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Research paper

The distribution and length size of corbicula fluminea (ETAK) in Sungai Pergau at Gunung Reng

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Abstract

Corbicula fluminea (Bivalvia: Corbiculidae), locally known as "etak" which is the favorite freshwater clams in the Kelantan state. This study was conducted to study on Etak distribution in Sungai Pergau at Gunung Reng which is known as a recreational spot. As it is the favorite freshwater clam in the state, the data could be helpful in monitoring its presence and if in decline, remedial and replenishment could be introduced. The numbers, weight and the length measurement of C. fluminea were identified as C. fluminea parameters. In addition, water quality used (conductivity, pH, turbidity, salinity, temperature, DO and nitrate) and types of substrate were also studied to identify the habitat characteristics that affect the distribution of this species. As there was no documentation of distribution and density of C. fluminea in Sg. Kelantan, it would be difficult to compare the density and distribution of "etak" in the others river in Kelantan. In total 166 individuals of C. fluminea (77g) found at middle streams with 11-12.5mm in length. As the finding shows that, the distribution of C. fluminea at Gunung Reng was not affected by water quality. In this study shows that the most substrate ranged from 0.25mm and 0.71mm which represent sand (sand-coarse and sand-fine). It is believed that the smaller substrates help to trap more suspended materials as food for C. fluminea and the harvesting activities reduce the time for the clams to grow mature with a larger size in length.

Keywords: *Corbicula fluminea; etak; Gunung Reng; length size; substrates type*

1. Introduction

C. fluminea is one of bivalve species which commonly named as Asian clam. This species can be found in the eastern Mediterranean, South East Asia, Africa and some place in eastern Australia (1). *C. fluminea* is viewed as one of the world's most invasive freshwater clam, having invaded North America, South America, Europe and northern Africa. It is used as fish bait and sold as "pygmy clam", or "golden clam" in North America and cause problems by overpopulated in the water channel. However, it is one of the popular foods and snacks in Kelantan which known as 'etak'. It can be prepared in many ways and sold in the wet market or roadside stalls in Kelantan (2, 3)
Gunung Reng River is one of the well-known recreational spots in Kelantan and this activity may influence the distribution of *C. fluminea* in this area. Hence, this study aimed to study the distribution of *C. fluminea* in Pergau River at Gunung Reng River.

2. Literature Review

C. fluminea typically found with 25mm in length and can reach 50-65 mm in length. It has an oval shape without elongated and deep on the hinge side. The outer layer of the shell has well-defined, thick growth rings and varied coloration. The older clams the darker colored periostracum can be. Typically, this clam is found buried within the top 10-15 cm of the substrate in 2m to 40m of water with highest densities occurring between 3-10m depth. John (4)stated that the suitable substrate composition for *C. fluminea* was in >40% fine sand, <45% silt, and 8% organic content. Castaneda (5)mentioned that it is easy to colonize and shape thick neighborhood populations. Crepso, Dolbeth (6) state this bivalve species usually found in oxygenated waters and is intolerant to high salinity values, low pH and low calcium fixations. However, they also get a high reproductive ability and consequently make it more resilient and help them to recover quickly from events of catastrophic mortality (7). *C. fluminea* also act as the filter feeder and indirectly help to clear the water by removing broad quantities of planktonic food and fostering the distribution of macrophyte algae (7).

3 Methodology/Materials

3.1. Study area

The study area is located at Sungai Pergau in Gunung Reng River, Kelantan. The study area consists of 10 sampling points at 200m along the river with a total of three stations (upstream, middle and downstream) and the sampling was repeated three times.

3.2. Substrates composition

The substrate sample from each station was retained for granulometric analysis (Rory *et al*., 2014) by using a mechanical sieve shaker. Next the substrate characteristic categorized according to the Wentworth Grain Size Chart. In sieve size of 2.36mm, the

substrate was in category of pebbles (fine granules). While 1.18mm, 0.71mm, 0.50mm, 0.25mm and 0.125mm was from sand which each of the stated sieve size was very coarse, coarse, medium, fine and very fine sand respectively. On other hand, silt and clay were from the sieve size of 0.045 and 0.02 respectively.

3.3. Water Quality

Six physical water quality parameters were measured by using YSI instrument, which were conductivity, pH, temperature, DO, salinity. Turbidimeter used to measure turbidity. In addition, water sample has been collected at each point selected for collection of *C. fluminea* samples to analyze the concentration of nitrate at the laboratory.

3.4. *C. fluminea* collection and measurement

C. fluminea were collected by sieving the sediments through the sieve for Etak in size of 17.85m^2, at random point. At every point, the samples were taken triplicates to take the average value. The *C. fluminea* within each quadrat were handpicked and retained in marked zipper bags plastic. The conventional morphometric characteristics, which were, shell height (H- umbo to gape) and length (L-anterior to posterior margins of the shell) of each specimen measured to the nearest 0.1 mm using vernier caliper. The total shell length was used as a standard size measure for statistical adjustment of the measured variables (8).

4. Results and Findings

4.1. Substrate's distribution

Table 1 showed that a quite similar pattern of substrates weight % from downstream toward upstream. Right and middle side were composed around 40%-45% pebbles-fine granules, 25%-28% sand-very coarse, 10%-15% sand coarse and sand medium and 1%-5% sand fine and very fine. In contrast, the left side composed of 30%=37% sand coarse and sand fine and less than 10% for other substrates categories.

Table 1: The substrates weight % from downstream toward upstream.

