

Surviving the pandemic, building resilience and thriving economies: Trickle-down effect of COVID-19 on fisheries

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Abstract

Across the globe, countries have been fighting hard to grapple the intimidating spread of the pandemic caused by coronavirus (SARS-CoV-2¹). Pandemic has led to grave consequences, paralysing the society and economy. The pandemic outbreak has not only catapulted a mass health crisis but also shrunk economies. With millions of deaths, soaring unemployment, mounting economic inequality, and staggering national GDPs, livelihoods of people are at risk. The ultimate aim of preventive health measures is to flatten the curve and bring the exponential growth of virus to a halt. The unprecedented and appalling economic meltdown caused by the outbreak of virus has had ubiquitous effects globally, invariably on all sectors, with no exception on fisheries. The pervasive reverberations are perspicuous on terrestrial and marine ecosystems with the externalities caused being, both positive and negative. This article aims to map the socio-economic consequences and determinants of COVID-19 on coastal and marine environment and the related government policies/measures enforced towards the amelioration of living standards of the people. It has been attempted to record the temporal effect of COVID-19 on parameters like employment, revenue, crew size, wages, fishing days lost, fish supply-demand parity, purchase power, economic inequality and the resultant policy changes. Furthermore, short and medium term recommendations discussed, endeavours to provide timely and comprehensive solutions in the swiftly emerging economic scenarios of fisheries and allied segments.

Keywords: COVID-19; Socio-economic disruptions; Economic inequality, Unemployment; Man days lost

Introduction

Across the globe, countries have been fighting hard to grapple the intimidating spread of the pandemic caused by a corona virus (SARS-CoV-2¹). The outbreak was named as COVID-19, the Coronavirus Disease-19 (Qiu et al., 2020). The pandemic has led to grave consequences by paralysing the society and economy. The pandemic outbreak has not only catapulted a mass health crisis but also shrunk economies, making the world more vulnerable. With millions of deaths, soaring unemployment, mounting economic inequality and staggering national GDPs, the livelihoods of enormous number of people are at risk (UNCTAD, 2020). The viral spread has apparently hampered all scopes for development. Governments have been fighting hard to contain the spread of the virus. Containment seems to be the fairly prospective strategy to save the masses until the effective vaccine evolves. "Social distancing" was also emphasized to break the chain of virus spread (Fong et al., 2020). The ultimate aim of these preventive health measures is to flatten the curve and finally bring the exponential growth of virus to a halt (John Hopkins University, 2020a). The governments' influx enormous fund towards these confinement measures like complete/partial lockdown. These initiatives not only dry up the resources and revenues of the government, but also exacerbate the social and economic challenges confronted by the people (Ernst & Young, 2020).

The pandemic has contracted the national economies in a considerable way. Initially the International Monetary Fund (2020a) made an early prediction of 3 percent fall in global GDP in 2020, far worse than that of the recent 2008-09 Global Financial Crisis. Later, the estimate was revised to 4.9 percent contraction in 2020 (International Monetary Fund, 2020b). However, the World Bank (2020) has projected a contraction of 5.2 percent in global economy. And OECD (2020) has rolled an alarming prediction estimate of about 6 percent to 7.6 percent contraction in global GDP. The global economies are likely to worsen further, with the emergence of second wave of COVID-19.

The repercussions of COVID-19 reflected on the wages, jobs, industries, economies and government indicate the heinous sequel of the viral spread. In precise economic terms, for an individual, this ripple effect has been witnessed through the gruesome alterations in the cost of living, cut in wages, earnings, thrift and standard of living (UNDP, 2020), apart from the descending health status. With the developed countries like US, having succumbed to the devastating outbreak, the plight of developing and under developed countries is truly pathetic. This pandemic spurt seems to have a continuing effect, penetrating in a resounding manner and resulting in several economic, human and social losses.

Apart from these, the governments' also focus to steer the wounded economies towards revival through certain mitigation measures. These measures are generally focussed on revival of businesses, generating employment, boosting liquidity and strategically planning for the "new normal". The United Nations calls for recovery from pandemic and acceleration towards achievement of 2030 Agenda for Sustainable Development Goals through UNCTAD (UNCTAD, 2020). The economic impacts inflicted by the virus in India have been grave, particularly in terms of confronting trade turbulences, disrupted supplies, liquidity shocks, unsteady employments and attenuated growth. Chief concern of our country was laid on securing the massive population from health hazards and providing timely relief to the vulnerable, ensuring their robust safety. The real GDP of India decelerated to lowest in six preceding years in the third quarter (Q3) of 2019-20 financial year (MoSPI, 2020).

