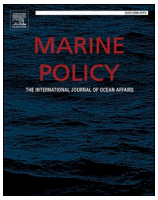
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Marine Policy 134 (2021) 104803

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol



COVID-19 impacts on coastal communities in Kenya

Jacqueline Lau [a,b,*], Sarah Sutcliffe [a], Michele Barnes [a], Emmanuel Mbaru [c], Innocent Muly [e], Nyawira Muthiga [d,e], Stephen Wanyonyi [e], Joshua E. Cinner [a]

[a] Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Australia
[b] WorldFish, Batu Maung, Malaysia
[c] Kenya Marine and Fisheries Research Institute, Mombasa, Kenya
[d] Wildlife Conservation Society, Marine Program, Bronx, NY, USA
[e] Wildlife Conservation Society, Marine Program, Mombasa, Kenya

A B S T R A C T

COVID-19 is continuing to have far-reaching impacts around the world, including on small-scale fishing communities. This study details the findings from 39 in-depth interviews with community members, community leaders, and fish traders in five communities in Kenya about their experiences since the beginning of the COVID-19 pandemic in March, 2020. The interviews were conducted by mobile phone between late August and early October 2020. In each community, people were impacted by curfews, rules about gathering, closed travel routes, and bans on certain activities. Fish trade and fisheries livelihoods were greatly disrupted. Respondents from all communities emphasized how COVID-19 had disrupted relationships between fishers, traders, and customers; changed market demand; and ultimately made fishing and fish trading livelihoods very difficult to sustain. While COVID-19 impacted different groups in the communities—i.e., fishers, female fish traders, and male fish traders—all experienced a loss of income and livelihoods, reduced cash flow, declining food security, and impacts on wellbeing. As such, although small-scale fisheries can act as a crucial safety net in times of stress, the extent of COVID-19 disruptions to alternative and informal livelihoods stemmed cash flow across communities, and meant that fishing was unable to fulfil a safety net function as it may have done during past disruptions. As the pandemic continues to unfold, ensuring that COVID-19 safe policies and protocols support continued fishing or diversification into other informal livelihoods, and that COVID-19 support reaches the most vulnerable, will be critical in safeguarding the wellbeing of families in these coastal communities.

1. Introduction

The novel coronavirus (COVID-19) is having major impacts on society. As of July 27th 2021, there have been 195 million cases with almost 4.2 million associated deaths [39]. Additionally, restrictions on human movements to curb the spread of the disease (e.g., lockdowns, curfews) are affecting global food systems and employment [2,28].

Fisheries are a major source of employment and food security for millions of people globally, and they are particularly at risk from the pandemic. Small-scale fisheries are often highly communal, requiring close proximity to harvest, sell, and process fish. Poor sanitation and unenforced social distancing at landing sites can make them a hotspot for contamination [28]. Fish are also one of the world's most traded commodities, which means fisheries market chains—and the livelihoods and food security they support—are highly vulnerable to the types of trade and movement restrictions that have been implemented under COVID-19 [4,20]. Yet, we are only just beginning to understand how COVID-19, and the policies and measures put in place to contain the pandemic, have affected fisheries-dependent communities.

A handful of studies have begun reporting on how COVID-19 has reduced the food security of fisheries-dependent communities [18,22,32]. For example, in parts of Vanuatu, COVID-19 restrictions have reduced food availability [32]. In Sabah, Malaysia, market disruptions and reduced income made food less accessible; fishers reported being unable to afford basic foods like rice [18]. Studies are also beginning to examine how COVID-19 has impacted different dimensions of well-being—material, subjective and relational—which form a crucial part of the broader social values of small-scale fisheries [17]. For instance, in Vanuatu, COVID-19 impacted people's relational wellbeing by affecting day-to-day relationships people value and rely upon [32]. Several studies have also examined some of the mechanisms through which wellbeing and food security have been affected, primarily focused on changing livelihoods, market disruptions, and a lack of external support (e.g., [34]; [12]; [38]. Others have charted how different actors drew on aspects of adaptive capacity to adapt or cope with shocks [4].

Here, we contribute to this body of emerging empirical literature by examining the impacts of COVID-19 on markets and livelihoods, associated response strategies, and broader impacts on wellbeing and food

* Corresponding author at: Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Australia.
E-mail address: jacqueline.lau@jcu.edu.au (J. Lau).

https://doi.org/10.1016/j.marpol.2021.104803
Received 1 March 2021; Received in revised form 12 August 2021; Accepted 17 September 2021
Available online 22 September 2021
0308-597X/

security in five coastal communities in coastal Kenya, who rely on fisheries and fish trade for their livelihoods.

To understand the impacts of COVID-19 on small-scale fishing communities in Kenya, we conducted a series of in-depth interviews with 15 women (12 female fish traders, three female fishers) and 15 male fishers of various ages, four male fish traders, and five community leaders (see Supplemental Material for interview questions). Specifically, we asked about impacts to livelihoods, markets, food security, and wellbeing (which encompassed subjective, material and relational wellbeing), and content organised these themes into disruptions livelihoods and markets, associated coping strategies, and overall outcomes on food and nutrition security and wellbeing. We present findings about experiences of the impacts of the COVID-19 pandemic, highlighting how COVID-19 and rules to combat it impacted food security and wellbeing. From these findings, we outline implications of the continuing pandemic for small-scale fisheries.

2. Background and study sites

As of July 27th 2021, Kenya has had 197, 959 cases of COVID-19. In June 2020, the government put in place a number of measures to stem the spread of COVID-19, including curfews and limits on social gatherings, transport, movement, and permitted business activities. Coastal areas around Mombasa have been greatly affected by a drop in tourism, risking a poverty and hunger crisis among poorly paid workers (UN [35]. Each of our five study sites—anonymized as community A, B, C, D and E— have slightly different fishing livelihoods, connections to markets, and levels of reliance on tourism and informal work (see Table 1). These sites were selected both to capture this diversity, and because we had existing long-term connections that enabled us to successfully undertake mobile phone data collection.

3. Methods

To understand the impacts of the COVID-19 pandemic on wellbeing and food and nutrition security, we conducted qualitative interviews over mobile phones with respondents from five coastal communities (Table 1). These protocols were approved by the James Cook University Human Ethics Committee (Approval H8109). The interviews took place between September and October 2020. We asked participants to recall their experiences since March 2020. We interviewed three women and three men from each community, who were chosen to represent different ages (under 30, 30–45, over 45). Aside from three women in Community E (all of whom were Octopus fishers), all women interviewed were female fish traders, and all men were fishers. We also interviewed five key informants—one active local leader from each community—and a total of four male fish traders.

We focused on these different characteristics in order to capture and thus diverse perspectives on the pandemic. First, age has been associated with differential ability to adapt to changes (e.g., because of differences in accumulated assets and knowledge [21]). Older and younger fishers and traders in different locations may fish differently, and hold different alternative livelihoods. Second, the experiences of female fish traders are likely very different to that of others in the community; gender has been shown to shape people's adaptive capacity to shocks [27,30]. Female fish traders tend to sell lower quality fish, buy directly from fishers and have specific locations that they sell from and customers they sell to, and thus be particularly vulnerable to market changes [15]. Interviews with fish traders enabled us to ask specifically about disruptions and disconnections to larger markets that individual fishers and female fish traders did not experience directly. Finally, interviews with community leaders allowed us to ask about changes and coping mechanisms at a community scale, which we then triangulated with findings from individual interviews.

