Review Article

The impacts of COVID-19 pandemic on aquatic food production: A review

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Abstract

The novel pandemic disease has been evaluated as a global health emergency by the World Health Organization (WHO) due to its rapid spread worldwide. In many countries, the established restrictive measures on the movement and travel have had adverse economic outcomes, including a substantial drop in both jobs and salaries, in these communities. The economic consequences of the COVID-19 have severely affected the aquatic food supply chain, i.e. the fishers, aquaculture farmers, processing, and marketing sector due to the decrease in consumer purchasing power. There is increasing evidence that the farmers are not able to sell their products which lead to the live fish stocks increasing and therefore higher costs for feeding. In contrast, a fall in demand and selling price of aquatic food has resulted in a decline in fishing activities, which may give wild fish stocks a chance to recover. This review aims to summarize the impacts of the novel coronavirus disease (COVID-19) on aquatic food production.

Keywords: COVID-19, Aquatic food, Fishermen, Fish farmers

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Introduction

Coronavirus disease 2019 (COVID-19) a new type of coronavirus was first emerged in Wuhan, Hubei Province, China, at the end of December 2019 and has then rapidly outspread not only in neighboring Asian countries but also in many other countries (Wang *et al*., 2020). This novel coronavirus was considered a pandemic potential threat by the World Health Organization (WHO) (Zorriehzahra *et al*., 2020). On 30 January 2020, to accelerate preparation in all countries, the WHO director

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declared a public health emergency of international concern for novel coronavirus (2019-nCoV) outbreak. On 8 November 2020, approximately 50,369,940 confirmed cases of COVID-19 and 1,257,957 death cases have been recorded from 218 countries (Worldometer, 2020a). The lists of the worst corona-affected country have been summarized in Table 1. In many countries, a complete set of preventive measures to reduce mortality and slow down the transmission of this deadly virus has been provided (Balachandar *et al*., 2020). However, such restrictions have profoundly altered the daily lives and have also a negative impact on livelihoods and human activity as well as economies and industries (FAO, 2020b). The economic consequences of COVID-19 restriction measures have severely affected the aquatic food supply chain, i.e. the fishers, aquaculture farmers, processing, and marketing sector due to the decrease in consumer purchasing power (European Commission, 2020; (Kakoolaki *et al.*, 2020). Thus, the main aim of this study is to summarize the impacts of the novel coronavirus infection on the aquatic food industry.

Table 1. Countries with the most coronavirus cases in November 2020 (https://www.worldometers.info/coronavirus/)

No.	Country	Total cases	Total deaths	Total recovered	population
1	**United States**	10,185,012	243,269	6,442,094	331,182,250
2	**India**	8,507,754	126,162	7,868,968	1,381,233,876
3	**Brazil**	5,653,561	162,286	5,064,344	212,698,326
4	**Russia**	1,774,334	30,537	1,324,419	145,940,412
5	**France**	1,748,705	40,169	127,938	65,324,901
6	**Spain**	1,388,411	38,833	N/A	46,756,500
7	**Argentina**	1,236,851	33,348	1,053,313	45,264,053
8	**UK**	1,171,441	48,888	N/A	68,012,457
9	**Colombia**	1,136,447	32,595	1,029,082	51,073,990
10	**Mexico**	961,938	94,808	710,940	129,410,151

A brief overview of coronavirus

Coronavirus is caused by *Coronavirinae* subfamily; an enveloped and positive-sense single- stranded RNA viruses, belonging to the family *Coronaviridae*. (International Committee on Taxonomy of Viruses). The *Coronavirinae* has been classified into four genera based on the phylogenetic analysis: *Alphacoronavirus*, *Betacoronavirus*, *Gammacoronavirus* and *Deltacoronavirus* (Cui *et al*., 2018). It infects humans and several animal hosts including cattle, swine, horse, camel, rodent, cat, dog, bat, palm civet, ferret, mink, rabbit, snake, birds and other animals (Malik *et al*., 2020). There have been currently seven types of CoVs (HCoVs) isolated from human, as shown in Table 2. The coronaviruses can range from acute and chronic respiratory to enteric and central nervous system (CNS) disease in animals and humans (McIntosh, 1974). A COVID-19 is initially characterized by a flu-like symptom including fever and coughs and in later stages of the disease the symptoms of pneumonia, with chest tightness, chest pain, shortness of

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breath and in some cases death has been observed (Zhou *et al*., 2020). The estimated incubation period of a novel coronavirus from exposure to onset of symptoms is between 2 and 14 days. During this period, it is, possible that someone who gets infected with the coronavirus would be able to transmit the virus before the onset of symptoms an infected person transmits (Worldometers, 2020b).

