



## RESEARCH ARTICLE

### Blue swimming crab (*Portunus pelagicus*, Linnaeus 1758) capture fishery practices in Tigbauan, Iloilo, central Philippines

Maria Liza B. Toring-Farquerabao<sup>1</sup>  • Albaris B. Tahiluddin<sup>1\*</sup> 

<sup>1</sup> College of Fisheries, Mindanao State University-Tawi-Tawi College of Technology and Oceanography, Sanga-Sanga, Bongao, Tawi-Tawi 7500 Philippines

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#### ABSTRACT

Blue swimming crab (BSC) (*Portunus pelagicus*) is an economically significant aquatic species contributing to the Philippine economy. Tigbauan, a coastal municipality in Iloilo, central Philippines, has been practicing BSC capture fishery for decades. However, there is a limited existing study on BSC fishing practices in this particular area. Thus, this study aimed to assess the status of the BSC capture fishery in Tigbauan, Iloilo. A household survey was done in October 2019 for the five crabbing villages (barangays) in the area using a semi-structured questionnaire. Results showed that most crabbers (83.4%) were still living below the country poverty threshold. Although some crabbers were engaged in other livelihood opportunities, the marginal contribution from these earnings to the household income was still inadequate to supplement the fundamental and other family needs. Limiting their chances to other sources of income may be due to their lack of formal education. Fishing gears used by locals were crab pots locally known as *panggal* and crab entangling net or bottom-set gillnet locally known as *pukot*. Crabbing operation varied in each village and was done regularly and even twice a day in peak season time. The instances of catching gravid females were high. Hence, threatening the status of wild stocks. Rampant trawling and dragging activities in the municipality also became a big problem for the crabbers and contributed to the catch decline. Strict implementation of the existing ordinances must be carried out and focused on the biology, seasonality, and stock enhancement to formulate an effective management framework plan.

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\* Corresponding author  
E-mail address: [albarist20@gmail.com](mailto:albarist20@gmail.com) (A. B. Tahiluddin)



## Introduction

Crab fishing is one of the primary livelihoods in a coastal community. In the Philippines, as an archipelagic country, crabbers are common to find. Since crabs are among the most vital aquatic resources of the Philippine waters (Camacho & Aypa, 2001), they also provide a family living. Among the commercially significant crab species are the BSCs, scientifically known as *Portunus pelagicus*, which are either sold in the live state or as processed products locally or exported mainly to Taiwan, Hongkong, Japan, and the USA (Camacho & Aypa, 2001). In the Philippines, BSCs constitute a crucial part of the local fisheries production. *P. pelagicus*, over 90% of the crabs landed, was the main species in the country's crab fishery since it started in the 1950s (Ingles, 2004). In the first quarter of 2018, the BSC fisheries production amounted to 5,923.67 metric tons, contributing 0.01% to the total Philippine fisheries production (PSA, 2018a).

BSC fisheries occur throughout the Philippines (BFAR, 2013). The fishing activity of *P. pelagicus* started in the Philippines as early as the 1950s (Mesa et al., 2018). The BSC fishery is a multi-gear activity where crabbers are usually artisanal and capture crabs by gleaning, bamboo trap use, crab lift nets (Romero, 2009; Gadhavi et al., 2013), crab pots, and gill nets (Del Norte-Campo et al., 2004; Ingles, 2004; Germano & Melgo, 2003). The most common artisanal gear used in shallow water is crab pots or *panggal*, but crabbers also use the bottom set gillnets, otter trawl, crab lift net or *bintol*, and push net (Mesa et al., 2018). In the study of Ingles (2004) and Mesa et al. (2018), they have identified eleven different fishing gear types used in catching BSCs in the Western Visayan Sea. Five out of these eleven crab gears are considered as one of the major fishing gears used by crabbers. Gadhavi et al. (2013) also mentioned that a large number of fishers around Sikka, Gulf of Kutch, Gujarat, India is engaged in artisanal crab fishery using spears, traps, and other traditional gears like umbrella net and fence net. Different specifications of crabbing gears and crabbing operations were also discussed by Romero (2009), particularly used as well in the Visayan Sea. Hence, few publications show several fishing gears used in this type of species with its unique specifications and operations depending on the location it is being utilized.

In Tigbauan, a coastal municipality in Iloilo, central Philippines, BSC fishing activities have been practiced for years. This practice provides a livelihood for the crabbers. Accordingly, different fishing gears are used to catch BSC. The fishing gears, gear operations, and fishing practices are not well

documented (Pers. Comm. Municipal Aquaculturist, Tigbauan, Iloilo). Thus, this study aimed to assess the BSC capture fishery practices in Tigbauan, Iloilo, central Philippines.

