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Impact of COVID-19 on aquaculture and fisheries in ASEAN countries: some aspects of challenges, mitigations for future strategies in Malaysia

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ABSTRACT

This review paper discusses some of the challenges on the effects of COVID-19 on aquaculture and fisheries and their mitigations and strategies in ASEAN perspectives with special emphasis on Malaysia due to significant impacts of COVID-19 occurred in this country's enormous aquaculture and fishing industries. Substantial factors within fishery systems, as well as ecological and social impacts outside their control, such as climate change, chronic pollution, resource degradation, fluctuating commodity prices and changes in management strategies that can asymmetrically affect different communities, stress fish culturists and fisher-folk communities. COVID-19's broken food supply chain and shrinking market have certainly impacted everyone in the fishing and aquaculture business, with small-scale fishermen being the most susceptible. During COVID-19 pandemic in ASEAN countries, it was discovered that the potential effects on agricultural sectors in Malaysia needed to be protected in order to defend the well-being of farmers, breeders, fishers, and workers, the majority of whom are low-income earners. The relevant authorities have created different supply chains and expand supply sources to maintain revenue in the event of a national economic downturn through traditional marketing channels. The Post COVID-19 monitoring should be undertaken as a model role based on the Malaysian scenario to gain a quick grasp of the food security and livelihood situation of all fishing communities. As a result, a national platform is urgently needed to boost production, supply, and marketing integration so that the fisheries and aquaculture products may be traded efficiently. Nevertheless, transparency in policy responses, as well as regional and international cooperation, will support to build trust in the future of fish value chains and markets. Furthermore, these real-world lessons will make it easier to learn from the pandemic crisis to improve the sustainability and viability of fisheries and aquaculture industries in ASEAN countries and global as well.

Keywords: COVID-19 Pandemic; Aquaculture; Fisheries; Value chain; Mitigations strategies

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1. Introduction

COVID-19 (the disease produced by the Severe Acute Respiratory Syndrome Coronavirus 2:SARS-COV-2) has wreaked havoc on global healthcare systems, with ramifications affecting every part of modern life. The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020, citing almost 3 million cases and 20,973 deaths in 213 nations and territories [1]. Because of the measures implemented by countries to restrict the rate of infection, such as home confinement, travel bans, and business closures, the COVID-19 pandemic has produced a public health catastrophe followed by an ongoing economic crisis. Hundreds of millions of people throughout the world rely on fisheries and aquaculture for food, and over 10% of the world's population relies on them for a living. The COVID-19 pandemic has a significant impact on all elements of the fish supply chain, putting employment, earnings, and food security at risk. With the current trend of the COVID-19 affecting countries worldwide, the Food and Agriculture Organization of the United Nations (FAO) predicted that food supply chains would be disrupted as early as April and May 2020, with the poorest and most vulnerable segments of the population bearing the brunt of the impact. The effects of COVID-19 are already being felt in the aquaculture and fisheries industries around the world [2].

Government and business measures are required to address the immediate economic and social devastation that the fish industry is experiencing as a result of the crisis. Governments must also sustain long-term commitments to conserve natural resources, ecosystems, and fisheries viability. Economic, equitable, and environmental factors all point to the same best practises: boosting the incomes of the poorest people rather than subsidising inputs or fishing effort, and ensuring that evidence-based management is enforced. Transparency in policy responses will help to build trust in the future of fish value chains and markets, as well as promote learning from the crisis to improve fisheries and aquaculture sustainability and resilience [3].

