

Potential impact of Covid-19 pandemic on fisheries export sector in Indonesia: literature review and pointer of future research agenda

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Abstract. The increase in the export volume of fishery products during the Covid-19 pandemic shows that the fisheries sector contributes to the national economy. This study aims to analyze the factors that cause fishery export performance to experience a positive trend during the Covid-19 pandemic. The study systematically reviews the literature to identify, assess, and interpret all available research evidence to answer specific research questions. The results showed that in the case of fish and shrimp export performance, the Covid-19 pandemic had a positive impact, but previous studies generally showed negative results.

Key Words: fish, shrimp, positive performance, systematic literature review.

Introduction. Since designated as a pandemic by the World Health Organization (WHO), the Covid-19 pandemic has put economies in various countries at their worst. European countries are experiencing the deepest growth contraction. No different, in Asia, the Philippines, Singapore and Hong Kong are some countries experiencing recession and negative growth that is very nosedived (Dwi Anggi 2020). In Indonesia, the impact of Covid-19 made the economy under worse pressure than the global financial crisis in 2008/2009. Indonesia's economic growth in the first quarter of 2020 was recorded at 2.97% (YoY) and in the second quarter by -5.32% (YoY), while in the third quarter, it grew by -3.49% (YoY) or improved from the previous quarter (Central Bureau of Statistics 2020).

Indonesia's marine and fisheries sectors play an important role in the national economy as a maritime country. According to Anisyah (2020), the fisheries sector contributes 7% to Indonesia's Gross Domestic Income (GDP). Furthermore, the Covid-19 pandemic has significantly impacted the fisheries sector. Movement space restrictions forced fishermen to stop fishing for several weeks. On April 23, 2020, www.liputan6.com released news about dozens of fishers in Cirebon being forced to stop going to sea due to the effects of the pandemic (Prayitno 2020; Ranny 2020).

A total of 26,675 Fisheries Households (RTP) were affected by COVID-19 due to plummeting fish prices and marketing for closed exports (Efrizal 2020; Ranny 2020). The cost of fish dropped by 50 percent or more. The price of octopuses fell by 75 percent because local collectors buy at low prices, so fish sales only occur at the local level (Paino 2020).

In addition, the policy of closing some areas also affects the absorption of fishery production of fishers. Fishers in some areas have difficulty selling fish and getting a reasonable price. However, despite declining fish prices, Indonesia's exports showed a positive trend. Based on statistics from the Ministry of Trade (2020), fisheries export data in January-September 2020 was recorded at USD 2.72 billion or grew 8.82 percent compared to the same period in 2019.

Due to the coronavirus outbreak, restrictions on trade relations with China have prompted Indonesia to increase exports of its seafood products to other key markets, including the United States and European countries. The market is an ideal destination for shrimp and tuna from Indonesia, mainly processed, ready-to-eat, and canned seafood products, which have been in demand at the retail level during the pandemic (FAO 2020). According to data from Indonesia's Central Statistics Agency (Central Bureau of Statistics 2020), the country exported \$427.7 million (EUR 394 million) worth of seafood in March, up 6.34 percent from February. In the first quarter, Indonesia's seafood export volume increased 10.96 percent year-on-year to 295,130 metric tons (MT), valued at USD 1.24 billion (EUR 1.14 billion), up 9.8 percent from a year earlier. The U.S. was the largest buyer of seafood products from Indonesia, buying volumes worth USD 508.7 million (EUR 469 million), followed by China with USD 173.2 million (EUR 160 million) (KKP 2020).

In addition to shifting exports from China to the U.S. and Europe, Indonesia also grabbed China's export market share, which declined due to the Covid-19 pandemic. Of the total export value in the first three months, shrimp sales accounted for USD 466.2 million or 37.6 percent of the total. The value of tuna exports in the period was recorded at USD 176.6 million, or 14.2 percent of the whole. In the first quarter, it earned USD 131.9 million from squid and octopus exports, USD 105.3 million from crab exports and USD 53.75 million from seaweed exports (Ministry of Trade 2020).

For this reason, the fisheries subsector has become one of the mainstay sectors to boost national economic growth through export routes. This study aims to analyze the factors that cause fishery export performance to experience a positive trend during the Covid-19 pandemic. With fish export arising during the Covid-19 pandemic, it helps the marine and fisheries sector remain strong in the face of the Covid-19 pandemic conditions so that the welfare of small fishers and coastal communities does not decrease too profoundly due to the loss of products and reduced market demand.

