Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company’s public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Impact of COVID-19 and closed fishing season on commercial fishers of Davao Gulf, Mindanao, Philippines

Edison D. Macusi, John Kenny A. Rafon, Erna S. Macusi

ARTICLE INFO
Keywords: COVID-19, Closed fishing season, Davao gulf, Davao region, Commercial fisheries

ABSTRACT
Understanding the disruption of fishing activities due to COVID-19 and closed fishing season can provide an immediate reference for policy directions that help the government direct its resources to the most affected agricultural sectors. This study examined the impact of COVID-19 and closed fishing season on the commercial fishers’ fishing operation and economic well-being in Davao Gulf, Mindanao. A total of N = 66 commercial fishers, 33 ringnet and 33 bagnet fishers were interviewed one-on-one in their homes and in the landing sites using a semi-structured questionnaire. Data was further validated using four focus groups in the study areas (N = 55). The findings of the study showed that the average catch per fishing trip for ringnet and bagnet fishers were 1,719 kg and 417 kg. The common catch species of ringnets were bigeye scad (Selar crumenophthalma), bullet tuna (Auxis rochei), roundsca (Decapterus macrosoma), skipjack tuna (Katsuwonus pelamis), and yellowfin tuna (Thunnus albacares). While the common catch species of bagnet fishers were roundscad (Decapterus macrosoma), Bali sardinella (Sardinella lemuaru), moonfish (Mene maculata), short mackerel (Rastrelliger brachysoma), anchovy (Engraulidae), and bigeye scad (Selar crumenophthalma). Both types of fishers operated at the height of the pandemic but met difficulties selling the fish due to travel restrictions. Thus, they had lesser income. Other impacts include disruption in their children’s education, feeling fearful and frustrated. In addition, during the closed fishing season, the bagnet fishers find alternative livelihoods such as hired labor and construction. In contrast, ringnet fishers fish beyond the Davao Gulf and continue to do so until the closed fishing season ends.

1. Introduction

The COVID-19 outbreak has become one of the largest public health crises of our time (Ozdemir, 2020). Coronavirus disease 2019 (COVID-19) is an infectious disease caused by a newly discovered coronavirus that can be fatal (Ozdemir, 2020). In 2020, the world faced COVID-19, a globally effective virus leading to mass losses and socio-economic panic (Ozdemir, 2020). The pandemic profoundly altered the way people live their lives and experience the world, the combined effects of the virus and the strategies to control its spread have caused increased social isolation, financial insecurity, and uncertainty about the future (Cucinotta and Vanelli, 2020). The virus spreads from one person to another through droplets produced from the respiratory system of the infected people during coughing or sneezing (McLeod et al., 2020). It was first documented in Wuhan, Hubei Province, China in December 2019 (Xiao et al., 2015; Zhu et al., 2020). Shortly after that, on March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus outbreak a global pandemic (Buhej et al., 2020; Cucinotta and Vanelli, 2020; Mishra et al., 2020). In the Philippines, the first case was investigated on January 22, 2020 (Edrada et al., 2020). Following its occurrence, the Philippine government has enforced sweeping preventive measures to contain further transmission. In March of 2020 with the onslaught of the COVID-19 the lives of working adults changed exponentially, and so did the lives of children (Edrada et al., 2020). These measures involved imposing strict home quarantine, implementing lockdowns in places with positive COVID-19 cases, suspending public transportation systems, and restricting air and sea travel (Lau et al., 2020). These measures, however, have triggered an economic crisis that has affected almost all sectors of society, from livelihood, education, logistics, transport, markets, and every health sector (Bank, 2020; Bennett et al., 2020; Cao et al., 2020; Pedrosa et al., 2020; Saladino et al., 2020). In the fisheries sector, negative impacts include...
market closures due to port restrictions and the fear of acquiring COVID-19 from the public (Sorensen et al., 2020), reduced fishing activities, and disruption in the fisheries food supply chain as consumer purchasing power has decreased (Gregorio and Ancog, 2020; Zorrieh-zahra et al., 2020). The lack of transportation also reduced fish marketing, while the closure of ice plants and long checkpoint queues resulted in fish spoilage (Mirasol, 2020).