Table 2. Human Coronaviruses

Coronavirus genus	The common name of the virus	Reservoir	Diseases	References
Alphacoronavirus	HCoV-229E	Bat	Mild respiratory disease	Hamre and Procknow (1966)
Alphacoronavirus	HCoV-NL63	Bat	Mild respiratory disease	Fouchier *et al*., (2004)
Betacoronavirus	HCoV-HKU1	Rodent	Mild respiratory disease	Woo *et al*., (2005)
Betacoronavirus	HCoV-OC43	Rodent	Mild respiratory disease	McIntosh *et al*., (1967)
Betacoronavirus	MERS-CoV	Bat	MERS, Severe respiratory distress, diarrhea and vomiting; a case-fatality rate of 36 %	Zaki *et al*., 2012
Betacoronavirus	SARS-CoV1	Bat	SARS, Severe respiratory distress, diarrhoea; a case-fatality rate 10 %	Ksiazek *et al*., (2003)
Betacoronavirus	SARS-CoV2	Bat, Snake	COVID-19, Severe respiratory distress and diarrhea (10 % of patients), a case-fatality rate3−4%	Wu *et al*., (2020)

The implications of COVID-19 pandemic on the aquatic food production industry

The negative impacts

Following COVID-19 identification in September 2019, there have been lockdown measures to prevent the spread of the disease; however, these preventive measures have led to disruption in all section of the aquatic food supply chain, including fishing, aquaculture production, fish processing and marketing (FAO, 2020a). In general, the prevalence of COVID-19 has adversely affected both supply and demand of the aquatic food system (Sunny *et al*., 2020).

Impact on fishing activity

Social distancing measures and further coronavirus (COVID-19) restrictions have caused to decrease in fishing activity (Ocampo, 2020). According to Global Fishing Watch, since a pandemic COVID-19 was officially declared by World Health Organization, global industrial fishing activity has been dropped by 10% or more in some localities compared to the previous year's average (FAO, 2020a). In some countries, such as India, fisheries were banned at the beginning of movement restrictions caused by pandemic development (Bennett *et al*., 2020). As a result of reduced global demand and also market disruptions have been severely

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impacted fisheries industry and consequently, most of the fishers wouldn't be able to sell their produce directly (Sunny *et al*., 2020). Moreover, a large number of workers who were employed in processing, harvesting and marketing of aquatic food have lost their job and their income stopped, especially in the developing countries (Sunny *et al*., 2020; Bennett *et al*., 2020). Finally, limited supplies of ice, fuel, gear, bait, etc. and labor shortages are the main barrier for fishing activities (FAO, 2020a; Sunny *et al*., 2020) (Fig.1).

