

# Impact of COVID-19 Pandemic Lockdown on Small Scale Fishers (SSF) Engaged in Floodplain Wetland Fisheries: Evidences from Three States in India

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## Research Article

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## **Abstract**

The COVID-19 pandemic has created unprecedented human health crisis in recent global history with rippling social and economic effects. The outbreak in India has resulted in emergency lockdown in the country for more than two months and that caused decline in the fish catch has severely affected the life and livelihoods of the fishers. The wetlands offers tremendous scope for expanding both culture and capture based fisheries for livelihood security of fishers. They also play a key role in socio-economic development by generating employment and livelihood in the studied regions. In the present study a systematic rapid assessment was conducted to find the impact of COVID-19 lockdown on floodplain wetland fisheries in India to evaluate the impact of lockdown on wetland fisheries production, income and food access. We undertook a rapid telephone survey with 176 wetland fishers in 3 states. Fishers of three Indian States Bihar, West Bengal, and Assam lost 20, 25, and 9 fishing days respectively. Fish harvest during March to May was 32, 44 and 20 percentage lower respectively than the previous year in Bihar, West Bengal and Assam. Fishers of Bihar, West Bengal and Assam lost income of INR 10000/-, 12500/- and 4500/-due to lockdown. Demand supply gap during the lockdown led to the in 20–40 percent increase in farm gate price of fishes at the wetland level. The wetland fisheries potential to contribute to the Sustainable Development Goals (SDGs) 'eradication of poverty'; 'zero hunger' and 'good health and well being' have also been considerably impacted due to this pandemic. The paper discusses several magnitudes of immediate impacts of lockdown on floodplain wetland fishers livelihood, income and food access, highlights issues and suggests strategies, advisories and decisions support to mitigate the impact.

## **Introduction**

The COVID-19 pandemic has created unprecedented human health crisis in recent global history with rippling social and economic effects (Bennett et al., 2020; Everard et al., 2020; Hakovirta and Denuwara, 2020). This Coronavirus 2 (SARS-CoV-2) was first recorded in Wuhan City in Hubei Province, People's Republic of China in December 2019 (Wang et al. 2020) and reported to the World Health Organization (WHO) on 31 December 2019 (WHO 2020). To control the spread of COVID-19, mobility restriction in the form of lockdown set in place in early 2020 disrupted economies worldwide and affecting population vulnerable to poverty and malnutrition (Laborde et al. 2020). As on 1 January 2021, 81.9 million cases of SARS-CoV-2 have been reported in 222 countries across the globe with death toll stands at 1,808,041. Asian Development Bank has assessed the potential economic impact of the COVID-19 outbreak on Asian economies across various scenarios and suggested a global impact of \$77 billion to \$347 billion or 0.1–0.4% of global GDP (Gross domestic product), with a moderate case estimate of \$156 billion or 0.2% of global GDP (ADB 2020).

With the high population density and inadequate health infrastructure, the potential of large quick and deadly outbreak prompted early response from the federal government in the form of national lockdown. The Prime Minister of India declared nationwide complete lockdown since 24 March 2020, during this period, restriction imposed on the commercial and industrial activity coupled with ban on the movement of people and goods deemed non-essential in nature as a preventive measure against the COVID-19 pandemic in India. These lockdown measures were anticipated to safeguard the public health, however have a direct and distressing impact on income and food security, predominantly for the susceptible subsistence segment in rural India. Complete lockdown of all economic activities created an immediate economic crisis leading to extreme hardship and rising food insecurity. This unprecedented lockdown measures has resulted in adverse impacts on employment, income, food and nutrition security of the fishers, and the potential to cause social unrest. The SSF are in fact characterized by high level of risks and uncertainty; and COVID-19 lockdown, a shock that accelerate the uncertainty and leads the vulnerability of the poor fishers.

Worldwide, SSF is responsible for sustainable livelihoods of more than 120 million people, 95% are of them belong to developing countries (FAO 2000). The outbreak of COVID-19 pandemic in India has called for sudden strict and prolonged lockdown in the country for more than two month that caused adverse impact on the SSF, fish demand and supply and value chain disruptions in the fisheries sector. It has put the India' marine sector in a deep sea imposing a daily loss of INR 224 crore and monthly loss was estimated INR 6838 crore (Aqua International 2020).

These lockdown measures were implemented during the medium intensity harvesting season of March-April. Although the policy response to COVID outbreak was largely coordinated by the federal government, states adopted additional restrictive and relief measures with different levels of enforcement and monitoring, resulting in diverse lockdown environment and may have given rise to a large number of heterogeneity in the COVID response on fisheries activity and consumption (Ceballos et al. 2020).

During this pandemic, majority attention was on the human health front, but there have been numerous reports on the impact of the pandemic on different sectors including agriculture and fisheries. Although several studies related to agricultural production, livelihoods, and food security during the COVID-19 lockdown in India have recently been reported (Acharya 2020; Azim Premji University 2020; Ceballos et al. 2020; Harris et al. 2020; Jaacks et al. 2021), however the impact and analysis of the inland SSF sector has not been studied so far. Studies on SSF were mainly focused on the marine and coastal fisheries sectors (Bennett et al. 2020, Briceno-Lagos and Monfort 2020, FAO 2020, Mangubhai et al. 2020). Keeping the importance of small-scale inland fisheries sector we analyses disruption of COVID 19 to fisheries incomes and food security in wetland fisheries sector in India.

To contribute the understanding of the effects of COVID responses on small scale wetland fishers, in this communication, we present results from Primary phone based survey closely after the lockdown was announced covering 176 wetland fishers of fifteen wetlands of three wetland dominated states namely West Bengal, Bihar and Assam. These surveys were complemented by key informant interviews to provide insight on how fishers livelihood were disrupted and how they responded to these challenges imposed due to lockdown restriction. We also attempt to bring out immediate impacts on wetland fisheries in India and suggest effective management strategies, decisions and institutional responses to mitigate the threats.