Specifically, this study aimed to;

- (1) survey the crabbers' socio-demographic profile, crabbing gears and gears modifications (if there is any), and crabbing practices which emphasized the operation of crabbers with specified gear used;
- (2) assess whether the municipal ordinance has regulatory measures regarding BSC fishery management; and
- (3) measure the level of crabbers' awareness about the ordinance (if there is any).

## Materials and Methods

### Study Site and Duration

A household survey (HS) of the various crabbing villages in Tigbauan, Iloilo, central Philippines, was conducted for a month in October 2019. The study covered the five Tigbauan coastal villages engaged in crab fishing: Barroc, Atabayan, Baguingin, Namocon, and Parara Norte (Figure 1).

### Data Gathering

Preliminary survey and key informant interview (KII) were carried out with the Municipal Fisheries Officer and the president of the Barangay Fisheries and Aquatic Resources Management Council (BFARMC) in each sampling station to have an overview of the crab fishery in the municipality. After which, a one-on-one HS was done with the crabbers. A semi-structured questionnaire was developed and used to address the objectives of this study. The survey had included individual fishers who engaged in crabbing activities either part-time or full-time, as adopted in the study of de la Cruz et al. (2018), who were available and willing to participate in the study. The survey questions included information on the crabber's socio-economic profile, namely age, sex, civil status, educational attainment, number of dependents, and average monthly income from crabbing. For the gear preference and crabbing practices, each crabber was asked the following: type of gear used or preferred; dimension or number of gear units; soaking time of gears; the frequency of crabbing; bait used, if any; and companion in crabbing. Regarding BSC fishery management awareness, the respondents were asked about what type of problems and concerns related to crabbing experiences, knowledge on any government or non-government regulatory measures to manage the BSC resource, and suggestions to

address their issues and concerns and to manage the resources effectively.

Fishing gears used in crabbing and its specification were described and documented.

### Data Analysis

A database was made on the socio-demographic profile of the crabbers using IBM SPSS Statistics version 20. The data were tabulated and thoroughly analyzed. Qualitative data were analyzed using descriptive statistics, and mean scores were derived for all quantitative results.

## Results and Discussion

### Crabber's Socio-Demographic Profile

A total of 24 crabbers were interviewed from five villages of Tigbauan: Parara Norte, Namocón, Baguingin, Atabayan, and Barroc. Only two out of the total interviewed crabbers were not members of the BFARMC. Atabayan village has the highest percentage of crabbers (45.8%), followed by Baguingin (25%), Namocón (16.7%), Parara Norte (8.3%), and Barroc (1%) (Table 1). All crabbers were male, aged from 27 – 72 years old, married with 6-10 household members, and practiced Roman Catholicism. About 79.2% of them resided in the area for more than 30 years. The majority (33.3%) graduated high school, 20.8% attained vocational courses, 4.2% had gone into college, and only 4.2% successfully gained a degree.

Each crabber varied in their years of crab fishing from more than 30 years to just 1 to 5 years of engagement. Half of the total count of crabbers already owned a lot of permanent residents, but half of them were informal settlers (Table 1). Crabbers' houses, made of semi-concrete materials, were provided by electricity from Iloilo Electric Company (ILECO) and available water supply from a deep well or water pump.

**Table 1.** Crabbers count per village in Tigbauan, Iloilo, Philippines

Village	Crabbers' Count	Percentage Composition (%)
Barroc	1	4.2
Namocón	4	16.7
Atabayan	11	45.8
Parara Norte	2	8.3
Baguingin	6	25
Total	24	100

Most crabbers (54.2%) had an average monthly income of PHP 1,000.00 (US\$ 19.46) – PHP 5,000.00 (US\$ 97.28). About 29.2% of the respondents had an income of PHP 6,000.00 (US\$

116.74) – PHP 10,000.00 (US\$ 194.57) and 8.3% earned PHP 11,000.00 (US\$ 214.03) – PHP 15,000.00 (US\$ 219.85) monthly. Only 8.4% of the crabbers earned an average monthly income of more than PHP 26,000.00 (US\$ 505.88) (Table 2). During the 1st semester of 2018, a family of five needed around PHP 10,481 (US\$ 03.93) monthly to meet their minimum basic food and non-food needs. This represents an increase of about 11% from the 1st Semester of 2015 to the 1st half of 2018. On the other hand, a family of five needed around PHP 7,337 (US\$ 142.76) per month to meet their minimum basic food needs (PSA, 2018b). The study revealed that the average income mostly crabbing households in Tigbauan Municipality was way below the indicated poverty threshold. Though some of the crabbers engaged in other livelihood opportunities, such as carpentry, fish vending, and construction works, the marginal contribution from these earnings to the household income was still inadequate to supplement the basic and other needs of the family. Other sources of income are needed for the crabbing families to live a decent life. The reason for this state of living, according to them, was the decline in catch of BSC and other target crabs as well as the increasing number of crabbers in the area, which contributed to the lowering of catch per crabber. Another aspect was their educational attainment. The lack of formal education beyond high school severely limits alternative employment opportunities (Rhodes et al., 2001). This might be one factor that limits the crabbers from having a high-paid job. However, as per observation, the crabber's children were all sent to schools aiming to have a better future.

