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# Socio-Economic Aspects of the Blue Swimming Crab Fisheries (BSC, *Portunus pelagicus*) in Maginti Island, West Muna Regency, Indonesia

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## ABSTRACT

This study aimed to analyze the socio-economic aspects of crab fisheries in Maginti Island, West Muna Regency. Data collection was carried out from March 2021 to December 2023. The data collected were the socio-economic aspects of crab fisheries, including the level of community education, the number of fishermen, income from crab fishing, crab production 2017 - 2023, crab prices during 2017-2023, and the crab trade supply chain. Data were obtained through in-depth interviews with stakeholders, including 62-74 fishermen, three local collectors, and two district-level collectors. Interviews were directly conducted with an open-ended question system based on data needs. Data analysis was carried out with a descriptive-quantitative approach. The study results showed that in the social aspect, crab fishermen's education is dominated by elementary school (S.D.) graduates, namely 61.29% in 2017 and 60.81% in 2023. In the economic aspect, most fishermen have a net income ranging from 1,000,000 - 2,000,000 IDR/month, which was affected by fluctuations in BSC prices. Crab prices from fishermen to collectors tend to fluctuate throughout 2017–2023. The average price of crabs per kg was 32,083.33 IDR in 2017, 36,166.67 IDR in 2018, 30,750 IDR in 2019, 23,750 IDR in 2020, 64,666.67 IDR in 2021, 31,083.33 IDR in 2022, and 44,791.67 IDR in 2023. Price fluctuations occurred since BSC fisheries in Maginti Island are part of the global fisheries supply chain that reaches the international market to America, China, and others. Fluctuations in the global BSC prices not only affected the prices locally but could increase fishermen's income by up to 11.25% which is >2,000,000 IDR/month from 2017-2023. The increase in income indicates that BSC fisheries in Maginti Island have supported the implementation of the sustainable development goals (SDGs), specifically SDGs-1, namely no poverty.

#### **INTRODUCTION**

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Scopus

The blue swimming crab (BSC, *Portunus pelagicus*) is predominantly found in the Indo-Pacific region (Germano *et al.*, 2006). In Indonesia, the BSC is distributed starting from the west of Sumatra Island, the north of Java Island, the east of Kalimantan, and the southern part of Sulawesi Island (La Sara & Astuti, 2015). One of the areas where the BSC is widely found is the waters of the Tiworo Strait (Muskita *et al.*, 2015; La Sara *et* 

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*al.*, 2019; Aswandi *et al.*, 2023), which has finally become a fishery commodity for coastal communities since 1993 (Afdal *et al.*, 2023). Crab fisheries are fishery resources that have a high economic value and are important for the welfare of coastal communities, including those in Maginti Island, West Muna Regency. As one of the mainstay fishery commodities, crabs significantly contribute to fishermen's income and the local economy. The abundant crab potential in this region makes it a major focus for numerous fishermen in fishing activities.

However, the utilization of crab fishery resources is inseparable from various ecological and socio-economic challenges. Overfishing and irregular fishing of crabs can threaten the sustainability of crab stocks in nature (**Ihsan** *et al.*, **2015**). In addition, socio-economic aspects such as fishermen's income levels, access to markets, and lifestyle patterns of coastal communities also play an important role in determining the sustainability of crab fisheries (**Suryawati** *et al.*, **2023**).

The socio-economic conditions of fishermen on Maginti Island reflect the dynamics of coastal communities that depend on natural resources to meet their daily needs. Factors such as education level, access to fishing technology, and government policies related to fisheries affect the efficiency and effectiveness of crab fishing activities. Therefore, understanding the socio-economic aspects of Maginti Island crab fisheries is crucial to formulating a sustainable and equitable management strategy.

