



*Biodiversity, Ecology and Environment:  
UNIMAS Life Sciences Pre-Unique Curriculum*

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## **Message from the Chairman**

*Assalamualaikum Warahmatullahi Wabarakatuh and Salam Sejahtera,*

First and foremost, I would like to express my gratitude to all biological students' Session 2018/2019, lecturers in Biology Unit, laboratory and administration staff, and also the invited juries from FRST and FMHS for their commitment, participation and effort in ensuring the 5<sup>th</sup> edition of Asasi Biology Colloquium 2019 (ABC 2019) successful. This year's event is also in conjunction and a continuation from students' biological educational trip to various national parks in Kuching, namely; Kubah, Santubong and Bako which was held throughout March 2019. Each group of students was given a specific title of study before the trip and they are required to observe, document and interpret the data based on their findings. The findings will be then documented in a form of short scientific writing and poster. The main objective of this learning activity is to expose students with appropriate methodology of conducting scientific research. Therefore, the curriculum will be a good learning experience for them prior the degree level in the near future. Besides that, it will also help them to improve their communication skills as there will be an oral presentation during the colloquium. On behalf of the committee, I would like to thank everyone especially the management of Pusat Pengajian Pra-Universiti (PPPU) UNIMAS for their continuous support and encouragement for making this event a reality. Also, I would like to thank Sarawak Forestry Corporation (SFC) for their continuous support during the field trips to the various national parks under their care. Thank you.

**ROHAIZA DAUD**

**CENTRE FOR PRE-UNIVERSITY STUDIES**

**UNIVERSITI MALAYSIA SARAWAK**

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## Table of Content

Content	Page
Message from the Chairman	iii
Organizing Committee	iv
Table of Content	v
Tentative	vi
List of Extended Abstracts	vii-viii
Extended Abstracts Kubah National Park, Sarawak	1-120
Extended Abstracts Santubong National Park, Sarawak	121-192
Extended Abstracts Bako National Park, Sarawak	193-253

## Tentative

**Date:** Thursday, 11 April 2019

**Venue:** Foyer and Seminar Room of Pre-University Academic Complex,  
Universiti Malaysia Sarawak

**Time:** 0900 – 1730

**Participants:** All Life Sciences Students, Pusat Pengajian Pra-Universiti

Time	Program	Venue
9.00 am – 11.00 am	Poster exhibition	Foyer
11.30 am – 12.00 pm	Colloquiums' briefing Posters and oral presentation evaluation briefing	Computer Lab 4
12.00 pm – 12.30 pm	Pre-poster evaluation	Foyer
12.30 pm – 1.20 pm	Lunch	Computer Lab 4
1.20 pm – 2.20 pm	Poster Presentation (Attended by Students and Evaluations by Juries)	Foyer
2.20 pm – 2.35 pm	End of evaluation Marks calculation	Computer Lab 4
2.35 pm – 2.50 pm	Announcement for the Best Posters Kubah: 5/15 Santubong: 3/9 Bako: 2/6	Foyer
2.50 pm – 4.30 pm	Oral Presentations (From all the Best Posters by student's group representative) 10 groups (10 mins each group (5 mins presentation, 5 mins Q&A session)	Tutorial Room
4.30 pm – 4.45 pm	Comments from the guest juries Certificates and hampers giving ceremony	Tutorial Room
4.45 pm – 5.00 pm	End of program Tea and snacks	Computer Lab 4

