustments as the most common ones: temporarily pausing or shortening the duration of operations; minimizing operating costs; acquiring alternatives to inaccessible inputs; buying inputs in bulk and stockpiling; selling products at reduced prices; and bribing individuals to keep the business afloat.

Bangladesh's aquaculture and fishing industries are vital to society's requirements and help the country meet many S.D.G.s. The fisheries sector may suffer due to the COVID-19 crisis, making it more challenging to meet development goals. The appropriate technology must be used if the brackish, coastal and mariculture sector of Bangladesh will be successful. Consequently, the nation's continued and considerable contribution to its health and economic sectors depends on effective and sutainable management of aquatic resources.

**Conclusions and Recommendations**

This was globally found that problem of epidemic COVID-19 impacts on individual behaviour & actions have substantially impacted aquaculture food and small-scale fishing. The global pandemic has significantly harmed underdeveloped countries, with most economies steadily declining. Because of the limitation of migration opportunities, decreased acquiring influence & additional consequences for the the majority susceptible artisanal fishers & related persons, demands of food & security of enough food are adversely damaged. Fisherfolk communities & additional value chain participants had experienced on variety of confronts those consequences of pandemic Covid-19, counting imperfect capital supplies, absence of the technological assistance, a lack of marketability for their products, restricted access to transportation, low fish prices and export restrictions on fish and fisheries goods. The epidemic has brought attention to pre-existing weaknesses and low resilience, endangering the welfare of small-scale fishing households. These modifications have been made to the supply, demand, labour, and production of fish. Restrictions due to COVID-19 pandemic have caused considerable imbalance among supply & demand in the supply chain of fisheries products, which has led to a downturn in the fishing industry. This study evaluates the pandemic's overall impact on the Chattogram region's fisheries industry over a specific period. A review of each fisheries sub-sectors will be presented, even though it was outside the scope of this study, in order to develop a comprehensive recovery strategy. It is also crucial to recognize the sources of adaptation about the livelihood capital and resilience qualities of fishers and stakeholders to deal with distresses & pressures & recover as of these qualms. However, the finding of the study and suggestions might significantly impact how actions are planned, organized, and carried out to aid fisheries and aquaculture industries of Bangladesh in its recovery from the COVID-19 epidemic.

* Dumpy & extensive phrase of the recuperation plans could finally address the pandemic COVID-19 issue for convene both instant requirements and enduring period of goals for the durable revival for the fishing sector. Taking into account both individual and societal attitudes, the list of recovery strategies follows:
* Inducements, financial supports, free of loan interest and other alternative earning occasions must be incorporated in efforts for the strengthen the aquaculture and small-scale fisheries enterprenership.
* Strict enforcement of the stakeholders' protection from COVID-19 and exploitation should be implemented immediately. Different stakeholders like Government and NGOs should join forces for producers to right of entry into the local markets.
* Reconstruction of the supply chain of fish products, which include marketplace communications, goods storeroom facilities, carrying arrangements, relations between farmers & markets, and increased marketplace documentation process, is necessary due to the COVID-19 pandemic making it difficult for subsistence farmers to sell their catch. If policies and programs facilitate digital tools, fisheries and aquaculture systems may be more adaptive.
* The farmer's association and the upazila fisheries officers should collaborate to monitor and manage the market. This strategy would steady the bazaar and give a roadmap towards the sectoral durable and enduring time of achievement with appropriate species equilibrium to equally the consumer and invention souks.
* In Bangladesh, local Government be supposed to encourage to expansion of processing companies in the region. This would boost the product's value while also easing the problems brought on by perishable goods and irregular supply and demand. It might be achieved through monetary rewards or public-private partnerships. The residents would also have employment opportunities.
* The endeavour to learn commencing the fatalities & harms have to get support from different applicable organizations and industries. Current improvement programs may give imminents depend on knowledge and learning. Communities that depend on fishing and community-based organizations (CBOs) that have encountered and overcome challenges should be encouraged to participate in this knowledge integration.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

# References

Abate, G.T., de Brauw, A. and Hirvonen, K. (2020\_. Food and nutrition security in Addis Ababa, Ethiopia during COVID-19 pandemic (No. 145). Food Policy, 40(3), 89-98

Ahmed, N., Howlader, N., Hoque, M., & Pradhan, B. (2021). Coastal erosion vulnerability assessment along the eastern coast of Bangladesh using geospatial techniques. Ocean and Coastal Management, 50 (4): 89–110.