¹ Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the strain of coronavirus that causes coronavirus disease 2019 (COVID-19), the respiratory illness responsible for the COVID-19 pandemic

The unprecedented and appalling economic meltdown caused by the outbreak of the virus has had ubiquitous effects globally, invariably on all sectors, with no exception on fisheries. The pervasive reverberations are perspicuous on terrestrial and marine ecosystems with the externalities caused being, both positive and negative. The panoramic view of the impacts of the virus on the marine ecosystem has been constructive. Naively ignoring what is harmful, the near-term benefits for the ocean have emanated from the diminished anthropogenic pressures viz; overfishing, beach litter, ecosystem damage, destructive fishing practices, toxic effluences and climate change impacts (UNDP, 2020). It has been speculated that the diminished anthropogenic pressures could have stemmed from the cascade effect of lock down such as work from home options, diminished vehicle emissions, lesser particulate pollution, repatriating floating metro population, etc.

Despite these substantial benefits, there have been copious ill effects realised, placing the livelihood and food security of millions of people at stake. The explicit negative externalities of the pandemic include; health deterioration, death, unemployment, poverty, travel restrictions, business disruptions due to export-import constraints, GDP contraction, labour crunch due to working in shifts, supply-side and cash flow restrictions in industries (UNCTAD, 2020; Ernst & Young, 2020). Being aware of the ruinous impact on the sector, the Government of India included fisheries sector under essential services (G.O.(Ms).No. 152; Indian express, 2020).

Being cognizant of the prevalent background, this study had been attempted. This article aims to map the socio-economic consequences and determinants of COVID-19 on the coastal and marine environment and the related government policies/measures enforced towards the amelioration of the living standards of the people. It has been endeavoured to record the temporal effect of COVID-19 on the fisher folk through parameters depicting the extreme frugality viz., employment, revenue, crew size, wages, fishing days lost, fish supply-demand parity, purchase power and the resultant policy changes. Furthermore, the short term and medium term recommendations discussed endeavours to provide timely and comprehensive solutions in the swiftly emerging economic scenarios of fisheries and allied segments.

In this context, the study objectives were confined to:

1. Elucidate the losses in employment and labour income in fishing due to the pandemic, which acts as a tool to assess the livelihood security of the marine fishers'.
2. Retrospect the alterations in marine policy framework emanating from the lockdown, in order to understand the specific government initiatives for the fishing community to cope with the present vulnerable situation.
3. Appraise the potential impacts that the pandemic had inflicted and suggest relevant key recommendations to realign the sub segments of the fisheries sector.

Materials and methods

Study area

The livelihood study was carried out in 2020, during the COVID period in Tamil Nadu using both primary and secondary data. The qualitative data were collected from the major landing centres across Chennai, Nagapattinam, Ramnad and Thoothukkudi districts of Tamil Nadu through off line in-depth structures interviews of all stakeholders including fishers, fisheries department officials, whole sale buyers and auctioneers. The questionnaire was well designed containing all socio-economic and livelihood parameters. Simple random sampling methodology was adopted to interview the respondents. Participatory Rural Appraisal (PRA) tools such as Key Informant Interviews (KII) and Focus Group Discussions (FGD) were employed for data collection with the boat owners, fishermen association leaders, fisheries department officials and auctioneers and were considered adequate to meet the research objectives. Longitudinal data were also collected from the same respondents over telephone (due to the travel restrictions during COVID) for the first and last 6 months of 2020 and were analysed.

Determination of employment losses

Raw data for all the attributes were collected from secondary data sources such as online fishing craft registration portal (ReALCraft) of the State Fisheries Department of Tamil Nadu (TNFD) and Central Marine Fisheries Research Institute (CMFRI). These attributes were then computed to measure the socioeconomic impacts of the pandemic on the fishing community. Social and economic loss (in terms of employment days and wages) resulting from the lock down and closed season was assessed by comparing average daily wages (income) earned by mechanised and motorised fishing sectors during fishing days, the average loss in crew employment and the number of fishing days lost due to the pandemic. Further, social and economic losses inflicted on the people helps us to ascertain the livelihood security of the marine fishers'.

Government interventions and policy support for the marine fishers'

In order to abet the viral spread, the government promptly introduced safety measures. Among which, a few of them were directly relevant to the fishing community, for them to cope with the present vulnerable situation. In this context, effort was taken to orient the specific government initiatives put forth for the fishing community during the pandemic. The secondary data were collated from the online directory of Government of Tamil Nadu, Department of Animal Husbandry, Dairying, and Fisheries. The Policy Note of Fisheries Department of subsequent years (2013 to 2020) was pooled to gather precise details. It was noticed that the alterations in marine policy framework pertaining to fishing ban was announced, to boost the social security and integrity of the fishing community.

Results and Discussion

Past studies on pandemics reveal that generally, pandemics have severe adverse economic impacts, both in the short and long run. Jonas (2013) has recorded the impacts in the following way: i) resistance behaviour to the social distancing measures as the individuals have to forgo consumption of certain goods and services, ii) minor direct costs like hospitalization and medical costs, iii) higher indirect costs (production loss, labour loss, employment loss), and iv) offsetting and cascading effects (supply-side disruptions, travel restrictions). Carlsson-Szlezak et al. (2020a & 2020b) explained three major economic impact transmission; (i) minimum consumption of goods and services, (ii) resultant financial market shocks and reduced consumption spending, (iii) disrupted supply chains and labour market.

