

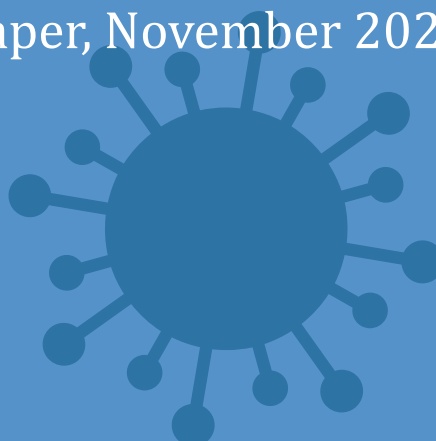


Food and Agriculture Organization
of the United Nations



The impact of COVID-19 on fisheries and aquaculture food systems Possible responses

Information paper, November 2020



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CONTENTS

| | |
|---|----|
| Acknowledgements | 5 |
| Introduction | 7 |
| Key messages | 7 |
| Overview of fisheries and aquaculture before the virus outbreak | 8 |
| What makes fisheries and aquaculture food systems vulnerable to COVID-19 related shock? | 9 |
| How pandemic is affecting fisheries and aquaculture food systems | 10 |
| Capture fisheries production | 10 |
| Aquaculture production | 11 |
| Post-harvest, market and trade | 12 |
| Vulnerable groups, working conditions, health & safety, and gender | 13 |
| Fishery and aquaculture research and management implementation | 14 |
| Food security and nutrition | 16 |
| Food safety | 16 |
| Future possible pathways | 17 |
| What can FAO and its partners do? | 18 |
| Annex: How are governments, the private sector and small communities impacted and planning to address changes in the fish food system | 21 |
| References | 31 |

INTRODUCTION

The purpose of this information paper is to update information on the impact of the COVID-19 pandemic on the fisheries and aquaculture sector. The paper looks at the measures taken to inform on the ongoing impact on the fisheries and aquaculture food systems, and responses from aquatic food providers and governments to counteract the negative impacts on aquatic food value chains. In the first half of 2020, there were many adjustments by governments and the private sector to the evolving situation of the coronavirus pandemic. There have been new challenges, as well as innovations by governments and actors along the aquatic food value chain. Already some lessons are emerging on ways to build back better, to ensure that the resilience of aquatic food value chains are strengthened to endure future crises, so that sustainability, livelihoods and food security are not compromised, and that food loss and waste of high-value and perishable food is reduced to meet the sustainable development goals (SDGs) targets. The paper relies on information collected through interviews,¹ secondary sources (e.g. media articles), and publicly available data. The Annex contains examples of regional responses which were collected in April and October 2020.

KEY MESSAGES

Food itself is not responsible for the transmission of the disease to people. According to both the World Health Organization (WHO) and the World Organisation for Animal Health (OIE), the COVID-19 pandemic is being sustained through human-to-human transmission and not through international trade in animals and animal products. There is currently no evidence that people can catch COVID-19 from food.

The application of sound principles of environmental sanitation, personal hygiene and established food safety practices further decreases the likelihood of cross-contamination.

Each stage of the fisheries and aquaculture supply chain is susceptible to being disrupted or stopped by measures arising from COVID-19 restrictions. Only by protecting each stage of the supply chain can the continued availability of fish and fish products be ensured. In aquaculture, there is growing evidence that unsold production will result in increasing levels of live fish stocks, creating higher costs for feeding as well as risks of fish mortalities.

Disruptive border restriction measures on food trade should be minimized for food security. The dissemination of information on food-related trade measures is fundamental to avoid food shortages.

Consumer demand for packaged and frozen products increased from the second quarter of 2020 as households looked to stock up on non-perishable food. High-value fresh fish and aquatic food demand has fallen as restaurants and hotels have closed, or partially closed, owing to COVID-19 and related restriction measures.

In developing countries with large informal sectors, the lockdown and physical distancing measures have especially impacted vulnerable small-scale and artisanal workers and communities. Many of these workers do not belong to producer organizations that represent their combined interests, making it challenging to access government support. Adequate coverage of the fisheries and aquaculture sector, including informal workers, should be provided.

It is important to work with sectoral and regional organizations to develop a range of adaptations to manage fisheries and aquaculture during the pandemic. These adaptations would support job protection and ensure a fast recovery of the sector without compromising sustainability, including by assessing and adjusting transport and market development options.

¹ FAO regional and subregional fisheries and aquaculture officers, FAO field offices, project partners as well as regional organizations are gratefully acknowledged for their most valuable inputs to this paper.

Online distributors report increased use of online orders and home delivery services, as house-bound consumers accelerated their adoption of e-commerce alternatives during lockdowns.

Recognizing their specific vulnerability, as food producers, processors, vendors and carers, the impact of COVID-19 on women should be considered, and access to government support should be secured for women along the fish value chain.

Levels of Monitoring, Control and Surveillance (MCS) of fishing activities need to be maintained to ensure management control measures are enforced and Illegal, Unreported and Unregulated (IUU) fishing activities do not increase. The most common impact on MCS activities being reported is the disruption to at-sea observer programmes.

Uncertainty continues to dominate the outlook for the fisheries and aquaculture sector, particularly with regard to the duration and severity of the pandemic. Investment in the sector will be impacted by the pandemic. The availability of investment funds for future production may be limited by the falling demand and lower prices and this is likely to bring long-term transformations to the sector.

Transformation of the sector should always bear in mind the principles outlined in the Code of Conduct for Responsible Fisheries (FAO, 1995) and related instruments to ensure that fisheries and aquaculture remain sustainable and support the needs of people for years to come.

OVERVIEW OF FISHERIES AND AQUACULTURE BEFORE THE VIRUS OUTBREAK

In 2018, global fisheries and aquaculture production (excluding aquatic plants) reached an all time record of nearly 179 million tonnes in live weight equivalent. Overall capture fisheries, with 96.4 million tonnes represented 54 percent of the total, while aquaculture, with 82.1 million tonnes, accounted for 46 percent. For the last three decades, aquaculture has been the main driver of the increase in fish production, but the capture fisheries sector still remains dominant for a number of species and vital for domestic and international food security. Developing countries, mainly in Asia, are by far the predominant producers with China, Indonesia, India, Viet Nam and Peru being the key producers in 2018.

About 89 percent of fish production is directed to human consumption, with the rest destined to non-food uses, including reduction into fishmeal and fish oil. About 45 percent of the fish destined for human consumption is marketed in live and fresh form, followed by frozen (34 percent), prepared and preserved (11 percent) and cured (dried, salted, in brine, fermented, smoked at 10 percent). World apparent per capita fish food consumption has significantly grown during the last few decades, from 9 kg in the 1960s to about 20.3 kg in 2017. At the global level, fish accounts for about 17 percent of the world population's intake of animal proteins and provides about 3.3 billion people with almost 20 percent of their average per capita intake of animal proteins and 5.4 billion people with 10 percent of such proteins.

The fisheries and aquaculture sectors operate in an increasingly globalized environment. Fish can be produced in one country, processed in a second and consumed in a third, reflecting the sector's degree of openness and integration into international trade. Fish and fish products are among the most traded food commodities worldwide with a significant share of total fish production (about 38 percent, live weight equivalent) being exported. International trade has also played an important role in broadening fish consumption by providing wider choices to consumers. A sizeable and growing share of fish consumed in North America, Europe and Africa consists of imports, owing to steady demand, also for non-locally produced species, combined with static or declining domestic fish production. Salmonids (salmon, trout, etc.) became the most important commodity traded in value terms since 2013 and account for about 18 percent of the total value of internationally traded fish products. The other main groups of exported species are shrimps and prawns with around 17 percent, followed by groundfish at 9 percent (e.g. hake, cod, haddock and Alaska pollock) and tuna at 9 percent.

Preliminary figures for 2018 indicated a further growth of trade of fish and fish products to reach a new record of USD 163 billion. Developing countries had a share of 54 percent of these exports by value and 59 percent by quantity (live weight equivalent) and for many of these countries, fish trade represents a significant source of foreign currency earnings in addition to the sector's important role in income generation, employment, food security and nutrition. China is not only the main fish producer, but also the main exporter of fish and fishery products and third major importer. Norway is the second major exporter, followed by Viet Nam, India, the United States of America and Thailand. Developed countries still dominate fishery imports, although with a declining share in recent years (about 70 percent compared to 88 percent two decades ago). The European Union, the United States of America and Japan are by far the major markets.

In 2017, about 59.7 million people were employed in the primary sector of capture fisheries and aquaculture. Of this total, 40.4 million people were engaged in fisheries and 19.3 million in aquaculture. Most of the people directly employed, on a full-time, part-time or occasional basis, as fishers and fish farmers are artisanal and small-scale producers, with the bulk of them in Asia. Worldwide, about 200 million people are directly and indirectly employed along the value chain, from harvesting to distribution. Women play an important role in this workforce and represent about 13 percent of the people employed in the primary sector, and half of them, if the secondary sector is included (Monfort, 2015).

WHAT MAKES FISHERIES AND AQUACULTURE FOOD SYSTEMS VULNERABLE TO COVID-19 RELATED SHOCK?

Fisheries value chains are experiencing greater demand from consumers coupled with a declining trend in the sustainability of some fish stocks. Capture production has slowed and stabilized, and the proportion of fish stocks sustainably exploited has declined to below 70–90 percent in the 1970s. The full range of activities that are required to deliver fish and fish products from fisheries and aquaculture production to final consumers are complex, and technologies employed to manage these value chains vary from artisanal to highly-industrial.

Key activities in a fisheries or aquaculture supply chain are fishing, aquaculture production, processing, transport of inputs, distribution, wholesale and retail marketing. Each of these activities are of equal importance to the success of the supply chain. Each stage of the chain is susceptible to being disrupted or stopped by impacts arising from COVID-19 and related measures. If one of these buyer–seller links is ruptured by the disease or containment measures, the outcome will be a cascading chain of disruptions that will affect livelihoods and food security. Households experiencing financial distress may slow down their spending.² The reduction of household demand, also influenced by containment measures (e.g. closure of food services, tourism sites, etc.) affects production, processing and distribution, and causes disruption in international and domestic supply chains. The fact that live, fresh or chilled fish – which represent 45 percent of fish consumed – are highly perishable presents additional logistical challenges in the supply chain.

Furthermore, the reduction in domestic demand and widespread containment measures affects both a nation's imports and reduces foreign income, with significant consequences on a sector highly dependent on international trade. Finally, financial distress in businesses can lead to a reduction in wages, working hours or labour layoffs. As the financial sector is in difficulty, it has fewer resources to sustain the economic losses incurred. In addition, many insurers do not cover business interruptions due to events such as the COVID-19 disease.

In summary, a flow disruption anywhere in the supply chain causes a slowdown everywhere else. Only by protecting the buyer–seller links and each stage of the supply chain can human consumption of fish and fish products, and therefore the successful and continuing completion

² Initial estimates of the International Labour Organization (ILO) indicate a significant increase in unemployment and underemployment in the wake of the pandemic (draft HLPE Issue paper, dated 24 March 2020).

of the supply chain, be achieved. It is therefore of paramount importance to provide all possible protection to each stage of the fisheries and aquaculture food chain. In the longer term, bottlenecks identified during the pandemic, and the apparent need to shorten some fish supply chains, can guide improvements that increase the sustainability of fish supply and demand, including reduction of food loss and waste.

HOW PANDEMIC IS AFFECTING FISHERIES AND AQUACULTURE FOOD SYSTEMS

The Corona Virus Disease 2019 (COVID-19) started as a locally circulating infection. On 11 March 2020, WHO characterized the COVID-19 outbreak as a pandemic with a growing number of cases reported outside of China, from Eastern Asia to Europe and North America (WHO, 2020a). In the first half of 2020, the pandemic entered all regions of the world, some worse than others, including many major fish-producing and/or fish-consuming countries and global suppliers of fish feed.

While fishing and aquaculture and the distribution of their products are considered an essential activity in most countries, the measures adopted to contain the spread of infection caused significant direct and indirect challenges to the sector, as explained below.