In the European Union's (EU) pandemic emergency response to sustain the fishing and aquaculture sectors, the European Commissioner for Environment, Oceans, and Fisheries stated that fishers and aquaculture farmers are the first to suffer the economic consequences as seafood demand has sharply decreased. To better understand the virus's spread, countries implemented potential measures such as transportation restrictions and the closure of non-essential services such as restaurants, hotels, and catering, all of which had an immediate impact on the supply and demand of fish and fish products both globally and locally. These consequences have had a negative impact on the livelihoods of fishers, aquaculturists, and fish farmers, as well as the food security and nutrition of low-income developing countries and Small Island emerging states that rely heavily on fish for animal protein, essential micronutrients, and/or trade [4,5]. COVID-19 wreaked havoc on Southeast Asian countries. COVID-19 has had a significant health and economic impact across the region, but the virus has not expanded as swiftly as it has in other regions of the world [6,7]. This is largely owing to the region's harsh measures, which include cross-border travel restrictions and lockdowns. The pandemic has caused significant suffering for individuals in the region, particularly vulnerable groups, and has highlighted widespread injustices, hazards, threats, and difficulties ranging from a lack of social protection to human rights violations, degraded ecosystems, and biodiversity loss [8]. COVID-19's rapid proliferation throughout Southeast Asia (SEA) has had an impact on the regions value chain in the form of capture and culture fisheries [9,10].

The activity of fish production in the aquaculture sector has also decreased as a result of COVID-19. Because of the spread of COVID-19 to other parts of the world, governments and legal authorities have been obliged to enforce a lockdown in order to contain the virus, which has hampered the economy. As a result, there are less demands for seafood, disrupting aquaculture production plans in certain larger producers and exporters, such as China, which relies heavily on exports for its survival and earnings [11].

The livelihoods, nutrition, and health of fishermen and fishermen's families have all been adversely impacted. Fishermen have faced difficulties as a result of national lockdown measures in several countries, which prevent them from venturing out to sea or selling their catch. Fishing activity has decreased as a result of lower demand for seafood from local markets, restaurants, and hotels. Small-scale fisheries value chain input providers, merchants, processors, transporters, financiers, and others have suffered a decline in activity. Due to reduced fishing activity, providers have closed, limiting the availability of ice boxes, fuel, bait, and fishing gear. Different sorts of trade have slowed as a result of transportation restrictions that hinder things from moving. Seafood processing plants have been shut down or are working at a reduced capacity. The problems and vulnerabilities that aquaculturists, fish farmers, and small-scale fishermen face in Southeast Asia. Poverty, market access, financial services, livelihoods, poor access to public services like health care, clean water, and sanitation, social protection, political and economic marginalisation, gender inequity, and natural disasters have all been exacerbated as a result of COVID-19 in these contexts [12,13]. Because many small-scale fishermen rely on daily catch to feed and maintain their families, they have been particularly susceptible. Many fishermen have gone further in debt as a result of borrowing money from unofficial sources to maintain themselves and their family. Women are more vulnerable to infection because they are more likely to work in the post-harvest sector, where they have more direct contact with potentially contaminated fish vendors and consumers [14]. Table 1 shows a complete summary of the COVID-19 lessons learnt in six severely affected potential Southeast Asian countries.

2. COVID-19 and the economy

The COVID-19 infection has not only become a public health emergency, but it has also had an economic impact on the world. Reduced output, loss of life, business closures, trade disruption, and devastation of the tourism industry have all had significant economic consequences around the world. Fisheries and aquaculture are important food and nutrition sectors that represent the worldwide state of

Table 1
Effects of COVID-19 on Fisheries and Aquaculture Sectors in Six Southeast Asian Countries

Indonesia	Malaysia	Myanmar	Philippines	Thailand	Vietnam
Fishers are susceptible to distractions	Fishers are susceptible to distractions	Fishers are susceptible to distractions	Fishers are susceptible to distractions	Fishers are susceptible to distractions	Online marketing
Fish in relief packages create undisputable and direct market for catch	Need for social infrastructure and safety nets	Negative impact on the small scale fishers	Fishers maintain food supply amongst crisis	Online marketing	Financial help difficulties
Importance of cold storage during overabundance	Need to strengthen fisheries cooperatives	–	Need for social infrastructure and safety nets	Direct marketing	–
Online marketing works for fish	–	–	Direct marketing and online marketing work for fish	Fish handling techniques	–
–	–	–	Importance of cold storage during overabundance	Promotion of fish to local consumers	–
–	–	–	–	Establishment of fishers groups to develop resilience strategies	–

Source: [15]

food security. Many ASEAN countries are among the leading producers, exporters, and importers of fish and fishery products, and the epidemic has had a direct impact on their products [16].