This condition justifies the implementation of research, wherein previous studies generally showed the negative impact of pandemics on fishery exports. Still, fishery export data in Indonesia shows different conditions. The study systematically reviews the literature to identify, assess, and interpret all available research evidence to answer specific research questions. According to Kitchenham and Charters (2007), a systematic literature review (SLR) aims to identify, evaluate, and interpret all relevant research on the particular subject area studied.

Material and Method

Description of the study sites. The research was carried out from June to July 2020 in Indonesia. Indonesia is one of the world's leading producers of fish and shrimp, with a big fisheries sector (Figure 1). In 2018, Indonesia occupied the second position as the second most significant contributor to world fishing production, reaching 7.2 million tons. In addition, in the same year, Indonesia ranked 3rd as the world's leading aquaculture producer, with a production of 5.4 million tons.

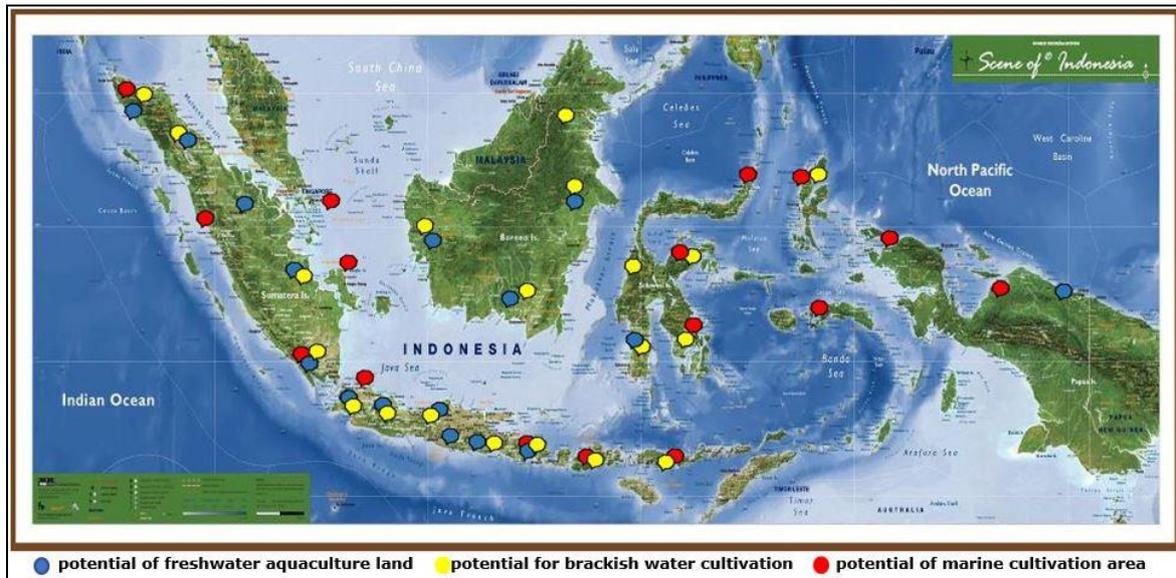


Figure 1. Indonesian fishery map (map source: KKP 2021).

This study focused on the export performance of fish and shrimp that experienced positive performance despite restrictions on activities due to the Covid-19 pandemic. The object of this study was not only shrimp and fish that experienced positive performance, but also processed products and canned foods of fish and shrimp, which also experienced an increase in exports.

Data collection. Secondary data used in the study was obtained from the Ministry of Trade, Ministry of Marine Affairs and Fisheries (KKP), NGOs in Indonesia and international institutions.

Data analysis. Data analysis was done through systematic literature review (SLR) or systematic review. There are four types and forms of literature review: formal assessment, systematic mapping study, systematic literature review, and tertiary study. This study uses the SLR method. A systematic literature review aims to provide as complete a list as possible of all the published studies relating to a particular subject area (Kitchenham & Charters 2007). The systematic review in this paper identified 33 papers from previous relevant journals.

Results. In the situation of the COVID-19 pandemic, fishing communities are impacted differently. It is based on the thought that the scale of the impacts encountered by small fishermen and big fishermen are different. Small anglers, for example, meet the most vulnerable conditions due to limited livelihood diversification opportunities. Bennet et al (2020) revealed negative impacts on small-scale fisheries such as stalled fishing, fishers' health risks, disrupted market access, and illegal fishing is increasing.