Interviews were arranged at a convenient time for participants and were conducted in Swahili over the phone by two co-authors (Muly, I &

Table 1
Summary of fishing, alternative livelihood opportunities and connections to markets across the five different study communities.

	Community A	Community B	Community C	Community D	Community E
Summary	A coastal fishing village in Kilifi County. Fishers in Community A share the same fishing ground as fishers from Community B. The locals are dependent on fishing.	A rural area that is sparsely populated with dispersed settlements comprised of several sub- villages. In 2006 the village established the Community B Community Conservation Area (KCCA), and hosts the Community B community closure (tengefu) which is comprised of six fish landing sites (including Community A and Community B).	A coastal fishing village in Kilifi County. The local people depend mainly on marine resources as their key source of livelihood, especially fishing. The landing site is located on shore from a lagoon protected by fringing reefs. Majority of the fish caught are associated to coral and seagrass habitats.	A coastal fishing village in Kwale County. Customary rules led to gear restrictions on destructive gears such as beach seines and spearguns. Most household heads are either fishers or women involved in postharvest work. There are two major landing sites; Community D and another nearby community.	Fishing village located on an Island, Kwale County. The area is adjacent to a Marine Park and Reserve, where a lot of tourism activities take place as a result of the diversity of coral reefs, marine species, extensive mangrove areas and sea-grass beds. There is a large population of female foot fishers targeting octopus.
Fishing	Majority foot fishers, little investment in fishing (i.e., no canoes). Majority of the fish caught are associated to coral and seagrass habitats. A large population of fishers that use spearguns—a gear that is prohibited under the fisheries regulations.	Fishing is largely traditional involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption.	Labour-intensive fisheries using a very limited number of small crafts (if any) and little capital and equipment per person-on-board. Most often family-owned.	Fishing is mostly inshore to the outer edges of the fringing reef, in waters generally not exceeding 20 m depth. Most fishers operate using traditional fishing gears within coastal waters and the gear owner is involved in day-to-day operations.	95% of household engage in fishing. Most women collect octopus. More investment in fishing, many fishers own at least one canoe. The local community prohibits any type of fishing within the community fisheries closure.
Alternative livelihoods	Fishing is supported by other activities such as small- scale businesses and subsistence agriculture. Most women are involved in postharvest work.	Livelihoods are often diversified, including with hotel and tourism industry (e.g., golf course, beach houses), construction industry (e.g., cement factories), some farming.	Alongside fishing, livelihoods include informal employment activities and subsistence agriculture which is largely seasonal and highly influenced by rainfall.	Alongside fishing, the community is dependent on agriculture (largely seasonal and highly influenced by rainfall), stone mining and limited tourism.	Tourism provides secondary income for community (e.g., as boat operators, tour guides (especially the youth), handicraft sales. Little arable land.
Connection to market	Connected to bigger markets, Local markets reliant on workers from local industries	Connected to bigger markets, Local markets reliant on workers from local industries	Connected to bigger markets, Local markets reliant on workers from local industries	Connected to bigger market in Ukunda town, Kwale town and Mombasa city.	Local traders purchase fish from Community E, and on-sell to traders on the mainland for distribution to shops in Mombasa and other large towns.

Wanyonyi, S). Interviews lasted between 30 min to one-hour. The interviewers recorded, transcribed, and translated interviews from Swahili to English. Our qualitative questions aimed to elicit detailed descriptions of individual and household's experiences around the pre-identified themes of impacts to livelihoods (particularly fishing), markets, food security, and wellbeing, and other impacts (see Appendix A for interview questions). Interviews with women and men from the community comprised questions at a household level. Interviews with community leaders focus on the same questions at a community-scale, to gain a broad sense of whether the impacts and outcomes described by individual households were observed at a broader scale. Interviews with male traders had a more explicit focus on how connections to broader markets beyond the community were disrupted. Interview transcripts were coded and content organised across into disruptions livelihoods and markets, associated coping strategies, and overall outcomes on food and nutrition security and wellbeing.

We focused specifically on the outcomes of COVID-19 disruptions on food and nutrition security and wellbeing, as holistic and interrelated indicators. Food and nutrition security 'exists when all people at all times have physical, social and economic access to food of sufficient quantity and quality in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life' [9], p. 7). The FAO predicted that in 2020, between 83 and 132 million more people were undernourished globally as a consequence of COVID-19 [13]. In Kenya, a rapid assessment of the impacts of COVID-19 on rural farmers found that two-thirds had suffered losses of food security and income, and that both those who were income-poor and those more dependent on income from labour were worse off [19]. Before the pandemic, 1.3 million people across Kenya were already facing crisis levels of food insecurity [36]. The second outcome focused on wellbeing. Wellbeing is multidimensional, encompassing three interconnected dimensions: material, subjective and relational. Broadly, multidimensional wellbeing encompasses what a person has (material), how they are able to use what they have, including through fulfilling social relationships (relational), and the level of satisfaction or quality of life derived from what a person has and can do (subjective) [24,25].

We note that these outcomes are not mutually exclusive. For instance, food security is directly connected to material wellbeing. Thus, we use these outcomes as a heuristic for exploring key patterns, rather than as completely conceptually distinct concepts. In the following sections, we therefore present all results on food and nutrition security under that heading, and not as part of material wellbeing, though the two issues are clearly interconnected.

4. Results

4.1. Measures to stem COVID-19

The first case of COVID-19 was reported in Kenya on 12th March 2020. By 15th March 2021, the total number of confirmed cases had reached 113,967 + [26]. Throughout March and early April 2020, the Kenyan government instituted measures to reduce the spread of the virus and minimize causalities. These included cessation of movement in and out of cities, such as the capital city of Nairobi, and the three coastal counties of Mombasa, Kwale, and Kilifi where most fishing activities occur. Other key measures included dusk to dawn curfews, closure of areas of mass gathering such as schools and places of worship, social distancing, wearing of face masks, and restricting international travel. These measures—especially curfews, social distancing and the cessation of movement to cities that act as primary fish markets—affected fishing trips and duration, disrupted the fish value chain, and affected the livelihoods of fishers.

4.1.1. Government and other support

To cushion vulnerable communities, such as those involved in fishing and fish processing, the government of Kenya prioritized the provision of direct financial assistance (e.g., some counties like Kilifi distributed cash stipends via mobile funds transfer), relief food, and tax relief. Respondents across the five communities articulated different experiences in receiving aid and support, and also regarding communication about its distribution. Three respondents in Community E, including one trader, described receiving a small portion of aid in the form of food. A community leader in Community B was involved in organizing donations from other community organizations (e.g. Community B Beach Residents Association) to deliver a once-off food aid package to fishers that included maize flour, beans, sugar, and soap for fishers, and mentioned that fishers in Community A had received similar support from the Community A Beach Residents associations. In contrast, a small number of respondents from other communities articulated delays, confusion or absence of support. For instance, several respondents mentioned that while they had heard talk of government or other support, they had not received aid, even after registering. One woman from Community A said, "we had been told there were donations like foods that were to be brought [here]. I think it was brought, but… but we never got relief food" (Woman, age 46). In Community C, respondents explained that there was some government support in the form of payment, but that only some in the community received it; one woman explained that her family "were registered to get aid but we have not seen any assistance" (Woman, age 29). Others were confused about how and who to register with. Two respondents expressed concern about how aid was distributed. One community leader described how,

"the government also selected the weak fishers and helped them and the strong fishers were left out. They also selected one fisher in each household to get the support hence some fishers did not get the aid and that becomes a big problem" (Man, community leader, age unknown).