I. Socio-economic impacts of COVID-19 on fisheries sector

The economic slowdown in Indian economy as triggered by lockdown restrictive measures decelerated the production, consumption and distribution of the local economy. CMIE (2020) has estimated that about 91 million people, including hawkers and daily wage workers have lost their livelihood. Though the agriculture sector recorded an increase of 6 million jobs it is referred as disguised unemployment as the change does not reflect in the total economic output. More specifically, a total of 14.5 million people have been estimated to be affected due to the economic lockdown in the fisheries sector (Purkait et. al., 2020). Interference in the supply chain and diminished consumer demand directly affected the livelihood of fishermen, fish vendors, suppliers and workers. The shutdown of restaurants for dine-in and withdrawal of both public and private events lead to the collapse in seafood demand (OECD, 2020). The supply and demand side disruptions caused a major scale uncertainty in consumption and investments. The effects are majorly realised on GDP, health, employment rate, tourism, business disruptions and cash flow restrictions. Figure 1 demonstrates the impact of COVID-19 on the Indian economy.

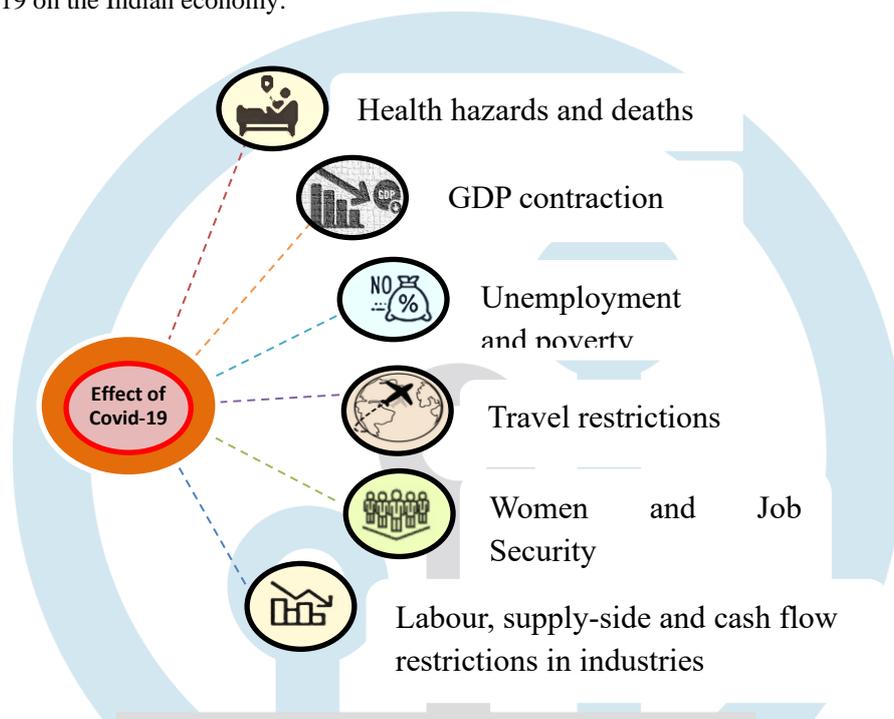


Fig. 1 Socio-economic impacts of COVID-19 on fisheries sector

Health hazards and deaths

Threats to health have been the elemental, yet grave effect of the pandemic. The severity and vigour of the virus was consummated proportionate to the number of lives being succumbed. People with multiple ailments easily yielded to the infection and are prone to higher risk of survival. With the continuous efforts of World Health Organization (WHO), the Coronavirus awareness was advocated to the people on symptoms, spread and prevention.

GDP contraction

The coronavirus-related containment measures significantly reduced consumer demand and investment. The Indian Economy grew at a real GDP growth rate of 4.7% in 3QFY20. The primary sector has clearly been the highest contributor in the GDP. The primary sector comprises of agriculture and allied activities including fisheries and forestry. In India, about nine million people rely directly on fishing industry for their livelihood. The sector accounts for 1.1% of GDP (Economic Times, 2020). The Covid lockdown severely impacted the contribution of fisheries to national and agricultural GDP.

Unemployment and poverty

The global multidimensional Index (UNDP, 2019) reported that India was successful in uplifting 271 million people out of poverty between 2006 and 2016. Seasonal migration of labour for work is a prevalent reality in rural India (Chaudhary et al., 2020). Rural migrants are generally hired in urban areas as skilled and unskilled workers in industries and other service sectors. The pandemic induced unemployment sustained price divergence leading to scissors effect in the farm economy, further resulting in decline in income.

Travel restrictions & Tourism

Coastal tourism provides additional revenue to the coastal communities. According to Liu et al. (2019), tourism is the the most dynamic sector that benefits many other sectors like lodging, catering, transportation, retail, entertainment, etc. contributing to global economic growth and recovery. Due to the confinement, the closure of borders and the cancellation of international flights, rate of arrival of tourists in India has been greatly affected. The arrival of foreign tourists to India from different parts of the world has reduced by 68% in March 2020 (Jaipuria et al., 2020). The Indian tourism and hospitality industry currently faces an estimated loss of 38 million jobs (Dogra, 2020). Local vendors and other coastal communities reliant on tourism have witnessed a fall in income and opportunities. In response to this, as a mitigate measure, the Government of Tamil Nadu has recently introduced “Experimental Tourism” to promote local tourism (TOI, 2021).

