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Organic content and the number of *Corbicula fluminea* (Muller, 1774) in Lubok Tani Irrigation Canal, Tumpat, Kelantan

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Abstract. *Corbicula fluminea* can be found living in the bottom of lakes, rivers and irrigation canal in Kelantan. *C. fluminea* usually receives nutrients and food source that are carried along with the runoff and these nutrients are considered pollutants to the water. Plus, the number of *C. fluminea* present is believed to be influenced by organic content in the sediment. Hence, the objective of this study was to determine the concentration of organic matter in the sediment and the number of *C. fluminea* at Lubok Tani Irrigation Canal, Tumpat, Kelantan. Samples were collected from two points, with six composites sampling of sediment and six samples of *C. fluminea*. Thus, organic matter in sediment was measured using Loss on Ignition analysis. The results indicated that an average of 55 clams was collected at the left bank, 57 clams at the middle and right bank. The average organic matter at the left bank was recorded at 1.61%, centre at 1.37%, and right bank at 2.42%. The results showed that area with higher organic matter had higher composition and size of *C. fluminae*. This study also showed that *C.fluminae* in the study area started to reproduce in May and believed to be matured in August. However, more data collection is required to obtain a significant statistical correlation. In conclusion, organic matter in substrates can influence the composition and size of *C. fluminae* and the suitable harvest time can be scheduled to ensure the sustainable harvesting.

1. Introduction

Corbicula fluminea (*C. fluminea*) is originally from Asian countries and commonly known as Asian clam. Bódis *et al*., [1] stated that *C. fluminea* have been introduced to several parts of Africa, Europe, North America, and the Mediterranean. Glaubrecht *et al*.[2] found that Asian clams belong to the genus Corbicula of the family Corbiculidae. *Corbicula fluminea* is a hermaphroditic self-fertilizing clam with a span of 1 to 5 years [3]. It will start to reproduce at a shell size of about 10 mm, between the ages of 5 and 9 months of age. Regarding the habitat, *C. fluminea* can survive in almost any freshwater environment, including permanent brackish and estuarine waters. The substrate is generally sand, mud or a mixture of both. *C. fluminea* also has the ability to filter the particles suspended in water including algae, bacteria, detritus and pedal by feeding on the sediment.

Kelantanese have frequently consumed *C. fluminea* as a snack since a very long time ago [4]. However, the number has decreased due to habitat disturbance as well as water quality deterioration

[5, 6] due to industrial, household, waste water, sullage from the kitchen, and oily waste water from automotive workshop discharges [7] to the river. Total organic content from the soil [8] attached to the runoff and flowed into irrigation canal/river is also one of the pollutants. It has promoted the growth of microorganisms that will compete for oxygen in the water. However, the organic matter of the river is believed to have affected the growth of *C. fluminea*. Many authors reported that organic matter is essential to provide the energy source for biogeochemical transformation and greatly influences metabolism, growth, feeding strategies, and benthic assemblages [9, 10]. According to [11], macroinvertebrates do not rely on physico-chemicals water quality alone but also depend on other factors such as habitat characteristics, the river's morphology, the river bank itself, canopy protection and river substrate composition. Currently, there are very few studies conducted to determine the organic contents and the number of *C. fluminea* in the irrigation canal. Hence, this research is aimed to determine the organic matter and size of *C. fluminea* in the irrigation canal.

2. Materials and methods

2.1. Sampling and size measurements

The sampling of *C. fluminea* was carried out six times in Lubok Tani irrigation canal, Tumpat, Kelantan. The *C. fluminea* was collected using a dredger. Three sampling lines were set at the left, centre and right bank. The samples were sealed using a zipper bag and preserved at 4°C in the icebox before being sent to the Universiti Malaysia Kelantan Jeli Campus laboratory. Upon arrival, the size (height and width) was measured immediately using digital callipers.

