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RESEARCH NOTE

Notes on the Herpetofauna of Kampung Giam, Padawan, Sarawak

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ABSTRACT

Padawan lies at one of the proposed Sarawak Geopark, yet information on the herpetofauna of the area is limited. A survey was conducted from 16 August 2008 to 24 August 2008 to determine species assemblage and relative abundance of herpetofauna at Kampung Giam, Padawan. Sampling involved stream and forest transects, quadrat, pitfall and sticky traps at four study sites along Sungai Sewa. A total of 13 species of frogs (62 individuals), eight species of lizards (nine individuals) and four species of snake (one individual each) were captured. The area was dominated by the family of Ranidae (83.9%), followed by Bufonidae (8%), Dicroglossidae (3.2%), Microhylidae (3.2%) and Megophryidae (1.6%). The most abundant and dominant species was *Odorrana hosii*, with 36 individuals caught. In addition three endemic Bornean frogs namely *Limnonectes leporinus*, *Meristogenys phaeomerus* and *Meristogenys orphnocnemis* were also captured in this study, which account for 33.33% endemism. The reptiles caught, on the other hand, were relatively low with only 12 species and 13 individuals captured. Nevertheless this study provides an increment of Sarawak faunal database for conservation management of Bornean fauna as well as the Sarawak Geopark.

Keywords: Herpetofauna, abundance, endemic, Padawan

Research on Bornean reptiles is rather limited, compared to the anuran amphibians. Nevertheless, a total of 289 species of reptiles (158 snakes, 109 lizards, 19 turtles and tortoises and three crocodiles) have been recorded from the island of Borneo (Das, 2006). There are about 150 species of frogs in Borneo, which can be divided into six families- Bombinatoridae, Megophryidae, Bufonidae, Microhylidae, Ranidae and Rhacophoridae (of these, 90 species are endemic to Borneo (Inger & Stuebing, 2005)).

None of the studies listed above provide details of the Padawan Fauna. As one of the site for the proposed Sarawak Geopark, it is important to have faunal checklist of the area. Thus, the objective of this study is to determine species assemblages of herpetofauna (amphibians and reptiles) at Kampung Giam, Padawan. Furthermore, the forests surrounding Kampung Giam and Gunung Sewa have never been scientifically surveyed. The information on species checklist will serve as baseline data for future research.

Limestone formations are found throughout Borneo and include extensive areas in the Sangkulirang Peninsula and the limestone hills of Sarawak. Limestone areas provide high levels of radiation and endemism in both plants and animal species. A wide array of flora and fauna composition is present in limestone areas. Moreover, some of them have developed specialized morphological features to adapt to this dry and nutrient poor environment. Detailed surveys of the limestone areas are lacking, but preliminary studies, mostly on the botanical richness, suggest that this habitat supports a great diversity of flora species, many of them probably endemic.

The forests over limestone in Sarawak are greatly under protected. Only a few hills are within protected areas, such as Gunung Api and Gunung Benarat within the Gunung Mulu National Park, and the Subis Formation within

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the Niah National Park. Most limestone areas of the Bau-Serian (Padawan) formations are located outside any protected areas system.

Therefore, an assessment of the fauna of these limestone forests is considered important in order to obtain a comprehensive species list for baseline data of the Sarawak fauna.

Kampung Giam (1˚19'01.04"N, 110˚16'34.53"E) is located in the Padawan Limestone Area, about 50 minutes' drive from Kuching town. It is surrounded by limestone forest; orchard and shrub land (Lim *et al*., 2008). The rocky stream (Sg. Sewa) is a suitable habitat for herpetofauna, especially for anuran amphibians. Nonetheless, it was heavily disturbed by human activities such as water and food supplies, washing and recreational activities.

Herpetofaunal species were collected during riparian and non-riparian night transects and during day-time searches, including close examination of litter in non-riparian floor quadrats, as detailed in Heyer *et al*. (1994). Pitfall-trap and sticky trap were also used to sample arboreal herpetofauna. Stream and forest transects were conducted during night-time by wading through streams and forests. All of the caught animals were put inside a plastic bag for identification and measurements. Ecological parameters such as time and location of each animal caught, density of canopy and the condition of the weather, density of light, vegetation type and forest litter (for quadrat) were also recorded. Anurans identifications were following Inger & Stuebing (2005), while reptile identification was based on Stuebing & Inger (1999) and Das (2004; 2006). All specimens were fixed in 10% formalin and later stored in 70% alcohol. Specimens were deposited at the UNIMAS Museum.

