

---

**Research article**

---

**An ethogram construction for the Malayan Flying Lemur (*Galeopterus variegatus*) in Bako National Park, Sarawak, Malaysia****M. N. DZULHELMI<sup>1</sup> and M. T. ABDULLAH<sup>2</sup>**<sup>1</sup>*Ecology Laboratory, Department of Zoology.*<sup>2</sup>*Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*

**ABSTRACT.** This paper describes the behaviour of the Malayan Flying Lemur (*Galeopterus variegatus*) or colugo as obtained from direct observation in its natural habitat at Bako National Park, Sarawak. An ethogram of *G. variegatus* was constructed by characterising and defining the behavioral patterns of the colugo. A record of 10 different categories comprising 37 behavioral types has been catalogued from individual colugo including a male (orange and white colour), female (grey and white colour), mother and young (grey and white colour) and unidentified gender colugo (grey and white colour). The animals were observed for a total of 4526 minutes from 16<sup>th</sup> August 2008 to 17<sup>th</sup> December 2008 between 1600 and 0330 hours. The ethogram of the Malayan colugo is presented here for the first time.

**INTRODUCTION**

The Malayan Flying Lemur (*Galeopterus variegatus*) or colugo (Kool & Nawi, 1995; Nowak, 1999) is known by the locals as “Kubong” or “Kubong lumut”. It is classified in the Order Dermoptera and Family Cynocephalidae (Khan, 1992; Payne & Francis, 2005). There are only two species of colugo; one confined to Borneo and elsewhere in Southeast Asia, while the other is found in southern Philippines (Wilson & Reeder, 2005).

---

*Keywords:* Ethogram, behavioural patterns, *Galeopterus variegatus*, Malayan Colugo.

The colugo has a gliding membrane connecting the neck and its upper body. This membrane extends along the limbs to the tip of the fingers, tail and toes. The kite-shaped membrane is known as the patagium and allows the colugo to glide between trees with partial loss of height (Khan, 1992; Nowak, 1999; Burnie, 2001). The foot is broad while the nails are sharply curved to clinging on trees, trunks, branches and twigs.

It is generally a solitary mammal and can be found in tree holes or resting among dense foliage (Burnie, 2001). It is nocturnal but sometimes active in the morning and late afternoon (Payne & Francis, 2005). Vaughan (1986) mentioned that the colugo is a skillful climber albeit slow. It uses the peculiar comb-shaped lower teeth to groom and clean their fur (Burnie, 2001). However, the colugo is generally helpless on the ground (Vaughan, 1986).

It can be found in secondary forests, gardens and throughout the lowlands and hills up to 900m (Nowak, 1999; Payne & Francis, 2005). It occurs in Java, Sumatera, southern Indonesia islands, southern Indochina, Burma, peninsular Thailand and Malaysia (Khan, 1992; Payne & Francis, 2005). Dermopteran have enlarged tongues and specialised lower incisors for picking leaves (Vaughan, 1986). The diet consists mainly on fruits, leaves, sap from plants, flower buds, nectars and shoots (Burnie, 2001; Payne & Francis, 2005). Colugo often glides to the same spot on the same trees night after night (Nowak, 1999).

A single offspring is produced after an eight week gestation period (Burnie, 2001). Reproduction and breeding occur throughout the year (Nowak, 1999). At birth, the offspring clings to its mother continually for about six months (Burnie, 2001). She carries her young enclosed in its gliding membrane (Payne & Francis, 2005) and glides progressively less frequently as the young grows.

It is hunted for food and its fur in Sarawak. Habitat loss is a major threat to colugo populations (Ketol *et al.*, 2006). According to Ketol *et al.* (2006), the lack of awareness among local villagers and ineffective enforcement of the law may contribute to drastic population decline and local extinction of certain wildlife. In the Convention on International Trade in Endangered Species (CITES), the colugo is listed under Appendix 2 and is presently considered neither threatened nor endangered.