Sieve size's (mm)	Substrate Category	Weight (%)								
		Downstream			Middle stream			Upstream		
		Right	Middle	Left	Right	Middle	Left	Right	Middle	Left
2.36	Pebbles-Fine granules	0.44	0.32	0.05	0.44	0.32	0.04	0.43	0.32	0.04
1.18	sand-very coarse	0.26	0.27	0.08	0.26	0.27	0.08	0.26	0.28	0.07
0.71	sand-coarse	0.14	0.22	0.33	0.14	0.21	0.34	0.14	0.21	0.33
0.5	sand-medium	0.10	0.09	0.11	0.10	0.09	0.11	0.10	0.09	0.12
0.25	sand-fine	0.03	0.06	0.36	0.03	0.07	0.36	0.03	0.06	0.36
0.125	sand-very fine	0.03	0.04	0.07	0.03	0.04	0.07	0.02	0.04	0.07
0.045	silt-coarse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	clay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Water quality

Table 2 showed the water quality of the river. There is no much difference for seven parameters measured. This river temperature ranges from 26-30˚C with pH 6.4-7.2 and the salinity was less than 0.02. *C. fluminea* could tolerate salinities ranging from 0% to 5% (9). The small size of *C. fluminea* experience little energy loss at lower (4-11˚C and 11-18˚C) and upper (25-32 ˚C) temperature ranges and is capable of performing seasonal compensation to maintain their capacity to survive in their range of temperature tolerance ((10). The water cloudiness measured in turbidity was less than 10 NTU, while nitrate measured less than 0.2mg/l and DO concentration is less than 4mg/l. Based on NWQS standard, all parameter categorized this river as class I but DO concentration categorized this river as Class III at downstream and IV at upstream.

4.3. *C. Fluminea* Collection And Length

There was no *C. fluminea* recorded in upstream and downstream even though the substrate composition and size was no different with the middle part. This may be caused by the area was the best and easier spot for Etak harvesting by local communities compared to middle stream. Therefore, it was about 166 individuals of Etak had been collected at the middle stream with 77.3g. Figure 1 shows the length of Etak and the number of individuals collected in the middle stream of the river. Most of the collected Etak were length around 11.5-12.3mm. The highest abundance of Etak found was 11.9mm in length. According to the John statement, *C. fluminea* can also be found at the substrates with higher fine granules but maybe in small length size as found at this study area range around 11-12 mm compared to the range of shell length for small size was mentioned in guideline (19.310±1.137mm) by Xiao and Jiang (11). However, McMahon (12)stated that *C. fluminea* can live in a variety of substrates, but prefers sand and gravel, over silt hard surfaces.

It is also can be said that the collected *C. fluminea* was just past the juvenile phase. As mentioned in New York invasive species information (NYIS) (2012), juvenile clams can reach maturity about 6-10 mm in size for 3 to 6 months, and reach 10 to 30 mm in size during their first year. Besides that, the size of C. fluminea was depending on food availability and temperatures. On the other hand, the increasing of substrate particles size will slow *C. fluminea* burrowing speed and impaired horizontal movement, especially the largest gravel. In addition, *C. fluminea*, was functioning as the filter feeder that can increase water clarity by removing broad quantities of planktonic food and fostering the distribution of macrophyte algae (7). This means they feed on small material suspended in water which easily to trap by small particles of substrates compared to larger substrates particles.

Table 2: Water quality of the river

Station	Water quality parameter	
Downstream	Conductivity (µS/cm)	0.038
	pH	7.18
	Temperature (^{0}C)	29.23
	Salinity (Sal)	0.01
	DO (mg/l)	3.52
	Turbidity (NTU)	2.66
	Nitrate (mg/l NO_3^-)	0.15
Middlestream	Conductivity (µS/cm)	0.026
	pH	6.44
	Temperature (^{0}C)	28.95
	Salinity (Sal)	0.01
	DO (mg/l)	3.71
	Turbidity (NTU)	2.57
	Nitrate (mg/l NO_3^-)	0.14
Upstream	Conductivity (µS/cm)	0.038
	pH	6.59

	Temperature (^{0}C)	26.26
	Salinity (Sal)	0.02
	DO (mg/l)	2.54
	Turbidity (NTU)	2.06
	Nitrate (mg/l NO_3^-)	0.1

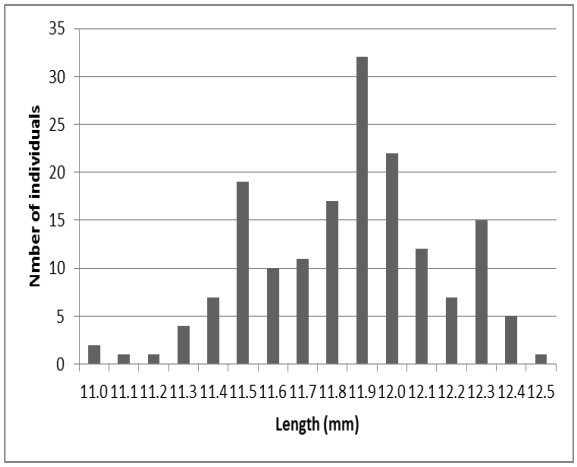

Fig. 1: The length of Etak and the number of individuals collected at the middle stream of the river.

5. Conclusion

The result from water quality analysis showed there was no big different among the six parameters used for water quality as well as substrates composition. Meanwhile, Gunung Reng River was not polluted by any pollution that could cause low result in water analysis except for DO concentration at downstream was lower than 2mg/l. However, the Etak was only found and collected at the middle stream. Meanwhile, the collected Etak were found more with length around 11.5-12.3mm. This was believed to be due to the substrates type and food availability in the area. Besides the area was the spot for Etak harvesting which may lead to the small size as the clams had not enough time to develop to the larger size.

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