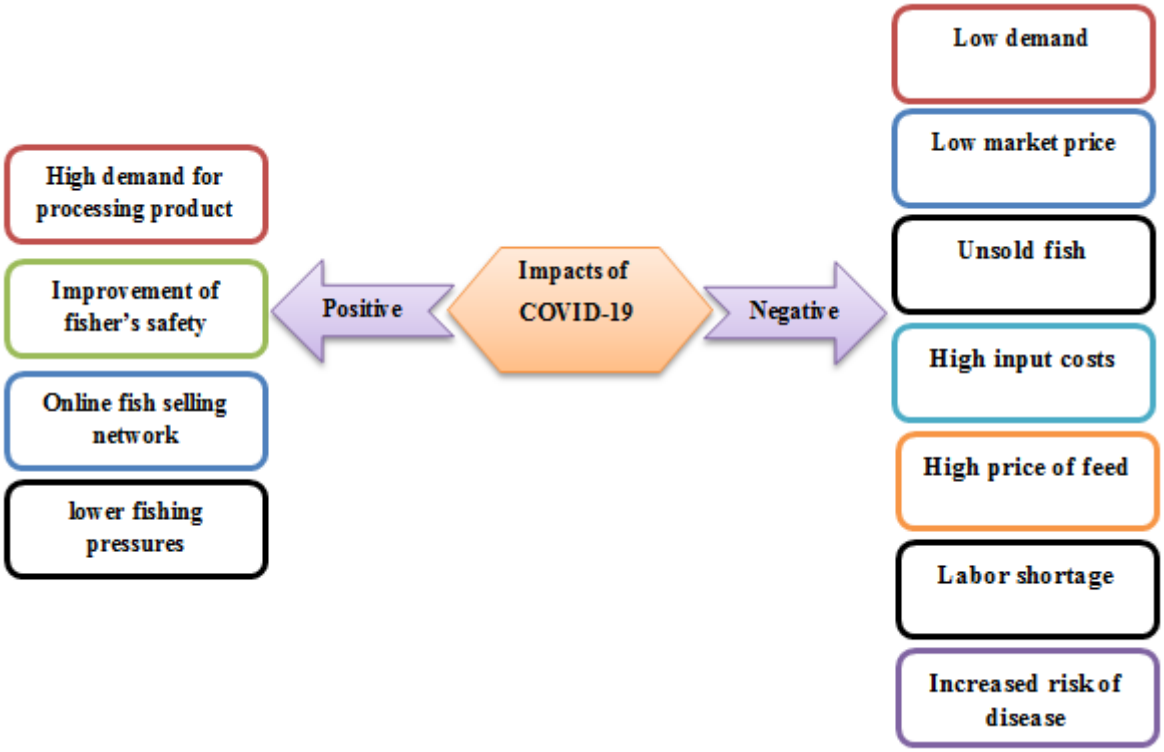

Figure 1. The impacts of the COVID-19 pandemic on the aquatic food production.

It should be considered that there is no monitoring and control of fishing activities in this emergency condition which may increase the likelihood of illegal fishing (Thomson, 2020).

Impacts on Aquaculture Farms

During the lockdown period, the fish farms faced problems with collecting and selling product because of a vast reduction in market demand and limited transportation (FAO, 2020a). If the farmers are not able to sell their products, it would lead to the live fish stocks increasing and longer the fish culture period as well. This has increased costs related to feeding and risk of fish mortalities. Since the farmers are unable to harvest the final product, so there is no chance to start a new farming cycle. Therefore, they have to sell their product at a low price it will pursue negative economic effects on the farmers' livelihood (Sunny *et al*., 2020; FAO, 2020a).

It has been reported that the farmers experienced challenges with production inputs like shortages of seeds and fingerlings, limited

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access to consultant or engineering services feed, labors, medicine, chemicals, and vaccines, due to the strict movement protocol. The shortage of essential items such as medicine caused poor management of water quality and a higher prevalence of infection has been observed in the aquaculture farms (Sunny *et al*., 2020; FAO, 2020a) (Fig.1).

The Positive Consequences

Although the fresh fish and shellfish supply chains have been adversely affected by the imposed control measurements related to COVID-19, the demand for processing products like frozen, canned, marinated and smoked fish with longer shelf life has remained steady or increased (FAO, 2020a; OECD, 2020). The lockdown situation provides an opportunity for improvement of the working and sanitary conditions to promote fisher's safety, health, and welfare as vulnerable groups (Bennett *et al*., 2020).

A fall in demand and selling price of seafood has resulted in a decline in fishing activities, which may give wild fish stocks a chance to recover (Bennett *et al*., 2020).

Worldwide, the online local food networks and community-supported fisheries emerge to connect farmers directly with customers during COVID-19 lockdown (Bennett *et al*., 2020; Smith, 2020). These new services (e.g. home delivery systems and online fish selling platforms) facilitate sales and marketing of products in around the world, thereby both the farmers make better profits and the customers purchase fresh produce at better reasonable prices (CFFA, 2020) (Fig. 1).

Conclusion

Like many other industries, the aquatic food production industry is facing intense disruption following the COVID-19 pandemic outbreak. Briefly, disruptions in transportation, trade, labor, and also fall of demand for fresh farmed fish or seafood due to the lockdown of the foodservice sectors (e.g. hotels, restaurants, and caterers, including school and work canteens) have caused detrimental effects on both fisheries activities and aquaculture industry. Unfortunately, some countries, like Iran, have experienced a second wave of the COVID-19 infections shortly after the first wave onset, so strict security measures and the border closure have remained in place in these countries. Closing land, air, and sea borders, as well as the lost international market, are found to be the main challenge in export-oriented farms. For example, as a result of the international shipment lockdown, the culturing sturgeon farms in Iran have been faced many problems selling their products which resulting price falls. Besides these negative consequences of a pandemic outbreak, we have also witnessed some positive implications such as more opportunities for fish consumption following a reduction in the price of aquatic food, the boom in the online shopping market, the improvement of fisher's safety, health, and welfare, and lower fishing pressures in some regions. Also, given the continuity and survival of pandemics in the world and the possibility of its presence in human societies,