Ahorsu, D.K, Lin, C.Y., Imani, V., Saffari, M., Griffiths, M.D. and Pakpour, A.H. (2020). The fear of COVID-19 scale development and initial validation. International Journal of Mental Health and Addiction, 20 (3), 56–74.

Akhtar S, Hossain MS, Islam MJ, Liza AA., and Sayeed MA. (2018). Consumers profile analysis towards chicken, beef, mutton, fish and egg consumption in Bangladesh. British Food Journal, 20 (2), 2818–2831.

Al Arif A. (2017). The legal status of maximum sustainable yield concept in international fisheries law and its adoption in the marine fisheries regime of Bangladesh: a critical analysis. The International Journal of Marine and Coastal Law, 32 (3), 544–569.

Alam GMM, Sarker MNI, Gatto M, Bhandari H., and Naziri, D. (2022). Impacts of COVID-19 on the fisheries and aquaculture sector in developing countries and ways forward. Sustainability. 14 (1), 1071-1091.

Alam S, Rahman M, Arif AA. (2021). Challenges and opportunities in artisanal fisheries (Sonadia Island, Bangladesh): the role of legislative, policy and institutional frameworks. Ocean and Coastal Management. 20 (1), 45–65.

Amjath Babu, T. S., T. J. Krupnik, B. Barman, A. K. M. A. Wadud, K. M. Shikuku, M. S. and Ali, B. ( 2020). Second rapid assessment of food and nutrition security in the context of COVID-19 in Bangladesh. Society, 30(3), 90-110.

Amjath-Babu, T.S., Krupnik, T.J., Thilsted, S.H., McDonald, A.J. 2020. Key indicators for monitoring food system disruptions caused by the COVID-19 pandemic: insights from Bangladesh towards effective response. Food Security 12:761–768

Anwar S, Nasrullah M, Hosen MJ. 2020. COVID-19 and Bangladesh: Challenges and how to address them. Public Health. 8: 154.

Anwar, S., Nasrullah, M., Hosen, M.J. (2020). COVID-19 and Bangladesh: Challenges and how to address them. Frontiers in public health. 8 (2), 154-174.

Arafat SMGB, Azom RH, Munir MMH, Ahmed SG, Bansal T, Stidsen S. (2021). Sector-wide human rights impact assessment (swim) in small-scale artisanal fishing communities in Barguna and Cox's Bazar district of Bangladesh. Fishing Chimes, 40(3), 110-120

Bashar A, Heal RD, Hasan NA, Haque MM. (2021). Effect of COVID-19 on shrimp aquaculture in Bangladesh. Fish and Fisheries, 10(4), 45-65

Bhendarkar, M. P., Gaikwad, B. B., Bhalerao, A., Kamble, A. L., Reddy, K. V., Giri Bhavan, S., Sendhil, R., Ramasundaram, P., & Kalbande, S. R. (2023). Impacts of COVID-19-induced lockdown and key reforms in the Indian fisheries sector—a stakeholders’ perspective. *Aquaculture International*, *31*(3), 1583–1605.

Belton B, Rosen L, Middleton L, Ghazali S, Mamun AA, Shieh J, Thilsted SH. (2021). COVID-19 impacts and adaptations in Asia and Africa's aquatic food value chains. Marine Policy, 129(2), 104–120.

Béné C, Barange M, Subasinghe R, Pinstrup-Andersen P, Merino G, Hemre GI, Williams M. (2015). Feeding 9 billion by 2050–Putting fish back on the menu. Food Security 7 (2), 261–274.

Bennett J, Finkbeiner NC, Ban D, Belhabib SD, Jupiter JN, Kittinger SH, Mangubhai J, Scholtens D, Gill P, Christie H. (2021). The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. Journal of Coastal Management. 8 (5), 336–347.