In Malaysia, the colugo is protected by a number of laws such as the Wildlife Protection Act 1972 (Federal law), Wildlife Protection Ordinance 1998 (Sarawak State law) and Wildlife Conservation Enactment 1997 (Sabah state law). Colugos are difficult to keep in captivity, and die quickly if caged and improperly fed (Nowak, 1999).

The objective of this study is to construct an ethogram, describe and define the behaviour of colugo as observed in Bako National Park, Malaysia.

## MATERIALS AND METHODS

### Study area

Bako National Park in which was gazetted as a totally protected area in 1957, covering an area of 2,727 hectares and is known as the oldest and smallest National Park in Sarawak (Hazebroek & Abang Kashim, 2000). It is located about 30 km northeast of Kuching, at longitude 110°26' E and latitude 1°41' N and an altitude ranging from sea level to 244 meters (Briggs, 1991).

A variation in soil types provides a corresponding range of diverse vegetation communities, consisting of seven distinct types of vegetation (Anderson, 1961; Ashton, 1971). This includes the beach vegetation, cliff vegetation, tropical heath forest (*Kerangas* forest), mangrove forest, mixed-dipterocarp forest, padang or grassland vegetation and peat swamp forest (Ashton, 1971; Hazebroek & Abang Kashim, 2000) which offer a wide range of habitats and ecosystem for plants and animals (Anderson, 1961; Rothschild, 1971).

Twenty-three species of mammals, 150 species of birds and 24 species of reptiles have been recorded at Bako National Park. Mammals such as the Bearded Pig (*Sus barbatus*), the Silvered-leaf Monkey (*Presbytis cristata*), the Long-tailed Macaque (*Macaca fascicularis*) as well as the rare and endangered Proboscis Monkey (*Nasalis larvatus*) can be seen very easily at Bako National Park. Some bat species such as the Horseshoe bats (*Hipposideros* sp. and *Rhinolophus* sp.) and the Long-tongued nectar bat (*Macroglossus minimus*) have also been recorded (Hazebroek & Abang Kashim, 2000).

Recent observations at the park includes nocturnal species such as the Flat headed-cat (*Felis planiceps*), the Common Palm Civet (*Paradoxurus hermaphroditus*), unidentified flying squirrel, the Oriental Bay Owl (*Phodilus badius*), the Buffy Fish-owl (*Ketupa ketupu*), unidentified scops owl, Flying Fox (*Pteropus* sp. and cobras. These animals may sometimes occur and forage at the surrounding area depending on the occasion. According to Lim (2007), colugo shares its habitat and to some extent its ecological space with other nocturnal mammals (frugivorous bats, civet cats, slow lorises and flying squirrels).

### Field methodology

A search for colugo was conducted between 0800 and 1600 hours at Bako National Park headquarters. Once found, the location, colour of colugo and sex were recorded. The nocturnal

behaviour of the colugo was observed directly using a flashlight (Bulb: 4.8 volt /0.75 amp, Dolphin Eveready 1209) from 1600 until the colugo could not be followed or sighted anymore. The observed patterns were then divided into several categories based on functions.

### ETHOGRAM CONSTRUCTION

The classification and description of an animal's behaviour is fundamental to quantitative ethological studies (Macnulty *et al.*, 2007). According to Torr & Shine (1994) a comprehensive knowledge of the basic behavioural patterns is needed before detailed studies can be conducted on social interactions. A basic definition and description are needed in order to classify animal behaviour into categories.

The ethogram is based on observation of individual colugos comprising of a male (orange and white colour), a female (grey and white colour), a mother with young (grey and white colour) and an unidentified individual (grey and white colour). Animals were observed for a total of 4526 minutes in Bako National Park headquarters from 16<sup>th</sup> August 2008 to 17<sup>th</sup> December 2008 between 1600 and 0330 hours.

The different behavioural categories are modified from Wharton (1950), Lehner (1979), Wemmer *et al.*, (1984) and Lim (2007). In this study, the “non-active period” is defined as commencing when colugo starts to rest on a selected tree just before dawn until dusk or just before dusk. The “non-active period” was usually between 0800 and 1600 hours.