2.2. Determination of organic content in sediment

On the other hand, the sediment sample was collected manually with an Ekman Grab sampler [12] at the same sampling line with *C. fluminea*. Sediment samples were kept in a zipper-lock bag and placed in an icebox prior to being transported to the laboratory [13]. All of the samples were labelled with the location, date and time of collection. The collected sediment was dried in the drying oven at 105 °C for 24 hours. The samples were grounded into powder using mortar and pestle. The grounded sediment was sieved with a 2 mm sieve to ensure uniformity of heat penetration. All the porcelain crucibles were dried in the oven for 30 minutes prior to sample loading. The dried crucibles were initially weighed to the nearest 0.001g, and 5g of ground sample was placed in the crucible. After that, the sample was placed into the furnace (Muffle Furnace, CARBOUTE, UK), with a temperature of 600°C. The ignition process was operated for 5 hours to determine the percentage of organic matter. After completing the ignition process, the samples were allowed to cool down at approximately 150°C. The samples were taken from the furnace and cooled in desiccators. Within 30 minutes, the final weight of the crucible with the sample was measured. The percentage of organic matter was calculated using equation (1) as shown below:

$$\%\boldsymbol{OM} = \left(\frac{\textbf{pre ignition weight} - \textbf{post ignition weight}}{\textbf{pre ignition weight}}\right) \times \mathbf{100} \tag{1}$$

2.3. Statistical Analysis

Partial correlations method used to identify the correlation of organic matter in sediment with *C. fluminae* composition and size.

3. Results and Discussion

The average number of *C. fluminea* collected at the left bank, middle or center and right banks of the canal from March until August were 55, 57 and 57 clams respectively. The lowest number recorded at the left bank was 29 clams, middle/centre was 32 clams, and at the right bank was 33 clams. On the other hand, the highest recorded sample was at the left bank with 73 clams, the middle/centre with 75 clams, and at the right bank with 78 clams. Generally, the highest number of *C. fluminea* was collected from May till August. March and April showed a lower number in terms of samples collected in all sections (left bank, centreand right bank) (Figure 1). However, the highest number of *C. fluminae* was collected at the right bank (73 clams). The number of *C. fluminea* collected has increased from the left to the right bank. Table 2 shows the average size of *C. fluminae* at the left bank, centre and right bank. On average, *C. fluminae* found at the centre has a bigger size with 16.24mm (length) and 15.23mm (width) compared to the left and right bank.

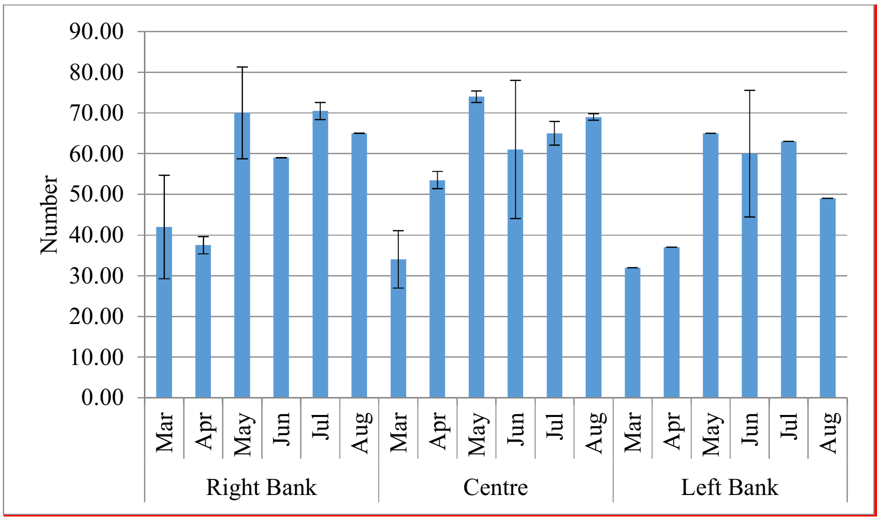

Figure 1. Monthly average number of *C. fluminea* collected at the left bank, middle and right bank.

Table 1. Average length and Average width of *C. fluminae* at each bank.