CAPTURE FISHERIES PRODUCTION

The drop in demand, which in some cases has resulted in reduced prices of fish and fish products, have stopped or reduced activity for many fishing fleets, as their work has become unprofitable. In some cases quotas have not been filled due to low demand and lack of storage for a perishable product. Fleets relying on export markets are likely to be more impacted than those serving domestic markets. Sanitary measures (physical distance between crew members at sea, facial masks, etc.), and lack of necessary equipment (e.g. masks and gloves) are making fishing difficult (and in some cases more dangerous) and can also cause a cease of activity. Limitations of input supplies (e.g. ice, gear, bait) due to suppliers being closed or unable to provide inputs on a credit basis is yet another constraint on the fishing industry. Globally, the impacts on catches have varied with many countries seeing sharp drops in production during the first weeks of the crises followed by improvements as the sector adapted. At the height of the coronavirus crisis in the United States of America, catches dropped by up to 40 percent across the country (White, 2020).

In addition, movement restrictions for professional seafarers and marine personnel, who have not been permitted to disembark in ports and transit through national territories (i.e. to an airport), have prevented crew changes and repatriation. This has resulted in cases where fishing crews have been stranded for many months at sea on vessels (Santos, 2020) or in foreign countries and without wages, thus becoming a human rights crisis, especially for migrant and transitory workers. This is an area that needs building back better, to insure in future situations these vulnerable workers have social protection.

Pauses in production and in the operation of fleets is also linked to potential upsides, in resting overfished fish stocks that could speed their recovery (Korten, 2020). However, most studies suggest that as much as 10–15 years of reduced fishing is required to permit depleted stocks to recover so, in the absence of governance and management reforms that sustain reduced pressure, such recoveries to date seem unlikely (UNDP, 2020). Also, the decreasing fossil fuel use (Rapier, 2020) might be a potential upside, resulting in reducing greenhouse gas releases, as required under climate change adaptation and mitigation scenarios.

AQUACULTURE PRODUCTION

The aquaculture production sector is extremely diverse, both freshwater and marine, but it nevertheless relies heavily on labour, inputs, financing and markets, which have been and will continue to be impacted during and after the COVID-19 pandemic. After an initial phase of near-complete lockdown on people and merchandise in an attempt to block the spreading of the virus, many countries have been able to resume their activities, to the extent possible, allowing businesses such as aquaculture farms and companies to resume production by respecting a series of preventive measures. Nonetheless, the economic environment of aquaculture production and markets remains highly volatile and uncertain, which necessarily impacts the activities (OECD, 2020).

In many countries, fish production is considered an essential activity contributing to income, household resilience, trade and food security, so it is expected that farmers will continue to take care of their fish, and not give them away as gifts nor dispose of them (Le Télégramme, 2020). However, the sector will possibly struggle to sustain its activity or maintain its planned production cycles, as it might find that markets, supplies of production inputs (e.g. seeds, feeds), but also access to credit, are stopped or significantly reduced due to the current lockdown and economic slowdown (Zhang, 2020). In some other countries, such as Peru, the shrimp farming industry relies more than 70 percent on external seed (postlarvae) supply, and due to biosecurity restrictions they are having many difficulties importing at least the minimum quantity of seed needed for next production season (FAO and CEPAL, 2020).

Labour layoffs may also increase, due to confinement measures in the short term, but also because of financial or cash flow issues facing farmers, or travel barriers for seasonal or migrant workers, in the medium to long term (Virginia Agricultural Research and Extension Centers, 2020). Some countries have exempted the aquaculture sector from lockdown measures (Ramsden and Harkell, 2020) or established guidelines to regulate the exercise of the free movement of workers during COVID-19 outbreak (EUR-Lex, 2020).

Low market demand has been a main concern for most aquaculture operators worldwide as this has direct negative impact on quantities sold and price per unit, reducing revenues. During lockdowns, the farmers supplying the live fish markets have been struggling with growing live fish stocks that cannot be sold but still must be fed for an undetermined period. Farmers can reduce costs slightly by feeding at maintenance and not growth rates, however some feed needs to be provided to keep fish alive. Cash flow and access to credit may be another challenge because of the additional costs incurred in the absence of revenue, especially if aquaculture clients are also affected by the crisis and they delay payment for past deliveries (Ojeda, 2020). Some species farmed for export have also been reportedly affected by the closure of international markets (e.g. China, European Union) (Pham Thi, 2020) whereas several fish and shellfish aquaculture operations have been severely impacted by the closure of food services (e.g. tourism, hotel and restaurant market) and wholesalers. One emerging adaptation observed globally has been to develop direct retail sales (Blank, 2020), through internet ordering and home delivery or aquaculture drive-in (France 3, 2020). Another adaptation has been to process and freeze fish that have reached their commercial size, to keep them in cold storage (see section below) (EFE: AGRO, 2020).

On the other hand, small-scale aquaculture and fish farming operators in areas where fish imports are important may benefit from reduced competition, especially if they can secure their retail markets (BBC News: Afrique, 2020).

POST-HARVEST, MARKET AND TRADE

The wild and farmed aquatic food sector, along with the majority of industries, is having to deal with an uncertain demand outlook as well as an array of supply challenges. With the effective shutdown of the restaurant industry in many places, food service demand has reduced substantially, while retail sales have been marked by extreme volatility. For example, sales of fresh fish in France, Italy, and Spain declined by 30 percent.³ In addition, many seafood trade events around the world have been cancelled, leading to lost transactions between major buyers and sellers who depend on these regional events.

Fresh fish processing is affected by worker health and resulting staff shortages due to COVID-19 illness and required quarantine of staff. Fish processing factories in many countries have closed due to COVID-19 positive workers (Xuemin, 2020). Processing operations may also be disrupted due to worker demand for better health and safety conditions. This reduces processing capacity and output. Furthermore, the low demand for fish leads to production disruption and a need for processors to increase storage capacity to cope with incoming raw material and finished products. Proactive processors have reacted by putting stringent controls in place, including the physical distancing of workers and temperature tests.

In a joint effort to ensure that global trade flows continue to be as free as possible, the heads of FAO, WTO and WHO called for the prevention of disruptive border restriction measures on trade in food to avoid food shortage, emphasizing that the dissemination of information on food-related trade measures is fundamental (WTO, 2020).

Demand for packaged, canned (FAO, 2020a) and frozen products has spiked as households look to stock up on non-perishable food. At the same time, online distributors are reporting increased interest as house-bound consumers explore retail alternatives e.g. private box schemes. Overall, however, demand has sharply reduced and prices have fallen for many species, particularly those that are targeted at the food service industry. Changes in demand are also affecting storage of fish and seafood, which is a high value perishable food product, resulting in increased food loss and waste. However, at consumer level in some regions there is evidence to suggest waste (Freedonia, 2020) is reduced as consumers are tending to shop smarter and also to freeze the product rather than throw it away. In aquaculture production, overloaded storage facilities are common, due to delayed production cycles, associated with broken supply chains and uncertain demand.

Transportation by road or sea must contend with closed or restricted borders and customs and health inspection delays, while the large-scale cancellation of flights has directly affected trade in some high-end fresh products that are transported by air. All these aspects have increased transport costs. Despite the falling global demand for air transport, the cost of air shipment has risen significantly (Lennane, 2020).

Many wholesale and retail fish markets, particularly in less developed countries, are often congested and crowded providing infection risks to traders as well as consumers. In some countries, retail markets have become highly regulated to secure physical distancing and other sanitary rules, which indirectly refrain consumers from accessing the market and thus reduce income for fish traders and fishers. In more developed countries retailers have adopted home delivery and ecommerce services to address infection risks (Anthonysamy, 2020).

The outlook for the global fisheries and aquaculture sectors continues to be dominated by the wide-ranging implications of the COVID-19 pandemic and the new market landscape. Fish supply, consumption and trade revenues are all expected to decline this year due to the impact of containment restrictions on demand, logistics, prices, labour and business planning. Global aquaculture production is now expected to fall for the first time in many years, by some 1.3 percent (FAO, 2020b). Sectors with longer production cycles, such as salmon, cannot adjust rapidly to

³ GFCM webinar on the experience of the aquaculture sector through best practices and mitigation measures, 1 July 2020.

the demand shifts, though shrimp and pangasius farmers have been able to quickly reduce their output significantly. Global catches from wild fisheries are also expected to decline slightly, as overall, there is a reduced fishing effort due to COVID-19-related restrictions on fishing vessel crews and poor market conditions.

The market effects of the pandemic have brought about several far-reaching changes, many of which are likely to persist in the long term. Aggregate prices for 2020, as measured by the Fish Price Index (FAO, 2020c), were down year-on-year for most traded species. The importance of retail sales has significantly increased at the expense of food services, as the hospitality sector has remained subdued. Consumers, who are trying to limit frequent visits to grocery stores and are concerned about future lockdowns, have shifted their seafood preferences towards preserved and prepared products, while demand for fresh fish has waned. The necessity of home cooking is a new focus for marketing campaigns and online distributors, while product innovations centred on convenience are proliferating. The economic downturn and rising unemployment are affecting household incomes, with demand for luxury products such as lobster weakening. At the same time, sales of canned tuna, sardines and mackerel have seen a boost (FAO, 2020b).

The outlook for the fourth quarter 2020 was uncertain with a strong tendency towards risk aversion on the part of businesses and consumers alike. A second wave of the pandemic in many countries underlines the continuing threat to market stability. On the positive side, product innovations, new distribution channels, e-commerce and home deliveries, and the shortening of supply chains that have coincided with this upheaval are likely to benefit the seafood industry for many years to come.

VULNERABLE GROUPS, WORKING CONDITIONS, HEALTH & SAFETY, AND GENDER

Disease outbreaks disproportionately affect vulnerable and marginalized people. Women, girls, children, youth, the elderly, persons with disabilities, indigenous populations, refugees, migrants, displaced people and minorities are at greater risk of suffering the adverse effects of the epidemic around the world (Regional Risk Communication and Community Engagement Working Group, 2020) and particularly in countries with weak health and sanitation infrastructure. Access constraints to health care coupled with gender inequality make public health care responses immeasurably more complex. Gender inequalities persist in fisheries and aquaculture, where women represent half of the workforce when both the primary and secondary seafood sectors are considered (Care, 2020) but are often assigned the most unstable and poorly or unpaid positions. They are particularly at risk to job loss – especially for those informally engaged and female migrant workers in the seafood processing factories (Briceño-Lagos and Monfort, 2020). They are thus very unlikely to be eligible for access to social protection benefits offered by some governments to handle the COVID-19 outbreak.

Women are traditionally and predominantly involved in post-harvest sectors, where the reduction of fishing and fish farming activities affects women's livelihoods and income due to shortage of fish available for processing and trade. The restrictions in mobility affecting logistics and the transfer of fish to the markets is further limiting the amount of fish to be processed and sold by women. There is also an increased risk for women processors of food loss and waste if they do not have appropriate storage and cold chain systems. In addition, some rotational systems to access the port have been implemented to ensure physical distancing, such as in Côte d'Ivoire, further constraining women in accessing resources and raw materials to be processed (CFFA, 2020).

Women and girls are disproportionately impacted by the gendered division of unpaid care and domestic work that constrains them as caregivers (UN, 2020a; Australian Government and UN Women, 2020). This burden is exacerbated by COVID-19, as schools close and health systems are being heavily depleted to contain the epidemic (Care, 2020). This reinforces restrictions in access to care, including sexual and reproductive health services (UN, 2020a; Care, 2020; Marcoux, 2020; Beech, 2020). Special attention and support must be given to women and children who

face an increased risk of domestic violence, gender-based violence and intimate partner violence (WHO, 2020b), sexual exploitation and abuse (Guidelines for Integrating Gender-Based Violence Interventions in Humanitarian Action, 2020). Globally, a surge of domestic violence cases have been observed with the COVID-19 outbreak (Financial Times, 2020; UN Women, 2020; UN, 2020b; Allen-Ebrahimian, 2020).

Working conditions and safety of fishers at sea are affected where the number of available fishers to crew vessels are reduced. The number of available crew could be reduced owing *inter alia* to contracting the virus, restrictions on movements or wider lockdowns. In addition, it is difficult for fishers to be more than a metre apart from each other on board a fishing vessel. Should fishing vessels be forced to operate with less crew, this may result in working longer hours and compromise safety measures putting the well-being and health of fishers at risk.

Crew on large-scale industrial vessels, who are working on/off for several weeks and then are replaced by another crew during their work break, are unable to travel home due to flight restrictions and quarantine periods. As a consequence, they have to work longer periods on board, which increases fatigue and stress (also relevant to the health of family members back home). The longer working periods lead to increased risk of on-board accidents.

