Small scale handline tuna fishery in Buru Island, Maluku Province, Indonesia, during the Covid-19 pandemic

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Abstract. Small scale handline tuna fishery is an important livelihood for the coastal communities in Buru Island which includes Buru and South Buru Regency. Information regarding the livelihood condition of the tuna handline fishery in Buru Island is still limited. This situation is increasingly complex, due to the COVID-19 pandemic which impacted the communities livelihood, due a significant decrease of the prices and demand. Understanding of socioeconomic conditions is important for planning and developing policies and programs for sustainable fisheries. The study aimed to assess the socioeconomic conditions of tuna handline fisheries in Buru Island, including the costs-revenues balance and the fishers' income. Data collection was carried out in March-August 2020 in Buru and South Buru Regency. This study showed that the average revenue, gross profit and income of fishers during the pandemic period decreased by 39.05, 66.26 and 63.22%, respectively, compared to the situation in 2019.
Key Words: fishers income, gross profit, operational cost, revenue, tuna.

Introduction. Socially and economically, fish and fishery products are essential (Sumaila 2017) for solving employment, food supply and poverty reduction issues, and as a source of wealth and economic growth (The World Bank 2012), especially in the small-scale fisheries sector (FAO 2016). Globally, an estimated 39 million people were engaged (on a full-time, part-time or occasional basis) in the primary sector of capture fisheries in 2018, and varies by region, most of those are in developing countries, and the majority are small-scale fisheries. The highest number of fishers workers are in Asia (85 % of the world total) (FAO 2020). Small-scale fisheries vary widely by country (Smith & Basutro 2019). In Indonesia, the fleet structure is dominated by small scale vessels (Sunoko & Huang 2014), in 2019 around 96% of 862,032 fishing vessels were categorized as small-scale fisheries, with a total of more than 1.8 million people involved as fishermen (MMAF 2021). To support the sustainability of the small-scale fisheries sector, it is important to understand its socio-economic roles and interests (The World Bank 2012; Schuhbauer & Sumaila 2016). Thus, a focus on the fisheries management options is required, in particular on the performance data collection and on the socio-economic indicators monitoring (Unal & Franquesa 2010). Socio-economic data is a major component of the scientific advice needed for evidence-based fisheries management, in order to improve the fisheries' planning and monitoring, and their responsible management (FAO 1999; Graaf et al 2011; Pinello et al 2017). The fisheries socio-economic study aims to determine the income of fishermen and their prospects, the level of productivity of commercially important species, the prices of fishery products and the economic efficiency of the fisheries sector (Pinello et al 2017). The focus of the assessment is on the demographic and employment patterns, on the fishers community business profit and personal income estimation.

Small-scale handline tuna fishery is a major economic activity of the communities spread across coastal villages on Buru Island (Duggan & Kochen 2016), as a provider of employment opportunities and as a source of income and food for fishermen and their families. This activity is also important for the regional economy and on a national scale, and even in the international trade of seafood (Bailey et al 2016a). There is a need to better understand the socioeconomic conditions of this small-scale tuna fisheries, in order to integrate them into sustainable management programs (Bailey et al 2016b; Duggan & Kochen 2016; Neitzel et al 2017; Satria & Sadiyah 2018; Borland & Bailey 2019). The COVID-19 pandemic presents a difficult challenge for the global small-scale fisheries sector, providing broad socio-economic impacts (Bennet et al 2020). This study aimed to assess the socio-economic conditions of tuna handline fisheries on Buru Island, which include: gross revenues, profits and fishermen's income during the COVID-19 pandemic. The results of this study are expected to provide information that can improve the understanding and support for small-scale tuna handline fisheries on Buru Island towards its socio-economic sustainability.

Material and Method

Description of the study sites. This study was conducted in Buru Island, which includes Buru and South Buru Regency's, Maluku Province, Indonesia. In these two districts, tuna handline fishing activities are carried out by communities from the villages scattered along the coast of Buru Island (Figure 1).