This study aimed to comprehensively examine the socio-economic aspects of smallscale fisheries, especially the crab fisheries in Maginti Island, West Muna Regency. By understanding the interaction between crab fishing activities and the socio-economic conditions of the community, it is hoped that the right solution can be found to improve the welfare of fishermen while maintaining the sustainability of crab resources. The results of this study are expected to provide useful information for policymakers, researchers, and the community in efforts to manage sustainable fisheries. Consequently, this study contributes to SDG 1 (No Poverty) by enhancing the well-being of coastal communities, SDG 8 (Decent Work and Economic Growth) through boosting the local fisheries sector, and SDG 14 (Life Below Water) by promoting the sustainable use of marine resources.

# MATERIALS AND METHODS

#### 1. Description of study sites

Maginti of the islands in the Tiworo Strait Island is one (https://bit.ly/Maginti\_Island), and part of West Muna Regency, Southeast Sulawesi, Indonesia. The ocean surrounds this island, so it has the potential for fishery resources, which are the main support for people's lives. This island has the potential for macroalgae (Lokollo et al., 2023), seagrass ecosystems (Pasanea et al., 2024), and coral reefs that are habitats for aquatic biota including BSC.

#### 2. **Data sampling**

Data collection was carried out from March 2021 to December 2023. The data collected were the socio-economic aspects of crab fisheries, including the level of community education, the number of fishermen, income from crab fishing, crab production 2017 - 2023, crab prices 2017 - 2023, and the crab trade supply chain. Crab production and price data were obtained directly through bookkeeping records from local collectors, so these data can be categorized as primary data since they haven't been documented in official sources such as the fisheries service or other official sources. Data were obtained through in-depth interviews with stakeholders, including 62 - 74fishermen, three local collectors (P1, P2, and P3), and two collectors at the regency level (Bombana and West Muna Regencies). Interviews were conducted directly with an openended question system based on data needs.

#### 3. **Data analysis**

Data analysis was carried out quantitatively by displaying data through tables or images as a visualization of research results. Value chain analysis (VCA) was also used to determine the added value (margin) and key actors at each stage in the supply chain. The price margin analysis referred to by Phiri et al. (2013) is as follows:

Marketing margin (MM) = Sale price (S.P.) – Purchase price (P.P.)

# RESULTS

#### Socio-economic of fishermen 1.

#### *1.1*. Education level

In general, the education of crab fishermen in Maginti Island is dominated by elementary school (S.D.) graduates. From 62 to 67 fishermen in 2017 – 2023, only eight have education levels up to the high school level or 12.9% in 2017 and 10.81% in 2023 (Table 1). The level of education is included in the low category since it is generally dominated by elementary school graduates.

			0				
Education level	Years (%)						
	2017	2018	2019	2020	2021	2022	2023
Elementary School (SD)	61.29	64.18	60.56	61.64	61.64	61.64	60.81
Junior High School (SMP)	25.81	23.88	28.17	27.40	27.40	27.40	28.38
Senior High School (SMA)	12.90	11.94	11.27	10.96	10.96	10.96	10.81
Notes: N in 2017 – 62 N in 2018	R = 67 N ii	n 2019 – 7	1 N in 20	20-2022 -	- 73 and N	J in 2023 -	- 74

Table 1. Educatio	n level of crab	fishermen of Magir	nti Island (2017 – 2023)
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Notes: N in 2017 = 62, N in 2018 = 67, N in 2019 = 71, N in 2020-2022 = 73, and N in 2023

## 1.2. Fishermen's income level

Most crab fishermen in Maginti Island have a net income ranging from 1,000,000 – 2,000,000 IDR/month. From 2017 to 2023, the number of fishermen with this income is 28 to 33 individual. Fishermen with a net income between 500,000 - 1,000,000 IDR/month amounted to 10 to 13 people. Meanwhile, fishermen with a net income of > 3,000,000 IDR/month amounted to eight people in 2017, 9 in 2018 – 2019, and 11 in 2020 – 2023 (Table 2). Based on this income, the average income for each fisherman was 1,818,548 IDR in 2017, 1,899,253 IDR in 2018, 1,890,845 IDR in 2019, 1,996,573 IDR in 2020 and 2021, 2,010,247 IDR in 2022, and 2,040,540 IDR in 2023. The average income of the fishermen is still below the provincial minimum wage of 2,885,964 IDR. However, for the standard of living of the islanders, the income is enough to meet their living needs, since most of the food needs such as fish and other seafood are obtained in fishing at a relatively low cost.

