

A comparative study of bait efficiency in the rakkang crab fishery

Rakkang yengeç avcılığında yem verimliliğinin karşılaştırmalı bir çalışması

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Abstract: This research aimed to analyze the catch composition, CPUE (Catch per unit effort), and productivity between two bait types (small crabs and trash fish) associated with rakkang traps in Bawah Layung Village, Tanah Laut Regency, Indonesia. The method used was a field experiment with a randomized block design, and the data were analyzed using analysis of variance (ANOVA). Research activities were conducted between June and September 2025, where a total of 620 rakkang units were deployed around mangrove areas. The results showed that the rakkang captured *Scylla paramamosain* (77.74%) was 3.5 times higher than *S. tranquebarica* (22.26%), with species-specific preferences. *S. paramamosain* outnumbered *S. tranquebarica* in terms of CPUE and productivity rates ($p < 0.05$). The CPUE for rakkang traps baited with small crabs (0.53 ind./trap) was considerably higher than using trash fish (0.14 ind./trap). Similarly, the productivity rate was much higher with small crabs (1.71 ind./h) compared to trash fish (1.05 ind./h). Small crab bait proved significantly more effective than trash fish ($p < 0.05$). These findings suggest that optimizing bait choice, specifically using small crabs, can contribute to more efficient and sustainable mud crab fisheries, potentially reducing bycatch and supporting conservation efforts. The capture of both legal-sized and undersized crabs emphasizes the need for species-specific management to balance market demand with sustainable fisheries.

Keywords: CPUE, bait types, green mud crab, mangrove crab, sustainability, Bawah Layung

Öz: Bu araştırma, Endonezya'nın Tanah Laut Bölgesi, Bawah Layung Köyü'ndeki rakkang tuzaklarıyla ilişkili iki yem türü (küçük yengeçler ve çöp balıkları) arasındaki av kompozisyonu, CPUE (birim çaba başına av miktarı) ve verimliliği analiz etmeyi amaçlamıştır. Kullanılan yöntem, randomize blok tasarımı ile gerçekleştirilen bir saha deneyidir ve veriler varyans analizi (ANOVA) kullanılarak analiz edilmiştir. Araştırma faaliyetleri Haziran ve Eylül 2025 tarihleri arasında gerçekleştirilmiş olup, bu süre zarfında mangrov alanlarının çevresine toplam 620 adet rakkang ünitesi yerleştirilmiştir. Sonuçlar, rakkang'ın yakaladığı *Scylla paramamosain* türünün (%77,74), *S. tranquebarica* türüne (%22,26) göre 3,5 kat daha fazla olduğunu ve türe özgü tercihler gösterdiğini ortaya koymuştur. CPUE ve verimlilik oranları açısından *S. paramamosain*, *S. tranquebarica*'dan daha fazla sayıda olduğu tespit edilmiştir ($p < 0,05$). Küçük yengeçlerle yemlenmiş rakkang tuzaklarının CPUE'si (tuzak başına 0,53 birey), ekonomik olmayan balıklarla yemlenmiş tuzaklara göre (tuzak başına 0,14 birey) önemli ölçüde daha yüksek olduğu saptanmıştır. Benzer şekilde, küçük yengeçlerle (1,71 birey/saat) elde edilen verimlilik oranı, ekonomik olmayan balıklardan önemli ölçüde daha etkili olduğu kanıtlanmıştır ($p < 0,05$). Bu bulgular, özellikle küçük yengeçlerin kullanılmasıyla yem seçiminin optimize edilmesinin, daha verimli ve sürdürülebilir çamur yengeci balıkçılığına katkıda bulunabileceğini, potansiyel olarak istenmeyen avı azaltabileceğini ve koruma çabalarını destekleyebileceğini göstermektedir. Hem yasal boyuttaki hem de yasal boyutun altındaki yengeçlerin avlanması, pazar talebini sürdürülebilir balıkçılıkla dengelemek için türe özgü yönetime duyulan ihtiyacı vurgulamaktadır.

