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COVID-19 and marine fishers in India: livelihood implications and coping strategies

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Abstract The paper examines the livelihood impacts of COVID-19 on marine capture fishers in India, the coping mechanisms adopted by them, and their correlates, by using primary data collected from fishers of Andhra Pradesh on the eastern coast and Kerala on the western coast. The fishers adopted several coping strategies, correlated with personal attributes, ownership of economic assets, social capital, and economic status. The study advocates the need to carefully evaluate the trade-off between restrictions to contain COVID-19 and loss of livelihood.

Keywords COVID-19, livelihood security, food security, coping strategies, small-scale fisheries, vulnerability, risk

JEL codes I38, O13, Q18, Q54, Q58

Ever since the new coronavirus (2019-nCoV) was first detected at Wuhan in China on December 2019 (WHO 2020a), it has quickly spread to almost all parts of the globe (Siche 2020). On 11 March 2020, WHO declared the highly contagious disease, popularly known as COVID-19, a global pandemic (Cucinotta and Vanelli 2020). As on 9 January 2020, COVID-19 had affected a cumulative number of 88.9 million persons globally, causing 1.9 million deaths (Johns Hopkins University 2021).

In the number of positive cases, India is placed second globally, with cumulative positive cases of 10.41 million and deaths of 0.15 million as on 7 January 2021 (GoI 2021). Since then, the second and third waves of COVID has spread all across the country, but it has subsided over time, although with significant causalities. In India, the first positive case was reported from Kerala on 27 January 2020, in a student returned from Wuhan (Andrews et al. 2020). The number of cases increased to 519 on 24 March 2020 (WHO 2021).

In a televised address to the nation, the prime minister of India announced a nationwide lockdown with effect from 25 March 2020, initially for a period of 21 days (PIB 2020). Subsequently, the national lockdown was extended to the end of May. The lockdown was envisaged to contain the spread of the disease by telling people to stay home but for unavoidable circumstances and by observing social distancing strictly. All transport

services, educational institutions, hospitality services, tourism activities, social and religious functions and activities that attract gatherings were prohibited or suspended, with exemptions for designated essential services (PIB 2020; GoIb 2020). Subsequently, the national lockdown was relaxed in a phased manner.

However, economic activity continues to function only partially; it is limping back to normalcy. The pandemic and its containment methods focusing on social distancing have impacted the global economy to the level of a recession. Workers lost jobs, and an economic contraction was visible, particularly in the first and the second quarters of the year 2020; 400 million jobs (full time equivalent) were lost between April and June (McKeever 2020).

The pandemic affected the Indian economy as well. The growth in gross domestic product (GDP) fell from 3.9% for FY 2019–20 to –7.2% for FY 2020–21 (CSOa 2021), and from 3.0% for the January–March quarter of 2020 (CSOa 2021) to –22.8% during April–June and –7.0% during July–September 2020 (CSOb 2020; CSOc 2020).

Marine fisheries in India and the pandemic

With a production of 13.7 m tonnes of fish in 2019–20, India accounts for about 12% of the global fish production and contributes about 4.5% of the global marine capture fish production. Of this, marine fish accounts for about 4.8 million tonnes, from a coastline of 8,129 km. Also, marine products are the largest exported commodity group within the agricultural sector. Exports grew at 10.8% per annum over the past decade to reach a revenue of US$ 6.7 billion in 2019–20.

About three-fourths of total marine fish produced in India is marketed domestically. India has about 3.78 million fisherfolk, of which 92% belong to the traditional and small-scale category. About 4 million people depend directly on marine fishing and allied activities for their livelihood.

The pandemic has disrupted the supply chain of aquatic commodities in India. The restriction on the movement of persons, vehicles, and mass gatherings have affected fishing operations and working of harbours and landing centres. Organized fish marketing was closed as a measure to maintain social distancing during the lockdown. Fish processing activities were also closed. This is in line with the global experience. Restrictions on operation of flights and other logistics, and restriction on trade is found to have impacted exports and market access during COVID-19 globally (FAO 2020; Ivanov 2020; IFPRI 2020).

In this backdrop, this article examines the impact of COVID-19 on livelihood of marine fishers in India during its first wave, the coping strategies adopted by them and the correlates of the adopted coping strategies. Based on the insights from the study, it identifies important considerations while preparing strategies for managing COVID-19 and similar situations beyond.

Review of studies on impact of COVID-19 on fisheries

In this section we review the impact of COVID-19 on fisheries in India and in other countries during the first wave. The pandemic affected the value chain of marine and aquatic products. The disruption of the value chain has increased financial risks in terms of reduced cash flow, reduced repayment capacity, risk-bearing ability, and capability to meet financial obligations. In USA, prior to the pandemic, restaurants made about 68% of seafood purchases (Tiernan 2020), but since COVID-19, sales declined 95% (Sorenson et al. 2020). Relative to the previous year, the fresh seafood catch declined 40%, imports 37%, and exports 43% (White et al. 2020).

The COVID-19 crisis has severely affected the income and livelihood of fishers in Cyprus. (Elias et al. 2020). The average gross margin during the lockdown month was lower by 4 times that for the previous winter period (December 2019–February 2020) and 2.5 times lower than that of 2019.

The negative impacts have fallen disproportionately and heavily on small-scale fisheries, which employ more than 90% of the world's fishers (FAO 2019). COVID-19 has accentuated the vulnerability of such marginalized groups (Bennet et al. 2020; Sorenson et al. 2020). The impact has been severer on small-scale fisheries (America et al. 2020) that depended on global markets, as in the case of South-East Asia (Kaewnuratchadsorn et al. 2020). Export-oriented small-scale fisheries with low level of geographical diversification are shown to be highly vulnerable to

the pandemic and to other global disruptions like recessions, trade wars, and natural disasters (Knight et al. 2020).

