

HERPETOFAUNA IN SOUTHERN PART OF PULAU TIOMAN, PAHANG, PENINSULAR MALAYSIA

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ABSTRACT

Pulau Tioman is the largest island in the outer arc in Seribuat Archipelago with Gunung Kajang is the highest peak at 1,035 m. Previous herpetofaunal surveys were conducted from 15-20 April 2016 at two areas on the southern part of Pulau Tioman, which were Kg. Asah and Kg. Mukut. Two main methods were implemented, namely visual encounter survey (VES), and cages trapping. A total of eight species of anuran amphibians and 22 species of reptiles was recorded from this area. The diversity of herpetofaunal reported in Kg. Asah was higher than Kg. Mukut due to higher habitat heterogeneity and sampling efforts. The additional fieldworks are needed to assess and obtain a better picture of the true diversity of herpetofaunal in southern parts of Pulau Tioman for conservation purposes.

Keywords: Amphibia, reptile, Kg. Asah, Kg. Mukut, Seribuat Archipelago, South China Sea.

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INTRODUCTION

Pulau Tioman is the largest island (110 km²) in the outer arc in Seribuat Archipelago, with steep mountainous terrain, reaching the highest peak of 1,035 m (Gunung Kajang) and various zones of vegetation such as mangroves, coastal vegetation, lowland dipterocarp forest, hill dipterocarp forest and ridge forest. Previous studies on herpetofauna in Pulau Tioman have recorded the remarkable number of herpetofaunal species that comprised of 23 species of amphibians and 74 species of reptiles, and hosted 11 endemic species recorded from various localities on this island (Hendrickson, 1966a, 1966b; Denzer *et al.*, 1989; Day, 1990; Manthey & Grossmann, 1997; Lim & Lim, 1999; Grismer *et al.*, 2004; 2006). Grismer (2005) listed all localities surveyed on Pulau Tioman including its archipelago. However, several areas on this

island were not exhaustively documented for the diversity of its herpetofauna. Therefore, this study aims to document the diversity of herpetofauna at two small areas in the southern part of Pulau Tioman.

METHODOLOGY

Study area and data collection

The herpetofaunal survey was conducted for five sampling days at two areas in the south region of Pulau Tioman, which are Kg. Asah and Kg. Mukut (Figure 1). The study area at Kg. Asah consists of areas at the basecamp, trekking trail heading to Kg. Mukut and Sungai Asah. The sampling area at Kg. Mukut consist of human settlement area and the nearby river, Sungai Raya. During the inventory, two methods were carried out which are visual encounter survey (VES) to systematically searched for active terrestrial and arboreal species, while cage trapping employed to focus on aquatic species. The active searches of VES consist of diurnal and nocturnal surveys, with the headlight for visual aid during night time. VES was done just after nightfall (c. 7.30pm) and lasted for 4 hours involving 2 to 5 persons. Three fish traps were set up in order to sample aquatic reptiles in the small stream at the study area. The representative individuals were collected for species identification and photographed. The samples were euthanised, and fixed with 10% formalin and transferred to 70% ethanol for long term storage. All of the collected specimens were deposited in the Institute of Biodiversity, Department of Wildlife and National Park, Lanchang, Pahang.

