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Impacts, Diversity, and Resilience of a Coastal Water Small-Scale Fisheries Nexus during COVID-19: A Case Study in Bangladesh

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Abstract: The COVID-19 pandemic has profoundly affected many world regions' coastal social-ecological systems (SESs). Its extensive consequences have exposed flaws in numerous facets of society, including small-scale coastal fisheries in developing countries. To this extent, by focusing on two coastal districts in Bangladesh, namely Chittagong and Cox's Bazar, we investigated how the lockdown during COVID-19 impacted small-scale coastal fishers in Bangladesh and which immediate measures are required to develop and implement insights, on the role of the scale of governance attributes, in facilitating or impeding the resilience of small-scale fisheries (SSFs). We analyzed both qualitative and quantitative data obtained through semi-structured, in-depth individual interviews (n = 120). Data were further validated using two focus group discussions in the study areas. The impact of the pandemic on the fishers' livelihood included halting all kinds of fishing activities; limited time or area for fishing; livelihood relocation or alternative work; low fish price; fewer fish buyers, causing difficulty in selling; and travel or free-movement restrictions. Additionally, the study discovered several coping skills and found that the most prevalent coping strategy against the effect of the COVID-19 pandemic was to take out loans (48%) from different organizations and NGOs and borrow money from relatives, neighbors, friends, or boat owners. Finally, the current research analysis identified possible recommendations to enhance the resilience of coastal fishers during COVID-19, emphasizing arrangements that should be made to provide alternative livelihood opportunities for coastal fishermen via need-based training, technical and vocational education and training, and microcredit to keep them afloat and earning during the pandemic, not relying only on fishing.

Keywords: COVID-19; small-scale fisheries; impact; coping strategies; alternative livelihood possibilities

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1. Introduction

COVID-19 is an infectious and deadly disease caused by SARS-CoV-2, coronavirus. This virus was first identified in Wuhan, China, on 1 December 2019, and then spread to other parts of the world, including Bangladesh [1]. The COVID-19 pandemic has profoundly affected many world regions' coastal social-ecological systems (SESs) [2,3]. Its extensive consequences have exposed vulnerabilities in various facets of society, including food and ecological systems. Though many governments have supported most of the impacted sectors and societies, governments' assistance to small-scale sectors has been less definitive in developing countries [4]. This may be a consequence of the limited information on the small-scale fisheries (SSFs) sector's economic impacts from the COVID-19 pandemic.

SSFs lie primarily in the blue economy's decentralized and fragmented informal and productive sector. Thousands of independent actors are involved, including owner-operators, microenterprises, and small businesses that fish, process, and trade across a broad network of markets, largely without the use of conventional financial records or without linking financial institutions [5]. This leads to the sector's systematically imprecise employment and economic data outputs. Due to a lack of data, the government is unable to identify, quantify, and respond to the effects of economic shocks in the informal sector and may lack mechanisms to provide sufficient economic stimulus packages to affected households and small businesses, given their exclusion from formal financial systems [6].

An estimated 32 million people work directly as small-scale fishers, while another 76 million work in post-harvest activities, and 81% of the catch is consumed locally [7]. While SSFs vary substantially by locality, region, and country, some defining characteristics include smaller vessels and engines, simpler or more traditional gears, proximity to the coast, smaller crews, family or local ownership, and importance for local livelihoods and subsistence [8]. The overall effects of COVID-19 further marginalize many SSFs and coastal communities already vulnerable to many social and environmental changes [9]. Negative impacts on the fisheries sector include the closure of some fisheries, market disruptions, increased health risks for coastal communities, exacerbated vulnerabilities to marginalized groups, and increased illegal and unregulated fishing [10]. As an illustration, suppose the COVID-19 pandemic continues in this manner. Crop, aquatic food, and livestock production will be impacted in such a case, including wheat, rice, vegetables, fish, shellfish, eggs, meat, and dairy [11].

Bangladesh is a lower-middle-income Southeast Asian country. The country's economy is based on agriculture, organized into three subsectors: agricultural production, fisheries, and livestock [12]. Bangladesh is currently battling the negative impact of COVID-19, which is crippling the economy by disrupting the industry, poultry, dairy, agricultural, and marine food systems, directly or indirectly threatening the livelihoods of dependent communities [13]. Furthermore, due to the presence of inland open water (capture fishery), inland closed water (culture fishery), and maritime fisheries in Bangladesh, fish play a critical role in the country's nutrition [14].

Bangladesh is one of the world's largest fish producers, producing 4,276,641 MT of fish, of which 1,216,539 MT (28%) come from inland open waters, 2,405,415 MT (56%) from inland confined waters, and 654,687 MT (16%) from coastal fisheries [15]. Bangladesh provides 62.58 g of fish per person per day as part of their daily diet, accounting for 60% of their animal protein intake [16]. The fisheries sector not only contributes 3.57% of the national GDP and more than one-fourth (25.30%) of the agricultural GDP, but it also contributes 3.57% of the national GDP and more than one-fourth (25.30%) of the agricultural GDP for socioeconomic status shaping [17]. Bangladesh is ranked third in the production of inland open water capture fisheries and fifth in the value of global aquaculture production [18]. However, natural disasters such as droughts, floods, heavy rains, storms, and hurricanes pose considerable barriers to fisheries' output [19]. Additionally, the recent global coronavirus pandemic has served as a thundering signal to the country's fisheries sector.