Business disruptions due to export-import constraints

The loss of local seafood demand was further compounded by the downfall in export markets (OECD, 2020). Further, social distancing, confinement measures, and border closures created more challenges in the sale of fresh fish. Reduced imports and exports resulting from global containment and supply chain disruptions have crippled the Indian economy (Economic Times, 2020). The GDP growth amounted to 5% during the first quarter of January 2020 (Fig. 2). Fish and fish products contribute to a significant share of international trade. However, the fish supply chains are severely affected by the closure of global markets (Purkait et al., 2020). Falling demand and reduced production capacity, amplified the costs all along supply chains posing serious difficulties to the producers (OECD, 2020).

Women and job security in the Aquaculture sector

According to FAO (2021), women's role in the post-harvest sector has been significantly affected by the decline in mobility and consumer demand. This pandemic has severely hit the job and income security of women especially those informally employed in the fisheries and aquaculture sectors and other migrant workers in seafood processing factories among the coastal communities. In India, aquaculture was not considered as an essential sector, hence was not initially exempted from lockdown measures, so, the shrimp hatcheries were forced to destroy the unsold seed stock. There were innumerable challenges faced by this sector in pre- or post-production processes, trade inspections, product testing, certification, port protocols, and operations (OECD, 2020). The inaccessibility of cold storage and processing units amplified their vulnerability further.

Labour, supply-side and cash flow restrictions in industries

The seafood sector had been working on a target of around \$7-billion of export value in 2020 (Business Line, 2020) and the corona outbreak has disrupted the fishing sector with respect to crop harvesting, processing, supply and marketing. All major sectors of the economy have been affected and the restrictions imposed by Government have worsened the business cycle. The scarcity of inputs, labour supply, transport, closure of hotel industry and lack of markets have had a direct impact on the fisheries industry as a whole (MSSRF, 2020). The closure of processing industries has resulted in a lack of production flows to domestic and international markets as major importers have partially/completely closed the markets. This has disrupted the cash flow of the economy as many companies have opted for layoffs as a significant mitigation measure. The poor circular flow of domestic income further affected the overall demand of the economy and has hampered the recovery process.

II. Economic effects of the pandemic

Since the initiation of economic liberalisation reforms, the Indian economy has recorded an average of 7 per cent GDP growth rate. The total suspension of economic activity in the first quarter of 2019-20 fiscal year, arising from the series of worldwide lockdowns to curtail the spread of virus, led to a staggering fall in Gross Domestic Product (GDP) growth, compared to the preceding fiscal year (Fig. 2). India's latest GDP estimates show that the country's economic growth rate has been stalling at an all-time low of 3.1 per cent in the fourth quarter, Q4 of 2020 (January – March quarter), as against the expected growth of 4.2 per cent. At 3.1 per cent, the Q4 financial growth rate of 2020 has been the lowest in 11 years.

The impact has been severe in all the three sectors of economy, viz., agriculture, secondary and service sector. Except for agriculture, the growth indicators of secondary and service sectors were hit worst. The services sector attributes to about 55 per cent of the country's GDP. Moreover, as the major job generating sectors are severely affected, the total income and output of the production sector has also been very low, fuelling the increase in unemployment. This clearly signifies that the manufacturing sector has been severely incapacitated by the nation-wide lockdown, leading to ripple effects on employments and economic growth.

With the spread of COVID-19 soaring high, all scopes for development were apparently hampered. Government of India has been fighting hard to contain the spread of the virus, railing against the legislations. Complete/partial lockdowns have become the mainstay of the prevalent situation. "Social distancing" has also been emphasized to break the chain of virus spread (Fong et al., 2020). The ultimate aim of these preventive health measures is to flatten the curve and finally bring the exponential growth of virus to a halt (John Hopkins University, 2020a).