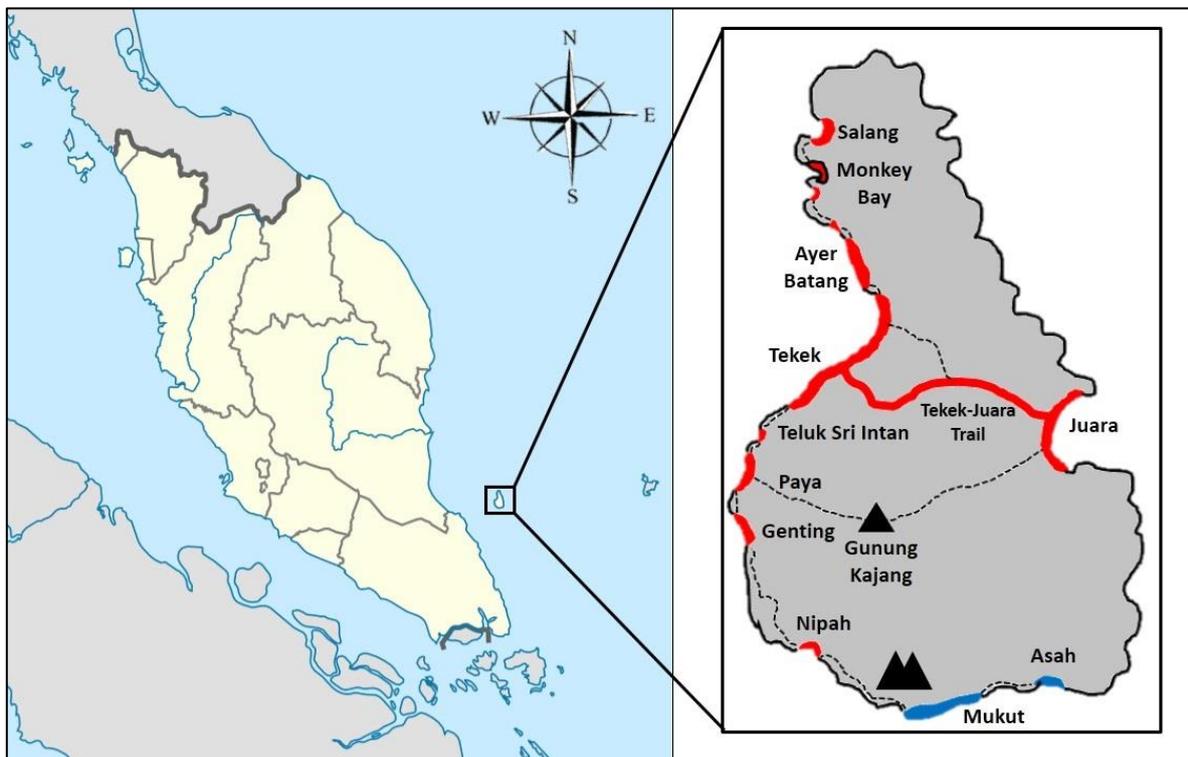


Figure 1 The map of Peninsular Malaysia showing the location of Pulau Tioman, off Pahang-Johor coast. Enlarge is the map showing the location of the study sites (in blue) at the southern part of Pulau Tioman, Pahang, Malaysia.

RESULTS

A total of 30 species was discovered in this study, comprised of eight species of anuran amphibians and 22 species of reptiles from two nearby locations at the southern part of Pulau Tioman (Table 1.). The diversity of herpetofauna reported in Kg Asah (25 species) was higher than Kg Mukut (11 species) bringing the total species known from each location to 28 and 27 species, respectively. For amphibians, there were four families (two species of toads and six species of frogs) and eight families of reptiles (seven species of lizards and geckos, three species of skinks, one species of softshell turtle and four species of snakes) were recorded. All recorded species were collected by using the active searches of VES, except for *D. subplana* which was captured by using the cages trapping technique.

Systematic account

CLASS AMPHIBIAN

FAMILY BUFONIDAE

Duttaphrynus melanostictus (Schneider, 1799) (Plate 1A) - *Duttaphrynus melanostictus* was collected from the areas of human settlements in Kg. Mukut. This species was regularly observed in disturbed open areas in Kg. Mukut, with several road-killed individuals encountered during the survey.

Ingerophrynus parvus (Boulenger, 1887) (Plate 1B) - This toad was collected at night from Sg. Asah and an individual observed perched on rock surfaces along the stream of Sg. Asah.

FAMILY DICROGLOSSIDAE

Limnonectes blythii (Boulenger, 1920) (Plate 1C) - *Limnonectes blythii* was collected at night from both Kg. Asah and Kg. Mukut. In Kg. Asah, this species was observed in leaf litters on forest floors, or rock crevices and low vegetation on riverbanks of Sg. Asah. The collected individuals show varying pattern on dorsum marking with or without the vertebral strips.

FAMILY RANIDAE

Odorrana hosii (Boulenger, 1891) (Plate 1D & 1E) - *Odorrana hosii* are the most common species recorded during this surveys, frequently observed at night perched on rocks in creeks and occasionally found perched on leaves of shrub along the stream. Several males also were observed congregated and actively calls for mating in the vicinity of the waterfall of Sg. Asah.

