Habitat preferences of Freshwater Prawn, *Macrobrachium* spp. in the Petagas River, Sabah, Malaysia

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ABSTRACT *Macrobrachium* species is one of the most abundant and valuable cultured freshwater prawns in the world, serving as a high-value food resource. A study conducted in Petagas River, Sabah aimed to determine the habitat preferences of this freshwater prawn, as suitable habitats play an important role for the survival and growth of each species. Six stations were selected representing different habitats: vegetation or shades, dead logs or tree roots and no shelter, consisting only of mud or sand. Prawns were caught using fish traps equipped with two entrance funnels, left overnight, and retrieved the next day. Data were analyzed using SPSS, involving Kruskal-Wallis and Mann-Whitney U tests. Habitats with the presence of dead logs or tree roots portrayed the highest percentage of adult individuals caught (54.43%), followed by those with vegetation (27.22%), and mud (18.35%). Additionally, sstatistical analyses revealed a significant difference in the number of adult individuals among all stations (Kruskal-Wallis; $p < 0.05$), except between stations V1 and V2 (Mann-Whitney U-test; $p>0.05$). This study showed that freshwater prawn, *Macrobrachium* spp. in Petagas River exhibit a preference for habitats that include dead logs or tree roots serving as shelter over those containing only vegetation and mud or sand.

KEYWORDS: Habitat preferences, *Macrobrachium*, vegetation, dead logs, mud sand
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INTRODUCTION

The presence of suitable habitats and shelters is crucial for the survival and growth of freshwater prawns, *Macrobrachium* spp., due to their aggressive and territorial behavior (Murthy *et al.*, 2012). Growth variations within freshwater prawn populations can be influenced by the use of shelters and artificial habitats (Ochwada *et al.*, 2009), which also improve survival rates by reducing cannibalism (Avault, 1986). A study by Mercy & Shankaran (1992) demonstrated that juvenile *M. rosenbergii* preferred substrate pebbles over garden soil and river sand, likely because the pebbles offered more hiding spaces. Similarly, Murthy *et al.* (2012) found that *M. rosenbergii* exhibited the highest growth rates in tanks with PVC pipes and the lowest in tanks without substrates. Guerrero & Molina (2008) observed that *M. americanum* had higher survival and growth rates in environments with shelters, as these provided protection. Shelters are essential in the culture of crustaceans like *Macrobrachium*. Ochwada *et al.* (2009) showed that prawn postlarvae preferred macrophyte habitats over bare mud and sand. According to the author, for *M. rosenbergii*, the presence of shelters or substrates reduces predator exposure, and complex habitats can decrease predator foraging efficiency and prawn mortality rates.

The population of *Macrobrachium* spp. in Petagas River has shown a notable increase following the implementation of a series of community-based stock enhancement programs (Anton *et al.*, 2016). Recording the habitat preferences of adult *Macrobrachium* spp. in the river is essential for future program monitoring and effective species management. Due to the limited data available on

the previous stocking efforts, this study was conducted to assess the habitat preferences of *Macrobrachium* spp. in the Petagas River, Sabah.

METHODOLOGY

Six stations located at the upstream part of river were used to identify the habitat preferences of *Macrobrachium* spp. (Figure 1). Each two stations represent habitats of vegetation or shades, substrates and no shelter (only mud sand) respectively (Table 1) as shown in Figure 2 (a), (b) and (C). The prawns were caught using a modified fish trap with two entrance funnels. The traps were left overnight and were hauled the following day. A series of sampling was conducted following the stocking programs. Statistical analyses were undertaken using the IBM Statistical Package for the Social Sciences (SPSS) Statistics 23 software. Normality tests were carried out using the Shapiro-Wilks ($\alpha < 0.05$). The data that did not meet the assumptions for parametric testing were analyzed using non-parametric methods. Specifically, the Kruskal-Wallis and Mann-Whitney U tests were performed in SPSS to evaluate whether there were significant differences in the abundances of *Macrobrachium* spp. caught at various stations and times.