## Methods

### Study Context

Inland Fisheries in India: Inland fisheries sector of India is dynamic in nature, which produces more than 8.4 million tonnes including culture and captures fisheries, contributes more than 65% of total fish production during 2018-19 (Handbook on Fisheries Statistics 2018). Food and Agriculture Organization of the United Nations (FAO) reported 11.9 million tonnes of global inland fisheries catch, representing 12.7 percent of total global capture fisheries (FAO 2019). Worldwide, inland fisheries contributes a significant role in food and nutritional security, poverty alleviation, gender empowerment, socio-economic development of small and marginal fishers, ecosystem services, and biodiversity conservation (Funge-Smith and Bennett 2019; Zhang et al. 2020). As per Livestock Census, 2003 the total inland and marine fishermen population in India was 14,485,354 which includes 4,696,158 males, 4,033,963 females and 5,755,233 children, contributing to 1.1 percent of the Indian GDP (Handbook on Fisheries Statistics 2014).

### Floodplain Wetland Fisheries

The floodplain wetlands one of the prime fisheries resource of India having 5,25,028 ha water area having high production potential to the tune of 2000–2500 kg ha<sup>-1</sup> yr<sup>-1</sup> (Chandra and Das 2019; Sugunan and Sinha 2001; Sarkar et al. 2019; Sarkar et al. 2020). The average fish production from these water bodies is 230 kg ha<sup>-1</sup> yr<sup>-1</sup> (Chandra et al. 2013). Bihar has the highest area under floodplain wetlands (2,09,000 ha) followed by Uttar Pradesh (1,53,000), Assam (1,00,872 ha), West Bengal (42,500 ha), and Manipur (16,500 ha) (Chandra and Das 2019; Sarkar et al. 2020). These wetlands (locally known as beel/baor in West Bengal, Maun or Chaur in Bihar, beel in Assam), are the one of the prime SSF resources of eastern and north eastern India (Sugunan and Bhattacharjya 2000), providing livelihood support to a large section of the population next only to agriculture (Chandra 2010; Chandra and Das 2019). These resources are managed for various objectives like economic benefit, livelihood security, sustainability, equity, conservation of biodiversity, maintenance of the ecosystem, etc. (Chandra 2009; Chandra and Bhattacharya 2016; Sarkar et al. 2020). Scientific management along with good governance and adoption of technological interventions can double the production of these wetlands (Sarkar et al. 2020). Over the years, management guidelines for

development of floodplain wetland fisheries were time to time issued by ICAR-CIFRI (Sugunan and Sinha 1997; Sugunan et al. 2000; Sugunan and Bhattacharjya 2000; Sugunan et al. 2002; Das et al. 2019).

## Study area

Three states namely West Bengal, Bihar (Ganga River system) and Assam (Brahmaputra River system) were selected for this study. Floodplain wetlands are one third of the area of fisheries resources of these states. Five floodplain wetlands from each of the states were selected under this study (Table 1). The cooperative based management regime governs the wetland fisheries in West Bengal and Bihar (Chandra and Ekka 2015; Chandra and Das 2019; Sarkar et al. 2020), hence all five states of these two states were cooperative managed. In Assam both Cooperative and individual management regimes are operational (Chandra 2009, Chandra 2011) hence, three individual and two cooperative managed wetlands were selected from Assam. The location of the study area has been presented in Fig. 1.

Table 1  
Basic information of the study sites in three different states of India

Sl. No.	Name of the State	Wetland	Management (Individual/Cooperative/Open access)	Area (ha)	Number of members	Yield of carps (Tonnes/ha/year)	Number of respondents interviewed
1	West Bengal	Chamardaha	Cooperative Management	38.85	147	0.55	15
2		Beledanga	Cooperative Management	60	176	0.53	15
3		Panchita	Cooperative Management	47.39	237	0.74	15
4		Akaipur	Cooperative Management	32	80	0.60	10
5		Kholsi	Cooperative Management	62	151	0.53	15
6	Bihar	Karariya	Cooperative Management	120	120	0.55	15
7		Rulhi	Cooperative Management	80	90	0.15	15
8		Sirsa	Cooperative Management	82	125	0.32	15
9		Kothiya	Cooperative Management	80	230	0.27	15
10		Majhariya	Cooperative Management	120	120	0.2	15
11	Assam	Rupahi	Individual Lessee Managed	75	30	0.4	3
12		Garudharia	Cooperative Management	32	25	0.2	5
13		Borghuli	Individual Lessee Managed	21	20	0.55	3
14		Borbila	Cooperative Management	55	200	0.3	15
15		Warigendeng-Kenduguri	Individual Lessee Managed	40	35	0.4	5

## Sampling and design

The first nationwide lockdown phase one was clamped for 21 days from 24 March 2020 to 14 April 2020. This lockdown was further extended for 19 days as phase two till 3 May 2020 and then further for 14 days till May 17 as phase three to stop the spread of COVID-19. However, many states including West Bengal extended to 31 May 2020. In this contributions phase three included the period up to 31 May 2020.