4.2. COVID-19 disruptions to livelihoods and markets

Lack of cash, curfews, and limits on gathering and mobility disrupted the transfer of fish through the value chain in ways that impacted fishers and fish traders (both women and men). Across all communities, almost all respondents designated loss of livelihood and income as the worst impact of Covid-19 and emphasized it as an ongoing challenge (Table 2), regardless of age or gender. All respondents described how the loss of jobs and cash flow more broadly had changed demand for fish and rendered fishing and trading livelihoods very precarious. Specifically, whole industries closed, hotels had no visitors because of international and internal movement bans, and cement and industrial work could not continue because of social-distancing requirements and lack of customers. These closures led to income and cash shortages in all five communities, and were particularly disruptive in Community A, Community B and Community C, where a large number of industries and hotels provided wage labour for workers from both within and outside the community. One trader explained:

"Many people do casual jobs and they are the majority who buy fish, but they were not working. You know there are women who depend on going somewhere to wash clothes and get income so that they can at least buy fish and taste it, but they didn't have money. When you got fish there were no buyers as there was no money." (Man, fish trader, age unknown).

Reduced cash in the community led to decreased demand for fish, which created a feedback that decreased supply when fishers were unable to sell fish.

COVID-19 greatly disrupted local market dynamics at landing sites, within communities, and beyond. Specifically, limits to gathering combined with limited time to trade (because of the curfew), meant that normal face-to-face negotiations were nearly impossible and existing customer-trader and fisher-trader relationships could not be sustained. Timely and direct negotiations about the price and on-sale of fish are particularly important because if not sold quickly, or if left to sit in the heat of day, fish will spoil and lose value. One community leader explained how:

Table 2
Summary of general disruptions to livelihoods and markets and disruptions and responses specific to different livelihood groups within communities.

	Disruptions	Responses
General	Income and cash shortages	Used savings and sold assets
	Lack and loss of jobs	Fishers/ traders stopped negotiating prices of fish, simply sold to avoid waste
	Lack of capital to start new livelihood activities	Some respondents looked for alternatives to supplement income (tailoring, general manual labour, mining etc)
	Difficulties in communication/ organization	Supplemented purchases with food from home gardens if possible
	Social distancing and movement restrictions disrupted market interactions	
	Curfew rules disrupted trading and fishing hours	
Fishers	Unable to fish at night because of curfew	Started hawking fish directly in community
	Influx of fishers to cope with collapse of informal livelihoods (Community A, Community D, Community C)	Some started processes fish so they wouldn't spoil
	Unable to travel to fish because of movement restrictions	Switched to fishing for locally desirable species
	Unable to sell to traders	Some fishers changed tactics (e.g. shift to net from spear fishing, or fishing illegally at night)
	Demand for high value species decreased because of closure of hotels	Accepted lower prices
Female fish traders	Ban on selling cooked food (at outset of lockdown) disrupted female fish traders' businesses	Buying fish from shops (alongside or instead of from fishers)
	Decrease in supply of fish at landing sites,	Hawking fish door to door
	Decrease in customers	Changed marketing practices from single stall, open until late at night, to selling from home or door to door
	Curfew reduced selling hours	Some raised prices to compensate for buying fish at higher prices
	Buying/selling less fish	Accepted lower prices
	Decrease in profit from fish trading business (lower price)	
Male traders	Unable to access larger markets (e.g., Mombasa)	Fish that normally be sold at "fresh" prices in the evenings sold at reduced prices next day
	Curfew reduced selling hours	Sold fish locally (instead of at bigger markets) for lower prices
	Buying/selling less fish	Accepted lower prices
	Price reductions, lack of circulating money reduced demand for fish	

"And social distance rules also affected us to some extent because at the landing site, when fish are coming there are normally many types of traders like Mama Karanga.[1] They come in big numbers and even other traders also come in big numbers. Now people were forced to use their network. You call someone to come and again call another one and sometimes fish go bad" (Man, community leader, age unknown).

A fish trader emphasized the importance of face-to-face social negotiations in the market:

"Normally in our place of work, we're used to socialising and mingling with people to negotiate and agree on price as in a normal market situation, you know. So, it's not possible with the rules in place especially when they are pinning people down it becomes very hard, because when fishermen come, they have no time to negotiate. Instead, they tell you to take fish for this price and go away" (Man, fish trader, age unknown).

Alongside a lack of cash in the community, the inability of fishers, traders and customers to conduct market negotiations explains the variety of reports about the changed dynamics of landing sites, where fishers found fish hard to sell, and traders (both women and men) found fish hard to procure.

As we describe in the following section, these disruptions to livelihoods and markets impacted fishers, female fish traders and male fish traders differently. Different groups coped differently, and were differently constrained in the ways they could cope. However, across all communities, all groups experienced the same broad outcome of decreased food and nutrition security and decline in wellbeing (discussed in Section 4.3). We found no distinct patterns between older and younger respondents, and few between communities (noting that we were not seeking to test differences between respondent characteristics, but rather gain a broad sense of experiences across a range of identities within communities). We describe the experiences of each group in turn (Table 2), before describing these collective outcomes.

4.2.1. *Fishers and fishing*

For fishers that fish at night, or who travel to their fishing grounds, the curfew rules left only a short window to both catch and then sell fish. In Community B, two fishers and the community leader mentioned this as a problem. Ten fishers—including at least one from each community—mentioned the curfew as a major disruption, and described being cautious about going out fishing or selling fish late because of a fear of not reaching home again before the curfew came into place. Fishers who were not close to their fishing and landing sites had difficulty physically getting there to fish.

"You know we fishers; we get more catch at night. Now if the curfew rules have come and we want to go and fish at night, it becomes a problem. Sometimes we want to go early morning when it still darkness but it was also a problem" (Man, Community leader, age unknown).

One woman explained how her husband had been unable to fish because of the curfew:

"He used to get his livelihood in the ocean but he could not go because they were stopped from going to the ocean. He could only go during the day and get very little catch because he normally fishes at night with other crews but he could not go because of curfew" (Woman, age 38).

The closure of informal industries and lack of alternative livelihoods increased fishing pressure in some communities. Community leaders in Community C and Community D, and one fisher from Community A noted an increase in the number of people fishing in the community. In Community C, a community leader described how people who had been living away and pursuing fishing livelihoods in other communities returned home and began fishing there. In Community D, a community leader explained that "the number of fishers has increased and brought negative impacts, because people who had fishing experience but stopped fishing to get employment, after losing their jobs they all came back to do fishing" (Man, community leader, age unknown). In contrast, a community leader from Community B explained that "Sometimes there were more, as those who were doing other livelihoods started fishing, but due to high fish supply the fish traders didn't buy fish, [so the number of] fishers reduced." (Man, community leader, age unknown). In sum, the number of people fishing fluctuated across communities in line with the depressed market. The closure of hotels and the coastal tourism industry also decreased market demand for higher-priced fish. Fishers turned to selling their catch within villages, but there was less demand and ability to pay fish trader prices for products that were previously only sold to hotels (e.g., rabbit fish and lobsters). One fisher explained that "You sell at a different price as people in the village don't know types of fish and when you sell at a high price, even if the fish is big, they will refuse to buy it" (Man, age 21). The female

[1] Female fish traders who produce and sell cooked fish in street stalls.

fishers in Community E described shifting from fishing to gleaning (one) or farming seaweed (one), or fishing with a smaller crew to comply with social distancing rules.