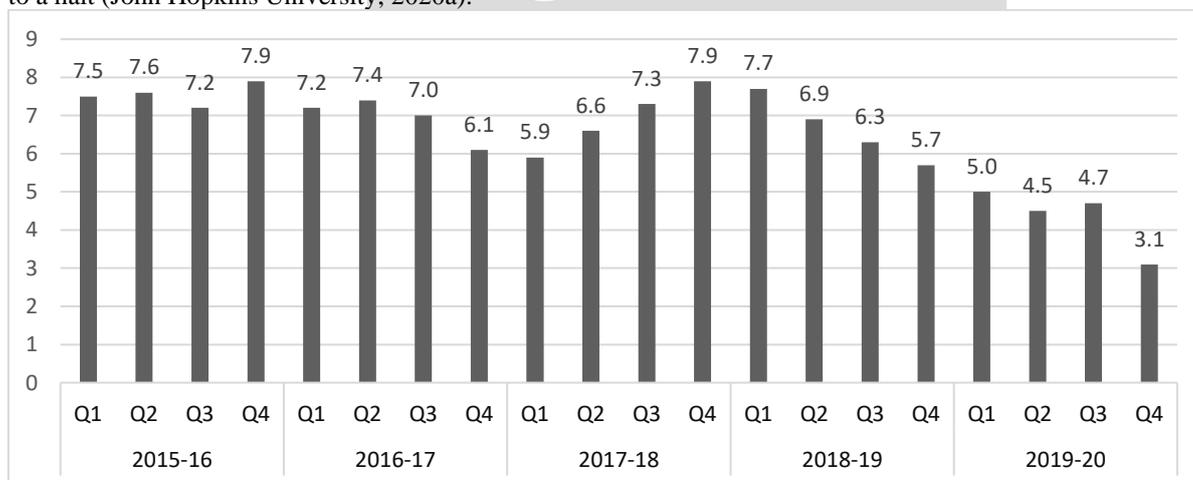


Fig. 2 Quarterly estimates of real GDP growth rate (in percent, at constant 2011-12 prices) of India, MoSPI

In the process, the economic growth has been crippled, contracting the national economies in a considerable way. Hence, government interventions have been closely focussed on health, labour/employment, and environmental aspects to overcome people of the complete penury. On 24th March, 2020 the Government of India announced a special financial package on statutory and regulatory compliance for various sectors, to boost the ailing economy. These announcements were particularly focused in the areas

of income tax, EPF, ESI, GST, Customs & Central Excise, Corporate Affairs, Insolvency & Bankruptcy Code (IBC), Fisheries, and banking services and commerce. Several flagship supportive measures were announced by Government of India from January to May 2020 to shield the shrinking economy during the first wave of Covid. Needless to mention that, the measures were stringent during the first wave, and the similar mechanism was implemented during the second wave with considerable relaxations.

III. Employment and labour income loss in fishing

The pandemic forced lockdown has led to employment challenges invariably across several sectors globally. Pandemic impacts on the fisheries sector include; obstruction of conservation/restoration efforts, loss in fishing days, employment and revenue losses in fishing, fish farming hurdles, fish/shrimp feed availability, marketability, seafood supply/value chain disruptions, retail market uncertainty, market inefficiency, fall in demand, reduction in purchase power, decrease in per capita consumption, shift to online purchases, export imports hindrances and related policy changes (Ocean Conservancy, 2020; UNDP, 2020). This wide array of effects has had massive and irrevocable consequences on the lives and livelihood of fishers' which is often overlooked. This study holds more significance in assessing the employment and revenue loss borne by the fishers'. Though fishing was deemed as an essential service, fishers restrained from fishing in order to adhere to social distancing, due to small vessel sizes and trading in close grips in local markets (Orlowski, 2020).

Generally, fishing is one of the uncertain sectors where fishers' barely manage break even. Seafood being a highly perishable commodity, fishers' manage to sell their produce at a better price incredulous. With occasional windfall gains and losses, they always have a semblance of insecurity (Narayanakumar et al., 2000). To worsen the situation further, the viral spread and lockdown has had a toll on their nominal livelihood security. Confined to the current pandemic state and resultant uncertainties, fishers' do not expect any spike in income. However, there are chances of them being short changed in terms of market pricing. In the zeal to push this narrative, the social and economic loss (in terms of employment days and wages) consequential to the lock down and closed season was assessed by comparing average daily wages (income) earned by mechanised and motorised fishing sectors during fishing days, the average loss in crew employment and the number of fishing days lost due to the pandemic. Sector-wise landings in Tamil Nadu shows that mechanised sector contributes to 83.3% of the total landings followed by motorised (16.3%) and non-motorised (0.4%) sector (FRAD, CMFRI, 2020).

Average catch per unit effort (CPUE) for mechanised and motorised crafts arrived to 1571 and 816 kg in 2016 (Sivadas et al., 2019). Table 1 explains the employment and labour income loss incurred in fishing in Tamil Nadu during the pandemic. The data has been elucidated across three sectors; non-motorised, motorised and mechanised. While, the number of fishing units operated increased in the motorised sector between 2018-19 and 2019-20, it needs to be noted that the number of non-motorised and mechanised units have reduced in 2019-20. This could have been attributed due to the economic and operational inefficiencies of non-motorised and mechanised units created by the covid protocols. During 2018-19, fishing days lost was primarily due to the fishing ban and the mechanised sector remained the only sector affected in this regard, as the ban is not applicable to non-motorised and motorised sector. On the flip side, in 2019-20, fishing days lost was accounted by fishing ban and COVID lockdown. All the three sectors witnessed lockdown and the fishing days lost due to COVID was higher for non-motorised crafts (28) compared to the motorised (20) and mechanised (20) crafts. Fishing days lost due to fishing ban remained nil in case of non-motorised and motorised sector. However, mechanised sector witnessed a reduction in the ban period from 60 to 45 days (Anon, 2020) only for the year 2020. Hence, the total fishing days lost was higher in 2019-20 across all three sectors.

