

# PRELIMINARY CHECKLIST OF MILLIPEDES, WORMS AND FRESHWATER MOLLUSCS WITHIN THE MARAI PARAI AREA OF KINABALU PARK

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## ABSTRACT

Borneo is known as a biodiversity hotspot but many less-charismatic, yet ecologically-important invertebrate species remained largely neglected. This study aims to record the diversity and distribution of millipede, worm (annelid and flatworm) and freshwater mollusc species within the Marai Parai area of Kinabalu Park. The terrestrial fauna (i.e., myriapods and worms) were surveyed in the day and night along the trails, while freshwater molluscs were collected by hand in shallow water bodies. Millipedes from three orders were collected, potentially consisting of eight species. Among the annelid worms, the earthworms may potentially consist of two species, while the leeches, which included terrestrial and aquatic species, may potentially consist of 4–5 species. For flatworms, three species were recorded. Only one species of freshwater mollusc, *Melanoides tuberculata*, was recorded from the paddy fields of Kampung Kiau Nuluh. Aside from the mollusc, the other taxa, i.e., millipedes, annelids and flatworms, all require further research to clarify their identities, with the possibility of new species being discovered.

**Keywords:** *Myriapoda, Annelida, Platyhelminthes, Mollusca, Borneo*

## INTRODUCTION

Borneo is known as a biodiversity hotspot but many less-charismatic, yet ecologically-important invertebrate species, including freshwater molluscs, millipedes and worms, remained largely neglected.

Freshwater molluscs in Sabah are under-studied and poorly understood, with limited published studies, all conducted decades ago (e.g., Lim et al., 1976; Supian & Ikhwanuddin, 2002). Native species including those of the family Nassariidae, Pachychilidae and Paludomidae, which are more commonly found in undisturbed habitats, have not been studied in detail and may consist of cryptic species (Ng et al., 2017).