Hylarana erythraea (Schlegel, 1837) - This species was collected at night from a swamp area near the residential areas and Sg. Raya of Kg. Mukut. *Hylarana erythraea* was observed perching on a rock in the creek and sometimes found in thick riparian vegetation. Calling of this frogs was heard, but none amplexant pairs were found.

Chalcorana labialis (Boulenger, 1887) (Plate 1F) - *Chalcorana labialis* was collected at both streams from Kg. Mukut and Kg. Asah during the surveys. Mating calls were actively heard along the streams. The individuals of this species were found perching on boulders, or sometimes in low vegetation along the stream.

FAMILY RHACOPHORIDAE

***Polypedates leucomystax* (Gravenhorst, 1829) (Plate 1G)** - This arboreal frog was collected only from Kg. Mukut at night. The individuals of this species were found on a bridge in the village area, followed by several callings in nearby areas. This species co-existed with its congeners, *P. discantus* within the same habitats.

***Polypedates discantus* Rujirawan, Stuart, and Aowphol, 2013** - This arboreal frog is a new record of anurans in Pulau Tioman, which have been collected only from Kg. Mukut. The individuals of this species were found in human-made structures during the night and suspected to occur at several places within Kg. Mukut according to their distinct callings heard (Rujirawan *et al.*, 2013). This species can be distinguished from its congeners, *P. leucomystax* by lacking four-line strips instead of dark blotches on its dorsum and almost-like 'X' marking on the interorbital region (Rujirawan *et al.*, 2013).

CLASS REPTILE

FAMILY AGAMIDAE

***Acanthasaura armata* (Gray, 1827)** - This species was visually spotted on hilly terrain near the campsite at day chasing away another lizard, *Bronchocela cristatella* on the tree trunk.

***Bronchocela cristatella* (Kuhl, 1820)** - An individual of *B. cristatella* was recorded near the campsite area. This species was briefly observed while escape from being pursued by *A. armata*.

***Aphaniotis fusca* (Peters, 1864)** - An individual of *A. fusca* was collected at the walking trail near the stream of Asah. *Aphaniotis fusca* was observed resting on branches of low vegetation beside the walking trail during the daytime.

***Draco melanopogon* Boulenger, 1887** – This species was collected along the walking trail near the stream of Asah. During the day, most of the individuals observed on the trunks of trees of open areas in forest edges.

***Draco sumatranus* Schlegel, 1844** – This diurnal lizard was collected near the basecamp. An individual was observed perched on the large tree trunk near the basecamp area.

***Draco fimbriatus* Kuhl, 1820 (Plate 1H)** – This diurnal lizard was also collected near the base camp. An individual was observed perching on a large tree trunk in open areas of base camp.

FAMILY VARANIDAE

***Varanus salvator* (Laurenti, 1768) (Plate 1I)** - This species was observed during the day in the vicinity of beaches and human settlements of Kg. Mukut. An individual of *V. salvator* was also observed basking in open areas and taking shelter beneath the debris piles.

FAMILY GEKKONIDAE

Gekko monarchus (Schlegel, 1836) – This species was collected at night from a human-made structure at Kg. Asah and Kg. Mukut. Individuals commonly found on walls or ceiling of a man-made building, and occasionally on tree trunk.

Gehyra mutilata (Wiegmann, 1835) – This scansorial species was collected at Kg. Asah during nocturnal surveys. An individual was observed on the ceiling of an abandoned building at the walking trail of Sg. Asah.

Hemidactylus frenatus Dumeril & Bibron, 1836 – This species was collected during the night surveys at Kg. Mukut. Several individuals were observed on tree trunks at swampy areas, and also on the jungle trail near Kg. Mukut.

Hemiphyllodactylus typus Bleeker, 1860 (Plate 1J) – This scansorial species was collected at night in the vicinity of Sg. Asah only. An individual was observed perched on the leaf of low vegetation.

Cyrtodactylus tiomanensis Das & Lim, 2000 (Plate 1K) – This scansorial species was collected during the night in the vicinity of Sg. Asah only. Most of the individuals were encountered hiding in rock crevices, regularly found on boulders in the vicinity of slow-flowing streams of Asah.