The Philippines’ Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF–EID) was created through Executive Order No. 168, s. 2014 which the Department of Health (DOH) secretary as chair, this inter-agency task force aimed at initiating inter-sectoral collaboration to ensure preparedness and adequate response to assess, monitor, contain, control, and prevent infectious disease epidemics in the country. Recognizing the threat of the novel coronavirus, IATF enacted Republic Act 11469 (2020), otherwise known as the Bayanihan to Heal as One Act, and set community quarantine guidelines to cushion the impact of the COVID-19 pandemic in the country (Atienza et al., 2020). The quarantine includes strict observance of safety and health protocols such as physical and social distancing and closure of non-essential businesses/establishments, including schools. In education, these restrictions resulted in the delay of the opening of classes for both public and private basic education schools and higher education institutions (Tuga et al., 2020). Face-to-face classes have shifted towards online classes, distance learning, flexible learning, and other alternative learning modes to cushion the disruption amidst the pandemic. These platforms, however, have led to some fundamental challenges for students, teachers, parents and administrators. Some of these challenges included lack of internet access, weak yet expensive internet connection, the inadequate skills and experience of both teachers and students in using such platforms, and the inaccessibility of those platforms on a school-wide basis (Ocampo and Yamagishi, 2020).

Amidst the threatening impact of the COVID-19 pandemic, commercial fishers similarly suffered income loss due to the closed fishing season policy being implemented to conserve and protect marine resources (Macusi et al., 2021; Rola et al., 2018). This policy was promulgated in the country since 1989, but was only strictly implemented in 2012 (Bagsit et al., 2021; Napata et al., 2020). Closed fishing seasons are sometimes imposed during the breeding period of harvested species in the belief that this will achieve greater annual reproductive output, but no studies have modelled the validity of this (Arendse et al., 2007). In 2011, this regulation was enforced for three months in the Zamboanga Peninsula to conserve the sardine species and sustain long-term operations for the sardine industry in the region (Brillo et al., 2016; Rola et al., 2018). The adoption of fisheries closures and gear restrictions in the conservation of coral reefs may be limited by poor understanding of the economic profitability of competing economic uses of marine resources (Mcclanahan and Keniano, 2010). Consequently, the implementation has led to income loss among the fisheries workers as the fishing regulation resulted to work suspension. Furthermore, the study revealed that the fisher’s total decrease in income is at Php 25,655 (US $513.51) annually, that is Php 31,898 (US $638.47) in Zamboanga City and Php 19,252 (US $385.35) in Zamboanga del Norte (Brillo et al., 2019). It has been increasingly accepted within the conservation community that conservation policies will not be successful unless they simultaneously speak to local development needs (Villanueva, 2018; Owusu and Andriesse, 2020).

In Davao region, the Davao Gulf is home to many marine ecosystems that support the livelihoods of its fisheries activities. The closed fishing season policy is annually imposed in Davao Gulf to allow the fish stocks to recover and address the declining fish catch (Brillo et al., 2016). Seasonal closure may lead to four main challenges: restricted access to coastal waters, decreased financial capital, decreased fish trading activities and declining small-scale fisheries opportunities (Brillo et al., 2016). There is also a broad consensus that the main problem facing fisheries globally is too many boats chasing too few fish (Fulton et al., 2011). It encompasses multiple fishing activities composed of commercial and small-scale fisheries (Villanueva, 2018). In pursuing their livelihood, fishers develop strategies when faced with changes in regulations and other fishery conditions (Salas and Gaertner, 2004). Closed fishing season for artisanal and inshore fishing is an effective management measure for restoring the fish stock (Adom et al., 2019). At present, there are no published studies that document the impact of the COVID-19 pandemic and closed fishing season policy on commercial fishers in the Davao Gulf, Mindanao. This study fills that gap to investigate the impacts of COVID-19 and closed fishing season on commercial fishing operation and their families’ well-being.