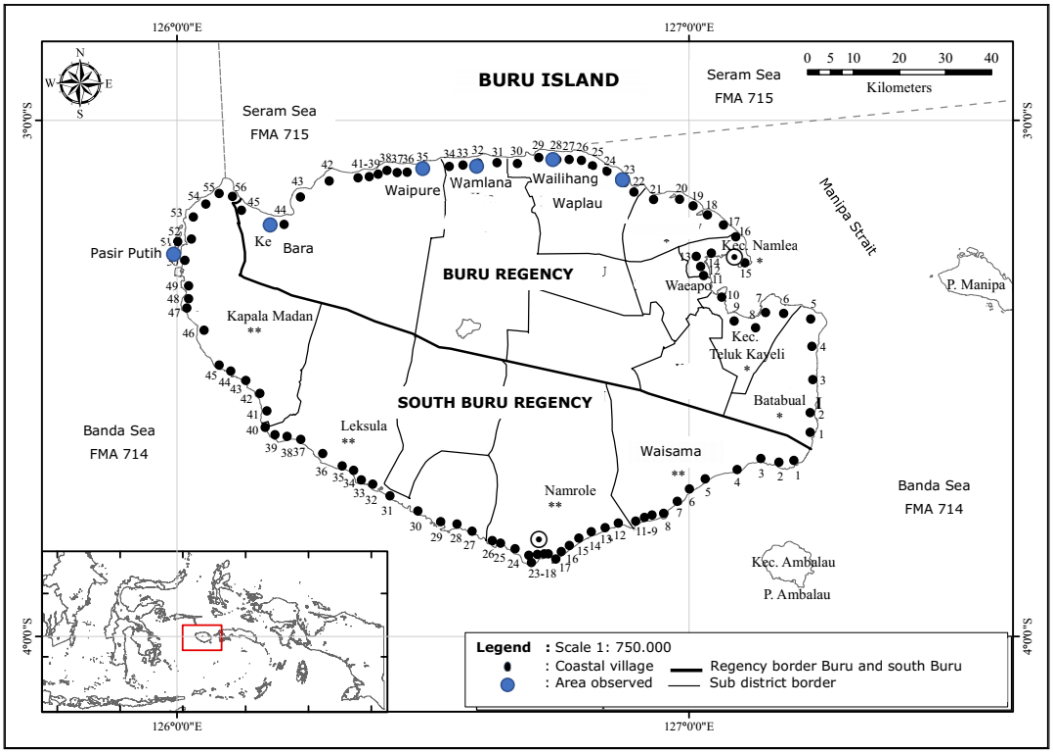

Figure 1. The study area on Buru Island.

Data collection method. This study uses primary and secondary data. Primary data concern the number of fleets and fishermen who are directly involved in handline tuna fishing activities (Pinello et al 2017), the price of catch products based on species the costs (FAO 1999; Sparre 2000; Stamatopoulus 2002), the fishing activity and the actual data at the landing site. The considered costs concern the fuel, the supplies per trip and the ice per trip (Pinello et al 2017). Data collection was carried out by means of field observations and interviews with fishermen and collector traders, processing companies and village or local government officials, in order to capture information related to this research. Secondary data in the form of tuna handline landing data were obtained from

the Maluku Tuna Fisheries Co-Management Committee, formed by the Maluku Provincial Fisheries and Maritime Affairs Agency and the MDPI Foundation. This secondary data consist of 2019 records of tuna handline landing based on samples, at least 20% of the daily landings at the sampling time (MDPI 2019) from the villages of Buru and South Buru regency taken. The data used in this study are the landings records for the villages of Waplau, Wailihang, Wamlana, Waipure and Bara in Buru Regency, and Pasir Putih village in South Buru Regency, a total of 788 landings data throughout 2019 were used in the analysis.

Data analysis method. To assess the socioeconomic conditions in this study, the data were analyzed based on the socioeconomic indicators suggested by FAO (1999), Stamatopoulos (2002) and Pinello et al (2017). The revenue, is the value of the sold landed production. The gross profit is the revenue deducted by the operating costs: energy cost (fuel consumption*fuel price), ice cost (ice consumption*ice price), supply and food cost (number of persons per vessel*cost per person). The income per fisher is the gross profit per number of persons and per vessel. All analyzes use actual prices obtained during observations, for both 2019 and 2020. In order to describe the actual socioeconomic situation at the study location, the 2019 secondary landing data were analyzed and compared to the 2020 actual data from the field survey.

Results and discussion

Handline tuna fisheries structure in the study area. Based on the field survey in the two districts, there are approximately more than 1,082 tuna handline fleets and more than 1,600 fishermen who work directly in fishing activities, which does not include support workers. The tuna handline fishing unit on Buru Island operates using vessels of an average size of 8.25 m. Boats are made of fiber glass materials, the average engine power is of 16.23 HP, and they are operated by 1 to 4 fishers for each vessel (average 2 fishers) (Table 1), using handline fishing gear. According to Halim et al (2018), these characteristics confirm that the tuna handline fishery on Buru Island is a small scale fishery.