## List of Abstracts

### Kubah National Park

Poster	Title	Group
PA 01	The Observation of Invertebrates in Kubah National Park, Sarawak	H3-9
PA 02	Habitat Association of Anurans in Kubah National Park, Sarawak	H2-7
PA 03	The Observation of Class: Insecta in Kubah National Park, Sarawak	H1-3
PA 04	Documentation of Mixed Dipterocarp Forest in Kubah National Park, Sarawak	H3-3
PA 05	The Observation of Plant-Animal Interaction in Different Elevations of Kubah National Park, Sarawak	H3-8
PA 06	Documentation of <i>Nepenthes</i> in Kubah National Park, Sarawak	H2-9
PA 07	Documentation of Pteridophyta in Kubah National Park, Sarawak	H2-1
PA 08	Documentation of Basidiomycota and Ascomycota in Kubah National Park, Sarawak	H2-6
PA 09	The Observation of Plant-Plant Interaction in Different Elevations of Kubah National Park, Sarawak	H1-6
PA 10	The Observation of Waterfall Ecosystem (Flora) in Kubah National Park, Sarawak	H1-8
PA 11	The Observation of Waterfall Ecosystem (Fauna) in Kubah National Park, Sarawak	H1-1
PA 12	The Potentials of Kubah National Park in Ecotourism	H3-7
PA 13	Documentation of Angiosperms in Kubah National Park, Sarawak	H1-7
PA 14	Documentation of Herbaceous Plants in Kubah National Park, Sarawak	H3-6
PA 15	Documentation of Palms in Kubah National Park, Sarawak	H2-4

### Santubong National Park

Poster	Title	Group
PB 01	Documentation of <i>Nepenthes</i> in Santubong National Park, Sarawak	H3-1
PB 02	The Observation of Plant-Animal Interaction in Santubong National Park, Sarawak	H2-2
PB 03	The Observation of Invertebrates in Santubong National Park, Sarawak	H1-4
PB 04	Documentation of Mixed Dipterocarp Forest in Santubong National Park, Sarawak	H2-10
PB 05	The Observation of Plant-Plant Interaction in Santubong National Park, Sarawak	H3-10
PB 06	Documentation of Pteridophyta in Santubong National Park, Sarawak	H2-8
PB 07	Documentation of Basidiomycota and Ascomycota in Santubong National Park, Sarawak	H1-10
PB 08	The Observation of Waterfall Ecosystem (Flora) in Santubong National Park, Sarawak	H3-2
PB 09	The Potentials of Santubong National Park in Ecotourism	H1-5

### Bako National Park

Poster	Title	Group
PC 01	The Observation of Beach Ecosystem in Bako National Park, Sarawak	H2-3
PC 02	Documentation of Different Forest Types in Bako National Park, Sarawak	H3-4
PC 03	The Observation of Mangrove Ecosystem in Bako National Park, Sarawak	H3-5
PC 04	Documentation of <i>Nepenthes</i> in Bako National Park, Sarawak	H1-2
PC 05	The Observation of Vertebrate in Bako National Park, Sarawak	H1-9
PC 06	The Potentials of Bako National Park in Ecotourism	H2-5



## THE OBSERVATION OF INVERTEBRATES IN KUBAH NATIONAL PARK, SARAWAK

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### Abstract

Kubah National Park is situated in Borneo Island, specifically in Sarawak at the east side of Malaysia. This national park is known for its diversity in wildlife. Within the 2230 hectares park, a documentation was conducted to observe and record the various types of invertebrates found along the 5 km long Summit trail. The research was conducted by observing and taking photographs of invertebrates along the trail. More detailed research on each invertebrate found was then done to distinguish them. Overall, there were six invertebrates documented mainly under the phylum Arthropoda. This includes Northern Jewelled spider (Arachnida), short-horned grasshopper (Insecta), geometer moth (Insecta), tractor millipede (Diplopoda), giant pill millipede (Diplopoda), and Flame leg millipede (Diploda). The environment in Kubah National Park which is high in humidity and high abundance of food sources offered suitable habitat for invertebrates and hence there are vast species of invertebrates that can be found there.

