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Global impact of COVID-19 on aquaculture and fisheries: A review

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Abstract

The recent epidemic that affected the whole world badly is Covid-19. The RNA virus disease effect particularly respiratory system causing difficulty in breathing and if condition get severe, it leads to death. This worldwide pandemic disturb each and every sector of the world as mostly all the countries impose lockdown and restrictions in movement in order to control its spread. This create a huge loss for many sectors such as import/ export, industries, stock markets, aquaculture and economies. Considering specifically its impact on aquaculture and fisheries, it greatly reduces its consumption particularly seafood. Fish food chains are affected, small scale fisheries are facing extreme consequences and there is an increase in illegal, unreported and unregulated fishing. Some positive aspects of this situation such as food sharing and decline in fishing pressure also appears but obviously the negative impacts it holds are far greater than these constructive impacts.

Keywords: Covid-19, aquaculture, small-scale fisheries, sea food sector, blue economy

Introduction

Aquaculture which is also commonly known as aquafarming is the process in which different aquatic species such as animals and plant are reared, breed and harvested in controlled aquatic environments. Different types of environments such as oceans, lakes, rivers, ponds and streams can be used for farming. Aquaculture production has been increasing at a greater rate recently than in past (Luchini and Panne-Huidobro, 2008) [46]. As globally population has increased by 6.3% from 2004 to 2009 according to FAO report, the increasing demand of food is fulfilled with an increase in the production of aquatic organisms by by 31.5% in the same period. So aquaculture and fisheries has several benefits such as production of good quality food in large amount and its easy accessibility. It also improving the economy of country by contributing to it through profit and annual production (Pauly and Froese, 2012) [55]. But like other sectors, aquafarming is also disrupted seriously due to a severe pandemic that has affected the world badly.

East Asia and the Middle East are the regions where, corona viruses (CoVs) have been associated with significant disease outbreaks over the past two decades in. The respiratory syndrome (SARS) and the Middle East respiratory syndromes (MERS severe acute) began to come out in 2002 and 2012 respectively. At present, a narrative coronavirus, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causing the Coronavirus Disease 2019 (COVID-19) has prominent in late 2019. It causes severe health problem all over the world (Rodriguez-Morales *et al.*, 2020) [56].

Covid-19 Coronavirus (2019-nCoV) is a type of epidemic that first appeared in December 2019 in Wuhan City, Hubei Province, China (Ruiz Estrada *et al.*, 2020) [57]. Deep sequencing analysis from lower respiratory tract samples identified a novel virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as causative agent in January 2020, for that observed pneumonia cluster (Haung *et al.*, 2020) [32]. Director-General, Dr. Tedros Adhanom Ghebreyesus, of the World Health Organization (WHO) named the disease SARS-CoV-2 as “COVID-19” (WHO, 2020) on February 11th, 2020. Corona Virus Disease 2019 (COVID-19) is an RNA virus. It has crown-like appearance under an electron microscope. This crown covers with glycoprotein spikes on its envelope (Perlman and Netland, 2009) [54]. It is not the first time that a corona virus causing an epidemic.

It has been a significant global health threat- in November 2019. The occurrence of corona viruses (CoVs) with harsh acute respiratory syndrome (SARS)-CoV ongoing in the Chinese province of Guangdong. September 2012 in the Middle East respiratory syndrome (MERS)-CoV appeared (Lu *et al.*, 2020) [45].

Clinical facial appearance and peril factors are highly variable. This makes the clinical severity range from asymptomatic to fatal (Phan, 2020) [55]. The study about COVID-19 is on-going. (Di Gennaro *et al.*, 2020) [23]. There have been serious increases in the number of cases and death. This affects the China mostly, after that Italy and Iran. These pandemic started to affect the both social and cultural activities all over the world. Due to the virus, international flights between many countries have been canceled. The border crossings with risky countries have been closed. State of Emergency has been announced in some countries (Ayithey *et al.*, 2020) [5]. The Covid-19 pandemic affects badly global trade as well as social and cultural life. Particularly tourism, trade in property, production and transportation sectors have started to be affected negatively by this epidemic. Many countries, their goods manufactured in China and import goods from China have been decided to stop these activities. With all these negative effects, it has seemed foreseeable that stock markets, exchange rates and economic growth will also have a line in these circumstances (Zeren and Hizarci, 2020) [76].

