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# Livelihood challenges and healthcare-seeking behavior of fishermen amidst the COVID-19 pandemic in the Sundarbans mangrove forest of Bangladesh

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## ABSTRACT

The outbreak of coronavirus disease (COVID-19) has posed significant challenges to human wellbeing and survival, particularly among groups of people such as the Sundarbans mangrove forest resource-dependent communities (SMFRDCs), and especially the fishermen in these communities, in developing countries like Bangladesh. It is therefore essential to explore the livelihood conditions, health status and care-seeking behavior of the fishermen in these communities during the ongoing pandemic. This study was carried out by applying mixed methods, including interviews and focus group discussion (FGD), in the three sub-districts of Khulna, Satkhira, and Bagerhat, which are in the southwestern region adjacent to the Sundarbans mangrove forest (SMF) of Bangladesh. Quantitative data were collected from 76 fishermen through telephone interviews, while 24 fishermen participated in three distinct focus group discussions. The findings suggest that the fishermen have experienced a reduction of income, as they have been barred from entering the SMF during the pandemic, which has gradually affected their number of trips to and stays at the forest as well as their catch of fisheries resources. The decline in demand in both regional and international markets has left the fishermen with only a handful of alternative ways to adjust to these unprecedented circumstances, such as borrowing money, selling household assets, and in some extreme cases marrying off young children to reduce the financial burden, as many are now jobless. Their financial hardship during the pandemic has affected their households' capacity to afford basic household necessities, including food, fuel, education, and health expenses. Subsequently, when these fishermen suffer ailments such as fever, cough, headache, and cold – the general symptoms of COVID-19 – they cannot seek medical assistance from trained doctors. Their financial constraints have compelled them to rely on indigenous knowledge, in particular village quack doctors, or in some cases to seek help from local pharmacies for modern medicine. Thus, the government should provide financial support and strengthen the local market value chain so that disadvantaged fishermen in SMFRDCs can adopt alternative livelihood opportunities. Furthermore, longitudinal research on the impacts of COVID-19 on livelihood, local adaptation strategies, health status, and care-seeking behavior is also strongly recommended.

## 1. Introduction

The outbreak of coronavirus disease (COVID-19) from Wuhan, China (Forster et al., 2020) has been acknowledged worldwide as a significant public health threat, particularly in densely populated countries like Bangladesh, which have inadequate livelihood and healthcare facilities

(Masrur et al., 2020). The World Health Organization (WHO) has devised comprehensive anti-epidemic strategies, including restricting the travel of foreign nationals, closing international and internal transit and transportation systems, and shutting down public spaces (Ahmed et al., 2020; Cao et al., 2020; Savitsky et al., 2020) in order to thwart human-to-human transmission of the highly infectious virus.

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Bangladesh, like many other countries, imposed a country-wide lockdown from March 26, 2020, under the guise of “general holidays”, and has also enacted compulsory social distancing and other similar strict containment measures (Jahid, 2020). As a result of prolonged home confinement, people from different cohorts in Bangladesh have been experiencing intensified mental ailments such as anxiety, depression, stress, fear, and sleep disturbance (Ahmed et al., 2021; Akter et al., 2021; Islam et al., 2020a; Shovo et al., 2021). Despite the implementation of non-therapeutic measures, as well as mass vaccination programs from February 7, 2021, around 0.8 million people in Bangladesh alone have been infected with COVID-19, and more than 12,000 of these people have died from the virus (WHO, 2021a). Globally, as of June 1, 2021, 169 million people have been infected with COVID-19 and more than 3.5 million have died of the virus (WHO, 2021b).

Apart from affecting public health, the spread of the outbreak poses significant risks not only to subsistence security, but also to production, distribution, and access to food and other basic amenities (Amjath-Babu et al., 2020). Developed and developing countries alike have been experiencing a global value chain crisis. The closure of markets, both formal and informal, and the disruptions to international trade followed by the shutting down of regional and international transit and transportation systems have significantly affected not only supply systems but also production cycles (Kumar et al., 2021). The situation has further worsened due to a sudden change in consumer behavior, including a spike in consumption of ready-made foods and buying of groceries, while there has been a prejudice-related prohibition of vegetables and seafood items (Ben Hassen et al., 2021; Gu and Wang, 2020; Poskute et al., 2021; Smith et al., 2021; Workie et al., 2020). Studies from countries on different continents have reported frequent disruptions of food supply chains, generated mostly by the lockdown measures imposed by governments at regional and national levels (Kumar et al., 2021; Mandal et al., 2021; Marusak et al., 2021; Prosser et al., 2021). These containment measures, together with a change in the demand for food items and displaced market systems, have gradually reduced the manufacturing of products as well as the income of producers (Ilese et al., 2021; Perrin and Martin, 2021); the volatile market system has led to an increase in some commodities (Arouna et al., 2020), while others have experienced a sudden drop (Wang et al., 2020), thus affecting the lives and livelihoods of both the producers and the consumers (Mandal et al., 2021).

Like the mainstream commercial sectors, small-scale traditional and nature-dependent livelihoods are also suffering from intensified negative impacts, particularly in forest resource-dependent communities (FRDCs) (FAO, 2020b; ILO, 2020). Forests are an important source of livelihood for billions of people (Koy and Sasaki, 2013), and FRDCs rely on four ecosystem services for their livelihoods: provisioning services, regulating services, cultural services, and supporting services (Hussain and Badola, 2010; Islam and Hossain, 2017; Lee et al., 2014; Uddin et al., 2013). However, the prolonged and frequent lockdown measures, together with restrictions on entering the forest, have put the already marginalized forest-based industries – of both wood and non-wood items – and the people engaged in the production and trade of forest products at the crossroads of life and living (FAO, 2020b), especially for aquaculture in South (Lima et al., 2021) and South-East Asia (Magcale-Macandog et al., 2021).

In Bangladesh, the fisheries resources of the Sundarbans mangrove forest (SMF) have played a significant role in the local as well as the national economy (Hasan and Naser, 2016); they not only provide 20% of the total fish catch in Bangladesh (Huq et al., 2001) but also serve as a major breeding and nursery ground for most off-shore commercial fish stocks (Sen, 2010). In this context, the fishermen of SMF were already highly vulnerable due to climate change-induced natural calamities (Sadik and Rahman, 2009), as these were affecting their livelihoods by deteriorating forest health and reducing productivity (Ahmed et al., 2021)(Islam et al., 2014; Raha et al., 2013). However, the emergence of

the COVID-19 pandemic – the most pressing global challenge for humanity in recent years – has strained the lives and livelihoods of people, ranging from young to old, and from urbanites in megacities to FRDCs living deep in the forests; it affects people's social, economic, health, and mental wellbeing (Bennett et al., 2020; Chattopadhyay, 2020; DESA, 2020; Hossain et al., 2020; Islam et al., 2020a).