COVID-19 impacted the efforts to ensure the health and safety of fishers working on board vessels. The pandemic has cut short the opportunities for training on safety measures to be followed while fishing because it is difficult to provide training while maintaining safety protocols (Sorenson et al. 2020). Migrant industrial fishing workers are vulnerable to poor health and safety conditions, poor remuneration, exploitative working conditions, and unreasonable deductions in payments (EJF 2019; Greenpeace East Asia 2020), which has intensified during the COVID period (Marschke et al. 2020). The impact of the pandemic has transcended the marine fisheries sector, and it is set to affect the blue economy, including maritime transport, coastal tourism, and port and harbour activities, as noted in the case of the EU (Kolesnikova 2020; Gamlen 2020).

The pandemic has had a few positive outcomes, however, such as in enhancing sustainable fisheries and increasing social cohesiveness (Bennet et al. 2020; Kemp et al. 2020). COVID-19 has effected a global slowdown of commercial fishing, reducing pressure on some threatened stocks and thereby helping to build up stocks. This would give a unique opportunity to further build up stocks and move to sustainable fisheries, provided it is followed with supportive policies of fish resource management (Kemp et al. 2020).

Studies in India

The lockdown and the supply chain disruption has affected almost 14.5 million people associated with the sector. It has impacted multiple dimensions of the fisheries sector, including production distribution and marketing of inland fisheries, marine capture fisheries, seed supply, and seafood export (Purkait et al. 2020).

The economic loss of COVID-19 on shrimp aquaculture during 2020–21 was about USD 1.50 billion (Kumaran et al. 2021). An analysis carried out using primary data showed that the major constraints were associated with shrimp seed production and supply, logistics and the supply chain, processing activities, marketing, and loss of employment and income for workers. In the case of marine fisheries, disruptions in the supply chain of both inputs and outputs were reported (Suresh and Sajesh 2020). In the initial months of the lockdown, only a few traditional fishers were venturing out into the seas. The Central Institute of Fisheries Technology (ICAR-CIFT) estimated the daily loss at about INR 2.24 billion (Businessline 2020). Several media reports suggested all the stakeholders in the value chain lost their livelihood. Women, who constitute 75% of the workforce in processing units (Jeyanti et al. 2015) and 72% of the casual labour force, also became jobless.

Materials and methods

The study primarily utilizes data collected from fishers of two maritime states. A total of nine major maritime states in India are spread along the eastern and western coasts. Out of the nine states, one state from each of the coasts, Andhra Pradesh from the eastern coast and Kerala from the western coast, was selected purposively based on the convenience of conducting the primary survey. From each state, fishers operating in one major fishing ground was selected purposively, based on the quantity of fish landed. Accordingly, Vizag in Vishakhapatnam district of Andhra Pradesh and Kochi (also known as Cochin), in Ernakulam district of Kerala state, were selected.

Description of study location

Vizag / Visakhapatnam in Andhra Pradesh

The Visakhapatnam district of Andhra Pradesh has a coastline of 136 km dotted with 43 fish landing centres. The district has a fisher population of more than 0.11 million. There are 4,408 marine fishing vessels in the district. Fishing operations consist mainly of small-scale traditional (artisanal fishing), motorized, and mechanized fishing, in fishing vessels of (less than 24 m overall length. Mechanized fishing consists of mainly trawling, gillnetting, and longlining. Dwindling trawl catches in recent years have brought combination fishing practices like trawling and long lining into vogue.

Visakhapatnam is a major centre of exports of marine products along the east coast, particularly shrimp and marine capture fishes. The domestic fish market is not well developed. The local marketing system mainly survives on freshwater fishes, with little contribution

from marine capture fisheries. Most of the fish catch is either transported to other states and/or exported.

Ernakulam in Kerala

Kochi, in Ernakulam district, is the most important marine fish landing centre in Kerala. Kerala has 9 maritime districts (out of a total of 14), with a total coastline of 590 km. The total marine fish production is about 610,000 tonnes in the year 2019, of which 11.1% is contributed by Ernakulam district. (GoK 2020). Ernakulam has a coastal length of 46 km, with an estimated marine fisherfolk population of over 73,000 in 2019–20, accounting for 9.2% of the total marine fisherfolk population of the state.

Fishing operations in Ernakulam are mainly small-scale traditional (artisanal fishing), motorized, and mechanized. Trawl fishing, mini purse seining (also known as ring seine), gillnetting, and long lining are other major fishing practices. Ernakulam is a major centre of exports of marine products from India, particularly marine capture fishes. Further, more than 90% of the population in Kerala state and Ernakulam district consume fish regularly. Therefore, there is always a thriving local demand for marine fish and fish products in Ernakulam. The district caters to demands for marine fishes from other districts of the state as well. The survey locations are shown in Figure 1.

Data

The study is mainly based on primary data collected from fishers of Vizag and Ernakulam (Kochi). The primary data was collected following the snowball sampling method (a non-probability sampling method). Initially, some known fishers who operate in major harbours or landing centres were contacted, and the telephone or mobile number of other fishers were gathered from them. Information was collected from fishers who are engaged in fishing operations. Data was collected from 181 fishers from Andhra Pradesh and 169 fishers from Kerala.