Although there is considerable knowledge on the predicted economic and health costs of infectious disease outbreaks, the world has failed to spend properly in preventive, awareness, and preparedness efforts to decrease the risks of big epidemics. Infectious disease outbreaks and epidemics have become global concerns as a result of globalization, urbanization, and environmental change, necessitating a coordinated response after spreading to other regions of the world, particularly Southeast Asian countries in early 2020. Malaysia, Singapore, Indonesia, Thailand, Vietnam, Philippines, Brunei, Myanmar, Cambodia, and Laos are among the Southeast Asian countries afflicted, with Singapore being the first to report a case of COVID-19. The introduction of the new COVID-19 in Southeast Asia has had a direct impact on the economies of those countries [17]. Furthermore, as a preventive measure to combat the transmission of the virus, people are obliged to stay inside and restrict interaction as much as possible through social distance. Furthermore, because to the extravagant economy, numerous sectors have been closed and then partially reopened. The complete spectrum of activities used in the fisheries and aquaculture industries is complicated, and the methods used vary from artisanal to large-scale industry around the world. In truth, not all sectors/value chains have been impacted equally, and certain value chains (for example, frozen, canned/pre-packed seafood) appear to have benefited from the disaster as long as they had access to supplies, storage, and transportation. Despite the fact that COVID-19 does not affect fish and is not caused by fish eating, the fish industry is still affected by the pandemic's indirect effects, such as altering consumer desires, market access, and logistical issues connected to transportation and border restrictions. However, this has had a negative impact on the livelihoods of fishermen and fish farmers, as well as food security and nutrition for people who rely largely on fish for animal protein and key micronutrients [18,19].

3. Distinctive effects on fisherfolk livelihoods in Southeast Asia

Southeast Asia has a dreadful reputation for contributing ominously to global fisheries production. However, starting early 2020, the COVID-19 pandemic has had a significant influence on the aquaculture and fishery industries. Stakeholders in the fisheries sector, such as fishermen, traders, fish growers, and consumers, are the ones who are most impacted. This is because the food supply chain has been disrupted. The closure of food services such as restaurants, hotels, retails, catering, and tourism, which previously relied on the fishing sector, has resulted in a decrease in seafood demand. This has an impact on the fish supply chain because of lower customer demand for seafood, resulting in lower prices than in the usual period prior to the spread of COVID-19 [20]. Obviously, this is due to poor demand, despite the fact that production continues. However, they are producing an imbalance, resulting in low fish catch/production and trade. As a result, poor productivity and decreased trade will have an impact on the income and employment of fishermen who rely on the

fishing industry. Low demand from fish-consuming countries will have an impact on fishing-producing countries' export activities. Southeast Asian countries have been badly impacted by the COVID-19 epidemic, and as a result, have implemented some mitigations to address the various challenges. Cambodia had clearly prohibited all fishing exports in order to maintain domestic supplies and food security, but the prohibition on fishing exports has been relaxed in order to bolster the economy as a result of the Pandemic crisis. Indonesia, on the other hand, has temporarily halted trade with China and sought for new markets by diverting shrimp and tuna markets to the United States and European Union (EU) countries. As a result, a new trend in Asia has emerged: door-to-door sales of fresh and frozen seafood. When consumers cancel or postpone their seafood orders, Vietnam suffers as well. On the other hand, the covid-19 pandemic has led governments to implement lockdowns, restrict movements and travel, and shut down most industries, including fisheries. As a result, curtailed fishing operations were imposed to reduce fish harvest by fisherman, potentially affecting the livelihood of those fishermen who rely on fishing for a living. COVID-19 has an impact on both large-scale and small-scale fisheries in the fishing industry. Large-scale fisheries may have reduced workforce availability as a result of travel restrictions, limiting their operations. Indeed, enhanced preventative measures may limit sea fishing, fish storage in ports, and transportation. Meanwhile, the effects on small-scale fisheries may be more severe than on large-scale fisheries. They may be hampered in their ability to catch fish due to movement restrictions and transportation challenges, and they may also be hampered by poor customer demand [21]. This may result in a decrease in their income and a negative impact on their well-being. As illustrated in Figs. 1 and 2, a loss of income leads to food insecurity.