In response to changed market conditions and inability to organize effectively, some fishers started selling their own fish and processing them to make them last longer, which decreased their value. Two fishers from Community B and one from Community C described how they had illegally and secretly continued to go fishing at night, while another fisher from Community A described breaking movement restrictions to fish in better spots; "my fellow fishers who live there used to call to inform me when police were not around to go and fish. At least I was getting something for my children to eat." (Man, age 45).

To cope with changed markets, fishers and two female fish traders described hawking fish door to door in the community (four respondents from Community A, four from Community B, two from Community C, three from Community D). Another two fishers with freezer access, stored large fish until they were able to be sold. Two fishers from Community B stopped fishing for higher value species that were previously sold to hotels (such as lobster) and turned to fishing species more popular with local consumers.

Other fishers described being limited in their ability to cope because of immobility caused by travel restrictions, and the collapse of other possible alternative livelihoods, such as work in factories or the tourist industry. Three respondents in Community E described seeking out casual work such as manual labour or selling processed foods (when available), while two respondents from Community C noted increased competition for the casual construction work that was still available.

In addition to COVID-19 restrictions, fishers in all communities were concurrently impacted by the south east monsoon season (*Kusi*), when sea conditions are rough, fishing is difficult and catch is usually low. COVID-19 restrictions on mobility and time when people could be out of their homes severely limited strategies for coping with decreased fish catch during *Kusi*—such as moving to find alternative sources of livelihoods, or access fishing opportunities elsewhere—creating a double burden. As one fisher explained:

"Corona affected us greatly. Before corona I was capable of looking for livelihood in different places. For example, I used to go to Shimoni, Lamu and many coastal landing sites to go fishing. But when corona came… it was not easy to go to the ocean and fish, therefore I used to dodge [police] to at least go and fish and when I came back the catch was very small and I had to look for someone to buy my fish. When I get traders, they complain that they don't have money. They even wanted to take fish and pay later but because I used to depend on the catch I got each day, I used to plead with them to at least take fish and give me some money even if it was a little" (Man, age 25).

4.2.2. Female fish traders

All female fish traders noted that they were impacted by COVID-19 disruptions. The curfew greatly reduced the time female fish traders had to both procure and sell fish. One woman explained that "Back when corona started and curfew time started at 7 [pm], you'd be forced to remove your display box because when the police find you, they pour out your fish and you lose everything" (Woman, age 42). Another emphasized that she 'was not getting customers because the curfew time was barring customers to buy fish and jobs had been lost and people had no livelihood. Most companies had closed down" (Woman, age 29).

In addition, early in the state of emergency, selling cooked food was banned for a short time. As such, female fish traders—who commonly fry and sell fish in portions—were unable to continue to sell fish, and struggled to maintain their businesses. When the state of emergency passed and female fish traders were able to continue operating, all female fish traders described both being unable to buy enough fish from fishers, and also struggling to sell the fish they had procured at a profit. One woman explained the need to connect early with fishermen, as supply and demand of fish became uncertain:

"You have to tell fishermen please assist me to get fish so that I can go try my luck [selling it]. If you don't do that and there are many traders at the landing site, they'll give someone else and you come back without fish" (Woman, age 42).

Others experienced long queues at fish shops and difficulty buying fish directly from fishers at landing sites. In all communities, female fish traders were buying and selling less fish because of a combination of changed supply and demand, and thus making less profit than before COVID-19. In Community B, one woman estimated her sales had decreased from 10 to 15 kg to only 3–5 kg, and all respondents mentioned that profit had decreased dramatically.

Female fish traders tried to cope with these livelihood shocks by using existing savings and loans where possible, until they had exhausted their savings. Three female fish traders from three different communities referred to this as 'eating capital'. One woman said, "we still continue with the business but it's very hard. We have been forced to eat capital" (Woman, age 38). To cope with the restrictions imposed by the curfew, some female fish traders started selling door to door, while others simply had to limit their selling time. In Community A, for instance, female fish traders changed marketing practices from having single stalls set up until late at night, to selling from home or door to door and ending before curfew. However, two female fish traders also explained they were hesitant to leave their usual spot in case customers thought they'd given up selling fish; they considered consistent face-to-face interactions with customers and fishers as critical to continuing to maintain a presence and healthy business. Another female fish trader explained that she felt disadvantaged by others who, having lost other incomes, had turned to fish trading but were moving about selling fish, rather than staying in one spot.

To continue their business and cope with decreased supply of fish, female fish traders started buying fish from fish stores to supplement and sometimes replace fish bought directly from fishers. Almost all female fish traders explained that they had started buying from fish shops because they did not see any alternative. One female fish trader explained that even though "fish trading has little profit, like KES 200–300, we are used to fish trading and cannot leave doing it. If we don't get fish at the landing site, we go to the fish shop" (Woman, age 38).

4.2.3. Male fish traders

Traders (who were all men) who previously transported fish to bigger cities (e.g., Mombasa) were unable to move across closed borders between the three coastal counties of Mombasa, Kwale, and Kilifi. One trader explained that "everybody in coast region depends on Mombasa as economic hub. But now if all boundaries are closed, where do you pass through?" (Man, fish trader, age unknown). Many traders saw drastic drops in their customer base, were unable to access bigger markets (e.g., on Mombasa).

"The market share changed because if you were trading with 100 people a day before corona, right now you only have 5 people a day. So, some fish vendors have stopped doing their business and disconnected storage equipment like freezers because you cannot leave your freezer on with only 1 kg of fish" (Man, fish trader, age unknown).

Like female fish traders, male traders faced reduced selling time because of curfews. Fish that would normally be sold at "fresh" prices in the evenings sold at reduced prices the next day. One fish trader explained how:

"The rules have also affected me and other traders because the time you expect customers to come and buy fish in the evening from 7 pm onwards, that's the very time curfew is almost starting and you're required to close the fish shop and go home. So, it affected me so much" (Man, fish trader, age unknown).

A community leader from Community B described how the closure of the hotel and tourism industry impacted local markets; "There was difficulty in getting market as the markets here had very few consumers. Like the fish traders of [Regional hub 1] and [Regional hub 2] locally depended on consumers from [Regional Hub 2] estate, [Regional Hub 2]

ridge, [Regional Hub 2] and these places were all closed." (Man, community leader, age unknown, additions included for anonymity).

To cope with these disruptions, one trader had shifted to selling vegetables alongside fish. Others had attempted to sell fish locally. One trader explained, "when you get fish and because you can't sell it outside, the little you get you have to look for ways to sell it locally" (Man, fish trader, age unknown). Finally, traders resorted to selling fish at reduced prices the following day, and some, when lacking cash, traded store goods for fish as payment to fishers.

4.3. Outcomes

The disruptions to markets and livelihoods described above led to a range of outcomes (Table 3) that were evident across the five communities and groups there-in.

4.3.1. Food and nutrition security

The disruptions described above severely impacted food security across all five communities. All households reported a decrease in both the quality and quantity of food they consumed. Although foods were available in shops, all respondents mentioned that they could not afford the same quantities or variety of food because of reduced cash flow. One woman explained:

"If you're not working, how do you eat? If you're not working you cannot get food because it really affected us for sure. Because eating is a problem, we're not getting food properly. Where do we get food when people are not working?" (Woman, age 29).