While for large fishers, the pandemic impacts consumer demand, either from restaurants or hotels, also decreased due to restrictions on activities so that many retail businesses closed. Furthermore, Mardhia et al (2020) research shows that the prices of fish caught are reduced due to fishers' income. At the same time, closures in some regions also cause fish supply chain disruption. According to Anta (2020), when the fish distribution chain is disrupted, the heaviest impacts are coastal areas that do not have cold storage as fish shelters. As a result, fish caught are wasted or sold at low prices.

The study results align with Love et al (2021), which revealed that the seafood and trade sectors are disrupted by sudden shifts in demand, supply and limited movement of people and goods. Fresh fish caught locally declined due to fleet lockdowns, but household consumption of frozen and canned fish remained stable or increased.

Seafood companies sell frozen and preserved food products. Having an emotional and close relationship with retailers can reduce the risk of a contraction in production. A close relationship with the retailer is considered a more advantageous position. However, small and medium-sized businesses may have to reduce their activities as financial risks in the scenario increase costs (Villasante et al 2021).

Fish export performance in 2020. Our results show that in 2020 the export performance of fish and shrimp (H.S. 03) was excellent. Citing data from the Ministry of Trade (2020), the export value of fish and shrimp in October 2020 amounted to USD 362.7 million, up 11.3% Month over Month (MoM) and 14.4% YoY. While by volume, fish and shrimp exports in October 2020 reached 85.5 thousand tons, growing 12.8% (MoM) and 17.1% YoY. The cumulative fish and shrimp exports reached USD 2.9 billion in January-October 2020, rising 11.5% compared to the previous year. By volume, fish and shrimp exports in the same period reached 695.2 thousand tons growing 18.8% YoY (Ministry of Trade 2020).

Some factors that cause fish export to rise are the following. First, the Government supports the sale of national fish products with the opening of aircraft cargo to China, Japan and South Korea to encourage exports of fishery products and keep the national economy reasonable, and also support the import of goods for people's needs in the conditions of the Covid-19 pandemic (Ministry of Communication and Informatics 2020). Second, the market absorbs the catch of traditional fish as a whole. It can be seen from the results of the Indonesian Traditional Fishermen's Union (KNTI) survey, which showed that during the pandemic, the economic rate of fishers improved throughout 2021 because the catch of traditional fishers was entirely absorbed by the market (KKP 2021).

However, in contrast to fish exports that experience growth, precisely the price of fish shown in the fish price index decreased. Noted, the cost of the fish index in September 2020 fell by 2.1% (MoM), and cumulatively the price of the fish index in January-September 2020 decreased by 7.9% compared to the same period last year (FAO 2020).

Thus, the interim analysis is that fish exports continue to grow despite the decline in fish prices. The world demand for Indonesian fish and shrimp products remains high amid a decrease in demand for various products. This positive performance needs to be maintained to contribute to the increase in Indonesian exports. In 2018, Indonesia was ranked second as the most significant contributor to world fishing production with 7.2 million tons. In contrast, China's occupied first rank, with production reaching 14.6 million tons (FAO 2020). Indonesia ranked third as the world's top aquaculture producer in 2018, producing 5.4 million tons. China is the first rank of the world's aquaculture producers, with production reaching 47.6 million tons, then India in second place with 7.1 million tons (Ministry of Trade Indonesia 2020).

Based on Central Bureau of Statistics (BPS) (2020) realization figures, Indonesia's fish and shrimp exports (H.S. 03) in the January-September 2020 reached USD 2.5 billion or grew 11.1% (YoY). The main export product from Indonesian fish and shrimp exports in the January-September 2020 period was frozen white shrimp (H.S. with an export value reaching USD 544.4 million, growing 31.9% (YoY). The export share of this product reaches 21.6% of Indonesia's total exports to the fish and shrimp products group (HS 03061729). Most after that are sotong/frozen squid (HS 03074310) with an export value of USD 237.8 million (export share of 9.5%), grew 0.6% (YoY) and frozen fish/fillet hemisphere from tuna/cakalang with an export value of USD 155.4 million (6.2% share%), grew 0.5% (YoY) as shown in Table 1.