### Crabbing Gears and Practices

The crabbing villages in the Municipality of Tigbauan, Iloilo, used two types of fishing gears in their crabbing operations namely bottom-set gillnet or crab entangling net and crab pots. Ingles (2004) pointed out in his paper that these two are the major crabbing gears used in the Philippines. Namocón, Atabayan, Baguingin, and Barroc used crab pots, while Parara Norte was the only village that used bottom-set gillnet or crab entangling net. The use of this other type of gear in Parara Norte was due to the influence and assistance given by the government through projects implemented by the Bureau of Fisheries and Aquatic Resources (BFAR), an agency of the Philippine government under the Department of Agriculture responsible for the development, improvement, management, and conservation of the Philippines' fisheries and aquatic resources. This particular village was the only beneficiary of the implemented project done in their locality.

**Table 2.** Socio-demographic profile of crabbers in Tigbauan, Iloilo, central Philippines

<b>Respondents (24)</b>	<b>Crabbers' Count</b>	<b>Percentage Composition (%)</b>
<b>Gender</b>		
Male	24	100
<b>Years of Residence</b>		
16 – 20 years	2	8.3
21 – 25 years	1	4.2
26 – 30 years	2	8.3
>30 years	19	79.2
Total	24	100
<b>Religion</b>		
Roman Catholic	24	100
<b>Civil Status</b>		
Married	24	100
<b>Household Members</b>		
1 – 5	10	41.7
6 – 10	14	58.3
Total	24	100
<b>Educational Attainment</b>		
Elementary level	2	8.3
Elementary graduate	4	16.7
High School level	3	12.5
High School graduate	8	33.3
College level	1	4.2
College graduate	1	4.2
Vocational course	5	20.8
Total	24	100
<b>Average monthly income (PHP)</b>		
1,000 – 5,000	13	54.2
6,000 – 10,000	7	29.2
11,000 – 15,000	2	8.3
26,000 – 30,000	1	4.2
31,000 – 35,000	1	4.2
Total	24	100
<b>Years of engagement in crab fishing</b>		
1 – 5	5	20.8
6 – 10	3	12.5
11 – 15	4	16.7
16 – 20	1	4.2
21 – 25	2	8.3
26 – 30	2	8.3
More than 30	7	29.2
Total	24	100
<b>Owned a lot</b>		
Yes	12	50
No	12	50
Total	24	100
<b>Tenure of house</b>		
Informal settlers	12	100
<b>Member of BFARMC</b>		
Yes	22	91.7
No	2	8.3