We conducted rapid assessment using semi structured interview with questions including socio-economic and socio-psychological variables. We collected primary data through phone survey on wetland fisheries operation undertaken between the months of March to May. We aimed to survey sample representative of wetlands fishers of Assam, West Bengal and Bihar. Following the survey, Key informant interviews (KIs) were conducted with nine managers (lessees in the individual managed

wetlands and Secretary of fisheries cooperative society for cooperative managed wetlands) from three wetlands each from Assam, West Bengal and Bihar to understand the context and implementation of regulation in the studied location. 176 fishers having mobile phones were purposively selected for this study (Table 1) and data were collected through direct conversation with the stakeholders. We conducted the interviews on three occasions, first week of April, second week of May, and second week of October 2020 over the telephone to comply with the restriction imposed on movement within states and interstate in India and COVID guidelines issued by respective state government. Telephone interviews were restricted to limited numbers of questions to ascertain the impact of lockdown and fishers response to mitigate the problem. The phone survey was conducted in the fishers' primary language (Bengali in West Bengal, Hindi in Bihar and Assamese in Assam) and included questions on how wetland fisheries operations were affected by the lockdown. We asked questions focused on stresses faced by the fishers. The survey also included question on access to food during the lockdown and month before the lockdown. The use of mobile phones/ telephones as a method for conducting interviews has a number of benefits: cost effectiveness; time efficiency; access to individual etc. and it is now gradually becoming more popular data collection means (Cooper and Kurland 2002; Polkinghorne 2005; Schweitzer and Duxbury 2006; Ilies et al. 2007). Studies conducted by using semi-structured interview methods through telephonic dialogue have gathered equally robust information with respect to breadth and depth (Block and Erskine 2012).

Within the States, restrictions continued even after relaxations were announced in pockets depending on the status of the locality in terms of severity of contamination. Therefore, the last interviews with key informants were conducted in the month of October to comprehend the situation in the lockdown period with the normal period.

## Data analysis

We extracted data for qualitative and quantitative analysis by hand transcribing audio data from telephone interviews. We triangulated the data and results with key informant interviews to determine how much of the observed changes were likely due to COVID-19 or to other reasons.

## Results

The floodplain wetlands of Bihar, Assam and West Bengal are under the ownership of different government departments. In Bihar and West Bengal these waterbodies were leased to fisherman cooperative society for fisheries management (Chandra and Ekka 2015, Sarkar et al. 2020, Chandra and Das 2019), while in Assam the waterbodies are leased to either individual fishers or fisherman cooperative society (Chandra 2009, Chandra 2011, Chandra and Das 2019). Fisheries management practices also differ in these states (Chandra 2010, Chandra et al. 201, Sarkar et al. 2020). The COVID-19 impact on the wetland fishers shows visible changes in various activities related to fisheries. The fisher responses to the lockdown were different in all three states.

The result presented in three broad themes that emerged from the survey, namely impacts on wetland fishers livelihood, income and food access. These themes are also disaggregated based on the respondents' engagement.

## 1. Impact on Wetland Fisheries

### 1.1 Fishing Days

All the fishers (100%) responded that they were not allowed to fishing in first phase due to strict lockdown enforced by the local authorities. In second phase, fishers of Bihar, West Bengal and Assam responded 73, 56 and 30 percentage loss in fishing days respectively. There was 53 and 42 percentage loss of fishing days in West Bengal and Bihar respectively. Fishing ban was observed from 20 April to 15 June, hence no loss in third phase in Assam (Fig. 2). The sudden lockdown falls during the medium intensity period of fishing in wetlands of Bihar, Assam and West Bengal, led to a significant economic loss to fishers because of loss of fishing days. In Bihar local administration allowed fishers to fishing and its sell for 4 hours in the morning in the second phase. In third phase of lockdown this restriction was lifted by the district administration leading to normalcy in the

fishing operation. In West Bengal, though fishing partially allowed in second phase of lockdown but most of fishers could not do fishing due to supply side problems. The fishers of Bihar, West Bengal, and Assam lost 20, 25, and 9 fishing days respectively due to lockdown. Overall, one fishing day provides an average income of INR 500 to wetland fisher.

## **1.2 Fish catch/ fishing practices**

To further quantify the impact of COVID 19 lockdown on wetland fishers livelihood we asked the fishers if they were a) fishing same amount of fish; b) fishing in group as like previous year. When asked more directly about fish harvest, majority of fishers (68%) stated that the fish catch was less than the last year. Fishers of Bihar, West Bengal and Assam responded that the fish harvest during March to May was 32, 44 and 20 percentage lower respectively than the previous year due to lockdown restriction. Explanations for the reduced fish catch include reduction in fishing days, restrictions on group fishing due to COVID-19 measures and time allowed for harvesting operation. Group fishing is a community based practice in wetland fisheries in all three states, but due to COVID-19 measures, numbers of fishers fishing in wetlands were restricted. Fishers of West Bengal stated that due to restriction on group fishing both the harvesting operation delayed. Fishers of Bihar stated that in earlier years, during this period fish harvesting was done on alternate days with 300 kg catch per fishing day. The fish harvesting during lockdown initiated after 15 April, 2020 keeping with the COVID advisory by maintaining 2 meters of physical distance with covering of the face. The distance between two boats was maintained at six meters apart. Due to the loss of 20 fishing days in the month of March-April and reduced intensity of fishing after 15 April onwards, fishers estimated a loss of 32%.

## **1.3 Marketing /fish value chain**

Three kinds of value chains were operational in wetland fisheries prior to lockdown in all the three states. a) Fishers-retailers-consumers, b) Fishers-landing centres-whole sellers- retailers-Consumers and c) Fishers-consumers .