Table 1

Main products of Indonesian fish and shrimp exports

No	HS	Description	Export value: million US\$				Change (%)	Trend (%)	Share (%)	
			2017	2018	2019	Jan - Sep				
						2019				2020
		<i>Total</i>	3273.31	3218.96	3268.80	2264.41	2516.60	11.14	5.23	100
1	03061729	Whiteleg shrimp (<i>Litopenaeus vannamei</i>)	525.52	488.44	592.77	412.88	544.37	31.85	6.24	21.63
2	03074310	Cuttle fish	263.34	367.71	389.29	236.33	237.85	0.64	24.97	9.45
3	03048700	Frozen fillet of tunas	93.74	207.71	217.44	154.62	155.38	0.49	29.08	6.17
4	03061711	Giant tiger prawn	222.32	174.36	162.94	101.89	136.95	34.41	21.80	5.44
5	03061722	Whiteleg shrimp (<i>Litopenaeus vannamei</i>)	137.19	166.09	114.25	84.40	128.18	51.87	2.52	5.09
6	03061721	Whiteleg shrimp (<i>Litopenaeus vannamei</i>)	300.93	275.75	128.53	94.84	100.17	5.62	-15.78	3.98
7	03061790	Other shrimp and prawn, frozen and fit	87.82	111.73	168.89	127.65	94.40	-26.05	21.71	3.75
8	03048900	Frozen fillet of other fish	94.76	105.52	123.11	85.73	89.29	4.15	22.49	3.55
9	03038919	Other marine fish, frozen, excl. edible fish	52.42	91.46	136.50	92.88	87.88	-5.39	38.80	3.49
10	03038914	Savai hairtails, Belanger's, Reeve's & Biges	34.82	31.63	40.56	17.96	57.32	219.18	1.94	2.28
		Others	1460.45	1198.57	1194.53	855.25	884.81	3.46	-2.33	35.16

Furthermore, when viewed from the top destination country to export fish and shrimp products (H.S. 03) from Indonesia in January-September 2020, the United States has an export value of USD 964.5 million shares, reaching 38.3%. Next are China, with an export value of USD 434.7 million (17.3% share) and Japan, with an export value of USD 303.5 million (12.1% share), as shown in Table 2.

Table 2

Destinations for Indonesian fish and shrimp exports

No	Country	Export value: million US\$				Change (%)	Trend (%)	Share (%)
		2015	2019	Jan - Sep				
				2019	2020			
	<i>Total</i>	2658.64	3268.80	2264.41	2516.60	11.14	5.23	100
1	United States	984.94	1193.21	844.00	964.54	14.28	4.60	38.33
2	China	223.00	589.25	357.73	434.74	21.53	28.16	17.27
3	Japanese	476.88	459.21	341.79	303.53	-11.20	-0.24	12.06
4	Thailand	84.09	78.90	53.82	116.33	116.14	-1.98	4.62
5	Vietnam	139.09	144.94	92.69	101.34	9.33	-2.71	4.03
6	Taiwan	76.71	124.94	82.78	99.19	19.83	13.24	3.94
7	Malaysia	134.64	128.17	91.04	90.04	-1.10	-1.69	3.58

8	Singapore	98.58	82.05	59.18	57.79	-2.35	-3.18	2.3
9	Hong Kong	61.90	84.30	58.04	49.95	-13.93	8.89	1.98
10	Italy	55.22	50.01	41.25	45.12	9.38	0.02	1.79

Furthermore, the primary market for Indonesia's fresh fish exports in the January-September 2020 period was China, with an export value of USD 167.4 million, growing 65.5% (YoY). Then the second position is Thailand, with an export value of USD 96.1 million or up by 256.7% (YoY). The third-largest place in Japan, with an export value of USD 23.82 million or down by 31.5% (YoY). Table 3 provides a complete explanation.

Table 3

Main markets for Indonesia's fresh fish exports

No	Country	Export value: million US\$				Change (%)	Trend (%)
		2015	2019	Jan - Sep			
	Total	329.20	427.34	282.90	401.00	41.75	5.25
1	China	49.05	178.79	101.09	167.35	65.54	37.40
2	Thailand	64.00	43.36	26.29	96.14	265.66	-7.23
3	Japan	35.34	46.83	34.78	23.82	-31.52	6.20
4	Taiwan	13.25	24.41	16.77	16.38	-2.38	12.00
5	Malaysia	8.92	16.17	11.83	11.02	-6.86	14.86

The primary export market of Indonesia's fish hemisphere/fillet in January-September 2020 is the United States, with an export value of USD 182.1 million or a decrease of 5.9% (YoY). Other key markets are Japan, with an export value of USD 44.9 million and Italy, with an export value of USD 23.4 million. Indonesia's fish/fillet exports in the Japanese market also fell by 13.2% (YoY), but Indonesia's exports in the Italian market increased significantly to reach 1,507.3% (YoY) in January-September 2020 period, as shown in Table 4.