**Keywords:** Invertebrate, insecta, diplopoda, arthropoda, Kubah, Borneo

### Introduction

Kubah National Park (KNP) located at the east side of Malaysia (1°36'46.0"N 110°11'48.9"E), a state from a Borneo Island known as Sarawak. The park is within 2230 hectares and various types of flora and fauna can be found such as rare ferns, orchids and diversities of palm trees that was known as 'The World of Palms' (Sarawak Forestry, 'Kubah National Park', 2018). The park also has three sandstone mountains, namely Gunung Serapi, Gunung Selang and Gunung Sendok. Overall, there are six trails available in KNP and the

observation was conducted along the Summit Trail. KNP consists of mixed dipterocarp forest with small acres of scrub forest and isolated patches of *Kerangas* Forest (Sarawak Forestry, 'Kubah National Park', 2018). Along the trail, both sides of the track were heavily surrounded by various layers of forest canopies that act as a home for a vast of species invertebrates. Invertebrates are the most diverse animals in the world's natural communities, be they marine, freshwater or terrestrial, and are acknowledged widely as playing central role in sustaining the ecosystem (New & Yen, 1995). Hence, the purpose of this observation was to document the invertebrates that can be found in KNP along the Summit trail.

### Materials and Methods

Observation on invertebrates was conducted along the Summit Trail which is about 5 km. Photos of the invertebrates were taken using phone cameras and later compiled. Further research was done to describe and identify the invertebrates. The identified invertebrates were then recorded.

### Results and Discussion

Along the trip, there were six invertebrates representing Phylum:Arthropoda recorded (Table 1).

**Table 1:** The common names and classes of the documented invertebrates.

Common Name	Class
Northern Jewelled Spider	Arachnida
Tractor millipede	Diplopoda
Flame leg Millipede	Diplopoda
Giant Pill Millipede	Diplopoda
Short-horned grasshopper	Insecta
Geometer Moth	Insecta

Photos and brief description of every invertebrates are as follows:

**A. Arachnida**

Arachnids are a group of invertebrates that are commonly related to spiders. Arachnids have the same general characteristics as all the other arthropods, but they have some unique characteristics such as having mandibles, have eight appendages and a fused head and thorax, called a cephalothorax (Mikell, 2018). One of the example of arachnids is as shown in Figure 1.



Taxonomic Level	Northern Jewelled Spider
Kingdom	Animalia
Phylum	Arthropoda
Class	Arachnida
Order	Araneae
Family	Araneidae
Genus	<i>Gasteracantha</i>
Species	<i>fornicata</i>

**Figure 1:** A Northern Jewelled Spider weaving large orb webs.

*Gasteracantha fornicata* or commonly known as Northern Jewelled Spider (NJS) is a species of spiny orb-weavers of the family Araneidae (“*Gasteracantha fornicata*”, 2018). Although the size and colours of adult NJS can vary, the basic shape of individuals within a species is typically consistent. The size of females is around 10mm lengthwise with the width of 25mm (Fabricius, 1775). The abdomen of this species has a unique characteristic which has six spines (Fabricius, 1775). This species settles on green leaves or a small web usually in rainforest settings, but it is rarely in open forest settings (Atkinson, 2013). This spider is relatively timid and too small to be harmful to humans. NJS is a carnivorous animal which feeds on insects or other arthropods caught in its web (Fabricius, 1775).

**B. Diplopoda**

Members of class Diplopoda are generally known as millipedes. Millipedes can be distinguished from the other arthropods easily because each of their body segments are actually made up of two segments that were fused together to form a diplosegment. They also have two pairs of feet for each segment of their body (Chesnutt, 2018). There are many species of millipedes such as those shown in Figure 2, Figure 3, and Figure 4.



Taxonomic Level	Tractor Millipede
Kingdom	Animalia
Phylum	Arthropoda
Class	Diplopoda
Order	Polydesmida
Family	Platyrachidae
Genus	<i>Barydesmus</i>

**Figure 2:** A Brown Tractor Millipede crossing the trail pathway.

Tractor millipede ("*Tractor Millipede*", 2008) was named after its flattened dorsal plates that create the appearance of a tread from a tractor tire that creeps on the forest bed (Raupp, 2014). This millipede is blind and depends on the senses of touch and smell alone to find food (Raupp, 2014). Millipedes are detritivores which feed on decaying/dead organic matter ("*Millipede*", 2019) and that explains their preferable habitat which is locations with high level of moisture, typically forest floor dwellers where they live in leaf litter, dead wood or damp soil. Millipedes' aid of protection is by curling its body into a spiral when threatened and most species emit foul-smelling liquid secretion through microscopic holes along the sides of their bodies ("*Millipede*", 2019). This is to protect their soft abdomens.