4. COVID-19: impacts on fish and aquatic food systems

It is because numerous sectors will be affected, the effects of COVID-19 on the fish and aquatic food systems could be the worst. Production, processing, distribution, customers, and markets are all affected. Since the COVID-19 pandemic, demand for seafood has decreased, notably in the local and international markets. Because of the low market demand, the price of seafood will be lower than usual. As a result, fishing activity is hampered because it is unprofitable for the fishermen. Because fishing is a major source of income for most fishermen, this could have an impact on their livelihood. The fishing industry is also hampered by a number of problems, including a lack of hygienic procedures, vital equipment, and fishing gear. Several hygienic measures should be implemented, including social separation between ship crews and the use of face masks by the crews. It is well understood that hygienic measures must be implemented whenever and whenever possible to prevent the spread of COVID-19. As a result of the lack of hygienic precautions, fishing activity is restricted as much as possible, as there is a high risk of spreading COVID-19 in the absence of appropriate sanitary procedures. The lack of appropriate equipment, such as masks and gloves, is the next issue. In addition to hygienic precautions, required equipment is also critical. The shortage of input supplies, such as fishing gear and bait, is the next issue. Due to a lack of available suppliers during the epidemic, this is the case. Fishing gear and other input supplies are essential for catching marine species such as fish and other seafood, and so a lack of any input supply can reduce fishing activity. Aside from that, the fishing sector is harmed by the COVID-19 when there is a lack of clarity regarding the legal duty of fishing activities [22].

COVID-19 has also resulted in labour shortages in the aquaculture sector, potentially as a result of travel and movement restrictions for workers. Shortages of labour are also a result of financial difficulties and cash flow problems faced by the owners of hatcheries and fish farms. The labour shortages in aquaculture farms can cause output to be disrupted. Next, feed, seed, and vaccination shortages may have an impact on fish productivity because these goods must be imported from outside, which is difficult because travel and movement are prohibited. As a result, import and export activity were impacted. Low productivity and stocking might result from a lack of food, seeds, and vaccines, causing production plans to be disrupted. Furthermore, poor market demand for fish results in increased costs for fish farmers because they must hold fish that should be sold. Aquaculture producers also encountered difficulties as a result of cancelled or postponed orders when international markets, food services such as tourism, hotels, and restaurants were closed due to the COVID-19 outbreak [23].

5. COVID-19: economic impacts on fishing communities and Malaysian aquaculture

Disrupted food supply chain and shrinking market have certainly impacted everyone in the fishing business, with small-scale fishermen being the most susceptible. During the COVID-19 epidemic, it was discovered that the agriculture sector needed to be protected in order to defend the well-being of low-income farmers, breeders, fishers, and labourers [24]. In March 2020, Malaysia began to face the COVID-19 epidemic. The Malaysian government issued the Movement Control Order in response to the increasing number of cases (MCO). At the end of March 2020, 52.6% of Malaysians were experiencing financial troubles, and 21.9% of those employed in the agricultural sector had lost their jobs [25]. The impact of MCO and Conditional Movement Control Order (CMCO) on the economy is unpredictable at this time period, even in the agro-food market, so FAMA took the initiative to assess the impact of MCO and CMCO on the agricultural sector [26]. Food, water, energy, communication, and the internet are among the critical services authorised to operate during the control order, according to the administration. Despite the good intentions, it is a difficult time for the people, particularly the rural population in coastal areas. Despite the government allowing fishermen to continue operating under the MCO, it has been stated that their income has been significantly impacted [27–29].