Table 4

Main markets for Indonesian fish hemisphere exports/fillets

No	Country	Export value: million US\$				Change (%)	Trend (%)
		2015	2019	Jan - Sep			
	Total	572.56	686.96	482.18	487.34	1.07	5.21
1	United States	185.89	272.76	193.48	182.14	-5.86	10.95
2	Japanese	59.49	72.71	51.78	44.94	-13.22	8.7
3	Italian	16.77	2.21	1.46	23.43	1507.29	-36.70
4	Malaysia	22.85	21.26	14.44	18.98	31.44	-4.32
5	China	3.88	25.22	13.38	14.64	9.46	54.15

With previously shown data, it can be analyzed that Indonesia's fish and shrimp export performance (H.S. 03) did not experience shock during the pandemic, even though the price of the fish index decreased. For this reason, the government must be able to help strengthen promotion so that the export performance of fish and shrimp that has been good, will increase again. However, the government also needs to improve the export of fish or shrimp and fish products (HS 1604) or processed shrimp (HS 1605). It is due to the increasing importance of retail sales in the consumption patterns of the world community due to the Covid-19 pandemic.

In addition, consumers who restrict visits to hotels and restaurants have shifted their preferences for fresh seafood consumption to preserved or packaged products (FAO 2020). Therefore, sales of canned tuna, sardines, and mackerel are expected to increase. Decreased household income due to the pandemic is also predicted to cause a decrease in demand for fish or shrimp products at high prices (FAO 2020)

The FAO data can be one factor causing the increase in Indonesian exports for packaged fish/shrimp processed products, especially in packaged shrimp exports. Indonesia's packaged shrimp exports (HS 1605) in the January-September 2020 period amounted to USD 636.1 million, an increase of 22.1% (YoY). However, exports of packaged fish (HS 1604) in the same period amounted to USD 328.0 million, down 12.6% (YoY). In total, the export value of Indonesian processed fish/shrimp in January-September 2020 amounted to USD 964.0 million, growing 7.6% (YoY). While in volume, exports in the same period amounted to 143.8 thousand tons, rising 5.7% YoY (Ministry of Trade 2020).

It is linear with the research results from Villasante et al (2021), showing that canned food production and importing and exporting of processed and preserved seafood products followed an upward trend during the Covid-19 pandemic. We note changes in the consumption behavior of the Galicia resident, which significantly increased spending on fresh and canned seafood products during the first confinement (Villasante et al 2021).

The results of Love et al (2021) study revealed that fresh fish caught locally decreased due to fleet lockdown, but household consumption of frozen and canned fish remained stable or increasing.

Consumer response has primarily been conditioned by public health measures that have restricted people to their homes, such as panic buying, changes in people's behavior from buying in restaurants to retail purchases, home delivery and local seafood purchases (Xia 2020).

High-income countries have focused on purchasing seafood products with longer shelf life and frozen products. In contrast, early examples of declining household incomes in low-income food-deficit countries have shifted to staple foods and away from nutrient-dense foods like fish (Hivrvonen et al 2020).

The shift was due to SARS-CoV-2 being detected on seafood packaging in China, causing concern for seafood safety (Liu et al 2020). However, the most common transmission route is respiratory from person-to-person (Vella et al 2020).

Discussion. To minimize the impact of the Covid-19 pandemic, the Government must resolve correctly and appropriately issues related to public health protection and prevention of economic crises. It can be seen in creating short-term coping strategies to address the immediate challenges posed by the problem. For example, from the beginning, many governments, including in Russia, Canada, and South Africa (Seaman 2020; www.undercurrentnews.com 2020c; Oirere 2020), appointed fishermen, fish farmers, and fish processors as "essential workers" who allow them to operate to maintain food supplies.

Protective measures must be taken to safeguard workers' health, such as social protection to reduce the socioeconomic toll from the pandemic and keep enterprises running (Bloom 2020; Low Impact Fisheries of Europe 2020).

While in Indonesia, the Government's short-term coping strategy to help Indonesian fisheries businesses during the Covid-19 pandemic, including the purchase of fishery products by state owned enterprises (SOEs) and local governments to reduce the buildup of fish stocks, social assistance for fishing families and farmers, relaxation of debt for small-scale fisheries businesses, placement of cold storage according to the availability of fish stocks, implementation of warehouse receipt system, and the expansion of the coverage of Minister of Finance Regulation No.23 of 2020 on Tax Incentives for Taxpayers Affected by the Coronavirus Outbreak (Ministry of Communication and Informatics 2020).