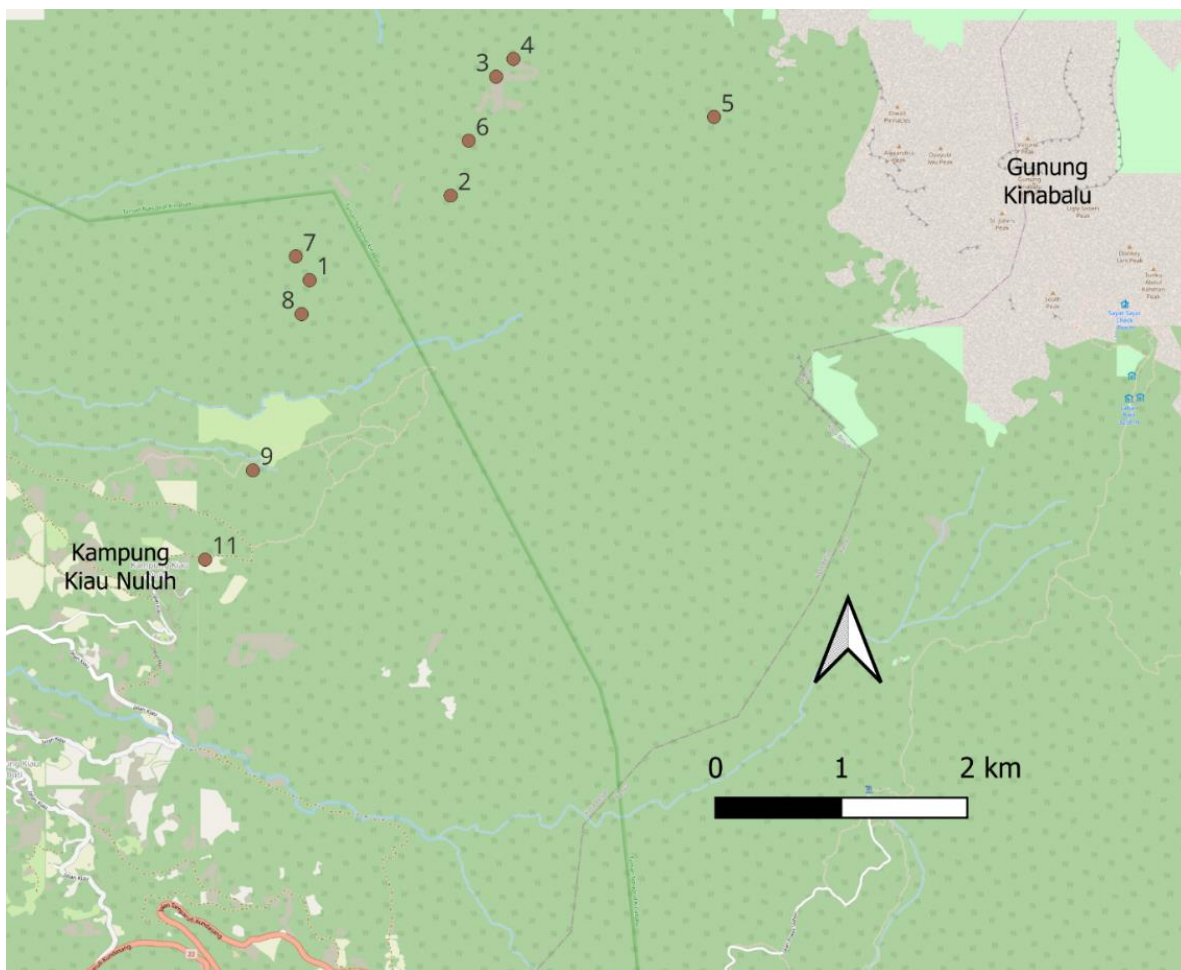
One-off, limited studies of earthworms (Blakemoore et al., 2007) and leeches (Kappes, 2013) have been conducted at Mount Kinabalu. Two species of flatworms were described from Mount Kinabalu almost a century ago (de Beauchamp, 1933). Only two species of millipedes have been described from Mount Kinabalu from opportunistic collection efforts—one in the late 19th century (Pocock 1897), and the second described almost three decades ago (Golovatch, 1996).

For all previous studies on Mount Kinabalu, local voucher specimens are lacking, and proper documentation of their distribution within Kinabalu Park remains to be updated. The Marai Parai area has yet to be surveyed for these taxa and may yield new records or provide important data regarding the distribution of millipedes, worms and freshwater molluscs of Kinabalu Park. This study provides a preliminary checklist of freshwater molluscs, myriapods and worms of the Marai Parai area.

## METHODOLOGY

Surveys were conducted from 9 to 13 October 2023 at the Marai Parai area of Kinabalu Park, Sabah, Malaysia, along the trail from Kampung Kiau Nuluh, Nunuk Camp, Marai Parai Camp, to Kobuturan Camp (Figure 1). For the terrestrial fauna (i.e., myriapods and worms), day and night sampling were conducted along the trails. Briefly, myriapods and worms were searched for within ground vegetation, in leaf litter, and under rocks and large fallen debris (e.g., branches or logs). Freshwater molluscs were collected from a single locality in the paddy fields of Kampung Kiau Nuluh by hand-picking in water bodies.

All samples were sorted, photographed and identified to tentative levels. Voucher specimens were preserved in ethanol and deposited in the BORNEENSIS Zoological Collection, Universiti Malaysia Sabah and the Sabah Parks Zoological Collection for future molecular analysis and taxonomic research.



**Figure 1. Sampling localities at Marai Parai area, Kinabalu Park. 1. Nunuk Camp, 2. Sungai Kinotoki, 3. Marai Parai Camp; 4. trail northeast of Marai Parai Camp; 5. trail from Marai Parai Camp to Kobutoran; 6. trail from Marai Parai Camp to Nunuk Camp; 7. trail northwest of Nunuk Camp; 8. trail from Nunuk Camp to Kampung Kiau Nuluh; 9. Kampung Kiau Nuluh paddy fields; 10. Kampung Kiau Nuluh, farmland; 11. Kampung Kiau Nuluh, rubber plantation.**

## RESULTS

### Diplopoda

Millipedes from three orders were collected, potentially consisting of eight species (Table 1, Figure 2).