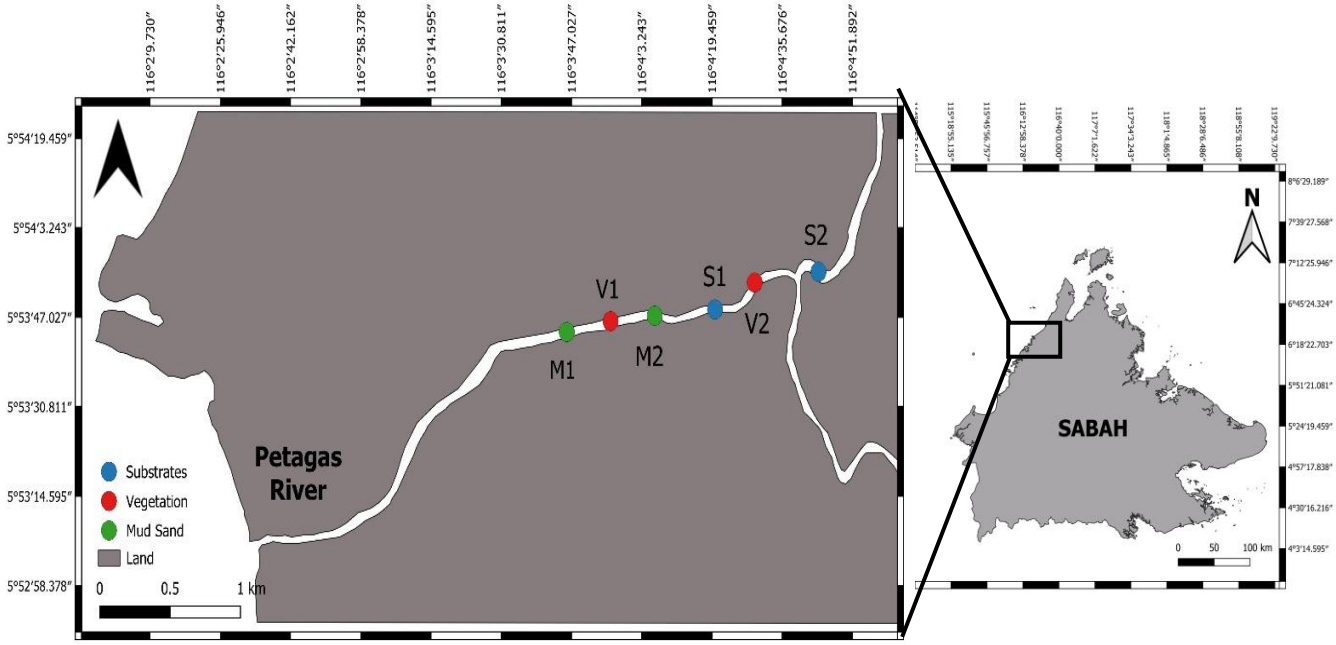

Figure 1. The sampling stations in Petagas River, Sabah

Table 1. Sampling stations

Station	Station's description	General water quality description
V1	Presence of vegetation	0 ppt salinity, 5.26-7.19 mg/L dissolved oxygen (DO), 6-7 pH
V2	Presence of vegetation	
S1	Presence of dead logs or tree roots	
S2	Presence of dead logs or tree roots	
M1	Mud sand only	
M2	Mud sand only	