Indeed, the FRDCs of the SMF are socio-economically vulnerable groups due to their low income and unsustainable livelihood opportunities (Islam et al., 2020b), and the new challenge posed by the COVID-19 pandemic is making this specific group more vulnerable, particularly fishermen (Rafiquzzaman, 2020). Fishermen in Bangladesh, according to a recent report by FAO, World Fish and CGIAR (2020), have been the hardest hit, as the lower demand among consumers for fisheries products is leading small and medium enterprises towards bankruptcy. A longitudinal study on five countries in Africa and Asia also found that the fisheries food value chain has sustained a severe setback during the COVID-19 pandemic, which has affected not only the availability and accessibility of fisheries goods and services but also the demand, production cost, and lives of the affiliated labor force (Belton et al., 2021). Furthermore, the ongoing pandemic has also placed a new burden on their healthcare-seeking behavior (Anderson, 2020; DESA, 2020; Lima et al., 2021). Therefore, it is essential to understand the livelihood conditions and healthcare status of this group during the COVID-19 pandemic, and to identify the ways in which they are coping with this unprecedented health emergency. On these grounds, this study is expected to help stakeholders and policymakers formulate and execute effective policies in order to mitigate the livelihood and health emergency for these fishermen, who solely depend on fishing in and around the SMF.

## 2. Materials and methods

### 2.1. Research design

In this study, the data were collected using mixed methods, with both qualitative and quantitative approaches, to assess the impact of COVID-19 on the livelihood opportunities, health status and healthcare-seeking behavior of SMF resource-dependent fishermen. Considering the strength of mixed methods, this study extracted its data by employing a telephone survey and focus group discussion (FGD). Such an explanatory sequential approach allows researchers to gain a contextual understanding of social phenomena from empirical observations (Bryman, 2006; Creswell and Clark, 2011; Johnson and Onwuegbuzie, 2004) through triangulation of both quantitative and qualitative methods in a single investigation, clarifying the findings extensively and extending the range of inquiry to guide further inquiries (Bryman, 2006; Greene et al., 1989). The quantitative data, gathered through the telephone survey, enriched the investigation by providing both background information and data about the livelihood and healthcare challenges and adaptation strategies experienced by the fishermen dependent on the SMF during the COVID-19 pandemic, while the qualitative data from FGD generated themes in order to rationalize the fishermen's adaptive behavior through an in-depth inquiry (Creswell and Clark, 2011). It is important to note that the telephone survey, which involved semi-structured question items, could not by itself uncover the underlying causes of the livelihood struggle and healthcare behavior of the fishermen of the SMF. Thus, it was complemented by the FGDs, where fishermen were asked about their experiences of disrupted fishing activities during the COVID-19 pandemic and invited to explain its impact on their livelihood opportunities, health status, and care-seeking behavior. The responses from the telephone survey and FGDs were compared, where possible, in order to understand the overall impact of the COVID-19 pandemic.

## 2.2. Study area and sampling

In this study, data from both the survey and the FGDs were collected from three sub-districts, Shymanagar, Mongla, and Dacope, which lie respectively within the Satkhira, Bagerhat, and Khulna districts of Bangladesh (see Map 1). These areas were considered for this study due to their close proximity to the SMF and the fact that a significant percentage of the residents are directly dependent on SMF resources for their livelihoods (BBS, 2015a; b; 2015c). Thus, these areas were purposively selected; the aim was to reach out to the residents and to understand the dynamics of their livelihood, including challenges as well as adaptive behavior, and their healthcare-seeking behavior during the COVID-19 pandemic. In 2020, a total of 13,050 fishermen (including fishermen and crabbers) received boat license certificates (BLC) from the Bangladesh Forest Department between January and September for harvesting fish and crab. Considering the size of the population, the sample size aim was set at 70, which would provide 95% confidence and a 12% level of precision (sampling error) (Yamane, 1967). In the end, a total of 76 participants were selected randomly for the telephone survey. In contrast, a total of 24 fishermen over three FGDs – eight participants in each FGD (Creswell and Poth, 2018) – were purposively selected to facilitate the group discussions as well as to complement and validate the findings of the survey.

Among the participants of the survey, more than half (56.6%) were aged between their 30s and mid-40s; the average age of the participants of the telephone survey was 36.8 years (SD = 10.4). The majority were male (97.4%) and followed Islam as their religion (89.5%). A significant percentage of the participants had primary education (46.1%), but only a few had completed secondary (25%) or higher secondary education (3.9%). The participants were mostly married (84.2%), and were split evenly between fishermen and crabbers (50% each). Out of the total 24 participants of three FGDs, most (95.8%) were male and Muslim, and a quarter of them (25%) were crabbers with either no education or primary education (Table 1). (See Map 1.)

## 2.3. Ethical issues

This study was conducted with formal ethical approval from the institutional ethical clearance committee (KUECC-2020/12/10). The anonymity of the participants, for both the survey and FGDs, was strictly

**Table 1**

Socio-demographic characteristics of SMF dependent fishermen communities in the coastal areas of Bangladesh. Here,  $N = 76$ .

Indicators	% (N)	Statistics (M & SD)
Age (in Year)		
≤30	30.3 (23)	36.8 & 10.4
31–45	56.6 (43)	
46≥	13.2 (10)	
Sex		
Male	97.4 (74)	
Female	2.6 (2)	
Religion		
Islam	89.5 (68)	
Sanatana	10.5 (8)	
Occupation		
Fishing	50.0 (38)	
Crabber	50.0 (38)	
Education		
Not literate	25.0 (19)	4.1 & 3.4
Primary (Class I-Class V)	46.1 (35)	
Secondary (Class VI-Class X)	25 (19)	
Higher Secondary (Class XI-XII)	3.9 (3)	
Marital status		
Unmarried	14.5 (11)	
Married	84.2 (64)	
Divorced	1.3 (1)	

Note: <sup>M</sup> Mean; <sup>SD</sup> Standard Deviation.

maintained. An informed consent letter was read out by the interviewers during the telephone interviews and by the moderator in the FGDs in order to assure the participants' voluntary participation in this study. Through the consent form, all participants were provided with detailed information concerning the research purpose, the confidentiality of their information, and the right to revoke their participation without prior justification.