The “active period” is defined as commencing when colugo starts to be in motion just before dusk until dawn or just before it stays in a selected tree for its next roosting tree either in the same or a different roost tree. Normally, the “active period” is between 1800 and 0600 hours. There was also a period described as the “inter-

active period” where the colugo may or may not be active during this particular time. In some occasions, the colugo was sighted to be in motion (e.g. gliding) between 1600–1800 hours before the “active period”. The duration of this activity may be between 0600 and 0800 hours and 1600 and 1800 hours. Because no observation were done between 0600 – 0800 hours, the “inter-active period” is not included in the description of this paper.

This paper divides the behaviour activities of *G.variegatus* into 10 different categories comprising of 37 different types of behaviour.

#### Stationary body position

Immobile, eyes can either be opened or closed depending on active and non-active period, hanging or standing posture. Two types of behaviour in the stationary body position category are described below.

##### *Sleeping*

Immobile, eyes closed, can be hanging or standing posture. When hanging, head is either curled inside between the patagium or head facing out. When standing, head and body are leaning on the tree or on its shoulders.

In either posture, a mother covers the baby in the patagium fully or partially. Sometimes, the head of the young can be seen sticking out from the patagium. When disturbed, the colugo may shift to another part of the same or different tree depending on the nature of the disturbance.

##### *Resting*

Immobile, eyes opened or partially opened, can be in hanging or standing positions. When hanging, the head is facing out or leaned closely between arms without curling between patagium. When standing (Figure 1), the head is either leaning or not on the tree.



**Figure 1.** A colugo resting in head up posture on a bole of a tree.



**Figure 2.** A mother and young colugo resting in hanging posture in tree or on branches

A colugo adopts a hanging position when it rains with the head pointing downwards to the ground. Otherwise, it adopts a standing position but moves into another tree and takes shelter under the leaves. Resting and sleeping only differ based on the eyes since both categories can take place during active and non-active period.

### **Locomotion pattern**

Movement from a point can involve using either front, back or all legs towards or away from facing direction, with or without expanding the patagium. There are six kinds of behaviour in the locomotion category and are described as follows.

#### *Walking*

Walking is done either while hanging or on a branch. When hanging, both front and back legs are lifted sequentially from time to time, moving either the facing direction (Figure 3) or opposite direction.



**Figure 3.** A mother and young colugo walking in inverted posture on tree branch.

The colugo can also switch from a hanging position to walking on top of branches, usually when jumping to the next branches or tree. This act can either be a slow or fast moving locomotion.

#### *Hopping*

Hopping is done in a standing position to an ascending movement. This is done in a jumping motion along the same branch (Figure 4).



**Figure 4.** A colugo hopping upward to reach the crown of a tree.

The ability to climb fast from the ground especially if an individual is threatened is accomplished by the act of hopping which gives force to move faster gaining a greater distance than climbing.

Most of the time, this act often comes before or after gliding. Before it glides and if it is very close to the ground but needs to glide a reasonable distance to another tree, the colugo will move to a higher position above the ground. After it glides, the colugo will climb higher either to glide to another tree or to feed in the crown of the tree.

Basically, hopping and climbing differs in the locomotory movement of the fore and hind legs.

### *Climbing*

While standing, both front and back legs are lifted sequentially from time to time, moving upward, downward or sideward (left or right).

Colugo can climb up the tree either by hopping or climbing depending on the situation as well as the surrounding. Climbing is usually done to

accomplish short-distance movement between branches, ascending or descending with head facing the direction of movement.

### *Jumping*

Jumping involves an abrupt short distance movement from branch to branch or between trees. This does not involve the expansion of its patagium.

### *Switching direction*

A colugo changes direction at anytime either while hanging or in standing position. This is done by making a turn instead of reversing. Reversing, however, might sometimes be done depending on the situation.

### *Gliding*

A smooth, quiet movement as if without effort, controllable through the stretching and expanding of the patagium.