The data was collected using a structured interview schedule (questionnaire), which was prepared based on consultations with fishers, academics, and

Figure 1 Map showing the study locations
Source https://www.istockphoto.com/vector/kochi-india-map-with-city-labels-gm878970092-245066615

development personnel engaged in the marine fisheries sector. The survey schedule was pretested with selected fishers and reformatted based on pretesting observations. The final questionnaire focused on social and economic background of fishers and their household; type of fishing assets owned and fishing operations undertaken; ownership of assets and access to facilities; perceived impact due to COVID-19 on fishing and other operations; impact on employment and income; perception of the constraints faced by the fishermen; and types of coping strategies followed.

The data collection set a reference period of six months, starting from 25 March 2020, when the country went into full lockdown. The period of six months was used as it was relatively easier for the fishers to avoid recall bias. The data was collected during November and December in 2020 using interviews over the telephone and in person. Face-to-face interviews were used in the later stages of data collection when the regulations were relaxed. The enumerators used all the prescribed measures like maintaining physical distance, face masks, frequent washing of hands, usage of sanitizer etc., as prescribed by the health department. The enumerators were allowed to choose the data collection method subject to government advisories. None of the enumerators or respondents contracted the disease due to the data collection process. The data was collected on a survey schedule.

Data analysis

The data, after cleaning, was subjected to statistical analysis. The descriptive statistics of fishermen, their family background, perception on COVID-19 impacts, and coping strategies followed were elicited through frequency analysis and percentages. The correlates of the coping strategies were analysed through the logit model (Gujarati et al. 2012). The dependent variables in this analysis are the adoption status of groups of coping strategies.

Four logit regressions were undertaken, each for a group of coping strategies—availing credit, liquidation of assets, food adaptation, and reduction in other expenditure. The dummy value of 1 was assigned if a coping strategy is adopted, and 0 otherwise.

The hypothesized correlates belonged to the farm and family characteristics of the fisherfolk (age of the decision maker, education of the decision maker, family size); economic status (asset position, number of sources of income, type of vessel, poverty status); and social capital (membership in various organizations).

The underlying hypothesis is that the resource-poor would tend to adopt these strategies, and that the younger the person, the more probable that they would avail credit as they would not have savings or alternative income sources to fall back upon. Higher family size is hypothesized to correlate positively as the family expenditure would be high. The status of BPL category, being workers in fisheries instead owners, and not having alternative employment in the household are hypothesized to correlate positively. The education status is anticipated to have a negative correlation as education provide prospects of having higher income.

The more the fisher is linked with social capital, the higher the probability that they would avail credit, as there is higher chance of approval for loan from formal agencies and money lenders. Therefore, a positive relation was hypothesized.

Results and discussion

General information

In general, the fishermen are middle-aged (43 years in Andhra Pradesh and 50 years in Kerala) (Table 1). Both Andhra Pradesh and Kerala have progressed in per capita income and in several developmental indicators.

Despite a lower per capita income, Kerala ranks the highest on the Human Development Index (HDI); its literacy rate is 94%, compared to 74% at the national level (Census of India 2011); the average life expectancy at birth is 75.2 years compared to 69 at the national level (MoHFW 2020); the infant mortality rate is 10 for 1000 children at age 1 compared to 33 at the national level (Office of the Registrar General 2019). However, Kerala's per capita income for 2018–19 was INR 184,000, compared to INR 135,050 at the national level, ranking it 11th among the major states of India (JagaranJosh 2020). Fisheries in Kerala is said to be an outlier in the overall developmental saga of the state (Kurian 1995), and it is reflected in the social development of fishers.

Andhra Pradesh has a per capita income of INR 106,425, and its developmental parameters are improving fast. The average literacy rate is 67.7%, life

Table 1 Basic information regarding households in Andhra Pradesh and Kerala

Characteristic	Andhra Pradesh	Kerala
Age of the decision maker of the household (years)	43.0	50.4
Mean family size	4.0	3.9
No. of females (mean)	2.1	1.9
No. of males (mean)	1.9	2.0
Total number of earning members in the family (mean)	1.6	1.3
No. of earning males (mean)	1.5	1.2
No. of earning females(mean)	0.2	0.38
Dependency ratio (number of total earning members to total number of family members)	40.7	33.1
N	169	181

expectancy 69.7 years, and infant mortality rate 32 per 1000 births.

The family composition of fishers shows that households are highly vulnerable to shocks in income and employment in fishing activities, as the families in general are nuclear (family size 4), and the dependency ratio in both states is high. The number of earning members is relatively low (1.6 in Andhra Pradesh and 1.3 in Kerala), and the ratio of earning members to family size is 41% in Andhra Pradesh and 33% in Kerala. One key feature is the poor participation of women in work; they participate mainly in marketing and processing activities.

Education is a critical factor that could affect the ability to enhance income and reduce vulnerability (Muttarak and Lutz 2014). While about 84% of the sampled fishers in Andhra Pradesh were illiterate, that percentage was only 1% in Kerala (Figure 2). About 57% of the fishers in Kerala are educated up to the high school level.

Status of ownership of fishing vessels and types of fishing operations performed

Based on vessel ownership and operations undertaken, fishers are grouped into (1) those who are owners of vessels (either full or a share) and participate in fishing, (2) those who own vessels but do not participate in fishing, and (3) those who do not own vessels and only work on them. The difference between these two states in ownership and operations of fishing vessels is perceptible (Table 2).