In addition, several steps taken by the government to improve the welfare of fishers are fishers' insurance programs, funding facilities, business diversification training, arrangements for the transportation of seeds, feed and fishery products in some

areas that implement PSBB, support for smooth fisheries exports, cold storage management, and fishing boat licensing and relaxation for sea vessels (Henny 2021).

According to Kaewnuratchadasorn (2020), there are 50% more small-scale fishers in Southeast Asia and the groups most vulnerable to the impact of the Covid-19 pandemic. Restrictions on fishing activities, limited transportation and movement, and tourism disruptions have directly impacted small-scale fisheries.

This condition certainly impacts the reduced income of fishers due to falling fish production and low demand for fish products, decreasing fish prices. However, if observed wisely, the condition can offer family members of fishers who lose their jobs. It can be an opportunity to increase further their involvement in small-scale fisheries, especially skills in e-marketing and product promotion through social media. Industrial era 4.0 certainly provides opportunities for them to increase the marketing of fish products.

Women and youth can utilize e-commerce to explore skills in fish processing related to the safety and quality of fish products, considering that fish catches from small fishers are often sold in wet or local markets for local consumption and tourism. With this form of digital marketing, small-scale fisheries will ultimately improve small fishers' food security and livelihood opportunities.

In the era of industry 4.0, technology benefits companies in terms of online sales because promotional activities and product marketing can be directly connected with consumers. However, reliance on technology as a solution to the crisis may increase inequality across the seafood value chain, as these tools are not available to everyone (Love et al 2021).

One of them can be anticipated by facilitating fisherwomen's economic development through digital training in fishers' cooperatives. Thus, they have the skills to market their products through online systems. In addition, other efforts that governments can make are health protection and education, such as the socialization of health protocols in fishing villages that are difficult to reach by the government.

Conclusions. The results showed that fish and shrimp export performance experienced a positive trend. The increase in exports of fish/shrimp products in packaging also increased. It is in line with the change in the preference of fresh seafood consumption to preserved or packaged products. Thus, the results of this study show that the Covid-19 pandemic has positively impacted the export of fish and shrimp products and fish /shrimp products in packaging.

Some of the efforts made by the government to maintain the export performance of fish and shrimp are (1) the opening of aircraft cargo to China, Japan and South Korea to encourage the export of fishery products out; (2) the purchase of fishery products by SOEs and local governments to reduce the buildup of fish stocks; (3) relaxation of debt for small-scale fisheries businesses; (4) placement of cold storage according to the availability of fish stocks; (5) implementation of Warehouse Receipt System, and expansion of coverage of Ministry of Finance No. 23 of 2020 on Tax Incentives for Taxpayers Affected by Coronavirus Outbreak (Ministry of Communication and Informatics 2020).

Conflict of interest. The authors declare no conflict of interest.

References

Anisyah A. F., 2020 [The contribution of fisheries to the Indonesian economy is still very small]. <https://www.merdeka.com/uang/kontribusi-perikanan-ke-perekonomian-indonesia-masih-sangat-kecil.html> (Accessed on October 09, 2021) [in Indonesian].