Bennett NJ, Finkbeiner EM, Ban NC, Belhabib SD, Jupiter JN, Kittinger S, Mangubhai J, Scholtens D, Gill P. 2020. The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. Coastal Management. 48 (4): 336–347.

Billah MM, Kader MA, Siddiqui AAM, Mahmud SS, Khan MR. (2018). Studies on fisheries status and socioeconomic condition of the fishing community in Bhatiary coastal area Chittagong, Bangladesh. Journal of Entomology and Zoology Studies. 6 (6), 673–679.

C.O.B.I. (2020). Mexican fishing communities' resilience to COVID-19: economic and social impacts. Comunidad y Biodiversidad AC, Mexico. Economic Policy, 20(3), 90-100

Cameron, D. (2001). *Working with spoken discourse*. London: SAGE.

Campbell SJ, Jakub R, Valdivia A, Setiawan H, Setiawan A, Cox C, Box S. (2021). The immediate impact of COVID-19 across tropical small-scale fishing communities. Ocean and coastal management, 60(3), 80-98.

Campbell, S.J., Jakub, R., Valdivia, A., Setiawan, H. 2023. Immediate impact of COVID-19 across tropical small-scale fishing communities. Ocean and Coastal Management, 200 (1), 105-125

Chambers, R. Conway GR. (1992). Sustainable Rural Livelihoods: Practical Concepts for the 21st Century, I.D.S. Discus, I.D.S., Brighton, 1992.

Chanrachkij I, Laongmanee P, Lanmeen J, Suasi T, Sornkliang J, Tiaye R, Yasook N, Putsa S. (2020). The severity of the impacts of the COVID-19 pandemic on small-scale fisheries of Thailand: A preliminary assessment. Fish People. 18 (4), 33–47.

Choudhury MUI, Haque CE, Hostetler G. (2021). Transformative learning and community resilience to cyclones and storm surges: the case of coastal communities in Bangladesh. International Journal of Disaster Risk Reduction. 55 (3), 45–65.

Coates, J. (2007). Talk in a play frame: More on laughter and intimacy. *Journal of*

*Pragmatics, 39*, 29–49.

Coll M, Ortega-Cerdà M, Mascarell-Rocher Y. (2021). Ecological and economic effects of COVID-19 in marine fisheries from the Northwestern Mediterranean Sea. Biological Conservation, 25(5), 100-120.

Shamsuddin, M., Hossain, M. B., Rahman, M., Tazim, Md. F., Ali, Md. R., Kawla, Mst. S., Begum, T., Albeshr, M. F., & Arai, T. (2023). Impact of COVID-19 Pandemic on Fisheries Sector and Actions Taken to Cope with the Situation: A Case Study from a Top Fish-Producing Country. Sustainability, 15(4), 360-380

Muntaha, A., Sunardi, S., Sulkhany, E., & Siahaan, I. B. (2023). Covid-19 And Its Effects on Fish Production and Fishermen Income: Evidence from Pondokdadap Fishing Port in Indonesia. Fish and Fisheries, 40(3), 45-65

D.F.I.D., (1999). Sustainable livelihoods guidance sheets, department for International Development, London, UK. 1999.

DoF (2016). Fisheries Statistics in Bangladesh: Issues, Challenges and Plans, Department of Fisheries, Ministry of Fisheries and Livestock, Government of Bangladesh, Dhaka, Bangladesh.

DoF (2024). National Fish Week Compendium (In Bengali), Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh, p. 21–32.

DoF, (2024). Yearbook of Fisheries Statistics of Bangladesh 2018-19, Fisheries Resources Survey System (F.R.S.S.), Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh. 36, 135

Drew P., & Heritage J. (1992). Analysing talk at work: An introduction. In P. Drew, & J. Heritage (Eds.), *Talk at work* (pp. 3–65). Cambridge: Cambridge University Press.