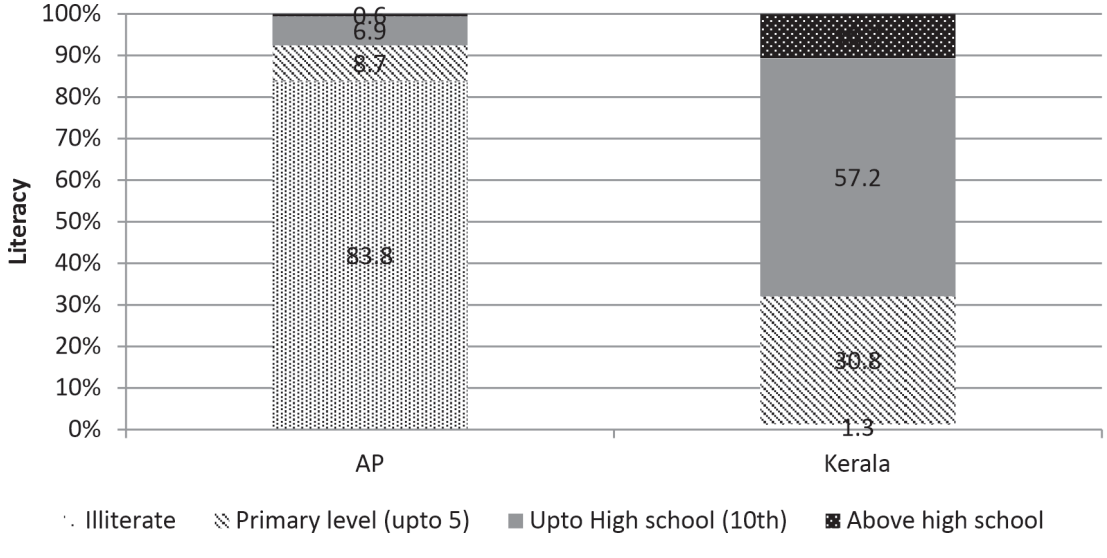

Figure 2 Distribution of education status of the head of the households

Table 2 Distribution of respondent by category (%)

Sl No	Category	Andhra Pradesh	Kerala
Distribution based on ownership of vessels and operational status			
1	Owner of vessel and a fish worker	9.4	55.7
2	Owner of vessel and not a fish worker	0.6	7.4
3	Non-owner, only worker	90.1	36.9
	Total	100	100
Type of vessels own/ has share / work with, Andhra Pradesh and Karnataka (%)			
1	Traditional	0	31.1
2	Motorized- Outboard	28.2	22.6
3	Motorized- Inboard	2.8	23.2
4	Mechanized traditional (ring seine)	59.7	5.5
5	Trawlers	0	14.0
6	Purse seine	0	0.6
7	Other	9.4	3.1
		100	100

Most fishers in Andhra Pradesh (90%) but only 37% in Kerala are non-owner workers. Fishers acting only as labourers generally receive a meagre share in the economic rent in marine fishing on a per capita basis.

The type of fishing operations undertaken by the sampled fishers varies widely (Table 2). Most of the sample fishers in Andhra Pradesh (60%) operate ring seines (small purse seines) followed by motorized outboard engines (28%), whereas that in Kerala consisted of traditional/ artisanal fishers (31%), inboard motors (23%), outboard motors (23%) and trawlers (14%).

Diversification is considered to reduce vulnerability and enhance household income by using labour power efficiently, but 98% of the respondents in Andhra Pradesh and 85% in Kerala reported fishing as their highest source of income, and only about 2% of the fishing households in Andhra Pradesh and 8% in Kerala participate in activities other than fishing. Occupational diversification and, gradually, the movement of fishers out of the primary sector activities is key to transforming the sector (Olale and Henson 2012).

Access to housing and other facilities

Only about 30% of fishing households in Andhra Pradesh owned their house, but that percentage in Kerala was as high as 98% (Table 3). While all the fishing households in Andhra Pradesh fall below the poverty line (BPL), based on income that is sufficient enough to purchase a basket of goods that yields 2,100 kilo calories per day, that percentage is about 80% in Kerala.

The Government of India and state governments provide foodgrains through the public distribution system (PDS) through designated outlets for the families targeted. During the COVID situation, foodgrains and other essential commodities were supplied through PDS shops under allocation from the central and state governments. The Government of Kerala has implemented a slew of measures to distribute kits containing essential commodities through the PDS shops, over and above those allocated by the central government (FAO 2020).

Fishermen's co-operatives facilitate the supply of inputs like credit and fishing gear and marketing (Table 3). Ownership of livestock as an income-yielding asset is relatively low. Kisan Credit Card (KCC) is a facility provided to avail short-term credit, at a very nominal interest rate, and thereby helps fishers to avoid non institutional sources of credit at least to a certain extent, but its penetration is quite low—only 12% fishers in Kerala.

Perceived impact of COVID-19

The pandemic has affected several dimensions of the activities of fisheries (Table 4). All the fishers in Andhra

Table 3 Status of ownership of assets, amenities, and membership in organizations (%)

Asset status	Andhra Pradesh	Kerala
Ownership of house (%)	30	98
Fishermen below poverty line (BPL) category (%)	100	80
Ownership of ration card (%)	100	99
Status of availing food through PDS (%)	100	96
Status of having regular drinking water supply (%)	88	78
Membership in cooperative society	94	78
Membership in any fishermen organizations (%)	93	69
Membership in political parties	2	21
Membership in women's groups/ self help groups	89	25
Status of ownership of livestock (%)	0	25
Status of having own transportation facility (%)	44	52
Possession of Kisan Credit Card (%)	0	12

Table 4 Perceived impact of COVID-19 (% of households)

Asset status	Andhra Pradesh	Kerala
Fishing and related activities are disrupted	100	97.6
Cost of fishing / expenditure of fishing has increased	100	61.3
Selling price of fish at harbour has increased	88.9	66.1
Income from fishing related activities were reduced	100	76
Household income reduced	100	71.4
Diet / food consumption pattern has changed adversely during COVID time	100	32.7
Some family member lost job/ returned back and rendered jobless	0.6	29.2

Pradesh reported a total disruption of fishing activities. The increase in cost and expenditure of fishing per trip is reported by 100% of the sample households of Andhra Pradesh and 61% of the sample households of Kerala.