While COVID-19 did not directly affect aquatic food production in Bangladesh, it did complicate transportation, and the lack of buyers resulted in an abnormal decline in the prices of fisheries' products [13]. Thus, not only are fishers, fish farms, retailers, wholesellers, and other members of the aquatic value chain directly impacted, but the country's whole blue economy is also threatened. Achieving food and nutrition security and a sustainable blue economy is Bangladesh's top priority and most significant challenge [19]. Though different scientific studies have addressed the response of Bangladesh related to the COVID-19 issue, few reports are available on the disruption to SSFs in Bangladesh due to the COVID-19 pandemic [13,20–22]. COVID-19 cases may indirectly and directly impact fishing communities across the coastal regions of Bangladesh through trade disruptions, infected people being unable to work, and government response policies [23,24].

Additionally, the coastal SSFs nexus under the ongoing COVID-19 crisis should be evaluated, as it can contribute to the resilience of coastal SESs and linked aquatic food systems [25]. The pandemic and its consequences necessitated a greater emphasis on resilience, notably in aquatic food systems and long-term recovery efforts [26]. Understanding the effects and responses of pandemic and lockdown conditions on local coastal SSFs can be enhanced by understanding the traits and mechanisms that result in vulnerabilities and resilience [27]. Resilience is a system property that enables the system to restructure itself in response to change to preserve its functions and dynamics in the face of a shock or perturbation [28]. It is defined by the system's adaptability and potential for transformation and reform if current circumstances become unacceptable [29]. Coping methods, which contribute to resilience, are ways for people or organizations to mitigate the negative consequences of shocks or stressors [30]. These tactics have been critical in enabling people to safeguard and maintain a sense of well-being, for example, by figuring out how to acquire food and other necessities amid the restricted conditions imposed by the COVID-19 lockdowns [31].

The primary goal of the present study is to investigate how small-scale coastal fishers of Bangladesh and their households cope with the adverse situation due to COVID-19. To accomplish this primary goal, the following research questions are posed:

- How has the lockdown during COVID-19 impacted small-scale coastal fishers in Bangladesh?
- Which immediate measures are required to develop and implement insights on the role of the scale of governance attributes in facilitating or impeding SSF resilience?

2. Methods

Study areas—The present study was conducted in the southeastern coastal region of Bangladesh, focusing on mainly two coastal districts, namely Chittagong and Cox's Bazar (Figure 1). Both industrial (trawling) fishing and artisanal (small scale) fishing take place in the southeastern coastal regions of Bangladesh, which mainly focus on coastal and marine fisheries. Further, most marine fish landing and processing operations occur in this region. Most importantly, of the total national fish production (in 2018–2019), approximately 15.05% comes from coastal and marine fisheries, among which small-scale fishing contributes almost 12.61% [32]. Therefore, in the Chittagong district, we conducted our survey in five places (Sitakunda and Sandwip Island, Halishahar, Kotwali, and Patenga). In the Cox's Bazar district, we interviewed the fisher communities in Moheshkhali and Cox's Bazar Sadar Upazilas (Figure 1).

Methodology—We collected both primary and secondary data. Mixed approaches were applied to better understand the linkages or inconsistencies between qualitative and quantitative data. Additionally, these techniques enable participants to have a strong voice and share their experiences throughout the research process [33]. These included in-depth individual interviews (n-120) with general fishers (n-70), boat owners (n-10), money lenders (n-10), Upazila fishery officers (n-6), district fishery officers (n-2), Upazila Nirbahi officers (n-6), and other government and non-government representatives (n-16). In addition, two focus group discussions (FGDs) (n = 10) were also conducted from 15 March to 30 August 2021. In-depth interviews are advantageous when specific information about respondents' beliefs and behaviors is desired or when thoroughly investigating current concerns [26]. Each FGD was convened to bring stakeholders and their perspectives together on a shared platform. Questionnaires are included for the in-depth individual interviews (see Supplementary Materials). The interview respondents were chosen using purposive and snowball sampling strategies [34,35]. We explained our purpose for collecting the data and gained spoken informed consent.

The data were stored, evaluated, and then digitized for processing to conduct the quantitative data analysis. Excel and SPSS were used to analyze the data, and the results are presented in tabular format. Qualitative data analysis comprises three phases: preparing and arranging the data for analysis, reducing the data to themes, and expressing the

data in tables or as part of a conversation [36]. Following transcription of the qualitative data, the content was evaluated, and themes were developed and grouped into several explanatory variables. Secondary data were acquired from various scientific papers and related literature using an online search, depending on the search methods available in the bibliographic databases. Finally, the acquired data were thoroughly examined and synthesized, utilizing pertinent information [37].