This act also depends on the weather condition especially wind direction. During the active period, particularly when moving from its roosting site to its feeding tree, it will glide rather than jump from tree to tree.

Gliding often takes place across an open space between trees. Since gliding involves a loss of altitude, climbing to maximum height before sliding is a rule.

### **Visualising**

Movement of any part of the body, with involvement of the eyes, during active or non-active period, focusing on other individuals, organism or surroundings. There are two types of behaviour in this category that are described below.

### *Staring*

Immobile, between two individual, in standing or hanging posture with eyes opened.

This behaviour usually occurs between different sex with eye contact for a very long period that can last up to 1 hour. A female colugo can be with or without young. In theory, a mammalian eye can only be opened for certain short period of time, before blinking. Otherwise, they will become dry.

It is also considered that this behaviour could be an introductory act before courtship takes place between two individuals.



**Figure 5.** A colugo watching an animal (*Sus barbatus*).

### *Observing*

Observing is done by facing the objects or by scanning around by moving its head (Figure 5). Colugo usually visualise their surrounding area before moving especially before gliding.

### **Self movement**

A collection of movements of any parts of its body, during active or non-active period, that may or may not involve another colugo or other animals, and having its own function that may or

may not depend on the surroundings. Four types of behaviour are described under this category.

### *Yawning*

Opening mouth wide and breathing deeply for several seconds (Figure 6). The gape position is maintained just before the mouth is closed. Eyes can either be wide opened or partially closed and the tongue can either be inside or protruding out of the mouth.



**Figure 6.** A colugo yawning just before dusk.

### *Swaying*

In a hanging position, head curled inside between patagium or head facing forwards without curling between patagium, and the body moves back and forward repeatedly.

Just before the active period, the colugo sometimes move its body back and forth repeatedly before commencing other behavioral act. This appears to be the behaviour for relaxation before the active period.

### *Clinging*

While in a hanging position, only the back legs are used to grip on the branches, while the body, head and front legs are released, the patagium is either expanded partially or not (Figure 7).



**Figure 7.** A mother and young colugo clinging to groom its young.

In this position, the colugo can also groom itself or its young (if present). This behaviour is also done to correct the young posture on the female colugo before moving.

According to Wharton (1950), if the female colugo leaves the young in a nest hole, it clings onto branches close to the young, leaving the young to climb back on the front body.

#### *Raised-tail*

In a standing position, the tail will rise up and straighten; the inner part of the patagium is covered by the outer part of the patagium.

The tail is raised whereby sometimes the inner part with white line can be seen very clearly but the actual function of a raised-tail was not studied during this survey.

#### **Maintenance**

In any position, during active or non-active period, may or may not involve another individual, a movement of any part of the colugo's body to make contact with another part of its body or other individual that appear

to involve body maintenance. There are three kinds of behaviour that are described in this category.

#### *Mouth-lick*

Tongue protruding from mouth, licking outer part of mouth.

This is usually done before or just after yawning. But, it may also be done at other time such as after grooming and eating. This is apparently done for moisturising the lips.

#### *Scratching*

Using the front or hind legs to scratch any part of the body, probably to get rid of ectoparasites or other foreign objects on the body (Figure 8). Scratching is also associated with autogrooming.

#### *Grooming*

Licking or biting of the fur or any other part of its own body or of other individuals (e.g. young), with the intention of cleaning or drying the body.



**Figure 8.** A colugo is scratching using its hind legs.

Allogroom is done an individual licks or bites the body of another individual or when social grooming between mother and young. The most frequently seen is the allogrooming between mother and young and vice versa.

### Vocalisation

A variety of noises are produced through squeaking vocalisation. Although vocalising attempts were observed, the frequency and purpose of the vocalisations were not quantified properly. Only four types of behaviour are recorded as vocalisations.

#### *Greeting call*

Producing a noise as the male approach and sniff the mother and young colugo on the first attempt.