Due to the restrictions in fishing by mechanized vessels, the competition for fish was relatively low in the seas. After the sector was opened gradually and fishing resumed, more fish was available than during the pre-COVID period (*The Hindu* 2020). The reduced supply of fish during the COVID period led to a price rise. The demand for fish in households in the coastal regions of India is thriving, and 89% of the respondents in Andhra Pradesh and 66% in Kerala report an increase in the selling price.

Reduction in income from fishing during the COVID period is also widely reported, mainly because of reduced catch. Though the price was higher, the fishermen did not have sufficient catch. There are regional differences in the perception regarding the impact.

The national lockdown prohibited restaurants from functioning and mass functions, including marriages and other social gatherings, that create demand for fish. However, there was latent household demand. Small scale fishing operations were partly allowed after a few weeks. Following central government norms, states issued guidelines to manage fishing operations. In Kerala, fish marketing was reorganized, disallowing auctioning to avoid mass gatherings. Alternatively, a fixed price system of fish marketing was brought in. This innovative fish marketing system envisaged a fixed price for fish depending upon the size and quality (Government of Kerala 2020).

Change in employment and income

To estimate the change in employment, the number of employment days during the COVID-19 period (six

Table 5 Level and change in employment during COVID and pre-COVID period, Andhra Pradesh, and Kerala

Variable	No. of labour days		% Change	
	Andhra Pradesh	Kerala		
Employment during pre-COVID period for men	123	87	61	38
Employment during COVID period for men	49	54		
Employment during pre-COVID period for women	19	17	92	42
Employment during COVID period for women	1	10		
Total employment during pre-COVID period	142	104	65	39
Total employment during COVID period	50	64		

months) and the six-month period prior to that (normal period) are elicited at the disaggregate level for both men and women of every respondent household (Table 5).

In a normal six-month period, an average fisher household works for 142 days in Andhra Pradesh and 104 days in Kerala. The extent of reduction in employment days is 65% for Andhra Pradesh (92 days) and 39% for Kerala (41 days).

One important dimension is the gender impact of COVID 19 on employment. During the pre-COVID period, women provided 19 labour-days in Andhra Pradesh and 17 labour days in Kerala on average, accounting for 13% of the total labour-days in Andhra Pradesh and 16% in Kerala, which fell to, respectively, 3% and 15% during the post-COVID period. The reduction in the total employment days for women is 92% in Andhra Pradesh and 42% in Kerala. Correspondingly, the extent of loss of employment-days for men was, respectively, 61% and 38%. Thus, the proportionate employment loss was severer for women compared to men. Women were mainly involved in fish processing activities, which were totally disrupted during COVID-19.

Change in income

The average reported income for a six-month period during pre-COVID and COVID period were elicited (Figure 3). The total income was INR 65,556 in Andhra Pradesh and INR 46,157 in Kerala during the pre-COVID period, which fell by, respectively, 74% and 14% during the COVID period. The reduction in the quantity of fish has outstripped the beneficial impact of the increase in fish prices in several cases.

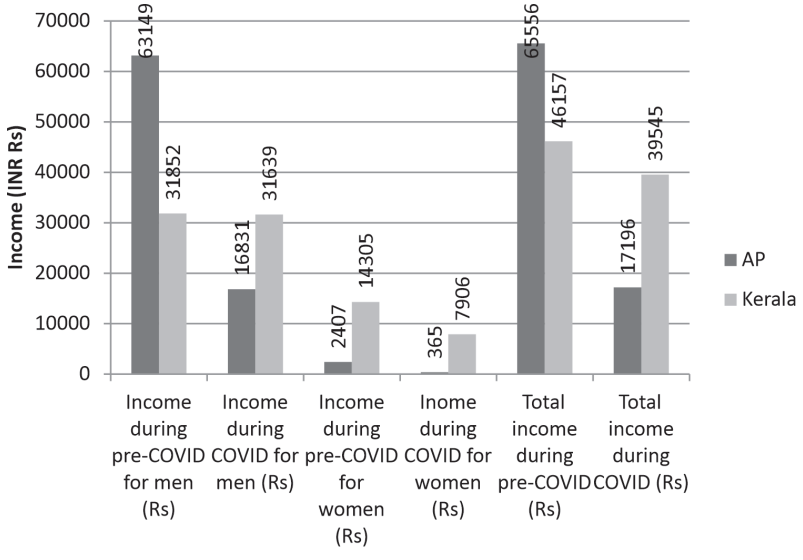

Figure 3 Level of income for six months during pre-COVID and COVID period, in Andhra Pradesh, and Kerala