Supply side constraint mainly mobility restriction and closure of transport led to disruption fish value chain. During lockdown restrictions the broadly operated value chain involving fishers-whole sellers-retailers-consumers was completely wanting. In Bihar after the relaxations in phase II, all harvested fish were directly purchased by the retailers from fishers at farm gate level in the morning hours due to restricted fish sale time from 8–10 AM in the morning. The other impact of lockdown was visible in increase in price of fish in market due to huge demand supply gap. The supply of fish was half of normal times in the market and this demand supply gap led to the in 20–40 percent increase in farm gate price of carps and catfishes in Bihar, West Bengal and Assam. Around 15 percent of the fish demand of Assam met by fishes imported from other states of India. Due to transport restriction, fish supply from other states has completely stopped and this led to the increase of fish price by 25–40 percent higher than the period before lockdown. In West Bengal, Cooperative Societies (PFCS) of the selected wetlands decided not to harvest the fish because of very low options of selling the harvested fish to the whole sellers.

## **2. Impact on Income**

The sudden lockdown and restriction of fishing in wetlands led to considerable loss of income to the fishers. 70, 60 and 55 percent of the respondent fishers of wetlands of West Bengal, Bihar and Assam admitted that the lockdown made them partially jobless. Due to loss of fishing days, fishers of Assam, West Bengal and Bihar lost income 70, 56 and 60 percent income in first phase of lockdown and 30, 44 and 40 percent in second and third phase of lockdown (Fig. 3). The income loss to each fisher due to lockdown was INR 10000/-, 12500/- and 4500/- respectively in Bihar, West Bengal, and Assam and on an average INR 9000 for an Indian wetland fisher.

Perceived economic loss by Fishermen Cooperative Societies (FCSs) of Bihar and West Bengal during the COVID-19 Lockdown period has been presented in Fig. 4. All the respondents of West Bengal reported decrease in fish consumption due to high demand and less supply of fish in the market raising its price.

## **3. Food access**

Disruption of agriculture sector as a whole including fisheries and income losses has also affected fishers as a consumer. During the phone survey we asked the respondents on a) household affordability of sufficient quantity of food b) affordability of sufficient variety of food (includes grain, pulse, fish/egg, vegetables) to assess the potential impact of lockdown on the fishers household. We found that around 70 percent of the households were affording more or less same quantity of food during the lockdown period. They said that they have used household saving for purchase of food materials. Only 45, 52 and 40 percent of fishers of Assam, West Bengal and Bihar responded that they afforded more or less sufficient variety of food as like before lockdown period. Almost all the respondents of West Bengal reported that there was a decrease in fish consumption due to high demand and less supply of fish in the market raising its price. According to them, 75 percent of people did not consume fish or consumed fish occasionally during lockdown. In comparison to West Bengal, fish consumption by fishers by Assam and Bihar were slightly better. The lack of income during the lockdown probably caused insufficiency in the nutritional needs of the fishers' families in all the three states.

The federal government of India announced under Pradhan Mantri Garib Kalyan Yojana (PMGKY), 5 kg food grains and 1 kg pulses per persons of each household below the poverty line provided free of cost through the public distribution system for the month of April to September. PMGKY provided the necessary safety net to the poor population during this lockdown (Dev 2020).

## 4. Other Stress

Due to the pandemic and consequent lockdown, households have faced different kind of stresses like financial, mental physical and social stress. The fishers were anxious, constantly under stress and faced difficulty for not being able to socialize. Concerning their physio-psychological changes, however, due to restriction on social gathering created a feeling of occasional isolation and sadness among them. 25 percent of respondents rated the psychological impact of the COVID outbreak as moderate to severe; 25 percent of the fishers reported moderate to severe anxiety symptoms. Most fishers reported that they are spending more than 17 hours per day at home.

One phenomenon seen in all the states was that fishers were comparatively less anxious about the financial loss as they believed they would be able to recover the loss after the opening of the lockdown. The price of fish has been appreciated by 25–40% due to supply-side constraints. The fishers are anticipating that they will recover partial loss due to high price realization. The most contrasting case was of Kothia wetland in Bihar, where harvest was allowed only in third phase of lockdown after 12 May 2020. Harvesting was carried out for next ten days and 5 metric tons of fish harvested, providing a good earning to the fishers community.

## Institutional Response To Support Fishers

Institutional response to support fishers varied in different states. In Bihar the response was timely. Department of fisheries notified fisheries as essential activity and instructed the district administration to allow fisheries activities in water bodies. Fishing was allowed from 5–10 AM in the morning by the district administration from 15 April, 2020. This timing was further relaxed from 25 April 2020.

Government of India and state governments have announced several measures to help the public to cope hardship during the lockdown period. This includes announcement of fisheries as a part of essential activity and allowing fishers to do fishing operation during lockdown period maintaining COVID social distancing protocol. Government of India announced \$22 billion relief package which include food and cash transfers for the poor. This includes INR 2000 cash transfers to the bank accounts of 87 million farmers under PM Kisan scheme (Dhakade 2000). The daily wages under MNREGS was increased from INR 182 to 202, apart from it LPG gas used in cooking food was provided free of cost by Government of India under Ujjawala yojana to below poverty line households. All these measures have helped fishers during this COVID-19 pandemic.

## Discussion

The unprecedented havoc created by COVID-19 virus worldwide prompted many countries in the world including India to rapidly respond with measures to stop the spread of corona virus and save the human life. For rich and poor countries alike, the coronavirus pandemic and the associated policy responses brought a widespread health calamity, economic hardship, severe disruptions to services, and previously unimaginable restrictions on movement. Many poor and vulnerable people have faced serious threats to their immediate food security, health, and nutrition (GFR 2021). The pandemic's impacts on food security have been induced primarily by falling incomes. The World Bank estimates that the global economy shrank by 5 percent in 2020, with the greatest burden borne by poor people. Food supply chains were disrupted by labor restrictions and falling demand, although impacts varied along the value chains.