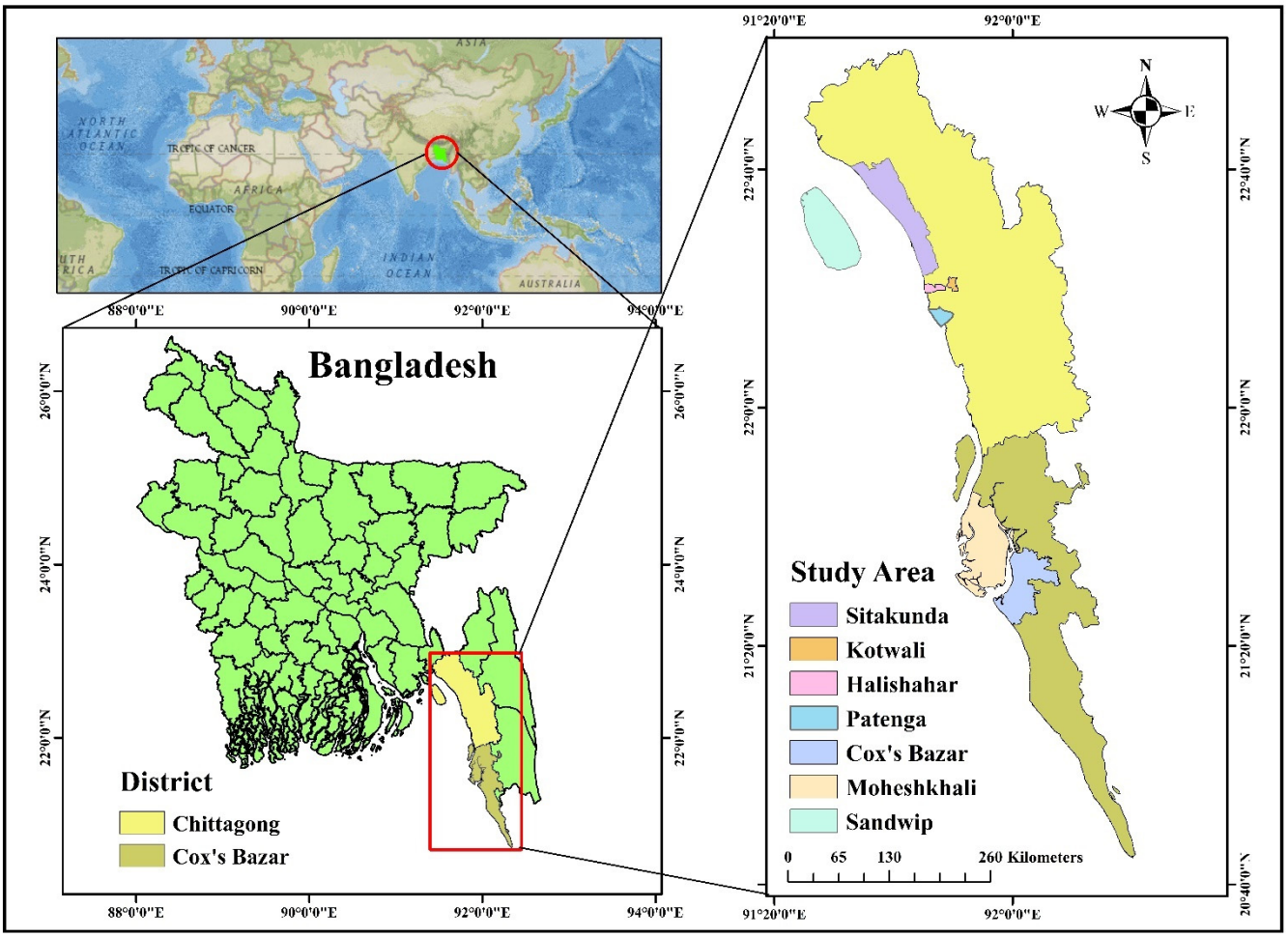

Figure 1. Study areas.

3. Results

3.1. Profile of the Respondents

3.1.1. Fisheries (The Price of Fish; The Number of Days, Hours, and Years Spent Fishing)

The average fishing experience of fishers was 22 years (Table 1), with the vastest experience being 55 years. The average weight of fish caught per fishing trip was 67 kg, with a highest catch weight of 209 kg. Price ranged from 50 BDT to 400 BDT (1 USD = 89 BDT), with an average of 200 BDT for all fish caught by individual fishers during the COVID-19 period.

Most of the fishers fished almost the entire week (7 days) with an average daily fishing time of 7 h, calculated from when they arrived at the fishing ground to when they caught their last fish. However, some fishers spent up to 20 h daily in the fishing ground for fishing purposes.

3.1.2. Networking (Involvement in Neighborhood Organizations; Fisherman's Family)

Around 83% of Chittagong's fishers engaged in fishing activities but were not members of a community organization, such as fisherfolk. In comparison, approximately half of Cox's Bazar's fishermen (55%) were active members of community organizations, while

the remaining did not belong to any. Around one-third of single-family members were involved in fishing activities, including the head of the household and their elder sons. Most of them were hereditary fishers, so their male child was engaged in fishing activities with seniors from a very early age.

Table 1. General fisher's profile.

Variables	Definition	Mean (Minimum, Maximum)
Age in years	Individual fishers' ages	42 (18, 70)
Education	Years of formal education	2 (0, 9)
Size of household (HHS)	Total number of family members	6 (3, 12)
Years fishing (years)	Years of experience as a fisherman	22 (1, 55)
Capture per voyage (kg/voyage)	The quantity or number of fish caught during a fishing voyage	67 (5, 209)
Hours spent fishing	The number of fishing hours between arriving at the fishing ground and the final fish caught	7 (1, 20)
The days of fishing	The number of days in a week that these fishermen work	6 (2, 7)
Per-unit-effort capture (CPUE; kg/days)	Catch per unit effort is calculated by dividing the number of fish caught (kg) every trip by the number of fishing hours.	23 (2, 105)
Price of fish (BDT)	Each fisher's average fish price for all species	200 (50, 400)
Daily expenditure (BDT)	Daily expenditure for fishing purposes, such as fuel, food, and ice	1365 (50, 7500)
Fishkeeping capacity (kg)	Individual boat's average fish keeping capacity	649 (100, 1800)
Revenue (BDT)	The total catch (kg) of a fishing trip is multiplied by the trip's average fish price (BDT).	13,322 (1000, 41,800)
Monthly income before COVID-19 (BDT)	Monthly income of fishers before COVID-19	24,452 (6330, 70,000)
Monthly income after COVID-19 (BDT)	Monthly income of fishers after COVID-19	2729 (0, 20,000)