Cnemaspis limi Das & Grismer, 2003 – This scansorial and nocturnal species was collected during the night at Kg. Mukut and Kg. Asah. An individual was observed on the large tree trunk in swampy areas at Kg. Mukut, quickly retreats into rock crevices. Other individuals were visually observed on tree trunks in jungle trails towards Kg. Mukut, and large boulders in the vicinity of Sg. Asah.

Cnemaspis kendallii (Gray, 1845) – This scansorial species was collected during the night surveys from Kg. Asah only. Individuals were frequently observed hiding within rocky crevices, granite boulders on river banks of Sg. Asah. An individual exhibit an unusual escape-behaviour, jumping between rocks before quickly retreat into deeper crevices.

FAMILY SCINCIDAE

Eutropis multifasciata (Kuhl, 1820) – This skink was collected at night from Kg. Asah only. Individuals were frequently observed in forest floors with leaf litters.

Eutropis longicaudata (Hallowell, 1856) – This species was also collected at night from Kg. Asah only. One of the individuals was caught while resting beneath mossy layers on large boulders on river banks of Sg. Asah.

Sphenomorphus scotophilus (Boulenger, 1900) – This diurnal species was collected in the vicinity of streams from Kg. Asah only. Most individuals were observed on the surface of rocks, which were swift and agile in escaping into crevices on rocks or tree trunks when approached.

FAMILY TRIONYCHIDAE

Dogania subplana (Geoffroy, 1809) (Plate 1L) – This soft-shelled turtle was caught by using the cage trapping with baits in the vicinity of streams from Kg. Asah only.

FAMILY COLUBRIDAE

Ahaetulla prasina (Boie, 1827) (Plate 1M) – This species was collected at night from the walking trail of Kg. Asah. Individuals were observed perched on the branches of the tree at least 3-5 m above the ground.

Dendrelaphis pictus (Gmelin, 1789) (Plate 1N) – This species was collected near the base camp at Kg. Asah. An individual was encountered crawling through the branches of trees before being caught.

FAMILY HOMALOPSIDAE

Hypsiscopus plumbea (Boie, 1827) – This species was collected at night from the human settlements of Kg Mukut. An individual was caught near the village area in a wet drain.

FAMILY ELAPIDAE

Calliophis intestinalis (Laurenti, 1768) (Plate 1O) – This coral snake was collected at night in the vicinity of streams at Kg. Asah. An individual was caught near fast-flowing streams.

DISCUSSION

The number of species reported from Kg. Asah (25 species) was higher than Kg. Mukut (11 species) due to the heterogeneity of habitats and sampling efforts. The samplings in Kg. Asah was carried out three times and focused on pristine streams and adjacent trekking trails that provide various microhabitats. While for Kg. Mukut, this area was surveyed in a one-night survey that consists of human inhabitants and disturbed areas. Disturbed environments in Kg. Mukut provided many breeding sites for commensal species such as *D. melanostictus*, *P. leucomystax*, *P. discantus* (Shahrudin *et al.*, 2011) and foraging ground for insects for scansorial geckos such as *G. monarchus* and *G. mutilata*. Semi-disturbed habitats in Kg. Mukut such as swamps, forest edges, and riparian vegetation (Sg. Raya) support common anurans such as *H. erythraea*, *L. blythii* and *C. labialis*, *H. frenatus*, and unexpectedly found rock gecko, *C. limi*. Disposals of food wastes and garbage in human villages seem to attract scavenged reptiles such as *V. salvator* (Botejue & Wattavidanage, 2012) which can be seen many times during the surveys.

The anurans that have been reported in Kg. Asah were mostly stream-dweller and lived along the riverbanks such as *I. parvus*, *C. labialis*, *O. hosii*, and *L. blythii* (Shahrudin & Ibrahim, 2014). Reptiles such as *C. limi*, *C. kendallii*, *S. scotophilus* and *C. tiomanensis* were typically agile and restrictedly occurs in rocky and shaded areas with plenty of deep crevices and steep surfaces on the river banks for escaping. The forests edges along the trekking trails provided vegetation with an open-layer canopy that favoured by diurnal lizards (*D. melanopogon*, *D. sumatranus* and *D. fimbriatus*) and skinks (*E. multifasciata*, *E. longicaudata*, and *S. scotophilus*) for basking during the day for thermoregulation (Randriamahazo & Mori, 2004).