**Table 1. Millipedes from the Marai Parai area, Kinabalu Park.**

Species	Locality
<b>Order Polydesmida</b>	
<b>Family</b>	
<b>Paradoxosomatidae</b>	
<i>Euphyodesmus</i> sp.	Trail northwest of Nunuk Camp
? <i>Malayorthomorpha</i> sp.	Trail northwest of Nunuk Camp

<i>Orangutana</i> sp. 1	Nunuk camp and trail northwest of Nunuk Camp
<i>Orangutana</i> sp. 2	Trail northeast of Marai Parai Camp
? <i>Pleuroporodesmus</i> sp.	Trail northwest of Nunuk Camp
<b>Order Spirobolida</b>	
Spirobolida sp. 1	Trail from Marai Parai Camp to Kobutoran Camp
Spirobolida sp. 2	Trail from Nunuk Camp to Kampung Kiau Nuluh
<b>Order Spirostreptida</b>	
<b>Family Hargophoridae</b>	
Hargophoridae sp. 1	Trail from Nunuk Camp to Kampung Kiau Nuluh, farmland and rubber plantation

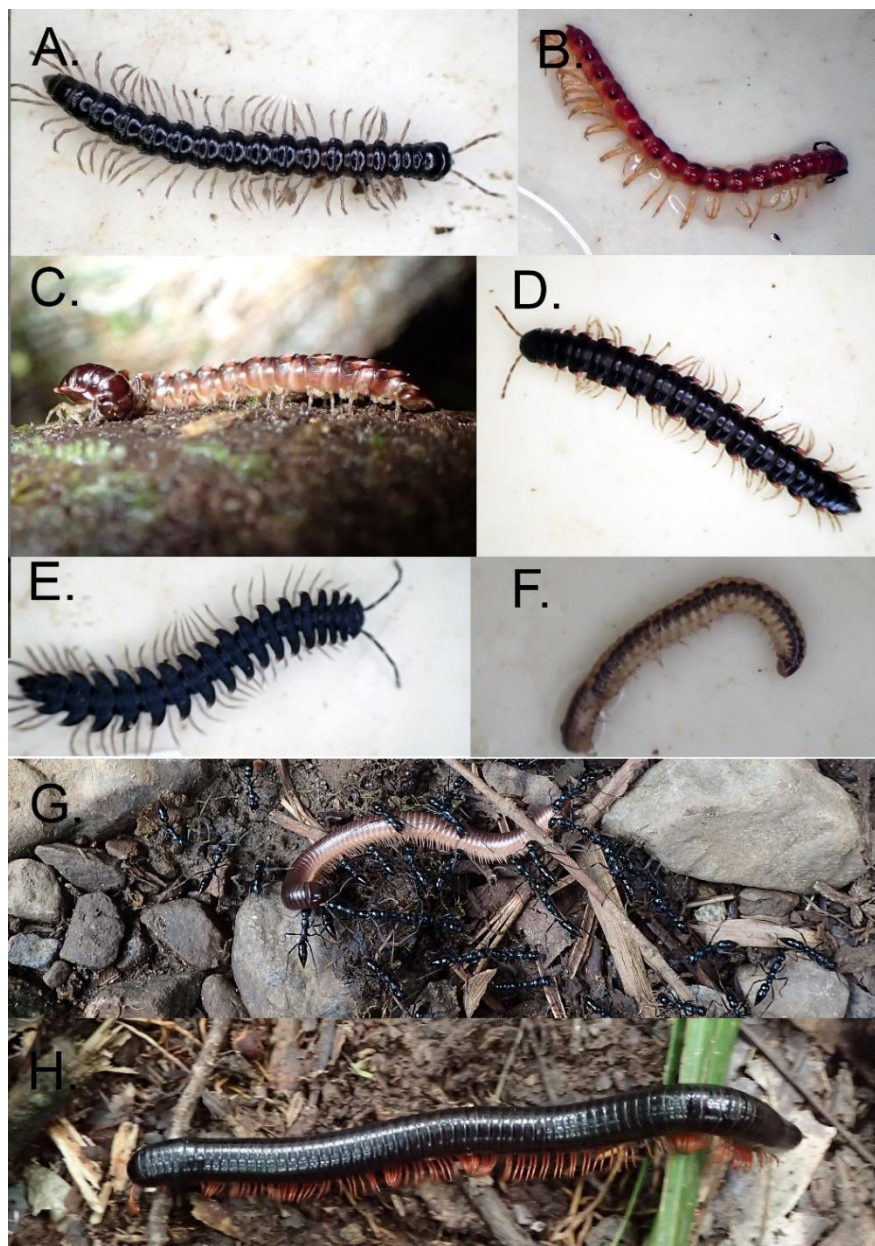


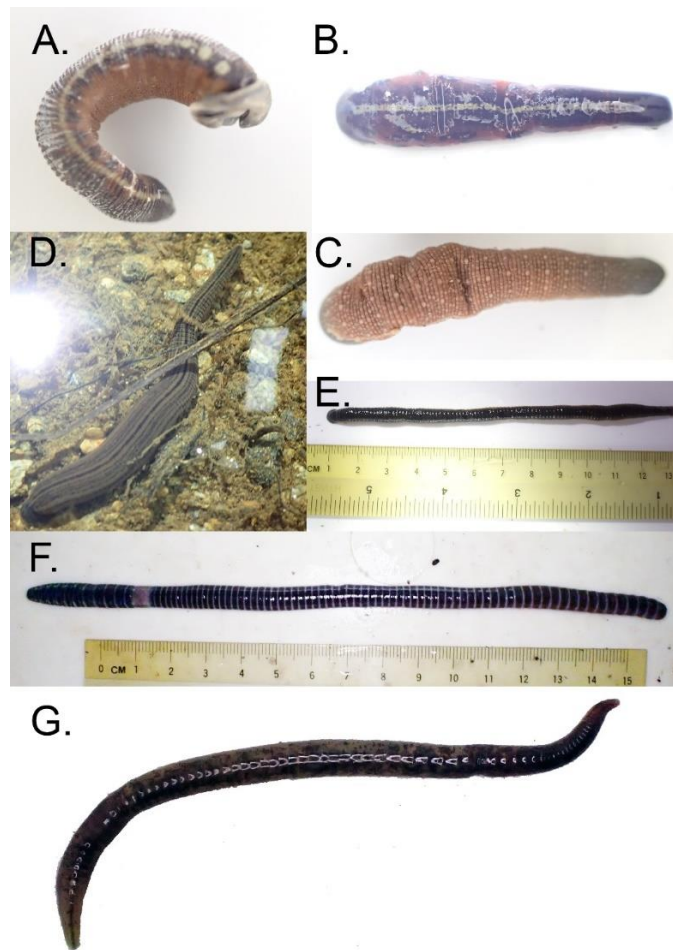
Figure 2. Millipedes from the Marai Parai area, Kinabalu Park. A. *Euphyodesmus* sp.; B. ?*Malayorthomorpha* sp.; C. *Orangutana* sp. 1; D. *Orangutana* sp. 2; E. ?*Pleuroporodesmus* sp.; F. *Spirobolida* sp. 1; G. *Spirobolida* sp. 2; H. *Hargophoridae* sp.

## Annelida

This phylum consists of leeches (Subclass Hirudinea) and earthworms (Subclass Oligochaeta). The earthworms from the Marai Parai area may potentially consist of two species, while the leeches, which included terrestrial (Dusun: limatok, limantang) and aquatic species (Dusun: lingugud), may potentially consist of 4–5 species (Table 2, Figure 3).

