PRELIMINARY SURVEY OF THE HERPETOFAUNA OF MARAI PARAI – GURKHA HUT, KOTA BELUD, SABAH

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ABSTRACT

Marai Parai at Mount Kinabalu is a well-known location that was explored by early naturalists. Many noteworthy discoveries were made in the past, especially involving botanical research. However, detailed studies on the herpetofauna of the area are lacking. A recent expedition by Sabah Parks to Marai Parai and associated areas resulted in the discovery of 21 species of frogs, four species of lizards and five species of snakes. This resulted in a total of 24 frog, four lizard and seven snake species reported from the area when combined with previously published records. The frogs composed of six families: Rhacophoridae (seven species), Bufonidae and Megophryidae (five species each), Dicroglossidae and Ranidae (three species each) and Microhylidae (one species recorded). Lizards composed of three families: Agamidae (one species), Gekkonidae (two species) and Scincidae (one species). Snakes comprised four families: Colubridae (four species), Pareidae, Elapidae and Viperidae (one species each). These findings reveal that Marai Parai and its associated areas are home to a diverse assemblage of amphibian and reptile species. The results of the study also indicate that the diversity of herpetofauna in the area is still underestimated as many new records were made. Research on the herpetofauna of Marai Parai and Mount Kinabalu in general should be supported as it will not only result in more discoveries, but also aid in the conservation of the species.

Keywords: *Amphibians, Borneo, Endemics, Kinabalu, Reptiles*

INTRODUCTION

Mount Kinabalu in Sabah is home to a rich diversity of plant and animal species (Frahm et al., 1990; Beaman, 2005; Wood, 2013; Phillipps and Phillipps, 2014, 2018; Wong & Chan, 2015), and these includes herpetofauna (Malkmus et al., 2002; Stuebing et al., 2014; Inger et al., 2017). Numerous locations on the massif have been the collection sites of many amphibian and reptile species first described from Borneo (Loveridge, 1938; Malkmus et al., 2002; Nishikawa et al., 2012, 2013; Matsui et al., 2014; Dehling et al., 2016; Quah et al., 2019, 2020, 2021a, b; Kaiser et al., 2020).

Marai Parai, on Mount Kinabalu is known to harbour a rich diversity of unique and rare plants that were discovered during many botanical expeditions in the past (van der Ent, 2013; van der Ent et al., 2014). It is the type locality of enigmatic species like *Nepenthes rajah* that was discovered by Hugh Low. The location is named after the local Dusun name of the *Tetraria pilisepala* grass that bears resemblance to hill rice (van der Ent, 2013; van der Ent et al., 2014). Waterlogged areas are dominated by sedges such as *Scirpus subcapitatus*, while the surrounding montane forest has a stunted appearance and dominated by species such as *Dacrydium beccarii*, *Syzygium* spp., and *Leptospermum recurvum* (van der Ent et al., 2014).

Although the floral diversity of Marai Parai is well-studied, the herpetofauna assemblage of the area is incompletely known and only 17 species were previously reported from the area in the past. The records include 14 species of frogs, one lizard species and two species of snakes (Smith, 1931; Tan, 1993; Malkmus et al., 2002). Previously reported species include *Ansonia fuliginea*, *A. hanitschi*, *Pelophryne misera*, *Leptobrachium montanum*, *Pelobatrachus nasutus*, *Limnonectes* aff. *kuhlii*, *Meristogenys kinabaluensis*, *M. orphnocnemis*, *Staurois tuberilinguis*, *Leptomantis angulirostris*, *Rhacophorus baluensis*, *Philautus larutensis*, *P. macroscelis*, *P. nephophilus*, *Sphenomorphus kinabaluensis*, *Oreocalamus hanitschi* and *Asthenodipsas laevis* (Table 1; Smith, 1931; Tan, 1993; Inger et al., 1996; Malkmus et al., 2002). Herein, we report on the additions to the herpetofauna of the Marai Parai-Gurkha Hut and surrounding areas based on a recent scientific expedition to the location.

METHODOLOGY

Field surveys

Field surveys were conducted from 9–14 October 2023 at the areas of Kampung Kiau Nuluh (6.0430°N, 116.4959°E; 887m), Nunuk camp (6.0674°N, 116.507°E; 1178m) and Marai Parai camps (6.0819°N, 116.5204°E; 1675m). Collecting in the field was conducted via visual encounter surveys by a team of three people, both during the day and at night. Daytime surveys were conducted from 0830 to 1200 hours while nocturnal surveys were from 2000 to 0000 hours with the aid of torches and headlamps. In addition to chance encounters, leaf litter was raked and logs and other debris overturned to look for fossorial snakes and lizards, both during the day and at night. Any interesting observations of the behaviours of the animals encountered were noted and recorded with photographs whenever possible.

Representative specimens for each species were photographed prior to preservation. Back in the lab, specimens were identified to species or at least generic level using Inger & Marx (1965), Inger (1966), Malkmus et al. (2002), Das (2004, 2006, 2007), Stuebing *et al*. (2014) and Inger *et al*. (2017). Voucher material and DNA samples were preserved and deposited at

the Institute for Tropical Biology and Conservation Zoological Collection (BORNEENSIS), Universiti Malaysia Sabah as well as the Sabah Parks collection (SP) as reference and for possible future research works.