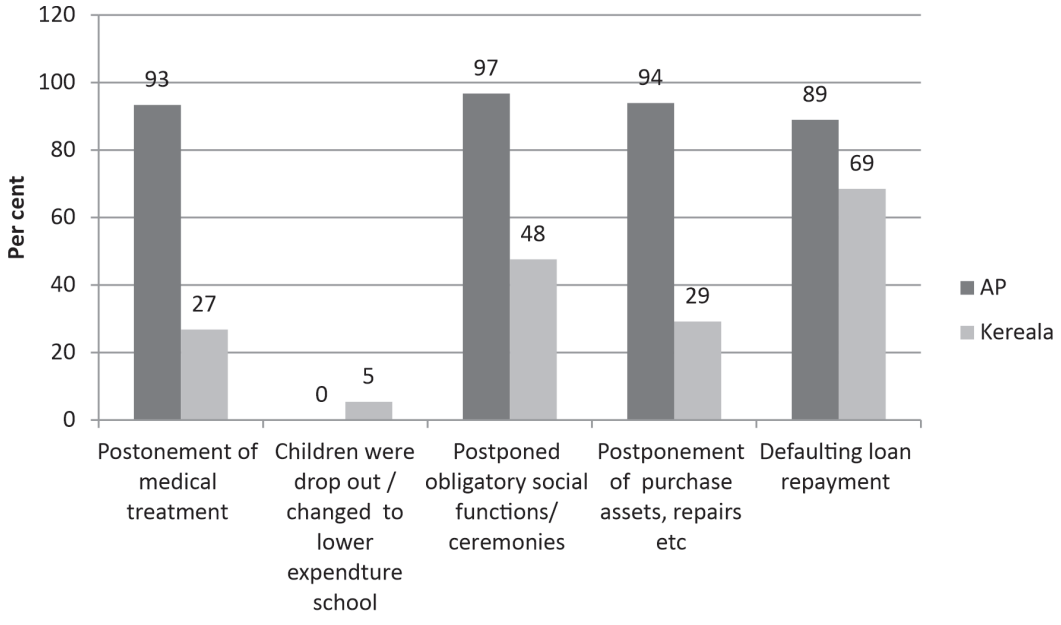

Figure 4. Impacts of COVID on households across Andhra Pradesh and Kerala

During the pre-COVID period, women provided 4–31% of the total household income (INR 2,406–14,305) from fisheries activities. During the COVID period, the income for women reduced by 85% for Andhra Pradesh and 45% for Kerala. The income of men did not change significantly in Kerala, mainly due to the high prices for fish in local markets.

Impact on other household activities

Depressed household income impacted several household necessities and activities, such as the medical treatment of members and education of children (Figure 4). The fear of COVID spreading from hospitals, high expenditure for private consultation, and the reduced availability of health services during COVID could have restricted access. Several households reduced educational expenditure (books, stationery, tuition, etc.), but about 5.4% of the households in Kerala shifted children to schools with lower expenditure. Households postponed social functions, obligations, ceremonies, the purchase of household durable assets like furniture and repairs of household items and defaulted on loan repayments.

The pandemic has impacted personal wellbeing in terms of interpersonal relationships (Figure 5). However, this information could be collected only from Kerala. Worsening of interpersonal relations in family is reported by 31% of respondents. This could also strain relations with society (26%). Psychological wellbeing is affected due to fear of loss of employment and income (82%). There were cases of anxiety (78%), and a sense of feeling isolation (46%). Income loss and the consequent strains within the family and society has lowered the prestige and self-esteem of people (13%).

Perceived reasons for the change in fishers' family income

An attempt is made to understand fishers' perception of the major reasons for the difficulties during COVID-19 (Table 6). One reason could be that some fisher families might have been affected by the first wave of COVID-19.

This information was not collected due to the sensitivities involved regarding data privacy. The restrictions imposed on movement, fishing, and fish marketing emerged as the most important reason (almost 100%), followed by reduced economic activity in general (72% in Andhra Pradesh and 50% in Kerala). Many migrant labourers work in marine fisheries in Kerala, and 51% of the households reported that labour was not available. When the national lockdown was relaxed, many migrant labourers left for home by buses and trains chartered for this purpose.

Another important reason suggested was loss of jobs for some family members. Spoilage of fish due to the

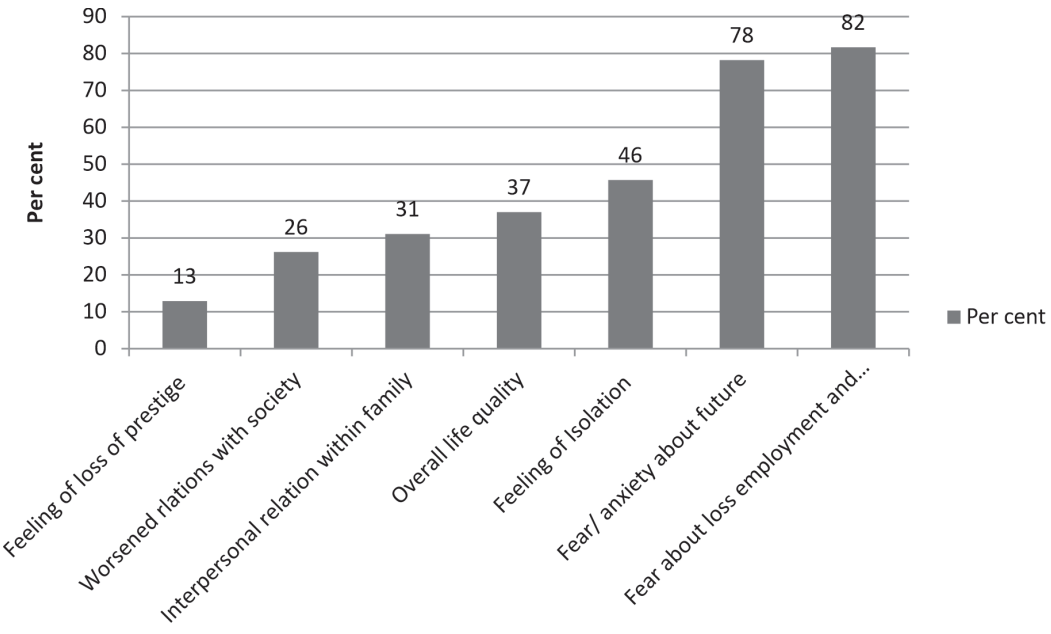

Figure 5. Perceived impact on personal and social wellbeing (% change), Kerala

Table 6 Reasons for change in income (% of respondents)