2. Methodology

2.1. Description of study sites

The study was conducted in Davao Gulf mainly in areas that host commercial fishing (Fig. 1). These include the municipality of Governor Generoso in Davao Oriental and the Island Garden City of Samal (IGACOS) in Davao Del Norte. The municipality of Governor Generoso is a second-class municipality with a population of 55,109 people and a land area of 365.75 km². Situated along the west coast of the Pujada Peninsula, it stretches between the Davao Gulf and the Pacific Ocean. Governor Generoso has a total of 2,362 registered fisherfolk (BFAR, 2021a,b).

On the other hand, Samal City (IGACOS) is a fourth-class component city in the province of Davao Del Norte with a population of 104,123 people. It is geographically separated from mainland Mindanao and has a total area of 301.30 km². The island has an estimated length of 34 km and 15 km wide. It is situated at the heart of Davao Gulf. A coastal city, fishing is one of the sources of living of its residents with 7,136 registered fishers (BFAR, 2021a,b).

2.2. Data collection

There are about 65,950 fishers, including both commercial and small-scale fishers, and a total of 11,125 registered boats in Davao region. Of these registered boats, 209 were registered commercial fishing vessels with 125 registered commercial fishing gears wherein 83 of them were bagnets and ringnets (BFAR, 2021a,b). A total of N = 66 respondents were selected with 33 who use ringnets as their primary fishing gear, and another 33 who use bagnets as their main fishing gear. This was approximately 55% out of the 83 bagnet and ringnet users. Respondents included the owners, boat captains, assistant boat captains, operators, and other fishing vessel crew members. The survey was done in the fishers’ homes and landing sites using a semi-structured questionnaire. The questionnaire collected data on the respondents’ socio-demographic profile specifically their (age, education, years in the community), fishing characteristics like (years fishing, number of fishing hours, fish hold capacity, fishing days), and catch characteristics (catch per trip, fish price, revenue). They were asked on their knowledge and experience with regards to the closed fishing season and the pandemic.

The data collection was conducted in February 2021 and as a protocol, the researchers sent permission letters to all barangay captains in the study areas. A follow-up data validation was later conducted in the same areas using four focus groups with total number of participants N = 55 in July 2021; this was 83% out of 66 respondents interviewed last February 2021. The survey and focus group discussion were done in selected barangays in the Island Garden City of Samal and in the municipality of Governor Generoso. This was because Governor Generoso and Samal were known to have more commercial fishers than the rest of the other areas in Davao region. The focus groups were conducted with a brief lecture on the study results showing the summary graphs and tables while the team worked together since the responses from the respondents were many and another person was assigned to take notes.
2.3. Data analyses

Numeric data such as age, education, household size, etc., were checked for their distribution, with the catch and CPUE in particular and plotted onto graphs for visualizations. These data were checked for their normality and homogeneity and then log_{10} transformed when it violated the assumptions of ANOVA. To analyze the data on the influence of various factors on the catch per unit effort (CPUE) during this time of the pandemic, we reduced the number of selected factors into four variables using principal component analysis (PCA) namely fisheries (fish price, number of fishing days, number of fishing hours and number of years fishing), network (membership to community organizations, family of fishers), sociodemographic (age, household size, number of years community, number of years of education), and economics (revenue, access to credit, boat ownership, land ownership). The PCA was used to reduce the number of factors related to the fishing and socioeconomic characteristics that would then be used as predictors in the succeeding multiple linear regression analysis (Macusi et al., 2021). Thus, the obtained variables from the PCA were used to predict what mainly influences the CPUE (dependent variable) using a multiple linear regression. The CPUE was derived from the average catch (kg) and the number of fishing days spent by the fishers. In order to further analyze the data on which factors were highly influencing the volume of catch during the time of pandemic on whether it decreases or remains the same as the pre-pandemic volume of catch, a binary logistic regression was used and different factors were related to the response variable. These variables were shown in Table 1 which showed their description and mean: age (years), education, household size, years in the community, years fishing, catch per trip (kg/trip), number of fishing days, catch per unit effort (kg/day), fish price, fish hold capacity (kg), and revenue. Data analyses were conducted using MINITAB 17.0 (State College, Pennsylvania, USA).