3.1.3. Socioeconomic Characteristics (Age, Household Size, Years in the Community, and Years of Education)

The participants were between 18 and 70 years old, with a mean age of 42. Most of them were married, and their households ranged from 3 to 24 people, with an average of six people. Almost all the fishers interviewed were permanent residents of the studied areas, and these were generally Jele Para (areas consist of fishers' families only). They were hereditarily fishers who lived mainly in fishers' communities. Most fishers were illiterate or had only received an elementary education and could only write their name. However, some had completed secondary school up to grade nine (class 9).

3.1.4. Economic Outlook (Income, Credit Availability, Ownership of a Boat, and Property Ownership)

The average revenue of fishers was 13,322 BDT, and their daily highest expenditure for fishing activities was 7500 BDT (expenditure for several fishing purposes such as boat fuel, food, and ice). Only 28% of fishers had their own boat, whereas 72% worked on other boats. Most of the fishers had a tiny hut with limited facilities. Before COVID-19, their monthly income ranged from 6330 to 70,000 BDT, with an average of 24,452 BDT (1 USD = 89 BDT).

3.2. Fish Catch Characteristics

The most frequently caught species by fishers in the studied regions included the following: hilsha, shrimp, bata, bele/tank goby, Poa/Pama croaker, Loitta/Bombay duck, Chewa/bearded, worm goby, Rita, Barramundi, long-whiskered catfish, Gangetic hairfin

anchovy, Pangas catfish, Kachki/Ganges river sprat, pale-edged stingray, and small crabs. In addition, they caught a variety of fish prior to and following the pandemic, including shrimp, hilsa, bata, and poya (Table 2). Fishers typically caught a sufficient amount of fish before and after COVID-19. However, during the COVID-19 period, most of them passed their days sitting at home. Some occasionally went fishing, although there were lower fish catch volumes due to travel limitations, short stays at fishing grounds, and fewer working folks/laborers.

Table 2. Main fish species caught by the artisanal coastal fishers and average catch per day during COVID-19.

English Name	Fish Family	Fish Species	Frequency	Average Catch per Day/Total Weight (Kg)
Hilsha	Clupeidae	*Tenualosa ilisha*	46	25
Shrimp	Penaeidae	*Penaeus indicus*	61	9
Bata	Cyprinidae	*Labeo bata*	33	14
Bele/tank goby	Gobiidae	*Glossogobius giuris*	2	11
Poa/Pama croaker	Sciaenidae	*Otolithoids pama*	25	9
Loitta/Bombay duck	Synodontidae	*Harpadon nehereus*	21	14
Chewa/bearded worm goby	Gobiidae	*Taenioides cirratus*	19	20
Rita	Bagridae	*Rita rita*	1	20
Barramundi	Latidae	*Lates calcarifer*	8	15
Long-whiskered catfish	Bagridae	*Sperata aor*	15	10
Gangetic hairfin anchovy	Engraulidae	*Setipinna phasa*	14	7
Pangas catfish	Pangasiidae	*Pangasius pangasius*	2	15
Kachki/Ganges river sprat	Clupeidae	*Corica soborna*	10	20
Pale-edged stingray	Dasyatidae	*Dasyatis zugei*	16	15

3.3. Effect of COVID-19 on Fishers' Livelihood

When the government noted the severe spread of COVID-19 in Bangladesh, it immediately initiated enhanced community quarantine (ECQ) measures. In addition, a significant number of cities, municipalities, and coastal areas placed under lockdown imposed stringent movement and social gathering restrictions, significantly impacting fishers' livelihoods. The impact of the pandemic on the fishers' livelihoods included halting all kinds of fishing activities; a limited time or area for fishing; livelihood relocation or alternative work; low fish price; fewer fish buyers, which caused difficulty in selling; travel or free movement restrictions; or no effect.

During the pandemic, some fishermen could not catch any fish due to the lockdown and spent the day sitting. Others engaged in other activities such as band parties or agriculture farming, while others were unable to engage in any other activities. During the outbreak, fishers tried to collect and trade fish but could not do so due to travel restrictions, labor shortages, market closures, and a decline in local fish prices.

In both Chittagong and Cox's Bazar, 42% and 58% of respondents, respectively, had no work during the lockdown period, as all kinds of movement and social gathering were stopped. As a result, fishing activities were partially halted. Some respondents (11%) faced direct travel restrictions, especially in Chittagong's city areas. The second greatest impact of COVID-19 was fewer buyers (19% and 12% in Chittagong and Cox's Bazar, respectively) or low fish price (11% and 6% in Chittagong and Cox's Bazar, respectively) (Figure 2).

However, some fishers could catch fish but could not sell them properly. Due to the lockdown and fear of spreading COVID-19, fewer buyers were in the market. As a result, people bought less, so it was not easy to sell all the fish. Those who could continue fishing also faced time or area constraints. Most of them previously fished 25–30 days a month, but their fishing days were cut to fewer than 15 or 10 days during COVID-19.