Anahtar kelimeler: CPUE, yem türleri, yeşil çamur yengeci, mangrov yengeci, sürdürülebilirlik, Bawah Layung

INTRODUCTION

Mangrove crabs, particularly those of the genus *Scylla*, are a crucial fishery resource that supports coastal economies, but their population are at risk due to overfishing and ecosystem degradation (Jumawan et al., 2021; Riyanto et al., 2025). The rakkang, a simple and low-cost passive trap, is widely used by small-scale fishers to catch these crabs (Supeni et al., 2020). While this method is considered environmentally friendly (Yulisti et al., 2024), its effectiveness is highly dependent on key factors like trap design, deployment strategy, and, most critically, bait selection. Despite its importance, a clear understanding of how different baits impact catch rates and efficiency is presently unclear. This lack of quantitative data creates a significant knowledge gap, making it difficult for fishers to optimize their efforts and ensure the long-term sustainability of this fishery. This study addresses this gap by investigating how different baits influence the performance of the rakkang.

Existing research on mangrove crabs covers their biology, ecology, and fishing methods (Cahyadinata et al., 2021). Several studies have highlighted that successful fishing requires a deep understanding of the target species' behavior and habitat (Putri et al., 2022; Afriani et al., 2024). Bait choice is particularly important, as highly effective baits directly influence crab foraging behavior and catch rates (Haqie et al., 2024; Tahmid et al., 2015). Specific to the rakkang, previous work has described its design, highlighting its simple, foldable, and low-cost nature (Phu et al., 2020; Rosalina and Utami, 2021). The ecological and economic significance of these crabs in mangrove ecosystems has also been well-documented (Abidin et al., 2022; Fazhan et al., 2022).

However, while the literature acknowledges the importance of bait, few data are available on how different baits specifically impact catch outcomes for the rakkang. Most studies focus on general principles (Kabalmay et al., 2017; Diana et al., 2018),

and little attention has been given to the practical implications of small, community-driven differences in bait choice on key performance metrics like Catch Per Unit Effort (CPUE) and overall productivity.

This study addresses this critical research gap by providing a direct, comparative assessment of two distinct baits used by fishers in Bawah Layung Village. The novelty of this research is that it's the first to quantitatively assess and compare the performance of the rakkang using different bait types. By systematically evaluating variations in bait and relating these differences to fishing outcomes, this study provides new, detailed insights that go beyond general descriptions. Optimizing bait choice may not only improve catch rates but also reduce gear saturation and enhance species selectivity, ultimately contributing to more sustainable fishing practices.

The significance of this work is twofold. Scientifically, it will advance our knowledge of how subtle variations in bait can influence the efficiency of artisanal fishing gear. Practically, the findings will offer direct, evidence-based recommendations to local fishers. By identifying the more effective bait, this research can contribute to improved management practices, enhanced fishing productivity, and better economic returns for coastal communities, ultimately supporting the long-term sustainability of the mangrove crab fishery.

The objective of this study was to assess the differences in catch composition, CPUE, productivity, and effectiveness between the two baits used with the rakkang. We hypothesize that small crab bait provides higher CPUE and productivity than trash fish. The main expected outcomes are to identify which bait provides a higher CPUE and is more effective at catching the target species, thereby offering a practical contribution to local fishing communities.

MATERIALS AND METHODS

Study site

The trapping experiments were conducted around mangrove areas of Bawah Layung village (191°3'40"S, 114°37'51"E) located in Tanah Laut Regency, South Kalimantan, Indonesia (Figure 1). Research activities were conducted between June and September 2025, including preparation, data collection with support from the rakkang's fisherman, and data analysis.

At the fishing site, several physical oceanographic conditions were also measured. The water depth ranged from 100-165 cm, and the water temperature was between 28.7-29.6 °C. Other measurements included water brightness at 45-64 cm, current speed from 0.03-0.15 m s⁻¹, and a salinity level of 6-12 ppt.