Table 1

Average vessel length, engine power, person per vessel, trip duration, fuel and ice consumption per trip of handline unit, on Buru Island

Location	*Vessel length (m)*	*Engine power (hp)*	*Person/ vessel*	*Trip duration (hour)*
Waplau	8	15	1	11
Wailihang	8.57	15	1.95	12.7
Wamlana	8.26	15.51	1.8	12.51
Waipure	8.1	16.46	1.45	12.11
Bara	8.11	16.28	1.65	12.76
Pasir Putih	8.46	19.14	1.69	10.38
Average	8.25	16.23	1.59	11.91

The fishing area for handline tuna fishermen on Buru Island is still within the Indonesian archipelagic waters (Satria & Sadiyah 2018), around the Banda Sea and Seram Sea. The fishing is operated in a one-day fishing system: usually fishermen leave early in the morning and return in the afternoon to evening or at night, on the same day, the duration of the fishing trip is generally 11.91 hours (the average fishing trip lasts less than 24 hours). The main catch target is adult sized tuna. The catch was dominated by adult yellowfin tuna *Thunnus alabacares* (87.2%), juvenile tuna (9.7%) and bycatch (3.1%). The tuna caught is processed directly on the boat, the landed tuna is usually in the form of loin, 1 tuna consists of 4 loin parts, 2 dorsal parts and two stomach parts. The average catch of adult tuna per boat per day is 60.53 kg (gross weight) or 1.69 indv. Loins measure about 67% of the adult tuna catch weight (Table 2). Most of the catch of

tuna is sold to collectors in the form of loins, which are further sold to processing companies, then to export and domestic markets. Other catches are sold directly to fish traders for the needs of the local market on Buru Island. The export destinations for tuna products originating from Buru Island are Vietnam and the United States (Bailey et al 2016a; Duggan & Kochen 2016; Zheng et al 2020).

Table 2

Average CPUE and composition of the tuna catch by handline on Buru Island

Location	*CPUE (kg boat^{-1} trip^{-1})*	*Adult tuna (ind)*	*Adult tuna (kg)*	*Loin weight (kg)*	*Small tuna (kg)*	*By catch (kg)*
Waplau	48.79	1.33	37.67	22.47	9.05	2.07
Wailihang	68.66	1.82	58	40.73	9.09	1.57
Wamlana	54.77	1.74	50.07	34.45	3.69	1.01
Waipure	63.48	1.83	54.19	30.7	5.04	4.25
Bara	65.1	1.55	55.45	37.78	8.41	1.24
Pasir Putih	62.36	1.92	61.24	46.03	0	1.12
Average	60.53	1.69	52.77	35.36	5.88	1.87
% of avg CPUE			87.2	67.0	9.7	3.1

Operating cost structures. Operating costs include energy, ice, food and supplies costs. The average cost of energy used in one trip of a handline tuna fishing operation on Buru Island ranges from USD 19.63 to 24.63 (an average of USD 23.07) which is derived from a fuel consumption ranging from 28.52 to 35.79 L trip^{-1}, at a cost per liter between USD 0.62 and 0.83 (the price of fuel has not changed during 2019-2020). The average need for ice per trip ranges from 9.86 kg to 28.89 kg (average 14.01 kg), with ice costs ranging from USD 2.04 to 5.96 (average USD 2.89), at the average price per kg of USD 0.21. The average cost of food and supplies per trip was USD 3.44 to 6.73 (average USD 5.48). Thus, the operational costs range from USD 29.11 to 34.15 (an average of USD 31.45).

Table 3

Average operational costs per tuna fishing trip on Buru Island

Location	*Fuel (L)*	*Energy cost (USD)*	*Ice (kg)*	*Ice cost (USD)*	*Food and supply cost (USD)*	*Total operational cost (USD)*
Waplau	35	24.09	11.67	2.41	3.44	29.94
Wailihang	28.52	19.63	13.33	2.75	6.73	29.11
Wamlana	35.21	24.23	9.9	2.04	6.20	32.48
Waipure	34.15	23.50	9.86	2.04	5.00	30.54
Bara	35.79	24.63	10.43	2.15	5.68	32.47
Pasir Putih	29.54	22.36	28.89	5.96	5.82	34.15
Average	33.04	23.07	14.01	2.89	5.48	31.45