The swift announcement of lockdown and closure of intra state and state borders has averted the catastrophic health crisis. The inland fisheries including wetland fisheries have not been immune to global health crisis (Bennett et al. 2020). The review of literature shows very few reports about the crisis faced by fisheries sector due to COVID-19 pandemic (Eriksson et al. 2020; Steenbergen et al. 2020; Aura et al. 2020; Campbell et al. 2021; Mangubhai et al. 2021; Love et al. 2021). This study identified the impact of COVID-19 lockdown on floodplain wetland fisheries in India and discussed comprehensively the impact on the livelihood, income and food access of the wetland fishers.

The prolonged lockdown have a direct impact on both the life and livelihoods of the wetland fishers since fish harvest was stopped in most of the wetlands. In West Bengal it was due to supply side disruptions while in other two states, it was due to restriction of fishing completely. Because of this the household income has suddenly gone down and forced fishers to do wage earning to support their family nutritional needs. Interestingly, fishers of different states responded differently to the crisis. Fishers of Bihar were able to harvest fish from 15 April, 2020 and sell their produce. Fishers of Bengal were facing supply side problems in sale of their produce; with the issuance of movement pass they overcome this problem. Assam fishers were most worried about the impending ban on fisheries from 15 April 2020. The Govt. of Assam allowed fishing till 20 April 2020 and this helped fishers to harvest fish. The livelihood loss was incurred due to sudden lockdown may have a prolonged economic impact upon the floodplain wetland fishers.

A speedy recovery is very much intended and it could only be possible if cooperation between state fisheries department and the fishers of respective wetlands shall be encouraged. This will also help the wetland fishers in getting medium and long term support from the institutions. In order to protect the livelihood security of the wetland fishing communities, an instantaneous assistance package may be rolled out. The Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGS) schemes shall also include wetland macrophytes cleaning, fish feeding, pen installation as skilled jobs and may be paid under the same scheme.

Inland Fisheries are an indispensable part of healthy aquatic ecosystems. Mainstreaming the ecosystem approach for the management of inland fisheries can fulfill the goal. Lockdown period has positive impact on ecosystem, biodiversity and 'Life below water' as well. Nevertheless, the wetland fisheries sector is also relevant to other five SDGs: Goal 1: Eradication of poverty; Goal 2: Zero hunger; Goal 3: Good health and well-being; Goal 8: Decent work and economic growth; Goal 13: Climate action.

Inland fisheries have a particularly low carbon footprint in comparison with other food sources (Ainsworth and Cowx 2018) and wetlands are an important carbon sink (Nag et al. 2018; Sarkar et al. 2020). Therefore wetlands have remained vital in global carbon balance and climate change mitigation (Were et al. 2019). A positive environmental change and aquatic ecosystem observed in India after the COVID-19 lockdown and reported in electronic media however negative impact was marked on the fishermen community (Fig. 5). Adverse impact was noticed on public health; employment and earnings; transport; alternate income generating option; food and nutritional security; mass socio-cultural-religious activities etc. Shutdown in educational sector hampered the access of learning of the children of fisher families. On the other hand decrease in wetland pollution was noticed due to less anthropogenic activities; reduced industrial waste; reduced emission of CO, CO<sub>2</sub>, NO<sub>2</sub>, and SO<sub>2</sub>. Less consumption of fossil fuel; less exploitation of aquatic-biodiversity and fisheries caused improved water

quality and ecosystem health and it ultimately lead to flourish aquatic biodiversity and recruitment of indigenous fish in the wetlands.

## Conclusion

COVID-19 has created an unprecedented situation as well as destitution for the wetland based SSF of India. Their livelihoods have been highly impacted and it has led to an increase in stress, anxiety and financial insecurity in their daily life. So, a speedy recovery is very much intended and it could only be possible if cooperation between state fisheries department and the fishers of respective wetlands shall be encouraged. State fisheries departments and National Fisheries Development Board (NFDB), India may also come out with need-based relief package for the floodplain wetland fishers on a priority basis. The timely advisories and recommendation can be applicable to the development of national and international wetland fisheries guidelines in this pandemic situation. One of the most important learning of this lockdown for authorities is that there is no need to completely stop fisheries activities in inland sector. In future, during the pandemic situations, fishing practices in wetlands may be allowed in calibrated manner within time limits with restrictions to the number of fishers. It is expected that the information generated will help the policy makers in formulating policies and guidelines for inland SSF management in floodplain wetlands in pandemic like situations.

## Declarations

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The submitted manuscript is not submitted in any other journal.

This manuscript doesn't involve the use of any live animal or human data or tissue. The data were directly obtained from the stakeholders and were used for research.

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### *Author contribution:*

Conceptualization: Basanta Kumar Das, Methodology: Aparna Roy and Ganesh Chandra, Formal analysis and data collection: Suman Kumari, Writing - original draft preparation: Sukanya Som, Writing - review and editing: Aparna Roy and Uttam Kumar Sarkar, Data collection: Archan Kanti Das and Arun Pandit, Data support: Birendra Kumar Bhattacharjya. All the authors read and approved the final manuscript.