- Anta M. N., 2020 [Economic recession, pandemic, and fishermen's distress]. <https://www.mongabay.co.id/2020/10/19/resesi-ekonomi-pandemi-dan-kesusahan-nelayan> (Accessed on October 09, 2021) [in Indonesian].
- Bennett N. J., Finkbeiner E. M., Ban N. C., Belhabib D., Jupiter S. D., Kittinger J. N., Mangubhai S., Scholtens J., Gill D., Christie P., 2020 The COVID-19 Pandemic, small-scale fisheries and coastal fishing communities. *Coastal Management*. doi: 10.1080/08920753.2020.1766937
- Dwi Anggi N., Rizki S., Kartika S., Wignyo P., Andi Y. T., Affan H. I., 2020 COVID-19 timeline notes of young analysts. Gramedia: Jakarta.
- Efrizal R., 2020 [Impact of COVID-19, fishermen in South Sumatra sell fish at a low price]. <https://sumsel.idntimes.com/news/sumsel/muhammad-rangga-erfizal/dampak-covid-19-nelayan-di-sumsel-jual-ikan-dengan-harga-miring/4> (Accessed on April 24, 2021) [in Indonesian].
- Henny R. S., 2021 The government is committed to improving the welfare of fishers in times of pandemics. <https://www.merdeka.com/peristiwa/pemerintah-berkomitmen-tingkatkan-kesejahteraan-nelayan-di-masa-pandemi.html> (Accessed on October 11, 2021) [in Indonesian].
- Hivrvonen K., Abate G. T., De Brauw A., 2020 Survey suggests rising risk of food and nutrition insecurity in Addis Ababa, Ethiopia, as COVID-19 restrictions continue. International Food Policy Research Institute (IFPRI). <https://www.ifpri.org/blog/survey-suggests-rising-risk-food-and-nutrition-insecurity-a-Addis-Ababa-Ethiopia-covid-19> (Accessed on October 11, 2021).
- Kaewnuratchadasorn P., Smithrithee M., Sato A., Wanchana W., Tongdee N., Sulit V. T., 2020 Southeast Asian fisheries development center capturing the impacts of COVID-19 on the fisheries value chain of Southeast Asia. Southeast Asian Fisheries Development Center. Volume 18(2):2-8.
- Kitchenham B., Charters S. M., 2007 Guidelines in performing systematic literature reviews in software engineering. EBSE Technical Report version 2.3.
- Liu P., Yang M., Zhao X., Guo Y., Wang L., Zhang J., 2020 Cold-chain transportation in the frozen food industry may have caused a recurrence of COVID-Nineteen cases in destination: successful isolation of SARS-CoV-2 virus from the imported firm cod package surface. *Bio safe. Health*. doi: 10.1016/j.bsheel.2020.11.003.
- Love D. C., Allison E. H., Asche F., Belton B., Cottrell R. S., Froehlich H. E., Gephart J. A., Hicks C. C., Little D. C., Nussbaumer E. M., da Silva P. P., Poulain F., Rubio A., Stoll J. S., Tlusty M. F., Thorne-Lyman A. L., Troell M., Zhang W., 2021 Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system. *Glob. Food Sec.* 28:100494. <https://doi.org/10.1016/j.gfs.2021.100494>.
- Mardhia D., Kautsari N., Ilham Syaputra L., Ramdhani W., Okta Rasiardhi C., 2020 [Implementing health protocols and the impact of Covid-19 on fishery commodity prices and fishing activities]. *Indonesian Journal of Applied Science and Technology*, 1(2):80-87 [in Indonesian].
- Oirere S., 2020 South Africa spares fishing industry from lockdown restrictions. *Seafood Source*. <https://www.seafoodsource.com/news/supply-trade/south-africa-spares-fishing-industry-from-lockdown-restrictions> (Accessed on October 09, 2021).
- Paino C., 2020 [Fishers affected by pandemic, here is the Gorontalo government's strategy and Central Sulawesi's strategy]. <https://www.mongabay.co.id/2020/05/31/nelayan-terdampak-pandemi-begini-strategi-pemerintah-gorontalo-dan-sulawesi-tengah> (Accessed on October 09, 2021) [in Indonesian].
- Prayitno P., 2020 [Stories of dozens of Cirebon fishermen stopped going to sea due to Covid-19]. <https://www.liputan6.com/regional/read/4235301/cerita-puluhan-nelayan-cirebon-berhenti-melaut-imbac-covid-19> (Accessed on April 23, 2021) [in Indonesian].