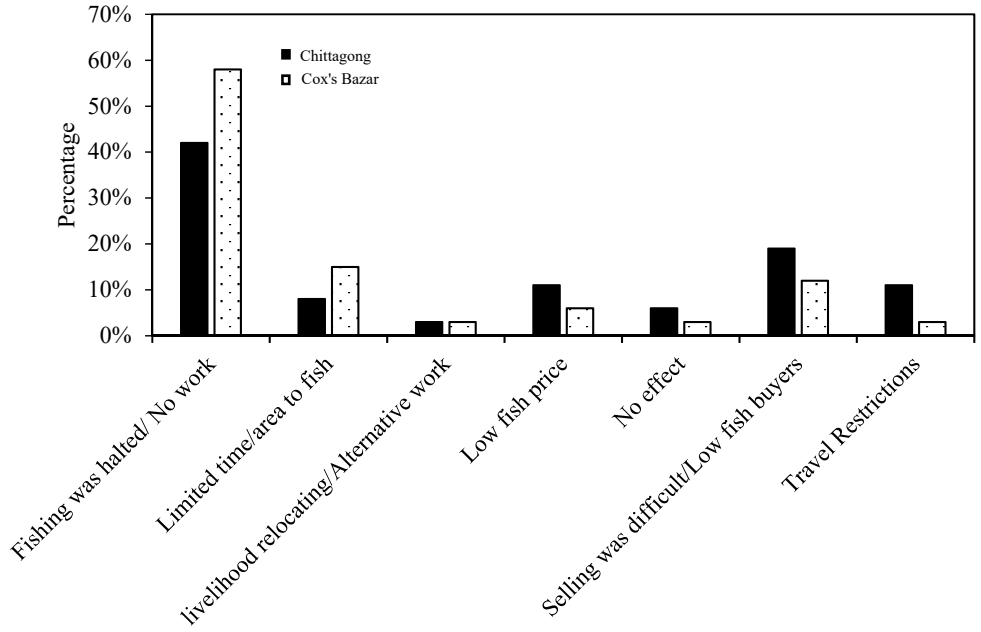

Figure 2. Impact of COVID-19 on fishers' livelihoods.

Additionally, their time spent on the fishing grounds was drastically decreased from 10–20 h to 2–3 h. Very few fishers relocated their livelihoods to cope with this dire situation by doing other work. Some have been involved in farming and band parties as a player. Only a few respondents said they faced no problem during COVID-19 (Figure 3).

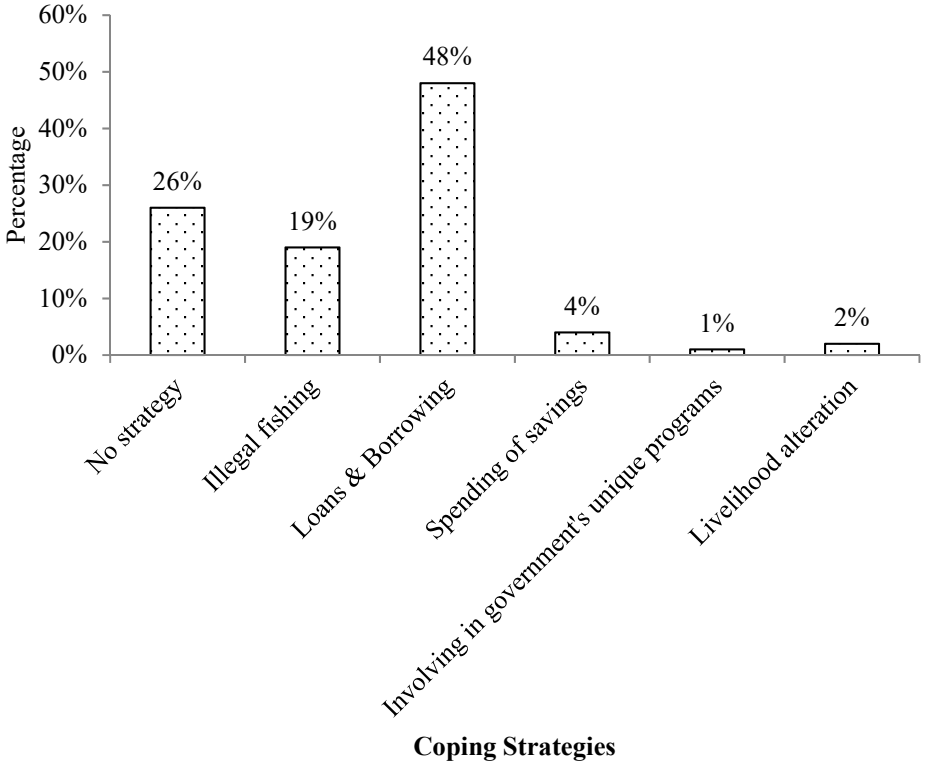

Figure 3. Fishers' coping strategies during the COVID-19 pandemic.

According to some respondents, "We could not reach fishing grounds properly during lockdown days due to travel restrictions." For example, one of the respondents explained, "I was unable to fish at the time because the Coast Guard prohibited us and refused to authorize us to go fishing. In addition, Coast Guards had broken down my boat while I was fishing during the lockdown."

