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Abstract. Blue Swimming Crab *(Portunus pelagicus)* is high export value product from Indonesia that usually exported as pasteurized crabmeat in cans, and has high consumer demand. Blue swimming crab production still depends on wild catch, so that it will threaten the existence of them in the sea. The use of traps will cause almost all sizes of blue swimming crabs to be caught (accidentally) including those that are still small (not suitable for catching). This study aims to analyze the effectiveness of the escape vent in collapsible traps to reduce small catches of blue swimming crabs in the Pamekasan area. This research was carried out from August 2021 - January 2022 in the southern waters of Pamekasan. The method used is descriptive analysis and the effectiveness analysis of collapsible traps with a size (length x width) of escape vents is 4,5 x 3,5 cm. The study carried out 106 females and 85 males with a total weight of 22,908 kg and the carapace width ranged from 9,7 to 15,8 cm. The effectiveness of escape vents is 98,65%, which is the higher value (closer to 100%) the more benefits it will give to sustainability of blue swimming crabs in the Pamekasan area.

Keywords: blue swimming crab, catch, escape vent, size, selectivity

1. Introduction

Blue Swimming Crab (*Portunus pelagicus*) is a high economic fishery commodity that has long been in demand by domestic and foreign consumers. This resulted in consumer demand continuing to increase. In addition, the production of crabs still depends on wild catch so that it will threaten the existence of crab resources in the ocean [1].

Catching crabs (*Portunus pelagicus*) using trap fishing gear has been widely used by fishermen from small, medium, to large scale [2]. One of the special traps used to catch crabs is a folding trap. Folding trap is a fishing tool that is currently popularly used by fishermen to catch crabs. This fishing gear began to be used by fishermen to catch crabs in early 2000. The folding trap uses a net cover made of Polyethylene with a mesh size of 25 x 50 mm tied to the trap frame [3]. Due to the relatively small mesh size of the trap, small fish have a great chance of being caught in the trap and unable to escape [4].

Pamekasan Regency is one of the regencies in Madura with geographical coordinates of 6°51'-7°31' latitude and 112°19'-113°58' east longitude, with an altitude of 350 m (highest) and 6 meters (lowest).

The district has a coastline of 57850 m (East Java Provincial Marine and Fisheries Service, 2016). The fairly long coastline makes the majority of coastal communities in Pamekasan Regency become crab fishermen, especially in Pagagan Village, Pademawu District. The fishing gear used by fishermen is still using traditional fishing gear, namely bubu (trap). In general, local fishermen operate to take and put their fishing gear back in the morning after dawn and return to the fishing base in the afternoon.

Catching crabs of the right size requires a folding trap that is able to escape crabs with a carapace width below 10 cm, through the addition of an escape gap with a certain location, shape, and size. According to [4] stated that the escape gap serves as an exit for crabs that are not suitable for catching because their size is below market size. Therefore, the purpose of this study was to determine the effectiveness of the escape gap in the collapsible trap, the size of the crab caught in the folding trap, and the catch of the crab in the collapsible trap.

2. Research methodology

This research was conducted in August 2021 - January 2022. This research was conducted in Pagagan Village, Pademawu District, Pamekasan Regency. The method used is descriptive analysis and analysis of the effectiveness of the folding trap with the size (length x width) of the release hole is 4.5 x 3 cm, there are 4 in each corner of the bottom side, to remove crabs with a shell width of less than 10 cm. the data collected in this study in the form of primary data and secondary data. The primary data needed include the number, weight, type and size of the catch. Secondary data is obtained through information from various literature studies, journals and reports from various related agencies.

The method used in this study is the method of description of the biology data to determine the characteristics of the crabs caught by fishermen in Pamekasan waters, Madura. The provisions of the Minister of Maritime Affairs and Fisheries Regulation No. 17 of 2021, namely carapace width > 10 cm, can be used as an indication of the effectiveness of the folding trap escape gap. Effectiveness states how far the target (quantity, quality, and time) is achieved. The greater the percentage of targets achieved, the higher the effectiveness [5]. The value of effectiveness in this study refers to the research of [6] which is adjusted to the objects and variables in this study.

$$Effectiveness = \frac{Small\ blue\ swimming\ crab\ (less\ than\ 10cm)\ that\ do\ not\ pass}{Total\ crab\ catch\ per\ month} \quad (1)$$

The decision-making provisions of the effectiveness value follow the following criteria:

- Effectiveness = 100% means that there are no small crabs that do not escape the total catch of crabs per month, it is stated that the gap in the escape of the folding trap is at the effective level
- 50% < Effectiveness < 100% or between 50 – 100 means that there are almost half to no small crabs that do not escape the total crab catch per month, it is stated that the gap in the escape of collapsible traps is at a moderate to effective level
- Effectiveness = 50% means that there are about 50% of small crabs that do not escape the total crab catch per month, so the escape gap is at a medium level
- 0% < Effectiveness < 50% or between 0% - 50% means that there are almost entirely up to 50% of the total small crabs that do not escape the total crab catch per month, it is stated that the gap in the escape of collapsible traps is at an ineffective to moderate level
- Effectiveness = 0% means that there are almost 100% of small crabs that do not escape the total crab catch per month, then the escape gap is at an ineffective level

3. Results and discussion

Fishermen in Pamekasan village mostly use collapsible trap as fishing gear for crabs. The collapsible trap is equipped with an escape slit at each end so that small crabs measuring less than 10cm can escape from the trap. This is one of the efforts in maintaining the sustainability and sustainability of crab stocks in nature. The total collapsible traps used in this study were 39 traps of the same size with 4 escape points at each corner of the trap. The size of the escape gap at each point is 4.5 cm long and 3 cm wide as shown in Figure 1.

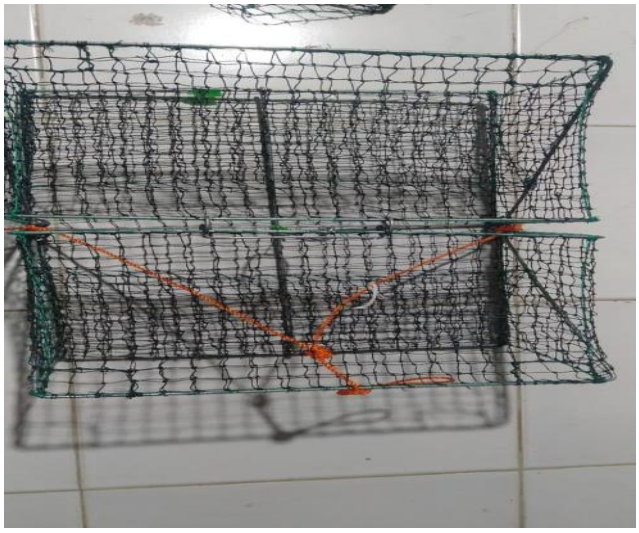

Figure 1. Collapsible traps.

The number of crabs obtained in August was 74 individuals, of which 38 female crabs were obtained, and 36 individuals of male crabs were 1 individual with a carapace width of less than 10cm which was caught. discussed further in the effectiveness points in this study, in September obtained as many as 66 crabs, where the female crabs were obtained as many as 40, and the male crabs were 26 crabs, In October obtained as many as 24 crabs, where the female crabs were obtained as many as 14 crabs, and 10 male crabs can be seen in (Figure 2).

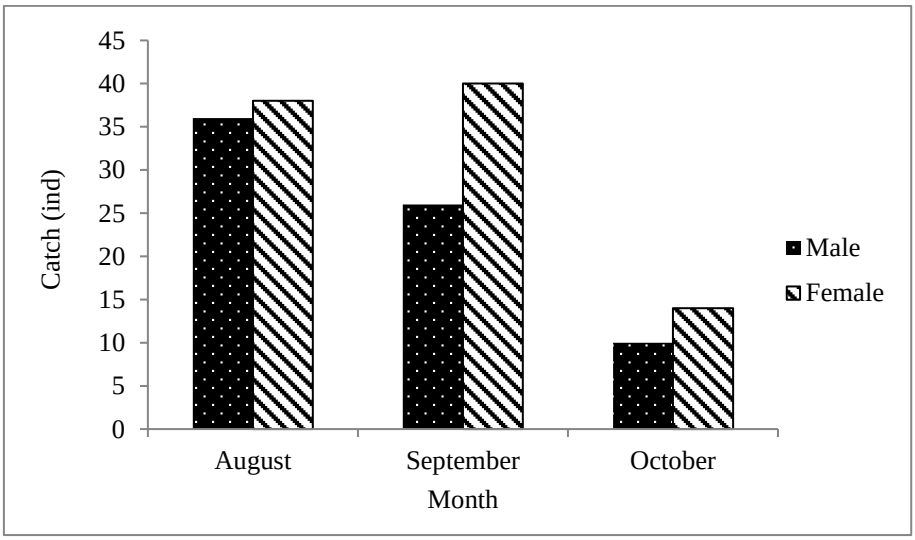

Figure 2. Number of crabs in August – October 2021.