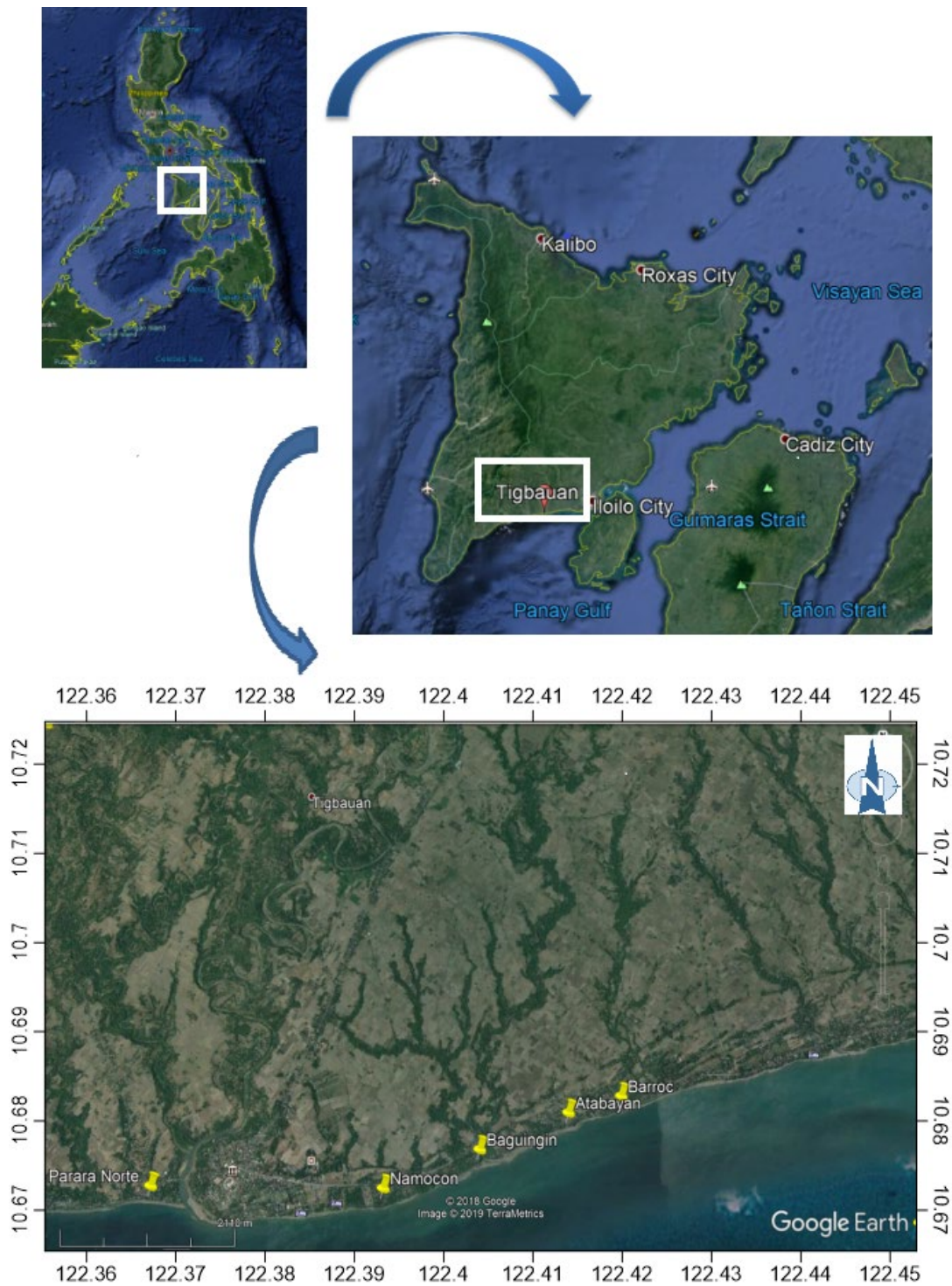


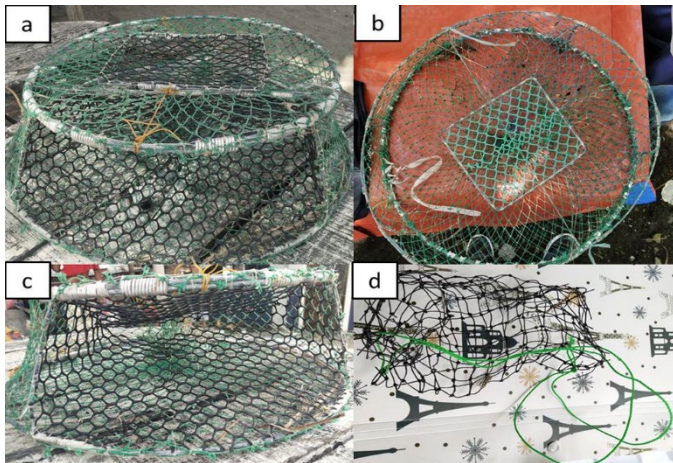
Figure 1. Map of the study site

### Crab pot

A crab pot is a type of gear designed for catching commercially important crab species. The gear is locally known as *bubo pangasag*, *panggal* or *timing* (Mesa et al., 2018) and is more favored among crabbers due to its cheaper cost, and it catches less by-catch (Romero, 2009). The gear used in Tigbauan, Iloilo, has a frustum shape with different sizes or dimensions. Crab pots used in shallow waters are larger than the ones used in deeper waters.

Crab pots used in shallow areas are usually made of ground wire for the frame, which is also served as sinker of the gear, wrapped around with polyethylene net and have an opening made from plastic hexagonal mesh-shaped wire having a dimension of height is 15.24 cm; diameter at the top is 35.56 cm; diameter at the bottom is 43.18 - 48.26 cm. The door with a rectangular-shaped, where the catch is collected, which is 17.78 × 17.78 cm, has an opening, which serves as an entry point of target species, measuring 20.32 cm (Figure 2). Another entry point design is circular, having a diameter of 11.43 cm, and is

made of green-colored plastic hexagonal mesh-shaped wire (Figure 3). Crab pot cost per unit is PHP100.00 (US\$1.90). The only distinct design used in the shallow area is the collapsible crab pot design that was donated to a fisherman from Sweden. It is made of a color black coated steel bar frame with black netting and with a rectangular shape having the following dimension: length is 59.70 cm; width is 17 cm; height is 15.20; and with an opening of 20.30 cm. Net mesh size is number 14. The openings or found on both sides of the gear (Figure 4).



