

THE BENTHIC INVERTEBRATE COMMUNITY OF RIVERS IN BARIO, KELABIT HIGHLANDS, SARAWAK

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ABSTRACT

A survey on the benthic invertebrates was carried out randomly at 8 stations in various rivers of Bario, Kelabit Highlands, Sarawak. The primary aim of the study was to record the density and number of taxa found in the area. Eleven orders of meiobenthos were recorded with density ranging from 19.8 to 121.2 individuals per 10cm². Five orders of macrobenthos, mainly insects, were also recorded. The macrobenthos density ranges from 2.8 to 73.2 individuals per 10cm². The benthic diversity found in the area was typical of the meiobenthos and macrobenthos found in rivers in other parts of Malaysia.

INTRODUCTION

Bario is located at the Kelabit Highlands which forms the uppermost catchment of the Baram River Watershed. The Plateau is about 1,200m above sea level with annual rainfall of 2,300mm and daily mean temperature of between 19° and 22° C. Bario is drained by several rivers such as Pa' Marario, Pa' Arul Dalan, Pa' Ramapoh, Pa' Lap, Pa' Puak and Pa' Ukat. These rivers flow into Sungai Dappur which is a long river adjoining Sungai Kelapang to form the Baram River.

Very few studies on the lotic invertebrates in Sarawak have so far been reported. Such reports include that of SAMA Consortium (1992) on the molluscs in the genera *Paludomus* and *Clea* in the Pelagus area. Abang et al. (1995) reported on the current status of the lotic invertebrate diversity of the Upper Balui River. Our preliminary survey reported here was the first study on the benthic invertebrates of rivers in the Bario Highlands. The primary objective was to record the density and number of taxa found in the area and the results presented here will serve as a baseline documentation on the current status of the invertebrates from the highland rivers in the Bario region.

METHODOLOGY

Types of habitat: The upper parts of the rivers studied were generally fast flowing. Rivers such as Pa' Marario, Pa' Ukat, Pa' Arul Dalan, Pa' Puak, Pa' Tenungan, Pa' Manaliu and Pa' Unimas all fed into Pa' Dappur (Fig. 1) All rivers studied had clear water during the study period in April except Pa' Dappur which was turbid particularly when it rained. Most of the sampling stations were shaded areas beneath the thick jungle canopy of the forest vegetations (Table 1).

Sampling procedures: Samples of meiobenthos and macrobenthos were taken at the

eupsammolittoral habitat and below the edge of the water level of the streams. Eight stations were selected in the study area (Fig. 1). At each sampling station macrobenthos was sampled using a 0.25m² quadrat. Sediments was scooped to a depth of 10cm. It was then sieved using a 0.5mm sieve before fixing in 5% buffered formaldehyde in labelled specimen bottles. After sorting, the samples were then counted and identified under a stereomicroscope. Meiobenthos was sampled using cores of 7.1cm² sampling area. Three cores of sediment samples per site were preserved in 5% buffered formaldehyde and Rose Bengal in labelled specimen bottles. The extraction and sorting procedures for meiobenthos follows those of Higgins and Thiel (1988). Briefly, samples were sieved through 0.5mm and 45um mesh size, following which the organisms were identified under a compound microscope based on the key by Higgins and Thiel (1988).

For aquatic insects, collecting was done by examining stones that were temporarily removed from its location. Light-trapping was done every night from 1900-2200 hours to collect adults of aquatic insects normally attracted to light. The insects were killed and preserved by placing them in a jar containing 70% ethanol. Soft-bodied adults were preserved in ethanol. Identification to species level was not immediately possible as keys and published descriptions to most major groups of aquatic insects encountered were still lacking.

Table 1: Types of habitat in the study area.

River	Location	Date	Station	Habitat description
Pa' Marario	3° 45' 16"N 115° 27' 40"E	11 Apr. 95	BM 01	Sampling station: covered by jungle Canopy. Water: Fast flowing and clear. Sediment: stony + sandy
Pa' Ukat	3° 46' 34"N 115° 28' 61"E	12 Apr. 95	BM 02	Sampling station: covered by jungle Canopy. Water: fast flowing and clear Sediment: stony + sandy
Pa' Arul Dalan	3° 45' 43"N 115° 26' 54"E	13 Apr. 95	BM 03	Sampling station: exposed to direct sun light. Water: fast flowing and clear: Sediment: stony + sandy
Pa' Puak	3° 44' 84"N 115° 28' 96"E"	14 Apr.95	BM 04	Sampling station: bushy area & covered by canopy. Quarry at the upstream. Water: moderately flowing and clear. Sediment: silty
Pa' Tenungan	—	15 Apr. 95	BM 05	Sampling station: covered by primary forest canopy Water: Fast flowing and clear. Sediment: stony + fine sand + leaf debris
Pa' Dappur	—	15 Apr.95	BM 06	Sampling station: moderately covered by primary forest canopy Water: moderately flowing and turbid. Sediment: fine sand
Pa' Manaliu	—	16 Apr. 95	BM 07	Sampling station: covered by primary forest canopy Water: fast flowing & clear. Sediment: stony + fine sand.
Pa' Unimas	—	17 Apr: 95	BM 08	Sampling station: covered by primary' forest canopy. Water: moderately

flowing & clear. Sediment: fine sand +
leaf debris.