3. Results

3.1. Profile of the respondents

The respondents have a mean age of 46 and range from 19 to 68 years old. The majority of them were married, with an average household size of 5. Their average number of years fishing were 24, with 52 years being the longest fishing experience; they have lived in their village for about 31 years (see Table 1). About 72% of the bagnet fishers were engaged in fishing activities and are active members of a community organization (fisherfolk). In contrast, 97% of the ringnet fishers do not belong to any community organization. The majority of the fishers attended an elementary level of education, and some reached grade eight level for their secondary education.

3.2. Catch characteristics and CPUE (catch per unit effort)

Significant differences can be drawn when comparing the fishing
operations of ringnet and bagnet fishers. Ringnet and bagnet fishers have the average CPUE based on the number of fishing trip was 307 kg/trip for ringnet and 84 kg/trip for bagnet; the difference between the cpue of the two fishing gears was highly significant (df = 1, MS = 4.87, F = 41.90, p = <.0001). Further, the analysis of the CPUE in terms of the influence of the various variables, fisherries, social networks, sociodemographic and economics showed that only the variable economics was highly significant (df = 1, MS = 4.08, F = 38.36, p = <.0001) and the regression as well (df = 4, MS = 1.46, F = 13.75, p = <.0001; R² = 0.48). Revenue and boat ownership contributed highly to the economic variables.

In terms of catch species of ringnets, these were bigeye scad (Seler crumenophthalmus) with the highest frequency (32), followed by bullet tuna (Aristis rochei) with 29, then roundscad (Decapterus macrosoma) with 27, skipjack tuna (Katsuwonus pelamis) with 13, and yellowfin tuna (Thunnus albacares) with the least frequency of 10. In comparison, bagnet fishers caught the following species: roundscad (Thynnus albacares) with 24, moonfish (Mene maculata) with 22, short mackerel (Rastrelliger brachysoma) with 18, and anchovy (Engraulidae) and bigeye scad (Seler crumenophthalmus) having the same frequency of 4 (Fig. 2).

3.3. Effect of COVID-19 on the volume of fish caught

Since the announcement of the first case of COVID-19 in the Davao region, the local governments quickly implemented the enhanced community quarantine (ECQ) in their areas. Major cities and municipalities placed under lockdowns have strictly imposed travel restrictions particularly influenced by variables such as fish price, \( X^2 (1, N=66) = 3.81, p = .051 \); number of fishing days, \( X^2 (1, N=66) = 13.58, p = .0001 \); number of years fishing \( X^2 (1, N=66) = 10.07, p = .002 \); number of years in the community \( X^2 (1, N=66) = 5.45, p = .02 \); age, \( X^2 (1, N=66) = 4.48, p = .034 \); education, \( X^2 (1, N=66) = 12.81, p = .0001 \); and land ownership, \( X^2 (1, N=66) = 3.95, p = .047 \) (see Table 2).

3.4. Coping strategies of the fishers and their families during the COVID-19 pandemic

Based on the results of the focus groups, the pandemic brought stress on the lives of fishers and their families. Half of these fishers confined in their homes have experienced unrelenting fear and frustration thinking about their food supply and bills to pay. Many of them resorted to the food packs delivered by the village chiefs (barangay captain) or food packs delivered by government workers through their doors. The government also provided cash assistance of Php 5,000 to Php 8,000 by virtue of RA 11469 (Republic Act declaring a national emergency arising from the COVID-19 situation) through social amelioration programs from the emergency subsidy to assist fishers and families with low-income. These are validated and assessed by their respective local government units (LGUs) to be financially and economically affected by the declaration of community quarantine due to the COVID-19 pandemic (Reyes et al., 2020). Despite the efforts of the government to extend support to these affected households, some fishers and their families still protested that such assistance was not enough to sustain their needs for the whole duration of the lockdown. One of them mentioned, “Our family is grateful to have received provisions from our local government, but we feel that the food we received was not sufficient for us.” Because of this situation, some have resorted to home gardening and used their produce while waiting to go fishing. Another respondent asserted, “The strict imposition of lockdowns has awakened my interest in home gardening. I found it helpful in relieving my stress and boredom during this pandemic.” Collecting of plants eventually became a trend in both rural and urban areas in the country. The increased engagement in gardening became one of their recreational activities to reduce boredom and cope with the stress of the pandemic. Gardening was believed to be an effective way of channeling negative emotions. It was more than just