A total of 25 species and 75 individuals of herpetofauna were collected during this study. Among them, 13 species were anuran amphibians (Table 1) and the remaining species are reptiles (Table 2). Anuran species was found to be more common at Kampung Giam than those collected at Borneo Height (Zainudin *et al*., 2006) and Bau (Duyun, 2004). The current study was dominated by *Odorrana hosii* from the family of Ranidae consisting of 36 individuals while only three endemic frogs were captured namely *Limnonectes leporinus*, *Meristogenys phaeomerus* and *Meristogenys orphnocnemis* (Table 1). This accounts for 33.3% of the total Bornean endemics. Despite close to human settlement this area harbours one part of total endemism among the Bornean frogs and consistent with previous study in other Padawan Karst of Bau (Duyun, 2004) but with lower endemism as compared to the Padawan Highland (Zainudin *et al*., 2006). The Borneo Height harbours a locally endemic of bush frog, *Philatus tectus* (see Zainudin *et al*., 2006), which was not collected at Giam. However, not all the anurans found in Giam were commensals of man.

The Ranidae also shows high propotion of species found in the area by dominating 46.2%, followed by 23% for the Bufonidae, and 7.7% each from the families of Microhylidae, Dicroglossidae and Megophyridae (Figure 1). This is consistent with other study on species assemblages of the anurans in Balambangan Island (Zainudin, 2011), Borneo Height (Zainudin *et al*., 2006), Bau (Duyun, 2004) and Sedilo Sarawak (Zainudin, 2002).

For reptiles, nine species of lizards and three species of snakes were caught within seven days of sampling (Table 2). The snakes namely *Tropidolaemus subannulatus* (one individual), *Psammodynastes pulverulentus* (two individuals) and *Coelognathus flavolineata* (one individual) were caught during line transect. In addition, a few lizards were observed but not captured, such as the agamids, *Bronchocela cristatella* and one indeterminate species of *Tropidophorus* from the family Scincidae. No endemic reptile was captured during the survey.

Among the reptiles, 23.1% proportion of species were represented each by the family of Agamidae, Gekkonidae and Colubridae, 15.4% from family Scincidae, and 7.7% each were from the family Lacertidae and Viperidae (Figure 2). Comparison of the relative abundance with Borneo Height and Bau was impossible due to lack of available information on the occurrence of reptiles from the areas.

Table 1. Amphibian species collected from Padawan Karst.

Family	Species	Giam, Padawan 2008	Borneo Height, Padawan (Zainudin *et al.,* 2006)	Bau, Padawan (Duyun, 2003)
Bufonidae	*Phrynoidis aspera*	3		22
	Duttaphrynus melanostictus	1		21
	Ingerophrynus quadriporcatus	1		
	*Ansonia longidigita**			4*
	*Ansonia spinulifer**		1*	2*
	*Ansonia minuta**		27*	
Megophyridae	*Leptolalax gracilis*	1	1	
Microhylidae	*Chaperina fusca*	2		
Dicroglossidae	*Limnonectes leporinus**	1*		5*
	Limnonectes malesianus	1		
	Limnonectes kuhli		21	
Ranidae	*Meristogenys orphnocnemis**	1*		
	*Meristogenys phaeomerus**	7*	8*	3*
	Hylarana raniceps	4	12	
	Hylarana erythraea	1	6	31
	Hylarana picturata	3	1	11
	Hylarana signata		1	
	Odorrana hosii	36		2
	Hylarana raniceps		4	8
	Staurois guttatus		2	2
Rhacophoridae	*Polypedates leucomystax*			1
	*Philautus tectus**		1*	
	Polypedates macrotis		1	
Total species		**13**	**13**	**12**
Total Bornean endemic		**3**	**4**	**4**
Total individuals		**62**	**86**	**112**

* Endemic species of Borneo (Inger & Stuebing, 2005).

Table 2. List of reptiles caught at Kampung Giam, Padawan Karst.

Family	Species	Number of individual(s)
Agamidae	*Bronchocela cristatella*	1
	Draco melanopogon	1
	Gonocephalus sp.	1
Gekkonidae	*Cyrtodactylus* sp.	1
	Cyrtodactylus ingeri	1
	Cyrtodactylus quadrivirgatus	1
Lacertidae	*Takydromus sexlineatus*	1
Scincidae	*Sphenomorphus* sp.	1
	Tropidophorus sp.	1
Colubridae	*Psammodynastes pulverulentus*	2
	Coelognathus flavolineatus	1
Viperidae	*Tropidolaemus subannulatus*	1
Total	**12**	**13**

Table 3 shows the breakdown of amphibians caught in five types of sampling methods used during this survey. The most fruitful method was stream transect with 49 individuals caught, followed by the forest transect with 12 individuals. Only one individual was captured in quadrat sampling, while nothing was captured in both pitfall trap and sticky trap (not shown). The methods used in terms of their effectiveness were significantly varies (χ^2 p-value = 6.259, $p<0.05$) among anuran Family (Table 4) with the most effective was the stream transect.