Net income	Year (person)						
(IDR/month)	2017	2018	2019	2020	2021	2022	2023
500,000 - 1,000,000	15	13	13	11	11	11	10
1,000,000 - 2,000,000	28	31	34	34	34	33	33
2,000,000 - 3,000,000	11	14	15	17	17	18	20
> 3,000,000	8	9	9	11	11	11	11

 Table 2. Net income of crab fishermen on Maginti Island 2017 – 2023

# 2. Daily production of crab fisheries

The average daily production of crab fisheries in Maginti Island is 255kg/ day or 3.61kg/ capita/ day. This value was contributed by P1 as much as 186.14kg/ day (73%), P2 as much as 21.71kg/ day (8.52%), and P3 as much as 47.14kg/ day (18.49%) (Table 3). The significant difference in the contribution of daily production to each collector is influenced by the number of crab fishermen who have a relationship with collectors. The number of fishermen in P1 ranges from 47 to 51 people; in P2, there are 5 to 7 people, and in P3, there are 10 - 12 people.

Vaar	Ι	Daily pro	duction (l	kg)	Number of fishermon	Average
rear	P1	P2	P3	Total	- Number of fishermen	(kg/capita/day)
2017	134	15	46	195	62 (47 P1; 5 P2; 10 P3)	3.15
2018	168	17	50	235	67 (50 P1; 7 P2; 10 P3)	3.51
2019	180	21	52	253	71 (51 P1; 9 P2; 11 P3)	3.56
2020	176	16	28	130	73 (51 P1; 10 P2; 12 P3)	3.29
2021	164	25	37	226	73 (51 P1; 10 P2; 12 P3)	3.09
2022	237	28	60	325	73 (51 P1; 10 P2; 12 P3)	4.45
2023	244	30	57	331	74 (51 P1; 11 P2; 12 P3)	4.47
Average	186.14	21.71	47.14	255.00		3.61

Table 3. Daily production of crab fisheries

# 3. Fluctuations in crab prices

Crab prices from fishermen to collectors tend to fluctuate throughout 2017 - 2023. The average price of crabs per kg was 32,083.33 IDR in 2017, 36,166.67 IDR in 2018, 30,750 IDR in 2019, 23,750 IDR in 2020, 64,666.67 IDR in 2021, 31,083.33 IDR in 2022, and 44,791.67 IDR in 2023.

The highest crab prices observed varied by year. In 2017, the peak price of 35,000 IDR/kg occurred from February to September. In 2018, the highest price reached 39,000 IDR/kg during November and December. In 2019, the price of 35,000 IDR/kg was observed from October to December. The price remained at 35,000 IDR/kg in January and February 2020. In 2021, the highest price surged to 80,000 IDR/kg from August to December. In 2022, the peak price was 76,000 IDR/kg in January and February. The most recent data from 2023 show a price range of 45,000 to 47,000 IDR/kg from October to December (Fig. 1).

During 2017 - 2023, the price per kg of crab from fishermen to collectors occurred during March – September 2020 at 20,000 IDR and during June – October 2022 with a price range of 15,000 - 17,000 IDR (Fig. 1).



**Fig. 1.** Price fluctuations per kg of crab (*Portunus pelagicus*) in 2017 – 2023 in Maginti Island, West Muna Regency

# 4. Crab fisheries supply chain

The crab fishery supply chain in Maginti Island, West Muna Regency, reaches the international market or exports to America, China, and others. The supply chain starts with fishermen who sell their catches to local collectors. From local collectors, crabs areboiled and processed into frozen crabs to be sold to collectors at the district level in Bombana and West Muna Regencies. Furthermore, from the district collectors, frozen crabs are sent to Makassar or Surabaya to be exported to America, China, and others (Fig. 2).