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in order to reduce economic losses in this area, the necessary solutions should be provided by governments. We recommend the governments take the following actions to remedy the emerging issues: first they should help the aquaculture farmers and fishermen through giving the low interest loan and subsidies for inputs and equipment, as well as provide a one-off payment. The governments should provide the insurance facility for fish and seafood products for compensating losses due to the strict movement protocol and continue to support the producers by storage facilities to store unsold fish. In another supporting effort, they must enhance local sales channels such as direct-to-consumer sales with designing e-commerce platforms for online stores or directly purchase fresh fish and seafood products for government institutions (e.g. schools or hospitals, etc.). Certainly, these measures and the guarantee of the desired results will be possible only with the consensus and unity of all countries. Conducting applied research and participating in the sharing of information and research findings will lead to greater alignment and synergy in the face of this global crisis.

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Conflict of Interest

The authors declare that they have no conflict interest.

References

Balachandar, V., Mahalaxmi, I., Kaavya, J., Vivekanandhan, G., Ajithkumar, S., Arul, N., Singaravelu, G., Kumar, N.S. and Devi, S.M., 2020. COVID-19: emerging protective measures. *European Review for Medical and Pharmacological Sciences*, *24*(6), 3422-3425.

Bennett, N.J., Finkbeiner, E.M., Ban, N.C., Belhabib, D., Jupiter, S.D., Kittinger, J.N., Mangubhai, S., Scholtens, J., Gill, D. and Christie, P., 2020. The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. *Coastal Management*, *48*(4), 336-347.

Coalition for Fair Fisheries Agreements (CFFA). 2020. In Ghana, a startup that sells fish online and delivers home is prospering. Coalition for Fair Fisheries Agreements. April 14,2020.https://www.cffacape.org/coronavirus-crisis impacts-on-african-artisanal-fisheries/in ghana-a-startup-that-sells-fish-online-and delivershome-is-prospering.

Cui, J., Li, F. and Shi, Z.L., 2018. Origin and evolution of pathogenic coronaviruses. *Nature Reviews Microbiology*, 17, 181–192.

European Commission. 2020. CORONAVIRUS: Emergency response to support the fishing and aquaculture sectors. Retrieved from European Commission website:https://ec.europa.eu/fisheries/sites/fisheries/files/2020-factsheet coronavirus_en.pdf.

FAO 2020a. How is COVID-19 affecting the fisheries and aquaculture food systems?

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[DOI: 10.52547/ijaah.6.2.15]

https://doi.org/https://doi.org/10.4060/ca8637en.

FAO 2020b. Food safety in the time of COVID-19.https://doi.org/10.4060/ca8623en.

Fouchier, R.A., Hartwig, N.G., Bestebroer, T.M., Niemeyer, B., de Jong, J.C., Simon, J.H. and Osterhaus, A.D. 2004. A previously undescribed coronavirus associated with respiratory disease in humans. *Proceedings of the National Academy of Sciences of the United States of America*, 101, 6212–6216.

Hamre, D. and Procknow, J.J. 1966. A new virus isolated from the human respiratory tract. *Proceedings of the Society for Experimental Biology and Medicine*, 121, 190–193.

Kakoolaki, S., Ebne al-Torab, S. M. A., Ghajari, A., Anvar, A. A., Sepahdari, A., Ahari, H., Hoseinzadeh, H. 2020. Socio-economic impacts of Coronavirus (COVID-19) outbreak on world shrimp aquaculture sector. *Iranian Journal of Aquatic Animal Health*, 6(1), 1-18.

Ksiazek, T.G., Erdman, D., Goldsmith, C.S., Zaki, S.R., Peret, T., Emery, S., Tong, S. Urbani, C., Comer, J.A., Lim, W., Rollin, P.E., Dowell, S.F., Ling, A.E., Humphrey, C.D., Shieh, W.J., et al., 2003. A novel coronavirus associated with severe acute respiratory syndrome. *The New England Journal of Medicine*, 348, 1953–1966.

Malik, Y.S., Sircar, S., Bhat, S., Sharun, K., Dhama, K., Dadar, M., Tiwari, R. and Chaicumpa, W. 2020. Emerging novel Coronavirus (2019-nCoV)-Current scenario, evolutionary perspective based on genome analysis and recent developments. *Veterinary Quarterly*, 1-12.