**Table 2. Annelida from the Marai Parai area, Kinabalu Park.**

<b>Species</b>	<b>Locality</b>
<b>Subclass Hirudinea</b>	
<b>Order Arhynchobdellida</b>	
<b>Subclass Hirudiniformes</b>	
<i>Haemadipsa</i> cf. <i>picta</i>	Widespread throughout Marai Parai area
<i>Haemadipsa</i> cf. <i>zeylandica</i> <i>sumatrana</i>	Widespread throughout Marai Parai area
<i>Haemadipsa</i> sp.	Trail from Marai Parai Camp to Nunuk Camp
<b>Subclass Erpobdelliformes</b>	
Erpobdelliformes sp. 1	Marai Parai Camp
Erpobdelliformes sp. 2	Marai Parai Camp
<b>Subclass Oligochaeta</b>	
Oligochaeta sp. 1	Nunuk Camp, trail from Marai Parai Camp to Kobuturan Camp
Oligochaeta sp. 2	Trail northwest of Marai Parai Camp, trail from Marai Parai Camp to Kobuturan Camp



**Figure 3. Annelida from the Marai Parai area, Kinabalu Park. A. *Haemadipsa* cf. *picta*; B. *Haemadipsa* cf. *zeylandica sumatrana*; C. *Haemadipsa* sp.; D. *Erpobdelliformes* sp. 1; E. *Erpobdelliformes* sp. 2; F. *Oligochaeta* sp. 1; G. *Oligochaeta* sp. 2.**

### Platyhelminthes

Three species of flatworms were recorded from the Marai Parai area (Table 3, Figure 4).

**Table 3. Platyhelminthes from the Marai Parai area, Kinabalu Park.**

Species	Locality
<b>Order Tricladida</b>	
<b>Family Geoplaniidae</b>	
<i>Bipalium</i> sp. 1	Nunuk Camp
<i>Bipalium</i> sp. 2	Trail northwest of Nunuk Camp
<i>Cotyloplana</i> sp. 1	Trail northwest of Nunuk Camp





**Figure 4. Platyhelminthes from the Marai Parai area, Kinabalu Park. A. *Bipalium* sp. 1; B. *Bipalium* sp. 2; C. *Cotyloplana* sp. 1.**

### **Freshwater Mollusca**

Only one species of freshwater snail, *Melanoides tuberculata*, was recorded from the Marai Parai area, in the paddy fields, Kampung Kiau Nuluh (Figure 5).



**Figure 5. Freshwater snails, *Melanoides tuberculata* from the Marai Parai area, at Kampung Kiau Nuluh.**

## DISCUSSION

### Diplopoda

Ongoing research suggests that there are multiple species of *Orangutana* (Dusun: koropungoi) around Kinabalu Park complex (unpublished data). Both species from the Marai Parai area may potentially be distinct species. Giant millipedes from the family Hargophoridae (Dusun: lontugi) appear to occur only at lower elevations, below Nunuk Camp to Kampung Kiau Nuluh (below 1100 m asl). A Spirobolida species was found to be carried by a chain of *Leptogenys* ants (Figure 2), a known characteristic for these ants (Mizuno et al., 2022), and recorded for the first time in Sabah in this study.

### Annelida

While the terrestrial leeches are commonly occurring species, the aquatic leeches were unique to the area at and close to Marai Parai Camp, in particular Erpodelliformes sp. 1, which was common in the shallow water in ditches around the campsite. The species was particularly active at night. It appears to have been recorded from the Bundu Tuhan area previously and is known by local communities to attach to nasal cavities of humans or animals, e.g., dogs, that drink from the water bodies (Smythies, 1959). At least seven species of earthworms have been previously recorded from Mount Kinabalu, primarily from the area along the Summit Trail (Blakemoore et al., 2007), including earthworms that may belong to a species complex. Further work is necessary to accurately identify the earthworms occurring at the Marai Parai area.