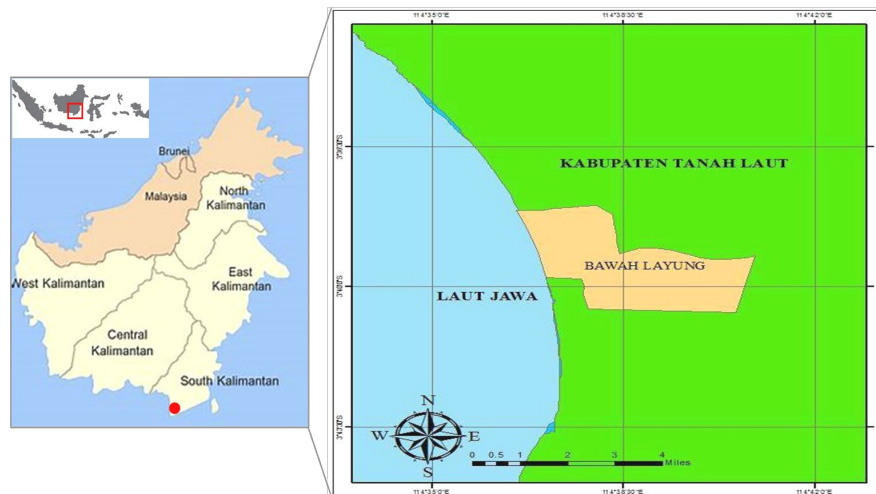


Figure 1. The map of Bawah Layung Village in Tanah Laut Regency, Indonesia, where the rakkang traps were placed

Data collection

A total of 620 rakkang units belonging to Bawah Layung Village were investigated. The detailed specification for this gear was provided in Table 1, while its performance was visually represented in Figure 2, with further explanations to follow.

Net body

The net body was made of polyethylene (PE) with a 50 mm stretched mesh size. This material was chosen for its durability and water resistance.

Frame

The frames were constructed from bamboo, a sturdy and

lightweight material. The upper part measures 350 mm, while the bottom part is slightly larger at 400 mm. Both ends of the frame were tied to form a circular shape.

Bait clip

The 230 mm bait clip was made from a thin slice of bamboo, which gives it enhanced flexibility and strength.

Support pole

A bamboo support pole (1100 mm long, 18 mm in diameter) was used to stabilize the gear and keep the net securely open. The pole's pointed lower end makes it easy to push into the muddy bottom of the water.

Support ring

A polyethylene support ring, with a 50 mm diameter, is placed on the bottom part of the gear. The pole passes through this ring, which serves to reinforce the overall structure.

Entrance

The entrance, made of polyethylene with a 15 mm stretched mesh size, was 190 mm high. Its narrow-slit design helps guide crabs to enter.

Binding rope

A polyethylene binding rope (630 mm long, 3 mm in diameter) was used to secure the gear components and make it easier to handle.

Table 1. Gear specification of rakkang used in the trapping experiments

Gear construction	Materials	Mesh size (mm)	Size (mm)		
			Length	Height	Diameter
Net body	Polyethylene	50	-	-	1
Frames:					
Upper part	Bamboo	-	-	-	350
Lower part	Bamboo	-	-	-	400
Bait clip	Bamboo	-	230	-	20
Support pole	Bamboo	-	1100	-	18
Support ring	Polyethylene	-	-	-	50
Entrance	Polyethylene	15	-	190	75
Binding rope	Polyethylene	-	630	-	3

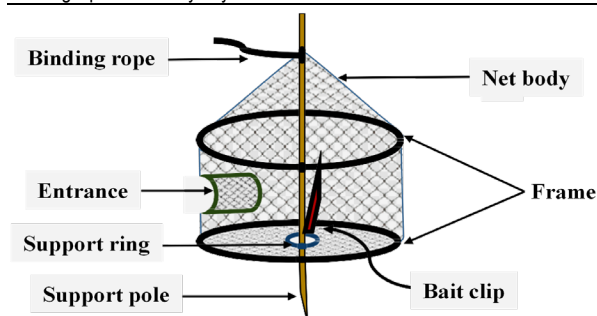


Figure 2. Gear performance of the rakkang used in Bawah Layung village

The rakkang fishing process involves three main steps:

1. Pre-operation

Before fishing, baits are prepared (Figure 3) and attached to the bait clips on the support poles. The Rakkang units are then loaded onto a 10.7 × 1.7 × 1.1 m wooden boat (2.5 GT), which is powered by a 26 HP Jiang Fa (JF) diesel engine.



Figure 3. The bait types used to lure *Scylla* crabs into the Rakkang traps: A. Small crabs, and B. Trash fish

2. Operation

At the fishing site, 30 rakkang units were deployed over 16 sampling days, with 2 replicates per day for each treatment (small crabs and trash fish), resulting in 32 replicates per treatment. The units were equally divided: 15 containing small crabs and 15 with trash fish. They were randomly assembled, anchored, and submerged in mangrove areas for a 6-hour soak time (10 am-4 pm). This duration was chosen based on local fishing practices, where traps are typically deployed during high tide periods (Rosalina and Utami, 2021), allowing sufficient time for crabs to be attracted to the bait. Bait assignment was randomized using a random number generator. After soaking, the catch was retrieved, and the pole was detached from the rakkang.