McIntosh, K., Dees, J.H., Becker, W.B., Kapikian, A.Z. and Chanock, R.M., 1967. Recovery in tracheal organ cultures of novel viruses from patients with respiratory disease. *Proceedings of the National Academy of Sciences of the United States of America*, 57, 933–940.

McIntosh K., 1974. Coronaviruses: a comparative review. *Current Topics in Microbiology and Immunology*, 63, 85–129.

Ocampo, K. R., 2020. Fishing communities bear brunt of lockdown j inquirer business. Philippine Daily Inquirer, April 15, 2020. https://business.inquirer.net/294753/fishing-communities-bear-brunt-of-lockdown.

Organisation for Economic Co-operation and Development (OECD). 2020. Fisheries, aquaculture and COVID-19: Issues and policy responses.http://www.oecd.org/coronavirus/policy responses/fisheries-aquaculture-and-covid-19-issues and-policy-responses-a2aa15de.

Smith, E., 2020. Lunenburg lobster captain sells directly to consumers to stay afloat during COVID-19. CBC News, April 6, 2020. https://www.cbc.ca/news/canada/novascotia/gail-atkinson-lobster-fishery-covid-19- nova-scotia-1.5523635.

Sunny, A.R., Sazzad, S.A., Datta, G.C., Sarker, A.K., Ashrafuzzaman, M.d. and

[DOR: 20.1001.1.2345315.2020.6.2.3.3]

[DOI: 10.52547/ijaah.6.2.15]

Prodhan, S.H., 2020. Assessing Impacts of COVID-19 on Aquatic Food System and Small-Scale Fisheries in Bangladesh. DOI:10.20944/preprints202006.0143.v1.

Thomson, J., 2020. Fisheries and oceans Canada pulls at-sea observers from fishing boats due to coronavirus pandemic. The Narwhal, April 8, 2020. https://thenarwhal.ca/fisheries-oceans-canada-pulls-at-sea-observers- fishing-boats-coronavirus-covid-19/.

Wang, C., Horby, P.W., Hayden, F.G. and Gao, G.F., 2020. A novel coronavirus outbreak of global health concern. *Lancet*, 395(10223), 470-473.

Worldometers 2020a. COVID-19 Coronavirus Pandemic.https://www.worldometers.info/coronavirus.

Worldometers 2020b. Coronavirus Incubation Period (COVID-19). https://www.worldometers.info/coronavirus/coronavirus-incubation-period.

Woo, P.C., Lau, S.K., Chu, C.M., Chan, K.H., Tsoi, H.W., Huang, Y., Wong, B.H., Poon, R.W., Cai, J.J., Luk, W.K., Poon, L.L., Wong, S.S., Guan, Y., Peiris, J.S. and Yuen, K.Y., 2005. Characterization and complete genome sequence of a novel coronavirus, coronavirus HKU1, from patients with pneumonia. *Journal of Virology*, 79, 884–895.

Wu, F., Zhao, S., Yu, B., Chen, Y.M., Wang, W., Song, Z.G., Hu, Y., Tao, Z.W., Tian, J.H., Pei, Y.Y., Yuan, M.L., Zhang, Y.L., Dai, F.H., Liu, Y., Wang, Q.M., Zheng, J.J., Xu, L., Holmes, E.C. and Zhang, Y.Z., 2020. A new coronavirus associated with human respiratory disease in China. *Nature*, 579, 265–269.

Zaki, A.M., van Boheemen, S., Bestebroer, T.M., Osterhaus, A.D. and Fouchier, R.A., 2012. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. *The New England Journal of Medicine*, 367, 1814–1820.

Zhou, P., Yang, X.L., Wang, X.G., Hu, B., Zhang, L., Zhang, W., Si, H.R., Zhu, Y., Li, B., Huang, C.L. and Chen, H.D., 2020. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*, *579*(7798), 270-273.

Zorriehzahra, S.M.J., Dadar, M., Ziarati, M., Hassantabar, F., Seidgar, M., Monfared, S.R., Ghasemi, M., Goharrizi, L.Y., Faeed, M. and Fallahi, R., 2020. A Perspective on the Origin of COVID-19 and Its Epidemic Situation in Iran and the World. *Journal of Marine Medicine*, *2*(1), pp.41-52 (In Persian).

[DOR: 20.1001.1.2345315.2020.6.2.3.3]

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