F.A.O. Summary of the Impacts of the COVID-19 Pandemic on the Fisheries and Aquaculture Sector; F.A.O.: Rome, Italy, 2020; ISBN 978-92-5-132789-0. [Google Scholar] [CrossRef]

F.A.O. The Impact of COVID-19 on Fisheries and Aquaculture Food Systems, Possible Responses; F.A.O.: Food and Agriculture Organization of the United Nations: Rome, Italy, 2021; ISBN 978-92-5-133768-4. [Google Scholar]

F.A.O., (2020b). How is COVID-19 affecting the fisheries and aquaculture food systems? F.A.O., Rome, Italy. https://doi.org/10.4060/ca8637en

FAO, 2020. The impact of COVID-19 on fisheries and aquaculture, A global assessment from the perspective of regional fishery bodies: Initial assessment, May 2020. No. 1. Rome, 2020, https://doi.org/10.4060/ca9279en.

Ferrer A.J.G., Pomeroy R.O.B., Akester MJ, Muawanah U, Chumchuen C.H.P., Viswanathan KK. (2021). Covid-19 and small-scale fisheries in Southeast Asia: Impacts and responses. Asian Fisheries Science. 34: pp. 99–113.

Fiorella KJ, Bageant ER, Mojica L, Obuya JA, Ochieng J, Olela P, Otuo PW, Onyango H.O., Aura CM, Okronipa H. 2021. Small-scale fishing households facing COVID-19: The case of Lake Victoria, Kenya. Fisheries Research. 237: 105856.

Food and Agricultural Organization (Fao), 2020a. How Is COVID-19 Affecting the Fisheries and Aquaculture Food Systems? https://doi.org/10.4060/ca8637en. Rome.

Food and Agricultural Organization (Fao), 2020b. Summary of the Impacts of the COVID-19 Pandemic on the Fisheries and Aquaculture Sector: Addendum to the State of World Fisheries and Aquaculture 2020. https://doi.org/10.4060/ca9349en. Rome, Italy.

Food and Agriculture Organization (F.A.O.). 2020. How Is COVID-19 affecting the fisheries and aquaculture food systems? Rome: Food and Agriculture Organization of the United Nations. 10.4060/ca8637en.

Fry JP, Ceryes CA, Voorhees JM, Barnes NA, Love DC, Barnes ME. 2019. Occupational safety and health in U.S. aquaculture: a review. Journal of Agromedicine. 24: 405–423.

G. Sar'a, M.C. Mangano, M. Berlino, L. Corbari, M. Lucchese, G. Milisenda, S. Terzo, M.S. Azaza, J.M.F. Babarro, R. Bakiu, B.R. Broitman, A.H. Buschmann, R. Christofoletti, A. Deidun, Y. Dong, J. Galdies, B. Glamuzina, O. Luthman, P. Makridis, A.J.A. Nogueira, The synergistic impacts of anthropogenic stressors and COVID-19 on aquaculture: a current global perspective, Rev. Fish. Sci. Aquac. (2021) 1–13, https://doi.org/10.1080/ 23308249.2021.1876633.

Haque AB, Washim M, D'Costa NG, Baroi AR, Hossain N, Nanjiba R. 2021. Socio-ecological approach on the fishing and trade of rhino rays (Elasmobranchii: Rhinopristiformes) for their biological conservation in the Bay of Bengal, Bangladesh. Ocean and Coastal Management. 65 (4): 90–110.

Haque MM. Impacts of COVID-19 on the fisheries sector of Bangladesh with particular emphasis on aquaculture value-chain actors, Keynote Presented in the Webinar Organized by the Food and Agricultural Organization (F.A.O.) of the United Nations, via Zoom Video Meeting Platform, held on August 10, 2020, 2020.

Hasan NA, Heal RD, Bashar A, Bablee AL, Haque MM. 2021. Impacts of COVID-19 on the finfish aquaculture industry of Bangladesh: a case study. Marine Policy. 130: 104577.

Hasan, A. (2020). Agricultural Sector of Bangladesh at Distress. Social Values, 15(1), 34-45

Hossain MT, Lima TR, Ela MZ, Khan L, Ahmed F, Al Masud A, Islam MN. 2022. Livelihood challenges and healthcare-seeking behaviour of fishers amidst the COVID-19 pandemic in the Sundarbans mangrove forest of Bangladesh. Aquaculture. 546: 737348.