For reptile, the most productive method was stream transect where four individuals were caught followed by forest transect with two individuals collected (Table 5). One individual was captured by sticky trap. Nothing was caught in pitfall trap and quadrat method (not shown). One individual each of *D. melanopogon* and *Gonocephalus* sp. were accidentally caught in mist net and *T. sexlineatus* were caught on the ground. However effectiveness of the methods used cannot be compared due to small sample size.

Naming & Das (2004) in Bau Limestone recorded 34 anuran species and 33 reptile species which are higher than what have been found in Giam. This might be due to the number of sampling days and area covered. However, nine species of anurans and eight species of reptiles from Kampung Giam were not recorded in Naming & Das (2004). This indicates that the herpetofauna richness in Padawan Karst can be high, and may have exhibit geographical variations from that of Bau Limestone Area. This can further supported by the number of endemic anurans

Table 3. List of successful methods used in the anurans survey at Giam, Padawan.

Species	Stream transect	Forest transect	Quadrat	Total
Odorranna hosii	32	3	1	36
Hylarana raniceps	1	3	-	4
H. picturata	2	1	-	3
H. erythraea	1	-	-	1
L. malesianus	-	1	-	1
L. leporinus	1	-	-	1
Meristogenys phaeomerus	6	1	-	7
M. orphnocnemis	-	1	-	1
Ingerophrynus quadriporcatus	1	-	-	1
Duttaphrynus melanostictus	-	1	-	1
Phrynoidis aspera	3	-	-	3
Chaperina fusca	2	-	-	2
Leptolalax gracilis	-	1	-	1
Total	**49**	**12**	**1**	**62**

Key: "-" indicates no observation.

Table 4. Effectiveness of methods used in the anurans Family at Giam, Padawan.

Family	Stream transect	Forest transect	Quadrat	χ^2 p-value	Total
Bufonidae	4	1	0	0.101^{NS}	5
Megophyridae	0	1	0	4.166*	1
Microhylidae	2	0	0	0.53^{NS}	2
Dicroglossidae	1	1	0	1.215^{NS}	2
Ranidae	42	9	1	0.164^{NS}	52
Total	**49**	**12**	**1**	**6.159****	**62**

*exact significant at $p < 0.5$
**exact significant at $p < 0.05$
^{NS} Not significant

Table 5. List of successful methods used in the reptiles survey at Giam, Padawan.

Species	Stream transect	Forest transect	Sticky trap	Total
Bronchocela cristatella	-	-	-	1
Draco melanopogon	-	-	-	1*
Gonocephalus sp.	-	-	-	1*
Cyrtodactylus sp.	1	-	-	1
C. quadrivirgatus	-	1	-	1
C. ingeri	-	-	1	1
Sphenomorphus sp.	-	-	-	1
Tropidophorus sp.	-	-	-	1
Takydromus sexlineatus	-	-	-	1*
Tropidolaemus subannulatus	-	1	-	1
Psammodynastes pulverulentus	2	-	-	2
Coelognathus flavolineatus	1	-	-	1
Total	4	2	1	13

found in other Padawan Karst which have different habitat types such as Borneo Height (highland) and Bau (limestone). The number of individual or species caught also depends very much on the experience and number of people involved in the sampling. Sampling outcome is also highly dependent on the weather conditions. For example, on the third day, heavy rain occurred which might affect sampling rate. As a result, fewer species individuals were caught on that day. In nature, anurans are active at night mainly to find their partner to mate and hunt for their prey. On rainy day, many of the small animals and insects (prey) did not emerge. Therefore it is costly for frogs to forage for food during heavy rainfall. Furthermore, frogs are ectothermic where their body temperature is dependent on the surrounding environment (Zug, 1993). Inger & Voris (1993) noted that anuran has varied activities in response to different pattern in rainfall and the fluctuation of temperature.

Most of the frogs caught were comprised of the riparian types, showing a high richness of anurans in stream habitat. The stream was suitable for riparian frogs because it had many small, scattered rain-filled ponds. Anurans were sensitive to ecological and climatic change. Therefore, they become good indicators for assessing forest condition (Iskandar, 2004). Their abundance is strongly correlated with the amount of forest litter (Iskandar, 2004). The composition of anurans species are dependent on the forest types. Inger & Stuebing (2005) stated that some anurans are habitat specialist. For example, *O. hosii* was the most abundant in Kampung Giam but not at Bau (Duyun 2003; Naming & Das, 2004). This is due to the type of microhabitats found there where rocky streams and strong water current of Sungai Sewa provide suitable mirohabitat to *O. hosii* as compared to the streams in Bau.