Dense undergrowth and low vegetation also provided sheltered and foraging ground for diurnal reptiles such as *H. typus*, *A. fusca*, *A. armata*, and *B. cristatella*. Hence their presence along stream banks or forest trails with high vegetation cover is expected. Most of the species recorded can be found elsewhere in Peninsular Malaysia except several species which were endemic such as *Gongylosoma mukutense*, *C. limi* and *C. tiomanensis* (Grismer *et al.*, 2003; Grismer *et al.*, 2004; Grismer *et al.*, 2006). The long isolation of this island promotes species to radiate and evolve into a new, distinct species that only can be found here (Sodhi *et al.*, 1999; Grismer *et al.*, 2006).

CONCLUSION

Overall, there were 40 species of herpetofauna that had been recorded that comprised of 10 species of amphibians and 30 species of reptiles from Kg. Mukut and Kg. Asah. Based on this survey, Kg. Asah seems to support more species of herpetofauna compared to Kg. Mukut due to availability of various microhabitats and pristine areas, asides from more samplings were conducted there. In contrast, Kg. Mukut was an established human settlement area has many disturbed habitats and only supports generalist species. No additional species or new record of herpetofauna for Pulau Tioman was made in this study and the species richness of the non-marine herpetofauna of Pulau Tioman is 94 species (Table 2). However, additional fieldworks are needed to assess the true diversity of herpetofaunal in these areas. Despite all the shortcomings, these two locations in the southern part of Pulau Tioman has rich herpetofaunal diversity and should be guarded against any future disturbances.

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Table 1 List of amphibians and reptiles recorded from Kg. Asah and Kg. Mukut, Pulau Tioman, Pahang, Malaysia.

	Family	Species	Kg. Mukut	Kg. Asah
AMPHIBIANS	Bufo	<i>Duttaphrynus melanostictus</i>	8	0
		<i>Ingerophrynus parvus</i>	0	1
	Dicroglossidae	<i>Limnonectes blythii</i>	1	15
	Ranidae	<i>Chalcorana labialis</i>	2	3
		<i>Hylarana erythraea</i>	2	0
		<i>Odorrana hosii</i>	0	35
	Rhacophoridae	<i>Polypedates discantus</i>	2	0
<i>Polypedates leucomystax</i>		1	0	
		Total number of individual	16	54
REPTILES	Agamidae	<i>Acanthasaura armata</i>	0	1
		<i>Bronchoecella cristatella</i>	0	1
		<i>Aphaniotus fusca</i>	0	1
		<i>Draco melanopogon</i>	0	8
		<i>Draco sumatranus</i>	0	1
		<i>Draco fimbriatus</i>	0	1
	Varanidae	<i>Varanus salvator</i>	2	0
	Gekkonidae	<i>Gecko monarchus</i>	1	2
		<i>Gehyra mutilata</i>	0	1
		<i>Hemidactylus frenatus</i>	3	0
		<i>Hemiphyllodactylus typus</i>	0	1
		<i>Cyrtodactylus tiomanensis</i>	0	8
		<i>Cnemaspis limi</i>	1	1
		<i>Cnemaspis kendallii</i>	0	6
	Scincidae	<i>Eutropis multifasciata</i>	0	3
		<i>Eutropis longicaudata</i>	0	2
		<i>Sphenomorphus scotophilus</i>	0	11
	Trionychidae	<i>Dogania subplana</i>	0	4
	Colubridae	<i>Ahaetulla prasina</i>	0	2
	Homalopsidae	<i>Hypsiscopus plumbea</i>	1	0
<i>Dendrelaphis pictus</i>		0	1	
Elapidae	<i>Calliophis intestinalis</i>	0	1	
		Total number of individual	8	56

Table 2 Updated checklist of herpetofauna in southern part of Pulau Tioman, Pahang. Previous records were derived from Hendrickson (1966a), Hendrickson (1966b), Day (1990), Lim & Lim (1999) and Grismer *et al.* (2006) in the same localities.