Hussain, M.G., Chowdhury, S.R., & Alam, A.K.M.N. (2020, October). Impacts of COVID-19 pandemic on the fisheries sub-sector in Bangladesh – Enhancing short-term recovery and medium and long-term resilience. Final Draft Report of FAO-WBCooperative Programme, F.A.O.

Hussain. A. 2019. Fisheries Ministry for Enforcing 65-Day Fishing Ban in the Bay of Bengal. Dhaka Tribune.

I. Scoones, Sustainable Rural Livelihoods: A Framework for Analysis, I.D.S. Workin, I.D.S., Brighton, 1998.

Islam MM, Khan MI, Barman A. 2021a. The impact of the novel coronavirus pandemic on aquaculture and fisheries in developing countries and sustainable recovery plans is the case of Bangladesh. Marine Policy. 131: 104611.

Islam MM, Nahiduzzaman M, Wahab MA. 2020b. Fisheries co-management in hilsa shad sanctuaries of Bangladesh: Early experiences and implementation challenges. Marine Policy. 117: 103955.

Islam, M.M., Islam, N., Mostafiz, M., Sunny, A.R., 2024. Balancing between livelihood and biodiversity conservation: A model study on gear selectivity for harvesting small indigenous fishes in southern Bangladesh.  Journal of Zoology and Ecology, 28 (6), 86–93.

Islam, M.M., Khan, M.I., Barman, A. 2021. Impact of novel coronavirus pandemic on aquaculture and fisheries in developing countries and sustainable recovery plans: case of Bangladesh. Marine Policy 131:104611.

Islam, M.M., Rahman, M.A., Paul, B., Khan, M.I. 2020. Barriers to climate change adaptation: insights from the Sundarbans mangrove-based fisheries of Bangladesh. Asian Fisheries Science 33:175–186.

Kabir J, Cramb R, Alauddin M, Gaydon DS, Roth CH. (2020). Farmers' perceptions and risk management in rice/shrimp farming systems in South-West Coastal Bangladesh. Land use policy. 95: 104577.

Keck M, Sakdapolrak P. 2013. What is social resilience? Lessons learned and ways forward. Erkunde: 67: 5–19.

Kibria R, Khan D, Sultana FH, Hasnin N, Morshed MT. (2020). Impact of Coronavirus on Livelihoods: Rural and Low-Income Population of Bangladesh, Covid-19 Series, LightCastle Partners, Dhaka, Bangladesh.

Kibria R, Khan FH, Sultana D, Hasnin D, Morshed MT. (2020). Impact of Coronavirus on livelihoods: Rural and low-income population of Bangladesh. Covid-19 Series, Light Castle Partners, Dhaka, Bangladesh.

Kumaran M, Geetha R, Antony J, Vasagam KPK, Anand PR, Ravisankar T, Angel JRJ, De D, Muralidhar M, Patil PK, Vijayan KK. 2021. Prospective impact of Coronavirus disease (COVID-19) related lockdown on shrimp aquaculture sector in India – a sectoral assessment. Aquaculture. 531: 735922.

Lazzari N, Becerro MA, Sanabria-Fernandez JA, Martín-López B. 2021. Assessing the social-ecological vulnerability of coastal systems to fishing and tourism. Sciences of the Total Environment. 50 (4): 70–65.

Lei Y, Wang JA, Yue Y, Zhou H, Yin W. (2014). Rethinking the relationships of vulnerability, resilience, and adaptation from a disaster risk perspective. Natural Hazards. 70 (1): 609–627.

Lima TR, Ela MZ, Khan L, Hossain MT, Jahan N, Rahman KS, Islam MN. 2021. Livelihood and health vulnerabilities of forest resource-dependent communities amidst the COVID-19 pandemic in southwestern regions of Bangladesh: In Environmental Resilience and Transformation in Times of COVID-19, Elsevier. pp. 343–356.

Love DC, Allison EH, Asche F, Belton B, Cottrell RS, Froehlich HE, Gephart JA, Hicks CC, Little DC, Nussbaumer EM. 2021. Emerging COVID-19 impacts, responses, and lessons for resilience in the seafood system. Global Food Science. 28: 100494.