When the male colugo attempts to visit the mother carrying young colugo, as the male colugo sniffs on the mother at first, the mother colugo produces a noise associated with other social interaction (e.g. prior to allogrooming).

#### *Disturbed call*

Producing a noise from the mouth when being disturbed.

It will produce a noise from its mouth when in direct contact or being disturbed by other animals (e.g. *Macaca fascicularis*).

#### *Calling*

Producing noise from its mouth for communication between individuals, usually a squeaking call, e.g. before gliding. A colugo does not vocalise when they are alone.

#### *Courtship call*

Vocalisation is also produced during courtship between individuals call albeit rarely. The female colugo will make a loud pitching noise when in

courtship. This call has been recorded previously on video (Anon, 2008).

### Defecation and excretion

This involved the discarding of urine or feces. The elimination process only involves two type of behaviour.

#### *Defecating*

In a standing position, the tail and the bottom part of the patagium is raised and folded up on the back of the body, where the inner part of the patagium is folded over the outer part (Figure 9). A slight body pressure is exerted as the feces and urine is passed.



**Figure 9.** A mother and young colugo defecating before foraging.

#### *Territorial marking by urinating*

In a standing position, the posture is merely the same as when defecating except that the tail is only raised partially upward to the back of its body. The urine will be eliminated and distributed on the tree trunk as the colugo climbs sideways. This appears to be a marking behavior as the urine is deliberately spread along the tree trunk.



## Feeding

This is the process associated with the intake of food. During feeding, the tongue can also function for licking moisture and other invertebrates (e.g. ants). Feeding comprises of three types of behavior patterns.

### *Drinking*

Drinking takes place by licking water or moisture from tree bark, leaves, mosses or any other part of the tree using its tongue.

Colugos regularly obtain water especially during or after rain as surface water can be obtained easily. Even though there is no rain, colugo can also obtain water from mosses or leaves. It does not go down to pond, river or stream to drink.

### *Eating*

This is the process of obtaining food by biting and chewing using the jaws. It involves the selection and consumption of available food resources (Figure 10).

Reaching the food might be done by lengthening the neck closer to food or pulling branches closer to its mouth using its fore limbs, biting and chewing the food. Sometimes, it can be seen sniffing the leaves before it starts to pull the branches and eat. Feeding usually done in earnest. Thus, it will just glide to a selected tree and start to feed at the crown of the tree. It was observed that colugo eats leaves, shoots, buds, and flowers from trees.

### *Licking*

The process of consuming food by licking on selected food resources using its tongue.

Colugo has been observed consuming on ants by licking inside tree holes which are occupied by ants (Dzulhelmi & Abdullah, *in preparation*). According to Payne & Francis (2005), there has



**Figure 10.** A colugo extending its neck to reach for food.

also been a record on colugo licking fluid oozing from a cut in the trunk of a coconut tree during heavy rain.

Lim (2007) mentioned that the colugo could be licking on tree bark to feed on lichens for nutrients, or licking for traces of salt and minerals on the bark.

## Companion-oriented locomotion

A movement towards or away from another individual or in response to another individual or situation. There are seven types of behaviour listed in the companion-oriented locomotion category.

### *Approaching*

An act of movement towards another individual which decreases the distance between the individuals.

Approaching can result from walking, climbing, gliding and can even vary by posture depending on situation.

*Departing*

To leave from one point, or moving away from another individual.

Departing occurs when the colugo commences to become active. It will leave its roost tree by locomotion or may also glide, and may or may not come back to the same roost tree. Also, when a colugo meets another individual or one that may just be passing by, one of the colugo will depart from that area.

If a colugo feels threatened, it will depart from a point either by climbing high from the ground or gliding to another tree.

*Following*

One or more individual attempting to follow another individual by locomotion or gliding.

A long period of staring between individuals occurs before following each other for mating or socialising purposes. The duration of this activity often takes longer than the resulting behaviour and can sometimes take up to 6 hours. Another situation is when one individual notifies (by vocalisation) another individual to follow, leaving an area, when there is a sense of danger.