At each stage in the supply chain, there are several margin values ranging from fishermen to the international market. There is a margin ranging from 6,750 to 10,750 IDR/kg at the Fishermen – Local collector – Regency level collector stage, 12,500 to 21,250 IDR/kg at the Local collector – Regency level collector – Exporting companies stage, and 5,586 to 23,214 IDR/kg at the Regency level collector – Exporting companies – International market stage (Table 4).



**Fig. 2.** The BSC fishery marketing supply chain 2017 – 2023 in Maginti Island, West Muna Regency

**Table 4.** Price margin based on value chain analysis of BSC fisheries 2017 - 2023 in Maginti Island, West Muna Regency

Supply chain	Margin (IDR/kg)
Fishermen – Local collector – Regency level collector	6,750 - 10,750
Local collector - Regency-level collector - Exporting companies	12,500 - 21,250
Regency-level collector - Exporting companies - International market	5,586 - 23,214

Notes. The price for frozen BSC is equivalent to the price per kg of fresh BSC, which is 1kg of frozen BSC is equivalent to 3-4kg of fresh BSC. The exchange rate of frozen BSC in the international market is 1 USD = 13,500 - 15,700 IDR.

#### DISCUSSION

# 1. Overview of crab fisheries (BSC)

Crab fisheries in Maginti Island have been in operation since the 1990s, initially using simple methods such as menyulu (searching for crabs at night during low tide) and basic fishing gear like bubu traps and nets (Afdal *et al.*, 2023). However, the price of BSC commodities in that era has not been able to support the community's economic life. Fishery commodities that are the main targets of the community are sea cucumbers, reef fish, and abalone.

In 1993, demand for BSC commodities emerged, triggering communities to adapt to new, more effective fishing methods such as trawls. Changes in fishing methods and technologies are fishermen's adaptation strategies to ecological changes (**Helmi & Satria, 2012**). The use of trawls continued to grow, especially from early 1998 to 2010, for BSC and shrimp fishing. From 1998 – 2010, around 90% of the people of Maginti Island worked as fishermen, which crab, shrimp, and reef fish fishermen generally dominated.

After 2010, the number of BSC fishermen in small-scale fisheries had decreased because many people have changed their profession to become traders and migrated to various regions in Indonesia, such as Kalimantan, the Maluku Islands, and others. This also affected the community's social order, especially BSC fishery fishermen. The use of trawl fishing gear began to be strictly prohibited, especially after the emergence of various conflicts due to the impact of damage to nets and land of seaweed farmers with the use of trawls. Conflicts of interest occurred several times, forcing trawl fishermen to switch their fishing time to daylight with the target of pelagic fish catches. Meanwhile, BSC fishery fishermen continue to increase in line with the decline in trawl fishermen and the increasing market demand.

## 2. Crab production potential

Maginti Island is part of the waters of the Tiworo Strait, which has a cluster of small islands with abundant fishery resources. One of the fishery resources that is the main commodity of the Tiworo Strait capture fisheries is the crab (*Portunus pelagicus*) (Muskita *et al.*, 2015; La Sara *et al.*, 2019; Aswandi *et al.*, 2023).

There are small islands that support crab fisheries on Maginti Island, including Pasi Toboang, Gala Island, Pasi Padangan, Pasi Mataha, Mandike Island, and others. Based on the potential of the area, Maginti Island has a large crab fishery potential, which is 171.44 - 312.84kg/ day or equivalent to 62.58 - 114.19 tons/year and contributed by fishermen ranging from 2.51 - 4.35kg/ capita/ day (total fishermen = 62 - 74). This potential can certainly still increase if all information on crab fishery production is comprehensively estimated, namely counting all catches not recorded by collectors.