In November obtained as many as 8 small crabs, where female crabs were obtained as many as 5, and male crabs were obtained as many as 3 crabs, In December obtained as many as 11 crabs, where female crabs were obtained as many as 6 crabs, and male crabs as many as 5 crabs, In January obtained as many as 8 crabs, where the female crabs were obtained as many as 6 crabs, and the male crabs as many as 5 crabs can be seen in (Figure 3). The total catch of crabs that were obtained during the study were 191 crabs, a total of 106 female crabs caught and a total of 85 male crabs caught. The number of females caught can be influenced by the abundant female crab season in these waters.

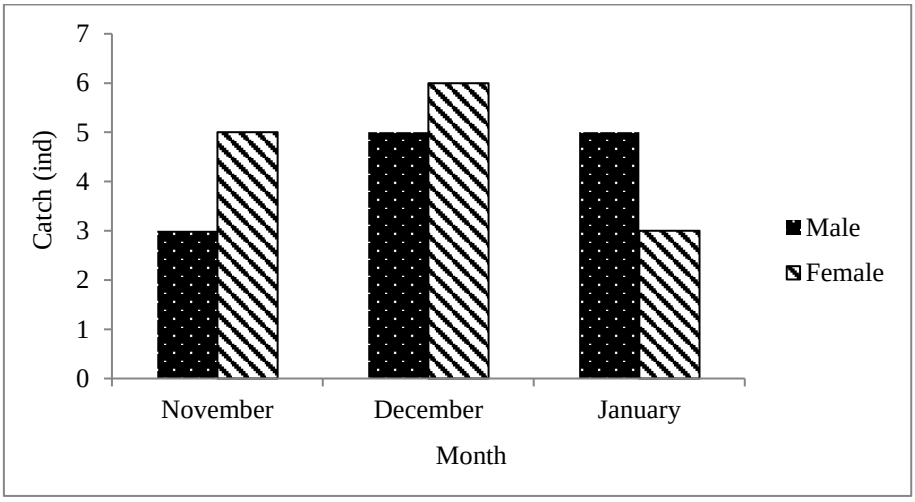

Figure 3. Number of crabs in November, 2021 – January 2022.

The crab weight obtained in August with a total average weight of 115.7 / 213.7 where the average weight of the female is 112.3 grams and the male crab is 119.4 grams. In September the total average weight of the crab was 112.9, where the average weight of the female was 107.9 grams and the male crab was 120.8 grams. In October the total average weight of the crab was 111.3, where the average weight of the female was 118.0 grams and the male crab weighed 101.9 grams (Figure 4).

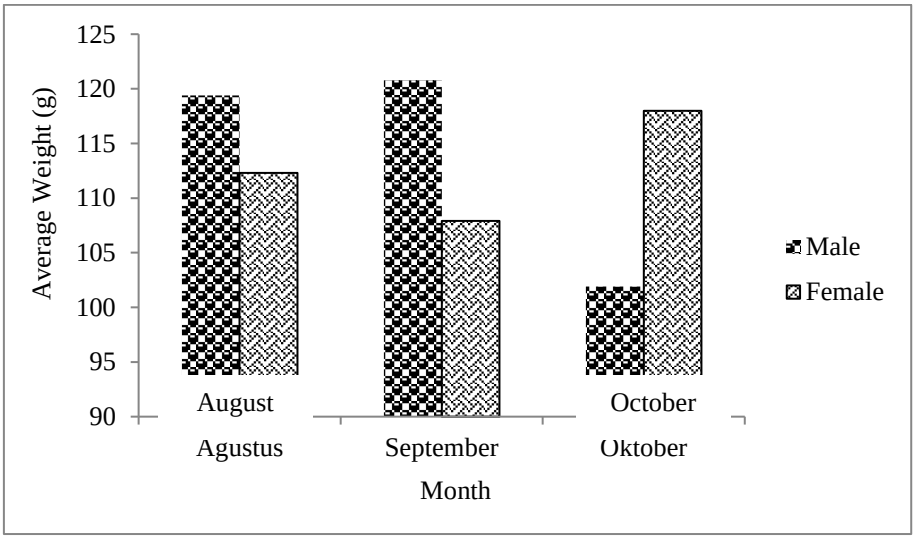

Figure 4. Average weight of crabs in August – October 2021.

The crab weight obtained in November with a total average weight of 110.2 grams where the average weight of the female is 116.5 grams and the weight of the male crab is 99.5 grams. In December the total average weight of the crab was 112.6, where the average weight of the female was 117.9 grams and the male crab weighed 106.3 grams. In January the total average weight of the crab was 110.3, where the average weight of the female crab was 117.2 grams and the male crab weighed 106.1 grams (Figure 5). So the above explains the weight and average per month. The total weight of the crab that was obtained during the study was 22.908 kg, the total weight of the female crab was 11.875 kg and the total weight of the male crab was 11.033 kg.