Large-scale industrial fishing vessels can also be confronted with COVID-19 cases among their crew members while far away at sea. The virus may spread rapidly among all the crew of a vessel and medical assistance is not always readily available. When trying to enter a port, crew who are not from the port State may not be allowed to enter the country.

Fishing and fish farming communities are often located far away from the main cities and the medical facilities (health clinics, hospitals) are often not of a high standard, compared to those in the cities. Transport to the cities during the COVID-19 outbreak may be restricted to reduce the spread of the virus, and consequently, the access of fisherfolk and their families to good quality health care, medicines and drugs may be limited.

Finally, the wide informality in the sector constitutes an added barrier for fishers and fish farmers to access protection from labour market policies and contributory social protection mechanisms. These might exacerbate the secondary effects of COVID-19, including poverty and hunger.

FISHERY AND AQUACULTURE RESEARCH AND MANAGEMENT IMPLEMENTATION

Surveys for collecting data into stock assessments' processes have been postponed or cancelled in some countries but there is no clear overview of the extent of these delays. In the North Atlantic, springtime is the most critical time for collecting data required to calculate Total Allowable Catches (TACs) for fish stocks. The situation now, with restrictions of how many persons can work near each other, with working from home policies in many countries and even some crew members or researchers becoming infected, means that cancelling stock assessment activities is the only possible solution. In these circumstances, estimating the stock sizes for long-lived fish species may be possible for some species by using trends or the same results as the year(s) before. However, for short living species (one to three years) this could be challenging and result in highly uncertain TACs, resulting in deteriorations in stock status where a TAC is overestimated, or a decrease in potential production where a TAC is underestimated.

Regional Fishery Management Organizations (RFMOs) and Regional Fishery Advisory Bodies (RFABs) play an important role in contributing to scientific research of many important shared fisheries around the globe which is achieved through scientific committees and dedicated working groups set up to work on specific tasks. For many of the larger RFMOs, these meetings are convened many times each year. The function of the scientific committee is to direct and review all stock assessments, analyses and recommendations presented by the working groups. Based on their assessments, the scientific committee will then make recommendations to the decision-making body regarding workplans and priorities and this may include setting of catch

or fishing effort limits. While efforts may be made to conduct some scientific meetings remotely, cancelled, postponed or reduced agendas of RFMO scientific committees, and meetings of other international organizations dealing with stock assessment and related research matters, will have short- to medium-term negative impacts on the research and the subsequent management decisions of many shared fish stocks globally.

The majority of RFMOs⁴ also have the capacity to adopt binding management measures while RFABs endorse management measures. While Regional Fisheries Bodies (RFBs)⁵ have adapted to travel restrictions by holding meetings online, virtual meetings may be shortened to account for differing time zones, the focus being on core RFB business while other matters are being deferred. Additionally, the nature of virtual meetings can present challenges to making progress on matters that require negotiation. Reduced agendas may delay implementation of some measures and may have an adverse impact on the management of many shared fish stocks. In November 2020, FAO repeated a COVID-19 impact survey of RFBs which was first held in April 2020 (FAO, 2020d), the results of which will produce a more informed global assessment of the impact of COVID-19 on fisheries and aquaculture and will be made available from early 2021 on the FAO Fisheries web page dedicated to the impacts of COVID-19 on the fisheries and aquaculture sector (FAO, 2020e).

Fish and shellfish farming businesses are complex and are facing multiple issues related to COVID-19 restrictions and other issues such as climate change. Regarding research and management, the challenges will be to either compensate or maintain ongoing indoor or field research, since movement restrictions in some places could possibly destabilize or delay ongoing research, either by lack of personnel or needed supplies. Management and policy measures must also consider the loss of income in addition to loss of production (Feijóo, 2020). Contingency plans should be prepared in case of fish mortalities occurring as a result of the shortage of feed or external drivers (e.g. drought and disease).

Monitoring, control and surveillance

Lockdowns could lead to reduced capacity in Fisheries Monitoring Centres (FMCs), as was the case in West Africa during the 2013–2016 Ebola outbreak – where not only were staff not available, but limited national resources were directed to funding emergency activities and this left the FMCs unable to function effectively. Fishers who are “safely out at sea” in their microcosm know this and may keep operating or adapt their operations to benefit from the MCS shortcomings to engage in illicit activities, including fishing in closed areas which may have long-term impacts on the habitat and stocks they are designed to protect.

RFMOs have an important role in contributing to MCS and combating IUU fishing for many important shared fisheries around the globe and this is achieved through convening regular dedicated compliance committee meetings. For many of the larger RFMOs, these meetings can be convened twice a year. The function of a compliance committee is to monitor, review and assess implementation of and compliance with adopted conservation and management measures (CMMs). This includes, but is not limited to, giving special consideration to MCS, data reporting and IUU fishing CMMs. The compliance committee will make recommendations to the decision-making body on actions to be taken in regard of *inter alia* non-compliance and development of new measures to address non-compliance. A lack of monitoring and enforcement of shared stocks may encourage some countries fishing these stocks to revert to a less responsible level of management, monitoring and control of fishing operations. The majority of RFMOs have experienced disruptions to MCS functions at some level. The most common negative impact is disruption to at-sea observer programmes. More details can be found in an initial FAO RFB impact

⁴ Regional Fisheries Management Organizations (RFMOs) are intergovernmental organizations set up to manage shared fish stocks, mostly, but not exclusively in international waters. For more info see FAO Fisheries and Aquaculture Technical Paper 651. <http://www.fao.org/3/ca7843en/CA7843EN.pdf>

⁵ Regional Fisheries Bodies (RFBs) is a collective term for both RFMOs and RFABs.

assessment produced in May 2020 (FAO, 2020d) and in an updated assessment to be made available on the following website in early 2021 (FAO, 2020e). Reduced capacity of compliance committees and levels of associated activities will have negative consequences on the MCS of fishing activities and the fight against IUU fishing globally.

FOOD SECURITY AND NUTRITION

Many processing and transport businesses have reduced, stalled or completely shut down operations due to lockdown measures, potentially contributing to food insecurity and increased malnutrition. Many developing countries and Small Island Developing States (SIDS) are reliant on fish for animal protein and essential micronutrients, especially in rural settings and communities that were already considered vulnerable before the COVID-19 crisis began. Of the 34 countries where fish contribute more than one-third of total animal protein supply, 18 are Low Income Food Deficit Countries, and five are SIDS (FAO, 2020f), where fish serve as the backbone to healthy diets. In addition, fish supplies important vitamins and minerals in bioavailable form for the human body and has an enhancing factor on absorption of minerals (such as iron and zinc) in predominantly plant-based diets that are typical in many developing countries. Fish is also an important source of fatty acids – such as eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA) – with evidence showing consumption of fish linked to positive outcomes for the cardiovascular system (Peter *et al.*, 2013). It is therefore important that countries most dependent on fish for their food security do not run short of fish supply.

The reduction in fish consumption could further exacerbate issues related to the “triple burden of malnutrition” (FAO, 2019) which has already affected over 200 million children and over two billion adults globally and cost society up to USD 3.5 trillion per year (Global Nutrition Report, 2018).

As many countries are restricting movements outside of the home, vulnerable fishing communities are becoming even more vulnerable. This is not only due to reduced supply of affordable animal protein, micronutrients and fatty acids through direct consumption of fish caught, but also through reduced income from limitations on livelihood activities, further reducing their purchasing power to afford a diverse range of foods to meet their dietary needs. Globally, 59.7 million people work in the primary sector of fisheries and aquaculture, with even more working in the secondary sector, including post-harvest activities (FAO, 2020g).

Provisioning of fisheries products faces challenges with its perishability, requiring capitalintensive cold chains or processing methods that meet food safety standards to support distribution (Johnson *et al.*; 2020). In high-income countries, producers selling live or fresh fish to restaurants were especially hard-hit, while those selling shelf-stable products have fared well as consumers have shifted their behaviour in food sourcing. Much of the value chain for nutrient-rich products, such as dried small fish, lies in the informal sector and is dominated by rural women, who were highly affected by restrictions on movement, despite the important contribution that dried small fish could have in ensuring food security and nutrition during this time due to their portability, affordability and extended storage life.

As women are often responsible for household food purchasing, preparation, and child feeding, they may be disproportionately affected by limitations in livelihood activities. Women face a great time burden for balancing work outside of the home as well as caretaking, facing tradeoffs that directly affect the family's and children's health and nutritional status, and these trade-offs are exacerbated during crises (FAO, ECA and AUC, 2020). It is important to support women through this crisis to ensure family well-being, food security and nutrition and continued livelihood activities.

FOOD SAFETY

Although early reports associated with the emergence of COVID-19 focused on fish and traditional markets, subsequent studies have increasingly demonstrated that COVID-19 is spread primarily through human-to-human transmission of the virus – known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) – either through droplets or direct contact with an infected person (Chih-Cheng *et al.*, 2020).

Fish are extremely unlikely to be infected by SARS-CoV-2 as the receptor proteins for coronaviruses on the cell membrane of humans and fish have very low genetic similarity (Chen *et al.*, 2020). In this context, it is important to underline that there is no evidence for any virus causing fish disease being pathogenic to humans (European Commission, 2000).

At present, there is no evidence that COVID-19 can be transmitted through fishery or aquaculture products (WHO, 2020c; OIE, 2020). However, as before the current pandemic, any food can potentially be contaminated with pathogens through contact with contaminated equipment, surfaces or environments, including people's hands, gloves or aprons. Proper cleaning, disinfection and the prevention of crosscontamination are critical in the control of foodborne illnesses. COVID-19 is primarily transmitted directly from human-to-human, and food workers that are infected with COVID-19 may contaminate food with of SARS-CoV-2. It is important to note, however, that food itself has not yet been identified as being responsible for the transmission of the disease to people. The application of sound principles of environmental sanitation, personal hygiene and established food safety practices remain important ways to reduce the likelihood of cross-contamination. Likewise, thoroughly cooking fishery and aquaculture products before consumption can also reduce food safety risks.

The Codex Alimentarius Commission (FAO, WHO, 2020a) has adopted several practical guidelines on how to apply and implement best practices to ensure food hygiene, handle fishery and aquaculture products and control viruses in foods (FAO, WHO, 2020b). FAO and WHO have recently developed the Joint FAO–WHO Technical Guidance for the Development of the Growing Area Aspects of Bivalve Mollusc Sanitation Programmes to guide the management of microbiological hazards in primary production of bivalve molluscs for consumption as live or raw products. Enhanced food safety practices at this time, such as those recommended in the Codex, FAO and WHO documents, will reduce the likelihood of contamination of foods with pathogens, and help lower the public health burden caused by established foodborne infections (FAO, 2020h).

FUTURE POSSIBLE PATHWAYS

Where there is prolonged uncertainty regarding the ability to transport goods and difficulty in logistics due to the measures to contain the spread of the virus, proximity to markets and investment in domestic or nearby supply chains (including markets and processing) helps to prevent food shortages and loss of livelihoods. Producing fish domestically (through investment in land-based aquaculture for instance) may also seem more attractive. While increased online retailing (e.g. digitization) has developed at a dramatic rate, especially in Asian markets and North America, the long-term trend towards e-commerce in household purchases of fish products may evolve (Cherry, 2020).

In the return to business-as-usual scenarios, the public and private sectors will want to re-establish supply chains and access to markets, which may have been disrupted during lockdown. Yet, they may also want to reduce the costs from possible future occurrences of similar outbreaks by correcting the vulnerability in the supply chain (as for example not being dependent on one supplier and shortening supply chains). This could involve diversifying suppliers/processors to have more supply chain control and focusing on local or regional suppliers. The tourism sector, restaurants and hotels, have been hardest hit by the lockdowns and there is already evidence that many will not reopen after the pandemic. This has implications for contractual arrangements with new clients at retail level or rethinking final delivery methods such as e-commerce and home delivery in face of the changing habits of consumers.

It is becoming clear that many of the changes in fish and seafood supply chain activities observed during the pandemic may prevail. These include increased digitization and traceability, increased volume of processed fish, and the increased acceptance of home delivery/home consumption and e-commerce. Although many countries have used short-term stimulus packages to support producers and workers (European Council of the European Union, 2020), (NOAA Fisheries, 2020), there may still be long-term impacts on the productivity of the fisheries and aquaculture sectors.