## 2.4. Procedure

### 2.4.1. Telephone interviews

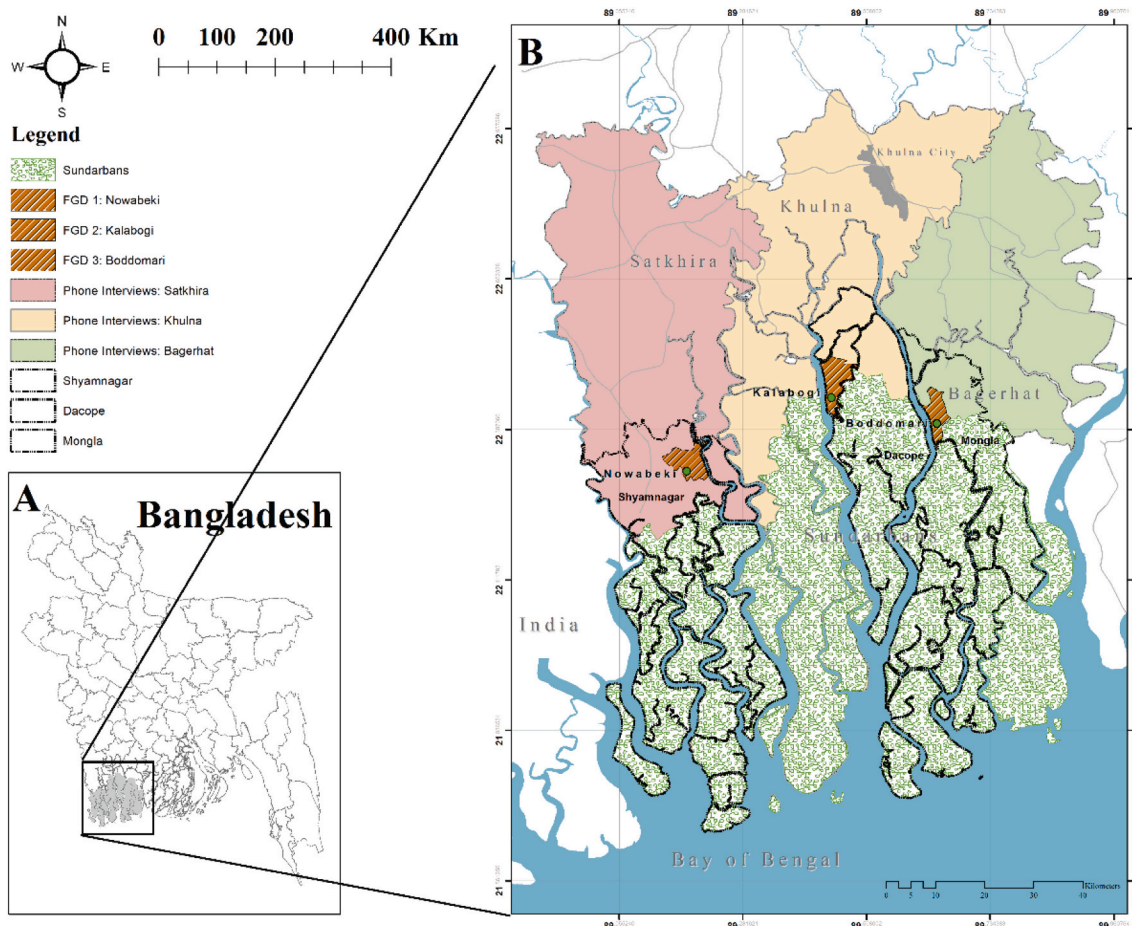
The survey was conducted using telephone interviews. The semi-structured interview schedule (see Appendix A), containing both open and close-ended questions, was prepared in Bangla to facilitate the conversation with the participants. The interview schedule was divided into three major parts: the first part focused on personal details, and was comprised of questions on personal characteristics and socioeconomic background; the second part included two different sets of questions: (i) livelihood challenges during COVID-19 and (ii) coping strategies to maintain livelihood during COVID-19; and the final part assessed health and care-seeking behavior during the COVID-19 pandemic.

The researchers collected the cell phone numbers of fishermen from the SMF area, with the help of local Union Council (UP) Members. Later, the researchers communicated with the fishermen over telephone to explain the purpose of the research as well as to attain their verbal consent for voluntary participation. With this verbal consent from the fishermen, the researchers arranged the telephone conversation sessions at times that were convenient for the participants. Telephone interviewing is an important catalyst in conducting research, particularly during health emergencies and other natural calamities, when it is difficult to reach participants directly (Silverman, 2013). Moreover, it confirms the uniformity and standardization of queries, and ensures the safety of both interviewers and interviewees (Brinkmann, 2013), especially during health emergencies like COVID-19. The interviews were conducted between October and the middle of December 2020; they took place over telephone in order to maintain the government-mandated “social distancing”, and were tape-recorded with prior permission. These interviews, without any break or interruption, lasted for 35 min on average. During the interview sessions, the researchers followed the rules of unrestricted acceptance, attentive listening, and explanation in order to endorse the validity of the data and to sidestep partiality.

### 2.4.2. Focus group discussions (FGDs)

The focus group discussions (FGDs) were carried out using a set of guidelines for unstructured FGDs (see Appendix B); the participants were encouraged to describe and discuss their experiences regarding their livelihood challenges and adaptation strategies during the ongoing COVID-19 pandemic. An unstructured FGD allows a researcher to extract contextualized information from an open conversation. The key research questions that guided the group discussion were: (i) What are the livelihood challenges faced by the fishermen in the Sundarbans during the COVID-19 pandemic? (ii) What are the strategies they have adopted to adjust or cope with these unexpected conditions? (iii) What are the major health issues they have experienced during COVID-19, and how did they cope with these situations?

A total of three FGDs were facilitated by the researchers, taking place between the middle and end of December 2020. In an explanatory sequential approach, the purpose of the follow-up FGDs was to validate the preliminary findings from the survey (Creswell and Clark, 2011; Creswell and Poth, 2018) as well as to collect feedback from the fishermen in order to refine and validate the outcomes of the telephone survey (Sarker et al., 2019). Because FGDs allow participants to express opinions in a natural setting, they give participants a feeling of empowerment and provide a window for researchers to understand the different perspectives of the individuals in a more discursive way



Map 1. Map of the study areas.

(Neuman, 2014). The FGDs were carried out within the selected study areas, with a group of eight fishermen in each FGD. They were conducted in Bangla and lasted on average 60 min, covering research questions about livelihood challenges, adaptation strategies, health conditions, and care-seeking behavior. The group discussions were tape-recorded with prior permission from the participants, and kept strictly confidential. In addition to tape-recording, notes were also taken by the researchers throughout the FGDs to summarize the outcomes and facilitate the analysis. The participants were coded as FGD 1-P1, P2, P3 etc. in order to maintain their anonymity.

2.5. Analysis

The data from the survey were analyzed using Statistical Package for Social Sciences (SPSS) v23. Descriptive statistics, including frequency and percentage analysis following multiple response analysis as well as measures of central tendency (e.g. mean and standard deviation), were used to present the details of the participants, the changes that have taken place in the lives and livelihoods of fishermen in the SMF, their adaptation strategies, their health status, and their care-seeking behavior. Following the completion of each FGD, the recordings were transcribed and analyzed by the researchers, and the themes highlighted. The themes were identified and organized using a structured coding system and systematic review and analysis in order to develop an insight into relevant issues. This approach specifies the boundaries of a theme through meaningful and coherent interpretation. Three themes were eventually generated from the FGDs: challenges to livelihood during COVID-19 restrictions; adaptive strategies to cope with these situations; and health status and care-seeking behavior during the

pandemic. These themes complemented the findings of the telephone survey.

3. Results

Table 2 presents the breakdown of resource collection practices and behaviors by SMF fishermen both before and during COVID-19. The findings suggest a significant reduction in both fishing (17.1%) and

Table 2  
Impacts of COVID-19 on resource collection by the SMF dependent fishermen communities in the coastal areas of Bangladesh. Here, N = 76.