WHO Guidelines

Fascinatingly, the world health organization issued comprehensive guiding principle including

- Regularly and thoroughly clean your hands with soap and water and an alcohol-based hand rub or sanitizer
- Avoid touching eyes, nose and mouth
- Practice respiratory hygiene, when you cough or sneeze cover your mouth and nose with your bent elbow or tissue or also use face mask
- Seek medical care, if you have fever, cough and feel difficulty in breathing,
- Stay knowledgeable and chase advice given by your healthcare provider
- Who is coughing or sneezing, maintain at least 1 m (3 feet) distance between yourself and anyone (WHO, 2020) [75].
- In public, people with respiratory symptoms are advised to use medical masks both in health care and home care planning (Hopman *et al.*, 2020) [31].

Impact of COVID-19 on all Sectors

The COVID-19 pandemic is having an extraordinary impact on communities around the world due to which social distancing practices and non-essential businesses are closed which is helpful to slow the spread of outbreak. Some specific sectors such as healthcare have skyrocketed in recent weeks. Other sectors such as air transportation and tourism have seen demand for their services disperse. Many governments restrain the activities of supplementary industries and workers are lined to their homes (Del *et al.*, 2020) [19]. Many commentators and economists suppose that the economic impact could be impressive (Baldwin and Weder, 2020) [7].

In a typical study based on collecting industry-level shocks, the OECD (2020) [52] supposes a drop in immediate GDP of around 25%, which is in line with our results. Another study by Barrot *et al.* (2020) [8] suggested that the industry level

shocks by considering the list of essential industries, the closure of schools and an estimate of the ability to work from home. Applying these shocks in a polysector income and outcome model, they find that six weeks of social distancing would bring GDP down by 5.6%. National and international trade has been affected by COVID-19 pandemic, especially tourism, production, food, and transportation apartments (Acar, 2020 [1]; Açıkgoz and Gunay, 2020 [2]; Alpago and Oduncu, 2020 [3]; Atay, 2020 [4]; Demirbilek *et al.*, 2020 [20]; Ibis, 2020 [33]; Zeren and Hizarci, 2020) [76].

WHO legitimately declaring a global pandemic, organizations transversely the board and around the world are faced with unmatched decisions that basically change the way they carry out trade and administer their workplaces. Owing to this pandemic, there were multiple undulate things that reverberated throughout all departments of our economy. The aquatic system and aquaponics department were also amongst those affected by the impacts of COVID-19. Restrictions such as lockdown cause disruption of market channels for aquatic culture system, aquaponics, and associated trades. It was supposed that 68% of all seafood or aquatic food devoted in the U.S. is consumed at food service maintenance (NOAA, 2018) [49]. As a result of the lost market sectors, trades have experienced a loss of income, interference in cash flow, difficulties with production, problems with labor, and so on (Senten *et al.*, 2020) [58]. The fishing sector hires employees at different stages such as logistics, storage, procurement, fishing operation, and retail trade (Can, 2012) [12]. In this context, changeable conditions observed from fishing operations to supply and marketing stages due to pandemic (Demirci *et al.*, 2020) [21].

Impact of COVID-19 on Aquaculture Food Systems

Impact on Blue Economy

The 3.5-7% of global GDP is blue economy accounts (UNCTAD, 2020) [65]. Blue economy channels, those who on a large scale depend on the marine environment, ecosystem and species to generate economic value are being negatively impacted. The pandemic is not limiting global fishing effort. It also heavy yield of other nautical goods and services, affecting reliant value chain globally (UNCTAD, 2020) [65].