According to the report, the imposed movement restriction measures have resulted in a significant drop in the price of fish throughout the food supply chain. Small-scale fishermen are the most affected, particularly those who live on islands isolated from major economic operations. The vast majority of fishing communities continued to rely on

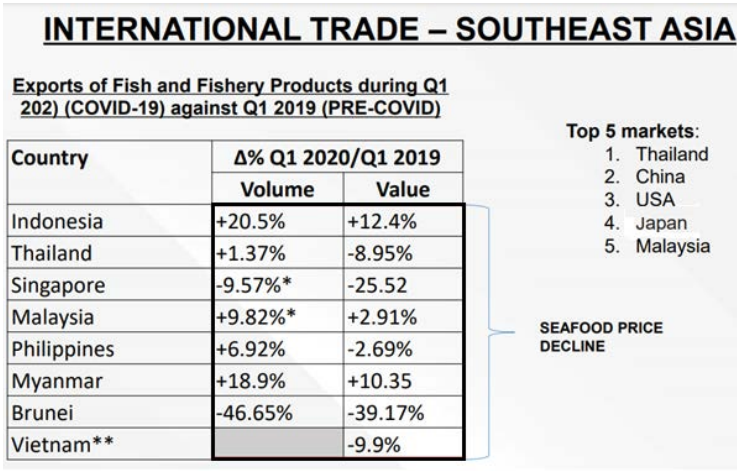

Fig. 1. Effects of COVID-19 on the export price of seafood for ASEAN countries.
Source: [16].

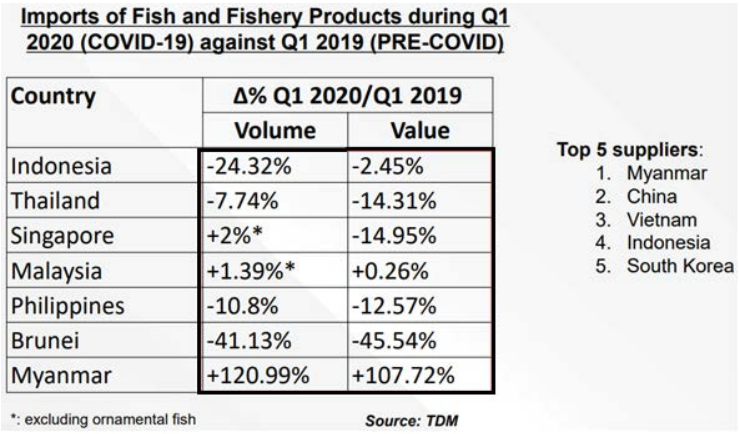

Fig. 2. Effects of COVID-19 on the import price of seafood for ASEAN countries.
Source: [16].

intermediaries. Currently, fish catch is sold to village middlemen for 50%–70% less than it was before to the movement restriction period. The price of Spanish Mackerels, or Ikan Tenggiri, used to be RM10/kg, but now some middlemen are buying them for as little as RM 3/kg along the coast's fish landing points. The decline in selling fish prices at the fish market has forced middlemen to buy fish supplies from small-scale fishers at a lower price. As a result, more tourism and sea-food-related businesses have been encouraged to participate in the growing economy towards the seafood industry, particularly in Northeast Asia countries [30,31].

6. COVID-19: overview impacts on fisheries livelihood in Malaysia

The following are the overall impacts on fisheries and aquaculture livelihoods that have been observed, [32]

- Logistical challenges hampered the domestic distribution of fish products.
- Traffic jams created by police barricades have already caused delays in the delivery of critical products.
- This is especially true for SMEs. The majority of European importers are currently putting financial strains on ASEAN fish traders.
- Ordering on the spur of the moment and constantly cancelling or postponing orders owing to pandemic concerns.
- Complete or partial hotel and restaurant closures.
- Travel bans and limitations for domestic and international air and land travel.
- Transportation disruptions result in fewer individuals shopping in local marketplaces.
- Imposed movement restrictions resulted in a large drop in the price of fish throughout the food supply chain.
- During Lockdown, fish catch is sold to village intermediaries at a price that is roughly 50–70% lower than before the movement restriction period.