Resource collection	Pre-COVID-19 (%)	During COVID-19 (%)	Change (%)
Resource collection			
Fish	52.6	35.5	-17.1
Crab and shrimp fry	47.4	25.0	-22.4
No resources		39.5	39.5
Duration of stay <sup>Day</sup> (number of permit)	130 (51)	33 (34)	-97 (17)
Distance of collection point (km)	7.9 (9.91)	4.7 (7.61)	-3.23
Trips (numbers per season)	18.4 (7.09)	4.8 (4.82)	-13.6
Stay in forest (days per trip)	7.3 (2.79)	4.5 (4.42)	-2.8
Expenditure (BDT <sup>1</sup> per trip)	3000 (1915)	1800 (2084)	-1200
Collected resource (Kg/ trip)	43.7 (57.95)	13.5 (15.6)	-30.2
Sold resources (Kg)	43.9 (59)	13.6 (15.7)	-30.3
Price (BDT <sup>1</sup> / Kg)	387 (162)	109 (111)	-278
Income (BDT <sup>1</sup> )	8542 (5004)	1818 (2437)	-6724

Note: Km, Kilometer; BDT, Bangladeshi Taka; Kg, Kilogram. <sup>1</sup> 1 BDT = US\$ 0.012 (Subject to daily exchange rate).

crabbing (22.4%) during the COVID-19 pandemic compared to the pre-pandemic situation. Moreover, 39.5% of the participants were not involved in any kind of fish-based resource collection during the COVID-19 period. This reduction and non-involvement in fishing can be attributed to the decrease in permits (from 51% pre-pandemic to 34% during COVID-19) from the Bangladesh Forest Department as well as the duration of their stay in the SMF (from 130 days, on average, pre-pandemic to 33 days during COVID-19). The reduction in permits and duration of stays eventually affected the collection of fish resources (30.2 kg) and the amount sold at the local market (30.3 kg). Moreover, the decline of market price (from BDT (Bangladesh currency) 387, on average, pre-pandemic to BDT 109 during COVID-19) subsequently resulted in a significant drop in overall income (BDT 6724) from resource collection for fishermen.

During the FGDs, the participants unequivocally stated that following the declaration of “general holidays” by the government and the restrictions imposed on entering the SMF in order to curb the spread of COVID-19, the fishermen experienced an unanticipated financial crisis. They were barred from entering the SMF – their sole means to survive or support their families. One fisherman (FGD 1, P5) said:

“When the Forest Department stopped me from entering the forest (SMF), which I had already paid for, I was in deep trouble, and the first thing that came to my mind was ‘how do I feed my family members, particularly my ailing parents’.”

Crabbers also experienced a similar crisis. However, unlike fishermen, who focus on supplying fish for local and regional markets, crabbers generally produce for the international market, particularly in South-East Asia and Europe (Bhuiyan et al., 2021). The restriction on export-import had a detrimental effect on the financial conditions of crabbers in the SMF in Bangladesh. The crabbers explained the situation thus:

“Before the coronavirus pandemic, we could sell the crabs at a higher price (FGD 2, P2), three to four times higher than usual price, especially during the Chinese *gon* (the peak season) in the winter (referring to Christmas) (FGD 3, P5). Now, the Chinese are not taking the crabs (FGD 1, P6) as the export is banned across the world (FGD 3, P5). In Bangladesh, crabs are not preferred, as the *Mowlana* (learned men of Islamic principles) declared the crabs as *Makruh* (detestable) or (as having) minor sin (FGD 1, P5 and P7). Thus, we could not sell crabs in the local market, and did not get the expected price (FGD 1, P6 and FGD 3, P5).”

The unexpected and unforeseen outcome of COVID-19 on the livelihoods of the fishermen dependent on the SMF, and their adaptation strategies, are reflected in Fig. 1 – there were multiple responses about the impacts of COVID-19 on the livelihoods. More than 90% of the participants reported a significant reduction in both income and

consumption as they could not continue fishing or crabbing (84.2% in the SMF due to losing their regular jobs (56.6%), i.e. the extraction of forest-based fisheries resources, including fish and crab, for livelihood. The reduction of involvement in income-generating activities (IGAs) by family members (47.4%) has further deepened the reduction of household income. To adjust to the unanticipated socio-economic circumstances, the fishermen used a few alternative strategies, such as borrowing money (82.9%) from local moneylenders and sometimes from relatives, selling key resources including fishing nets or boats (77.6%), working for others as day laborers (60.5%), changing occupations (52.6%), stopping educational expenditure for children (43.4%), selling other assets from the household including livestock or ornaments (22.4%), or forcing young family members to work as day laborers (10.5%). Some were forced to split their extended families (11.8%), while a few married off their children (3.9%) to reduce the burden on household expenditure and to adjust to the unforeseen event of the COVID-19 pandemic.

The participants of the FGDs, when asked about the impact of COVID-19 on their livelihoods and their adaptation strategies, expressed their discontent with the changing socio-economic conditions. The young men started working for others as day laborers, while some worked on their own farmlands and others even went to nearby towns for work. The older participants, in contrast, had nothing to do due to their growing age. They barely had any alternatives for managing their hardship during the pandemic, other than borrowing money from local moneylenders and in some cases from non-governmental organizations (NGOs). When they were asked about their coping strategies, they responded:

“Coronavirus is giving us an awfully hard time (FGD 3, P5). We did not have any work suitable for us to do (FGD 1; P5 and FGD 2, P7), and hardly had any savings (FGD 1, P5; FGD 2, P7). I had to borrow money from my relatives in exchange for some belongings (FGD 1; P5), while I borrowed some rice from my neighbor to feed my family (FGD 2, P7). The local moneylenders lent me some money (FGD 2, P1), while I borrowed some from local NGOs (FGD 3, P1). I had to stop sending my kids to private tuition (FGD 2, P3) as I could not bear the cost (FGD 2, P1). If you do not believe me, come with me to the bazaar, check the record books of the shopkeepers. Then, you will realize how much debt I have (FGD 2, Participant 3).”

To adapt to the changing circumstances, the fishermen of the SMF had been forced to sell some of their household assets (see Table 3), including televisions (1.4%), bicycles (1.3%), boats (1.3%), livestock (1.3%), poultry (1.3%), and even land (1.3%). Meanwhile, their dependence on borrowing money from moneylenders or relatives had doubled (from 31.6% pre-COVID-19 to 76.3%) in the previous eight to nine months.

Reduction in income or loss of a job immediately affected the fishermen's households' capacity to afford daily necessities. Table 4 shows

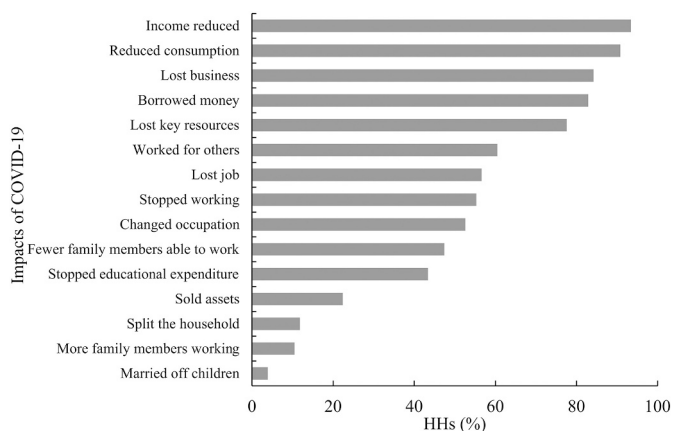


Fig. 1. Impacts of COVID-19 on the livelihood of the SMF dependent fishermen communities in the coastal areas of Bangladesh. Here,  $N = 76$ .