Fig. 2. Common catch species of ringnet fishers (A), Common catch species of bagnet fishers (B).

| Table 2 | Factors that influences the change in the volume of fish catch during the time of Pandemic in Davao Gulf (Significantly different factors are in bold). |
|---------|---------------------------------------------------------------|
| Variables | B (SE) | Odds Ratio | 95% Confidence Interval for Odds Ratio |
| Fish Price (Php) | 0.040 (0.023)* | 1.04 | 0.907 | 1.088 |
| Revenue | 0.0000002 (0.0003) | 1.000 | 1.000 | 1.000 |
| Fish days | −2.114 (0.855)** | 0.121 | 0.022 | 0.454 |
| Fish hours | −0.004 (0.05) | 0.996 | 0.901 | 1.102 |
| Year fishing | −0.1157 (0.0428)** | 0.891 | 0.82 | 0.97 |
| Year community | 0.076 (0.0362)* | 1.079 | 1.005 | 1.159 |
| Age (yrs) | −0.109 (0.0593)* | 0.896 | 0.797 | 1.006 |
| Education (yrs) | −0.636 (0.219)** | 0.53 | 0.34 | 0.81 |
| Household size | 0.150 (0.207) | 1.16 | 0.77 | 1.74 |
| Community Org | 2.12 (1.23) | 8.31 | 0.75 | 91.77 |
| Family of fishers | −3.14 (2.29) | 0.043 | 0.0005 | 3.844 |
| Credit access | −0.513 (0.810) | 0.598 | 0.122 | 2.928 |
| Own boat | 0.51 (1.10) | 1.657 | 0.191 | 14.385 |
| Own land | −2.37 (1.29)* | 0.093 | 0.007 | 1.176 |
| Constant | 20.41 (7.70) | |

Note: Deviance \( R^2 = 0.44; \) Model \( X^2 = 40, p = <.0001 \).

* \( p < .05 \)
** \( p < .001 \)
a casual leisure pursuit but an activity with therapeutic effects on their physical and psychological well-being (Chalmin-Pui et al., 2021). Thankfully, the policy on home restrictions for agricultural and food supply workers were lifted up after about a month of draconian lockdown due to dwindling food supply throughout the nation.

3.5. Experience during the closed fishing season

A joint administrative order by the Department of Agriculture (DA) and the Department of Interior and Local Government (DILG) mandated the implementation of a closed fishing season in Davao Gulf from June 1 to August 31 every year. Mainly, this was to allow tuna, and small pelagic species time to spawn in the Davao Gulf. Also, the closed fishing season was meant to curb illegal fishing and provide recovery time for small-pelagics. During the closed fishing season, the operation of bagnets and ringnets were prohibited; this policy, impacted the livelihood and food security of most commercial fishers. Based on the encoded data, 84% of bagnet fishers have stopped their fishing operation in an effort to prevent violating the order, which could lead to forfeiture of catch and cancellation of their fishing permit or license (Fig. 3A). This response contrasts with ringnet fishers where 65% of them continued to operate even during the closed fishing season. Since ringnet fishers have bigger fishing vessels, it allowed them to fish beyond the mouth of the Davao Gulf so that they can operate in these waters and continue to do so until the closed fishing season policy is lifted by September. This arrangement afforded them jobs and continuous catch, although this also increased their fuel and food costs for their vessel and crew. Those part of the crew who stopped fishing during the closed fishing season have sought some forms of alternative income source and other livelihood strategies to alleviate its impact. About 22% of bagnet fishers worked as hired labor and in construction companies (Fig. 3B), while 13% went for fish marketing. Other 9% worked as tricycle drivers. On the other hand, 33% of ring-net fishers neither worked but have to use their savings to sustain their families until the closed fishing season ends. Some of them also worked in construction, fish marketing, and driving. Several ringnet fishers think that there was no effect of the pandemic (45%) while for bagnet fishers about 29% perceived that the pandemic has no effect on their fishing operation. Some of these effects more felt by bagnet fishers are less fish buyers (13%), travel restrictions (29%), low fish price (3%), reduced fish catch (7%), no work (10%), and limited time to fish (10%) (see Fig. 3C). In addition to these impacts, the psychological and emotional well-being of fishers were also affected. Fig. 3D indicates that 42% of bagnet fishers and 53% of ringnet fishers confessed to having unfounded fears due to COVID-19 impacts. About 16% of bagnet fishers felt anger and frustration while this was stronger for ringnet fishers, 24% felt frustration and 3% felt anger. Lastly, 8% of bagnet fishers felt hope for the future.