*Visiting*

This is a movement between two or more individuals, having different roosting site but visiting in one place during the active period. This behaviour usually occurs between male and female colugo when a male visits a mother colugo especially one carrying a young. An observation was made where three individuals meet in the same area.

*Nuzzle*

This occurs between two colugos where one or both colugos lick or sniff the body or nose of the other colugo.

This behaviour probably functions to identify an incoming colugo to a particular area. It may be related to meeting behaviour before confirming the identity of the actual partner. This behaviour has been observed between mother and young colugo with the male colugo.

*Courtship*

No direct observations were made of this particular behaviour during the present study. However, for the sake of completeness, these two behaviour descriptions (courtship and mounting) are based on a video by Anon (2008). During this activity, both individuals have a head up posture, the male colugo quickly bites part of the female body and mounts the back of the female colugo. This behaviour is associated with the mounting behaviour.

*Mounting*

In head up posture, when both male and female colugos are ready for courtships, the male colugo approaches to the female colugo, biting the neck and mounts on the back of the female colugo before copulation takes place.

**Threats posture and pattern**

This occurs during the active or non-active period during the presence of another animal or a perceived threat. There are four types of behaviour in the threats posture and pattern category.

*Threat posture*

Hanging or standing posture, suddenly become inactive, eyes opened or closed a little, with the intention to be camouflaged or not to be noticed.

In hanging posture, the head can either be straightened backward or be placed close to its hind and forepaws that are grouped together. If it is standing posture, the head is leaned back while the body is in contact with the tree trunk.

This posture occurs when the colugo apparently feels threatened. Sometimes, the colugo will just become stationary in its normal posture while only the eyes are moved, observing the threats either before or after being noticed while an overt threat posture is not adopted.

#### *Unnoticed escape*

Made during a standing position, the eyes can either be opened or closed a little, with the intention of not being noticed, while making a quiet move away before being noticed.

Colugos have few ways to defend themselves from threats. One way is not to be noticed. In order to do this, and while the threat is still present, the colugo will move slowly raising its paws to reach the back of the tree trunk and pulling itself around to the back of the tree trunk without the slightest noise. It will avoid sliding on rough bark as some of the dust may come off and falls onto the ground.

Sometimes, the colugo will turn its head up 180 degrees to observe the intruder before it does a quiet escape.

#### *Aggression*

A short strike at another colugo or at another animal making direct contact with either of the front legs.

Aggression often occurs between colugos if one approaches while the other feels threatened. The threatened or disturbed colugo will strike first. But, if a colugo is threatened by another animal (e.g. *M. fascicularis*), direct contact from this animal has to occur first before aggression from the colugo occurs.

#### *Retreating*

The body is in a hanging or standing position and the eyes are open with the intention of moving away from threat or disturbance.

Arboreal animal such as *M. fascicularis* may sometimes threaten colugos. These animals disturb colugos by curiosity when foraging in trees. In order to defend itself, the colugo will either vocalise, attack when in close contact or retreat. If the colugo is in hanging position, it will pull itself away from the threat. It will also climb up to higher branches to avoid threats.

## CONCLUSION

Based on field observation of individual colugos including male (orange and white colour), female (grey and white colour), mother and young (grey and white colour) and unidentified gender colugos (grey and white colour) over a period of 4526 minutes, a total of 10 different categories comprising 37 different activities were recorded.

The resulting ethogram constructed for the colugos is important for the understanding of the behaviour that has a function in the maintenance and ecological significance of species in the evolution of our ecosystems. Since there is no ethogram ever produced for the colugo before, Bako National Park offers this great opportunity to study the behaviour and other ecology parameters of colugos in the wild. Nevertheless, there were some behaviour activities and patterns that the function had not been determined, thus, further study is still needed.

However, this ethogram knowledge will help us to improve our understanding of the colugo for conservation and *in situ* management of this endangered species especially in Malaysia.