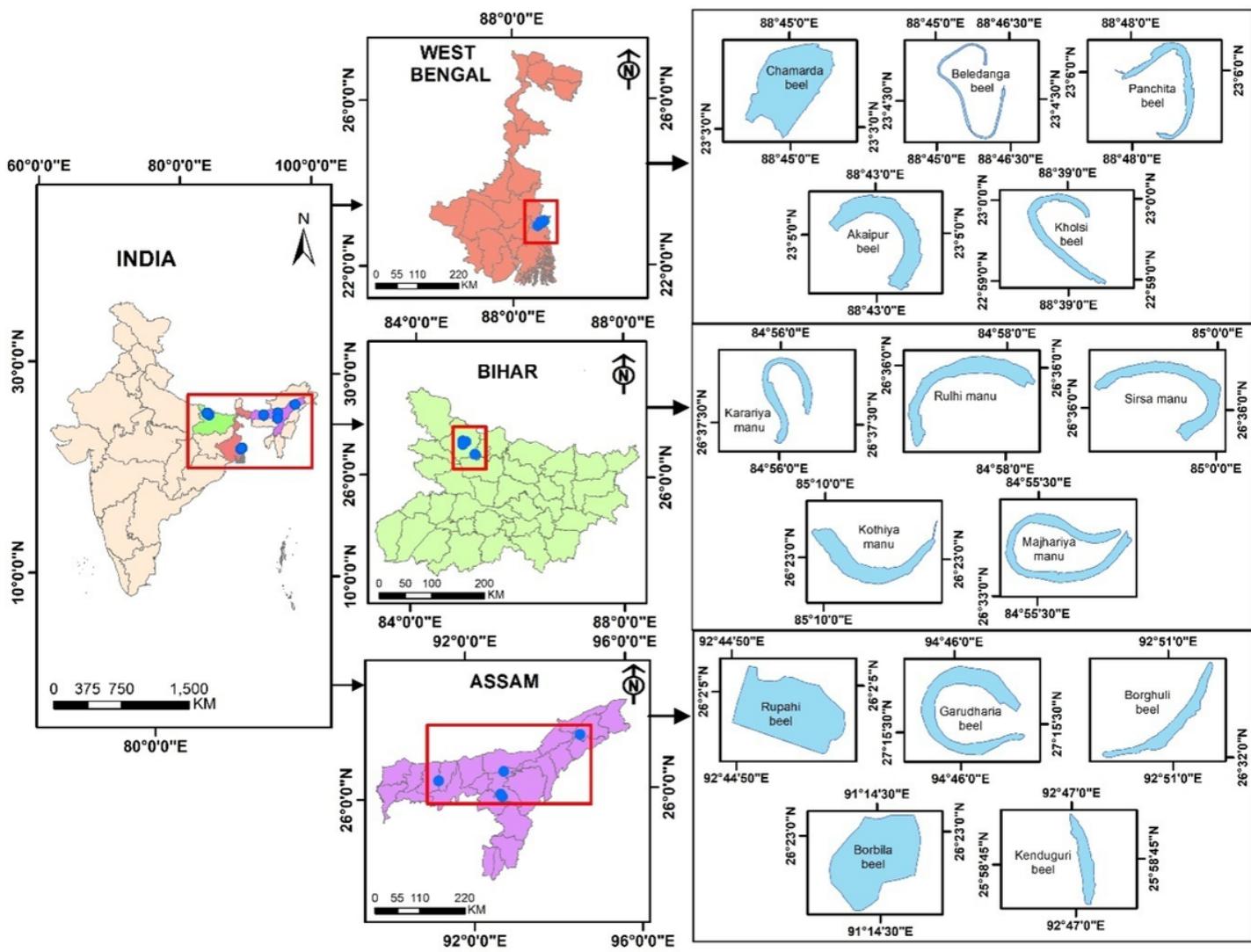
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## Figures