An academic from Chittagong gave his opinion about the effect of COVID-19 on the socioeconomic condition of the marginal fishers as follows:

> "I think Corona has had a severe effect on marginal fishers. Firstly, they could not catch fish, or even if they caught fish, they could not sell it properly because the communication system was closed. Secondly, many intermediaries or storekeepers buy fish from them at meager prices and store it with ice, and later they sell at a double price in different urban markets. However, fishers are being deprived of their fair price. They never got the actual price of the fish; they did not get the buyers and price at the time of COVID, so their miseries knew no bounds."

3.4. Impact of Closed Fishing Season

The most notable effect was the limitation of fishing operations by fishers. When fishing activities stopped, it negatively influenced fishers by increasing their debt due to no income and increased expenses, reducing their daily food and fish supplies for purchase and sale, and so on (Table 3).

Table 3. Impact of closed fishing period.

Impact of Closed Fishing Season	Chittagong		Cox's Bazar	
	Frequency	Percentage	Frequency	Percentage
Debt accrual	4	11%	15	45%
Insufficient food	2	6%	1	3%
Low fish stock	6	17%	0	0%
No effect	2	6%	0	0%
No fishing operation	19	53%	5	15%
No income	3	8%	4	12%
Increased expenses	0	0%	2	6%

In the current study areas, most fishers stated that they did not receive any particular assistance from the government throughout the pandemic. Among the few fishermen who had received assistance or aid, all stated it was insufficient to support their families. As a result, they were obliged to liquidate their savings and obtain loans from whatever source conceivable. The responders from Cox's Bazar and Chittagong stated that their debt increased significantly during the closed fishing period due to the lack of income from fishing operations (45% in Cox's Bazar and 11% in Chittagong). Fishermen in the Cox's Bazar region spoke frankly about their debt growth since nearly all of them borrowed money from money lenders, relatives or friends, boat owners, and, in some cases, from banks. Several stated that they received loans from their local fishing organizations. Most fishers were unable to eat three meals a day. Generally, they could eat only once a day. Some fishers faced no problem during the closed period.

According to one respondent, "As I had no work then, there was no income. I could not feed my family properly in a single day during the pandemic. Sometimes we had to remain fast or take only one meal for the whole day. I had to borrow money from money lenders with high interest to support my family and maintain the daily cost of my family."

A prominent economist from Chittagong, Bangladesh, stated, "The marginal fishermen could not catch or sell fish properly during the closed fishing time. In this case, the government has failed to make the right decision. Before the lockdown, the government needed to ensure the family maintenance cost of these fishermen so that they do not have to borrow money from money lenders with high interest."

3.5. Emotional Impact of COVID-19 on Fishers and Their Family

During the COVID-19 pandemic, almost all fishers and their family members were frustrated. They were not afraid of being attacked by the coronavirus during the pandemic; they were fearful of spending their daily lives with no work and no income (28% in Chittagong and 24% in Cox's Bazar). Almost half of the respondents (49% in Chittagong and 47% in Cox's Bazar) expressed their frustration. However, some were hopeful (15% in Chittagong and 10% in Cox's Bazar) that good days would come soon. Additionally, some expressed their anger because they could not obtain proper support from the government for their survival (Table 4).

Table 4. Emotional impact of COVID-19.

The Emotional Impact of COVID-19	Chittagong		Cox's Bazar	
	Number	Percentage	Number	Percentage
Frustration	33	49%	32	47%
Anger	0	0%	10	15%
Fear	19	28%	16	24%
Hope	10	15%	7	10%
Other	5	8%	3	4%

According to one respondent, "Corona has brought much more suffering and frustration for the poor like us. Because we live from hand to mouth. This Corona has disrupted our daily activities and has led to misery in our daily lives about how we will survive after eating three meals a day properly."

3.6. Fishermen's and Their Families' Coping Mechanisms during the COVID-19 Pandemic

During our survey, it was observed that the most prevalent coping strategy against the effect of the COVID-19 pandemic was taking loans (48%) from different organizations and NGOs, as well as borrowing money from other people, such as relatives, neighbors, friends, and boat owners (Figure 3). A respondent of the Moheshkhali region said, "Due to lockdown, fishing was completely closed. I borrowed money with interest from other people and fishing organizations/NGOs to maintain my family." However, finding no other way, a significant portion of fishers illegally continued their fishing (19%) to support their family. A fisherman from Sandwip Island mentioned, "Fishing is our traditional job, and we have no knowledge about other professions except fishing. Though fishing was illegal due to the COVID-19 pandemic, I had no other options to feed my family members. So, somehow, I continued fishing. However, the demand for fish was low because of the lockdown as fewer people came to market because they were afraid of Corona infection". Our study also found that a minimal number of fishers (2%) temporarily changed their fishing profession, and some (4%) had spent/utilized their long-term savings to support their family. Some (1%) have been involved in the government's unique programs such as "Mobile Market" or "alternative employment". According to Sabita Devi (Fisheries Quarantine Officer, Divisional Office, Chittagong, Department of Fisheries, Bangladesh), the Bangladesh Government had also taken special measures so that fishers could cope with adverse situations during the COVID period. She stated, "The government is taking special measures such as 'Mobile Transport' to help sell fish, which is still being done. Even the report of this work, i.e., the number of fish sold in any district/Upazila through mobile transport/growth center, is being sent to the Fisheries Department (DoF) every day. It has been done in the last lockdown. It is also being done in this lockdown." The government took this measure to support the fishers in coping with the COVID-related adverse situation. Devi also stated:

> "Fishers or fish sellers may have had some problems due to the lockdown. However, the government has ordered various sectors, such as our Fisheries Depart-

ment, to ensure that the transportation of essential commodities is not hampered. The District and Upazila Fisheries Offices issued a certificate to ensure no hindrance in the transportation of fish fry, fish food, fishery products, or fish for sale, which still exists. The certificate will be given to the fisherman or trader whenever he goes to the office and wants. I do not think they suffered much then or still do. However, the price of fish is relatively low in the market, which is also due to the lack of buyers in the market because of COVID. Because of the COVID situation, the demand is less now, so the price is comparatively less."