Love, D.C., Allison, E.H., Asche, F., Belton, B., Cottrell, R. 2022. Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system. Global Food Section, 28 (2), 100-125

Mandal SC, Boidya P, Haque MIM, Hossain A, Shams Z, Mamun AA. 2021. The impact of the COVID-19 pandemic on fish consumption and household food security in Dhaka City, Bangladesh. Global Food Security. 29: 100526.

Mandal, S.C., Boidya, P., Haque, M.I.M., Hossain, A., Shams, Z., Mamun, A.A. 2021. The impact of the COVID-19 pandemic on fish consumption and household food security in Dhaka city, Bangladesh. Global Food Security 29:100526

Manlosa AO, Hornidge AK, Schlüter A. 2021. Aquaculture-capture fisheries nexus under Covid-19: impacts, diversity, and social-ecological resilience. Maritime Studies. 20 (1): 75.

Orlowski A. (2020). Small-scale fishers are suffering significantly from the COVID-19 pandemic. Seafood Source.

Prawoto, N., Priyo Purnomo, E., Az Zahra, A. 2020. The impacts of COVID19 pandemic on socio-economic mobility in Indonesia. International Journal of Economics and Business Administration VIII:57–71.

Purkait S, Karmakar S, Chowdhury S, Mali P, Sau SK. 2020. Impacts of novel Coronavirus (COVID-19) pandemic on fisheries sector in India: A mini-review. International Journal of Pure and applied bioscience 8 (3): 487–492.

Purkait, S., Karmakar, S., Chowdhury, S., Mali, P., Sau, S.K. 2020. Impacts of novel coronavirus (COVID-19) pandemic on fisheries sector in India: a mini review. Indian Journal of Pure and Applied Biosciences 8:487– 492

Rahman MA, Pramanik MMH, Flura AT, Hasan MM, Khan MH, Mahmud Y. 2017. Impact assessment of twenty-two days fishing ban in the principal spawning grounds of Tenualosa Elisha (Hamilton, 1822) on its spawning success in Bangladesh. Journal of Aquaculture Research & Development. 8: 489.

Rahman, M.A., Alam, M.M., Barman, S.K., Hossain, M.J., Tikadar, K.K. 2022. Effect of COVID-19 on fisheries products exported from southwest Bangladesh: a case study. Journal of Bangladesh Agricultural University 20:217–224.

Rahman, M.A., Hossain, M.Y., Tanjin, S., Mawa, Z., Hasan, M.R., Jasmine, S. 2021. Effects of COVID‐19 pandemic on Baor (Oxbow Lake) fisheries: decreased economic livelihoods and food security. Lakes and Reservoirs: Research and Management 26:12374.

Ramachandran S. 2020. The COVID-19 Catastrophe in Bangladesh.

Rosen L. (2020). Field Notes: Impacts on Aquaculture and Fisheries in Bangladesh during COVID-19, WorldFish, Penang, Malaysia.

Said, A., Miah, M.J., Islam, T., Anika, N.R. and Anjum, I.S. (2020). The economic impact of COVID-19 and the way forward for Bangladesh. Social Change, 10(3), 90-85.

Sarafat S. (2020). COVID-19: Bangladesh's Tk 4.6b shrimp export orders cancelled |Prothom Alo. Prothom Alo.

Sari YD, Mira S, Suryawati1 BO, Nababan Y, Hikmayani N, Putri SP. 2021. The impact of the COVID-19 pandemic on fishers in the Indramayu District, Indonesia. I.O.P. Conference Series: Earth and Environmental Science. 8 (9): 70–90.

Shammi M, Bodrud-Doza M, Islam ARMT, Rahman MM. 2020. COVID-19 pandemic, socioeconomic crisis and human stress in resource-limited settings: a case from Bangladesh. Heliyon. 6: 04063.

Shammi, M., Bodrud-Doza, M., Islam, A.R.M.T., Rahman, M.M. 2021. Strategic assessment of COVID-19 pandemic in Bangladesh: comparative lockdown scenario analysis, public perception, and management for sustainability. Environment, Development and Sustainability 23:6148–6191.

Sharma G. (2017). Pros and cons of different sampling techniques. International journal of applied research. 3 (7): 749–752.