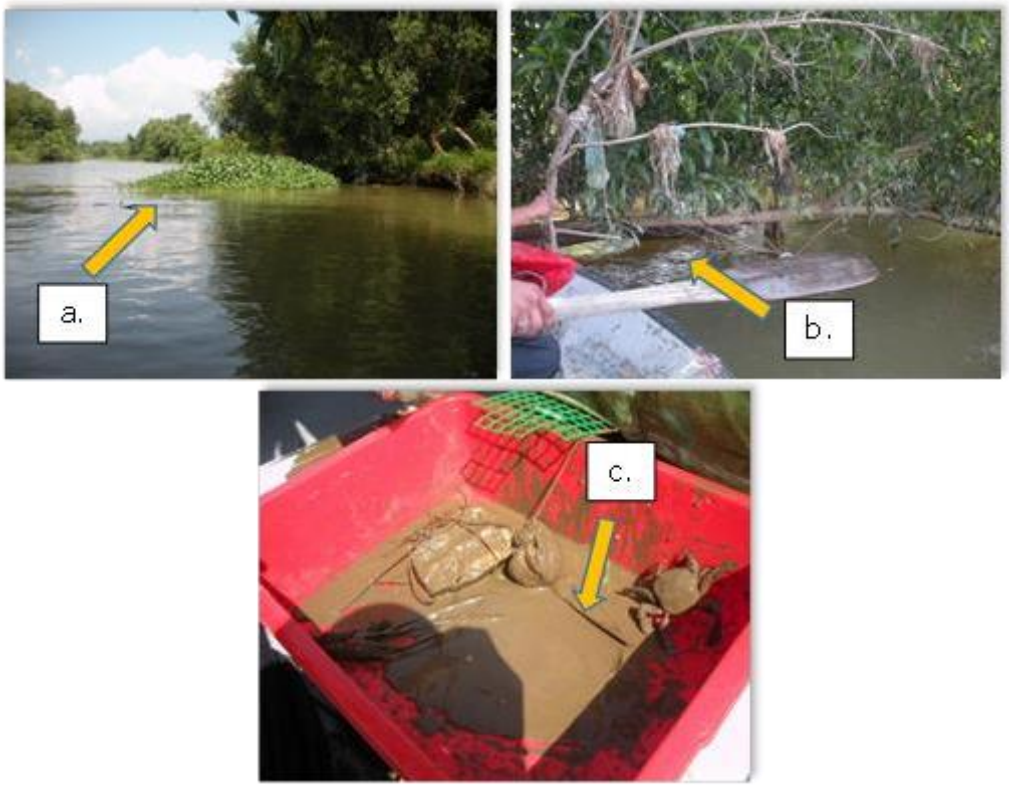

Figure 2. The types of habitats tested and involved in the study. a) Station with the presence of vegetation; b) Station with presence of dead logs or tree roots; and c) Station with no shelter or mud sand only.

RESULT AND DISCUSSION

The total number of adult individuals captured at all six stations (V1, V2, S1, S2, M1, and M2) ranged from 3 to 39 (Figure 3). Station S1 had the highest number of adult individuals (n=39) while the lowest number was recorded at station M2 (n=3). There were no significant differences in the number of adult individuals (Kruskal-Wallis; $p>0.05$). The highest percentage of adult individuals was caught at stations with dead logs or tree roots (54.43%), followed by those with vegetation (27.22%), and mud (18.35%) (Figure 4). Statistical analyses revealed a significant difference in the number of adult individuals among all stations (Kruskal-Wallis; $p<0.05$), except between stations V1 and V2 (Mann-Whitney U-test; $p>0.05$).

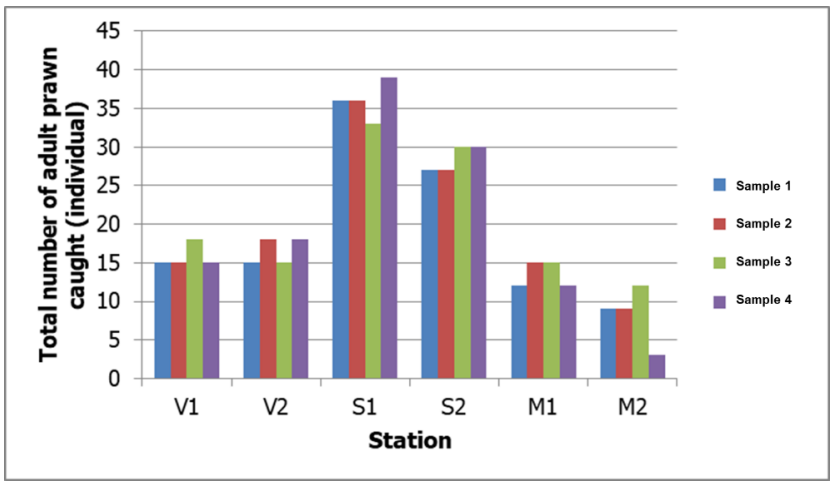

Figure 3. Total number of adult individuals, *Macrobrachium* spp. caught at different types of habitat stations.