Sl No	Characteristic	Andhra Pradesh	Kerala
1	Movement was restricted (due to containment zone or any other reason)	100	97.6
2	Fishing was restricted	100	96.4
3	Fish marketing was regulated / restricted	100	97.6
4	Remittances reduced	9.94	76.2
5	Some family members lost job (including fishing)	10.49	36.4
6	Delayed payment of salary / wage for family member	1.10	44.6
7	Salary / wage reduction	0	23.8
8	Reduced economic activity	72	50.3
9	Loss due to fish wastage/ spoilage	11.05	14.6
10	Scarcity of labourers	11.05	51.47

lack of ice (11%) and marketing facilities were also reported (15%). Several multi-day fishing vessels that were in the sea when the national lockdown was announced discarded their catch before returning to shore. Other reasons identified were the reduction in remittances from family members and delays or reductions in the payment of salaries or wages.

Coping strategies adopted by fishers

Fishers adopted a multitude of coping strategies (Table 7). The major strategy was availing credit, either from non-institutional sources like moneylenders at a high rate of interest, or without interest from friends and relatives (the social network of fisherfolk emerged handy in this situation).

Another strategy was the liquidation of assets, mainly durable assets, reported by as high as 89% of fishers in Andhra Pradesh. Reduction of the household expenditure on food, education, and health care was another approach. Almost all the fishers in Andhra Pradesh reported a reduction in the quantity of food consumed and a compromise in the quality.

The quality compromise is in terms of the diversity and composition of food, reflected mostly in a reduction in the consumption of high-value food items like fruits

Table 7 Coping strategies adopted during COVID (% respondents)

Coping strategy	Andhra Pradesh	Kerala
Borrowed money /credit	100	54.2
Unconditional help from friends and relatives	100	41.9
Reduced the quantity of food taken at a time	100	13.1
Reduced the quality of food taken at a time (like non-veg, fruit, etc.)	100	32.3
Reduced the number of time food is taken	100	7.8
Reduced educational expenditure	100	12.6
Reduced medical expenditure	100	26.2
Started going for wage labour for more number of days / duration	11.05	25
Sale of livestock	0	8.3
Sale of household durable assets (furniture/ gadgets/ land/ jewellery)	88.95	9.5
Relied on ration from Government	100	84.3
Relied on social security support and income transfers from Govt	11.05	30.3
Participated in employment guarantee programme (MGNREGA)	0	15.2

and non-vegetarian products. In Kerala, while the reduction in food quantity was reported by only 13% respondents, about 32% compromised on food quality. A reduction in educational and medical expenditure were also reported.

One major avenue of income for the fisherfolk during this period was the guaranteed employment programme offered by the Government of India under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). About 11% of the fisher household in Andhra Pradesh and 30% in Kerala relied upon this social security programme offered by the local administration and government. During the COVID period, both the national and state governments operated subsidized food grains and other essential materials. Community kitchens were arranged in Kerala to serve food to the needy.

Correlates of coping strategies

The results show that the age of the fishers is significantly negatively correlated with all the four group of coping strategies, except asset liquidation (Table 8).

Table 8 Correlates of adaptation strategies analysed through logit regressions

Variable	Availing credit		Asset liquidation		Food adaptation		Expenditure reduction	
	b	Prob.	b	Prob.	b	Prob.	b	Prob.
Age of the fisher	-0.05	**0.02**	0.00	0.78	-0.07	**0.00**	-0.04	**0.03**
Family size	-0.07	0.68	0.31	**0.02**	0.09	0.50	-0.04	0.79
Education	-1.73	**0.00**	-0.75	**0.02**	-1.09	**0.00**	-2.08	**0.00**
Category								
a. Owner	-1.78	**0.03**	-0.61	0.60	-2.64	**0.03**	-0.42	0.66
b. Only worker	0.89	**0.05**	1.13	**0.00**	0.95	**0.01**	1.52	**0.00**
Type of vessel	1.03	0.07	-0.77	**0.06**	-0.36	0.40	0.37	0.42
House ownership status	-0.38	0.62	-3.54	**0.00**	-2.74	**0.00**	-3.15	**0.00**
Poverty status	0.12	0.81	-1.04	0.09	0.56	0.33	-0.77	0.17
Organizational participation	1.33	0.06	1.01	0.15	0.38	0.55	0.77	0.25
Number of income sources	-0.33	0.27	-0.97	**0.01**	-0.55	0.06	-0.30	0.34
Constant	3.19	0.08	3.88	0.01	6.67	0.00	5.70	0.00
Model chi square	79.86		186.62		151		190	
Pseudo R square	0.3		0.42		0.39		0.48	
N	326		326		326		326	

On the other hand, family size is correlated only with asset liquidation. The higher the education (categorized as those having less than high school level education and those above), the higher the probability that the fishers desist from these strategies, probably because education provides the capability to cushion income and livelihood loss.