All respondents reported that their dietary diversity decreased because they were unable to afford to eat a variety of foods: almost all were eating only corn meal (*Ugali*), with some more affordable side dishes, such as sardines or amaranth leaves. For instance, one man explained that "Since corona started… there is no money you can eat *ugali* the whole month and I have even forgotten how rice tastes" (Man, age 30). A small number of respondents explicitly articulated the suffering caused by not eating a variety of foods. For instance, one man said "But all these [foods] I am mentioning for you, I am even salivating because right now I am not getting such type of food" (Man, age 69).

Table 3
Summary of broad outcomes across food and nutrition security and multidimensional wellbeing. Respondents across all communities and different livelihood types experienced a range of these outcomes.

Food and nutrition security
Reduced variety and quantity of food, reduced number of meals per day
Primarily consuming ugali, reduction in consumption of rice, fish, meat, vegetables and chapati
Purchasing smaller portions of food (unable to afford bulk)
Wellbeing
Material
Lack of income and money, loss of jobs
Unable to afford goods and services
Unable to complete building projects, long term advancement
Forced to borrow from neighbours, buy food on credit
Profit immediately goes towards food
Drawing on existing assets and savings
Relational
Unable to meet at landing sites, difficulty communicating
Unable to sit and talk with friends and family and provide mutual support in difficult times
Pressures of being the only breadwinner
Unable to participate in church/mosque/group prayer, weddings, funerals, sport
Feeling lonely and isolated
Subjective
Frustration at sensed lack of agency and inability to progress projects to support the household
Unhappiness at failure of business and future uncertainty
Worry about children at home, not attending school
Sense of hopelessness
Fear about the virus or being punished for lack of compliance with rules
Describing situation as "suffering"

Several respondents emphasized how the insufficient quality and quantity of food was having health impacts. One man explained that:

"[If] today you eat cassava, tomorrow ugali, the next day beans, and the following day rice, like that, yes, [your] stomach is used to that. But [if] today cassava, tomorrow cassava, and the following day cassava, it'll give you disease" (Man, age 69).

Finally, a small number of fishers emphasized that hunger was an ongoing problem, and contributed to a lack of energy. For example, one man explained that "the most pressing [challenge] was to do with *daily bread* [said in English] because you cannot do anything if you have nothing in your stomach. That is what impacted us most" (Man, age 48). Two respondents described severe food insecurity, whereby their household had gone for a whole day without eating anything. Some respondents tried to cope with and ameliorate food insecurity by supplementing food with household farming where possible. Almost all respondents had shifted to eating cheaper foods (such as sardines), budgeting almost all money towards food.

4.3.2. Wellbeing

The impacts of COVID-19 rules impacted all dimensions of the material, subjective and relational wellbeing of respondents. We describe the outcomes on wellbeing across each of the three dimensions.

4.3.2.1. Material Wellbeing. The direct outcome of disruptions to livelihoods and markets (Section 4.2) was a marked decrease in material wellbeing. This decrease was described in some form by all participants, who had either a family member who had lost their job(s), or whose business has deteriorated. As one woman explained: "my husband is out of job, children are not going to school and my business is down" (Woman, age 45). Another fisher described how "Some people in my family used to do casual jobs in different places, but now all of them are at home. They were laid off because of corona." (Man, age 28), while a fish trader summarized the situation as: "The rules meant no jobs and a job is money" (Man, trader, age unknown). Respondents' attempts to cope with the disruptions to livelihoods (see Section 4.2) meant that they used up savings (including money set aside for school fees in four cases), sold assets, and ended up spending the little money they made directly on food (or traded fish directly for food; see Section 4.3.1). As such, across all five communities, fishers, female fish traders, and male fish traders all experienced uncertainty, precarity, and growing stress on their material wellbeing. Seven respondents described using up or 'eating capital' to cope with the disruptions to their livelihoods, meaning that when restrictions do ease, they will have few reserves to draw on to invest in their businesses again.

The impact of COVID-19 on material wellbeing may be connected to the precarity of fishing-related livelihoods more broadly. For instance, one community leader emphasized that the impacts on material wellbeing were particularly acute for fishers and in fishing communities because of their direct dependence on fishing, which only provides a low income:

"For sure corona is all over the world but there are some communities whose income has always been small for a long time. They are affected so much. Like we fishermen, we must go out [fishing] in order to eat… there are special people whose income is very small, they have been affected so much" (Man, community leader, age unknown).

4.3.2.2. Relational wellbeing. The disruptions to communication and connections with other fishers, traders, and customers, and to family and friends more broadly, impacted people's relational wellbeing. All respondents also expressed a decrease in relational wellbeing. While all of our respondents had access to a mobile phone, several described how communication became difficult when meeting in groups was banned: "Communication was difficult as we could not meet in groups and others have no mobile phones, so we could not talk to each other" (Man, age 24). One respondent expressed how the stress and struggle of the

broader changes wrought by COVID-19 had been compounded because and he was unable to talk to, and find support from other friends as he normally would:

"My life has drastically changed to the extent that I even don't know what to say. When I come back home, I feel confused in respect to how life is taking me. In short things are very tight… After fishing we used to meet with friends and talk about life issues but that has changed. When we see each other, everyone is struggling to earn something and there is no time to sit together. That has been a big change to me" (Man, age 30).

Another older fisher also described that "there are things you may want to enquire from someone how to do them better but you are not allowed to be in a sitting of three to four people, so you are forced to do things your way and this is difficult." (Man, age 48).

Relational wellbeing impacts extended beyond livelihood settings, as all respondents were also unable to attend Churches, Mosques, and had shifted to praying at home. One man described these bans as 'impossible and… terrible" (Man, age 45). Important social events, such as funerals and weddings, had a limit on the number of people who could attend. Respondents also described being unable to shake hands with and hug others, visit relatives, and more generally having to maintain a distance. One respondent had been forced to send his wife and children to live with relatives when he could not afford to support them, and this caused him great distress. Finally, the pressures of COVID-19 disruptions caused stress on household relationships for some families. One man explained, "because there was no food my wife was getting annoyed with me" (Man, age 45).

4.3.2.3. Subjective wellbeing. Over three quarters of respondents mentioned a sense of frustration and a sense of hopelessness at being unable to progress with projects to improve their household's lives (for example in three cases, continuing progress on building a house), grow and develop their businesses, and save money because any income went immediately to food. In particular, almost all female fish traders, expressed a sense of hopelessness because they were unwilling to let their business or customer base collapse, and thus were running their business at very little or no profit, with a great deal of difficulty. One female fish trader described how 'corona brought us down to the knees, we still don't know what we shall do. We're therefore praying for corona to go away" (Woman, age 46). Another emphasized that the deterioration of her fish trading business "killed [her] hope… [and she is] experiencing difficulties in life because [her] business is completely deteriorated" (Woman, age 38).

Together, this lack of agency affected respondent's subjective wellbeing. One fisher said: "I don't have any happiness completely in my life. I don't know when all this will end." (Man, age 30). Indeed, at least one respondent from each community, including two community leaders, described their and their families' situation as suffering. For instance, one man explained how, "this situation has really made me suffer. My family has really suffered as we can go so many days unable to wash clothes and even getting tea in the morning is difficult." (Man, age 30). 28 respondents mentioned that they, or someone within their household had lost some form of income, thus increasing pressure on those who were still able to bring in some form of income. More than half of our respondents in each community mentioned concern and difficulties that came from their children not being able to attend school, and nine respondents (one from Community A, two from Community E, four from Community D, and two from Community C) articulated worry about not being able to fulfill school fees when schools did reopen.