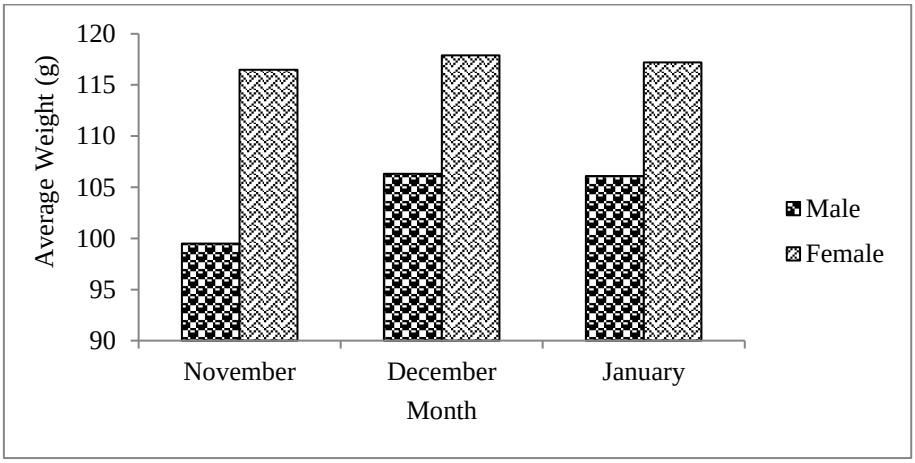

Figure 5. Average weight of crabs in November, 2021 – January 2022.

The carapace width obtained in August with a total average carapace width of 115.9 mm, where the average length of the female carapace is 116.3 mm and the carapace width of the male crab is 115.5 mm. In September the total average carapace width of crabs was 116.3, where the average length of the female carapace was 115.5 mm and the width of the male crab's carapace was 117.4 mm. In October the total average carapace width of crabs was 116.0 mm, where the average carapace width of the female crab was 118.1 mm and the carapace width of the male crab was 113.0 mm (Figure 6). Refers to the research of [7]. Peak spawning season occurs in August-September, so when the female crab has passed the peak spawning season many adult female crabs come out.

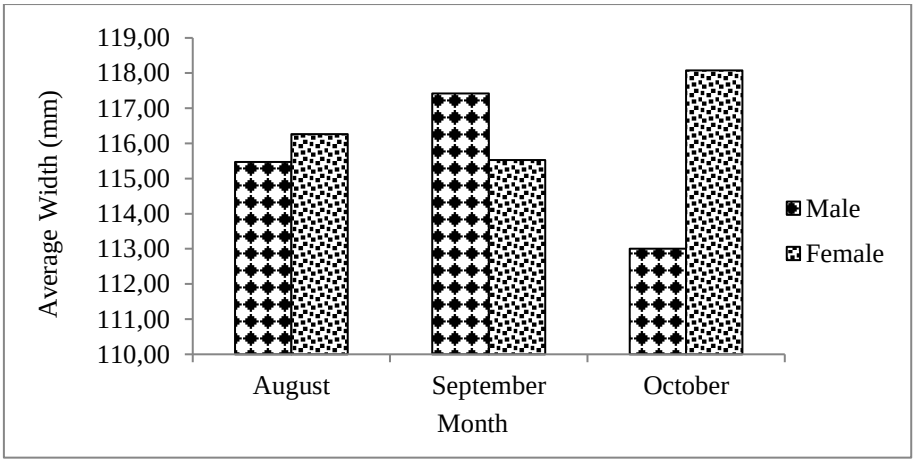

Figure 6. Average carapace width of Rajungan in August – October 2021.

The carapace width obtained in November with a total average carapace width of 115.9 mm, where the average carapace width of the female is 118.8 mm and the carapace width of the male crab is 111.0 mm. In December the total average carapace width of crabs was 117.3, where the average width of the female crabs was 120.2 mm and the width of the male crabs was 113.8 mm. In January the total average carapace width of crabs was 114.3, where the average carapace width of the female crab was 114.0 mm and the carapace width of the male crab was 114.4 mm (Figure 7). So the above explains the results of the size of the carapace width each month and also the average. The carapace size of the crab caught in this study ranged from 9.7 to 15.8 cm with an average of 116.0 cm, the size of the female carapace ranged from 10.