Regarding alternative employment, Devi stated, "Each cardholder fisherman is given 40 kg of rice in the off-season, but the government also gives them vans, sewing machines, cows, and goats for alternative employment through various projects for their survival." However, a lack of coping strategies was observed among about 26% of fishers.

4. Discussion

The COVID-19 pandemic has added pressure to a world already in flux, affecting every aspect of daily life. The pandemic has dramatically, rapidly, and extensively affected fisheries worldwide, although its effects have yet to be fully quantified [38]. SSFs are no exception. Market closures, collapsed prices, lockdown measures, traveling restrictions, and overloaded health services continue to impact the livelihoods of those living in coastal communities [39]. Many poor and vulnerable people have faced severe threats to their immediate food security, health, and nutrition [40]. The pandemic's impacts on food security have been induced primarily by reduced incomes. The World Bank estimates that the global economy shrank by 5% in 2020, with the most significant burden borne by poor people. Although impacts varied along the value chains, food supply chains were disrupted by labor restrictions and falling demand. The quick announcement of lockdowns and closures of intrastate and state borders averted a catastrophic health crisis. However, inland fisheries, including wetland fisheries, have not been immune to global health crises [41]. Review of the literature shows very few reports about the crisis faced by the fisheries sector due to the COVID-19 pandemic [41–44]. This study identified the impact of the COVID-19 lockdown on SSFs in Bangladesh and discussed the impact on livelihood, income, food access, and strategies to cope with the existing situation due to COVID-19.

The COVID-19 pandemic has spread worldwide, intensifying pre-existing structural inequalities with significant social and economic effects [45]. In addition, fishing communities are considered "hotspots" for disease transmission due to the clustering behavior of fishers at landing sites and poor sanitary conditions [46]. The negative implications for SSFs have included complete closures of some fisheries; market disruptions; increased health risks to fishers, processors, and communities; and an increase in illegal, undeclared, and unregulated fishing [10]. In other words, all aspects of fish supply chains have been severely affected by the COVID-19 pandemic, with jobs, income, and food security at risk [47]. The present study also revealed the same situation in the SSFs of Bangladesh, especially in Chittagong and Cox's Bazar.

The tight enforcement of quarantine standards forced some fishers to discontinue operations and rely on government help for food and cash, significantly reducing the volume of fish caught in the area [48]. The current study also showed a similar situation (Table 1). The impact of the pandemic on the fishers' livelihood included halting all kinds of fishing activities; limited time or area for fishing; livelihood relocation or alternative work; low fish price; fewer fish buyers, which caused difficulty in selling; and travel or free movement restrictions (Table 3).

Travel regulations and other government policies, such as social separation, made it impossible for fishers to operate, resulting in insufficient operating time. Due to these constraints, the volume of fish caught began to decline [49]. Our study uncovered such a predicament, as evidenced by respondents' responses during the interview process. Engaging in this form of livelihood with all the risks that coastal fishers experience demands the acquisition and development of skills and knowledge through time [50]. Due to their

years of expertise, elderly fishers better understand their fishing grounds and find locations with more abundant fish [51]. Individuals with less expertise will likely have less intimate knowledge of the fishing grounds than those with more experience, thus capturing fewer fish [52]. Due to their increased time spent in their communities, elderly fishers better understand the village's network and are regarded as wiser and more respected by their peers [53]. They can confer with or inquire of anyone for information about their daily fishing operations [54]. Fishers who have stayed in their community for a more extended period have developed a specific link with other fishers on which they can rely during difficult times [55]. In terms of education, fishers with fewer years of schooling appear to be more reliant on fisheries than those with a higher degree of education, who have a greater probability of exiting the sector [56].

On the other hand, fishers who did not own land were likewise more reliant on fisheries than those who owned land [57]. In such a scenario, individuals can always return to farming as an alternative to fishing during difficulties conducting fishing operations [58]. As a result, some fishermen chose to farm their land as a means of subsistence until fishing operations resumed normalcy [59]. Such anecdotes were provided throughout the current study's fisher interviews, notably about the fishers and their families' coping techniques during the COVID-19 pandemic.

The global impact of COVID-19 on social, economic, and environmental issues has not been measured, but some regional efforts have been made [60]. Coastal small-scale fishing and the communities that depend on it are not immune from these repercussions in Bangladesh [20]. Fishermen worldwide have reported income decreases ranging from 20% in the United States to 100% in Indonesia due to cessation of activity [39]. The present study areas also showed lowered income of fishers due to COVID-19 (Table 3).

