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Catch composition and fishing season of blue swimming crab using a collapsible trap in Pemalang coastal water, Central Java

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Abstract. The blue swimming crab (*Portunus pelagicus*) is an economically important fishery resources that has penetrated the export market that requires proper management. Pemalang Regency is still entirely dependent on natural catches, so information on seasonal patterns of blue swimming crab fishing is essential for fishermen to support the efficiency and effectiveness of the fishing activity. This research was conducted in Danasari village, Pemalang sub-district, in January–December 2022 with the aim of determining the composition of collapsible trap catches based on the crab fishing season in the waters of Pemalang Regency. Danasari fishermen classify the blue swimming crab fishing season into two, the west season starts in November–May (high rainfall), and the east season starts in June–October (low rainfall). The survey method was performed by collecting data of blue swimming crab catch as the main target and bycatch. Carapace width of the blue swimming crab was also measured. The data obtained was analyzed descriptively using Microsoft Excel 2010 software. The results showed that the catch composition of collapsible traps in Pemalang consisted of crustaceans, fish, and mollusks. The best season to catch blue swimming crabs was during the west season because the catch is more stable than during the east season.

Keywords: blue swimming crab; bycatch; collapsible traps; season

1. Introduction

Pemalang Regency is situated on the main economic corridor and the coastal area of the North Coast of Central Java, geographically bordered directly by the Java Sea to the north. Its strategic position and the abundance and diversity of open-access fishery resources make it potential for extensive utilization, especially by the local community, which is predominantly engaged in year-round fishing activities. Thus, proper management is essential to ensure the sustainability of the abundant fish resources [1].

Effective fishery resources management involves utilizing fish populations without continuous exploitation. Unregulated fishing activities that disregard the resource's ability to renew itself can endanger fish availability in the sea. Determining the target commodities is one of the initial steps to achieving sustainable fisheries management, aiming to boost the regional economy by properly utilizing the fishery potential. The leading capture fisheries commodities in Pemalang Regency include ricefish,

anchovies, mackerel, skipjack tuna, scad, blue swimming crab, squid, pomfret, mackerel scad, red snapper, yellowtail, and various other economically important fish species [2].

The presence of these crab resources represents a significant asset for regional development and the welfare improvement of fishing communities, whose livelihoods heavily depend on the fisheries' biological resources. Utilizing crab resources poses significant challenges, requiring appropriate management. One of the factors to understand in relation to crab resources is the seasonal pattern of crab migration [3]. Identifying the characteristics of the fishing season pattern is crucial to allowing fish in the wild to have opportunities for spawning and reproduction to maintain stock availability. The fishing effort must be managed to ensure the fishery resources remain sustainable and economically beneficial [4].

Efforts to create sustainable fisheries can also be achieved through the use of environmentally friendly fishing gear that does not harm fish habitats, thus preserving marine life and its development. collapsible traps, such as fish traps, are considered one of the most eco-friendly fishing gears, operating statically on the seabed and widely popular among coastal communities, especially crab fishermen. They offer better selectivity compared to seine nets and trawls [5, 6]. Danasari Village, the focus of this research, is a center for crab landing in Pemalang Regency, where all fishermen use collapsible traps with small fish as bait. The crab harvest season usually occurs during the rainy season or west wind season, while the crab scarcity season typically falls during the dry season or east wind season. The dynamics of crab fishing with collapsible traps in the waters of Pemalang Regency will be further examined in this study to understand the composition of the catch.

2. Methods

2.1. Study area

This research was conducted from January to December 2022 in the waters of Pemalang, Central Java, which is one of the potential crab fishing areas on the northern coast of Java (Figure 1). The method used in this study was experimental fishing, where data on collapsible trap catches were obtained from crab fishermen in Danasari Village, Pemalang. Experimental fishing was carried out in two fishing seasons, the west wind season and the east wind season. The crab fishermen in Pemalang perform crab fishing activities only once a day, commonly known as "one day fishing." The hauling of the collapsible traps, set the previous day, is conducted at 05:00–06:00 AM, immediately followed by the process of setting bait in the traps to be soaked and retrieved the following day (approximately 24 hours later) at a depth of 10–20 meters.