Revenue. The calculation results show that the average revenue per unit trip from the total landings of tuna handline at various locations on Buru Island during 2020 was around USD 33.35–76.31 (average USD 48.33) smaller than in 2019, when it ranged from USD 46.20 to 130.14 (average USD 81.64) (Table 4), which shows a decrease in revenue ranging from USD 12.85 to 53.83 (average USD 33.31) or in percentage ranging from 27.82 to 50.32% (average 39.05%), when compared with the revenue obtained in 2019 (Table 5). Revenue is the total selling value of the catch, considering both adult and juvenile tuna, and also the bycatch. The largest contribution to the revenue is from the catch of adult tuna, which is sold in the form of loins. Based on information from collectors and fishermen, since January 2020 the price of tuna loin per kg on Buru Island has begun to fall from USD 3.44 per kg in December 2019 to USD 2.75, then it continued

to decline until it reached the level of USD 1.72 for quality A (good quality, size >4.5 kg per 1 part of loin) or USD 1.03 for quality C (good quality, size <4.5 kg per 1 part of loin), and USD 0.41 for D quality (not good quality). Meanwhile, in 2019 the price of tuna loin per kg was in the range of USD 3.44-4.34 for quality A, USD 1.72-2.75 for quality C and USD 1.03-1.38 for quality D. Low prices causeds a decrease in the revenue per catch. The decline in prices was caused by the low demand, as a result of the disrupted seafood market conditions, due to the COVID-19 pandemic situation.

Table 4

Revenue, gross profit and fisher income of handline tuna before and during the Covid-19 pandemic, in several locations on Buru Island (in USD)

Location	*2019*			*2020*		
	Revenue	*Gross profit*	*Fisher income*	*Revenue*	*Gross profit*	*Fisher income*
Waplau	75.28	45.34	45.34	46.01	16.07	16.07
Wailihang	99.63	70.51	42.42	51.92	22.80	14.04
Wamlana	77.85	45.37	24.69	38.68	13.68	12.05
Waipure	60.76	30.22	22.37	43.73	12.01	8.28
Bara	46.20	58.92	40.63	33.35	13.74	9.95
Pasir Putih	130.14	91.97	33.91	76.31	38.14	14.18
Average	81.64	57.06	34.89	48.33	19.41	12.43

Table 5

Handline tuna fishing revenue decline in 2020, compared to 2019

Location	*Revenue per year (USD)*		*Decline of revenue*	
	2019	*2020*	*Value (USD)*	*%*
Waplau	75.28	46.01	29.27	38.88
Wailihang	99.63	51.92	47.71	47.89
Wamlana	77.85	38.68	39.17	50.32
Waipure	60.76	43.73	17.03	28.03
Bara	46.20	33.35	12.85	27.82
Pasir Putih	130.14	76.31	53.83	41.36
Average	81.64	48.33	33.31	39.05

This revenues decrease followed a lower demand for tuna products, especially from the United States market, due to the economic disruptions caused by the situation and conditions of the Covid 19 pandemic. So far, the catch production of tuna on Buru Island was marketed to the United States market, considering that a part of the tuna handline fishing community on Buru Island has integrated, since 2014, the Fair Trade USA group (Duggan & Kochen 2016; Doddema et al 2020; Zheng et al 2020), but it was also marketed in other countries. Domestic market demand has also decreased, which has contributed to the drop of the price of tuna loin. Revenues from the catch sold for the needs of the local market on Buru Island has not changed, the price was stable, which maintained a safety level of income, while facing the decline in the price of tuna loin.

Gross profit. In 2020, the calculated gross profit of the tuna handline fishing fleet on Buru Island was around USD 12.01–38.14 (an average of USD 19.41). This gross profit was lower than in the previous year, when it ranged from USD 30.22 to 91.97 (an average of USD 57.06), as shown in Table 4. This gross profit decreased ranging from USD 12.35 to 53.83 (an average USD 37.65) or decreased by 58.53 to 76.69% (an average of 66.26%), as shown in Table 6, compared to the previous year's gross profit calculation. This low gross profit is associated with a low revenue value, when compared to normal conditions, while the operational costs tended to remain constant with a stable price of fuel at the research location. The tuna handline fishermen in the study locations

access fuel at prices ranging from USD 0.62-0.83, well above the subsidized price, this price contributing to the high operating costs. If the operational costs are constantly high and the income value is getting lower, then there is a potential loss in the tuna handline business. Even in a pandemic situation, amidst the low selling value, the results show that on average the profit of the tuna handline fleet is still positive, at the existing price conditions. However, reducing operational costs and increasing the value of the catch by maintaining the quality of the fish caught is imperative. Field observations also show that the quality of the catch is the most important thing in increasing fleet revenue and profits. There would a significant price difference if the tuna delivered decreased in quality, which would detrimental to the local fishermen.