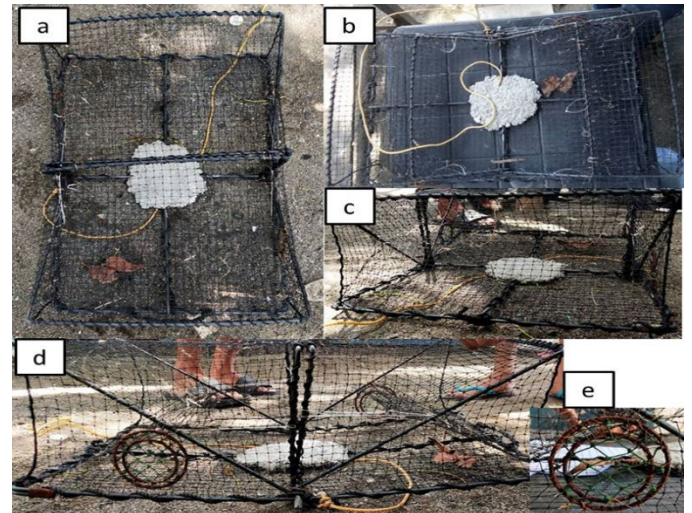
**Figure 2.** Crab pot used in shallow waters in Namocon, Tigbauan, Iloilo, central Philippines, showing the (a) side view of the crab pot, (b) top view with the door, (c) opening or the entry point of the crab and (d) mesh net where the bait is being put and tied inside the crab pot



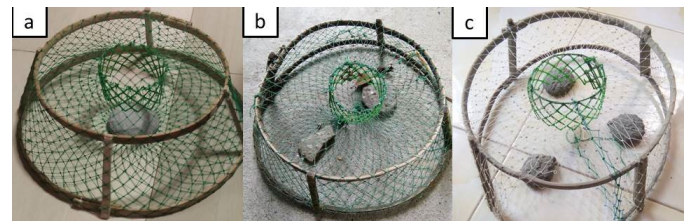
**Figure 3.** Crab pot used in shallow waters in Namocon, Tigbauan, Iloilo, central Philippines with circular-shaped entry point

In deeper waters, crab pots are made of bamboo wrapped with polyethylene green-colored net and monofilament nylon. According to crabbers, white nets have been used recently because it is easier to clean and more visible for crabs to see the bait inside the trap. Crab pots' sizes are almost uniform in the three villages with a height of 11.43 to 15.24 cm, a top diameter of 30.48 cm, and bottom diameter of 40.64 cm, an opening of 10.16 cm, which is made of green colored plastic chicken wire and a mesh size of 2.5 cm (Figure 5). Sinkers used are made of cement attached inside directly built in the flooring of the pot for the stability of the gear when deployed underwater. The said

gear can accommodate 10 pieces of small size crabs or 3 - 4 pieces of large sizes. Crab pot typically costs PHP70.00 (US\$ 1.36).



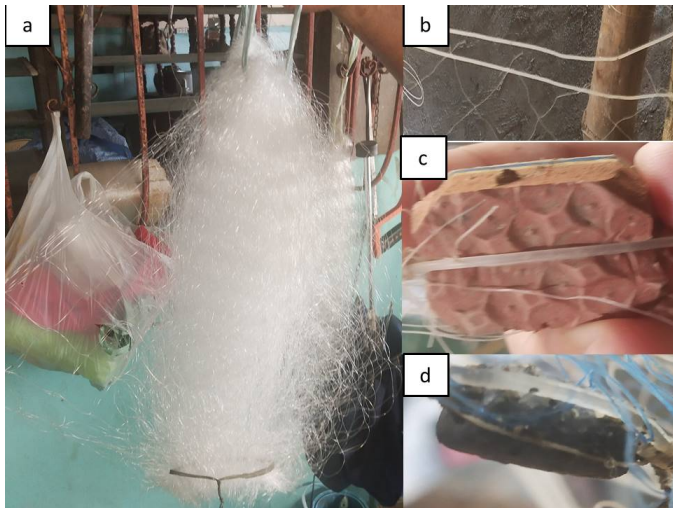
**Figure 4.** Collapsible crab trap designed from Sweden used in shallow waters in Namocon, Tigbauan, Iloilo, central Philippines showing the (a) top view of crab trap, (b) collapsed form, (c) opening or the entry point of the crab, (d) side view of the crab trap and (e) escape point of small size crabs



**Figure 5.** Crab pots used in deep water operation in Tigbauan, Iloilo, central Philippines for crab fishing operation; (a) crab pot use in Barroc, (b) crab pot use in Baguingin and (c) crab pot use in Atabay

### **Bottom-set gillnet/Crab entangling net**

The bottom set gillnet or the crab entangling net is a type of gillnet anchored and fixed on the seafloor. The gear is locally known as *palubog*, *palugdang* or *pukot* (Mesa et al., 2018). The net used in the village of Parara Norte is made of monofilament polyamide (PA), having a length of 600 m. Mesh sizes vary every 200 m. Monofilament PA size number 4 (approx. 85 mm) or size number 5 (78.5 mm) on first 200 m, size number 4.5 (approx. 85 mm) on second 200 m (middle part), and size number 3 (130 mm) on the last 200 m. The design was made by local fishers to maximize the chance of catching more crabs. The mainline was made of a monofilament PA size number 6 attached with rubber floaters. The footrope was also made of monofilament PA size number 6 with leads that serve as sinkers (Figure 6).