Table 3

Changes in the household assets of SMF dependent fishermen communities due COVID 19 in the coastal areas of Bangladesh. Here,  $N = 76$ .

Household assets	Pre-COVID-19 (%)	During COVID-19 (%)	Change (%)
Radio	5.3	5.3	0.0
Television	13.2	11.8	-1.4
Electric fan	69.7	69.7	0.0
Sewing machine	6.6	6.6	0.0
Wooden furniture	56.6	56.6	0.0
Bicycle	11.8	10.5	-1.3
Motorcycle	2.6	2.6	0.0
Boat	39.5	38.2	-1.3
Mobile	98.7	98.7	0.0
Cow	7.9	6.6	-1.3
Goat	18.4	18.4	0.0
Poultry	59.2	57.9	-1.3
Land	39.5	38.2	-1.3
Loan	31.6	76.3	44.7

**Table 4**

Impacts of COVID 19 on household capacity to maintain livelihoods of SMF dependent fishermen communities in the coastal areas of Bangladesh. Here, N = 76.

Household capacity to maintain livelihoods	During COVID-19 (%)
Staple foods	95.9
Transport	95.9
Other food items	90.5
Communication	90.5
Street meals	81.1
Household items	79.7
Fuel	78.4
Rent	75.7
Educational expenses	75.7
Health expenses	70.3
Water	64.9
Electricity	55.4
Support the relative	55.4

that more than 90% of the fishermen experienced a reduction of household expenditure on essential food and transport (95.9%) as well as other food items and communication (90.5%). They also reduced spending money on street food from roadside vendors (81.1%). The capacity to spend money on other household items such as soap, powder etc. (79.7%), fuel (78.4%), rent (75.7%), water (64.9%), and electricity (55.4%) reduced significantly. Moreover, the households of the fishermen also minimized their spending on education (75.7%) and health (70.3%) in order to re-adjust to the economically changed conditions. Their strained financial conditions also forced them to stop supporting relatives (55.4%) who were under economic stress.

Table 5 shows the overall health status of the participants before and during the ongoing COVID-19 pandemic. Apparently, ailments such as fever (67.3%), cough (50%), headache (28.8%), and cold (61.5%) – the general symptoms of COVID-19 – had increased among fishermen living in or around the SMF. Another symptom – loss of smell or taste (25%) – was also reported by the participants; however, none of them had been tested for COVID-19. Surprisingly, certain other health conditions, including forms of disease that were more common among fisheries resource-dependent communities (FRDCs) such as aches and pains, respiratory issues, diarrhea, gastrointestinal problems, water-borne diseases, and skin/eye/ENT problems reduced significantly.

When the participants of the FGDs were asked about their health status and healthcare-seeking behavior during the COVID-19 pandemic, most of them could not differentiate between the coronavirus infection and the seasonal flu.

“We do not know who is getting affected and who is not. We generally have the tendency of getting caught by cold or cough and even fever when the season changes. However, we learned about the symptoms of coronavirus infections from television and from YouTube (chuckles) (FGD 1, P7).”

Some participants reported that a few villagers had shown symptoms of COVID-19 in their local areas; however, none of them had been tested

**Table 5**

Changes in health status of SMF dependent fishermen communities due to COVID 19 in the coastal areas of Bangladesh. Here, N = 76.

Illness	Pre-COVID-19 (%)	During COVID-19 (%)
Fever	54.5	67.3
Cough	34.5	50.0
Headache	21.8	28.8
Cold	36.4	61.5
Aches and pain	63.6	57.7
Respiratory	16.4	7.7
Diarrhea	9.1	1.9
Gastrointestinal	49.1	34.6
Skin/Eye/ENT	21.8	9.6
Water-borne	16.4	9.6
Smell or tastelessness	0.0	25.0

at the COVID-19 testing centers or visited the trained MBBS doctors. They were afraid that if they were identified as having been infected with COVID-19, they would be abandoned by their family members, or their families would be socially excluded from the rest of the village. As an alternative, they relied on indigenous knowledge-based treatment, visited the village quack doctors, and sometimes sought modern medicines from local pharmacies.

“When the coronavirus pandemic was at its peak, we did not disclose our illness (FGD 2, P1 and P7); rather our family members took good care of us and we sought help from pharmacies (FGD 2, P7), village quack (FGD 1, P5) or ate Indian pennywort to get well, as we were panicked about our family (FGD 2, P1) and we could not afford the medical treatment (FGD 1, P5).”

Despite the presence of COVID-19 symptoms among the participants, the findings suggest that healthcare-seeking behavior decreased among the fishermen of the SMF (from 75% pre-COVID-19 to 55.3% during the pandemic). The participants opted to self-care (a 14.4% increase from the pre-COVID-19 period) rather than visiting a qualified allopath (trained doctor) for treatment (a 14.5% decrease from the pre-COVID-19 period – see Table 6). The fishermen preferred to seek medical assistance from local pharmacies (a 14.5% increase) and administer self-treatment (a 3.9% increase) rather than seeking medical aid from public or private hospitals (10.5% and 6.6% decreases, respectively). The findings also show that overall medical expenditure had decreased from pre-COVID-19 levels, and that most of the households spent borrowed money on medical treatment when necessary; they were reluctant to spend money from the household income.

#### 4. Discussion

The management measures to contain the spread of the COVID-19 virus, such as imposing travel restrictions, shutting down the transit and transport systems, and closing public spaces and educational institutions (Bhuiyan et al., 2020; Chen and Yuan, 2020) were implemented to reduce the spread of COVID-19. However, the mobilization of these strict anti-epidemic measures has had a substantial impact, not only on the wellbeing of people (Hossain et al., 2020; Islam et al., 2020c; Khan et al., 2020; Kumaran et al., 2021) but also on the environment. For example, the COVID-19 induced global lockdown has resulted in the reduction of air CO<sub>2</sub> level (Mukherjee et al., 2020) and minimized the waste discharge in water bodies (Chakraborty et al., 2020; van Senten

**Table 6**

Healthcare seeking behavior of SMF dependent fishermen communities in pre and during COVID-19 in the coastal areas of Bangladesh. Here, N = 76.

Healthcare seeking behavior	Pre-COVID-19 (%)	During COVID-19 (%)	Change (%)
Care sought			
Yes	75.0	55.3	−19.7
No	25.0	44.7	19.7
Nature of treatment			
Self-care	13.2	27.6	14.4
Traditional	3.9	3.9	0.0
Unqualified allopath	50.0	52.6	2.6
Qualified allopath	30.3	15.8	−14.5
Para-professional	2.6	0.0	−2.6
Place of treatment			
Government Hospital	27.6	17.1	−10.5
Private Clinic	7.9	1.3	−6.6
Pharmacy	52.6	67.1	14.5
Homeopath	0.0	0.0	0.0
Religious Persons	5.3	5.3	0.0
Self-treatment	5.3	9.2	3.9
Other	1.3	0.0	−1.3
Sources of treatment cost			
Household income	93.4	84.2	−9.2
Loan	6.6	15.8	9.2
Cost of treatment (in BDT)	1282 (2278)	1153 (2094)	−159

et al., 2020). In contrast, the substantial increase in medical waste, as well as the unsustainable use and disposal of sanitizers, masks, gloves, and untreated waste during the ongoing pandemic, is causing a significant threat to the environment (Das et al., 2021; Rume and Islam, 2020).