In 2018-19, 3.8 million man-days were totally lost during the closed season accounting for a total labour income loss of Rs 3767.6 million to the fishing sector for the entire Tamil Nadu. Similarly, for 2019-20, 9.4 million man-days were lost accounting for a total labour income loss of Rs 7602.3 million resulting in an increase of loss by 101.78%. Fishers' generally resort to fishing-related livelihood enhancement options (Colwell & Axelrod, 2017) or traditional fishing (Aswathy & Sathiadhas, 2006) to tide over the closed season. However, the scenario was unusual this year, hence, the fishers' became highly vulnerable and worst hit.

Table 1. Employment and labour income loss in fishing in Tamil Nadu during the pandemic

Category	Non-motorised sector		Motorised sector		Mechanised sector		Total	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
No. of fishing units operated	5900	5624	32879	35906	5893	5798	44672	47328
No. of fishing days lost due to ban	0	0	0	0	60	45	60	45
No. of fishing days lost due to covid	1**	28	1**	20	1**	20	3	68
Total fishing days lost	1	28	1	20	61	65	63	113
Average crew size	4	4	7	7	10	10	21	21
Total employment loss (in man days)	23600	629888	230153	5026840	3594730	3768700	3848483	9425428
Income loss per day per labourer (Rs.)	500	500	700	700	1000	1000	2200	2200
Total loss in labour income (Rs. millions)	11.8	314.9	161.1	3518.7	3594.7	3768.7	3767.6	7602.3

Source: Primary data

* **Total Crew Size** = No. of Mech. fishing units operated * Average crew size

Total employment loss = Total Crew Size * No. of fishing days lost

Total loss in labour income (Rs.) = Total employment loss (in man days)* Income loss per day per labourer (Rs.)

** **Fishing days lost due to COVID** was accounted as 1 (when the number of days lost was 0) in order to validate the total employment loss calculation

IV. Policy alterations in the fisheries sector

The enactment of Tamil Nadu Marine Fisheries Regulation Act (TNMFRA) happened in January, 1983 as an effort towards resolving the resource conflicts between trawlers and artisanal crafts in Tamil Nadu. TNMFRA later steered to the launch of trawl/fishing ban / closed season in 2001 for a period of 45 days from 15 April to 29 May each year as a conservation initiative to secure the marine fishery resources (Vivekanandan & Kasim, 2011). The trawl ban aids in marine habitat recovery and stock regeneration through recruitment, apart from threatening the livelihood security of the boat crew and dependent shore workers (Salim, 2007; Bavinck et al., 2008; CMFRI, 2012; Colwell & Axelrod, 2017). Hence, Government of India consented to provide Rs. 2,000 per ration card for the fishermen as a welfare measure (Anon, 2016).

Recently, in 2017, the fishing ban period has been extended from 45 to 60 days (from 15 April to 14 June) emphasising a uniform ban for the East coast of India (Anon, 2017). This has been looked upon as a critical step forward towards ecosystem-based marine fisheries management and responsible fishing (Amali et al., 2020). To protect the socio-economic integrity of the fishers' and to render timely financial assistance, the ban relief amount has been enhanced from Rs. 2000 to Rs. 5000 per ration card (Anon, 2017). The transaction cost of fishing ban implementation seems to budget around Rs. 330 million till 2016, when the trawl ban lasted for only 45 days (Table 2). The budget allocation skyrocketed to Rs. 831 million in 2017 after the extension of ban to 60 days and revolves around the same hitherto with negligible changes (Amali et al., 2020).

Table 2. Compensation cost during fishing ban period

Fishing ban compensation budget allocation			
Year	Period(days)	Amt. in millions	% change
2013-14	45	320.0	-
2014-15	45	334.9	4.66
2015-16	45	330.5	-1.31
2016-17	45	331.0	0.15
2017-18	60	831.7	151.27
2018-19	60	831.7	0.00
2019-20	60	835.0	0.40
2020-21	45	817.5	-2.10

Source: Fisheries Policy Note 2020–21, Government of Tamil Nadu

It is noteworthy to mention that, there have been few pandemic induced remarkable policy changes in the marine fisheries sector. The critical policy alteration among them is the reverting of 60 days fishing ban to 45 days, only for the year, 2020 (Anon, 2020). This move was initiated in order to compensate for the several man days lost in fishing due to the pandemic and lock down. Needless to mention, despite limiting the ban days, the same relief amount of Rs. 5000 was distributed to the fisher folk. This was put forth as a welfare measure to contribute to the livelihood security of the fisher folk amongst the prevailing apprehensive and uncertain pandemic state.