**Figure 6.** Bottom-set gill net used in Parara, Tigbauan, Iloilo, central Philippines for crab fishing; (a) monofilament net with number 5 mesh size, (b) nylon used for mainline and footrope, (c) floaters attached at the mainline and (d) lead sinkers attached at the footrope

### Crabbing Practices/Operation

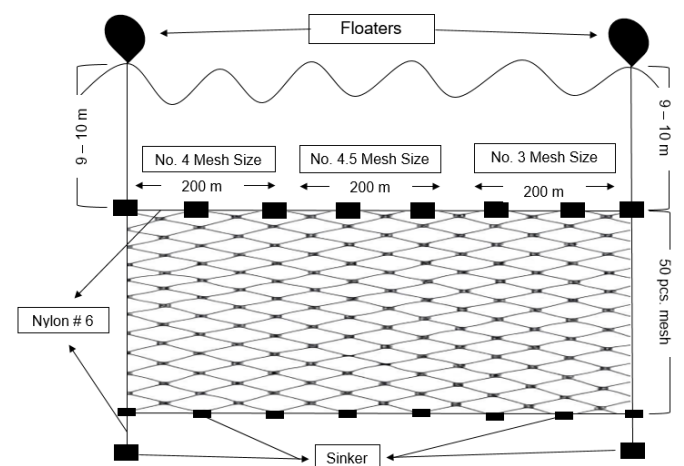
The crabbing operation varied in each area according to its fishing gear used. For the bottom-set gill net or crab entangling net, the setting is usually done in the morning at around 5 o'clock, and hauling is done on the next morning at around 5-8 o'clock. Soaking time is approximately 24 hours. The said operation is also similar to that is shown in the study of Romero (2009) and Mesa et al. (2018). However, Romero (2009) added that due to the eagerness of crabbers to gain more income, they would be setting out their operation further using bigger boats for 2-3 days at sea to catch more BSCs. Motorized banca, approximately 3 gross tons (GT) (Figure 7), is used by two persons for their crabbing operation. On the other hand, crabbers in the Western Visayan Sea use bigger boats with the size of 10-30 ft long powered by 8, 10-16 HP engines (Romero, 2009). Peak season in using bottom-set gill net is during southwest monsoon or *habagat*, i.e., June to October of the year, while lean season happens every November to December.

The bottom-set gillnet or crab entangling net has a total stretch length of 600 m. During operation, nets are deployed at the desired depth. Mesh size varies every 200 m-length of the net with a hanging ratio of 0.6. The distance from the surface of the water to the mainline is approximately 9-10 m. The net used has a mesh size count of 50 knots down. Lead sinkers tied in the rope line will serve as the weights to keep the net at a desired level of depth (Figure 8).

Crab pot fishing operation in the four villages varied as well. Namocon village operates in shallow waters, while villages such



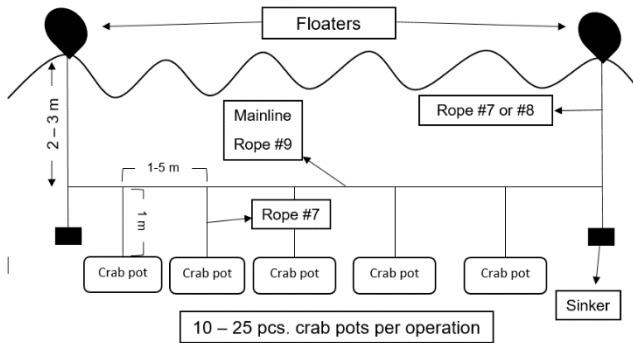
**Figure 7.** Motorized banca used by two crabbers in Parara Norte, Tigbauan, Iloilo, central Philippines



**Figure 8.** Lay-out of crab fishing operation using bottom-set gillnet or crab entangling net in Parara Norte, Tigbauan, Iloilo, central Philippines

as Baguingin, Atabayan, and Barroc operate in deeper waters. The setting of crab pots in shallow waters is done by carrying the pots to the fishing area and setting it manually by crabbers at around 4 - 5 p.m. Hauling is done on the next day at around 4 - 5 a.m. also. Soaking time is approximately 12 hours. The distance of operation from the shoreline is approximately 10 m away. Ten to twenty-five crab pots are used per operation. Bait used by the crabbers is small fishes, usually *Leiognathus* sp., and/or chicken head. The chicken head is preferred by Namocon village because it is cheaper and readily available in the local market. However, the silvery color of leiognathids believed to glint in the water, therefore, assists in the attraction of organisms into the gear (Picoy-Gonzales & Monteclaro, Unpublished data). The baits are also placed in a perforated container to prevent them from being eaten by scavengers (Bjoridal, 2002). Peak season occurs when the water is turbid and when the typhoons are frequent, which is usually every June to September of the year. On the other hand, the lean

season is every October to March of the year when the water is clear. And at this time, crabbers do not operate at all to avoid losses in terms of exerting effort. Instead, they engage in other possible alternative income whenever opportunities let them. The shallow water crabbing operation is shown in Figure 9.