3. Post-operation

Following the operation, the catch is removed from the rakkang and measured for both carapace width and weight. Each individual catch is tied before being transported to a local collector. Finally, the rakkang units are cleaned and properly maintained for future use. According to local fishermen, the gear typically remains functional for three months. Furthermore, the specific locations where the *Scylla* crabs were sampled were recorded using GPS coordinates.

Data analysis

A standard formula (Alfiatunnisa et al., 2020) was used to determine the proportional percentage of each crab type within the total catch once data collection was complete:

$$P_i = \frac{n_i}{N} \times 100\%$$

where P_i is the relative abundance of each species (%), n_i is the number of catches for species i (ind.), and N is the total number of catch (ind.)

The CPUE (catch per unit effort) is calculated as the total number of individuals caught divided by the number of traps used (Fazhan et al., 2022);

$$CPUE = \frac{Catch}{Effort}$$

The productivity for each rakkang was then estimated using a formula by Dahle (1989);

$$P = \frac{C}{t}$$

where P is the productivity (ind./h), C is the total daily catch (ind.), and t is the actual fishing time (h)

Statistical analysis

Data analysis was conducted using Microsoft Excel and SPSS version 18. Descriptive statistics, including mean ± standard error of the mean and percentages, were calculated and presented in graphs and tables. Normality was assessed using the Shapiro-Wilk test, and homogeneity of variance was confirmed using Levene's test. With assumptions met, an independent sample t-test compared catch number, CPUE, and

productivity rate between crab types and bait types. A one-way ANOVA examined the effect of bait type on the number of crabs captured. The chi-square goodness-of-fit test evaluated the male:female sex ratio against the expected 1:1 ratio. A p-value < 0.05 indicated statistical significance.

RESULTS

Rakkang proved to be highly effective for catching both mangrove crabs (*Scylla tranquebarica*) and green mud crabs (*S. paramamosain*) using two different bait types. These crabs were also commonly caught in the estuarine waters of Muara Kintap Village, located in the Tanah Laut Regency (Sakti, 2020). Overall, *S. tranquebarica* were noticeably larger than *S. paramamosain*. Their carapaces were wider (65-128 mm) and they were heavier (40-430 g), while *S. paramamosain* measured 54-118 mm and weighed 20-250 g, respectively.

The catch of 265 crabs showed a clear dominance of *Scylla paramamosain* (77.74%), which outnumbered *S. tranquebarica* (22.26%) by more than a three-to-one ratio (Table 2). The appearance of both crab species can be seen in Figure 4. The dominance of *S. paramamosain* in rakkang catches was likely influenced by its ecological adaptability and habitat distribution.

Table 2. Catch composition and proportion of rakkang by species

No	Species	Scientific Name	Total Catch (crab)	Proportion (%)
1	Mangrove crab	<i>Scylla tranquebarica</i>	59	22.26
2	Green mud crab	<i>Scylla paramamosain</i>	206	77.74
Total			265	100



Figure 4. The main catch of rakkang: A. *Scylla tranquebarica* and B. *Scylla paramamosain*

Out of 164 crabs caught using rakkang traps baited with small crabs, *S. paramamosain* was the most dominant species, accounting for 73.17% of the total catch by weight (120 crabs). While *S. tranquebarica* made up a smaller portion, with 44 crabs representing 26.83% of the total catch (Table 3).

The catch composition by sex revealed that male crabs were more frequently caught overall. Out of the total catch of 164 crabs, 87 were male and 77 were female. Specifically for *S. tranquebarica*, 28 males and 16 females were caught, showing a higher male catch rate. For *S. paramamosain*, the catch was more balanced, with 59 males and 61 females. The data also provides details on the size of the crabs, noting that *S. tranquebarica* had a wider weight range of 40-430 g (154.83±29.64 g) and carapace width of 65-128 mm

(90.29±4.15 mm) compared to *S. paramamosain*, which had a weight range of 20-250 g (93.45±11.97 g) and a carapace width of 54-118 mm (81.24±3.22 mm). This suggests that the traps may have captured a greater range of sizes for *S. tranquebarica*.