Conclusively, Kampung Giam Padawan harbours 12 species of frogs (62 individuals), eight species of lizards (nine individuals) and four species of snake (one individual each).This study is the first herpetofauna survey at Padawan Karst, and the results can be used as baseline data for future survey. Three endemic species of Borneo frogs (i.e. *L. leporinus, M. phaeomerus* and *M. orphocnemis*) were also found in this study. Species assemblages of anuran at Giam were also comparable with Bau Limestone (Duyun, 2004) and Borneo Height (Zainudin *et al*., 2006). The Padawan Karst (Giam, H = 2.321, Borneo Height, H=2.636) showed higher value of diversity indexes as compared to Bau Limestone (H = 0.99782). Therefore, Padawan Karst is found to be more diverse in herpatofauna than Bau Limestone Area. More extensive explorations and inventories are suggested in order to get a better representation of the entire herpetofauna composition of this area.

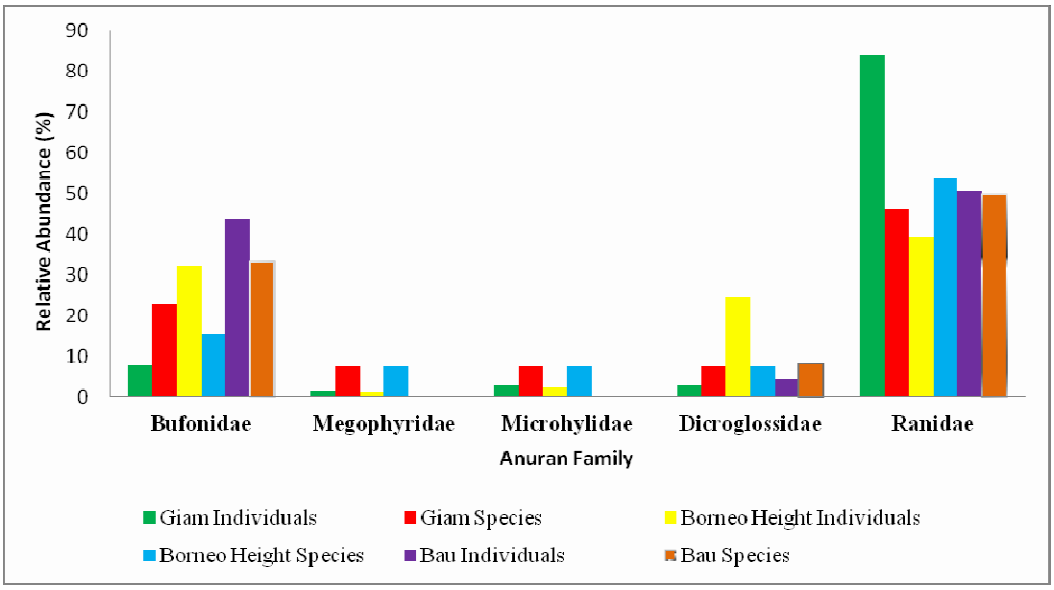

Figure 1. Relative abundance of species and individuals within Anuran Family at Padawan Karst.

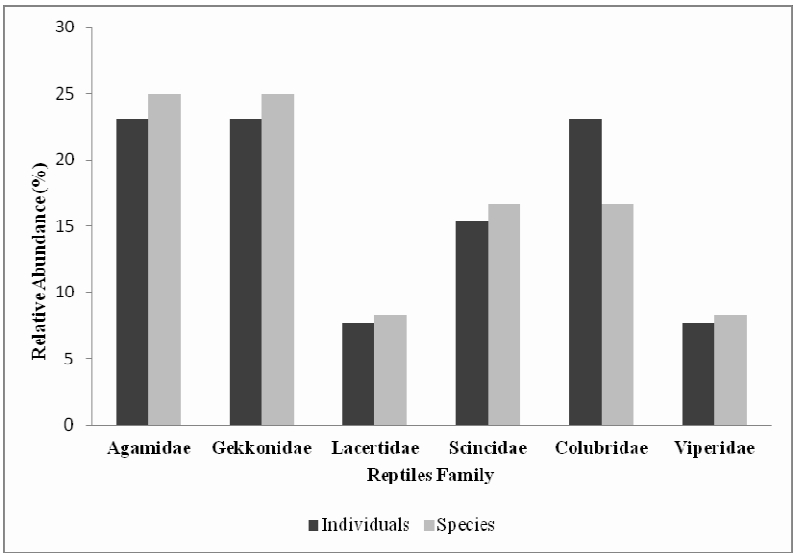

Figure 2. Relative abundance of species and individuals within Reptiles Family at Giam, Padawan.

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