7. Potential impacts of COVID-19 on value chain: fisheries and aquaculture products

The Malaysian coastal populations rely largely on aquaculture as their principal source of income. The majority

of businesses in the agriculture industry (78%), including aquaculture, are classified as micro and small businesses. In 2016, the aquaculture sector, along with other agriculture sectors, generated 9% of Malaysia's gross domestic product (GDP). Malaysia had around 21,156 full-time aquaculturists as of 2017. In Malaysia, aquaculture accounts for roughly 20% of total seafood production. Malaysia's total aquaculture production has gradually increased since 1980, reaching 1.69 million tons in 2017. According to a preliminary survey conducted by the Department of Statistics Malaysia in the year 2020. COVID-19 has reduced the income of roughly 79.1% of farmers and fishermen. Significant impact on value-chain actors, many of whom are women, and their goods, which are heavily dependent on export and tourism. Not able to fulfil all necessary seasonal duties such as fish breeding. Breeding operations were impacted in the case of a food stock shortfall. As a result, both marine and freshwater aquaculture have experienced a drop in growth [32].

Because of the decreased demand for fish, the value chain was reflected, and the consequences on daily income and health of small-scale fishermen and women vendors who rely heavily on selling fresh fish from their boats were noted. Small-scale fishermen are the most affected, particularly those who live on islands isolated from major economic operations. In a media statement released on March 28, 2020, the Malaysian Inshore Fishermen Action Network (JARING) expressed concern that there may be a disruption in the food supply chain, and that in order to avoid income losses, the majority of fishermen have decided not to go out fishing when their products can no longer be sold. Buyers are still looking for common Malaysian fish such as scads and tunas, rather than high-valued fish such as Spanish Mackerels and Groupers. Because the costs are still low during COVID-19, most people opt for pelagic fishes, also known as Ikan Rakyat (Folk Fishes). Due to the closure of key industries, the supply chain was interrupted, particularly for factory operations [33].

The producer, who are fishermen, are allowed to harvest the fish from the cages in this chain, but market demand is drastically reduced. This is due to the fact that the wet market is closed to the public, with the exception of large hypermarkets. Furthermore, canned fishery items were chosen over fresh farm-based products. Due to the inability to sell their caught fish on the market, some fishermen had no choice but to throw it away. Then, because the border is closed, certain fish caught primarily for export are unable to be transferred to other countries, and certain fish species imported from other nations are unavailable. These circumstances have a negative impact on the national and international commerce markets. Finally, after MCO is adopted, there is a shift that results in a loss for the fishing industry in the domestic market. Due to the inability to sell their caught fish on the market, some fisherman must simply throw it away. Then, as a result of the border restriction, certain fish caught primarily for export are unable to be transferred to other countries, and certain fish species imported from other nations are inaccessible. These circumstances have a negative impact on the national and international commerce markets. Finally, after MCO is adopted, there is a shift that occurs, resulting in a loss for the fishing industry in the domestic market [34].

Catfish, prawn, and freshwater fish breeders, for example, reported a reduction in sales due to a lack of demand from restaurants. The impact of the movement control measures on the fisheries industry along the market has been exaggerated, resulting in a drop in fresh fish and shellfish prices. Due to the closures of many seafood restaurants and the affected fish export enterprises, the high-value fish that fishermen used to sell before the MCO are no longer in demand. Many aquaculture growers who have been unable to sell their harvest have had to keep significant numbers of live fish on their farms. The consequences on aquaculture have varied according to geographies, species, markets, and farm financial capability [34].