Finally, three respondents (from Community D and Community B) described a general fear of the virus, and also fear of being beaten or punished by police if found breaking COVID-19 rules. For instance, one fisher who fished outside curfew hours or in locations that weren't approved to continue to have a fishing income, described how: "we decided to use secret routes like caves so that we could not meet the police. When we were fishing, we ensured that when we heard a boat coming, we looked who they were and we were fishing secretly but with fear." (Man, age 30).

5. Discussion

Early studies suggest that COVID-19 has been 'a harbinger of massive and life altering changes' for small-scale fisheries [5]. Disruptions to the seafood system continue, and will continue to have far-reaching and direct impacts on livelihoods and food security [20]. In coastal communities in Kenya, COVID-19 impacted food security and the connected dimensions of wellbeing. In particular, loss of income, lack of cash in the communities, and subsequent decline in food security combine to cause a decrease in material, subjective and relational wellbeing. Akin to inland fisheries in Kenya, continued food insecurity and lack of income may impact the health of fishing households, making them more vulnerable both to COVID-19 itself, and to the continued measures to contain it [14]. Prolonged periods of subsisting on staple carbohydrates leads to nutrient deficiencies, declines in health, work capacity and increased vulnerability to disease in short-term, and in the long-term, it can impact adult health and inhibit growth and development in children, reducing their future physical and cognitive capacity [7,8]. The impacts of COVID-19 on the subjective wellbeing of coastal communities are concerning. People are less able to access health services for other health problems aside from COVID-19 [1], and the mental health system is severely under resourced and unable to implement the recommended mental health guidelines [16]. Several respondents in our study spoke of confusion and lack of transparency around both government and other support. In other places a lack of support has caused some fishers to break COVID-19 rules [22,34]. However, many respondents in Kenya expressed that there was nothing that could be done except to wait for the pandemic to be over. Several emphasized the need to have faith.

We found that coastal communities in Kenya experienced livelihood losses and disruptions similar to those reported in inland fisheries in Kenya [2,14]. In Kenya's inland fisheries, curfews and lockdowns influenced fishing and fish trade [2]. In addition, restrictions on movement, and fear of contracting COVID-19 meant that small-scale fishing families had less access to fishing grounds and fished less [14]. Similarly, in Bangladesh, lockdown restrictions meant that small-scale inland fishers and fish farmers were prohibited from working on their ponds and wetlands [34].

Many of the key impacts to fisheries in Kenya and other places have been caused by disruptions to markets (e.g., insufficient gear supply, low demand resulting in unsold fish, increased commodity prices) [6,34]. The fish traders we interviewed expressed concerns that the pandemic had disrupted their trade networks, which might have longer-term consequences, especially for more marginalised female fish traders. In other parts of Kenya, Aura et al., [2] found inconsistent changes in price for key species in inland lake fisheries, with some locations reporting higher prices during COVID-19, and others (notably those with prolific aquaculture, which may glut the market) reporting lower prices. We did not estimate the price reduction at our sites, but in Malaysia fish sold to middlemen for 50–70% lower than before movement restrictions were implemented [18]. In other fisheries, several studies reported dramatic declines in sales to global market demand, as China banned many imports at the start of the pandemic [20,31,34]. For example, prawn prices in the Philippines dropped by as much as 50% due to a lack of exports [22]. However, in our study, international demand is not a strong component of many reef fisheries (except for the export octopus fishery, [37] or reduced sales to hotels). Similar to our findings in Kenya, there were also reduced local demands reported in Bangladesh [34] and in the Philippines [22] due to job and associated income losses. Consistent with our results, there were fewer middlemen operating and higher transportation costs and risks for fishers in Malaysia [18].

Rapid-onset crises like wars and pandemics can severely disrupt linked social-ecological systems [33]. In some instances, these disruptions may lead to increased pressure on natural resources, as people

migrate to secure alternative food sources, shift labour to natural resource-based livelihoods due to unemployment, or lead to over-exploitation due to limitations in management capacity [33]. In other instances, these may lead to an 'anthropause' where pressure on natural resources are reduced [33]. For example, in the Spanish Mediterranean, fishing effort, landings, and revenues were down by 34%, 49%, and 39% respectively during the COVID-19 pandemic [12]. Likewise, in the United States, landings declined by ~40% during the COVID-19 pandemic [38], though this was not the case for all species [31]. Our interviews revealed some increased fishing pressure on inshore fishing grounds in three communities, likely due to labour from the informal economy being attracted to the fishery as a result of COVID restrictions. However, this increased effort did not reportedly result in increased yield, likely since the Kenya fishery is already heavily overexploited [23]. Indeed, in line with our findings, preliminary evidence suggests conflicting reports on whether the COVID-19 pandemic has increased or decreased pressure on inland lake fisheries in East Africa [2,33]. For example, Aura et al., [2] report that fish stocks in inland capture fisheries in Kenya benefited from reduced fishing pressure. However, our results are similar to those reported in Vanuatu, where two thirds of surveyed villages reported an increase in fishing effort, mostly inshore canoe fishing, diving, and gleaning [32]. As with our sites in Kenya, this increase in effort in Vanuatu did not result in higher yields because most activity was from already overexploited reefs and was conducted by inexperienced fishers (including returned students and children, [32]. Our study relied on reported increases in effort; future studies could use remote sensing and fisheries yield data to triangulate these observations. Using remote sensing data to investigate changes in the area covered by fishing boats in harbor (instead of out to sea), Avtar et al., [3] estimated that a quarter of the annual fish production was lost due to COVID-19 across three key harbors in India.

Fishers, fish traders, and coastal communities are facing severe livelihood and food security challenges in the face of COVID-19. In line with findings on food insecurity in other fishery-systems, our findings suggest that when public health rules—such as curfews and social distancing—disrupt fisheries livelihoods, there is need to institute measures to support individuals and communities. Social capital and face-to-face interactions are critical for fish markets and fish value chains to function, especially for female fish traders who have smaller businesses, and a regular customer base. Fish spoils easily, and face-to-face transactions and quick sales help ensure that fish sold is fresh and thus less likely to be wasted. Thus, those who depend on fisheries livelihoods are particularly impacted when fish value chains are disrupted in places where digital or mobile communication, and access to freezers or other means of storing and preserving fish, are lacking—as in all the communities we interviewed, and most coastal fishing communities in Kenya. Enhancing access to alternative ways of selling and storing fish when markets are disrupted may help buffer the impacts of shocks such as COVID-19.

More immediately, there is need to ensure that support reaches communities in a timely manner and that community members are well informed about how to access it, especially during extreme shocks like the state of emergency. Several interviewees mentioned confusion about forms of support and how to access them. In addition, treating small-scale fisheries as essential services (e.g., by permitting people to be exempt from curfew), and or facilitating ways of communicating and trading that do not involve large gatherings will help ameliorate some of the disruptions to fisheries livelihoods [5]. Female fish traders—who are likely already more vulnerable within fish value chains [15]—may need targeted support to access resources, such as financial loans [29], to regenerate their fish trading businesses or to be able to explore and innovate in other sectors [11]. A number of female fish traders from all of our study sites explained that they had continued buying and selling fish, often at a loss, or barely breaking-even, because they did not want to lose customers, and had no other business to turn to.