V. Pandemic effect on fisheries research activities

The COVID-19 outbreak has not spared its adverse influence on the research front. With the continuous lockdowns, academics was badly struck. Nevertheless, it got slowly revamped accommodating to the prevailing scenario of digital rush (Pravat, 2020). Similar consequences have been witnessed in the field of research with the scope of work of researchers being extended far beyond. Initially, loss in productivity in research due to immobility, lock down and field visit restrictions were perceived but was soon adapted on need basis to the digital mode (De et al., 2020). Apparently this compulsive state seems to broaden scopes in generating novel ideas for the near future or developing research ideas for grants or writing and articulating research papers. Several research organizations have swiftly shifted to online training platforms contingent of the prevalent situation.

VI. Potential impacts and key recommendations in the sub segments of fisheries sector

The sub segments of fisheries in which the impacts of the pandemic were felt include; tourism, retail business and consumers and fish availability in retail markets. Potential impacts and recommendations have been finalised by the prioritization exercise carried out using 3*3 ranking grid (Low, Medium, High).

Tourism industry is one of the chief revenue providers to the nation's economy. In precise terms, tourism alongside coastal and marine areas has always been a treasure trove. The pandemic effect on this sub segment came to a screeching halt due to international and domestic travel restrictions. It is slowly picking up momentum amidst people's apprehensions. Retail businesses (like feed companies) got affected due to supply chain interruptions, raw material, labour crunch and logistics issues. Fish availability in retail

markets was hit due to fish availability, unplanned fishing holidays, supply chain disruptions, and reduced consumption due to immobility.

The supply chain of fish is one of the notable industries that were most significantly affected by the pandemic. Fisheries supply chains typically involve 5 participants, viz. Fishers, Agents/Middlemen, Wholesaler, Retailer, and Consumer. The pandemic did more harm to the industry than just suspending the supply chain. In fact, these supply chain disruptions have a number of causes which include; disrupted market, disrupted transport, decreased demand, disrupted employment and income, increased wastage and others. Transport disruptions were the primary cause of the supply chain's impact.



Fig. 3 Supply chain of fisheries: before and after covid disruptions

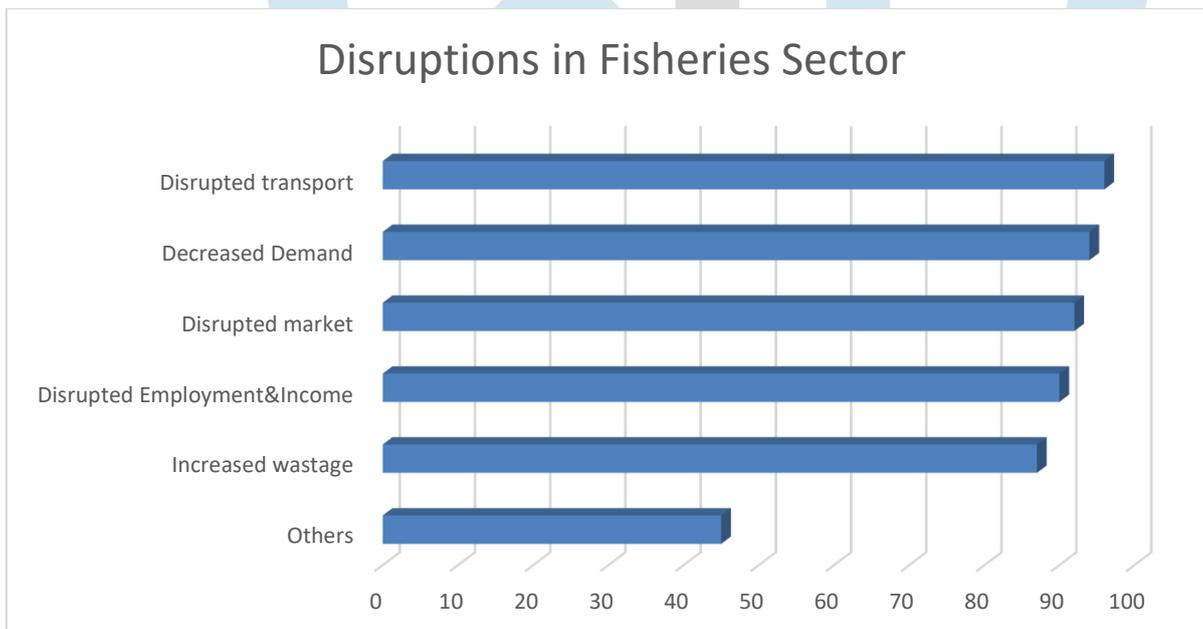


Fig. 4 Factors attributing to supply chain disruptions in fisheries

Other factors include lack of equitable access to Covid-19 vaccine by fishermen, consumers' buying preference to contact-free delivery services of sea food and comfortability of consumers. This induced the entry of competitive players in the online seafood market.

On the contrary, the viral spread and lockdown has had a toll on the fisher folks' nominal livelihood security. Confined to the current pandemic state and resultant uncertainties, fishers' do not expect any spike in income. However, owing to past experiences and fearful of changes amongst the prevailing measures, there are chances of them being short changed in terms of market pricing.