Family	Species	Kg. Asah		Kg. Mukut		
		This study	Previous records	This study	Previous records	
AMPHIBIAN						
Bufonidae	<i>Duttaphrynus melanostictus</i>	0	0	1	1	
	<i>Ingerophrynus parvus</i>	1	0	0	0	
Dicroglossidae	<i>Limnonectes blythii</i>	1	0	1	1	
Megophryidae	<i>Megophrys nasuta</i>	0	0	0	1	
Microhylidae	<i>Chaperina fusca</i>	0	0	0	1	
Ranidae	<i>Chalcorana labialis</i>	1	0	1	1	
	<i>Hylarana erythraea</i>	0	0	1	0	
	<i>Odorrana hosii</i>	1	1	1	1	
Rhacophoridae	<i>Polypedates discantus</i>	0	0	1	0	
	<i>Polypedates leucomystax</i>	0	0	1	0	
REPTILE						
Agamidae	<i>Acanthasaura armata</i>	1	0	0	0	
	<i>Bronchoecella cristatella</i>	1	0	0	1	
	<i>Gonocephalus grandis</i>	0	1	0	0	
	<i>Aphaniotus fusca</i>	1	1	0	1	
	<i>Draco melanopogon</i>	1	1	0	1	
	<i>Draco sumatranus</i>	1	0	0	1	
	<i>Draco fimbriatus</i>	1	0	0	0	
	<i>Varanus nebulosus</i>	0	0	0	1	
Varanidae	<i>Varanus salvator</i>	1	1	1	0	
	<i>Gecko monarchus</i>	1	0	0	0	
Gekkonidae	<i>Gehyra mutilata</i>	1	0	0	1	
	<i>Hemidactylus frenatus</i>	1	0	1	0	
	<i>Hemiphyllodactylus typus</i>	1	0	0	0	
	<i>Cyrtodactylus tiomanensis</i>	1	0	0	0	
	<i>Cnemaspis limi</i>	1	0	0	1	
	<i>Cnemaspis kendallii</i>	1	0	1	1	
	Scincidae	<i>Eutropis multifasciata</i>	1	0	0	1
		<i>Eutropis longicaudata</i>	1	0	0	0
<i>Lipinia vitigera</i>		0	1	0	1	
<i>Dasia olivacea</i>		0	1	0	0	
<i>Sphenomorphus scotophilus</i>		1	1	0	1	
<i>Subdoluseps bowringii</i>		0	0	0	1	
Trionychidae	<i>Dogania subplana</i>	1	0	0	0	
Colubridae	<i>Ahaetulla prasina</i>	1	0	0	0	
Homalopsidae	<i>Hypsiscopus plumbea</i>	0	0	1	1	
	<i>Dendrelaphis pictus</i>	1	0	0	0	
	<i>Gongylosoma mukutense</i>	0	0	0	1	
	<i>Rhabdophis chrysargos</i>	0	0	0	1	
	<i>Zaocys carinatus</i>	0	0	0	1	
	<i>Calliophis intestinalis</i>	1	0	0	0	
Elapidae						
Total number of species/site		25	8	11	22	
Total number of species		28		27		
Total species		40				

Herpetofauna of southern Pulau Tioman



(A) *Duttaphrynus melanostictus* (Bufonidae)



(B) *Ingerophrynus parvus* (Bufonidae)



(C) *Limnonectes blythii* (Dicroglossidae)



(D) *Odorrana hosii* (Ranidae) – green form



(E) *Odorrana hosii* (Ranidae) – brown form



(F) *Chalcorana labialis* (Ranidae)



(G) *Polypedates leucomystax* (Rhacophoridae)



(H) *Draco fimbriatus* (Agamidae)



(I) *Varanus salvator* (Varanidae)



(J) *Hemiphyllodactylus typus* (Gekkonidae)



(K) *Cyrtodactylus tiomanensis* (Gekkonidae)



(L) *Dogania subplana* (Trionychidae)



(M) *Ahaetulla prasina* (Colubridae)



(N) *Dendrelaphis pictus* (Colubridae)



(O) *Calliophis intestinalis* (Elapidae)

Plate 1 Selected herpetofauna recorded from southern Pulau Tioman, Pahang.