There were unexpectedly higher costs and hazards, especially when input supplies were disrupted, and restocking and subsequent harvests were delayed. During the MCO period, the Malaysian aquaculture sector began to show a downward trend. In mid-February 2020, the demand for seafood from Malaysia to Singapore dropped by half. Air cargo, live fish sea carriers, and even the low local market could not convey this fish. The demand for this fish in the local market plummeted dramatically as a result of the restaurant's closure, resulting in an overabundance of fish stock in their hatchery. As a result, the boat from Hong Kong and China was unable to enter Malaysia, and all of the fish gathered in the farms remained unsold [35].

8. Ongoing emergency measures

Governments and the fisheries/aquaculture industry are taking extraordinary steps to deal with and mitigate the pandemic's effects on the aquaculture and fisheries value chain [36].

- Promoting local consumption of export items that have lost their markets, as well as establishing and aiding farmers in using internet marketing platforms.
- Governments have been assisting producers, processors, and exporters. This includes a strategy to stabilise crop prices and allow farmers to refill critical agriculture inputs.
- Owners of fishing boats on Malaysia's east coast (Kuantan, Pahang) have started a free fish distribution scheme for those who have been financially impacted by the MCO. They had handed approximately 7,000 kg of freshly caught seafood to locals in the impacted areas.
- At Fish Market, LKIM (Malaysian Fisheries Development Authority) continues to offer fresh seafood.
- Aquaculture SMEs can postpone their income tax instalment payments for three months.
- COVID-19-related gifts qualify for a tax deduction as well.
- Because the aquaculture sector is primarily comprised of micro- and small-scale businesses, the Malaysian government's incentives and aids to reduce the impact of COVID-19 are well-timed.

The Department of Fisheries Malaysia, 2020, has implemented the following 'Short-Medium and Long-Term' actions in response to the significant COVID-19 impact on the "Aquaculture and Fisheries" industries in Malaysia [37].

9. Short–medium term recovery mitigation strategies

Issue 1: fishery activities

Measures

Proactive dissemination of information through fisheries state and district office as well through social media on fisheries being classified as essential service, thus allowing the activities.

Issue 2: disruption in processing, factories distribution, and supply chain to consumers

Measures:

The joint Inter-ministerial committee compromises of Ministry of International Trade and Industry, Ministry of Domestic Trade and Consumer Affairs, Ministry of Agriculture and Food Industry (MAFI) as well as Agencies under MAFI. MAFI established collaboration with online shopping platforms to facilitate marketing of fresh produce through online services. MAFI also established Controlled Fresh Fish Markets at locations strategically accessible to public.

Issue 3: restricted movement across society by enforcement officers (police and army)

Measures:

Ministry of Agriculture and Food Industry (MAFI) issued endorsement letters to registered farms, farmers and fisherman to verify that they are involved in providing essential services.

10. Long-term reform strategies

- Intensify Mechanization and Technology Adoption.
- Increase Budget Allocation for Agro Food Production.
- Industrialization of Agro Food Sector.
- Institutional Structural Reform.

The Ministry of Agriculture, Malaysia has announced the 12th Malaysian Plan towards Mitigations and Strategies for fronting the Future Challenges due to Natural Disaster in the Aquaculture and Fisheries Sectors as shown in Table 2