4. Discussion

4.1. Impact of the pandemic on the catch of fishers

The fisheries are one of the sectors greatly affected by the COVID-19 pandemic (Béné et al., 2015). The strict implementation of quarantine protocols left several fishers with no choice but to cease their operations and rely on food and cash assistance from the government, thus severely affecting the volume of fish caught in the area (Ferrer et al., 2021; Gregorio and Ancog, 2020). The volume of the fish catches, however, was influenced by several variables. These were: (1) economic factors such as the fish price and land ownership; (2) fisheries factors which include the number of fishing days and years of fishing; and (3) social factors like age, years in the community, and education.

Given the impact of pandemic to the fishing operation of bagnet and ringnet fishers, the volume of fish catch was affected, temporarily

---

Fig. 3. Impact of closed fishing season to fishing operations(A), Alternative livelihood during closed fishing season (B), Impact of COVID-19 to fishing operations (C), Emotional impact of COVID-19 (D).
increasing the fish price in the market (Love et al., 2020). Higher fish prices due to the limited supply in the market seems to have motivated fishers to catch more fish and increase supplies until fish price stabilizes (FAO, 2020a; Smith et al., 2020).

Also, during the normal days, ringnet fishers can operate for six days a week, with Sunday as their rest day, whereas bagnet fishers in Samal fish daily. When the pandemic started, regular fishing operations began to change (Bennett et al., 2020; FAO, 2020b). Travel protocols and other government provisions such as social distancing made it difficult for fishers to operate, resulting in limited operation time. With these limitations, the volume of fish caught started to decrease (Jomitol, 2020; Simunek et al., 2021).

With all the uncertainties that fishers have to face, engaging in this type of livelihood requires skills and expertise which can be acquired and enhanced through time (Fischer et al., 2015). Older fishers simply have better knowledge of their fishing grounds due to their length of experience and this provides them advantage in identifying which areas have more abundant fish (Wiber et al., 2012). Those with lesser experience will not have the same local knowledge of the fishing ground as intimately as the older ones and more likely catch less (Scholz et al., 2006). As they have spent more time in their communities, older fishers have better network information in the village, and are considered wiser and well respected by their peers (Farrr et al., 2018). They can consult or ask anyone at any time they needed information regarding their daily fishing operation (Pramitsari et al., 2015). Fishers who have lived longer in their community have established a special bond with other fishers that they could rely upon during critical times (Pita et al., 2020).

As for their levels of education, fishers with shorter number of years of education seem to be more dependent on the fisheries than those who gained better education who can have more chance of leaving the fisheries sector (Maddock, 2007; Noviyanjti et al., 2015).

On the other hand, fishers who do not own lands were also more dependent on the fisheries than those who have a land to cultivate (Anticamara and Go, 2016). In that case, they can always go back and farm as an alternative to fishing, when fishing operations are difficult to conduct (Ostergaard et al., 2016). As a result, some fishers opted to cultivate their land as their alternative livelihood until fishing operations are back to normal (Bappa et al., 2014).

4.2. Impact of the pandemic on fishers’ families

The COVID-19 pandemic ruins families globally, especially people who earn below-average income, including in the fisheries sector (Bolido and Irene, 2020). Closures of certain establishments and travel restrictions have created economic and emotional stress to fishers’ families (Demirci et al., 2020; Hidayati et al., 2021).