Taxonomic Level	Flame Leg Millipedes
Kingdom	Animalia
Phylum	Arthropoda
Class	Diplopoda
Order	Spirobolida
Family	Trigoniulidae
Genus	<i>Trigoniulus</i>
Species	<i>macropygus</i>

**Figure 3:** Flame Leg Millipede creeping across the road.

*Trigoniulus macropygus* or known as the Flame leg Millipede for its distinctive, bright, flame-like legs (Silvestri, 1897). Like any other millipedes, the Flame leg Millipede's habitat is usually under mulch, piles of leaves or clippings from grass ("*Millipede Control: What You Need to Know / Terminix*", 2017). They migrate in the fall or after heavy rain has disrupted their home. Their eggs are inserted into the soil and the female creates a nest like area, which is often made up of her own feces ("*Millipede*", 2019). It takes a year to fully mature into the adult stage, and when this happens the millipede can live up to 7 years depending on the type of species.



Taxonomic Level	Giant Pill Millipede
Kingdom	Animalia
Phylum	Arthropoda
Class	Diplopoda
Subclass	Chilognatha
Infraclass	Pentazonia
Superorder	Oniscomorpha
Order	Sphaerotheriida

**Figure 4:** An Orange Giant Pill Millipede was seen crawling back into the forest across the Summit Trail.

Pill millipedes are a unique kind of millipede which is morphologically different from the common long, worm-like millipedes. Pill millipedes (Oniscomorpha) have relatively short, unusually round and stout body covered by a strong exoskeleton comprised of curved shields called tergites (Khoza, 2014). Their primary defense mechanism is by rolling themselves into a tight ball to protect the vulnerable underbelly. Pill millipedes divided themselves into two main orders, differs in the number of tergites; Glomerida (10 or 11 tergites) and Sphaerotheriida (12 tergites) ("*Sphaerotheriida*", 2019). This pill millipede belongs to the order Sphaerotheriida because it has 12 tergites. Giant pill millipede (GPM) are detritivores (feed on decaying/dead organic matter) and lives in forests where there is high level of dampness ("*Sphaerotheriida*", 2019). GPM most common predator includes the South African snail family, Chlamydephoridae which have specifically feed on GPM ("*Sphaerotheriida*", 2019).

**C. Insecta**

The animals under the class Insecta are called insects. Generally, insects have three pairs of jointed legs and their body are segmented into three parts; head, thorax, and abdomen ("Characteristics of Insect Class Insecta", 2015). The examples of insects are as shown in Figure 5 and Figure 6.



Taxonomic Level	Short-horned Grasshopper
Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Orthoptera
Family	Acrididae

**Figure 5:** A Dark Brown-Coloured Grasshopper with orange and yellow stripes on its body, resting on a leaf.

Grasshoppers are herbivorous insects that live in fields, meadows or any places rich with green plants. There are two main types of grasshoppers: long-horned grasshoppers and short-horned grasshoppers both divided according to the length of their antennae ("*Grasshopper - Facts, Diet & Habitat Information*", 2009). Grasshoppers are normally brown, yellowish or reddish brown and light green in colour but some species have more variation of colours such as having stripes ("*Grasshopper*", 2019). This is to adapt and camouflage themselves to the green environment to avoid predators. Some male grasshoppers are brightly coloured in order to attract females and some as a warning to predators that they contain toxins in their bodies ("*Grasshopper - Facts, Diet & Habitat Information*", 2009). Most species are solitary and only come together during mating. However, some migratory species (migratory locusts) will gather in huge groups consisting of millions of individuals during their migrating time.