11. Mitigations and potential strategies towards Asian perspectives [38,39].

- Aquatic animals (finfish, reptiles, amphibians, and invertebrates like crabs and molluscs) have no role in the transfer of COVID-19 to humans. Fish and fish products are safe to eat and are an important part of a balanced diet. In certain nations, false impressions have resulted in lower consumption of these products.
- Create different supply chains and expand supply sources to maintain revenues in the event of a national economic downturn via traditional marketing channels.
- A post-COVID-19 rapid study should be done to gain a quick knowledge of all fishing communities' food security and livelihood condition.
- Create a national platform and promote production, supply, and marketing integration so that fisheries and aquaculture products may be traded efficiently.
- In order to overcome the fisherman's current economic income loss, the company should not be overly reliant on a single marketing channel.
- Provide interest-free loans for a set period of time (at least one year), which may be the finest alternative and stand-in option for aquaculture SMEs looking to re-establish their economic growth.
- Maintain a consistent level of online sales of branded new frozen fishery goods. Relevant industries should devote sufficient resources to commercialising these products.
- Ocean policy researchers must disseminate information on problems in order to aid policymakers and stakeholders in overcoming COVID-19 and achieving sustainable fisheries.
- Transparency in policy responses, as well as regional and international cooperation, could aid in the development of trust in fish value chains and markets in the future.
- International organisations such as the FAO, WHO, NACA, and the WORLD FISH CENTRE could contribute short- and mid-term funding to potential Sustainable Goals (SDG) flagship programmes within universities that meet the UN's global sustainability goals. These initiatives could run a community-based engagement campaign on the implications of COVID-19 in poor nations' "Fisheries and Aquaculture."

Table 2
Twelfth Malaysia plan 2021–2025: development dimensions

Key economic growth activities	Malaysian economic association dimension	Food security targets	Dept. of fisheries dimension
Coastal and maritime economy	Economic development	Food availability and safety	Ensure sufficient, affordable and safe fisheries produce
Green economy	Social re-engineering	Improve livelihood	Enhance fisheries resources sustainability
Smart and high valued agriculture	Environmental sustainability	Achieve sustainable development	Increase national economic contribution of fisheries sector

Source: [37]

12. Conclusion and recommendations

The COVID-19 crisis has caused instability in both local and global food markets, causing food supply and availability to be disrupted. As a result, make financial assistance available to producers, particularly in the form of revolving capital for fisheries and crop clusters, in order for them to remain competitive following the lockdown, as many of them are only able to operate at minimum production levels or have closed their businesses. It is necessary to encourage and persuade producers to continue indicting the digital platform or online sales channel in order to create opportunities for them to explore new markets, in keeping with the fourth industrial revolution, which focuses on digital technology. The target group should take advantage of the e-commerce platforms given by the government and the private sector to improve product competitiveness and eliminate reliance on middlemen. The formation of a special committee that will operate as an "Immediate Action Unit" capable of dealing with market chain concerns, notably in the agricultural industries, can play an important role.

This unit can determine and enforcing immediate and medium-term solutions to any concerns that may arise in the future. The Department of Fisheries Malaysia has implemented the following 'Short-Medium and Long-Term' steps in response to the impact of e COVID-19 on the "Aquaculture and Fisheries" sectors in Malaysia. While providing food and financial assistance has been beneficial in the short term, long-term support to combat not only pandemics like COVID-19 but also other stressors will necessitate the development of more irrepressible and sustainable aquaculture and fisheries management. It necessitates major social, economic, and environmental reforms that have an impact on the livelihoods of both freshwater and coastal communities. COVID-19, like its effects on food security, necessitates a globally coordinated response. In close conjunction with other organisations such as the WHO, FAO, WFP, and the UN, the CFS should take the lead in organising global food security policy guidelines in response. Aside from urgent health problems, food systems, food security, and nutrition are predicted to suffer short-, medium- and long-term consequences on Food Security and Nutrition on the baseline state of communities, countries, and regions.

On the other hand, an important finding gained along the road is that aquatic animals (finfish, reptiles, amphibians, and invertebrates such as crustaceans and molluscs) do not play an epidemiological role in COVID-19 transmission to humans. Fish and fish products are safe to eat and are an important part of a balanced diet. In certain nations, false impressions have resulted in lower consumption of these products. Fish items can get contaminated if they are handled by people who have COVID-19 and do not exercise appropriate hygiene. To safeguard fisheries and aquaculture personnel as well as fish products from infection, implement strict hygiene standards. Nonetheless, policy transparency and regional and international cooperation will aid in the development of trust in the future of fish value chains and markets. These lessons will benefit people learn from the challenges and catastrophe to improve the sustainability and viability of fisheries and aquaculture in ASEAN countries and globally as well.

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