In addition to the widespread increase of unemployment and difficulties in working, families with children face challenges related to school closures as a result of the pandemic (Karpman et al., 2020). The introduction of online classes added stress to parents as they have to pay for school and internet data (Chaturvedi et al., 2021). It was further stressful for parents with low income that struggle to earn daily wages and do not have internet access, as it compromises their children’s learning needs (Pokhrel and Chheteri, 2021; Poudel and Subedi, 2020; Goldschmidt, 2020). The same was true for the families of fishers (FAO, 2020b). The shift to online classes and the adoption of a flexible learning mode have increased parents’ worries (Aucejo et al., 2020). Most parents complain about the difficulty of answering modules and the inaccessibility of the internet in their area (Kapasia et al., 2020). Those parents who have not completed their formal education struggled to teach their children specific lessons found in the modules and fear that their children may not get a good learning experience (Lee, 2020). Moreover, some parents sadly stopped sending their children to school due to their impoverished situation (Bestantonno et al., 2020).

The emergence of the COVID-19 triggered severe anxiety and tension in many parts of the world. In the study of Pedrosa et al. (2020) various emotional and psychological conditions, such as fear, anxiety, depression, and suicide ideation, are prompted by the pandemic (Auriemma and Iannaccone, 2020; Anglim and Horwood, 2021). The same was true for the fisheries sector. The majority of fishers’ families were in a state of fear and worries during the pandemic (Lades et al., 2020; Mamun et al., 2020). Both fishers and their families were emotionally affected since they were worried about getting their daily food and at the same time also afraid of the virus once they go out of their homes (Bhuiyan et al., 2020). Some families were frustrated about not being able to conduct their usual routines, such as going to the market, doing other part-time jobs due to closures of some establishments, and the hassle of wearing face-masks and face shields (Avtar et al., 2021). Several bagnet fishers and a small percentage of ringnet fishers felt angry as they could not immediately provide money for their daily expenses (Ceylan et al., 2020). Others were still hopeful that this pandemic will end and everything will be back to its normal phase (Ferrer et al., 2021).

4.3. Impact of the closed fishing season

The closed fishing season policy can influence the livelihood of fishers as it prevents them from fishing at certain times of the year to allow the fish stocks to recover and address the declining fish catch (Colwell and Axelrod, 2017; Macusi et al., 2021). During this time, fishers reported a decrease in the volume of their fish catch as authorities prohibit the utilization of bagnets and ringnets (Green et al., 2003; Rola et al., 2018). Most bagnet fishers were forced to use hook and lines and other municipal fishing gears throughout the duration of the implementation of the policy (BFAR, 2021a,b). Considering that fishing is their primary source of income, this fishing regulation has created panic in the lives of fishers and their families, especially among commercial fishers. In the study of Chima and Musuka (2014), fishers that entirely depend on fishing as their source of food and income were economically handicapped as their alternative sources of income could not sustain them during the closed fishing season of the year (Justice et al., 2020). In the case of the Davao Gulf commercial fishers, the closed fishing season somehow provides opportunities for them to engage in various income-generating activities. This will support their families as they work in the construction industry, provide labor, do fish marketing, and driving (Rahman et al., 2012; Rahman et al., 2012). As the closed fishing season was in effect, most ringnet fishers went beyond the Davao Gulf to fish. Since these fishers cannot utilize the anchored fish aggregating devices (FADs), also known as payaos, they needed to venture outside the municipal borders, which implies more time of travel and more fuel to use for the fishing vessel (Macusi et al., 2015). Like most bagnet fishers, a portion of these ringnet fishers also engaged in alternative sources of income, such as mentioned above, while several others chose to stay in their homes (Rahman et al., 2012a,b).