More broadly, a critical focus needs to be placed on making small-scale fisheries more resilient [10]. Financial institutions such as the World Bank have begun to develop insurance schemes for small-scale fisheries that protect them from future disruptions [20]. For female fish traders specifically, and traders more broadly, access to short term business loans [29] to restart and build their businesses will be critical to re-building household assets and overall wellbeing once COVID-19 restrictions and impacts start to dissipate. For many fisheries, market diversification may be key to buffering against border closures and other market shocks [20]. In some cases, technology could help some fishers diversify into more affluent local markets through Online purchasing [22]. For example, in more affluent areas of Manila, Philippines, market demand for fish products remained strong and was aided by online purchase and delivery systems and weekly mobile markets [22]. That said, the far-reaching impacts of the COVID-19 pandemic in the coastal communities we studied, effectively closed off many existing avenues, such as alternative livelihoods, that may have buffered livelihoods in the past, and access to mobile phones and online distribution systems is limited.

6. Conclusion

There are fears that Kenya may experience more waves of COVID-19 in the future. If rules, lockdowns, and lack of cash flow continue, many in these fishing communities will be even more severely impacted. Many people we interviewed are experiencing prolonged food insecurity and poverty. Thus, the longer the situation continues, the more vulnerable and at-risk fishing communities will become. In the coming months and years, the COVID-19 pandemic will continue to reverberate across aspects of livelihoods, food and nutrition security, and ultimately human wellbeing, likely in unforeseen ways. As the pandemic continues to unfold, there is need to ensure that COVID-19 safe policies and protocols support or at least seek to accommodate continued fishing, trading businesses and diversification into other informal livelihoods. In addition, ensuring that schemes, such as small loans and financial reach the most vulnerable, will be critical in ensuring that coastal communities and households are able to safeguard and rebuild their wellbeing and adaptive capacity now, and in the face of future shocks.

CRediT authorship contribution statement

Jacqueline Lau: Conceptualization, Methodology, Data curation, Writing – original draft preparation, Writing – review & editing, Supervision. **Sarah Sutcliffe:** Conceptualization, Methodology, Data curation, Writing – review & editing. **Michele Barnes:** Conceptualization, Methodology, Writing – review & editing. **Emmanuel Mbaru:** Conceptualization, Investigation, Writing – original draft preparation, Writing – review & editing, Project administration. **Innocent Muly:** Conceptualization, Investigation, Writing – review & editing. **Nyawira Muthiga:** Conceptualization, Resources, Writing – review & editing, Project administration. **Stephen Wanyonyi:** Conceptualization, Investigation, Writing – review & editing. **Joshua E. Cinner:** Conceptualization, Methodology, Funding acquisition, Writing – original draft preparation, Writing – review & editing.

Declaration of Competing Interest

None.

Acknowledgment

This work was supported by the Western Indian Ocean Marine Science Association (Marine Science for Management grant No. MASMA/CP/2020/01) and the Australian Research Council (CE140100020, FT160100047). JL, SS, MB and JC acknowledge support from the ARC Centre of Excellence in Coral Reef Studies, James Cook University. The development of the methodology for this work was supported by the

CGIAR Research Program on Fish Agri-Food Systems (FISH) led by WorldFish. Phone interviews were supported by the Wildlife Conservation Society's Kenya Marine Program and supervised by the Kenya Marine and Fisheries Research Institute.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2021.104803.

References

[1] S. Ahmed, M. Ajisola, K. Azeem, P. Bakibinga, Y.F. Chen, N.N. Choudhury, O. Fayehun, F. Griffiths, B. Harris, P. Kibe, R.J. Lilford, A. Omigbodun, N. Rizvi, J. Sartori, S. Smith, S.I. Watson, R. Wilson, G. Yeboah, N. Aujla, S.I. Azam, P. J. Diggle, P. Gill, R. Iqbal, C. Kabaria, L. Kisia, C. Kyobutungi, J.J. Madan, B. Mberu, S.F. Mohamed, A. Nazish, O. Odubanjo, M.E. Osuh, E. Owoaje, O. Oyebode, J. Porto de Albuquerque, O. Rahman, K. Tabani, O.J. Taiwo, G. Tregonning, O.A. Uthman, R. Yusuf, C. Improving Health in Slums, Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements, BMJ Glob. Health 5 (8) (2020), e003042, https://doi.org/10.1136/bmjgh-2020-003042.

[2] C.M. Aura, C.S. Nyamweya, C.O. Odoli, H. Owiti, J.M. Njiru, P.W. Otuo, E. Waithaka, J. Malala, 'Consequences of calamities and their management: the case of COVID-19 pandemic and flooding on inland capture fisheries in Kenya', J. Gt. Lakes Res. Int. Assoc. Gt. Lakes Res. 46 (6) (2020) 1767–1775, https://doi.org/10.1016/j.jglr.2020.09.007.

[3] R. Avtar, D. Singh, D.A. Umarhadi, A.P. Yunus, P. Misra, P.N. Desai, A. Kouser, T. A. Kurniawan, K. Phanindra, Impact of covid-19 lockdown on the fisheries sector: a case study from three harbors in Western India, Remote Sens. 13 (2) (2021) 1–20, https://doi.org/10.3390/rs13020183.

[4] H.R. Bassett, et al., Preliminary lessons from COVID-19 disruptions of small-scale fishery supply chains, World Dev. (2021), https://doi.org/10.1016/j.worlddev.2021.105473.

[5] N.J. Bennett, et al., The COVID-19 pandemic, small-scale fisheries and coastal fishing communities, Coast. Manag. (2020) 336–347, https://doi.org/10.1080/08920753.2020.1766937.

[6] B.A. Bhat, et al., A study on COVID-19 lockdown impact on food, agriculture, fisheries and precautionary measures to avoid COVID-19 contamination, Galore Int. J. Appl. Sci. Humanit. 4 (2) (2020) 8–18. ⟨www.gijash.com⟩ (Available at: www.gijash.com).

[7] R.E. Black, L.H. Allen, Z.A. Bhutta, L.E. Caulfield, M. de Onis, M. Ezzati, C. Mathers, J. Rivera, Maternal and child undernutrition: global and regional exposures and health consequences, Lancet 371 (9608) (2008) 243–260, https://doi.org/10.1016/S0140-6736(07)61690-0.

[8] M.W. Bloem, S. De Pee, I. Darnton-Hill, Micronutrient deficiencies and maternal thinness first, in: A. Bendich, R.J. Deckelbaum (Eds.), Preventive Nutrition: The Comprehensive Guide for Health Professionals, Totowa: Humana Press, 2005, pp. 689–710.

[9] CFS (2012) *Coming to Terms with Terminology*. Rome. Available at: ⟨http://www.fao.org/3/MD776E/MD776E.pdf⟩.

[10] J.E. Cinner, W.N. Adger, E.H. Allison, M.L. Barnes, K. Brown, P.J. Cohen, S. Gelcich, C.C. Hicks, T.P. Hughes, J. Lau, N.A. Marshall, T.H. Morrison, Building adaptive capacity to climate change in tropical coastal communities, Nat. Clim. Change (2018) 117–123, https://doi.org/10.1038/s41558-017-0065-x.

[11] P.J. Cohen, S. Lawless, M. Dyer, M. Morgan, E. Saeni, H. Teioli, P. Kantor, Understanding adaptive capacity and capacity to innovate in social-ecological systems; applying a gender lens, Ambio 45 (3) (2016) 309–321.