Taxonomic Level	Geometer Moth
Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Family	Geometridae

**Figure 6:** A Black-and-Blue Geometer Moth resting on a wet leaf.

Geometer moths belong to the family Geometridae and often referred as Geometrids. The caterpillars of geometer moths have only two or three pairs of prolegs near their hind body, unlike most butterfly and moth larva. Without the presence of legs in the middle section of its body, a Geometer moth larvae moves in a looping fashion and are commonly known as inchworms or loopers (Hadley, 2018). The larvae of Geometer moth are herbivores which feeds on woody trees and shrubs. Adult geometer moths have a variety of size, from small to medium, with slender bodies and broad wings occasionally decorated with thin, wavy lines. (Hadley, 2018). For habitat, larvae live on vegetative host plants while the adults are usually nearby. Most species are nocturnal and attracted to light (McLeod *et al.*, 2017).

### Conclusion

Various types of invertebrate is known to inhabit KNP due to the environment of KNP which is high in humidity and abundant in food sources. A diverse array of invertebrates can be observed such as moths, grasshoppers and millipedes. From this observation, there were six invertebrates recorded, which represent Phylum Arthropoda. Each of the invertebrates has their own roles in the ecosystem so that the ecosystem will remain balanced. With the environment of KNP, these invertebrates choose KNP as their habitat. Lastly, KNP should be preserved and conserved so that these invertebrates will not lost their home and at the same time being conserved from extinction.

### Acknowledgments

The authors would like to thank the Centre for Pre-University Studies, Universiti Malaysia Sarawak and Sarawak Forestry for the financial support and visiting permit. The authors also thank Biology Unit laboratory staff for their assistant during the study.



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## HABITAT ASSOCIATION OF ANURANS IN KUBAH NATIONAL PARK, SARAWAK

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### Abstract

A study of habitat association of anurans was conducted at Kubah National Park rainforest where one of the speciality of this primary rainforest is a home for various species of frogs and palm. The main objective of our research is to study the habitat association of anurans at the Kubah National Park and identify suitable environment for anurans to live. The surroundings of the rainforest provide a suitable habitat for the anurans as there are a lot of trees and damp soil which is essential for its survival. This research was conducted by observation method where the habitat of anurans observed during the research was photographed using smartphones camera and Go Pro camera. Various species of anurans were found at different habitat and altitude at the water stream along the summit trail of Kubah National Park. Only three species of frog has been observed out of 68 species in Kubah National Park. There were three different genus from three different family respectively which are *Tlalocohyla* (Hylidae), *Limnonectes* (Dicroglossidae) and *Duttaphrynus* (Bufonidae). *Nepenthes ampullaria*, a pitcher plant played an important role to provide the microhabitat for tadpole and small frog. As observed during the research, Kubah National Park play a significant role for conservation of anurans species as it provides a suitable habitat environment for its survival.

**Keywords:** Kubah National Park, anurans, habitat, *Nepenthes*

### Introduction

Kubah National Park, Sarawak is one of the rainforest that situated at the northwest coast of Borneo island. It is one of the important region in this island because it has the most diverse

animals and plant live at any Old World Site (Whitmore, 1984). The research of habitat association of anurans was conducted at 2230 hectare protected area of mixed dipterocarp which is the Kubah National Park. This protected area built by massive sandstone ridge with its three mountain peaks which is Gunung Serapi, Gunung Selang and Gunung Sendok. The habitat association of anurans in this rainforest has been observed at the hotspots of this primary rainforest which is at the natural Frog Pond which situated at 900 feet above the sea level and along the water stream at the summit trail of Kubah National Park. This area provide a breeding ground for numerous frog species that live in this rainforest. The palm that live in this rainforest also has important role toward the survival of anurans where by it provide a moist and cold environment which were suitable for anurans to live as the long feathered fan-shaped of palm leaves avoid direct sunlight to the forest floor. This rainforest also has damp soil which will give benefits to anurans as it provides a source of nutrients from the living things such as insects that live inside the damp soil. The objective of our research is to study the habitat association of anurans at the Kubah National Park and identify the suitable environment for anurans to live.

### **Methodology**

The observation of anurans was conducted on 9 March 2019 in Kubah National Park, Sarawak. The frog species and its habitat was observed during the research at the Frog Pond and water stream along the summit trail of Kubah National Park was photographed using the smartphones camera and Go Pro camera. The size of anurans were measured using 30 cm ruler. The identification of the frog species were conducted based on their morphological characteristics using various references which are articles, book and online journal.