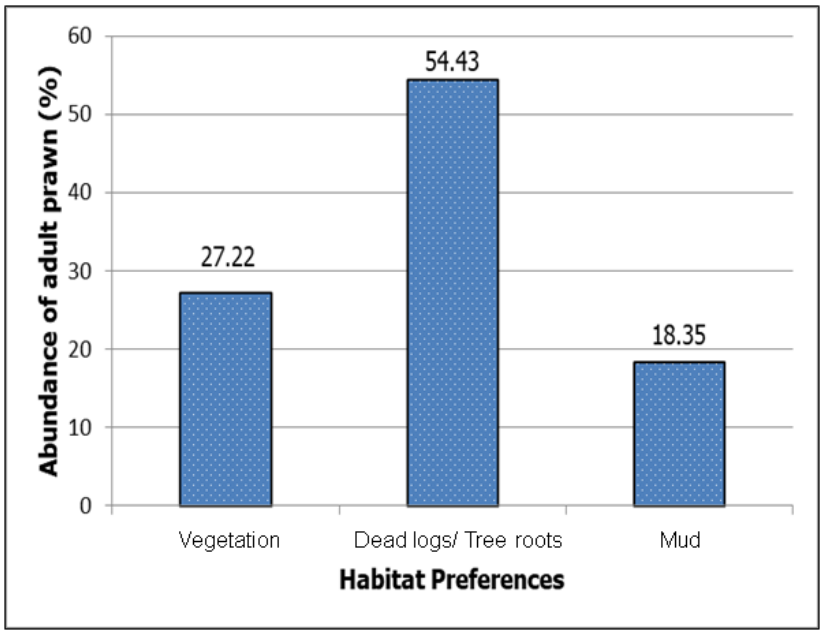

Figure 4. Percentage of adult prawn, *Macrobrachium* spp. in different habitat preferences

The implementation of shelters and artificial habitats has been shown to reduce growth variation within freshwater prawn populations and enhance survival by decreasing cannibalism (Ochwada *et al.*, 2009). Generally, juveniles of crustaceans prefer open areas, while adults favor dark shelters (Antonelli *et al.*, 1999). This aligns with the current study, which recorded the highest number of adult individuals at stations with abundant substrates: S1 (8.3 individuals/m²) and S2 (9.8 individuals/m²), accounting for 54.43% of adult prawns. Substrates such as dead logs, tree roots, and rocks were abundant at stations S1 and S2, providing habitation and protection for the adult prawns in the Petagas River.

Additionally, the second highest number of adult prawns was captured at stations V1 (3.8 individuals/m²) and V2 (4.5 individuals/m²), where vegetation was present. These findings are consistent with those of Mariam-Syarmilah (2016), who also examined the habitat preferences of juvenile freshwater prawns in the same river. Their study reported the highest number of juvenile *Macrobrachium* spp. in habitats with vegetation (78.9 individuals/m²), compared to open areas and sediment (30.8 individuals/m²). These observations suggest that juveniles occupy the riverbank vegetation and other structures along the shore, such as revetments, drain channels, rocks, dead logs, and wharfs, for feeding, molting, and growing. The distribution of juvenile and adult prawns is influenced by these structures, facilitating juvenile migration (Bauer & Delahoussaye, 2008). Covich *et a*l. (2003) categorized structures like undercut banks, woody substrates, root mats, and riparian edges as microhabitats that provide refuge for many prey species from predators.

The presence of substrates and vegetation is believed to provide dark shelters for freshwater prawns to hide. This study demonstrated that adult prawns prefer dark shelters created by substrates such as dead logs, rocks, tree roots, and vegetation. Balasundaram *et al.* (2004) noted that *Macrobrachium* sp. has a strong affinity for black substrates, spending 80% of its time on them. Furthermore, both juvenile and adult *M. nobilii* were found to favor dark shelters over open areas, while they never utilized transparent shelters (Mariappan & Balasundaram, 2003). This behavior allows prawns to hide from predators and thereby reduces their mortality rate.

CONCLUSION

Overall, freshwater prawn, *Macrobrachium* spp. in Petagas River exhibit a preference for habitats that include dead logs or tree roots serving as shelter over those containing only vegetation and mud or sand. This study provides valuable insights into the ecology of *Macrobrachiu*m spp., offering critical information for effective ecological management and population control of the species.

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