The most heavily traded food products in the world are fish and fish products. According to the Food and Agriculture Organization of the United Nations, China represents approximately 60 per cent of the world's aquatic food production. It is the largest exporter of goods. On the other hand, it is also third largest importer of fish and fish products all over the world (De, 2020) [18].

Negative Consequences

Effect on Fish Food Chains

Sea food is the most traded food product in the form of fish and fish products in the world. Approximately, 38 percent of seafood entered in international trade. Meanwhile, fishing and fish farming are important at local level for the economy. Many low income countries and that communities that livelihood depend on fish, as well as small island developing states rely on aquaculture for their expenses.

Preventions to contain the spread of COVID-19 have caused disruption in both household and international supply chains. The highly perishable products present in additional logistical challenges are live, fresh or chilled fish, which represent 45 percent of fish consumed. Moreover, widespread containment measures can have a notable impact on nations. Seafood is the

significant trade amounts for reducing foreign incomes or menacing food security. Keeping the supply chain open is essential to keep away from a global food disaster. But there are some issues in the production of sea food. The sea food system disruption there is also disruption in demand, labor, production of sea food items distribution (Love *et al.*, 2020) [44].

20 percent of all animal protein intakes for 3.2 billion people is fish and seafood consumption (UNCTAD *et al.*, 2019) [64]. After China, India is another major exporter for the shrimp. Their economy was profoundly relying on the shrimp industry. Due to the pandemic of COVID-19 the shrimp industry was affected badly. Shrimp were majorly exported to other countries. In social distancing and lockdown scenario all trades activities were stopped and effecting the shrimp production in India (George *et al.*, 2020) [27].

Sea Food

For almost half of the global population, consuming Seafood provides nutrients that can reduce risks of malnutrition and diseases (Willett *et al.*, 2019) [70]. Globally small-scale fisheries (SSFs) is a source of crucial food particularly in coastal communities and employ 90% of the world's fishers. Almost 50% of the world's seafood comes from SSFs (Kurien, 2015) [43]. On the onset of the COVID-19 pandemic, this important industry virtually collapsed in January, 2020, as the pandemic shuttered one of the world's largest seafood markets, China. The growing vulnerability of SSFs to global market shocks was highlighted on the closure of a single dominant market, as many such fisheries depend largely on foreign buyer's despite of domestic markets (Knight *et al.*, 2020) [41].

Lockdown and travel restrictions were implemented first in Wuhan city and then Hubei province in China as a result of health risks and high mortality due to COVID-19. As this pandemic prevailed during the Chinese New Year, demand for luxury seafood decreased and markets distorted for Canadian and American lobsters, Australian crayfish, Vietnamese shrimp and many other fisheries (Dao, 2020 [17]; Johnson, 2020 [37]; Taunton and Cropp, 2020 [60]; Tester, 2020) [61]. This was an indication of enormous life altering changes that were about to happen in SSF and coastal fishing communities around the world. Altogether, probably 32 million people are directly employed as small-scale fishers, an additional 76 million hired in post-harvest jobs, and for local human consumption 81% of catch is used (Kelleher *et al.*, 2012) [38].

Some crucial features of SSF include smaller vessels and engines, gears (simpler or traditional), vicinity to the coast, smaller crews, family or local ownership, and significance for native livings and subsistence although SSF vary considerably by region and country (Kittinger, 2013 [40]; Smith and Basurto, 2019) [59]. Many SSF and coastal communities which are already susceptible to numerous social and environmental changes are further being sidelined due to short and long term effects of COVID-19 (Bennett *et al.*, 2016 [10]; Freduah *et al.*, 2017) [26].