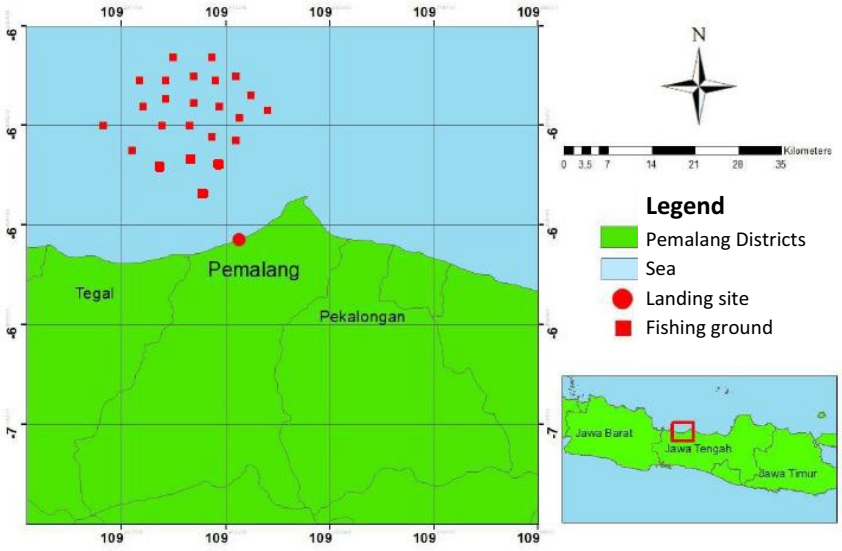

Figure 1. Map of research location in Pemalang waters, Central Java. (source: Indonesian Blue Swimming Crab Association)

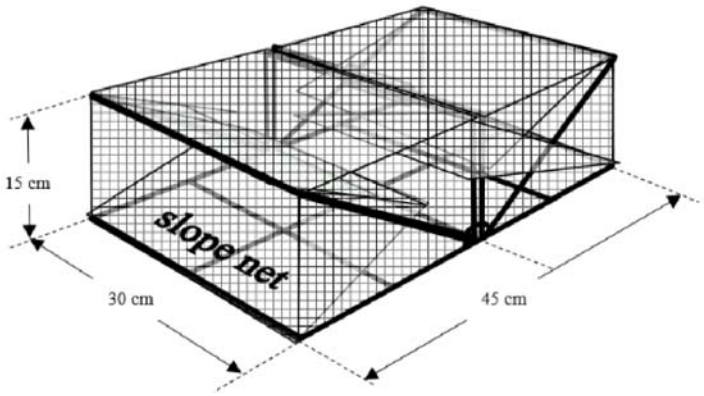

Figure 2. Collapsible trap Construction.
(source : Indonesian Blue Swimming Crab Association)

The fishing gear used in this research is a rectangular foldable trap (Figure 2) with dimensions of 45 cm by 30 cm by 15 cm, equipped with two funnel-shaped openings. The vessel used is 3–4 GT in size and equipped with 2 engines of 23 horsepower, with a capacity to hold 600–700 foldable traps.

2.2. Data collection

The sampling of foldable trap catches was conducted at the crab collector in Danasari Village, including the measurement and recording of the number of collapsible trap catches. The primary target of the trap is the blue swimming crab (*Portunus pelagicus*), but other species are also caught as bycatch, such as various types of fish, crustaceans, and mollusks that can be seen in Figure 5–7. Sample measurements for blue swimming crabs include total weight, individual weight, and carapace width. After weighing the blue swimming crab catches, their carapace width is measured using a ruler with a precision of 1 mm. Individual crab weights are measured using a digital scale with a precision of 0.1 g. The bycatch samples are grouped based on their species, and the number of individuals per species is counted, weighed using a digital scale per species, and documented. The data obtained from the blue swimming crab samples and bycatch is recorded for further analysis. The collapsible trap catch samples were obtained from 10 boats with a total of 30 fishermen, consisting of boat owners and crew members. Interviews were conducted with boat owners to gather information about the fishing gear, the number of fishing trips, fishing seasons, and catch results.