The COVID-19 pandemic is, indeed, distressing public health and causing unprecedented disruption to human lives (Rume and Islam, 2020; Sakamoto et al., 2020), particularly for marginalized people such as FRDCs and enterprises in the forest sector (FAO, 2020a, 2020b, 2020c; Lima et al., 2021). The lockdown measures, together with the international ban on transition and export-import, have had an instant impact on the supply and demand of forest resources, especially fisheries resources at regional, national, and international levels (FAO, 2020c; Chanrachkij et al., 2020; Kaewnuratchadasorn et al., 2020). As in other countries, the FRDCs in Bangladesh are going through an unprecedented social and economic hardship, which is affecting their lives and livelihoods, including their health status and healthcare-seeking behavior (Lima et al., 2021). Though the government has taken some emergency measures to minimize possible economic losses (Zabir et al., 2020), unfortunately, the FRDCs of the SMF – who completely rely on resource extraction from the mangrove forest – have been totally overlooked.

In the SMF, a significant percentage of FRDCs rely on fishing for their livelihoods (Habib et al., 2020; Hasan and Naser, 2016). Unfortunately, the COVID-19 pandemic has heavily affected the fisheries and aquaculture value chain, including the fish, crab, and shrimp culture sectors (FAO and ECLAC, 2020), and has ultimately unsettled the local market. Correspondingly, this study has noticed that small-scale fishers in the SMF have been vulnerable and negatively affected due to the COVID-19 pandemic. They have experienced a decline in total catch weight and also in price per kilogram of fish, which has led to a large decrease in total catch value of fish. Although catch quantity and value varies throughout the year, pandemic quantity and value has fallen along a negative curve, regardless of inter-annual differences. Because of the restrictions on mobility, delay or absence of transportation, and frequent cancellation of orders, the fishermen have lost their livelihoods, as they have not been able to sell their collected fish and crabs for the expected price and have instead been obliged to sell at a minimal price (Sunny et al., 2021). Moreover, the growing prejudice towards fish products among consumers (Ben Hassen et al., 2021; Fiorella et al., 2021) has also contributed significantly to the reduction in domestic consumption (Mandal et al., 2021; Sunny et al., 2021). Furthermore, the study has found that the price of aquatic resources has decreased substantially in the absence of demand from local and international markets. As a result, most of the fish processing and distribution companies have been forced to shut down their operations due to lack of purchase orders (FAO, 2020a).

COVID-19 has caused shockwaves in many societies (Ruszczyk et al., 2020), including among the fisheries sector of the SMF after the country was forced into strict lockdown. In general, fishermen and crab catchers have been the hardest hit. They have been plagued by fear (about becoming infected by the virus) and uncertainty (about when their livelihoods will return to normal). Notably, at the beginning of the outbreak of COVID-19 in Bangladesh, the fishermen could not enter the forest to collect fish and crabs, as the government had imposed a strict ban on entering (Lima et al., 2021). A few months later, they were able to start catching fish and crabs on a regular basis, but it was still less than the usual amount of time. The resulting small catch of fish and crabs, combined with the low price of their collected resources in domestic and foreign markets (FAO, 2020a; Fiorella et al., 2021; Sunny et al., 2021), means that they can barely afford daily necessities such as food, household items, medicine, and education. The absence of demand for certain fishing products, particularly crabs, has also had detrimental impacts on the production and supply value chain. In Bangladesh, which is a predominantly Muslim country, people have a negative perception of consuming crabs, largely due to religious values. Therefore, the decline in exporting crabs to countries such as China, Hong Kong, and Singapore has affected the people involved in crab production and

harvesting. With the relaxation of restrictions on fishing and exporting crabs, it was expected that the collection and marketing chain would return to normal, but this did not happen in the SMF. The FAO (2020a) has stressed that the decreased demand for fish and related goods and services has negatively affected the income and well-being of fishermen; it is estimated that this will continue.

The findings of both the survey and FGDs suggest that nearly all the fishermen had experienced a financial loss, and thereby were bound to reduce their consumption. Moreover, a large portion of fishermen had lost their business or livelihood and had become day laborers or been forced to change their century-old ancestral occupation. This has had a substantial impact on the household level, especially in terms of affordability of food and other essential amenities (Lima et al., 2021; Sunny et al., 2021). In the long run, this might lead to massive cases of malnourishment, especially among women and children (Fiorella et al., 2021). The results also indicate that the fishermen were more susceptible to seasonal flu symptoms such as fever, cough, headache, and cold, which is probably an indicator that inadequate food supply has made their immune systems weaker. Moreover, interaction with other people during fishing or crabbing could be a risk factor for COVID-19 exposure (Fiorella et al., 2021). Due to the growing unemployment and minimal work opportunities caused by COVID-19, the fishermen have relied on local moneylenders for cash at a higher rate of interest to survive, and it is likely that this will eventually lead these already marginalized people into a more vicious cycle of poverty. In a recent study, FAO (2020a, 2020b, 2020c) reported that in order to pay for basic amenities as well as to treat ailments, fishermen were borrowing money from different sources, including NGOs and local moneylenders, at a high interest rate. In addition to their crippled financial conditions, the fishermen could not afford a minimum standard of living or basic amenities including food, education, shelter, and health services.

Sustainable collection, production, and trade of forest resources by FRDCs and authorities is essential for building on the advancement made in the direction of the 2030 Agenda for Sustainable Development Goals, especially poverty eradication (Sakamoto et al., 2020). The adverse impacts of the COVID-19 crisis on the production and trade of forest products have already put essential livelihoods and industries at risk, particularly in developing countries where a large number of people directly or indirectly depend on forest resources (DESA, 2020). As the forest region is traditionally seen as more resilient, it can play a vital role in social and economic recovery in the aftermath of the pandemic (FAO, 2020b). Therefore, the fisheries and aquaculture sectors need short-term and long-term support actions, for example providing financial and knowledge-based support to resource-dependent people in order to help them adopt alternative livelihoods and introduce local knowledge-based technology and innovation (FAO and ECLAC, 2020; Sunny et al., 2020). From the above discussion, it is evident that COVID-19 has had a significant impact on fishermen's livelihoods, health status, and healthcare-seeking behavior, and that they have adopted different mechanisms to cope with the pandemic situation (Fig. 2).