WHAT CAN FAO AND ITS PARTNERS DO?

FAO is supporting countries through this COVID-19 pandemic, by providing policy recommendations as well as technical advice and support. The below provides an overview of some of the ongoing responses or recommended actions by FAO and/or partners.

Management and policy

- Collect data, as well as support research, on the impact of the COVID-19 pandemic on fisheries and aquaculture systems. FAO has compiled a guidance document on best practices for developing surveys and questionnaires on the impacts of COVID-19 on fisheries and aquaculture (FAO, 2020i).
- FAO has produced some global and regional fishery specific policy briefs, available on its web page *COVID-19 and its impact on the fisheries and aquaculture sector* (FAO, 2020e).
- FAO is repeating a COVID-19 initial impact survey of RFBs first conducted in the early stages of the pandemic in April 2020. The results, which will produce a more informed global assessment of the impact of COVID-19 on fisheries and aquaculture, may inform and guide the development of mitigation measures and will be made available on the above-mentioned website. This follow-up survey was a recommended action for FAO arising from the initial assessment.
- Develop assistance packages and contingency plans with specific fisheries and aquaculture measures.
- Maintain close engagement with small and medium enterprises (SME) and large-scale industry to ensure a good understanding of the issues facing fishers, fish farmers and other seafood businesses and working closely with the latter to ensure that measures considered are targeted and proportionate.
- Prioritize the most vulnerable, such as crew members, fish workers, women processors and vendors.
- Provide guidance on the adoption of international hygiene standards (HACCP,⁶ CODEX etc.) at factories to prevent spread of COVID-19 to among workers.
- Support food supply chains and avoid disruptions in the movement and trade of fish and fish products, to ensure that they function smoothly in the face of crises; and increase the resilience of food systems so that they can support food security and nutrition and be based on sound sustainability principles.
- Provide clear communications regarding how the virus is and is not transmitted. Promote seafood consumption and facilitate direct sales of fish and fish products.
- Work with the industry and regional organizations on developing a range of management options as well as measures to protect jobs and ensure a fast recovery, including assessment of transport and market development options, while at the same time ensuring sustainability.
- Management packages could include consideration for the following where appropriate:

⁶ Hazard Analysis and Critical Control Point <http://www.fao.org/3/y1579e/y1579e03.htm>

- control fishing effort (in conjunction with any established catch limits ‘quotas’ etc.) by limiting vessel numbers to match market size;
- ensure worker safety by only allowing vessels with a full complement of crew to leave harbours to conduct fishing operations;
- extend the fishing season but only with careful consideration of the overall impact on the sustainability of the fishery in question; where possible, enhance remote surveillance and non-observer monitoring programmes (cameras, log-books, electronic reporting systems);
- compensate owners and vessel crews prevented from fishing; and
- consider enhancing measures, where appropriate, that help safeguard the very ecosystems (including habitats) that fisheries and aquaculture depend upon.

Hygiene and sanitation

- Improve occupational health and hygiene in processing plants, the fish market and on board vessels (including provision of facial masks, gloves, etc.).
- Awareness-raising on hygiene measures through production of guidance documents, information posters (to post in harbours and fish markets), radio bulletins (rural communities) and text messages to those with mobile phones.

Supply chain

- Fishers, processors and distribution workers to be designated as “essential workers” as they provide food to the nation.
- Visa expediting for temporary, seasonal foreign labour for the harvesting and processing of fish and seafood.
- Ensure supply chain access. For those fishing operations that sell their products overseas, ensure continued access to and cooperation from officials at ports, rail, and border crossings.
- Stability of fisheries access by reducing unnecessary regulatory burdens that are preventing access to and sustainable harvest from fishing grounds.
- Where possible, link fishing centres or villages to, for example, the local level community kitchen in the area. Smaller varieties of fish can be easily fried (sardines, mackerels, anchovies) and, where possible, be supplied there for a fixed price.
- Use temporary storage of fish, divert fish to the home market, working with processors to adjust supply to the home market and replace products previously prepared for the export market.
- Fish which remains unsold to be processed (e.g. salted, smoked or stored in ice as appropriate). For the latter, the supply of medium-sized insulated fish boxes by the Department of Fisheries is desirable.
- Explore the possibility of freezing fish products with fish processing, refrigerating and distribution companies.
- Promote use of new technologies (WhatsApp, websites, Facebook, etc.) to get fresh fish delivered directly to the consumers taking the adequate safety measures for home delivery.
- Promote new and climate-smart low cost technologies (e.g. e-commerce using ICT platforms) to facilitate the interface between the supply (producers/fishers) and demand (consumers) and anticipate any problems.
- Undertake activities to strengthen and regain confidence in producer/buyer relationships.
- Undertake activities to promote the benefits of fish consumption and strengthen end demand.

Finance and social protection systems

The ocean economy, and aquatic food value chains as a whole, may be a victim of the impacts of the COVID-19 crisis, but it also holds solutions for rebuilding a more resilient, sustainable and equitable post-COVID-19 world. Investment in “blue” recovery and stimulus packages, along with policy reform, can immediately create jobs and provide short-term economic relief, all the while fostering long-term economic growth, resilience and social and environmental benefits. As we look to rebuild, cooperation between government and the public and private sector as well as a departure from business-as-usual scenarios can ensure this “blue transformation”. Solutions which will deliver jobs and significant economic benefits include investments in coastal and marine ecosystem restoration and protection, and sustainable community-led, non-fed mariculture to complement seafood supplied by capture fisheries.

To date, many stimulus packages have overlooked the role the ocean and aquatic food systems as a whole, can play in a “blue” recovery. A recent study demonstrated why policymakers should look to the ocean economy for mutually beneficial, no-regrets investments that will help the world set a course to a more resilient, sustainable and equitable future (Northrop, 2020).

Other actions to consider are:

- Declaration of a fisheries disaster to open up aid options.
- Increase access for fishers and others in the fisheries and aquaculture value chain to credit and microfinance programmes with reduced interest rates, flexible loan repayment, and options for restructuring of loans and related payment schedules.
- Grant programmes to cover economic losses in order to maintain domestic seafood supply chains and to ensure continued operations.
- Loan forgiveness for loans used to maintain payroll, grants for maintenance to keep vessels in good working order, and low-interest loans to refinance existing debt.
- Payment relief i.e. suspension of certain financial obligations such as utilities, real estate tax and mortgages.
- Payroll and unemployment assistance. Additionally, many vessel crew members and small-scale producers are considered self-employed and do not currently qualify for unemployment or paid leave, so relief efforts must also be extended to these workers.
- Government to expand purchase of seafood for institutional use (i.e. prisons, hospitals, school feeding programmes etc.) as well as for distribution as food assistance.
- Cash and in-kind transfers by local institutions (where no national social protection schemes exist) to support the most vulnerable.
- Where social assistance (cash/in-kind transfers) or social insurance programmes exist, adapt the programme design (delivery schedule, level of benefits) and relax conditionalities (e.g. waivers on contributions) to ensure wider and adequate coverage of the fisheries and aquaculture sector, including informal workers.
- Support inter-institutional coordination, through data information exchange between authorities responsible for fisheries development and governance to ensure coverage of fishers by social development.

ANNEX: HOW ARE GOVERNMENTS, THE PRIVATE SECTOR AND SMALL COMMUNITIES IMPACTED AND PLANNING TO ADDRESS CHANGES IN THE FISH FOOD SYSTEM

The following section provides examples of national policies and responses to COVID-19 as collected through secondary information and interviews.⁷ It also provides a description of impacts where available. This section is organized according to FAO regions and is not meant to be comprehensive.

Africa

In South Africa, the export price of rock lobster had significantly declined with the closure of the Chinese fish market which has impacted small-scale as well as large-scale fisheries. In Kenya, it was reported that local fish sales boomed for fear of contracting the virus through the Chinese fish exports (Dijkstra, 2019). In Madagascar, some transport disruptions were reported for aquafeed, and the early closure of markets to reduce disease spreading required some adjustments to the fishers and fish farmers habits. In Algeria, most fish markets and restaurants were closed, impacting fishers supplying those markets.

Some countries applied total lockdowns like Angola, Eritrea, Mauritius, Namibia, South Africa, and Zimbabwe. In Angola, for example, the Government declared a state of emergency. Restriction of the free movement of people, disruption of transport systems and closure of commercial establishments reduce the mobility of the workforce, the market available for commercialization of agrifood products (including seafood) as well as impacting the logistics and transportation of products.

In some other countries (e.g. Angola, Cabo Verde, Liberia), fisheries ministries/departments were requested to determine the necessary measures indispensable to ensuring continuity in the production, processing, transportation, distribution, and supply of fisheries and aquaculture products.

In response to the rock lobster market closure, the Department of Environment, Forestry and Fisheries of South Africa extended the nearshore fishery in Western Cape until June and the offshore and Northern Cape until September to help fishers compensate for the economic losses incurred. In addition, fishers in both the Western Cape Rock Lobster Association and linefish sectors were able to land their catch over weekends.

Asia and the Pacific

As the largest producer, exporter and one of the biggest importers of fish, China has been on the frontline suffering from the COVID-19. The impacts are demonstrated in several aspects: first, the nationwide lockdown inevitably halted the logistics and domestic distribution channels were almost cut off. This paralysis resulted in the shortage of feed for producers but has led to an over stock in farms due to the poor transportation and lower demand. Second, the closure of wholesale markets, supermarkets and restaurants translated into low demand that household consumption has apparently not been able to offset, putting more pressure on the farmers. The processing industry has played increasingly important roles to absorb the raw materials and convert them into processed/prepared products, which can be preserved for longer periods. The global fish trade pattern has been disrupted, with stagnant demand. Chinese exporters of tilapia, catfish, as well as the processors of whitefish have struggled to maintain orders from abroad.

⁷ FAO fisheries and aquaculture officers in headquarters and (sub)regional offices and FAO partners are gratefully acknowledged for their most valuable inputs to this section.

The Chinese Government conducted a series of measures to stabilize the fisheries and aquaculture industry. On 15 February 2020, a joint declaration was announced from the Ministry of Agriculture and Rural Affairs, National Development and Reform Commission and Ministry of Transport of China to assist the aquaculture industry.⁸ It included the following provisions:

1. Resumption of processing enterprises. Except for cities with severe epidemics, such as Wuhan, feed and processing enterprises should be allowed to resume work in various places without restricting conditions. Priority should be given to protecting workers of related enterprises, moreover, water, electricity and gas supplies to those industries are to be secured.
2. Ensure the smooth transportation of raw materials and feed ingredients, such as corn and soybean meal. Transportation of necessary materials cannot be blocked.
3. The Government set up a special fund to encourage leading companies who have cold storage facilities to pre-purchase fresh fish from individual farmers in order to reduce their financial burden.
4. All localities are establishing online information platforms to coordinate demand and supply. Information is collected on buying and selling activities and priorities are given to poorer counties and towns.

Financially, the Government facilitated the direct communication between banks and enterprises to materialize the financial aids and to implement special loans with discounted interest rates. During COVID-19, deferred payments of electricity, water and gas for related enterprises were allowed.

In response to the announcements, traditional farming and processing regions in China, like Guangxi and Hainan, implemented respective measures following the notice from the Ministry with more detailed guidance to reduce the pressure of the farmers.

In the capture fishery sector, the Ministry of Agriculture and Rural Affairs also developed specific notices to distant fishing vessels. For example, the daily reporting system should be applied to all the vessels by asking vessel owners to be responsible for all the preventive measures combating COVID-19; fuel supply and crew member recruitment should be conducted in safer ports, with relevant information communicated to the Fisheries Bureau.

The Chinese Aquatic Products Processing and Marketing Alliance,⁹ under the guidance of the Ministry, urgently put into place the National Fish Demand and Supply Information Platform, where many leading companies and small-scale enterprises are invited to register. By mobilizing the resources, the platform has successfully helped thousands of fishers to sell their products.

On top of that, the companies of the Alliance voluntarily donated their products and cash to the severely hit provinces in China; many leading companies have played major roles in combating the virus. It has emerged that those who have better processing facilities are better placed to cope with the market distortion because they are able to store the processed products for longer periods without incurring too many costs.