### Platyhelminthes

Previously, two species of flatworms were described from the Kinabalu Park area, a hammerhead species, *Bipalium everetti* var. *longitudinalis* from Kenokok, and a species that was tapered at both ends, *Cotyloplana borneensis* from Kamborangah (de Beauchamp, 1933). However, neither *Bipalium* spp. from Marai Parai appears to resemble *B. everetti* var. *longitudinalis*, while detailed anatomical study would be required to confirm if the *Cotyloplana* sp. from Marai Parai is *C. borneensis* or a distinct species.

### Freshwater Mollusca

The only species of freshwater mollusc found, *Melanoides tuberculata*, is a widespread, cosmopolitan species (Ng et al., 2017). Larger individuals are apparently eaten by locals in the area (L. Lungkim, pers. comm.).

## CONCLUSION

Aside from the single species of mollusc, the other taxa, i.e., millipedes, annelids and flatworms, all require further research to clarify their identities, with the possibility of new species being discovered in the process. To compare to annelid and flatworm species that were previously described from Kinabalu area decades ago, it would be prudent to obtain fresh material from the type localities for molecular analysis to be conducted, in tandem with morphological examination. The occurrence of unique species such as the aquatic leeches in the Marai Parai area is indicative of the value of the area in preserving the rich montane biodiversity of the Kinabalu Park complex.



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## REFERENCES

- Blakemoore R. J., Csuzdi, C., Ito, M., Kaneko, N., Kawaguchi, T. & Schilthuizen, M. (2007). Taxonomic status and ecology of Oriental I (Fletcher, 1886) and other earthworms (Oligochaeta: Megascolecidae) from Mt Kinabalu, Borneo. *Zootaxa*, 1613, 23–44.
- de Beauchamp, B. E. (1933). Planaires terrestres du Raffles Museum. *Bulletin of the Raffles Museum*, 8, 109–120.
- Golovatch, S. I. (1996). The millipede family Paradoxosomatidae on Borneo, with contributions to the faunas of some other islands of the Sunda area (Diplopoda, Polydesmida). *Revue Suisse de Zoologie*, 103, 151–193.
- Lim, B. L., Lim, T. W., Cheah, W. & Yap, L. F. (1976). *Angiostrongylus malaysiensis* from Tuaran, Sabah, with reference to the distribution of the parasite in Malaysia. *Southeast Asian Journal of Tropical Medicine Public Health*, 7, 384–389.
- Kappes, H. (2013). Genetics and morphology of the genus *Tritetradella* (Hirudinea, Haemadipsidae) from the mountainous rain forests of Sabah, Borneo, reveal a new species with two new subspecies. *Contributions to Zoology*, 82, 185–197
- Mizuno, R., Likhitrakarn, N., Suttiapran, P., Aupanun, S., Jaitrong, W. & Peeters, C. (2022). Field observations on nestmate recruitment to millipedes in the chain-assembling ponerine ant *Leptogenys cyanicatena* (Formicidae: Ponerinae) in northern Thailand. *Asian Myrmecology*, 15, 015003.
- Ng, T. H., Dulipat, J., Foon, J. K., Lopes-Lima, M., Zieritz, A. & Liew, T. S. (2017). A preliminary checklist of the freshwater snails of Sabah (Malaysian Borneo) deposited in the BORNEENSIS collection, Universiti Malaysia Sabah. *Zookeys*, 673, 105–123.
- Pocock RI (1897) New genera and species of millipedes of the family Platyrrhachidae from the Indo- and Austro-Malayan subregions contained in the collection of the British Museum. *The Annals and Magazine of Natural History, Zoology, Botany and Geology* 20: 427–446.
- Smythies, B. E. (1959). Leeches of Borneo. *Sarawak Museum Journal*, 9 (13–14), 279–294.
- Supian, Z. & Ikhwanuddin, A. M. (2002). Population dynamics of freshwater molluscs (Gastropod: *Melanoides tuberculata*) in Crocker Range Park, Sabah. *ASEAN Review of Biodiversity and Environmental Conservation July–September 2002*, 1–9.