The seafood sector is vastly globalized permitting shocks to proliferate internationally. It is also a central source of employment and nutrition, specifically in low-income countries. Disturbances, effects, and responses to the seafood sector in the first five months of COVID-19 were studied using 'action cycle' framework. Some supply chains, market segments, companies, small-scale actors and civil society

have shown initial signs of larger resilience than others by looking across high and low-income countries (Love *et al.*, 2020) [44].

As the restrictions were imposed globally due to pandemic, fish and fish products that are rely greatly on international trade suffered quite early, whereas fresh fish and shellfish supply chains were rigorously jammed by the shutting of the food service sectors (e.g. hotels, restaurants and catering facilities, including school and work canteens). As consumer demand was lessened/lost, the processing sector also faced difficulties. This especially affected women, who is the major portion of the workforce in the post-harvest sector. Due to this virus, restaurants are particularly affected as 70% demand of seafood is in restaurants (NMFS, 2018) [50]. COVID-19 pandemic is a rare socio-economics tremor in term of global scale and disturb all the supply chains encompassing all the sectors including seafood (White *et al.*, 2020) [67].

Some countries employed lockdowns which caused logistical problems in seafood trade, mainly related to conveyance and border restrictions. The salmon industry specifically, suffered from huge air freight costs and flights cancellation. The tuna industry has stated movement limitations for expert seafarers, including at-sea fisheries observers, and marine personnel in ports, thus avoiding crew changes and deportation of seafarers. Due to constraints on transportation and traveling, shortage of seeds, feeds and related aquaculture items (e.g. vaccines) have also been stated, with specific effects on the aquaculture industry (FAO, 2020) [24].

In some countries due to decrease in demand, reduction in prices, capture fishery production has been temporarily stopped or significantly reduced, that can positively affect wild fish stocks in the short term. In aquaculture, there is growing indication that unsold produce will increase live fish stocks, and consequently greater costs for feeding along with more threat of fish mortalities (FAO, 2020) [24].

In some areas, shutting of the food service industry leads to an increase in retail sales. However, canned and other preserved seafood products having a longer shelf life remains in profit as they were largely buy in panic at the starting of crisis. In some markets, suppliers have established methods to provide direct supplies to consumers (e.g. box schemes) to replace lost fresh fish sales from established retailers. As there are still many reservations ahead, predominantly with regard to that how long this pandemic will persist and what severe consequences it will brought globally, but an extended market decline is expected to introduce long-standing changes to the sector (FAO, 2020) [24].

Small Scale Fisheries (SSF)

The extreme repercussions that COVID-19 is having for the SSF sector are becoming apparent. We use instances from journalism, policy organizations, and public sources to provide understanding about the impacts that the SSF sector is facing globally. Many fisheries that were not considered important to national food supply systems e.g. Namibia, encountered complete shutdowns due to social distancing restrictions (Immanuel, 2020) [34]. Such indiscriminating lockdowns on fishing activities possibly disclose a preexistent tendency to underplay the role of fish in food systems (Bene *et al.*, 2015) [9]. In India, for example initially except farming fisheries were completely closed down, and only after huge pressure from civil society highlighting their important role in food provisioning was fishing permitted to continue processes within some boundaries (Mohan, 2020) [47].

Even in cases where fishing is considered a vital service, social distancing measures have prohibited many small-scale fishers from going fishing due to vessel size or trading in congested areas in local markets (Orlowski, 2020) ^[53]. Export-oriented SSF have encountered a massive decrease in demand (particularly from Asia, United States, and Europe), port closures, loss of access to cold storage, and cessation of shipping and air freight (Orlowski, 2020) ^[53]. SSF geared at local markets are also affected. In the Philippines, dropped prices due to less demand from local restaurants and hotels have severely decreased fishing activity, and factories are either completely closed or functional at reduced capacity (Ocampo, 2020) ^[51]. Around Lake Victoria, in order to minimize fish waste and loss and sustain local food security, access to cold storage is more significant now than ever (Kibiti, 2020) ^[39]. In Fiji, the momentary closing of interisland ferry transport lessened the disease prevalence to rural areas, but has taken away access for some to urban and semi-urban markets (Bennett *et al.*, 2020) ^[11].