Table 3. Catch composition of rakkang using small crabs

No	Species	Total catch		Weight (g)	Carapace width (mm)	Male (ind.)	Female (ind.)
		(ind.)	(%)				
1	<i>Scylla tranquebarica</i>	44	26.83	40-430	65-128	28	16
2	<i>Scylla paramamosai</i>	120	73.17	20-250	54-118	59	61
Total		164	100			87	77

Table 4 shows the catch composition of mud crabs obtained using rakkang traps baited with trash fish. A total of 101 crabs were collected, of which *S. paramamosain* was the dominant species, representing 85.15% of the total catch (86 crabs by weight). Conversely, *S. tranquebarica* contributed only 14.85% (15 crabs). These results indicate that the use of trash fish as bait in rakkang traps was also particularly effective for targeting *S. paramamosain*.

Table 4. Catch composition of rakkang using trash fish

No	Species	Total catch		Weight (g)	Carapace width (mm)	Male (ind.)	Female (ind.)
		(ind.)	(%)				
1	<i>Scylla tranquebarica</i>	15	14.85	59-400	72-125	8	7
2	<i>Scylla paramamosain</i>	86	85.15	20-200	55-110	41	45
Total		101	100			49	52

Analysis of the overall sex ratio revealed a slight female predominance, with 52 females and 49 males recorded. For *S. paramamosain*, the sex distribution was nearly equal, comprising 41 males and 45 females. Similarly, *S. tranquebarica* exhibited a balanced ratio, with 8 males and 7 females. Morphometric data demonstrated that *S. tranquebarica* exhibited a wider size range, with weights varying between 59-400 g (107.85±22.96 g) and carapace widths between 72-125 mm (82.62±3.72 mm). In contrast, *S. paramamosain* showed a narrower size distribution, ranging from 20-200 g (78.80±10.95 g) in weight and 55-110 mm (76.83±3.20 mm) in carapace width. This suggests that although less abundant, *S. tranquebarica* individuals were generally larger than *S. paramamosain*.

The analysis of variance (ANOVA) showed the F-statistic (3.29) for group variation was found to be greater than the critical value (2.40) at the 5% significance level, indicating that group differences had a significant effect on the catch. Furthermore, the F-statistic (23.39) for treatment variation was considerably larger than the critical value (8.68) at the 1% significance level. This confirms that the experimental treatments had a highly significant effect on the number of crabs captured (Table 5).

Using small crab bait, the overall CPUE for the rakkang traps was 0.53 ind./trap. The species *S. paramamosain* made up the majority of this catch, with a CPUE of 0.39 ind./trap, accounting for 73.17% of the total catch. In contrast, *S. tranquebarica* had a lower CPUE of just 0.14 ind./trap, making up only 26.83% of the total catch (Table 6).

The results were significantly different when using trash fish bait, which yielded a much lower overall CPUE of 0.33 ind./trap ($p < 0.05$). *S. paramamosain* again dominated this catch with a CPUE

of 0.28 ind./trap, but its proportion increased to 85.15% of the total catch. The catch of *S. tranquebarica* was very low, with a CPUE of only 0.05 ind./trap, accounting for just 14.85% of the total catch.

Table 5. ANOVA Results using a Randomized Block Design

Source of Variation	Degree of freedom	Sum of squares	Mean square	F _{Statistic}	F _{Table}	
					5%	1%
Group	15	63.28125	4.21875	3.29268293	2.40	3.52
Treatment	1	29.96875	29.96875	23.3902439	4.54	8.68
Error	15	19.21875	1.28125			
Total	31	112.4688				

Table 6. CPUE of rakkang based on bait types and crab species caught

Bait Type	Species	Total catch (ind.)	Σ Rakkang (trap)	CPUE (ind./trap)	Proportion (%)
Small crab	<i>S. tranquebarica</i>	44	310	0.14	26.83
	<i>S. paramamosain</i>	120	310	0.39	73.17
	Total	164	620	0.53	100
Trash fish	<i>S. tranquebarica</i>	15	310	0.05	14.85
	<i>S. paramamosain</i>	86	310	0.28	85.15
	Total	101	620	0.33	100

Table 7 clearly shows a clear advantage for small crabs as bait for catching both *Scylla* species than trash fish. The productivity rate was much higher with small crabs (1.71 ind./h) compared to trash fish (1.05 ind./h), and this difference was statistically significant ($p < 0.05$). The data revealed that *S. paramamosain* was consistently more productive to catch than *S. tranquebarica*, regardless of the bait type used, as evident from its higher catch total and proportion in both

scenarios. Interestingly, while the total catch was lower with trash fish, the proportion of *S. paramamosain* within that catch was the higher, suggesting that this species might be more attracted to a wider range of baits, or perhaps *S. tranquebarica* is less interested in trash fish as a food source. Hence, small crab bait outperformed trash fish, increasing CPUE by 60% and productivity by 63%, making it a more effective bait choice.