Examination of specimens and comparative analysis

Colour pattern characters were taken off living specimens or derived from digital images of living specimens photographed in the field. Various morphometric measurements suited to the taxa examined were taken from preserved specimens using Mitutoyo dial calipers to the nearest 0.1 mm under a dissecting microscope such as SVL–Snout-vent length (mm), TaL–tail length (mm), TL–total length (mm), Rel–TL relative tail length TaL/TL, MDSR–dorsal scale rows at midbody, VEN–number ventral plates, SC–number of subcaudal scales, ANA–anal plate single or divided, Lor–number of loreal scales, SL–number of supralabials, SL/Eye– numbers of the supralabials entering orbit, IL–number of infralabials, PreOc–number of preoculars, PostOc–number of postoculars, Tem– temporal scales, HL–head length, HW–head widthHD–head depth, ED–eye diameter, ES–eye to snout distance, EN–eye to nostril distance, IO– inner orbital distance, and IN–internarial distance. Comparative data were also obtained from references such as Inger & Marx (1965), Inger (1966), Malkmus *et al*. (2002), Stuebing *et al*. (2014) and Inger *et al*. (2017).

Literature review for collation of data for checklist

The species recorded on this expedition were compared with previously published records of herpetofauna reported from the Marai Parai area that were extracted from references such as Smith (1931), Tan (1993), Inger *et al*., (1996) and Malkmus *et al*., (2002). The data was collated and presented in Table 1.

RESULTS

Field work during the recent Sabah Parks expedition recorded 21 species of frogs, four species of lizards and five species of snakes. When consolidated with previously published records, the checklist of herpetofauna species recorded for Marai Parai and associated areas revealed a total of 24 frog, four lizard and seven snake species (Table 1). Representatives from six families of frogs were recorded with the largest being the Rhacophoridae (seven species), followed by the Bufonidae and Megophryidae (five species each), then the Dicroglossidae and Ranidae (three species each) and finally the Microhylidae (single species recorded). Lizards were represented by three families, Agamidae (one species), Gekkonidae (two species) and Scincidae (one species). There were four families of snakes recorded, namely Colubridae (four species), Pareidae, Elapidae and Viperdae (one species each) (Table 1).

DISCUSSION

The first report on the herpetofauna collected from Marai Parai was by Smith (1931) that reported six species: *Pelobatrachus nasutus*, *Philautus larutensis*, *P. nephophilus*, *Sphenomorphus kinabaluensis*, *Oreocalamus hanitschi* and *Asthenodipsas laevis* (Table 1). His records were then perpetuated by subsequent authors who added some of their own records. Inger et al., (1996) added 10 species of frogs to the list: *Ansonia fuliginea*, *A. hanitschi*, *Pelophryne misera*, *Limnonectes* aff. *kuhlii*, *Meristogenys kinabaluensis*, *M. orphnocnemis*,

Staurois tuberilinguis, *Leptomantis angulirostris*, *Rhacophorus baluensis* and *Philautus macroscelis*. The most recent publication by Malkmus et al., (2002) added *Leptobrachium montanum* to the list of species known from the area. This study recorded 19 additional species that were previously unreported which brings the total to 35 species of amphibians and reptiles known from Marai Parai and associated areas (Table 1).

The bulk of the frog species recorded from the area are members of the Asian gliding frog family Rhacophoridae, especially species from the bush frog genus *Philautus*. Most species of *Philautus* undergo direct development where their eggs hatched into fully formed froglets (Inger et al., 2017). The cool, moist and damp conditions in upland areas such as Marai Parai are conducive to their lifecycle and provide an abundance of nest sites which allows many species to flourish syntopically. Other noteworthy findings include the record of the recently described *Stegonotus caligocephalus* (Kaiser et al. 2020). This snake is endemic to montane areas in Sabah, similar to many other species recorded during the expedition such as *Bungarus flaviceps baluensis*, *Sphenomorphus kinabaluensis*, *Leptomantis angulirostris*, *Philautus aurantium*, *P. bunitus* and *Leptobrachella arayai* (Malkmus et al., 2002; Stuebing et al., 2014; Inger et al, 2017). Some of the recent records made by the team were through bioacoustics such as *P. bunitus* and *L. arayai*, where only the advertisement calls of males were heard. Future work is needed to collect voucher specimens of these species to confirm their presence at Marai Parai.

CONCLUSION

Marai Parai harbours a rich diversity of herpetofauna species that is comparable to that of other locations on the Kinabalu massif of similar elevation (Malkmus et al., 2002). The study illustrates the need for continued surveys of even well-known or well-studied locations as additional species stand to be recorded with sustained sampling effort.

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APPENDIX

Table 1. Checklist of the amphibians and reptiles of Marai Parai and associated areas in Kota Belud, Sabah.