In the Republic of Korea, as COVID-19 spread across the country, all related Government ministries jointly announced, on 28 February, a series of joint measures to minimize the impacts of the disease and to overcome it as early as possible at national level. In this context, the Ministry of Maritime Affairs and Fisheries prepared a set of comprehensive support measures considering the requirements of fishers and under the primary direction of joint actions of related ministries, to keep the economic vitality of the fisheries and aquaculture sector as follows:

⁸ Gazettes of the Ministry of Agriculture and Rural Affairs of the People's Republic of China: http://www.yyj.moa.gov.cn/gzdt/202002/t20200228_6337881.htm

⁹ <http://www.cappma.org/view.php?id=4718>

1. Support overseas marketing activities and liquidity with diverse fund mechanisms for seafood exporters.
2. Promote the seafood consumption through e-commerce and offline market transaction for local small-scale fishers and local seafood companies.
3. Provide public finance with low-interest rates for small-scale fishers to relieve their business difficulties.
4. Maintain the growth engine for the fisheries and aquaculture sector along with budget early implementation, expansion of social overhead capital investment, and the introduction of “the Public Benefit Debit System”.

Japan is the seventh largest large fish producer in the world, accounting for 2.1 percent of global fishery production in 2017 (3.5 percent for capture fisheries and 0.9 percent for aquaculture). Japan was the second largest fish import market in 2017, accounting for 10 percent of global fish imports, by value. It absorbed a large portion of global imports (by value) of several major aquatic species groups, such as brown seaweeds (nearly 90 percent), river eels (60 percent), clams/cockles/arkshells (30 percent), cephalopods (15 percent), tunas/bonitos/billfishes (15 percent), shrimps/prawns (12 percent) and salmon/trout/smelts (9 percent). Japan also had substantial fish exports which accounted for 1.3 percent of the world total in 2017. The COVID-19 pandemic has dramatically reduced seafood prices in Japan, particularly for high-end products such as bluefin tuna, due to lower demand from restaurants and hotels (Nippon.com, 2020). The pandemic has also affected fish/seafood trade operations e.g. the suspension of the “simultaneous auction” in the central wholesale market in Sapporo in order to prevent infection (FIS, 2020). The global spread of the virus also affects Japan’s fishing operations, disrupting its pelagic tuna fisheries due to the increased number of countries that regulate boarding and disembarking of crew members at major supply ports overseas (Seafoodnews, 2020).

In Indonesia, there was no lockdown and the domestic supply chain continued to operate normally, but some issues have been reported across social media on difficulties with the fish export market. This seems to have resulted in stock issues for some fish processors, whose cold storages are full.

In Nepal, the lockdown had an impact on the breeding of Common carp, Silver carp, Bighead carp and grass carps. Some disruptions for fish feed have also been mentioned.

In the Philippines, the lockdown was in effect on the island of Luzon. Agriculture and fisheries production workers are considered essential for food security and are still operating. The transport of agriculture and fisheries products to markets is still ongoing with Government support. Wet and supermarkets are still open with restrictions. In some cities, food products are brought closer to consumers who do not have means of transport. The only issue reported so far relates to imported seeds.

There was no lockdown in Cambodia but preventive measures are in place to avoid crowding. Some fresh and processed fish are sold online and home delivered. In terms of fish supply, wild fishery is important as well as the importation of aquaculture fish from neighbouring countries, which normally makes up for any shortfall in domestic fish availability (in urban areas) Note that 2019–2020 was a very poor year for Cambodian inland fisheries (due to a dry year, closure of Mekong dams and major impact on Tonle Sap fishery) which is a major cornerstone of food and nutritional security. Some larger aquaculture farms in Cambodia are also suffering from water shortages due to the ongoing drought and high temperature at this time of year. The closure of borders of neighbouring countries and restrictions on border trade may constrain fish imports and to a lesser extent exports. This will add further pressure on the supply of fish. There is an additional pressure of the over 25 000 migrant workers returning from Thailand due to COVID-19-related downturn in jobs to the Tonle Sap provinces. These workers will not be able to subsist on fishing or agriculture for a while. Some will be likely to turn to NTFPs (and TFPs) thereby increasing pressure on forest resources.

In Myanmar, the Myanmar Fisheries Association (MFA) said that if there were a lockdown due to COVID-19, there would be problems for shrimp companies related to shortage of labour and long-term storage. The buying and selling of dried fish has stopped. MFA is asking buyers to continue to buy their fish and maintain the market flow.

The GEF-funded and FAO-executed project, *Strengthening the adaptive capacity and resilience of fisheries and aquaculture-dependent livelihoods in Myanmar (FishAdapt)* conducted a three-phase remote survey between 23 April and 8 August 2020 in 120 communities where the project operates (FAO, 2020j). The findings include, among others, the following:

1. A large percentage (59 percent) of communities are encountering market price decrease, 46 percent of communities are experiencing continuing higher unemployment, 61 percent of communities have experienced a drop in wages/salaries paid and 86 percent of communities have less overall income than before the COVID-19 pandemic.
2. The majority (77 percent) of communities had less cash now compared to the period before the COVID-19 pandemic, due to market fluctuations in the price of fishery and aquaculture products.
3. The early food assistance by the Government of Myanmar in early April 2020 during initial COVID-19 restrictions reached 93 percent of communities, however, support reduced to 26 percent of communities in July 2020.
4. The elderly, the young, women and girls, and the linguistically, religiously and culturally diverse were disadvantaged by the COVID-19 pandemic, with 61 percent of communities observing a negative impact on women and children.
5. The percentage of communities with community management plans for fishing/aquaculture increased from six in survey one to 24 in survey three.
6. The study received overwhelming feedback from communities requesting training and skills development to address unemployment, food storage, health issues, disaster risk management, pandemics, climate change adaptation, and leadership.

On April 7th, the Thai Department of Fisheries organized a meeting with key actors along the shrimp value chain, mostly *Penaeus vannamei* and a small portion of *Macrobrachium rosenbergii* and *P. monodon*. Indirect impacts from COVID-19 include: i) over supply – harvest 15 000 tonnes (28 percent of respondent farms) in the next 3 months; ii) low price – nearly zero import order; iii) high production cost, low sale, no profit/loss which may bring farmers to give up production if there is no support. If farmers abandon their production, all actors in the value chain will be affected i.e. hatcheries (as of 7 Apr 2020, over supply of postlarvae of 625 million PLs), feed industry, processing plants and their workers, etc. Support measures proposed by key actors to DoF are to:

1. Discuss with associations of input trade and feed production if they can help reduce input prices.
2. Government to provide direct support i.e.:
 - Government buys harvest and trades later (G2G).
 - Price stabilization programme – set acceptable farm-gate price (F), processing companies buy at X price which is lower than F and Government subsidize F-X.
 - Pledging programme – Government buys, stores and sells shrimp. Ideally, farmers should retrieve their shrimp from the programme at a certain point, but this has not happened in the past.
 - Promote even more of domestic consumption – online internal trade.
3. Continue negotiations on the reduction of the price of electricity.

It was agreed that farmer groups would collect and compile data of total shrimp output in 2020 by size and production cost, and that the Department of Fisheries will meet again with key actors/associations along the value chain to put together the information and submit a request to the next ministerial meeting.

From April to June 2020, the Government of Thailand, through the Ministry of Agriculture and cooperatives, provided monthly financial assistance of THB 5 000 (equivalent to USD 167) to registered fish farmers and small-scale fishers. Local government units also provided food and daily subsistence goods (Chanrachkij *et al.*, 2020).

In Bangladesh (Dao, 2020), the Government provided the following support to the fisheries sector:

1. Loans amounting to BDT 260 million (USD 3 million or EUR 2.54 million) with an interest rate of 4 percent, which fishers and fish farmers used for buying aquafeed and other inputs.
2. The Ministry of Fisheries and Livestock offered incentives for fish farmers, fishers and shrimp exporters to help them maintain their business operations.
3. To make sure the supply chain is not disrupted, the Ministry launched a hotline to provide fish farmers and fishers with Government information and advice.

Most of the Pacific did not have confirmed cases of COVID-19 as of October 2020 (a few in Fiji and in some of the other Pacific territories). The strategy has largely been to stop flights and completely halt entry of anyone new to ensure they are not exposed. This has impacted the pearl and giant clam exporters of French Polynesia. At the moment, it is more an issue of restricted imports and increased reliance on domestic goods.¹⁰

Europe and Central Asia

The European Union and individual Member States are taking economic measures to counter the impact of COVID-19. Some of these measures target fisheries and aquaculture which are among the hardest hit sectors, as demand has seen a sudden decline. Below is a summary of some of the tools proposed by the European Commission Directorate-General for Maritime Affairs and Fisheries (MARE) and/or adopted at European Union level.

On 13 March 2020, the European Union approved the European Union Corona Response Investment Initiative of EUR 37 billion and maximum flexibility in the application of the European Union treaties as well as the potential deviations of European Union countries from budgetary rules (the so-called three percent deficit limit) to help countries contain the epidemic and mitigate the negative socioeconomic effects. EUR 1 billion of the Initiative was allocated to fisheries and aquaculture support in guarantee, and EUR 8 billion is for SME fisheries/aquaculture support (European Commission, 2020a). A week later, the European Union Commission adopted a Temporary State aid Framework to enable Member States to provide relief to economic operators hit by the crisis and allow aid support up to EUR 120 000 per active fishery/aquaculture sector. This can be provided in the form of grants or tax advantages, to help operators in lack of liquidity.

On 2 April 2020, MARE proposed a second package to support the European Union fisheries/aquaculture using the European Union Maritime and Fisheries Fund to: support temporary cessation of fishing/aquaculture activities; support producer organizations for fishery/aquaculture products storage and financing of this storage to 100 percent by the European Marine Fisheries Fund (EMFF). The goal was to allow greater market stability, mitigate the risk of having high-value seafood products wasted or redirected to non-human food purposes, and help to absorb the impact of the crisis on the return on products. The proposal is retroactive from 1/2/2020 to 31/12/2020 (European Commission, 2020b).

On 4 April 2020, MARE launched the 2020 EMFF pre-financing process with EUR 160.3 million, waiving the obligation to refund unspent pre-financing at the 2019 programme closure for 2020. This allowed Member States to use the funds to accelerate investments in response to the coronavirus outbreak and ease the socioeconomic burden caused by the crisis on the fisheries and aquaculture sectors (European Commission, 2020c).

¹⁰ As reported by FAO subregional fisheries and aquaculture officer.

The aquaculture industry, processors and traders are requesting that the processing part of the value chain is included in these extraordinary measures; and that import procedures be flexible. Social security protection is also sought. *Europêche* has called on European Union Member States to allow fishers to carry more than ten percent of their quotas into the next year, as well as offer fair intervention prices for unsold fish. The industry has also demanded measures guaranteeing the logistical safety of fishers, such as health protocols for each fleet as well as supplies of masks and gloves to vessels, fish markets and auction halls (Undercurrentnews, 2020).

Private initiatives are emerging to adapt to this unprecedented situation. Commercial distributors are offering to freeze producers' fish products (e.g. Picard). Food retailers and e-commerce using ICT platforms are providing options for both consumers and producers.

In France, it has been reported that farmers supply live fish markets (for restocking or sport fishing), restaurants and retail markets (especially trout, shellfish, ornamental, caviar). Processed fish, especially the large-sized smoked fish, seem less impacted than the fresh fish sector. The main difficulties encountered related to the financial impact incurred as a result of market closure and fears that, with the warm season approaching, live fish storage could reduce water availability and result in fish kills. Exports of fertilized eggs and fry were also stopped, as well as integrated tourism-fish farming. Some difficulties are emerging, as for example with the supply of imported products such as vaccines. Small farmers are most affected, but new initiatives like farmers markets and drive-through farmers markets, where customers can get their products in safe conditions, are emerging and easing impacts. Consumers seem to respond positively to these initiatives, and sales have been excellent so far, but the workload for small producers is huge, with 7–8 hours of preparatory work for each drive-through farmers market.¹¹

In the United Kingdom, there have been different initiatives aimed at facilitating direct sales from vessels to consumers and examples of direct selling guidance (Seafish, 2020a) as well as guidance for safe operation of seafood businesses (Seafish, 2020b) have been provided by Seafish, a non-departmental public body that supports the UK seafood sector.