## ACKNOWLEDGEMENTS

We would like to thank to Sarawak Forestry Department, Sarawak Forestry Corporation and Bako National Park for the permission and support in conducting this study. Thank you to Ahmad Syazwan Saidin and Millen Patrick for assisting in search for colugos. A special thank

to Dr. Les Hall and Datuk Sri Earl of Cranbrook for the review and comments to improve the initial draft of this paper. Dzulhelmi Nasir would like to thank his parents (Muhammad Nasir Bin Mokhtar and Munirah Binti Abdul Wahid) who have always financially supported him. This project was also supported by UNIMAS Scholarship.

## REFERENCES

- Anderson, J.A.R. 1961.** Bako National Park, Sarawak. *The Malayan Nature Journal, Special Issue*. pp. 1-30.
- Anon. 2008.** Flying Lemurs Mating, Bako National Park, Sarawak, Malaysia. Retrieved on 7th October 2008 from the world wide web: <http://www.youtube.com/watch?v=wavNc4nuVyk>.
- Ashton, P.S. 1971.** The Plants and Vegetation of Bako National Park. *The Malayan Nature Journal* 24: 151-162.
- Briggs, J. 1991.** *Parks of Malaysia*. Longman Malaysia, Petaling Jaya.
- Burnie, D. 2001.** *Animal*. Dorling Kindersley Limited, London.
- Dzulhelmi, M.N. & M.T. Abdullah.** The Foraging Ecology of the Malayan Flying Lemur (*Galeopterus variegatus*) in Bako National Park, Sarawak, Malaysia (in preparation).
- Hazebroek, H.P. & A.M. Abang Kashim. 2000.** *National Parks of Sarawak*. Natural History Publication (Borneo), Kota Kinabalu.
- Ketol B., S. Tedong & M.T. Abdullah. 2006.** Short Notes: Distribution Records of the Rare Flying Lemur in Kota Samarahan and Kuching Area, Sarawak. *Sarawak Museum Journal* VLXII (83): 237-241.
- Khan, M.M. 1992.** *Mamalia Semenanjung Malaysia*. Department of Wildlife and National Parks, Kuala Lumpur.
- Kool, K.M. & Y. Nawi. 1995.** *Catalogue of Skin in Sarawak Museum, Kuching, Sarawak*. Universiti Malaysia Sarawak, Kota Samarahan.
- Lehner, P.N. 1979.** *Handbook of Ethological Methods*. Garland STPM Press, New York.
- Lim, N. 2007.** *Colugo: The Flying Lemur of South-east Asia*. Draco Publishing and Distribution Pte Ltd, Singapore.
- Macnulty, D.R., L.D. Mech & D.W. Smith. 2007.** A Proposed Ethogram of Large-Carnivore Predatory Behaviour, Exemplified by the Wolf. *Journal of Mammalogy* 88 (3): 595-605.
- Nowak, R.M. 1999.** *Mammals of the World*. Sixth edition. John Hopkins University Press, Baltimore.
- Payne, J. & C.M. Francis. 2005.** *A Field Guide to the Mammals of Borneo*. Sabah Society, Kota Kinabalu.
- Rothschild, G. 1971.** Animals in Bako National Park. *The Malayan Nature Journal* 24: 163-169.
- Torr, G.A. & R. Shine. 1994.** An Ethogram for the Small Scincid Lizard, *Lampropholis guichenoti*. *Amphibia-Reptilia* 15: 21-34.
- Vaughan, T.A. 1986.** *Mammalogy*. Third Edition. Saunders College Publishing, Philadelphia.
- Wemmer, C., L.R. Collins & B.B. Beck. 1983.** *The Biology and Management of an Extinct Species: Père David's Deer*. Noyes Publication, Park Ridge.
- Wharton, C.H. 1950.** Notes on the Life History of the Flying Lemur. *Journal of Mammalogy* 31: 269-273.
- Wilson, D.E. & D.M. Reeder. 2005.** *Mammals Species of the World. Taxonomic and Geographic Reference*. Third Edition. John Hopkins University Press, Baltimore.