Figure 3. Carapace width measurement.

Figure 4. Blue swimming crab weight measurement

Figure 5. Fish *Bycatch* (*Platycephalus indicus*).

Figure 6. Crustacean *Bycatch Podophthalmus vigil*).

Figure 7. Mollusk *Bycatch* (*Sepia recurvirostra*).

2.3. Data analysis

The research data obtained from the measurements were then input and analyzed descriptively, including calculating the mean and standard deviation using Microsoft Excel 2010. The composition of the various types and the quantity of collapsible trap catches was also described descriptively. Furthermore, the data analysis included analyzing the seasonal pattern of crab fishing [3].

3. Results and discussion

3.1. Collapsible trap catches of blue swimming crab in Pemalang Waters

The catches from the collapsible traps during the research consisted of the main target catch, which was the blue swimming crab (*Portunus pelagicus*), and the bycatch of various fish, crustaceans, and mollusks. Based on the research findings, there were 26 different types of catches, with the blue swimming crab being the primary target of the traps. The composition of the trap catches can be seen in Table 1.

Table 1. Composition of collapsible trap catches of blue swimming crab in Pemalang Waters.

Species	Jan	Feb	Marc	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
BSC (*P. pelagicus*) (kg)	2159.50	2408.90	2871.40	2841.90	2236.90	3766.70	3770.50	2339.20	688.80	492.60	1984.10	2022.60
Epinephelus sexfasciatus	0.10	0.47	0.23	0.15	0.10	1.27	.	.	0.02	.	0.54	0.25
Teraphon theraps	.	.	.	0.05	.	.	.	.	0.01	.	.	.
Cynoglosus lingua	.	.	.	.	.	.	.	.	.	0.05	.	.
Platycephalus indicus	.	0.21	0.03	.	.	0.26	.	.	.	.	.	0.34
Epinephelus coioides	.	.	.	.	.	.	.	.	0.08	.	.	.
Johnius belangeri	0.33	.	.	.	.	.	.	0.26	0.07	.	.	.
Scylla sp.	1.09	2.38	1.49	3.89	5.52	1.42	1.50	4.73	6.88	4.98	6.59	5.82
Homoioplax haswelli	0.27	.	0.04	.	.	.	.	.	.	.	.	.
Harpiosquilla harpax	0.06	0.29	0.37	0.28	.	.	.	0.07	.	0.02	0.43	0.07
Charybdis lucifera	0.21	0.11	0.22	.	.	.	.	.	.	.	0.15	0.21
Charybdis natator	.	.	.	.	.	.	.	.	0.11	.	.	.
Podophthalmus vigil	21.10	4.46	3.55	10.95	0.06	5.20	0.33	0.48	3.14	0.20	5.50	28.00
Charybdis anisodon	18.73	28.26	10.00	0.03	.	0.08	.	0.06	0.14	0.05	0.06	0.98
Portunus sanguinolentus	0.13	0.06	.	0.16	0.07	0.11	0.13	.	0.36	0.79	.	0.06
Charybdis feriatus	1.11	3.12	2.07	5.03	2.69	1.85	0.06	1.59	7.72	4.62	2.48	0.71
Varuna litterata	.	0.39	.	.	.	.	.	.	0.07	.	.	0.08
Thalamita prymna	0.05	.	.	.	.	0.08	.	.	0.09	.	.	.
Kepiting Batu	.	.	.	0.06	.	.	.	.	.	.	.	.
Udang Peci	.	0.02	0.01	0.02	0.01	.	.	0.01	.	.	0.01	.
Babylonia sp.	1.00	.	.	.	18.50	7.00	.	60.60	70.30	.	.	.
Sepia recurvirostra	0.35	0.06	.	0.10	0.10	.	.	1.06	1.16	0.14	0.04	0.36
Natica sp3.	.	.	.	.	.	.	.	.	.	0.02	.	.
Octopus vulgaris	0.15	.	.	0.55	0.61	.	.	.	.	.	0.62	0.15
Anadara nodifera	.	.	.	0.29	.	.	.	.	0.04	.	.	.
Sulcospira thochels	.	1.14	.	0.13	.	0.02	0.02	.	0.10	.	.	.
Subtotal bycatch (kg)	44.68	40.97	18.01	21.69	27.66	17.29	2.04	68.86	90.29	10.87	16.42	37.03
Total (kg)	2248.86	2490.84	2907.42	2885.28	2292.22	3801.28	3774.58	2476.92	869.38	514.34	2016.94	2096.66