Latin America and the Caribbean (LAC)

In some LAC countries, restrictions on population movement were slowly introduced, so the actual impact on food systems was not generally felt.

In Brazil, processing companies that froze tilapia fillets seemed to have increased their sales significantly (+15 percent) but the fresh fillet or fresh fish market almost disappeared. In the meantime, sales to local slaughterhouses decreased, as a result of demand reduction from restaurants, which are the main clients. The live fish market was also impacted, as the *pesque-pague* (a popular leisure activity “catch and pay”) have been closed. A noteworthy adaptation is the home delivery of cleaned cooked fish.¹²

The Government of Peru, through its National Fisheries and Aquaculture Programme (PNIPA) launched REINOVA, a specific fund aimed at reactivating the fisheries and aquaculture sector within the context of COVID-19, through innovation in areas such as market recovery, increased production efficiency, reduced production costs and making production inputs (seed, feed etc) accessible to farmers.¹³

In Chile, some of the fisheries and aquaculture related measures include:

- Salmon farms converting their labs into COVID-19 test centres to enable health authorities to carry out tests on coronavirus samples.

¹¹ <https://www.facebook.com/lionel.dabbadie/posts/3101260199906169>

¹² <https://www.facebook.com/lionel.dabbadie/posts/3101268766571979>

¹³ Personal communication, Executive Director of PNIPA-Peru, 2020.

- Some fishers tackling the crisis of the pandemic by doing home delivery sales of fresh and frozen fish.
- Most fish market auctions have been suspended.
- Hard copy documents that are normally submitted to the offices of National Fisheries and Aquaculture Institutions in person are now being sent in digital form, via the Internet.
- National Fisheries and Aquaculture Services are issuing a series of resolutions oriented to adopting measures to reduce the risk of transmission of COVID-19.
- Fishers called for support from Government to help prevent and control coronavirus infections.
- Fisheries and aquaculture research institutions implemented a series of safety measures to prevent and control the pandemic.
- National fisheries and aquaculture services are communicating with fish farmers and artisanal fishers throughout the country, through WhatsApp. This is one of the measures that the regulatory agencies are implementing to support women and men during the emergency.
- Efforts are being made to ensure that fishing and aquaculture processing plants continue to work to ensure the continued delivery of fish products whilst safeguarding the health and well-being of its workers, through strict compliance with health recommendations provided by the government authorities.
- Contingency plans are being implemented in aquaculture processing plants by shift working, separating working areas to ensure physical distancing, and creating various points of disinfection, fumigation and surface sanitization; in addition to the delivery of alcohol gel and masks.
- The National Customs Service adopted a series of measures to facilitate foreign trade to maintain the logistics chain and, in turn, protect the health of the officials of the institutions and workers of customs agencies who must intervene in person in various customs processes.
- Industrial fishing implemented a series of measures in coordination with the health authorities to protect plant workers and their families.

Some of the common response measures that are being gradually rolled out by governments in the region (not specifically targeting but relevant to fisheries and aquaculture) include:

- Emergency food packages were delivered twice weekly in some countries to riparian communities.
- Tax duties have been relieved for fishing industries for at least three months.
- Setting of a basic income scheme for individuals running their own business or smallbusiness to compensate for the losses due to lockdown or general closure measures.
- Fuel prices were reduced, particularly for fisherfolk.
- Electricity and potable water bills were suspended for at least three months. This applied for fish farming.
- In at least two countries of the region, bank credit payments (commercial and personal) were deferred for up to three months without additional interest.
- Zero interest loans are being made available by governments, once the crisis is over. This includes fisherfolk organizations and aquaculture firms.

In the Caribbean, there is a minor boom in direct to consumer sales. The crisis spurred innovation, where a few fishers are delivering directly to households. This includes delivery of fresh fish (where possible) and small value added packages. As governments increase movement restrictions for all persons not involved in an essential business, direct household delivery is a rapidly expanding niche that might help continue demand (King, 2020; Ewing-Chow, 2020).

Near East

The main impact of COVID-19 on fisheries and aquaculture for the Gulf States and Yemen has been at the retail level. Following the outbreak of the disease, authorities closed or limited access to fish markets throughout the region (Saudi Press Agency, 2020a,b; Anonymous, 2020a).¹⁴ The operating markets limited the number of visitors and the time spent in the market. Since the March/April 2020, most of them have reopened, but they are implementing preventive measures such as physical distancing, the mandatory wearing of gloves and masks, the monitoring of temperature of all entrants, the provision of sanitizers, the regular cleaning of the market, and good ventilation. This comes in addition to a wide policy of testing the population. When occurrence of positive cases increased, hotels and restaurants were closed, but in October 2020, they were operating again, with physical distancing and preventive measures in place and enforced by the authorities. However, a noteworthy adaptation initiative in the United Arab Emirates has been to develop the direct sale to consumers by Internet, with home delivery (Shaaban and Al Khaimah, 2020). Precautionary and preventive procedures also continue to apply for home delivery. In most countries, supermarkets remained functioning as primary outlets for fresh fish, but only after having implemented preventive measures too.

Depending on the countries, fish auctions have also been adapted or temporarily cancelled (Anonymous, 2020b).¹⁵ Another noteworthy adaptation initiative in this regard has been reported in Oman, where the authorities collaborated with the Omani Fund for Technology to launch an integrated electronic platform, the [Behar platform](#), to allow remote auctions to take place at the central fish market of Al Fulajj, with the aim of reducing crowds. In Yemen, during the first wave of COVID-19, the authorities also reduced the total number of fishers authorized in the landing site and implemented physical distancing rules as well as isolation centres.

Exports and imports of fresh fish from abroad have also been impacted, at least temporarily (Mona Khalifa *et al.*, 2020; Xinhua, 2020).¹⁶ This led to some temporary shortage and increased prices in some countries (Anonymous, 2020b)¹⁷ but for the time being, these appear to remain relatively stable. There might also be in-country differences; for example, in Yemen, the quantity of fish offered has increased in the coastal cities but decreased in the other urban centres, as a result of organizational and technical difficulties for interurban transport. As a result, fish prices decreased in the coastal areas but remained stable or increased a little in the other cities, as the demand had also decreased. In some countries like the United Arab Emirates, the national carriers dedicated specific trips to fish-producing country destinations such as Turkey and Greece in order to import seafood back into the country. Therefore, overall the challenges are considered minor even though some decline in available quantities is expected, in line with the decline in demand due to the current economic slowdown.

The technical impact of the pandemic on aquaculture is currently limited, as key supplies such as feed and juveniles are not disrupted, and the foreign labour force had just returned from annual off-season leave shortly before the crisis. All aquaculture projects contacted are operating as usual, whether it be for growing-out, harvesting or transport of seed/fry. But the situation has brought auditing of third-party quality assurance/sustainability standards to a standstill and delays for the new initial audits. Aquaculture standards bodies are exploring 'risk-based' remote auditing options for farms with existing certification, in accordance with remote auditing policies established by certification bodies such as the Aquaculture Stewardship Council. Operators of large aquaculture farms in the subregion mentioned that although the hospitality sector sales were hugely impacted at the beginning of the crisis, so far they had managed quite well to sell their products on the retail market through their commercial departments. This was also confirmed by a Government official

¹⁴ Available only in Arabic.

¹⁵ Available only in Arabic.

¹⁶ Available only in Arabic.

¹⁷ Available only in Arabic.

who highlighted that the crisis actually had a positive impact on the sales of national aquaculture products in the country. He was even optimistic that this crisis would highlight the importance of food security and national production of aquatic products. The situation may be different for the large-scale aquaculture producers exporting a large share of their production to countries like China, Korea, Japan, the European Union, and the United States of America that are vulnerable to the economic slowdown. These export-oriented aquaculture business may be facing greater short-term disruption to impacts of COVID-19 on trade flows to major consumer markets.

As of now, there is no specific policy for the sector, although all government agencies contacted reported that they were monitoring the situation and working with companies, traders and fish transporters to ensure that the economic challenges are resolved. They are working especially to ensure an uninterrupted supply of fish at fish markets and distribution outlets, at prices suitable for both consumers and traders. Moreover, most countries have announced financial measures to minimize the economic crisis for individuals and business, but they are not specific to the sector (Bhatia, 2020).

In North Africa, governments have taken a series of measures to limit the spread of COVID-19. These measures directly and indirectly impacted the fisheries and aquaculture sector.

In Tunisia, the measures taken to curb the spread of the virus required the implementation of various movement restrictions measures, including lockdown or travel restrictions. Bans on gatherings and interurban travel have also been imposed to limit the risks. Some of these measures had a noticeable impact on aquaculture, like the establishment of a curfew, restrictions on trade and transport as well as the closing of borders. As for deep-sea fishing, the activity was suspended for two weeks before being re-authorized. During the lockdown, the demand for fish decreased by about 60 percent, particularly due to decreased consumer purchasing and reduced access to fish markets. At the same time, fisheries production decreased due to the interruption of certain fishing activities, while on the other hand aquaculture maintained the same level of production. Even so, the aquaculture sector was impacted by reduced imports of critical inputs supply and a reduced demand due to the closure of tourist facilities (e.g. hotels, restaurants). While Tunisia has taken measures to support economies and impacted communities, there are still no major policies specifically applied to support the fisheries and aquaculture sector (Jlassi *et al.*, 2020).

North America

In North America, fishing is still ongoing because it is considered essential. There is concern about loss of market – in particular international markets – for secondary processing and consumption. There is also concern that the containment measures will affect the availability of fishing crews and processing workers in some countries.

The United States of America has adopted a relief package of USD 2.2 trillion, the largest ever in the country's history. The package includes some USD 300 million of direct financial relief to fisheries participants,¹⁸ who have experienced economic revenue losses as a result of the pandemic. This will be delivered on a rolling basis and within a fishing season.

US seafood harvesters, processors, trade associations and others have requested a combined USD 4 billion in relief for the seafood industry, including a commitment to buy USD 2.5 billion worth of seafood. The measures put forward by the group include: essential status for seafood-related workers; grant or stimulus money to cover losses; loan or utility payment relief or suspension; the government purchase of seafood; payroll and unemployment assistance; the expediting of visas for temporary workers; federal fisheries disaster relief; help in providing transportation assistance for seafood exports; the reduction of unnecessary regulatory burdens that might prevent sustainable harvesting; and the promotion of American seafood abroad (Huffman, 2020).

¹⁸ Fishery participants are defined to include tribes, persons, fishing communities, aquaculture businesses not otherwise eligible under other provisions or other fishery-related businesses.

The fishing and aquaculture industry is adapting to COVID-19 containment and other measures by building capacity facilities (e.g. Maine land-based salmon farmer Whole Oceans), providing direct supply to restaurants and pubs where possible (e.g. New England groundfish harvester Blue Harvest Fisheries), or freezing fish products (e.g. Dungeness crab harvesters in the state of Oregon).