Sultana R, Alam M. 2020. Natural disasters and the dengue epidemic during the covid-19 outbreak: a deadly combination for public health threats in Bangladesh. Disaster Med. Public Health. 10: 493.

Sultana R, Irfanullah HM, Selim SA, Raihan ST, Bhowmik J, Ahmed SG. 2021. Multilevel resilience of fishing communities of coastal Bangladesh against covid-19 pandemic and 65-day fishing. Marine Science. 8: 721838.

Sunny AR, Ahamed GS, Mithun MH, Islam MA, Das B, Rahman A, Chowdhury MA. 2019. Livelihood Status of The Hilsa (Tenualosa Elisha) Fishers: The Case of Coastal Fishing Community of The Padma River. Bangladesh. Journal of Coastal Zone Management. 22 (2): 469.

Sunny AR, Mithun MH, Prodhan SH, Ashrafuzzaman M, Rahman S.M.A., Billah MM, Hussain M, Ahmed KJ, Sazzad SA, Alam MT. 2021. Fisheries in the context of attaining sustainable development goals (S.D.G.s) in Bangladesh: COVID-19 impacts and prospects. Sustainability. 13: 9912.

Sunny AR, Sazzad SA, Prodhan SH, Ashrafuzzaman M, Datta GC, Sarker AK, Mithun MH. 2021. Assessing impacts of COVID-19 on the aquatic food system and small-scale fisheries in Bangladesh. Marine policy. 126: 104422.

Talukder AS, Punom NJ, Eshik M.M.E., Begum MK, Islam H.M.R., Hossain Z, Rahman MS. (2021). Molecular identification of white spot syndrome virus (W.S.S.V.) and associated risk factors for white spot disease (W.S.D.) prevalence in shrimp (Penaeus monodon) aquaculture in Bangladesh. Journal of Invertebrate Pathology. 179: 107535.

Thomson J. (2020). Fisheries and Oceans Canada pulls at-sea observers from fishing boats due to the coronavirus pandemic. The Narwhal.

U.N.B., 13pc People Lost Jobs in Bangladesh Due Covid-19 Pandemic: BIDS Survey, Dly. Star., 2020. 〈https://www.thedailystar.net/business/13pc-people-lost-jobs-in-bangladesh-due-covid-19-pandemic-1920309〉(Accessed September 16, 2020).

United News of Bangladesh (2020). 65-Day Ban on Fishing in Bay from May 2020: Minister. Available online at: https://unb.com.bd/category/Bangladesh/ 65-day-ban-on-fishing-in-bay-from-may-20-minister/51737 (accessed March 18, 2021).

Waiho K, Fazhan H, Ishak SD, Kasan NA, Liew HJ, Norainy MH, Ikhwanuddin M. 2020. Potential impacts of COVID-19 on the aquaculture sector of Malaysia and its coping strategies. Aquaculture Reports. 18: 100450.

White, E.R., Froehlich, H.E., Gephart, J.A., Cottrell, R.S., Branch, T.A., Agrawal Bejarano, R., Baum, J.K. 2021. Early effects of COVID‐19 on US fisheries and seafood consumption. Fish and Fisheries 22:232– 239

WHO, WHO Director-General's Opening Remarks at the Media Briefing on COVID-19 - March 3, 2020, World Heal. Organ. (WHO), Geneva, Switz., 2020. 〈htt ps://www.who.int/dg/speeches/detail/who-director-general-s-opening-remar ks-at-the-media-briefing-on-covid-19—3-march-2020〉. (Accessed September 17, 2020).

Worldometers, (2020). Coronavirus Pandemic Live Cases. https://www.worldometers.

Z. Amin, S. Nazrul, S. Ali, K.M. Rafi, M.T. Morshed, Impact of Coronavirus on Livelihoods: Low- and Lower Middle-Income Population of Urban Dhaka, Covid-19 Series, LightCastle Partners, Dhaka, Bangladesh, 2020.

Verma, D. K., Sharma, S. K., Barad, R. R., Jayaswal, R., Inwati, P., Chandra, I., Kumar, V., Kurmi, A., & Khalasi, B. R. (2024). Impact of COVID-19 on River and Fisheries: A Comprehensive Guide. Archives of Current Research International, 24(7), 142–151.