### **Results and Discussion**

Figure 1 shows anurans belongs to the genus of *Tlalocohyla*. *Tlalocohyla* reaches the maximum size of 14 cm, and weight around 17 gram. It has a lifespan from two to four years and its lifestyle is solitary. The colours of anurans with genus *Tlalocohyla* is black, green, grey, brown and yellow, where it has a skin type permeable and feature of smooth skin and disc-like toes. *Tlalocohyla* is carnivore as it will eat insects, worms and small frogs and it live in the forest, woodlands and marshes. The predator for this anurans is birds, mammals and reptiles. (Anonb, n.d.)



**Figure 1:** Family: Hylidae; Genus: *Tlalocohyla*

Figure 2 shows anurans belongs to the genus of *Duttaphrynus*. The measurement of the anurans with genus *Duttaphrynus* found during the research is approximately 2 cm. The members of this genus show characteristics of yellowish-brown body, triangular head with dark ridges and had webless fingers and toes. It lives in the forests, shrub land, cultivated field and grassland. They also have good climbing ability. The diet of this genus are earthworms, ants, and other insects.



**Figure 2:** Family: Bufonidae; Genus: *Duttaphrynus*

Figure 3, shows anurans belongs to the genus of *Limnonectes* with the measurements approximately 3 cm, it has skin textures of rough with numerous small tubercles, its dorsal

colouration comprises various shades of brown including pale brown, dark brown, orange brown, and this usually patterned with darker mottles and streaks.(Anona, n.d.)



**Figure 3:** Family: Dicroglossidae; Genus: *Limnonectes*

For certain species of frog, they choose to live in pitcher plant (Figure 4). The pitcher plant is their microhabitat since it provides a breeding place, protection and food for the frogs (Indraneil, 2010). The relationship between this species of frog and pitcher plant is called mutualism. This is because the frogs contribute nutrients in the form of excrement falling into the pitchers. While, this species of microhylid frog (genus *Microhyla*) often observed outside of the pitchers probably waiting to prey on the insects which the pitchers attract (Rembold, 2009). Instead of deposits their eggs in the tree holes, the frog that belongs to the genus of *Microhyla* will use the *Nepenthes pitchers* for breeding. They live, lay eggs in the organic waste high in mineral nutrition in the plant. The pitcher acts as a reservoir for fresh water. The cup of pitcher will secrete variety of digestive enzymes to digest the arthropod and it will gives food for tadpoles (Lim and Ng, 1991).



**Figure 4:** Pitcher Plant

The frogs also prefer to live in or near the pond (Figure 5) because it is surrounded with damp soil, fresh water, plants and trees to maintain humidity and it can keep the frogs' skin from drying out too. Anurans usually require more humidity than other species such as arthropods because their delicate skin does not hold water as well. If the humidity is too low, the anurans may dehydrate and die (Demark, 2018)



**Figure 5:** Frog pond

Due to the presence of freshwater in this habitat, it allows them to fertilize externally. So when the frog lay the eggs in water, it will indirectly allow the larval stage to occur (Svarney & Svarney, 2014). The frogs also can breed in large quantities. Thus, it can increase the

survival of the offspring. Besides, the anurans can survive in freshwater habitats that keeps their skin moist for survival since that moist skin is one of the ways for them to respire. Some anurans lay their eggs attach on tree or leaves (Figure 6) to avoid from predator that eat the eggs such as small fish (Kelly, 2016). Besides, there is also anurans that spend their most life on land rather than in the river. Thus, they are more likely to lay eggs on land such as at bark tree or on the leaves.



**Figure 6:** Frog eggs

### **Conclusion**

As a conclusion, Kubah National Park has a suitable habitat and has the best environment for the anurans to live and survive. This is because Kubah National Park provides them shelter and enough food especially at the frog pond. Besides the frog pond, the *Nepenthes ampullaria* (pitcher plant) that found in Kubah National Park are known to be as suitable microhabitat for the anurans.

### **Acknowledgements**

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