

# Preliminary Study on Benthic Macroinvertebrates Distribution and Assemblages at Lata Meraung Waterfall, Pahang, Malaysia

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## Graphical abstract



## Abstract

This study aimed to identify the distribution and assemblages of benthic macroinvertebrates at Lata Meraung Waterfall, Pahang, Malaysia. Benthic macroinvertebrates were collected between 11-12 February 2014 from three stations located at upstream, midstream and downstream of the river. Benthic macroinvertebrates were collected by using Surber net with 500 micron mesh size combined with a rectangular quadrat with the size of 30 cm x 30 cm. The ecological indices (richness, diversity, dominant, and evenness) and benthic biotic index (Ephemeroptera, Plecoptera and Trichoptera or EPT) were calculated. Result shows that, the study area was dominated by insects where a total of 1,287 individuals from 27 taxa of insects were collected. The most abundant taxon was Hydropsychidae (Trichoptera) which contributed about 20% of total individuals. On the other hand, all stations recorded the present of sensitive organisms namely Ephemeroptera, Plecoptera and Trichoptera (EPT) but Trichoptera (Hydropsychidae) was the most abundant with 264 individuals. However, Ephemeroptera was the most diverse with seven families as compared to Plecoptera and Trichoptera. The assemblages of benthic macroinvertebrates were abundance at the downstream as compared to upstream. This was due to the composition of substrates such as sand, pebble, and cobble which are lesser at the upstream river.

**Keywords:** Assemblages; benthic macroinvertebrates; Hydropsychidae; ecological indices; EPT index

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## 1.0 INTRODUCTION

Lata Meraung is one of the recreational rivers located at one of the recreational forests in the state of Pahang, Malaysia. Benthic macroinvertebrates are referred to as invertebrates that can be seen by naked eyes and live most of their life at the bottom part of water body. Most of benthic macroinvertebrates are usually found at the bottom of recreational rivers. Nowadays, a new approach in water quality assessment is based on the benthic macroinvertebrates characteristics. There are lot of indices develop based on the species and distribution of benthos [1]. The assemblages of benthic macroinvertebrates were believed to not only depend on water quality but also the physical habitat characteristic of the watershed and feeding habit [2]. Different tolerance and survival in water and habitat changes are one of the criterions that make them suitable to be used as bioindicator. Besides that, they are also one of the biotic components that are most exposable to any changes due to their limited mobility as they live most of their life in the bottom part of water body [3]. Recreational rivers usually used for swimming and picnicking indirectly give some impact to water quality and also change some of the habitat physical characteristic. Thus, it will change

the distribution and assemblages of the benthic macroinvertebrates in the river. Therefore, the composition and distribution of benthic macroinvertebrates at Lata Meraung Waterfall will be determined in this study.

## 2.0 METHODOLOGY

### 2.1 Study Area

The study area was located at Lata Meraung, Jerantut, Pahang, Malaysia (refer Figure 1). Three sampling stations were identified using Global Positioning System (GPS) based on the following coordinates: (N3 51.761 E102 17.807).

### 2.2 Benthic Macroinvertebrates Sampling

Benthic macroinvertebrates sampling was conducted by using Surber Net with 500 micron mesh size combined with a rectangular quadrat with the size of 30 cm x 30 cm (0.09 m<sup>2</sup>). Five replicates of benthic macroinvertebrates were collected from each station. In order to preserve the benthic macroinvertebrates

samples before sending to the laboratory for sorting and identification 80% Ethanol was used.

### 2.3 Benthic Macroinvertebrates Analyses

The benthic macroinvertebrates samples were rinsed with tap water to remove the preservative before it can be sorted out into major taxa. Samples that have been sorted were stored in 15 ml

universal bottle containing 70% ethanol for preservation. The identification of this sample was only up to the family level.

### 2.4 Data Analysis

Ecological indices such as Margalef's index (d), Shannon-weiner index (H), Dominant index and Evenness (E) were calculated including one on the potential biotic index (EPT index).



Figure 1 Map of study area

### 3.0 RESULTS AND DISCUSSION

Table 1 shows the total of 1287 individuals which consist of 27 taxa (family) belonging to eight orders of insects (Ephemeroptera, Plecoptera, Trichoptera, Diptera, Coleoptera, Hemiptera, Lepidoptera and Odonata). The most highest abundance of species (800 individuals) was found at Station 1, with 24 families namely

Perlidae, Siphonuridae, Leptophlebiidae, Ephemmeridae, Baetidae, Heptageniidae, Hydropsychidae, Pilopotamidae, Stenopsychidae, Tipulidae, Ceratopogonidae, Chironomidae, Elmidae, Scirtidae, Psephenidae, Hydrophilidae, Aphelocheiridae, Veliidae, Gomphidae, Libellulidae, Euphaeidae, Platystictidae, Pyralidae. In contrast, Station 3 accounted for the lowest abundance and taxa numbers with 73 individuals, while sixteen

families of insect and 414 individuals were collected from Station 2. Benthic macroinvertebrates found at this area were dominated by insects. The most abundant families were Hydropsichidae (21% of total individuals) followed by the Tipulidae (17%), Chironomidae (14%), Baetidae (12%) and Perlidae (9%). EPT was most abundant at Station 1 followed by Station 2 and Station 3. Table 2 shows the distribution of EPT at Lata Meraung.