The crab production in this study was lower than the report of Agustina *et al.* (2014) which found that the crab production in Betahlawang – Demak Village is 176 tons/year. However, the trend of fishermen's catches or crab production in Maginti Island is still relatively stable during the years from 2017 - 2023, with a value of 71.18 tons in 2017 to 120.82 tons in 2023.

These findings indicate that the COVID-19 pandemic from late 2019 to early 2021 did not affect the productivity of fishermen to catch crabs as the main source of livelihood. This can be influenced by the powerful relationship between collectors and fishermen, which requires them to stay at sea to pay off debts or maintain relationships with collectors.

## 3. BSC price fluctuations 2017 – 2023

BSC prices in Indonesia are generally influenced by the export market demand to the USA and trade market competition between the USA and China (**Suhana, 2021**). Fluctuations in the price of frozen BSC in Indonesia also affect the fluctuation of purchase prices by the collectors who gather the yield from fishermen. Although BSC fishery production was relatively stable during 2017-2023, various factors influenced price fluctuations. An overview of the factors affecting the fluctuation of fresh BSC prices can be described as follows:

- 2017-2018: Crab prices tended to increase during these years. Strong international demand, especially from countries such as the United States and Japan, increased fishermen's purchase price from an average of 32,000 IDR/kg in 2017 to 36,100 IDR/kg in 2018.
- 2019: This year, the price of fresh BSC was relatively stable at 31,000 IDR/kg, but decreased compared to 2017 and 2018. The price decline was triggered by stricter fisheries policies in Indonesia to maintain the sustainability of crab stocks, which impacted the supply and price of BSC.
- 2020: During this year, there was a COVID-19 pandemic that had a significant impact on the world economy (Arianto, 2020), especially affected countries (Junaedi & Salistia, 2020), including Indonesia and its BSC market. Global demand has declined drastically as restaurants and hotels are closed or operating with limited capacity. The price of BSC continued to decline until it reached its lowest value, with an average of 23,750 IDR/kg. This value is the lowest in the period 2017 2020.
- 2021: There has been a market recovery and economic revival in line with the decline in COVID-19 cases (Adrian et al., 2022; Rusmini et al., 2023) and the reopening of economic sectors. Indications of market recovery are starting to be seen with the increase in BSC prices that occurred from January to December 2021, with a value of 37,000 IDR/kg in January – February,

50,000 IDR/kg in March-May, 76,000 IDR/kg in June – July, and 80,000 IDR/kg in August – December 2021.

- 2022: ThE year mentioned witnessed another decrease in the price of BSC compared to 2021. The downward price trend began to be seen from January to December 2022. The lowest BSC price purchased by collectors from fishermen this year reached 15,000 20,000 IDR/kg from April to October 2022. Collectors said that the price drop was the impact of the war between Russia and Ukraine which also affected the global economy including the crab fish market. This statement is in line with the study of Bakrie *et al.* (2022) and Yudianto *et al.* (2023), which found that the Russia-Ukraine war has an impact on the global economy, including the Southeast Asian region in which Indonesia is located.
- 2023: This year, crab prices were stable again, with selling prices ranging from 35,000 – 51,000 IDR/kg. These prices were relatively higher than in 2017, 2018, 2019, 2020, and 2022.

Overall, the fluctuations in crab prices during the 2017-2023 period reflected the global market dynamics, local policies, and natural factors that affect the availability and demand of crabs.

# 4. Supply chain and economic impact on fishermen

According to **Emhar** *et al.* (2014), the supply chain is a concept with a regulatory system related to product, information, and financial (financial) flow. This arrangement is important regarding the number of links involved in the supply chain, including BSC fisheries (Simbolon *et al.*, 2020).

The supply chain for crab products is important because the long supply chain consists of marketing actors involved in distributing crabs with the characteristics of perishable crabs and high selling prices. Supply chain actors start from fishermen catching BSC to end American and domestic consumers. The distribution of products starts from fresh BSC and is then processed in marketing institutions until the final product is marketed to the export market in the form of meat that has been separated (frozen BSC) according to meat grade (Agustina *et al.*, 2014).