## 5. Conclusion

This study was aimed at identifying the livelihood and healthcare-related challenges encountered by fishermen dependent on the SMF, as well as their coping mechanisms. The findings have revealed that the COVID-19 induced disruptions have substantially impacted the livelihood opportunities of the fishermen by reducing their income and other life chances and opportunities. Despite their high risk of being infected by COVID-19, the fishermen were unable to seek medical assistance from trained doctors or other healthcare services for even minimal support, largely due to their financial struggle. Therefore, in order to change their lives and promote the goals of sustainable development, the SMF-dependent fishermen could be supported in two distinct phases. Short-term support could include: (i) providing financial support to



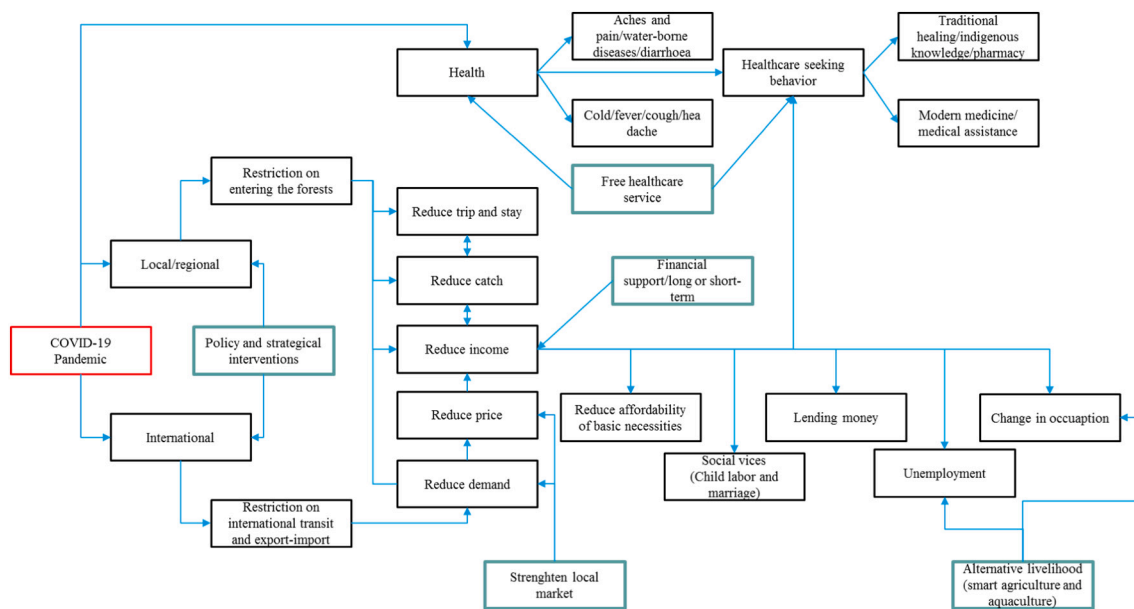


Fig. 2. Impact of COVID-19 on livelihood and adaptation strategies of the fishermen in the Sundarbans mangrove forest of Bangladesh.

fishermen who are truly dependent on resource extraction from the Sundarbans if the government imposes restrictions on entering the forest; (ii) providing soft loans so that fishermen can overcome this adverse situation without having to pay interest; (iii) strengthening the local market value chain through the development or improvement of transport services, as well as creating local demand for certain fisheries products such as crabs and oysters; and (iv) providing free emergency healthcare services to poor families in the Sundarbans through community clinics or by organizing a healthcare service campaign. Long-term support could include: (i) providing financial support for fishermen to adopt alternative livelihoods through an institutional process with low or no interest rates; (ii) introducing local knowledge-based climate-resilient smart agriculture and aquaculture technology and

innovation; and (iii) developing policies and strategies to tackle health and other emergencies in order to adjust to “new normal” situations. The assessment of the long-term impacts of the COVID-19 pandemic on the livelihoods, adaptation strategies, health status, and care-seeking behavior of SMF-dependent fishermen is imperative and recommended in order to monitor the progress towards sustainable development.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Appendix A. Interview schedule**

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A. Geographical Location

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A1. Village: \_\_\_\_\_ A2. Union: \_\_\_\_\_  
 A2. Upazila: \_\_\_\_\_ A4. District: \_\_\_\_\_  
 A5. Mobile No.: \_\_\_\_\_

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B. Personal details

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B1. Name of the Participant: \_\_\_\_\_  
 B2. Age (in Year): \_\_\_\_\_  
 B3. Sex: 1 Male 2 Female  
 B4. Religion: 1 Islam 2 Sanatan/Hindu 3 Others \_\_\_\_\_  
 B5. Education (in Year): \_\_\_\_\_  
 B6. Ethnicity: 0 Bengali 1 Munda 2 Others \_\_\_\_\_  
 B7. Marital Status: 1 Unmarried 2 Married 3 Divorced 4 Widowed/Widower  
 B8. Occupation: \_\_\_\_\_  
 B8.1 Primary Occupation: \_\_\_\_\_  
 B8.2 Secondary Occupation: \_\_\_\_\_  
 B8.3 Other Occupation: \_\_\_\_\_

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C. Details about Earning Family Members

Sl. No.	Relation with Respondent	Education	Occupation	Income
C.1				
C.2				
C.3				
C.4				
C.5				

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C. Details about Earning Family Members					
Sl. No.	Relation with Respondent	Education	Occupation	Income	
C.6					
C.7					
C.8					
C.9					
C.10					
D. Information about Household Assets					
Items	Pre-COVID-19		During COVID-19		Sell Assets
	Response	Quantity/Amount	Response	Quantity/Amount	
Radio					
Television					
Electric Fan					
Sewing Machine					
Wooden furniture					
Bi-cycle					
Motorcycle					
Boat					
Mobile					
Cow					
Goat/Sheep					
Poultry					
Land (in Decimal)					
Loan					
Others					
E. Other Socioeconomic Indicators					
Construction Materials of House:			1 Earth 2 Wood/Bamboo 3 Corrugated Teen 4 Brick/Concrete 5 Straw/Golpata		
Sources of Water:			1 Pond/Lake/River 2 Well 3 Bottled/Jar 4 Piped		
Sanitation Facility:			1 Open/Bush/Field 2 Pit Latrine 3 Toilet 4 Others _____		
Sources of Power:			1 Kerosene 2 Solar Energy 3 Electricity 4 Others _____		
Number of Room:			1 One 2 Two 3 Three 4 Four 5 Five and more		
F. Sundarbans Forest-related Income					
Questions	Pre-COVID-19 (Six Months Prior March 2020)		During COVID-19 (After March 2020)		
F.1 What are the resources you collect from the SMF ecosystem that contribute to your livelihood?					
F.2 Resource (See Code)					
F.3 Duration of permit (BLC) in each season or year for resource collection (days or months/season)					
F.4 Name the month of resource collection					
F.5 Average distance of collection point from your HH (km)					
F.6 Number of trips per season (trips/season)					
F.7 Average stay in SMF ecosystem per trip (days/ trip)					
F.8 Expenditure (BDT/ trip)					
F.9 Major heads of expenditure with % of expenditure					
F.10 Quantity of collected resources per trip (Unit)					
F.11 Challenges in collection of resources (challenges in decreasing order of ranking)					
F.12 Ways to overcome the challenges in resource collection					
F.13 Selling/ trading point					
F.14 Quantity of sold resources (Unit)					
F.15 Unit price (BDT/unit)					
F.16 Income (BDT/ trip)					
F.17 Challenges in selling/ trading of resources (challenges in decreasing order of ranking)					
F.18 Ways to overcome the challenges in resource selling/ trading					
Code: F.2 01 – Fishing, 02 –Crab & Shrimp Fry					
G. Coping strategies in livelihood of SMF dependent communities					
Questions	Pre-COVID-19 (Six Months Prior March 2020)		During COVID-19 (After March 2020)		
G.1 What are the strategies you sought to cope with?					
G.2 Who is mainly responsible for the work?					
G.3 Area for cultivation (Decimal)/farming/rearing					
G.4 Own land (Dec)/livestock/poultry					
G.5 Lease land (Dec)					
G.6 Period of alternative activities (example: June to December)					
G.7 Expenditure (BDT/season)					
G.8 Major heads of expenditure with % of expenditure					
G.9 Quantity of the produced (Unit)					
G.10 Challenges in alternative activities (challenges in decreasing order of ranking)					
G.12 Selling/ trading point					
G.13 Quantity of sold resources (Unit)					
G.14 Unit price (BDT/unit)					