Table 3. Potential impacts and key recommendations in the sub segments of fisheries sector

S.No.	Area	Current and Potential impacts				Key policy recommendations			
		Parameters	L	M	H	Explanation	Recommendations	Short-term	Medium to Long-term

1	Tourism	Price disparities		✓	As international and domestic travel remain restricted, turbine fuel demand declines	Tax related compliances	VAT can be rationalised by the states	GST holiday can be suggested for tourism services
		Cash flow limitations		✓	Attributed by bulk cancellations and travel restrictions	Easing financial pressures	Moratoriums on interests and principal amounts	Relief funds; No loan shall be classified under NPA
		Manpower		✓	Layoffs have been witnessed both in white and blue collar jobs	Initiatives towards customers	Compatible refund policies	Healthcare and insurance incentives
		Lockdown restrictions and consumer sentiments		✓	Inbound and outbound travel to India being very low	Others	Emphasize on restricting travels up to 12 months	Promote domestic tourism in a safe and hygienic way
2	Retail business and consumers e.g Feed companies	Price disparities of raw materials		✓	Supply chain disruptions lead to price fluctuations in raw materials	Tax related compliances	Tax incentives, GST waivers and rebates on interests and principle payments	Ease manufacturing rules for essentials, permit imports for critical products by duty cuts, no penalties for delay in filing of statutory returns
		Production halt		✓	Production had been a real challenge with demand being poor, with a resultant ripple effect on national GDP and global economic slowdown	Easing financial pressures	Interest waivers/special rebates for MSME to ensure cash flow	Rental moratoriums and suitable insurance coverage
		Cash flow limitations		✓	Pecuniary resources and cash rotation have been sluggish forcing companies to renegotiate/revise their rental agreements			
		Supply chain disruption		✓	Due to production redundancy and government limitations	Initiatives towards customers	Preference to digital payments in order to ensure contact-free transactions	Uninterrupted supply chain support for e-commerce players
		Man power		✓	Labour force had been urged to work on shifts with necessary safety procedures. Chances of lay-			

					off in case of contractual/ wage labour			
		Lockdown restrictions and consumer sentiments		✓	Consumers opt for essentials and preferably through e-commerce	Others	Guidelines, safety measures and proper disinfection procedures to be adopted	Gradual unlock of malls/market places with proper social distancing norms and sanitation procedures
3	Fish availability in retail markets	Price disparities of raw materials		✓	Discontinuous supply due to unplanned fishing holidays impacting prices	National policy on food supply chain during pandemic	Government should ensure undisrupted supply chain particularly for essential and perishable food items	Smoother supply chain and transport corridors
		Production halt		✓	Unplanned fishing holidays resulting from lockdowns			
		Cash flow limitations		✓	Reduced consumption, preference to e-commerce buying platforms	Easing financial pressures	Alteration in the fishing ban season, supply of fishing inputs	Financial incentives for domestic and export market
		Supply chain disruption		✓	Due to reduced demand for seafood			
		Man power		✓	Labour availability had been a challenge in this sector	Initiatives for customers	Safety guidelines, social distancing, digital payments and contact-free transactions	Uninterrupted supply chain support
		Lockdown restrictions and consumer sentiments		✓	Reduced demand, consumer's buying preferences shifts to online options and digital payments			
		Sea food exports		✓	Due to demand contraction and domestic supply chain disruptions			

*L-Low, M-Medium, H-High

The main economic impacts and possible recommendations (short term and medium to long term) have been summarised in Table 3. The welfare measures suggested needs to be implemented with the interference of both state and central Governments. Financial assistance and other incentives like tax incentives, GST waivers, special rebates, etc. would not only support to enhance the living standards of the people, but also boost the national economy considerably. Effective supply chain management would stimulate the seafood industry in the domestic as well global markets. Digital accounting of transactions would serve to maintain transparency and also substantially improve the efficiency of supply chain. These mitigating strategies would also support the fishers particularly women and small scale fishers to alleviate from the current distress. Continued support from the government is expected with more specific medium to long term diligent interventions to revive the lost business in the industry and build resilience among the fishing community (Nathan et al., 2020).

Conclusion

COVID-19 will be remembered as one of the massive black swan events. The socio-economic disruptions caused by the pandemic seem to be far worse than that of the 2008-09 Global Financial Crisis. Usually, fishing days lost in a year has been primarily due to the fishing ban/adverse weather conditions. But in 2020, fishing days lost have been resulted from pandemic lock downs, closed season and adverse weather conditions with a serious impact on all these fishing sector – mechanised, non-motorised and motorised sector. Specifically, a total of 14.5 million people have been estimated to be affected due to the economic lockdown in the fisheries sector, which signifies the prevailing employment and economic inequality in the sector. Interference in the supply chain and

diminished consumer demand directly affected the livelihood of fishermen, fish vendors, suppliers' and workers. Aware of the ruinous impact on the sector, the Government of India included fisheries sector under essential services and provided timely assistances which is highly appreciable. Continued support from the government with transparent policy responses is expected, with more specific medium to long term diligent interventions to revive the lost business in the industry and build resilience among the fishing community.

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