The crab fishery supply chain in Maginti Island consists of several stages involving various parties, from fishermen to the international market. The first stage is the fishermen in Maginti Island who catch crabs. They use various traditional fishing methods, such as nets and crab traps. The captured BSC were then collected and sorted based on their size and quality. With good size and quality, the BSC is sold to local collectors based on a powerful relationship with fishermen. Meanwhile, the low-quality BSC is sold to local communities if the quantity is large, and consumed alone if the quantity is small.

After the crabs are caught, fishermen sell their catch to local collectors. These local collectors usually operate around fishing villages and liaise between fishermen and district-level collectors. They collect crabs from various fishermen and ensure that the quality of the crabs is maintained before being sold to the next stage. Local collectors, especially P1, usually process the BSC by separating the meat from the shell, so that the frozen BSC meat is sold to district-level collectors. However, collectors such as P2 and P3 generally sell boiled BSC to district-level collectors. In some areas, local collectors are called mini plants (**Agustina** *et al.*, **2014**; **Aswati** *et al.*, **2019**). Mini plants have the task of building partners with BSC fishermen by providing capital and collecting their catches for further processing, both in the form of boiled BSC and separated BSC meat (**Aswati** *et al.*, **2021**).

Local collectors then sell the crabs that have been collected to collectors at the district level. This district-level collector has a larger capacity to store and process crabs. They typically have better storage facilities and access to a wider market. The crab may be further processed at this stage, such as separating the crab meat from the shell.

After the regency-level collectors process BSC, BSC is then sold to exporting companies. This exporting company ensures that crabs meet the international quality standards and comply with export regulations. They are also responsible for the packaging and shipping crabs to the international market. Exporting companies work closely with various parties to ensure a smooth export process, including transportation and customs.

BSC from Maginti Island reaches the international markets, such as the United States, China, and other countries. This crab is sold to consumers in the international market through various distribution channels, including supermarkets, restaurants, and wholesale markets (**Suhana, 2021**). High demand from the international market encourages fishermen and all parties in the supply chain to continue to improve the quality and quantity of crab production.

Various challenges are faced in each stage of this supply chain, such as price fluctuations, crab quality, and weather conditions that affect catches. However, with good cooperation, the crab fishery supply chain in Maginti Island can run smoothly, providing economic benefits for the local community. The significance of the BSC fisheries in influencing the community's economy can be seen in the increase in net income, as shown in Table (2). In 2017, 69.35% of fishermen had an income of 500,000 – 2,000,000 IDR/month, but it dropped to 58.11% in 2023. In contrast, fishermen with a net income >2,000,000 IDR/month increased by 11.25 to 41.89%. The increase in income indicates that the BSC fisheries in Maginti Island have supported the implementation of the SDG, specifically SDG-1, namely no poverty.

The increase in net income was influenced by the availability of the BSC stocks in the Tiworo Strait or the archipelago area that became a fishing ground. In addition, the price margin between Fishermen – Local collectors - and Regency-level collectors is still relatively small, which is 6,750 - 10,750 IDR/kg.

# CONCLUSION

Crab fisheries in Maginti Island are socially conducted by fishermen with a maximum high school education background and are dominated by elementary school graduates. Economically, crab fishermen are dominated by fishermen with an income level <2,000,000 IDR/month. Fluctuations in global BSC prices affect local prices but can lead to an increase in fishermen's income by up to 11.25%, with earnings rising to more than 2,000,000 IDR per month from 2017 to 2023. Based on these data, the governments of Southeast Sulawesi Province and West Muna Regencyare recommended to provide the BSC fishing gear that can improve the welfare of fishermen. The provision of fishing gear assistance can reduce production costs for fishermen while significantly increase fishermen's income.

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