Table 7. Productivity rates of rakkang using different bait types

Bait Type	Species	Total catch (ind.)	Duration (h)	Productivity (ind./h)	Proportion (%)
Small crab	<i>S. tranquebarica</i>	44	96	0.46	26.83
	<i>S. paramamosain</i>	120	96	1.25	73.17
	Total	164	192	1.71	100
Trash fish	<i>S. tranquebarica</i>	15	96	0.16	14.85
	<i>S. paramamosain</i>	86	96	0.90	85.15
	Total	101	192	1.05	100

DISCUSSION

The research findings revealed significant population dynamics between two mud crab species, *S. paramamosain* and *S. tranquebarica*, caught using rakkang traps. *S. paramamosain* was the dominant species, making up 73% of the total catch when small crab bait was used. This dominance indicates a higher population density or a faster life cycle, making it the primary target of this fishery. This species was known to tolerate a wider range of salinity and tends to dominate estuarine and mangrove-associated environments in Southeast Asia (Sharif et al., 2019). In contrast, *S. tranquebarica* accounted for only 26.83% of the total catch, despite individuals of this species being larger in size and weight. It was often associated with areas of higher salinity, such as offshore mangrove zones or brackish coastal waters, and thus appears less abundant in this particular catch (Le Vay, 2001). These crabs may be more attracted to the small crab bait because it's a natural prey item and they exhibit cannibalistic tendencies. Therefore, choosing the right bait, specifically its type and freshness, is essential for effective crab

fishing, potentially reducing bycatch and supporting conservation efforts (Gustiawan et al., 2018; Haqie et al., 2024).

This disparity in abundance became even clearer when using trash fish as bait, where *S. paramamosain*'s dominance increased to over 85% of the total catch. This susceptibility to trash fish bait suggests differences in feeding preferences and habitat ecology between the two species (Le Vay, 2001). While *S. paramamosain* seems to be more responsive to bait, *S. tranquebarica* may rely on different prey or inhabit areas less effectively targeted by rakkang traps. Consequently, although *S. tranquebarica* has high economic value due to its larger size, its low abundance makes it highly vulnerable to overfishing.

The analysis of sex ratios revealed interesting patterns. The *S. paramamosain* population showed a relatively balanced male-to-female ratio (59 males: 61 females with small crab bait; 41 males: 45 females with trash fish bait). A balanced sex ratio is often considered an indicator of a healthy and stable reproductive population, as skewed ratios can negatively

impact recruitment and long-term stock sustainability (Fazhan et al., 2022). However, the high proportion of mature females in the catch highlights the need for precautionary measures, especially during spawning periods. Conversely, the *S. tranquebarica* catch was skewed towards males (28 males: 16 females with small crab bait), possibly reflecting behavioral differences or habitat use. According to Ikhwanuddin et al. (2012), the movement of these crabs around mangrove areas can be tracked using a telemetry system. Knowledge of crab

behavior allows fishermen to implement more precise fishing strategies, targeting specific species and helping maintain the health and balance of the entire ecosystem (Tahmid et al., 2015).

The data suggested that the use of different baits did not significantly change the proportion of crabs with missing legs. The phenomenon was primarily observed in the more abundant *S. paramamosain*. Overall, the number of crabs with missing legs was a small fraction of the total catch (Table 8).

Table 8. Catch performance based on bait types and sex of two *Scylla* crabs

Bait type	Species	Number of Catch							
		Complete body	%	Missing legs	%	Male	%	Female	%
Small crab	<i>S. tranquebarica</i>	44	28.21	0	0	28	31.46	16	21.33
	<i>S. paramamosain</i>	112	71.79	8	100	61	68.54	59	78.67
	Total	156	100	8	100	89	100	75	100
Trash fish	<i>S. tranquebarica</i>	15	15.79	0	0	8	16.33	7	13.46
	<i>S. paramamosain</i>	80	84.21	6	100	41	83.67	45	86.54
	Total	95	100	6	100	49	100	52	100

The data clearly indicates that small crabs are a more effective bait, as shown by the higher overall CPUE of 0.53 ind./trap compared to the trash fish's 0.33 ind./trap (see Table 6). This suggests that using small crabs as bait is more efficient and yields a higher return for the effort invested. The overall CPUE for crabs in our study (0.86 ind./trap) was remarkably similar to the value of 0.80 ind./trap reported by Fazhan et al. (2022) in Terengganu, Malaysia. This suggests that, despite the different geographical locations, the crab populations in both areas have a comparable density and are equally susceptible to the fishing methods used.