REFERENCES

- Anthony, S. M.** 2020. *Impact of COVID-19 on the seafood market in Asia – A new wave*. FAO, INFOFISH. http://www.fao.org/fileadmin/user_upload/COFI/VirtualDialoguesCOFI34/Anthony-samy.pdf
- Anonymous.** 2020a. سوق السمك في الكويت يقع في شبك كورونا. *CNBC Arabia*. [Cited 19 March 2020]. <https://www.cnbc.com/arabia/news/view/64765/%D8%B3%D9%88%D9%82-%D8%A7%D9%84%D8%B3%D9%85%D9%83-%D9%81%D9%8A-%D8%A7%D9%84%D9%83%D9%88%D9%8A%D8%AA-%D9%8A%D9%82%D8%B9-%D9%81%D9%8A-%D8%B4%D8%A8%D8%A7%D9%83-%D9%83%D9%88%D8%B1%D9%88%D9%86%D8%A7.html>
- Anonymous.** 2020b. إلغاء مزادات سوق السمك والخضار والفواكه. *Al Watan newspaper*. [Cited 13 March 2020]. <http://alwatan.kuwait.tt/articledetails.aspx?id=612351&yearquarter=20201>
- ASC.** 2020. *ASC policy for audits during the COVID-19 outbreak* [online]. [Cited 17/06/2020]. <https://www.asc-aqua.org/wp-content/uploads/2020/03/ASC-POLICY-ON-AUDITING-DURING-THE-COVID-19-OUTBREAK-26032020.pdf>
- Australian Government and UN Women.** 2020. Discussion paper. *Unpaid care and domestic work: Issues and suggestions for Viet Nam*. <https://www2.unwomen.org/-/media/field%20office%20eseasia/docs/publications/2017/01/unpaid-care-and-domestic-work-en.pdf?la=en&vs=435>.
- Allen-Ebrahimian, B.** 2020. China's domestic violence epidemic. *Axios*, 7 March 2020. (also available at <https://www.axios.com/china-domestic-violence-coronavirus-quarantine-7b00c3ba-35bc-4d16-afdd-b76ecfb28882.html>).
- BBC News: Afrique.** 2020. *Coronavirus : les revenus des pêcheurs locaux kenyans augmentent*. [17/06/2020]. (Available only in French). (also available at <https://www.bbc.com/afrique/region-52092657>).
- Beech, P.** 2020. The COVID-19 pandemic could have huge knock-on effects on women's health, says the UN. *World Economic Forum*, 2 April 2020. (also available at <https://www.weforum.org/agenda/2020/04/covid-19-coronavirus-pandemic-hit-women-harder-than-men/>).
- Bhatia, N.** 2020. Closures extended to curb Covid-19 in region. *Middle East Business Intelligence (MEED)*, 29 March 2020. (also available at <https://www.meed.com/closures-extended-to-curb-covid-19-in-mena>).
- Blank, C.** 2020. Seafood suppliers, traders forced to adapt quickly to shifting demand. *Seafood Source*, 2 April 2020. (also available at <https://www.seafoodsource.com/news/supply-trade/seafood-suppliers-traders-forced-to-adapt-quickly-to-shifting-demand>).
- Briceño-Lagos, N. & Monfort, M.C.** 2020. *Why using a gender lens to analyse COVID-19 impacts on the seafood industry?* International Organization for Women in the Seafood Industry. [Cited 7 March, 2020]. <https://womeninseafood.org/why-using-a-gender-lens-to-analyse-covid-19-impacts-on-the-seafood-industry/>
- Care.** 2020. *Gender implications of COVID-19 outbreaks in development and humanitarian settings*. [Cited 7 March, 2020]. https://insights.careinternational.org.uk/media/k2/attachments/CARE_Gender-implications-of-COVID-19_Full-Report_March-2020.pdf
- Chanrachkij, I., Laongmanee, P., Lanmeen, J., Suasi, T., Sornkliang, J., Tiaye, R., Yasook, N., Putsa, S. & Chumchuen, S.V.** 2020. Severity of the impacts of COVID-19 pandemic on small-scale fisheries of Thailand: A preliminary assessment. *Fish for the People* 18 (2): 43-47.
- Chen, Y., Guo, Y., Pan, Y., & Zhao, Z.J.** 2020. Structure analysis of the receptor binding of 2019-nCoV. *Biochemical and Biophysical Research Communications*, 525(1), 135-140. doi: <https://doi.org/10.1016/j.bbrc.2020.02.071>
- Cherry, D.** 2020. *9 ways coronavirus is changing seafood forever*. *IntraFish*, 16 March 2020. (also available at <https://www.intrafish.com/opinion/9-ways-coronavirus-is-changing-seafood-forever/2-1-775088>).
- Chih-Cheng, L., Tzu-Ping, S., Wen-Chien, K., Hung-Jen, T., & Po-Ren, H.** 2020. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *International Journal of Antimicrobial Agents*, 55. doi: <https://doi.org/10.1016/j.ijantimicag.2020.105924>

- Coalition for Fair Fisheries Arrangements (CFFA).** 2020. *If small-scale fishing declines, there will be a food crisis* [online]. [Cited 17 June 2020]. <https://www.cffacape.org/coronavirus-crisis-impacts-on-african-artisanal-fisheries/if-small-scale-fishing-declines-there-will-be-a-food-crisis>
- Dao, T.** 2020. Bangladesh allocates loans to support pandemic-hit fisheries sector. *SeafoodSource*, 25 August 2020. (also available at: <https://www.seafoodsource.com/news/business-finance/bangladesh-allocates-loans-to-support-pandemic-hit-fisheries-sector>).
- Dijkstra, A.** 2019. Chinese imports 'driving fishermen to despair'. *BBC News*, 21 March 2019. (also available at <https://www.bbc.com/news/business-47611076>).
- EFE: AGRO.** 2020. Las empresas de acuicultura reducen sus ventas un 55% en marzo y abril por la COVID-19 [online]. (Available only in Spanish). [Cited 8 April, 2020]. <https://www.efeaagro.com/noticia/las-empresas-de-acuicultura-reducen-sus-ventas-un-55-en-marzo-y-abril-por-la-covid-19/>
- European Commission.** 2000. *Assessment of Zoonotic Risk from Infectious Salmon Anaemia virus* [online]. *European Commission, Health and Consumer Protection Directorate General*. [Cited 7 March 2020]. https://ec.europa.eu/food/sites/food/files/safety/docs/sci-com_scah_out44_en.pdf
- European Commission.** 2020a. *COVID-19: Commission sets out European coordinated response to counter the economic impact of the Coronavirus* [online]. [Cited 18 March 2020]. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_459
- European Commission.** 2020b. *Coronavirus response: Fisheries and aquaculture* [online]. [Cited 18 March 2020]. https://ec.europa.eu/fisheries/coronavirus-response-fisheries-and-aquaculture_en
- European Commission.** 2020c. *Coronavirus: Commission launches 2020 EMFF pre-financing process* [online]. [Cited 18 March 2020]. https://ec.europa.eu/fisheries/press/coronavirus-commission-launches-2020-emff-pre-financing-process_en
- Ewing-Chow, D.** 2020. Five ways that COVID-19 has changed what food insecurity looks like in the Caribbean. *Forbes*, 31 March 2020. (also available at <https://www.forbes.com/sites/daphneewingchow/2020/03/31/five-ways-that-covid-19-has-changed-what-food-insecurity-looks-like-in-the-caribbean/?sh=4799512d143e#45c27cad143e>).
- European Council of the European Union.** 2020. Press releases. *COVID-19: Council adopts rules to help EU fishermen* [online]. [Cited 17 June 2020]. <https://www.consilium.europa.eu/en/press/press-releases/2020/04/22/covid-19-council-adopts-rules-to-help-eu-fishermen/#>
- EUR-Lex.** 2020. Communication from the Commission: Guidelines concerning the exercise of the free movement of workers during COVID-19 outbreak. *EUR-Lex*, 30 March 2020. (also available at [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020XC0330\(03\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020XC0330(03))).
- FAO.** 1995. *Code of Conduct for Responsible Fisheries*. Rome, FAO. 1995. 41 p. (also available at www.fao.org/3/v9878e/V9878E.pdf).
- FAO.** 2019. *Triple burden of malnutrition slows down progress towards Zero Hunger in Europe and Central Asia*. [fao.org/news/story/en/item/1199760/icode/](http://www.fao.org/news/story/en/item/1199760/icode/)
- FAO.** 2020a. Food loss and waste in fish value chains. A renaissance in canned fish consumption during COVID-19. Is it good for food loss and waste?[online]. [Cited 17 June 2020]. <http://www.fao.org/flw-in-fish-value-chains/resources/articles/a-renaissance-in-canned-fish-consumption/en/>
- FAO.** 2020b. *COVID-19: Impact on global fish trade*. GLOBEFISH.[online]. [Cited 13 November 2020]. <http://www.fao.org/in-action/globefish/news-events/details-news/en/c/1326499/>
- FAO.** 2020c. Food Outlook. *Biannual Report on Global Food Markets. COVID-19*. <http://www.fao.org/documents/card/en/c/cb1993en/>
- FAO.** 2020d. *The impact of COVID-19 on fisheries and aquaculture – A global assessment from the perspective of regional fishery bodies: Initial Assessment*. May 2020. No. 1. Rome. <http://www.fao.org/3/ca9279en/CA9279EN.pdf>

- FAO.** 2020e. Aquaculture topics and activities. COVID-19 and its impact on the fisheries and aquaculture sector. In: *FAO Fisheries Division* [online]. Rome. Updated 24 June 2020. [Cited 20 November 2020]. <http://www.fao.org/fishery/covid19/en>
- FAO.** 2020f. *The State of World Fisheries and Aquaculture 2020. Sustainability in action*. Rome. (Available in all languages) <https://doi.org/10.4060/ca9229en>
- FAO.** 2020g. *The State of World Fisheries and Aquaculture 2020*. Interactive story. <http://www.fao.org/state-of-fisheries-aquaculture>
- FAO.** 2020h. *Food Safety in the time of COVID-19*. Rome. doi: <https://doi.org/10.4060/ca8623en>
- FAO.** 2020i. *Best practices for developing surveys and questionnaires on the impacts of COVID-19 on fisheries and aquaculture*. http://www.fao.org/fileadmin/user_upload/faoweb/FI/COVID19/Surveys_and_questionnairesCOVID.pdf
- FAO.** 2020j. *Strengthening the adaptive capacity and resilience of fisheries and aquaculture-dependent livelihoods in Myanmar (FishAdapt)*. Impact of the COVID-19 pandemic on fishing and aquaculture communities three-phase survey outcome report for FishAdapt. FAO, Yangon. <http://www.fao.org/in-action/fishadapt/en/>
- FAO & CEPAL.** 2020. Sistemas alimentarios y COVID-19 en América Latina y el Caribe: Hacia una pesca y acuicultura inclusiva, responsable y sostenible. *Boletín N.º 15*. Santiago. (also available only in Spanish). <http://www.fao.org/3/cb1197es/CB1197ES.pdf>.
- FAO, WHO.** 2020a. *All about COVID-19, CODEX and Food Safety*. Codex Alimentarius [online]. [Cited 17 June 2020]. <http://www.fao.org/fao-who-codexalimentarius/home/en>
- FAO, WHO.** 2020b. *Guidelines on the application of general principles of food hygiene to the control of viruses in food*. Codex Alimentarius [online]. [Cited 17 June 2020]. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXG%2B79-2012%252FCXG_079e.pdf
- FAO, ECA and AUC.** 2020. *Africa Regional Overview of Food Security and Nutrition 2019*. Accra. <https://doi.org/10.4060/CA7343EN>
- Feijóo, M.** 2020. EU aquaculture group says new measure still lack level playing field with fishing. *Undercurrentnews*, 8 April 2020. (also available at <https://www.undercurrentnews.com/2020/04/08/eu-aquaculture-group-says-new-measures-still-lack-level-playing-field-with-fishing/>).
- Financial Times.** 2020. *COVID-19 has brought a surge in domestic violence globally*. (Restricted access). (also available at <https://www.ft.com/content/c494f254-f6f8-44d5-a8e0-897f6e242a7f>).
- FIS.** 2020. In Brief: *Coronavirus (COVID-19): Sapporo Central Wholesale Market stops Seafood Auctions*. [Cited 7 March 2020]. (also available at https://www.fis.com/fis/worldnews/search_brief.asp?l=e&id=106723&ndb=1).
- France 3.** 2020. *Coronavirus et confinement : un pêcheur sachant pêcher ne peut plus pêcher* [online]. (Available only in French). [Cited 7 March 2020]. (also available at <https://france3-regions.francetvinfo.fr/nouvelle-aquitaine/correze/brive/coronavirus-confinement-pecheur-sachant-pecher-ne-peut-plus-pecher-1802604.html>).
- Freedonia.** 2020. *COVID-19 Economic Impact Tracker. COVID-19 Impact Analysis and Forecasts* [online]. [Cited 17 June 2020]. <https://www.freedoniagroup.com/Content/COVID-19-Economic-Impact-Tracker>
- Global Nutrition Report.** 2018. Chapter Two: The Burden of Malnutrition [online]. [Cited 7 March 2020]. <https://globalnutritionreport.org/reports/global-nutrition-report-2018/burden-malnutrition/>
- Guidelines for Integrating Gender-Based Violence Interventions in Humanitarian Action.** 2020. *COVID-19: Resources to address gender-based violence risks*. (also available at <https://gbvguidelines.org/en/knowledgehub/covid-19/>).