Parameter	Left Bank	Center	Right Bank
Average Length (mm)	15.91	16.24	15.81
Average Width (mm)	15.05	15.23	15.05

An average percentage of organic matter in the sediment, collected at canal's left bank from March until August was 1.61%. The average percentage of organic content in sediments collected at the middle/centre of the canal at the same period was 1.37%, and the average percentage of organic matter collected from the right bank of the canal was 2.42%. Generally, the highest percentage of organic matter was found in sediments collected July and August at the left bank, May and June at the centre bank and March and May at the right bank (Figure 2). Of all three locations (left centre and right banks), highest percentage of organic content were found in sediment collected at the right bank (7.54%). Generally, the percentage of organic matter also increased from the left to right bank.

Even though it is shown a negligible correlation for Pearson correlation analysis, the correlation results of *C. fluminea* indicates positive correlation between the number of *C. fluminae* (0.113, $p>0.05$), the average of width (0.213, $p>0.05$), length (0.239, $p>0.05$) and C. fluminae size with the organic matters found. The negligible correlation recorded was believed to be due to the amount of data (more data might be needed). This is supported by Lauritsen and Mozley [14], whereby they believed that the availability of nutrients and organic matters in the substrates would influence the number of *C. fluminea* as this species relies heavily on these components as a food source other than phytoplankton. Other findings have shown that the species of *C. fluminea* require pedal-feeder using the organic matter available in the sediment as a food source, whereby the sedimentary material is transported to the labial palps by using ciliary which are tracts on its foot [15, 16]. The results have also revealed that *C. fluminea* can survive even if the amount of organic matter is little. As mentioned by Hakenkamp et al., [17] and Strayer et al., [18], *C. fluminea* not only depend on organic matter but also other sources of food such as plankton and algae.

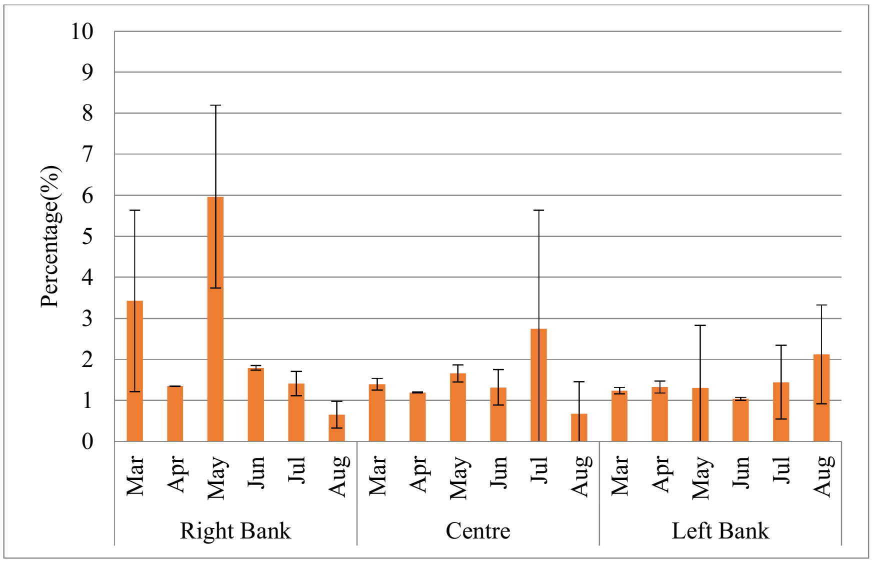

Figure 2. Monthly average percentage of organic matter recorded at the left, middle and right bank.

4. Conclusion

According to the result that has been discussed, the percentage of organic matter (%) does correlate with the number of *C. fluminea,* but it was not significant (p>0.05). The highest number recorded during May until August suggests that *C. fluminea* started to reproduce in May and matured somewhere in August. The highest number of *C. fluminea* collected at the right bank also indicated that they have enough food to survive and grow as the organic matter recorded was high compared to the middle and left bank.

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