The results also highlighted that *S. paramamosain* was more susceptible to trapping than *S. tranquebarica*, regardless of the bait used. This is supported by its significantly higher CPUE in both bait categories. The difference in CPUE between the two species could be attributed to factors such as population density in the surveyed area, feeding behaviors, or their relative attraction to the baits. The *S. paramamosain* was caught in higher proportions using both bait types, suggesting it is the more common species or has a more aggressive foraging behavior. Further research into the specific feeding preferences of each species would be valuable in understanding these results.

Based on the catch data, the sizes of the crabs caught in this study both align with and fall short of the requirements set by Ministerial Regulation No. 17/2021, which mandates a minimum legal size for domestic consumption or export of 150 g in weight or 120 mm in carapace width. While the rakkang traps were effective at catching many crabs that meet legal size standards, they also captured a significant number of undersized crabs (see Table 3 and 4). This raises concerns about the non-selective nature of the trapping practice and its potential impact on the long-term sustainability of the mud crab population.

A possible reason for the frequent capture of undersized

crabs is the poor selectivity of the traps used, particularly during the developmental stage of the crabs. Given the crabbing season (October to January) coincides with a period of immature crab growth, adjustments to fishing practices are necessary. Implementing measures such as minimum mesh size adjustments, release protocols for undersized crabs, or seasonal closures during spawning periods could help mitigate the issue. Additionally, gear modification and community education on selective fishing practices could improve the selectivity of the traps and contribute to the sustainability of the mud crab population. The undersized crabs caught by the traps are also commonly found in other geographical regions (Chakraborty et al., 2018; Jumawan et al., 2021), highlighting the need for region-specific management strategies.

Based on the provided pricing data from Bawah Layung village, the market value of the crabs caught in this study varies significantly with their weight and category. Egg-bearing females (>400 g) fetch the highest price (\$26/kg), followed by large males (300-400 g, \$6/kg) and standard-sized crabs (<300 g, \$2/kg). The analysis of the study's catch data shows a potential for varying revenue streams, with *S. tranquebarica* likely generating higher profits due to its larger size, including individuals exceeding 400 g.

The financial value of a catch depends heavily on the size and type of crabs, highlighting that not all crabs are equally profitable. *S. paramamosain*, the more abundant species, is often harvested at smaller sizes (up to 250 g), placing it in lower price brackets, including the "missing claw" category (\$1/kg). In contrast, *S. tranquebarica*'s larger size range suggests a greater proportion of high-value catches. To ensure long-term sustainability, species-specific management strategies are necessary, including catch limits for *S. paramamosain* and strict monitoring of mature *S. tranquebarica* harvests to protect breeding stock, which align with the previous studies (Hapsari et al., 2021; Riyanto et al., 2025).

CONCLUSION

Rakkang effectively captured both *S. tranquebarica* and *S. paramamosain* using different bait types. *S. paramamosain* dominated catches at a three-to-one ratio, suggesting strong population health but also heightened risk of overfishing due to high catchability. In contrast, *S. tranquebarica* was less abundant but consistently larger and economically valuable. Small crab bait outperformed trash fish significantly. The capture of both legal-sized and undersized crabs highlights the need for species-specific management to balance market demand with long-term sustainability. Further research on bait alternatives and habitat-specific efficiency is recommended to inform adaptive management strategies and ensure the long-term sustainability of mangrove crab fisheries.

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AUTHORSHIP CONTRIBUTIONS

The authors conceived, designed, analyzed, and prepared this manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

ETHICAL APPROVAL

No ethics committee approval is required for this study.

DECLARATION OF AI USE

A generative AI tool (e.g., ChatGPT) was used to enhance language clarity, improve readability, and ensure grammatical accuracy in certain sections of this manuscript. The authors, however, maintain full responsibility for the accuracy of all information, ideas, interpretations, and conclusions presented.

DATA AVAILABILITY

All relevant data are in the article.

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