**Figure 1**

Map showing study sites Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

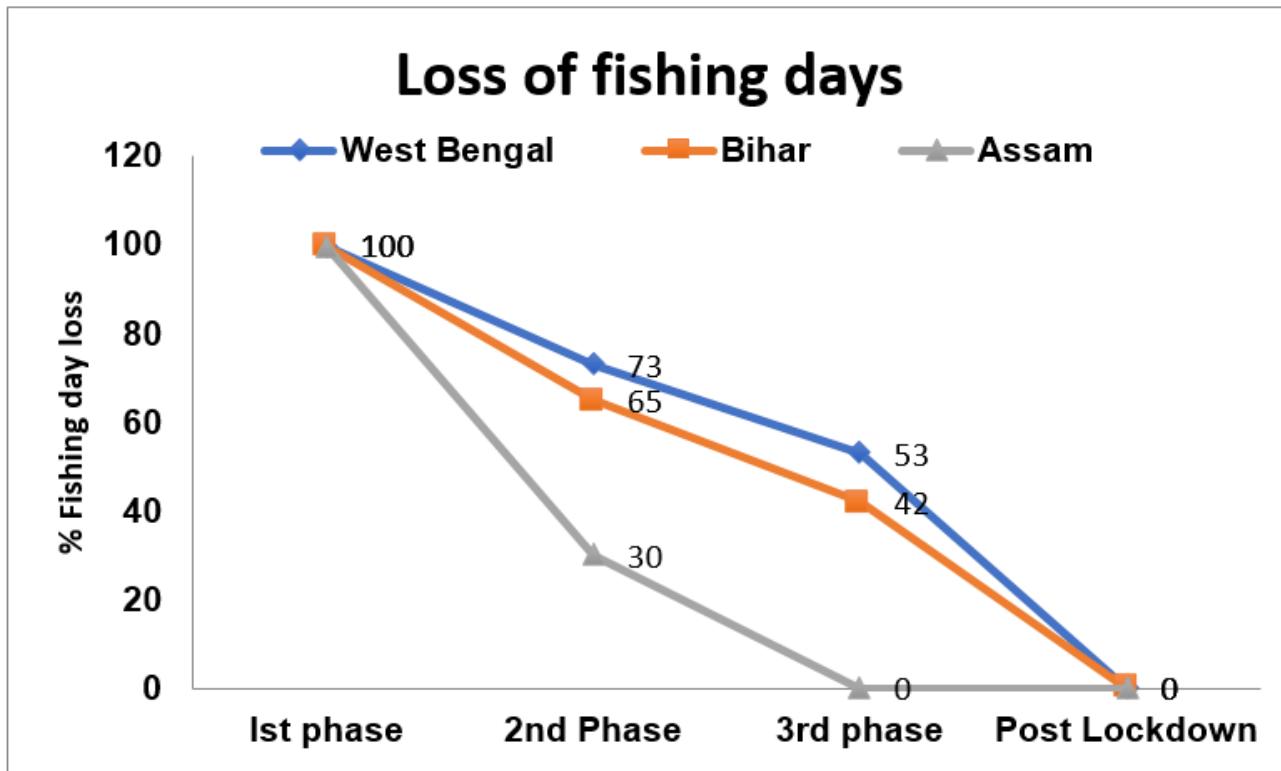


Figure 2

Percentage Loss of employment to fishers during different phases of lockdown

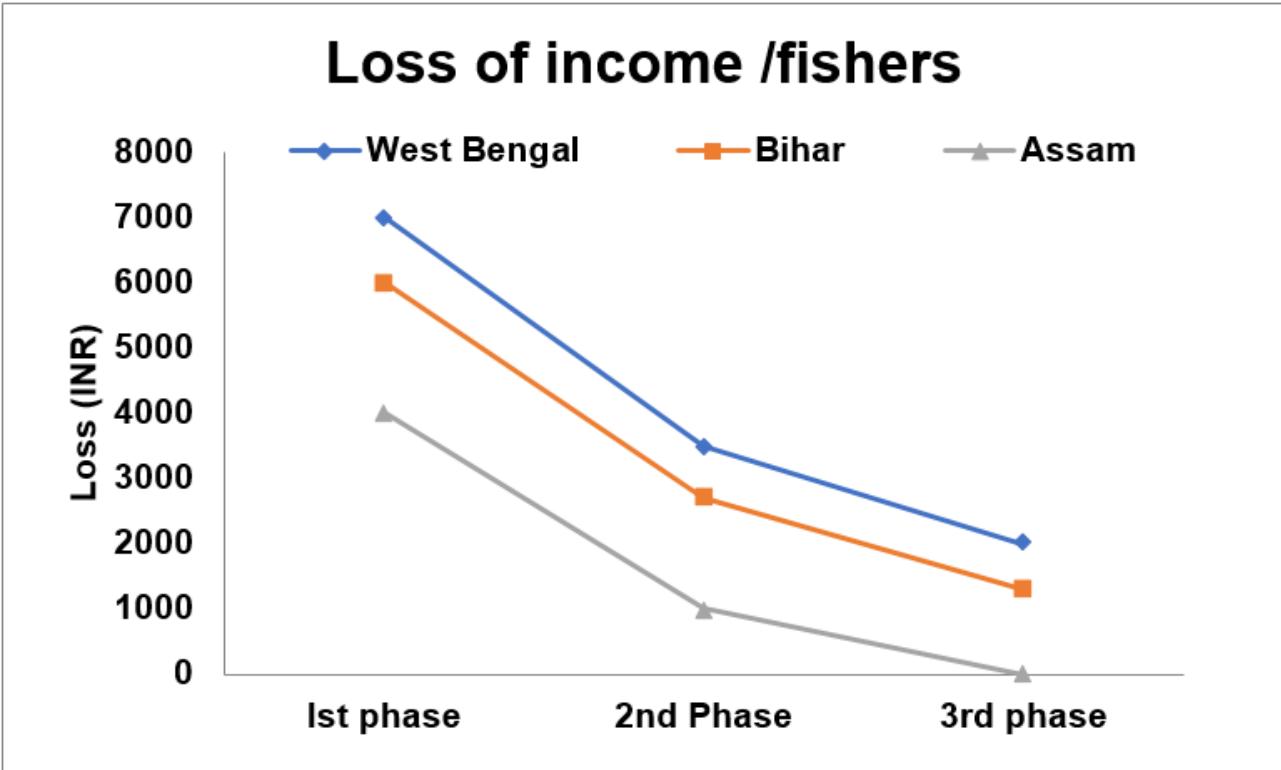


Figure 3

Income loss by individual fishers during different phases of lockdown