Table 2. The average catch of blue swimming crab (CPUE) in Pemalang waters.

	January	February	March	April	May	June	July	August	Sept	Oct	Nov	Dec
CPUE (kg/trip)	10.69	11.15	11.09	12.86	13.64	19.02	22.71	16.71	9.57	8.08	10.84	11.11

3.2. Catch composition of blue swimming crab during fishing season in Pemalang Waters

Blue swimming crab (BSC) fishermen in Pemalang Waters use collapsible traps for fishing. The fishing activities are conducted only once a day, in the morning. Based on the graph, the number of BSC catches shows that the peak fishing season in Pemalang Waters occurs in June (3766.70 kg) and July (3770.50 kg). Before the east wind season, or low catch season, there is a transition period characterized by a continuous decline in catch and dry weather conditions with strong winds both on land and at sea in the middle of July. The east wind season occurs from early August to October. According to Ihsan, the peak of the crab fishing season is in June, and entering July, there is a decline in catch, which is estimated to be due to the very high intensity of fishing in June [3]. Weather conditions, especially in the last week of June, become turbulent, with strong east winds causing large waves. In August, the catch was minim due to weather conditions entering the transitional period, where large waves and strong winds make it impossible for fishermen to operate crab fishing, resulting in a drastic decline in crab production.

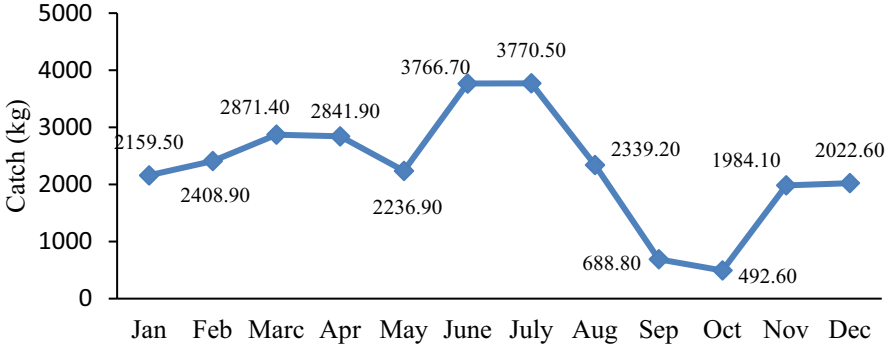

Figure 8. Blue swimming crab catches in Pemalang waters.

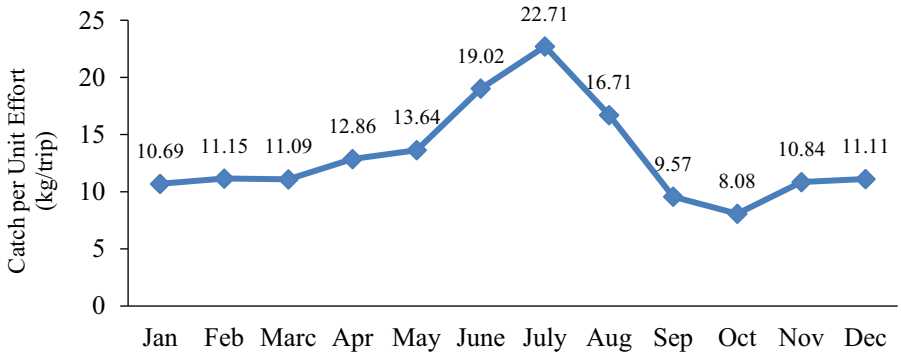

Figure 9. Average catch per unit effort (CPUE) of BSC in Pemalang waters.