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G. Coping strategies in livelihood of SMF dependent communities					
Questions	Pre-COVID-19 (Six Months Prior March 2020)	During COVID-19 (After March 2020)			
G.15 Income (BDT/ season)					
G.16 Ways to overcome the challenges in resource selling/ trading					
Codes: G.1 01 – Agro-farming, 02 – Home gardening, 03 – Aqua-farming, 04 – Livestock rearing, 05 – Poultry farming,					
G2: 1 Self, 2 Spouse 3 Children, 4 Father, 5 Mother, 6 Siblings 7 Others;					
G4. 1 Own, 2 Lease, 3 Both					
H. Impact of COVID-19 on Livelihood (The following are the questions on the impact of COVID-19 on the livelihood opportunities. The answers are in a Two-point Thurstone scale – ‘1’ = ‘Yes’ to ‘0’ ‘No.’ Read the questions carefully and record the response)					
Questions	Pre-COVID-19 (Six Months Prior March 2020)		During COVID-19 (After March 2020)		
	Yes	No	Yes	No	
Lost job permanently					
Lost business					
Lost key resources					
Fewer family members able to work					
Income reduced					
Changed occupation					
Stopped working					
Sold assets					
Borrowed money					
Reduced consumption					
More family members working					
Split the household to reduce the burden					
Married off children					
Worked for other persons					
Stopped funding educational expenditure					
I. Household's Capacity to Maintain Livelihoods (The following are the questions on the capacity of the household to maintain the livelihood. Read the questions carefully and record the response)					
Items	Affordability		Changes in Quantity during COVID-19		
	Yes	No	More	Less	No Change
Staple foods (Rice, Oil, Lentils, Vegetables, Onion, Sugar etc.)					
Other foods (Milk, Meat, Fish etc.)					
Household items (Soap, Washing Powder, Shampoo etc.)					
Fuel (Wood, Kerosene)					
Electricity					
Water					
Rent					
Education (School and Tuition Fees, Uniforms etc.)					
Transport					
Communication					
Street meals					
Health expenses (Medicine, Doctor/Quack etc.)					
Support to Relatives					
J. Health Status and Care-seeking Behavior (The following are the questions on health status and care-seeking behavior. Read the questions carefully and record the response)					
Pre-COVID-19		During COVID-19			
J.1.1 Illness		J.1.2 Illness			
<ul style="list-style-type: none"> <li>• Fever, Cough, Headache, Cold</li> <li>• Fever</li> <li>• Cough</li> <li>• Headache</li> <li>• Cold</li> <li>• Aches and Pain</li> <li>• Respiratory (Asthma)</li> <li>• Smell or Tastelessness</li> <li>• Diarrhea</li> <li>• Gastrointestinal</li> <li>• Skin/Eye/ENT</li> <li>• Water-borne</li> </ul>		<ul style="list-style-type: none"> <li>• Fever, Cough, Headache, Cold</li> <li>• Fever</li> <li>• Cough</li> <li>• Headache</li> <li>• Cold</li> <li>• Aches and Pain</li> <li>• Respiratory (Asthma)</li> <li>• Smell or Tastelessness</li> <li>• Diarrhea</li> <li>• Gastrointestinal</li> <li>• Skin/Eye/ENT</li> <li>• Water-borne</li> </ul>			
J.2.1 Duration_____		J.2.2 Duration_____			
J.3.1 Care-sought: 0 No 1 Yes		J.3.2 Care-sought: 0 No 1 Yes			
J.4.1 Nature of Treatment		J.4.2 Nature of Treatment			
<ol style="list-style-type: none"> <li>1. Self-care</li> <li>2. Traditional</li> <li>3. Unqualified Allopath</li> <li>4. Qualified Allopath</li> <li>5. Para Professional</li> </ol>		<ol style="list-style-type: none"> <li>1. Self-care</li> <li>2. Traditional</li> <li>3. Unqualified Allopath</li> <li>4. Qualified Allopath</li> <li>5. Para Professional</li> </ol>			
J.5.1 Place of Treatment		J.5.2 Place of Treatment			

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J. Health Status and Care-seeking Behavior (The following are the questions on health status and care-seeking behavior. Read the questions carefully and record the response)	
Pre-COVID-19	During COVID-19
1. Government Hospital	1. Government Hospital
2. Private Clinic	2. Private Clinic
3. Pharmacy	3. Pharmacy
4. Homeopath	4. Homeopath
5. Religious Persons	5. Religious Persons
6. Self-treatment	6. Self-treatment
7. Other _____	7. Other _____
J.6.1 Cost of Treatment _____	J.6.2 Cost of Treatment _____
J.7.1 Sources of Treatment Cost _____	J.7.2 Sources of Treatment Cost _____
Codes: Response – Yes/No; Duration – in days; Care-sought – Yes/No; Treatment - Self-care/Traditional/Unqualified Allopath/Qualified Allopath/Para Professional; Place - 1 Private Clinic/Government Hospital/Pharmacy/Drugstore/Home; Cost – in BDT; Sources of Treatment – Income/Borrowed Money	

## Appendix B. FGD guideline

### B.1. Personal information

Name of respondents	:		:
Gender	:	Village	:
Ethnicity	:	Union	:
Age (Years)	:	Upazilla	:
Education (Years)	:	District	:
Primary occupation	:		:
Secondary occupation	:		:
Other occupation	:		:
Mobile no	:	Date	:

### B.2. Questions for livelihood vulnerabilities

- What are the resources you collect from Sundarbans? What is the resource that mainly contribute to your livelihood?
- In what process you collected resources in pre-covid period? What are main challenges in collecting and selling resources in pre-covid period?
- During covid-19 how do you collect resources? What are the main challenges in collecting resources?
- How you transport and sell resources and what is the condition of income during covid-19?
- What is the impact of these livelihood vulnerabilities on your family member?
- How do you cope with these livelihood vulnerabilities and what challenges you face regarding this?
- What could be the solution to reduce these livelihood vulnerabilities?

### B.3. Questions for health vulnerabilities

- What are the major health problems usually you face? Describe the process of treating health problems?
- During covid-19 what health problems are you facing? Describe the process of how do you deal with these health problems?
- Are you stressed about covid-19? Tell us what do you feel?

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