Taxon Scientific name	Common name	Sources Smith 1931 (reported as Marei Parei)	Tan 1993	Inger et al. 1996	Malkmus et al. 2002 (reported as Marei Parei)	This study
ANURANS						
Bufonidae						
Ansonia fuliginea	Montane Slender Toad	-	-	X	X	-
Ansonia hanitschi	Kinabalu Slender Toad	-	-	X	-	-
Ansonia longidigita	Long-fingered Slender Toad	-	-		-	X
Ansonia platysoma	Flat-bodied Slender Toad	-	-		-	X
Pelophryne misera	Kinabalu Dwarf Toad	-	-	X	X	X
Microhylidae						
Chaperina fusca	Saffron-bellied Frog	-	-		-	X
Megophryidae						
Leptobrachella arayai	Kinabalu Slender Litter Frog	-	-		-	X
Leptobrachella baluensis	Kinabalu Dwarf Litter Frog	-	-		-	X
Leptobrachella picta	Painted Slender Litter Frog	-	-		-	X
Leptobrachium montanum	Montane Large-eyed Litter Frog	-	-		X	X
Pelobatrachus nasutus	Horned Frog	X (reported as *Megophrys monticola*)	-	X (reported as *Megophrys nasuta*)	-	X
Dicroglossidae						

Limnonectes aff. *kuhlii*	Kuhl's Creek Frog	-	-	X (reported as *Rana kuhli*)	X	X
Limnonectes palavanensis	Smooth Guardian Frog	-	-		-	X
Occidozyga baluensis	Kinabalu Puddle Frog	-	-		-	X
Ranidae						
Meristogenys kinabaluensis	Kinabalu Torrent Frog	-	-	X	X	-
Meristogenys orphnocnemis	Northern Torrent Frog	-	-	X	X	X
Staurois tuberilinguis	Green-spotted Foot-flagging Frog	-	-	X	X	X
Rhacophoridae						
Leptomantis angulirostris	Sharp-nosed Tree Frog	-	-	X (reported as *Rhacophorus angulirostris*)	X (reported as *Rhacophorus angulirostris*)	X
Rhacophorus baluensis	Kinabalu Tree Frog	-	-	X	X	X
Philautus aurantium	Golden-legged Bush Frog	-	-		-	X
Philautus bunitus	Green Bush Frog	-	-		-	X
Philautus larutensis	Larut Hill's Bush Frog	X (reported as *P. petersi*)	-		X (reported as *P. petersi*)	X
Philautus macroscelis	Mossy Tree Frog	-	-	X (reported as *Rhacophorus everetti*)	X (reported as *Rhacophorus everetti macroscelis*)	X
Philautus nephophilus	Cloud Bush Frog	X (reported as *P. mjobergi*)	-	X (reported as *P. mjobergi*)	X (reported as *P. mjobergi*)	X
LIZARDS						
Agamidae						
Pelturagonia cephalum	Mocquard's Eyebrow Lizard	-	-		-	X

Gekkonidae					
Cyrtodactylus baluensis	Kinabalu Bent-toed Gecko	-	-	-	X
Hemidactylus frenatus	Spiny-tailed House Gecko	-	-	-	X
Scincidae					
Sphenomorphis kinabaluensis	Kinabalu Litter Skink	X (reported as *Lygosoma kinabaluensis*)	X	X	X
SNAKES					
Colubridae					
Hebius sarawacense	Chequer-bellied Keelback	-	-	-	X
Oreocalamus hanitschi	Mountain Reed Snake	X	-	X	-
Rhabdophis murudensis	Fire-lipped Keelback	-	-	-	X
Stegonotus caligocephalus	Dark-headed Sabah Groundsnake	-	-	-	X
Pareidae					
Asthenodipsas laevis	Smooth Slug Snake	X (reported as *Amblycephalus laevis*)	-	X (reported as *Internatus laevis*)	-
Elapidae					
Bungarus flaviceps baluensis	Kinabalu Red-headed Krait	-	-	-	X
Viperidae					
Trimeresurus sabahi	Sabah Bamboo Pit Viper	-	-	-	X

Figure 1. Some frogs found at Marai Parai and adjacent areas: A. *Leptomantis angulirostris* from Marai Parai. B. *Rhacophorus baluensis* from Marai Parai. C. *Philautus macroscelis* from Nunuk. D. *Philautus aurantium* from Nunuk. E. *Pelophryne misera* from Marai Parai. F. *Ansonia longidigita* from Nunuk. G. *Meristogenys orphnocnemis* from Marai Parai. H. *Leptobrachella picta* from Nunuk. I. *Limnonectes* aff. *kuhlii* from Marai Parai. J. *Pelobatrachus nasutus* from Nunuk. All photographs by Evan S.H. Quah.

Figure 2. Some reptiles found at Marai Parai and adjacent areas. A. *Sphenomorphus* cf. *kinabaluensis* from Nunuk. B. *Cyrtodactylus baluensis*. C. *Pelturagonia cephalum*. D. *Hebius sarawacense*. E. *Stegonotus caligocephalus*. F. *Trimeresurus sabahi*. G. *Rhabdophis murudensis*. H. *Bungarus flaviceps baluensis*. All photographs by Evan S.H. Quah.