Benthic macroinvertebrates collected from Station 1 was abundant as compared to Station 3. This finding was expected due to the composition of substrates and several habitat physical characteristic factors. Ephemeroptera was found to be most diverse at Station 2 than others with six families namely, Potamanthidae, Leptophlebiidae, Caenidae, Ephemmeridae, Baetidae and Heptageniidae. However, the most abundant Ephemeropteran found was the Baetidae family with 152 individuals. Result shows that the distribution of EPT decreases towards upstream and it was believed to happen due to the composition of substrates at the upper area of the waterfall was not well distributed and has less percentage of pebble, cobble and boulder substrates. The most abundant family for EPT found at this waterfall was Baetidae, Hydropsichidae and Perlidae since their habitat was generally at lotic erosional area [2]. The most abundant Coleoptera found was Elmidae (8% of total individuals) followed by Hydrophilidae and Psephenidae (2% of total individuals). The assemblages of benthic macroinvertebrates were dependent on several factors. However, the survival and adaptation of each species was not the same to each other. Hydropsichidae was the most abundant and adaptive to this area

and are believed to be caused by the habitat of the area which is lotic area stream as they live on rocks, boulders or submerged logs at moderate or fast flowing waters. According to [4], Hydropsichidae is commonly distributed in lotic water erosional zone and functions as a net spinner which collects or filters particles that clings to its substrates. It was supported by Yule and Yong [5] who reported that Hydropsichidae was usually a filter-feeder as they form a shelter made of silk and debris with spinning filter net at the bottom or sides of rocks through water flow. On the other hand, Diptera that was found at this waterfall area consists of Tipulidae (215 individuals), Chironomidae (186 individuals) and Ceratopogonidae (6 individuals). Tipulidae is mostly found in Diptera as fast flowing water was their habitat especially when there are accumulated decomposed leaves and rotting wood on the forest floor [5]. Based on the ecological indices calculated on the diversity, richness, dominant and evenness of the benthic macroinvertebrates, the researchers found that there are not much difference on the readings at the stations as the diversity index was in a range of 2.26-2.45, while richness, dominant and evenness was ranged between 3.30-3.50, 0.18-0.25 and 0.34-0.57 respectively (refer Table 3). This showed that ecological status of benthic macroinvertebrates at all stations were not different. However, the readings at the upstream are the most diverse and less dominant then downstream due to high abundance of Hydropsichidae at downstream. EPT index range around 50% which indicates the area was in a cleaned and healthy river category.

**Table 1** Composition and distribution of benthic macroinvertebrates at Lata Meraung, Pahang, Malaysia

Order	Site Station Family	Lata Meraung (11-12/2)			
		1	2	3	Total
Plecoptera	Perlidae	67	34	10	111
Ephemeroptera	Siphonuridae	8	0	0	8
	Potamanthidae	0	6	0	6
	Leptophlebiidae	3	5	0	8
	Caenidae	0	11	0	11
	Ephemmeridae	7	2	2	11
	Baetidae	94	55	3	152
Trichoptera	Heptageniidae	7	32	10	49
	Hydropsychidae	198	65	1	264
	Pilopotamidae	7	8	3	18
	Stenopsychidae	7	12	9	28
Diptera	Tipulidae	157	45	13	215
	Ceratopogonidae	3	2	1	6
	Chironomidae	99	80	7	186
Coleoptera	Elmidae	80	25	4	109
	Eulichadidae	0	0	1	1
	Scirtidae	1	1	2	4
	Psephenidae	14	10	1	25
	Hydrophilidae	15	11	0	26
Hemiptera	Aphelocheiridae	1	0	0	1
	Veliidae	6	1	0	7
Odonata	Gomphidae	8	1	2	11
	Libellulidae	4	0	0	4
	Euphaeidae	3	0	4	7
	Platystictidae	3	1	0	4
Lepidoptera	Pyralidae	8	7	0	15
Unknown	Unknown species	5	0	0	5
NUMBER OF ABUNDANCE		800	414	73	1287
NUMBER OF TAXA		24	21	16	27

**Table 2** Composition and distribution of EPT at Lata Meraung, Pahang, Malaysia

Order	1	2	3	Total	No. of Family
Plecoptera	67	34	10	111	1
Ephemeroptera	119	111	15	245	7
Trichoptera	212	85	13	310	3
Total EPT	398	230	38	666	11
EPT %	49.75	55.56	52.05	51.74	-

**Table 3** Ecological indices for diversity, richness, evenness and dominant of benthic macroinvertebrates at Lata Meraung, Pahang, Malaysia

Ecological Indices	ST1	ST2	ST3
Shannon weaver Index	2.26	2.45	2.45
Margalef's richness index	3.44	3.32	3.50
Evenness index	0.34	0.41	0.57
Dominant index	0.25	0.19	0.18

#### 4.0 CONCLUSION

The result shows that Hydropsichidae and Tipulidae were the most abundant family found at this area with 264 and 215 individuals respectively. The most abundant benthic macroinvertebrates were found at Station 1 with 800 individuals and the lowest abundance at Station 3 with 73 individuals. The imbalance of EPT composition also indicated that there are more Trichoptera which was collected. However, Ephemeroptera are the most diverse EPT as there are seven families found in this study area as compared to Trichoptera and Plecoptera with three and one families respectively. There are about 27 families of benthic macroinvertebrates found with eight orders of insects. In conclusion, the compositions of benthic macroinvertebrates were found to decrease towards upstream. Similarly, EPT family was found at this study area to decrease towards upstream. However, ecological indices values showed not many differences between stations.

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