**Figure 9.** Lay-out of crab fishing operation using crab pots in Namocon, Tigbauan, Iloilo, central Philippines

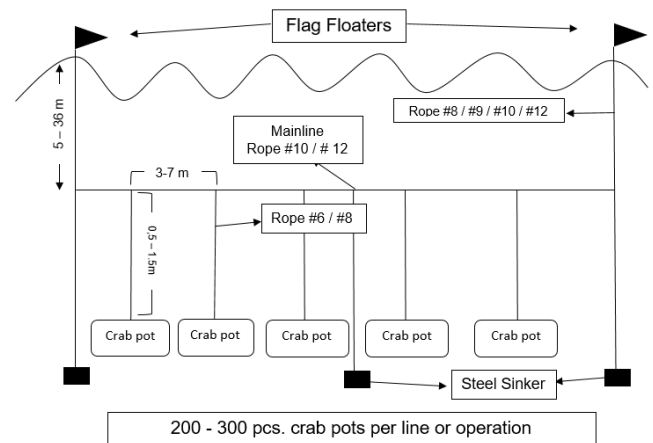


**Figure 10.** Motorized crabbing boat used in fishing operation in the deeper waters of Tigbauan, Iloilo, central Philippines

In deeper waters, the operation is done using a larger motorized banca (Figure 10) boarded by two persons. The setting is usually done at 5 - 9 a.m., and hauling is done on the next day at around 4 - 5 a.m. Soaking time is approximately 24 hours. Crab pots used range from 150 - 300 units per operation. Bait used in every operation is small fishes with low market value (e.g., leiognathids), same with Namocon village, which was purchased from the local market. Formerly, crabbers used frogs as bait because it is cheaper and more efficient. However, buyers opted to buy the crabs that are fed with frogs due to the perception of the consumers that they were also indirectly eating the frog as well. The peak season for the deep-water operation is usually October to June, while the lean season is somewhere from July to September. Crabbers can attain a catch up to 10 kilograms of crabs every peak season. However, during

the lean season, they could just acquire a half kilo or no catch at all.

Crab pot fishers, which are engaged in deeper water, typically operate near the Guimaras area with depths ranging from 15-20 fathoms. However, when water is clear, the operation is usually done 100 - 200 m away from the shoreline. The set-up of fishing gear underwater is shown in the figure below. The length of the rope from the floaters, which flags are used with varieties of colors such as red, orange, and black to be easily seen and identified, is around 5-36 m depending on the fisherman's depth preference to operate. The mainline used is PE rope number 10 or 12, where crab pots are tied individually. The distance between each crab pot is 3-7 m. Each crab pot is still tied with another rope, which is PE rope number 6 or 8, to the mainline with a distance of 0.5 - 1.5 m. The whole set-up is weighted by 3 steel bar sinkers. Crabbers usually used 200 - 300 crab pot units per operation. The more the crab pots are used, the lesser its distance away from each pot (Figure 11).



**Figure 11.** Lay-out of crab fishing operation using crab pots in Barroc, Atbayan and Baguingin, Tigbauan, Iloilo, central Philippines

Crab fishing in the Municipality of Tigbauan, Iloilo, is done every day or even twice a day if it is peak season. No catch limit was implemented per day per fisher, and the only ordinance is no catching of gravid females and crablets of less than 27.94 cm. This is stated in the Municipal Ordinance No. 2014 - 10, "Environment Code of the Municipality of Tigbauan" under Chapter 10, Article J of Section 2.5, which penalized the violators a fine of PHP 2,500.00 (US\$ 48.67) or will be imprisoned for not less than 5 days or both depending on the discretion of the court.

BSC is normally traded alive starting from the landing until it reaches the end consumers, for it commands a higher price. Crabbers usually let the crab recover by submerging them underwater before selling to the market. However, dead



individuals are also sold at the same price provided that those of good quality or fat. Species caught are only sold at the local market with a price of PHP280.00 (US\$ 5.45) if it is in small sizes and can reach up to PHP 420.00 (US\$ 8.18) at larger sizes. Species usually caught in every operation are *Portunus pelagicus* (*kasag*), *Charybdis feriata* (*kurusan*), *Portunus sanguinolentus* (*pintokan*), and *Scylla serrata* (*alimango*). By-catch includes flatfish, lobster, and stingrays.