- Pierre S., 2020 South Africa spares fishing industry from lockdown restrictions. *Seafood Source*. <https://www.seafoodsource.com/news/supply-trade/south-africa-spares-fishing-industry-from-lockdown-restrictions> (Accessed on October 11, 2021)
- Ranny R., 2020 [COVID-19 pandemic and fishermen: questioning the impact on livelihood sustainability]. <https://pmb.lipi.go.id/pandemi-covid-19-dan-nelayan-menyooal-dampak-pada-keberlanjutan-penghidupan> (Accessed on October 11, 2021) [in Indonesian].
- Seaman T., 2020 Russian pollock firms adapt to quarantine measures as fishing continues in country's paid week off. *Undercurrent News*. <https://www.undercurrentnews.com/2020/04/02/russian-pollock-firms-adapt-to-quarantine-measures-as-fishing-continues-in-countrys-paid-week-off> (Accessed on October 09, 2021).
- Seaman T., Haskell L., 2020 Chile, Norway sellers redirect salmon to the U.S. as coronavirus-hit China cancels orders. *Undercurrent News*. <https://www.undercurrentnews.com/2020/01/28/chile-norway-sellers-redirect-salmon-to-us-as-coronavirus-hit-china-cancels-orders> (Accessed on October 09, 2021).
- Vella F., Senia P., Ceccarelli M., Vitale E., Maltezou H., Taibi R., 2020 Transmission mode associated with coronavirus disease 2019: a review. *Health 1, 2. Eur Rev Med Pharmacol Sci*. 24(14):7889-7904.
- Villasante S., Tubío A., Ainsworth G., Pita P., Antelo M., Da-Rocha J. M., 2021 Marine fisheries, aquaculture and living resources. Rapid Assessment of the COVID-19 impacts on the Galician (NW Spain) seafood sector. doi: doi.org/10.3389/fmars.2021.737395.
- Xia R., 2020 Environmental groups urge Americans to eat more fish while hunkering down against virus. *Los Angeles Times*. <https://www.latimes.com/california/story/2020-03-20/environmental-groups-support-local-fishermen-during-coronavirus-pandemic> (Accessed on October 09, 2021).
- *** Bloom, 2020 [Bloom and 390 professionals in the fishing sector, leaders and elected officials launch a citizen appeal to the French government to safeguard small-scale coastal fishing]. <https://www.bloomassociation.org/appel-citoyen-petite-peche> (Accessed on October 11, 2021) [in French].
- *** Central Bureau of Statistics, 2020 [Indonesia's economic growth quarter III-2020]. No. 85/11/Th. XXIII, 5 November 2020 [in Indonesian].
- *** Food and Agriculture Organization (FAO), 2020 Food Outlook - Food Outlook - Biannual Report on Global Food Markets. <http://www.fao.org/documents/card/en/c/cb1993en> (Accessed on October 19, 2021).
- *** Food and Agriculture Organization (FAO), 2020 FAO yearbook. Fishery and aquaculture statistics 2018/FAO annuaire. <http://www.fao.org/documents/card/en/c/cb1213t> (Accessed on October 19, 2021).
- *** Food and Agriculture Organization (FAO), 2020 Food outlook - Biannual report on global food markets - November 2020. Rome. <https://doi.org/10.4060/cb1993en>. 7p (Accessed on October 19, 2021).
- *** Low Impact Fisheries of Europe, 2020 Covid-19 and small-scale fisheries. <https://lifeplatform.eu/covid-19-and-small-scale-fsheries> (Accessed on October 19, 2021).
- *** Ministry of Marine Affairs and Fisheries (KKP), 2021 Indonesia fishery map. https://www.djpb.kkp.go.id/index.php/mobile/arsip/c/423/peta-potensi-perikanan-budidaya-indonesia/?category_id=8 (Accessed on October 21, 2021).
- *** Ministry of Marine Affairs and Fisheries Indonesia (KKP), 2021 [Survey: Fishermen's economy improves amid pandemic]. <https://kkp.go.id/artikel/32261-survei->

- ekonomi-nelayan-membaik-di-tengah-pandemi (Accessed on October 21, 2021)[in Indonesian].
- *** Ministry of Marine Affairs and Fisheries Indonesia (KKP), 2020 [Quarter I 2020, THE value of fishery exports reaches USD 1.24 billion]. <https://kkp.go.id/artikel/18769-triwulan-i-2020-nilai-ekspor-perikanan-capai-usd1-24-miliar> (Accessed on October 11, 2021) [in Indonesian].
- *** Ministry of Trade Indonesia, 2020 [Optimizing the utilization of SRG in the fisheries sector, the Ministry of Trade and the Ministry of Marine Affairs and Fisheries (KKP) released tuna exports to South Korea]. <https://www.kemendag.go.id/en/newsroom/press-release/optimalkan-pemanfaatan-srg-di-sektor-perikanan-kemendag-bersama-kkp-lepas-ekspor-ikan-tuna-ke-korea-selatan> (Accessed on October 21, 2021) [in Indonesian].
- *** Ministry of Trade Indonesia, 2020 [Development of Indonesia's trade balance in October 2020]. http://bppp.kemendag.go.id/media_content/2020/11/nl_november_2020_compressed.pdf (Accessed on October 21, 2021) [in Indonesian].
- *** Ministry of Communication and Informatics Indonesia, 2020 [The government strengthens the maritime and fishery sector in facing the Covid-19 Pandemic]. <https://www.kominfo.go.id/content/detail/25911/pemerintah-perkuat-sektor-kelautan-dan-perikanan-hadapi-pandemi-covid-19/0/berita> (Accessed on October 21, 2021) [in Indonesian].
- *** Undercurrent News, 2020 Canadian gov't declares seafood sector essential during pandemic. Follows Provinces Undercurrent News. <https://www.undercurrentnews.com/2020/04/03/canadian-govt-declares-seafood-sector-essential-during-pandemic-follows-provinces> (Accessed on October 15, 2021).

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