Table 6

Handline tuna gross profit decline in 2020, compared to 2019

Location	*Gross profit per year (USD)*		*Decline of gross profit*	
	2019	*2020*	*Value (USD)*	*%*
Waplau	45.34	16.07	29.27	64.55
Wailihang	70.51	22.80	47.71	67.66
Wamlana	45.37	13.68	39.17	69.84
Waipure	30.22	12.01	17.03	60.28
Bara	58.92	13.74	12.85	76.69
Pasir Putih	91.97	38.14	53.83	58.53
Average	57.06	19.41	37.65	66.26

Income per fisher. The income of tuna handline fishermen on Buru Island is obtained from the fleet profit-sharing system. The profit-sharing system practiced by the fishing community on Buru Island is an equal distribution among owners, captains or crews, depending on the number of fishermen per boat, usually 1 or 2 people per boat (average 1.6~2 people boat^{-1}). The calculation results show that the average income of each tuna handline fisherman per trip is around USD 9.95 to 16.07 (average USD 12.43), lower than in the previous year, when it was around USD 22.37 to 45.34 (Table 4). The decline in fishermen's income ranged from USD 12.64 to 30.68 (an average USD 22.46) or ranged from 51.20 to 75.52% or an average of 63.22% (Table 7), compared to the previous year. It can be seen that the decline in income occurred in all locations (Table 7). Interviews also show that fishermen report a decrease of over 50% in their income. Income provides a measure of the contribution to the economy (Pinello et al 2017), which means that the current situation is making a negative contribution to the economy of tuna handline fishermen on Buru Island, where there is a decrease in the income received by fishermen.

Table 7

Handline tuna fisher income decline in 2020, compared to 2019

Location	*Fisher income (USD)*		*Decline of fisher income*	
	2019	*2020*	*Value (USD)*	*%*
Waplau	45.34	16.07	29.27	64.55
Wailihang	42.42	14.04	28.37	66.89
Wamlana	24.69	12.05	12.64	51.20
Waipure	22.37	8.28	14.09	62.99
Bara	40.63	9.95	30.68	75.52
Pasir Putih	33.91	14.18	19.72	58.17
Average	34.89	12.43	22.46	63.22

The assessment of the socioeconomic condition of the tuna handline fishery on Buru Island has illustrated that this type of fishery is socially very important, because it is a source of livelihood for more than 1600 fishermen, being both a source of income for

fishermen and their families and a global and local food supply. Face to the current situation of global pandemic, the tuna handline fishery on Buru Island is economically affected. This is in line with what Bennet et al (2020) and Campbell et al (2020), stating that the COVID-19 pandemic has an impact on many small-scale fisheries. The impact on the tuna handline fishermen on Buru Island was an average decrease of revenues reaching 39.05%, then an average gross profit decrease of 66.26% and an average decrease of 63.22% in the fishers' personal income. This decline occurred following the drop in the price of tuna loin (adult tuna), due to the market disruptions. According to Campbell et al (2020), high-value fisheries which enter export supply chains are more negatively affected. Buru Island handline tuna products are marketed on the domestic and export markets. Regarding the export/international markets, some of the tuna handline fishing communities operate through the Fair Trade scheme (Duggan & Kochen 2016; Doddema et al 2020; Zheng et al 2020), and most recently several tuna handline fishing communities on Buru Island achieved MSC certification (MDPI 2020). Consequently, demand forecasts are more optimistic. On the other hand, fishermen face socio-economic impacts that threaten the sustainability of their livelihoods and require support in terms of public policies. The socio-economic performance is still generally positive, as demonstrated by the income obtained from tuna catches, in line with the results of field observations which show persistence and continuous adaptations of the small fisheries facing external constraints.

Conclusions. This study provides the latest information on the socio-economic conditions of tuna handline fishermen on Buru Island, where the impact of the Covid-19 pandemic was felt directly by fishermen, namely a decrease in revenue, gross profit and income of 39.05, 66.26 and 63.22%, respectively.

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