### Perceived Economic Loss of the FCS due to Covid-19 Lockdown

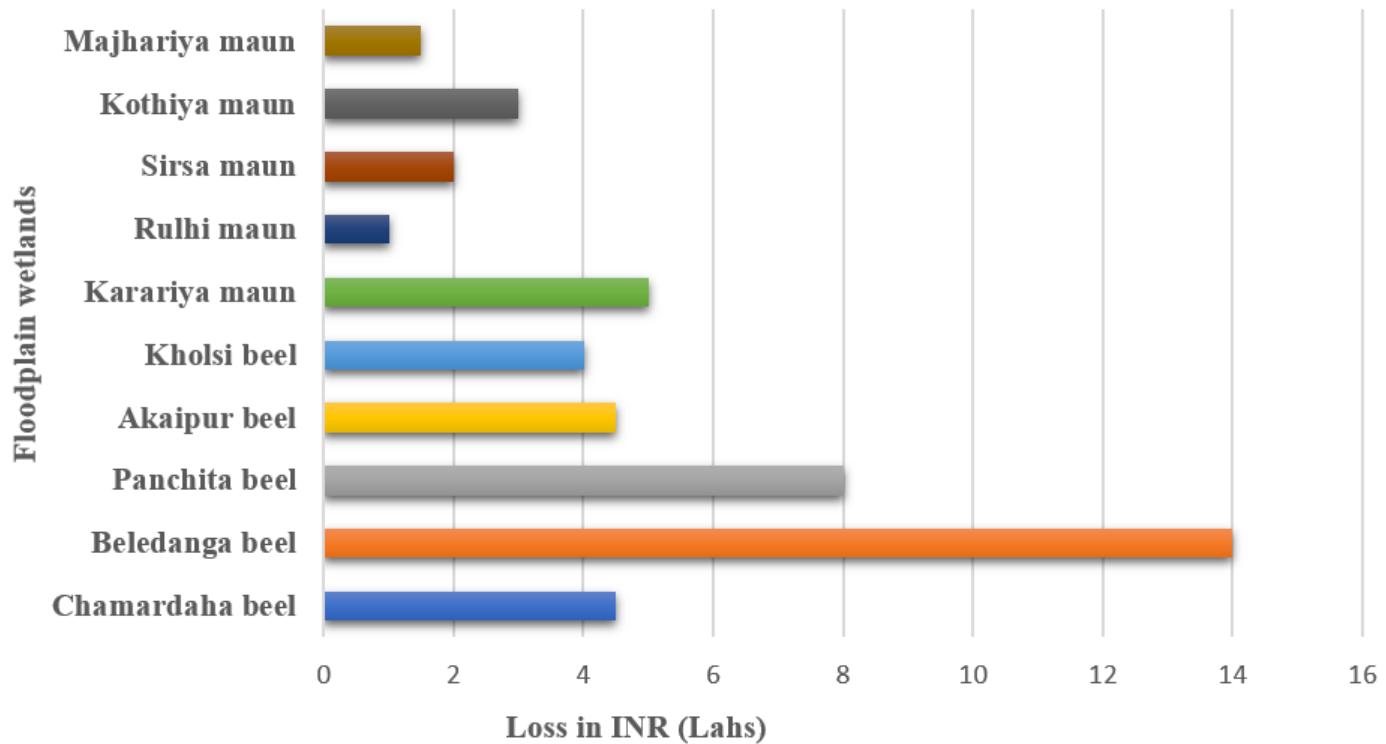


Figure 4

Perceived economic loss by Fishermen Cooperative Societies (FCSs) during the Covid-19 Lockdown period

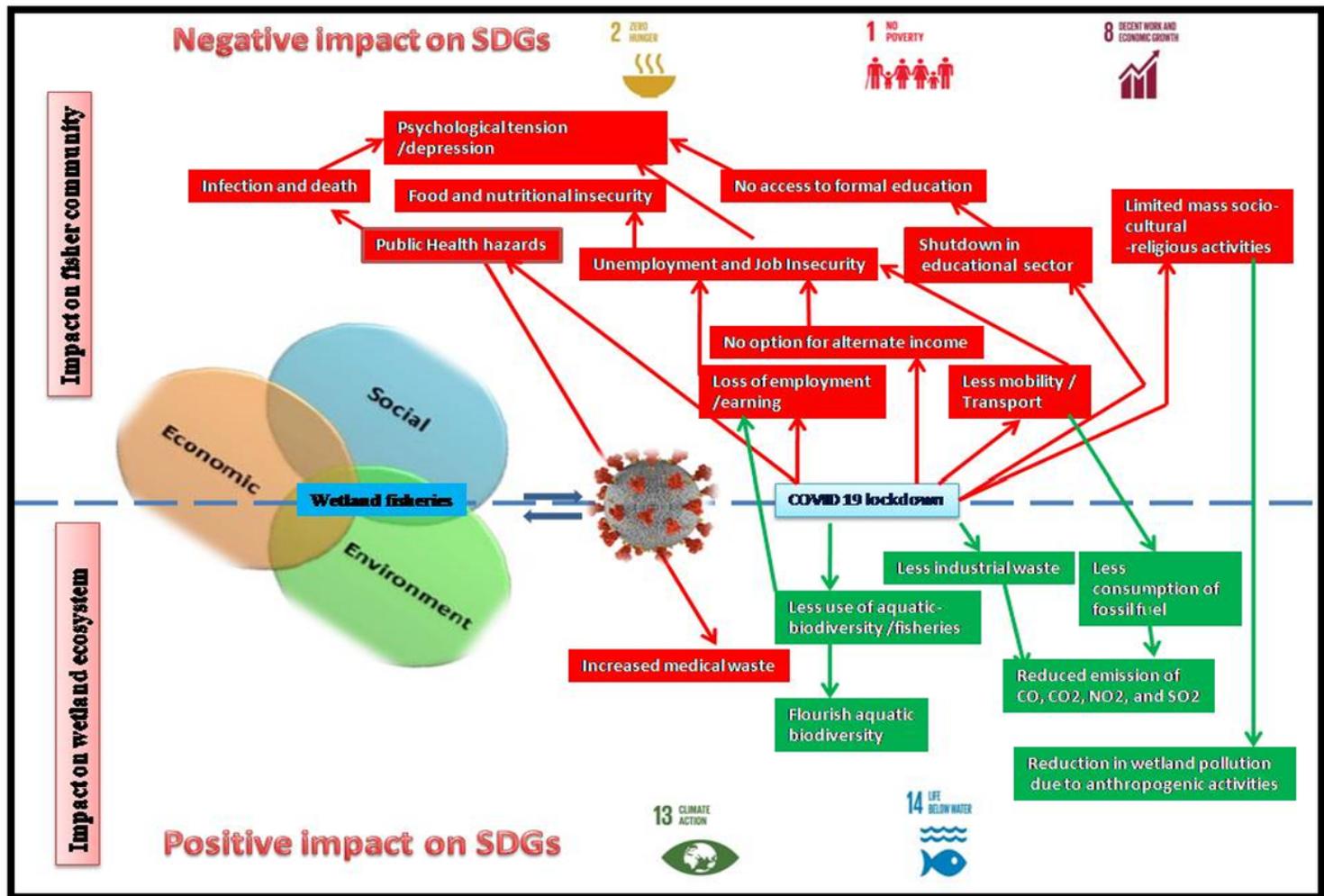


Figure 5

Impact of Covid-19 vis-a-vis Sustainable Development Goals