Federal and local governments assisted coastal communities with food assistance from the local level and subsidies from the federal level. Nonetheless, many fishers were dissatisfied, believing that the assistance had been allocated unequally while being scant; such statements were given by the respondents of the current study during interviews. Our results reveal that coastal small-scale fishing communities in Bangladesh adopted different coping strategies against the effect of the COVID-19 pandemic, and similar research has been conducted in different countries [61–63]. Additionally, based on a review of the literature, observations, and interviews with relevant stakeholders, this research analysis highlighted the following probable strategies or recommendations for enhancing coastal fishers' resilience during COVID-19:

- One of the earliest global efforts to prevent virus transmission was to spread the idea to "stay at home," isolate, and avoid contact. Additionally, most fishing villages in developing countries lack adequate health care and infrastructure, making them more susceptible to the virus's impacts [64]. Therefore, most coastal fishing communities in Bangladesh must decide to limit entrance of outsiders during the COVID-19 pandemic.
- Fishers live in coastal zones experiencing increasing sea-level rise and many extreme weather events. Poor access to health services or adequate water supplies decreases their resilience to events such as COVID-19 [16]. Therefore, there is an urgency to ensure proper and timely health services and adequate water supply during the COVID-19 pandemic.
- Local fishers in some communities are distributing fish to fellow residents and the elderly, as well as households struggling economically during COVID-19 [65]. Relevant measures can be taken in Bangladesh by developing community networks among fishers.
- Women fisher leaders have established food kitchens, have sourced donations from more affluent residents and local municipalities, and are feeding large numbers from their humble homes [66]. The coastal fishing communities of Bangladesh can take similar initiatives.
- Following the COVID-19 lockdown, a community-supported fishery enables the public to purchase online from the fishers' catch of the day. The fresh fish order is then delivered directly to the customer. This has protected fishers' livelihoods and con-

tributed to understanding the importance of local markets in different countries [64,65]. Hence, community supports for fishery organizations can be established in the coastal area of Bangladesh to support the fishers during the pandemic.

- Bangladesh's Ministry of Fisheries and Livestock should design specialized and promptly accessible funding to support the economic reactivation of all SSFs, considering the socioeconomic variations among fleets, their level of formalization, and the most appropriate credit amounts for them. Furthermore, additional attention should be directed to formalizing small-scale fishers.
- Recognizing the importance of SSFs and other similar fisheries to local and regional food security, it is proposed that the government designate SSFs and similar fisheries as strategic fisheries of national significance [46].
- Socioeconomic, health, and production indicators should be developed and monitored to rapidly assess COVID-19's impact on coastal fishing communities. This will enable the regional government to make more effective, dynamic, and proactive decisions to mitigate immediate COVID-19's effects while informing policies and actions used to reactivate economic activity [10].
- For coastal communities such as those examined in this study, a coordinated multi-sectoral approach and multi-level governance strategy are required to recover from the COVID-19 pandemic and economic crises, most likely with increased local government leadership [66].

5. Conclusions

The COVID-19 pandemic has substantial macroeconomic ramifications, varying in severity among nations because of variances in their economies' resilience and public health systems' capacities. To date, different variants of COVID-19 have been found. Moreover, nobody knows when this era will come to an end.

Despite the fact that an increasing amount of literature has been reporting the severe impacts of the COVID-19 pandemic on SSFs in a short time frame, limited studies have noticed the altering socioeconomic circumstances over time. This study investigated how the lockdown during COVID-19 has impacted small-scale coastal fishers in Bangladesh and which immediate measures are required to develop and implement insights on the role of the scale of governance attributes in facilitating or impeding SSFs' resilience through a case study in two coastal districts of Bangladesh. We propose that an arrangement be formed to give other livelihood opportunities for coastal fishers via need-based training, vocational refresher courses, and microcredit to keep them moving and earning during the pandemic, rather than relying solely on fishing. Additionally, such an initiative also helped to overcome the hardship during the fishing ban season imposed by the government. We anticipated that outcomes of the present study would provide readers, researchers, and policymakers with a state-of-the-art understanding of the COVID-19 pandemic's impact on SSFs, possible solutions to become more resilient and face the negative impacts of COVID-19, and the means to identify research gaps and signal future research avenues to achieve the sustainability of coastal fisheries.

Nevertheless, the findings and suggestions of this study may have important implications to prioritize, plan, and implement actions to help the SSFs of Bangladesh recover from this pandemic. As with Bangladesh, many developing countries have similar SSF infrastructures, including transport, fish culture, fishing, and marketing systems. Further, with meager per capita income and higher dependency on natural resources, developing countries are experiencing severe obstacles during this pandemic. Many people have no jobs, incomes, or savings and limited opportunities to practice social distancing and decent hygiene. Although this study focuses on Bangladesh's coastal regions, the findings could apply to a broader context with a similar backdrop.

While it is probable that COVID-19 had a temporary beneficial effect on ecology, some fishers and experts believe that the reduced fishing effort and generally restricted access to the water will likely increase fish production soon. However, further empirical research is

necessary to determine the positive effect of COVID-19 on coastal resources, including SSFs. In addition, we collected data during the pandemic; however, further research is necessary on the resilience of the SSFs after the pandemic. Finally, there is a need to determine the correlation between the effects of the COVID-19 pandemic and the COVID-19 global crisis, sustainability, and sustainability assessment, while focusing on the impacts, diversity, and resilience of a coastal water SSF nexus during COVID-19.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/w14081269/s1, Supplementary Materials: Questionnaire for Fishers.

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