[12] M. Coll, M. Ortega-Cerdà, Y. Mascarell-Rocher, Socio-ecological implications of COVID-19 in marine fisheries from the Northwestern Mediterranean Sea, Biol. Conserv. (2021), https://doi.org/10.1016/j.biocon.2021.108997.

[13] FAO, et al., The State of Food Security and Nutrition in the World 2020. Transforming Food Systems for Affordable Healthy Diets, FAO, Rome, 2020.

[14] K.J. Fiorella, et al., Small-scale fishing households facing COVID-19: the case of Lake Victoria, Kenya, Fish. Res. 237 (2021), https://doi.org/10.1016/j.fishres.2020.105856.

[15] S. Fröcklin, M. de la Torre-Castro, L. Lindström, N.S. Jiddawi, Fish traders as key actors in fisheries: Gender and adaptive management, Ambio 42 (8) (2013) 951–962, https://doi.org/10.1007/s13280-013-0451-1.

[16] F. Jaguga, E. Kwobah, Mental health response to the COVID-19 pandemic in Kenya: a review, Int. J. Ment. Health Syst. BioMed. Cent. 14 (1) (2020) 1–6, https://doi.org/10.1186/s13033-020-00400-8.

[17] D.S. Johnson, et al., Social Wellbeing and the Values of Small-scale Fisheries, MARE Publi. Cham: Springer, 2018, https://doi.org/10.1007/978-3-319-60750-4.

[18] J. Jomitol et al., 'The Impacts of COVID-19 to Small Scale Fisheries in Tun Mustapha Park, Sabah, Malaysia; What Do We Know So Far? Preprints, 2020, pp. 1–13 doi: 10.20944/preprints202005.0287.v1.

[19] M.K. Kansiime, J.A. Tambo, I. Mugambi, M. Bundi, A. Kara, C. Owuor, COVID-19 implications on household income and food security in Kenya and Uganda: findings from a rapid assessment, World Dev. 137 (2021), 105199, https://doi.org/10.1016/j.worlddev.2020.105199.

[20] C.J. Knight, T. Burnham, E.J. Mansfield, L.B. Crowder, F. Micheli, COVID-19 reveals vulnerability of small-scale fisheries to global market systems, Lancet Planet. Health 4 (6) (2020) 219, https://doi.org/10.1016/S2542-5196(20)30128-5.

[21] E.T. Lawson, R. Sidiki Alare, A.R. Zanya Salifu, M. Thompson-Hall, et al., Dealing with climate change in semi-arid Ghana: understanding intersectional perceptions and adaptation strategies of women farmers, GeoJournal (2020) 439–452, https://doi.org/10.1007/s10708-019-09974-4.

[22] A.O. Manlosa, A.-K. Hornidge, A. Schlüter, Aquaculture-capture fisheries nexus under Covid-19: impacts, diversity, and social-ecological resilience!Abstract, Marit. Stud. 20 (2014) (2021) 75–85, https://doi.org/10.1007/s40152-021-00213-6.

[23] T.R. McClanahan, Coral reef fish communities, diversity, and their fisheries and biodiversity status in East Africa, Mar. Ecol. Prog. Ser. 632 (2019) 175–191, https://doi.org/10.3354/meps13153.

[24] J.A. McGregor, Researching human wellbeing: from concepts to methodology, in: I. Gough, J.A. McGregor (Eds.), Wellbeing in Developing Countries: From Theory to Research, Cambridge University Press, Cambridge, 2007, pp. 316–350.

[25] J.A. McGregor, N. Pouw, Towards an economics of well-being, Camb. J. Econ. 41 (4) (2017) 1123–1142, https://doi.org/10.1093/cje/bew044.

[26] Ministry of Health (2021) Health Ministry announce 731 new cases of COVID-19 Nairobi, March 15, 2021., MoH News,. Available at: ⟨https://www.health.go.ke/health-ministry-announce-731-new-cases-of-covid-19-nairobi-March-15–2021/⟩. (Accessed: 15 March 2021).

[27] M.W. Ngigi, U. Mueller, R. Birner, Gender differences in climate change adaptation strategies and participation in group-based approaches: an intra-household analysis from rural Kenya, Ecol. Econ. (2017) 99–108, https://doi.org/10.1016/j.ecolecon.2017.03.019.

[28] I. Okyere, E.O. Chuku, B. Ekumah, D.B. Angnuureng, J.K. Boakye-Appiah, D. J. Mills, R. Babanawo, N.K. Asare, D.W. Aheto, B. Crawford, Physical distancing and risk of COVID-19 in small-scale fisheries: a remote sensing assessment in coastal Ghana, Sci. Rep. 10 (1) (2020) 1–13, https://doi.org/10.1038/s41598-020-79898-4.

[29] R. Pomeroy, et al., Financial inclusion to build economic resilience in small-scale fisheries, Marine Policy (2020), https://doi.org/10.1016/j.marpol.2020.103982.

[30] N. Rao, et al., A qualitative comparative analysis of women's agency and adaptive capacity in climate change hotspots in Asia and Africa, Nat. Clim. Change (2019) 1–8, https://doi.org/10.1038/s41558-019-0638-y.

[31] S.L. Smith et al., Adapt. Resil. Commer. Fish. Northeast. U. S. Early Stages COVID-19 pandemic 2020 1 35.(Available at)⟨https://osf.io/preprints/socarxiv/z3v2h/⟩.

[32] D.J. Steenbergen, et al., COVID-19 restrictions amidst cyclones and volcanoes: a rapid assessment of early impacts on livelihoods and food security in coastal communities in Vanuatu, Marine Policy (2020), https://doi.org/10.1016/j.marpol.2020.104199.

[33] G.L. Stokes, A.J. Lynch, B.S. Lowe, S. Funge-Smith, J. Valbo-Jørgensen, S.J. Smidt, COVID-19 pandemic impacts on global inland fisheries, Proc. Natl. Acad. Sci. U.S. A. 117 (47) (2020) 29419–29421, https://doi.org/10.1073/pnas.2014016117.

[34] A.R. Sunny, et al., Assessing impacts of COVID-19 on aquatic food system and small-scale fisheries in Bangladesh, Marine Policy (2020), https://doi.org/10.20944/preprints202006.0143.v1.

[35] UN News (2020) Kenya relief bid begins to avert 'hunger crisis' among poor workers hit by COVID, UN News. Available at: ⟨https://news.un.org/en/story/2020/10/1076542⟩ (Accessed: 24 February 2021).

[36] USAID (2020) Food Assistance Fact Sheet - Kenya, USAID.

[37] A.W. Wamukota, T.R. McClanahan, Global fish trade, prices, and food security in an African coral reef fishery, Coast. Manag. (2017) 143–160, https://doi.org/10.1080/08920753.2017.1278146.

[38] E.R. White, H.E. Froehlich, J.A. Gephart, R.S. Cottrell, T.A. Branch, R. Agrawal Bejarano, J.K. Baum, Early effects of COVID-19 on US fisheries and seafood consumption, Fish Fish. 22 (1) (2021) 232–239, https://doi.org/10.1111/faf.12525.

[39] Worldometer (2021) COVID-19 Coronavirus Pandemic. Available at: ⟨https://www.worldometers.info/coronavirus/⟩ (Accessed: 24 February 2021).