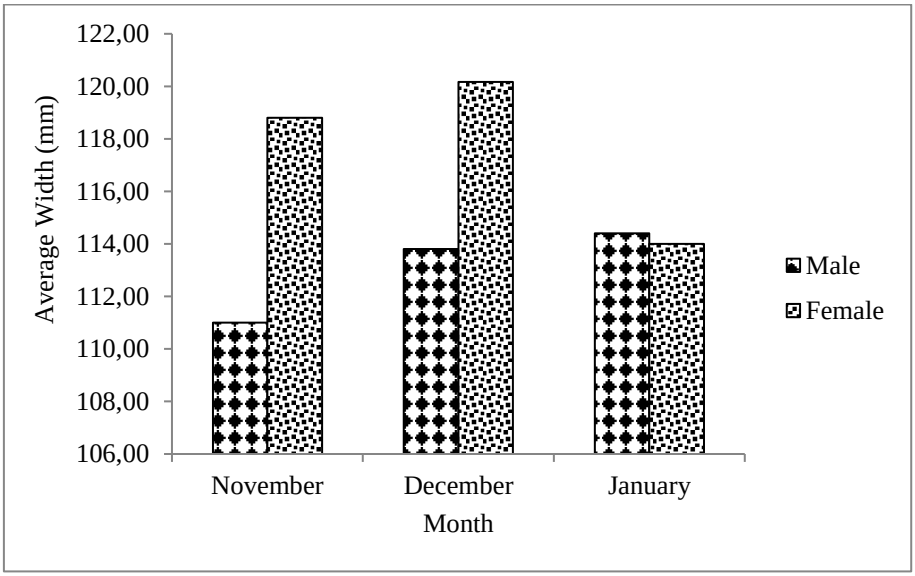

Figure 7. Average carapace width of Rajungan in November, 2021 – January 2022.

The by-catch or Non-Targeted Species (NTS) obtained during the research period (August 2021-January 2022) consisted of 3 species, namely *Scylla serrata* (Crab), *Charybdis feriatus* (Red Crab), and *Ephinephelus sexfaciatus* (Molen Grouper). As long as this research was conducted in the first month of the study, no NTS was obtained, namely in August. The following table of NTS data obtained during the research can be seen in Table 1.

Table 1. Bycatch or NTS (Non Target Species).

No	Month	Scientific name	Local Name	Amount	Weight (kg)
1	August	.	.	.	.
2	September	Scylla serrata	Crab	2	0.54
		Charybdis Feriatus	Red crab	2	0.37
3	October	Scylla serrata	Crab	2	0.51
		Charybdis Feriatus	Red crab	2	0.35
4	November	Scylla serrata	Crab	3	0.74
		Charybdis Feriatus	Red crab	6	0.96
5	December	Scylla serrata	Crab	4	0.85
		Charybdis Feriatus	Red crab	8	1.20
6	January 22	Scylla serrata	Crab	2	0.52
		Charybdis Feriatus	Red crab	4	0.90
		Ephinephelus sexfasciatus	Molen Grouper	1	0.19

During August 2021 to January 2022, to be precise in August 2021, there was an individual crab measuring less than 10 cm that did not manage to escape through the opening of the folding trap used by fishermen in Pamekasan Waters, Madura. The total catch of crabs in August 2021 was 74 individuals consisting of 73 individuals with a carapace width of more than 10 cm and 1 individual measuring less than 10 cm.

$$Effectiveness = \frac{Small\ blue\ swimming\ crab\ (less\ than\ 10cm)\ that\ do\ not\ pass}{Total\ crab\ catch\ per\ month} = \frac{1}{74}$$
$$= 0.9865 = 98.65\%$$

Using the formula applied in his research by [6] with adjustments (as described in the methodology points) the effectiveness value is obtained at 98.65% where the effectiveness value is included in the effective category. Thus, it is stated that the escape gap is 4.5 x 3 cm in each corner of the bottom side of the folding trap used by fishermen in Pamekasan waters, Madura is declared effective as an opening for crabs measuring under 10 cm to escape catcher. These results confirm the suggestion of [6] which states that the use of escaping gaps in addition to trapping fishing gear can also be applied to other trap fishing gear such as folding traps. In addition, this study also confirmed the results of [8] research which stated that the installation of escape gaps in the traps could allow the young crabs to escape so that the traps only caught the crabs of the desired size and the young mud crabs had the opportunity to spawn and breed.

4. Conclusion

The study was conducted on 106 females and 85 males with a total weight of 22.908 kg and carapace width ranging from 9.7 to 15.8 cm. Effectiveness value of 98.65% for small crabs and can be provided for the sustainability of the blue swimming crab in Pamekasan Waters, Madura. Will be provided for the sustainability of the crab in the Pamekasan area.

Recommendation

The use of escape gaps in folding trap fishing gear can be applied to other fishing gear that is a trap not only collapsible traps.

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