5. Conclusion

During the start of the closed fishing season, fishers sought alternative livelihood and other means to generate income. This forced some of the fishers and their family members to shift to land-based jobs, and some had undertaken unaccustomed works as their coping mechanism to secure food and their basic needs. While most ringnet fishers go beyond the Davao Gulf for fishing during the closed fishing season, this also has the corresponding burden of increasing their starting capital eventually decreasing their revenue. Moreover, because of the COVID-19 pandemic, this also added the burden of securing their livelihood and daily food sustenance affecting them emotionally as well as the education of their children. Indeed, this required cash assistance and foodpacks from the government for some time until the fishers were able to go back fishing again. Ultimately, this closed fishing season policy wrought positive results in conserving the Davao Gulf fisheries resources despite lingering socioeconomic impacts that remain to be addressed by the local governments, the Department of Social Welfare and...
Development (DSWD) as well as the Department of Agriculture through the Bureau of Fisheries and Aquatic Resources (BFAR) (Macusi et al., 2021; Rola et al., 2018).

**Funding**

This research project was funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCARRD) through the project entitled: *Fisheries catch assessment using GPS trackers and effort survey of municipal and commercial fishers in Mindanao*.

**Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Acknowledgment**

We want to acknowledge the help of fishers in Governor Generoso in Davao Oriental and Samal in Davao Del Norte, who took the time to participate despite their busy schedules. Likewise, to the Local Government Unit of each study area for taking part in this survey. We are also thankful to Ricksterle Verzosa and Michael Bensalido for making earlier and final maps of the study sites, Stefanie K. Siblos, Cheney Grace Liguie, Ajelynn Pancho, Michael Calderon and Dindo Diampon for help extended during the fieldwork and the revision of this paper.

**Appendix A. Supplementary data**

Supplementary data to this article can be found online at https://doi.org/10.1016/j.oceemanc.2021.105997.

**References**

Aucejo, E.M., French, J., Ugaile Araya, M.P., Zafar, B., 2020. The impact of COVID-19 on student experiences and expectations: evidence from a survey. J. Publ. Econ. 191, 104271 https://doi.org/10.1016/j.jpubeco.2020.104271.

Adom, D., Appiah, S.P., Yamley, L., 2019. A return to the Ghanaian cultural values of closed fishing season in Ghana’s artisanal marine fishing: an essential means of reorienting small pelagic fish FISHING SEASON IN Ghana – S ARTISANAL MARINE FISHING : an oct. https://doi.org/10.2473/trsr-2019-2020.

Anglím, J., Horwood, S., 2021. Effect of the COVID-19 pandemic and big five personality on subjective and psychological well-being. https://doi.org/10.1177/1948550620983047.

Arendse, C.J., African, S., Parks, N., Govender, A., Branch, G., 2007. Are closed fishing seasons an effective means of increasing reproductive output ? A per-recruit analysis using the limpet Coryphella granatina as a case history. June. https://doi.org/10.1016/j.fishes.2007.01.001.

Anticamara, J.A., Go, K.T.B., 2016. Spatio-temporal declines in philippine fisheries and sector in Hatay province from Turkey. Mar. Life Sci. 3 (MAR), 1–10. https://doi.org/10.5389/fmars.2016.00021.

Atienza, M.E.L., Arugay, A.A., Encinas-francisco, J., Go, J.R.R., Panao, R.A.L., 2020. Constitutional performance assessment in the time of a pandemic: the 1987 constitution and the Philippines’ COVID-19 response. In: International IDEA Discussion Paper 3/2020 (Quezon City, Philippines).

Auriemma, V., Iannaccone, C., 2020. COVID-19 pandemic: socio-economic consequences of the impacts of the 1987 Constitution. J. Coast Res. 53, 88–90. https://doi.org/10.1016/j.jcotrs.2020.04.013.

Bagnou, B., Faimpong, E., Asch, R.G., Monteclaro, H.M., 2021. Effect of a seasonal fishery closure on sardine and mackerel catch in the Visayan Sea, Philippines. Front. Mar. Sci. 3 (2020). 10. https://doi.org/10.3390/fmars.2021.00344.

Bai, J., Putri, L.A.P., Ghani, M.W., Sittumwaran, A., 2021. Small-scale Fishing Fleet and Their Daily Multiple-Strainer on Climate Change and COVID-19: Preliminary Findings Small-Scale Fishing Families and Their Daily Multiple-Strainer on Climate Change and COVID-19: Preliminary Findings. https://doi.org/10.1088/1755-1315/793/1/012047.