Compared to those who are owners-cum-workers, those who are owners only are less probable to avail credit and worsen food consumption. On the other hand, the "only worker" category is positively and significantly correlated with all the four adaptation strategies. The workers get a proportionately lower share in the rent appropriated from marine capture fishing.

The type of vessel (categorized as 1 for mechanized and 0 otherwise) is only weakly correlated with coping strategies—positively with credit, negatively with asset liquidation, and not at all with other strategies. House ownership and access to alternative income reduces the probability of adopting most of these coping strategies. Interestingly, social capital enhanced the probability of availing credit, but did not influence other strategies. Having additional income sources also was correlated negatively with food adaptation and asset liquidation.

The cross-cutting observation is that while the status of "only worker" is positively correlated with all the coping strategies, education is negatively related. Therefore, being relatively poorly educated and functioning only as a worker enhances the probability that a fisher will adopt multiple strategies, including lowering food consumption.

Major constraints

The major constraints faced by fishers during the COVID-19 period were listed based on the discussion with the fisher population and other stakeholders, including academics and development workers. Fishers were asked to indicate whether they faced these constraints during the COVID-19 period. The central tendency, mode, of the responses were analysed to identify the severity of each constraint. The restriction of fishing activities, marketing, and movement of fish, reduced credit facilities, and depressed demand severely affected fishers (Table 9).

The fishers undertake their daily operations on credit basis, sourced mostly from informal sources, particularly from auctioneers and traders. Tied credit-market (product) relations are widely prevalent in the marine fisheries sector. Once the markets stopped functioning, credit flow was restricted. Credit servicing emerged as an issue that affected the operations of professional money lenders too, as they could not recover the outstanding credit from many fishers (private discussion with moneylenders in Kochi).

Fish spoilage and low demand for processed fish was reported as major constraints by fishers in Andhra Pradesh, but not in Kerala, probably because the fish marketing system has been reformed and marketing activities streamlined, and initiatives were taken in and around fish landing centres to for localized online fish sale (*The Hindu* 2000b), which could sell out fresh fish. Further, Andhra Pradesh has reported scarcity of ice as well, which could have contributed to the fish spoilage. Scarcity of labourers affected fishing

Table 9 Major constraints faced by fishermen households (mode)

Major constraint	Andhra Pradesh	Kerala
Fishing was restricted	5	5
Scarcity of labour	3	4
Marketing activities were restricted	5	5
Scarcity of ice	4	1
Scarcity for fishing net and other facilities	3	2
Spoilage of fish	5	1
Low demand for processed fish	5	4
Restrictions on movement of fish	5	5
Reduced credit facilities	5	5
Low demand for fish during COVID time	5	5

operations in Kerala (mode being 4), once it was resumed.

Summary and conclusions

One important conclusion is that the pandemic has disrupted the entire value chain of marine fisheries, employment, and income. The total employment has fallen 65% in Andhra Pradesh and 39% in Kerala and total family income, respectively, 74% and 14%.

Fish prices rose in several cases, but it could not offset the effect of a contraction in the fish catch. The COVID-19 crisis forced several fisher families to postpone medical treatment and obligatory social functions and compromise on the quality of education. The impact of COVID-19 has affected the psychological wellbeing of fishers, their interpersonal relationship within the family and the relationship with society. Feeling of isolation and a sense of loss of prestige is noted.

The fishers in both the state have low economic development compared to the general population, which accentuated their vulnerability to the economic impact of COVID-19. The pandemic has deteriorated the participation of women in the labour market to a proportionally higher level compared to their male counterparts. Low occupational diversification of the fisher households has worsened the economic crisis, when the harvest and post-harvest operations were disrupted.

The fishers varied in their capability to adapt coping strategies. The foremost coping strategies were availing credit and liquidating assets, compromising food consumption, reducing household expenditure and increasing labour market participation, and availing government support. Being less educated and functioning only as a worker worsens the fisher's welfare.

One key feature that emerged is the criticality of government during the crisis. For example, streamlining the fish market system of Kerala has helped non-mechanized fishers to avail better prices while maintaining the COVID protocol. Also, interventions to supply essential food items and food kits has helped to reduce the chances of reducing the quality and quantity of food intake.

The insights from the study have implications for developing responses during the continuing COVID-19 period and for reducing vulnerabilities during similar circumstances that could emerge in future, too.

First, the criticality of the livelihood loss on the welfare of the fishers, their interpersonal relations, and relationship with society is to be factored into policy formulation on the management of the pandemic and similar circumstances. The trade-off between income loss and the risk of contracting disease is to be carefully evaluated to prevent greater welfare loss due to income shocks.

Second, public policy has to respond to the income disruption through public support—transfer payments, and support in terms of food and other essentials, at least in limited manner, to avoid extreme destitution.

Third, the study points to the need to develop a targeted approach to address the more vulnerable sections of society. The proportionate reduction of income was severer for women.

Fourth, the immediate and most widely adopted coping strategy was to avail credit. Therefore, public policy needs to address household credit needs. Nudging credit institutions to respond to the financial needs of the fishers, and promoting fishers to approach formal credit institutions, could have far-reaching implications in addressing the shocks of income loss. Formal credit institutions need to develop credit products suitable to fishers taking into consideration their social context (low occupational diversification, in particular) and livelihood generation characterized by high risk in profession.

Fifth, in view of the greater vulnerability of marine fishers to natural calamities, weather hazards, and contagious diseases, it is relevant to factor in these risks while charting out development pathways for marine fisheries.

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