Based on the landing data, the highest average catch of blue swimming crab was in July, with 22.71 kg/trip, while the lowest average catch was in October, with 8.08 kg/trip. The low catch is due to the increased fishing activities in the previous month and is a transitional period from the east wind season (dry season) to the west wind season (rainy season). According to Almaida *et al.*, the blue swimming crab catch in the northern waters of Java, such as in Demak, is influenced by the crab fishing season and the number of fishing trips [7]. The catch during the peak fishing season ranges from 20 to 30 kg per trip. According to Ihsan, the analysis shows that the blue swimming crab spawning season occurs in May, June, July, August, and September, with the peak spawning season in August [3]. Meanwhile, blue swimming crabs reach adulthood when they are one year old or older.

The catch of blue swimming crabs in Pemalang Waters varies each month due to seasonal changes. This is because of the changing weather conditions. The high waves in the sea during the west wind season (rainy season) so fishermen to venture out to sea as it is dangerous, especially with small boats sized 3–4 GT. During the rainy season, fishermen tend to catch blue swimming crabs in coastal waters to avoid large waves. According to Ihsan, crab production increases again and reaches its peak after the transitional period, which is in September [3]. It is estimated that the crabs caught were the ones that spawned in September of the previous year. Crab production starts to decline again after October, reaching its lowest point in March every year. According to Jafar, blue swimming crabs spawn throughout the year, with peaks during the west wind season in December, the first transitional period in March, the east wind season in July, and the second transitional period in September [8].

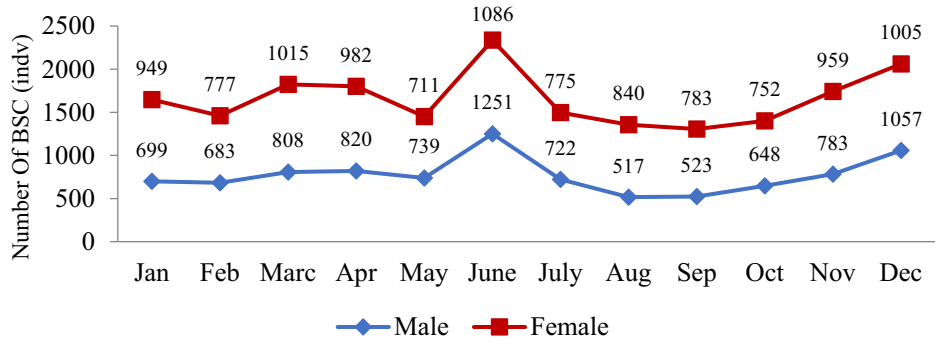

Figure 10. Graph of BSC composition based on sex.

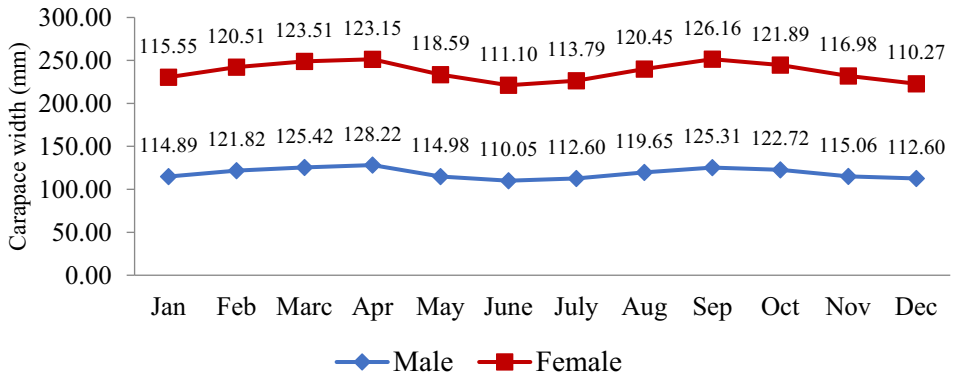

Figure 11. Graph of average carapace width crab catches.