**Awareness of Regulatory Measures Regarding Crab Fishery Management**

The only ordinance of the Municipality of Tigbauan in Iloilo with regards to crab fishing is the Municipal Ordinance No. 2014-10, “Environment Code of the Municipality of Tigbauan.” Chapter 10, Article J, Section 2.5 prohibits taking, catching, selling, processing, or transporting gravid crabs and crablets, mud crabs and/or blue crabs with a carapace less than 11.00 cm. This coincides with the size of BSC at first maturity, which is 10.56 cm for females and 9.64 cm for males. Violations on the said provisions will be penalized of PPH 2,500.00 (US\$ 48.67) or will be imprisoned for not less than 5 days or both depending on the discretion of the court. According to the survey, all crabbers are fully aware of the ordinance (Table 3), and the information was disseminated properly by the LGU. However, the lack of enforcement or strict implementation is still the constraint of this ordinance. The release of the species is still at the fishers’ discretion and guilt.

**Table 3.** Ordinance awareness of crabbers in Tigbauan, Iloilo, central Philippines

Respondents (24)	Crabbers’ Count	Percentage Composition (%)
Yes	24	100
No	0	0
Total	24	100

**Problems and Concerns**

The major problems and concerns among crabbers are the trawling and/or dragging activities in the area. The municipality has already formulated an ordinance to ban the use of the said destructive gear. However, operations are continuously rampant. Whenever trawling is operated after crab pots are being deployed, these fishing gears are being swept away and nowhere to be found. This could lead to loss of income to crabbers and add up to the cost of making new ones. Concerns were brought to LGU but accordingly, no actions were made and done. Crabber’s feedback is that

implementation of the ordinance is too weak in the area. No “bantay dagat” (sea guard) were assigned to each station to guard against this illegal activity. The second concern is poaching. Other fishers tend to harvest the crabs that were caught by their crabbing gears. Next is the use of drift gillnets or locally known *palutaw*, which could also drag and damage the mainline of the crab pots, resulting in the loss of the gears. Typhoons are also considered a problem since they could no longer operate during this period due to strong winds and waves. Therefore, it is too risky for crabbers to operate in deeper areas. At this point, they do not have an income to support their families, especially those who are only relying on crab fishing as their major source of income.

**Suggestions to Improve the Crab Fishery in Tigbauan, Iloilo**

As observed during the conduct of the survey, crabbing is done on a regular basis (except for bad weather) without considering the reproduction period of the BSC. Seldom, catching of gravid females is prevalent. Even though there is an ordinance of prohibition as mentioned above and all crabbers are well-informed, they tend to be tempted because there are times when the catch is scarce. In their minds also, when they return the caught gravid BSC, another crabber will fish it anyway. The probability of survival as well might be low due to stress during the catching and handling process. A study must be conducted on the reproductive biology of BSC taking into account its biology in the area, which could be a basis for the formulation of an effective management plan or of having a closed season to prevent overfishing of the stock. Crabbers tend to harvest one piece of crab for an overnight soaking time which could be a red flag of stock depletion. Stock enhancement might be a solution to address this phenomenon. Alternative livelihood should be given to crabbers to also reduce the fishing pressure. They could probably shift to having a business rather than crab fishing. Providing them with alternative livelihoods is a means of reducing fishing efforts in the area. The government support is necessary and should be appropriate. Fishing gears given to the fishers should fit on what is being used. A preliminary survey should be done before distributing supports so that efficient help is extended appropriately and efficiently.

**Conclusion**

Five villages were involved in crab fishing in the Municipality of Tigbauan, central Philippines. Almost all crabbers and their family in the area remained poor because of

their lack of formal education, which limited them from engaging in other types of livelihood that would increase their income. The majority of the income, which came from the BSC fishery, was barely enough to support the basic needs of the family. In terms of fishing gears, crab pots and crab entangling net or bottom-set gillnet were used by crabbers, and no modifications were found. Fishing operation varied per type of gear; however, species caught were similar. The daily operation may contribute to the decline of the catch of BSC. Thus, catching of gravid female BSC is inevitable. Hence, this paper suggests a comprehensive stock assessment program may be conducted to determine the dynamics of the population and the status of the habitat in the area. A review on reproductive biology in the area must be given attention to establish the appropriate time. In terms of giving alternative livelihood, a consultation with the end-users must be done to give the appropriate help. Lastly, the ordinance must be strictly implemented to help crab fishery in the municipality in the long run, and sustainability will not be compromised.

### Compliance With Ethical Standards

#### Authors' Contributions

MLTF and ABT designed the study. MLTF wrote the initial draft, and ABT edited it. Both authors read and approved the final version of the article.

#### Conflict of Interest

The authors declare that there is no conflict of interest.

#### Ethical Approval

For this type of study, formal consent is not required.

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