Everyone is under risk of COVID-19 spread and infection, and fishers, processors and sellers have to make tough decisions – either to feed their families or risking exposure. Due to the migratory nature of fishers and regularity of international visitors, fishing communities and ports could potentially become “hotspots” for rapid infection (FAO, 2020) ^[24]. Facilities related to health care in rural fishing communities are very difficult even under normal conditions (Orlowski, 2020) ^[53], and thus these areas have more tough situation in context of accessing testing, treatments, and sanitation supplies that are required to diagnose and control COVID-19 spread and infection (CFFA, 2020) ^[14].

Illegal, Unreported and Unregulated (IUU) Fishing

Marine environment is also affected probably due to this pandemic. Illegal, Unreported and Unregulated (IUU) fishing and incursions into areas used by SSF may increase in this duration due to decreased human observer coverage and lapses in monitoring and enforcement (Thomson, 2020 ^[63]; CFFA 2020) ^[14]. In both Argentina and Indonesia, as government priorities have obviously shifted toward pandemic control, cases of heightened illegal fishing activity by foreign vessels have been reported, which directly influence fish stocks and indirectly SSF (Gokkon, 2020 ^[28]; Watts, 2020) ^[66]. Moreover, in many places such as the Caribbean where tourism contributes greatly to economy, declines in global travel will have disturbing impacts on local maintenances and probably pressure to cope up with basic food and livelihood resources will be increased (Hoffman, 2020) ^[29].

Identify Power Imbalances in Seafood Systems

The seafood system is an interconnected network of producers (formal and informal), distributors, retailers, and consumers. Some supply chains, market segments, companies, small-scale actors and civil society have displayed initial signs of greater resilience than others. Countries with stable economy and high-income have somehow managed the situation by selling frozen seafood and food with a greater shelf life in response to COVID-19-related shifts in food sourcing, however live-fresh and high-value producers selling to restaurants were mainly hard hit. A heave in direct producer-to-consumer sales in the U.S. may forecast a longer-term shift in consumer purchasing habits. Contrariwise, in many low income countries such as India, the informal sector was chiefly affected due to restrictive government responses to the crisis that stopped many actors from engaging in their

livelihood activities (Balasubramanian and Samuel, 2020) ^[6]. This scenario leads to less household income and food insecurity (Love *et al.*, 2020) ^[44].

Positive Initiatives and Outcomes

Food Sharing

Despite of all the devastation happening in every sector of life globally, there are some bright spots that are highlighted during this pandemic situation. The SSF sector and their allies have taken action to respond. As SSF focus their resources and capacity to make food security contributions within their communities, there are several examples of food sharing. In Oaxaca, Mexico, to ensure availability of food to everyone in their community, local fishers are contributing their time and boats to provide 50–60 tons per week of free seafood. In Native communities on the British Columbia coast, people are turning to the sea and land to meet their food requirement as well as to share food with others (Wood, 2020) ^[71]. In Hawaii, the local food movement has grown substantively (Miles and Merrigan, 2020) ^[46], with fishers helping to supply vulnerable populations (elders) and food banks to strengthen local food security (Moore, 2020) ^[48].

Strong collective action within and across small-scale fishing communities has exhibited in different ways. Fishers have operated cooperatively to reaffirm their rights to food, livelihoods, or safe working conditions, pushing back against government response to COVID-19, and have leveraged associations and partnerships with their government counterparts to continue fishing. For example, after a week of dialogues with the Department of Fisheries, the South African Small-scale Fisheries Collective successfully advocated for migratory small-scale fishing activity to recommence amidst lock down measures (CFFA, 2020) ^[15].