Figure 11 shows the graph of the distribution of the mean carapace width of captured blue swimming crabs during the study. The mean carapace width of male BSC ranged from 110 to 128 mm, while the mean carapace width of female BSC ranged from 110 to 126 mm.

3.3. Bycatch of collapsible trap in Pemalang Waters

The bycatch in blue swimming crab collapsible traps increases during the transitional period from the east wind season (dry season) to the west wind season (rainy season), which is in August and reaches its peak in September. According to Mahiswara, although collapsible traps are considered environmentally friendly fishing gear, the selectivity of the traps towards target species in terms of type and size is determined by their design and construction, the type, number, and size of the trap mouth, the size of the mesh or grid, and the area and timing of operation [6].

As for the types of bycatches captured during the study, they include crabs (*Scylla* sp.), sentinel crab (*P. vigil*), red frog crabs (*C. feriatus*), tiger snails (*Babylonia* sp.), cuttlefish (*Sepia* spp.), octopuses (*O. vulgaris*), grouper (*E. sexfasciatus*), and blama fish (*J. belangeri*). These results are consistent with the findings of previous studies [5, 9] that in blue swimming crab collapsible traps operated in the waters of Pemalang and Rembang Regencies, Central Java, several types of bycatches were recorded, including crabs (*Scylla* sp.), reef crabs (*C. fariatus*), sentinel crabs (*P. vigil*), shrimps (*Harspiosquilla* sp.), tongue fish (*Cynoglossus* sp.), grouper, octopuses (*Octopus* sp.), cuttlefish (*Sepia* spp.), and tiger snails (*Babylonia* sp.). Total of bycatch in collapsible trap in Pemalang Waters can be seen in Figure 12 and the composition of bycatch in collapsible trap can be seen in Tabel 1.

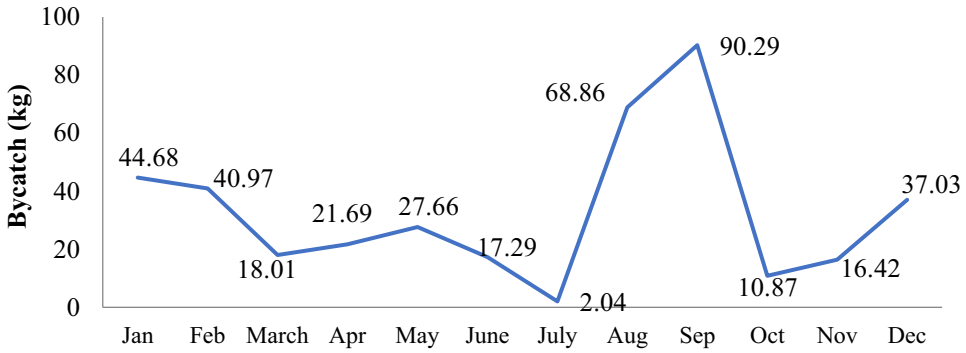

Figure 12. Graph of total bycatch in collapsible trap of BSC in Pemalang waters.

4. Conclusion

The catch from the collapsible traps includes blue swimming crabs (BSC) as well as bycatch such as ronggeng shrimps (*Harspiosquilla* sp.), tongue fish (*Cynoglossus* sp.), grouper, octopuses (*Octopus* sp.), cuttlefish (*Sepia* spp.), and tiger snails (*Babylonia* sp.). The highest average catch of BSC was recorded in July at 22.71 kg per trip, while the lowest average catch was in October at 8.08 kg per trip. During the west wind season (November–March) is the best fishing season, because the average catch of BSC remained relatively stable in the range of 10–11 kg per trip. It is necessary to conduct engineering and experimentation with different types of bait to improve the quantity and quality of the BSC catch.

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Author Contribution

Nur Arofah : Conceptualization, methodology, supervision, writing-original draft**.**
Meitha Permata Sari : Investigation, writing-original draft, writing-review & editing**.**
Ayu Ervinia : Investigation, writing-original draft, writing-review & editing**.**