RESULTS AND DISCUSSION

Due to difficulties in the taxonomic identification of some of the major groups of benthic organisms, it was not possible to identify the generic status of the invertebrates collected in this study. They were thus identified only to order level. Eight orders of meiobenthos were recorded from the study area (Table 2). Nematodes were commonly found, being encountered at all sampling sites. This was followed by Ciliata and Oligochaeta. Ciliata was recorded from 5 of the 8 sampling sites. It was not encountered at Pa' Ukat, Pa' Dapur and Pa' Tenungan whereas the oligochaetes were not found at Pa' Puak, Pa' Tenungan, Pa' Manaliu and Pa' Unimas. The absence of these taxa from the sampling sites was possibly due to localized distribution of the organisms rather than water condition and quality because in terms of water quality Lau Seng et al. (1995) reported that water quality of the Bario watershed was considered good without any sign of industrial pollution. The total number of individuals ranged from 19.8 to 121.2 individuals per 10cm². Most of the invertebrate taxa were found in the Pa' Manaliu, Pa' Marario and Pa' Arul Dalan rivers.

Table 2 Density (average number of individuals per 10cm²) of meiobenthos taxa in the Bario watershed in April 1995.

Taxa	RIVER							
	Pa' Marario	Pa' Ukat	Pa' Arul Dalan	Pa' Puak	Pa' Dapur	Pa' Tenungan	Pa' Manaliu	Pa' Unimas
Nematoda	56.1	32.4	113	83.1	9.9	49.3	95.8	95.8
Rotifera	9.8	-	-	-	-	-	7.1	-
Harpacticoida	5.6	-	-	-	-	-	1.4	-
Oligochaeta	2.8	5.6	5.6	-	7.1	-	-	-
Acarina	-	-	1.4	-	2.8	-	1.4	-
Ciliata	5.6	-	4.2	2.8	-	-	8.5	1.4
Tardigrada	-	-	-	-	-	-	5.6	-
Ostracoda	-	-	-	-	-	-	-	-
TOTAL	79.9	38.0	20.5	85.9	19.8	49.3	121.2	97.2

In terms of diversity the benthic diversity found in the study area was typical of meiobenthos found in tropical rivers previously surveyed in Malaysia; such as Gombak River (Bishop, 1973), the Sarawak River (Anon, 1992) and the upper Balui River (Abang et al., 1995).

The macrobenthos encountered were mainly insects. Table 3 showed the 5 taxa composition of the orders of aquatic insects identified from this study. Similar to the meiobenthos, all 5 orders of insects were encountered at Pa' Marario, Pa' Arul Dalan and Pa' Manaliu. The macrobenthos density ranged from 2.8 to 73.2 individuals per 10cm². Likewise to the meiobenthos, the absence

of certain macrobenthos taxa from other sampling sites was probably due not to the water quality but to the localized distribution of these insects. In this preliminary study data available thus far was insufficient to ascertain the reason(s) for the localized distribution of both meiobenthos and macrobenthos in certain sites of the rivers in Bario Highlands. Further studies need to be carried out to offer a plausible explanation for this observation.

Table 3: Density (average number of individuals per 10cm²) of macrobenthos in the Bario watershed in April 1995.

	RIVER							
	Pa' Marario	Pa' Ukat	Pa' Arul Dalan	Pa' Puak	Pa' Dapur	Pa' Tenungan	Pa' Manaliu	Pa' Unimas
Taxa								
Ephemeroptera	1.4	1.4	46.5	-	1.4	1.4	1.4	-
Plecoptera	2.8	-	2.8	4.2	-	1.4	1.4	-
Trichoptera	1.4	-	2.8	-	-	-	2.8	-
Coleoptera	1.4	1.4	1.4	-	-	-	1.4	1.4
Diptera	1.4	2.8	19.7	1.4	2.8	9.8	1.4	1.4
TOTAL	7.0	5.6	73.2	5.6	4.2	12.6	7.0	2.8

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