In Newfoundland, Canada, the Fish, Food, and Allied Workers Union enabled a barricade to distract out-of-province crab from entering the local processing plant, until safe working environment were guaranteed and fair prices assigned (CBC, 2020) ^[13]. And the Fijian Government has accepted the importance of SSF to local food security, permitting the sector to fish during curfew hours (Deo, 2020) ^[22].

Decline in Fishing Pressure

Lastly, while in some places increase in IUU have been reported, in other places decrease in fishing pressure, specially by legal industrial fleets, may enable fish stocks with more strong life histories to recover, with significant indirect effects for the small-scale sector. For example, the amalgamation of reduced demand, lower prices, and lockdowns on fisheries in many places means that boats are staying in port and fishing is reduced to almost 80% (Korten, 2020) ^[42]. If this condition persists, COVID-19 could be a cessation on heavily fished stocks similar to what happened after World War II (Holm, 2012) ^[30]. For SSF, this could possibly permit for retrieval of stocks they otherwise compete over with the industrial sector. For example, the lockdown and labor shortages have caused a shrinkage of the Indian trawler and fishmeal industry, giving some relief to marine ecosystems and probably assist for SSF in the longer run (Jigeesh, 2020 ^[35]; John, 2020) ^[36].

Conclusion

The analysis suggests that the COVID-19 pandemic presents major challenges for the SSF sector globally. Although some positive initiatives and outcomes prevail in this condition but they are completely dominated by the negative consequences,

particularly for groups that are most susceptible to these changes. Moreover, the crisis is far from over. The short-term impacts mentioned are probably to be followed by long-term crises associated to economic hardships and global food crises. Internationally, the SSF sector plays an important role in food and livelihood security. Thus, emphasis on the need for rapid organization by all parties in support of the SSF sector should be done. Short-term responses must be

immediate and directed to the most susceptible. In the longer-term, there is an urge to form a coordinated response and support network to alter existing institutions, supply chains, and food systems in such a way that mend conditions and resilience of the SSF sector (Bennett *et al.*, 2020) [11]. So, appropriate measures should be taken to cope up the challenges that aquaculture industry face during the pandemic (Fig 1).

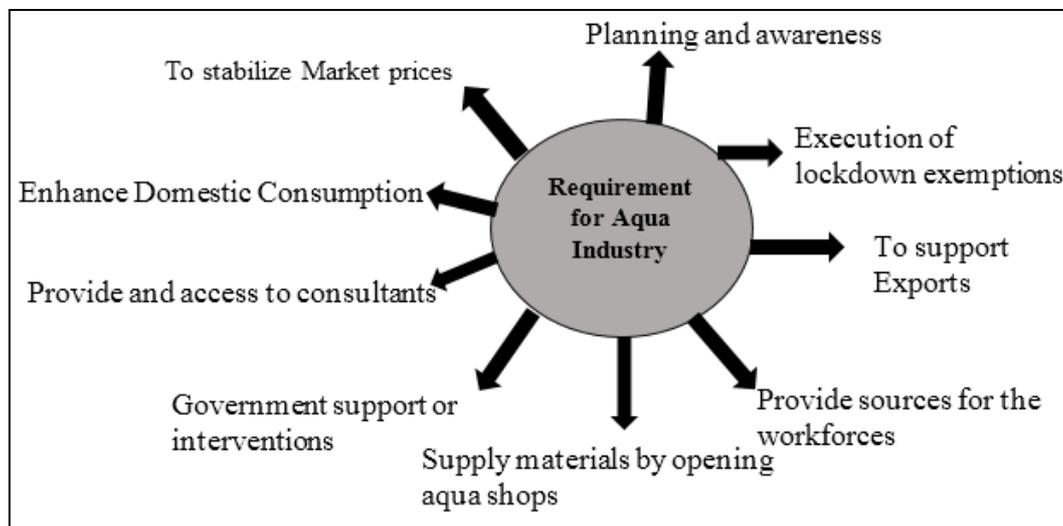


Fig 1: During the pandemic of COVID-19 following steps should be taken to cope up the aquaculture industry

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