- Hudson, A.** 2020. *The ocean and COVID-19*. United Nations Development Programme (UNDP), 8 June 2020. New York. <https://www.undp.org/content/undp/en/home/blog/2020/the-ocean-and-covid-19.html>
- Huffman, J.** 2020. US House passes coronavirus stimulus with \$ 330m for harvesters, aquaculture. *Undercurrentnews*, 27 March 2020. (also available at <https://www.undercurrentnews.com/2020/03/27/us-house-passes-coronavirus-stimulus-with-300m-for-harvesters-aquaculture/>).
- Jlassi A., Crespi, V. & Mahjoub, S.** 2020. Preliminary analysis of the impact of COVID-19 in the fishery and aquaculture sectors in Tunisia. *FAO Aquaculture Newsletter* No. 62, p: 34-36 www.fao.org/3/cb1550en/cb1550en.pdf
- Johnson, D., Thilsted, S.H. & Belton, B.** 2020. The Fish Tank [online]. *Dried fish in a COVID-19 world*, 19 May 2020. <http://blog.worldfishcenter.org/2020/05/dried-fish-in-a-covid-19-world/>
- King, K.** 2020. *Worried! Fish vendors get new closing times due to COVID-19*. *Loop*, 1 April 2020. (also available at <https://www.loopnewsbarbados.com/content/fish-vendors-worried-new-closing-times-may-affect-business>).
- Korten, T.** 2020. With Boats Stuck in Harbor Because of COVID-19, Will Fish Bounce Back?. *Smithsonian Magazine*, 8 April 2020. (also available at <https://www.smithsonianmag.com/science-nature/fish-stop-covid-19-180974623/>).
- Lennane, A.** 2020. Air freight rates on the up again, driven by more demand for less capacity. *TheLoadStar*, 22 October 2020. (also available at <https://theloadstar.com/air-freight-rates-on-the-up-again-driven-by-more-demand-for-less-capacity/>).
- Le Télégramme.** 2020. *Le confinement oblige la pisciculture de la Douffine à donner ses truites* 16 April 2020. (also available at <https://www.letelegramme.fr/finistere/pleyben/le-confinement-oblige-la-pisciculture-de-la-douffine-a-donner-ses-truites-16-04-2020-12539962.php>).
- Marcoux, C.** 2020. *Sexual and Reproductive Health During the COVID-19 Crisis*. International Women's Health Coalition. <https://iwhc.org/2020/03/sexual-and-reproductive-health-during-the-covid-19-crisis/>
- Mona Khalifa, Sherine Farouk, Ahmed Abu Al-Fotouh and Aisha Al-Kaabi.** 2020. الطقس وتراجع الاستيراد يرفعان أسعار السمك. *Al Bayan*. [Cited 25 March 2020]. <https://www.albayan.ae/across-the-uae/news-and-reports/2020-03-25-1.3812448>
- Monfort, M.C.** 2015. The role of women in the seafood industry. *GLOBEFISH Research Programme*, Vol. 119, Rome, FAO. 67 pp. (also available at http://www.fao.org/fi/oldsite/eims_search/1_dett.asp?calling=simple_s_result&lang=en&pub_id=316563).
- Nippon.com.** 2020. *New Coronavirus Affecting Fish Trade in Japan*. 29 February 2020. (also available at <https://www.nippon.com/en/news/yjj2020022900479/new-coronavirus-affecting-fish-trade-in-japan.html>).
- National Oceanic and Atmospheric Administration (NOAA) Fisheries.** 2020. NOAA Fisheries Coronavirus (COVID-19) Update. NOAA Fisheries is actively monitoring and adjusting to the COVID-19 national health crisis. [Cited 17 June 2020]. <https://www.fisheries.noaa.gov/national/noaa-fisheries-coronavirus-covid-19-update>
- Northrop, E., Konar, M., Frost, N. & Hollaway, E.** 2020. *A Sustainable and Equitable Blue Recovery to the COVID-19 Crisis*. Report. Washington, DC: World Resources Institute. (also available at https://oceanpanel.org/sites/default/files/2020-09/20_HLP_Report_COVID_Blue_Recovery.pdf).
- Ojeda, J.** 2020. Tenemos que dar salida a la acumulación de stock de peces y asegurar la liquidez de las empresas. *AECOC*, 30 March 2020. (Available only in Spanish). (also available at <https://www.aecoc.es/articulos/c84-javier-ojeda-tenemos-que-dar-salida-a-la-acumulacion-de-stock-de-peces-y-asegurar-la-liquidez-de-las-empresas/>).
- Organization for Economic Co-operation and Development (OCDE).** 2020. *Fisheries, aquaculture and COVID-19: Issues and policy responses*. OECD Policy Responses to Coronavirus (COVID-19). <http://www.oecd.org/coronavirus/policy-responses/fisheries-aquaculture-and-covid-19-issues-and-policy-responses-a2aa15de/>

- Peter, S., Chopra, S. and Jubbin, J.J.** 2013. A fish a day, keeps the cardiologist away! A review of the effect of omega-3 fatty acids in the cardiovascular system. *Indian Journal of Endocrinology and Metabolism*. 2013 May-Jun; 17(3): 422–429.
- Pham Thi, S.** 2020. Pangasius industry has been hit by COVID-19. *Vietfish Magazine*, 30 March 2020. (also available at <http://vietfishmagazine.com/news/pangasius-industry-has-been-hit-by-covid-19.html><https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3712371/>).
- Ramsden, N. & Harkell, L.** 2020. India exempts aquaculture from lockdown, with extension expected. *Undercurrentnews*, 13 April 2020. (also available at <https://www.undercurrentnews.com/2020/04/13/india-exempts-aquaculture-from-lockdown-with-extension-to-measures-expected/>).
- Rapier, Robert.** 2020. Will COVID-19 Hasten The Demise Of Fossil Fuels?. *Forbes*, 12 July 2020. (also available at <https://www.forbes.com/sites/rpapier/2020/07/12/will-covid-19-hasten-the-demise-of-fossil-fuels/>).
- Regional Risk Communication and Community Engagement (RCCE) Working Group.** 2020. *COVID-19: How to include marginalized and vulnerable people in risk communication and community engagement*. [Cited 17 June 2020]. https://reliefweb.int/sites/reliefweb.int/files/resources/COVID19_CommunityEngagement_130320.pdf
- Santos, A. P.** 2020. Philippine fishermen stranded at sea by pandemic: “We think about jumping overboard”. *Los Angeles Times*, 8 Sept. 2020. (also available at <https://www.latimes.com/world-nation/story/2020-09-08/philippine-fishermen-stranded-at-sea-by-the-pandemic-we-think-about-jumping-overboard>).
- Saudi Press Agency.** 2020a. أسواق الخضراوات والفواكه والأسماك بجدة. مخزون متوفر وأسعار مستقرة. *SABQ online newspaper*. [Cited 26 March 2020]. <https://sabq.org/bQM6mT>
- Saudi Press Agency.** 2020b. أمين جدة يتفقد سوق السمك والخضار. *Al Madina newspaper*. [Cited 20 March 2020]. <https://www.al-madina.com/article/678545>
- Seafish.** 2020a. *Selling fish directly to consumers* [online]. [Cited 15 September 2020]. <https://www.seafish.org/trade-and-regulation/covid-19-support-for-the-seafood-industry/selling-seafood-directly-to-consumers/>
- Seafish.** 2020b. Guidance for seafood businesses on working safely during COVID-19 [online]. [Cited 15 September 2020]. <https://www.seafish.org/trade-and-regulation/covid-19-support-for-the-seafood-industry/guidance-for-seafood-businesses-on-working-safely-during-covid-19/>
- Seafoodnews.** 2020. *Coronavirus Traps Fishing Crew of Japanese Long-Distance Tuna Vessels* [online]. [Cited 15 September 2020]. <https://www.seafoodnews.com/Story/1167571/Coronavirus-Traps-Fishing-Crew-of-Japanese-Long-Distance-Tuna-Vessels>
- Shaaban, A. & Al Khaimah, R.** 2020. COVID-19 in UAE: Fish markets now home-deliver fresh catches. *Khaleej Times*, 29 March 2020. (also available at <https://www.khaleejtimes.com/coronavirus-outbreak/covid-19-in-uae-fish-markets-now-home-deliver-fresh-catches>).
- Undercurrentnews.** 2020. *EU fishing industry calls for urgent measures to secure supply in wake of COVID-19*. 20 March 2020. (also available at <https://www.undercurrentnews.com/2020/03/20/eu-fishing-industry-calls-for-urgent-measures-to-secure-supply-in-wake-of-covid-19/>).
- United Nations.** 2020b. *WHO warns of surge of domestic violence as COVID-19 cases decrease in Europe*. UN Regional Information Centre for Europe. [Cited 17 June 2020]. <https://unric.org/en/who-warns-of-surge-of-domestic-violence-as-covid-19-cases-decrease-in-europe/>
- United Nations.** 2020a. *Policy Brief: The Impact of COVID-19 on Women*. [Cited 17 June 2020]. <https://asiapacific.unwomen.org/-/media/headquarters/attachments/sections/library/publications/2020/policy-brief-the-impact-of-covid-19-on-women-en.pdf?la=en&vs=1406>
- United Nations Women.** 2020. *COVID-19 and Ending Violence Against Women and Girls* [online]. [Cited 12 September 2020]. <https://www.unwomen.org/-/media/headquarters/attachments/sections/library/publications/2020/issue-brief-covid-19-and-ending-violence-against-women-and-girls-en.pdf>

- Virginia Agricultural Research and Extension Centers (VT).** 2020. *Impacts of COVID-19 on U.S. aquaculture, aquaponics, and allied businesses* [online]. [Cited 17 September 2020]. https://www.arec.vaes.vt.edu/arec/virginia-seafood/research/Impacts_of_COVID19.html
- White, C.** 2020. Study provides first comprehensive look at COVID's impact on US seafood industry. SeafoodSource, 22 November 2020. (also available at https://www.seafoodsource.com/news/supply-trade/study-provides-first-comprehensive-look-at-covid-s-impact-on-us-seafood-industry?utm_source=marketo&utm_medium=email&utm_campaign=newsletter&utm_content=newsletter&mkt_tok=eyJpIjoiWWpnM04yRTRNaUxT1RBMSlsluQioiI4VU83TEpJb1o-0VkmwUmttWFBcL2g1XC9kaWJiaFZXd0NaOERkK1BlcHJXUnFxbWVLeWhJcytJRUXyeG0zQW-00S3N5Z2YrdmdMTWdEM3psQmtvMTNuSGgzQmhyYTkNDVWtIVFhReEtmQzBsbXZkbjVTTDBjdG9DZXZcL09cL2VPQ1RQdlwvIn0%3D0).
- World Health Organization (WHO).** 2020a. *WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020* [online]. Geneva. [Cited 12 April 2020]. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>
- World Health Organization (WHO).** 2020b. *COVID-19 and violence against women - What the health sector/system can do* [online]. [Cited 17 June 2020]. <https://www.who.int/reproductive-health/publications/vaw-covid-19/en/>
- World Health Organization (WHO).** 2020c. *Coronavirus disease (COVID-19): Food safety for consumers* [online]. [Cited 17 June 2020]. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-food-safety-for-consumers>
- World Organisation for Animal Health (OIE).** 2020. *Questions and Answers on COVID-19* [online]. [Cited 17 June 2020]. <https://www.oie.int/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019-novel-coronavirus/>
- World Trade Organization (WTO).** 2020. *Agency chiefs issue joint call to keep food trade flowing in response to COVID-19* [online]. [Cited 17 June 2020]. https://www.wto.org/english/news_e/news20_e/igo_26mar20_e.htm
- Xinhua.** 2020. تقرير إخباري: تراجع الحركة بالمطاعم والمجمعات التجارية بالكويت بسبب فيروس كورونا. [Cited 3 March 2020]. http://arabic.news.cn/2020-03/03/c_138839687.htm
- Xuemin, Y.** 2020. COVID-19 Global Roundup: Why have meat factories become hotbeds for coronavirus outbreaks? *CGTN*, 23 June 2020. (also available at <https://news.cgtn.com/news/2020-06-23/Why-have-meat-factories-become-hotbeds-for-coronavirus-outbreaks--RyERNDEg1O/index.html>).
- Zhang, C.** 2020. Coronavirus hits sustainable aquaculture. *China Dialogue Ocean*, 31 March 2020. (also available at <https://chinadialogueocean.net/13453-coronavirus-hits-sustainable-aquaculture/>).

